ENVIRONMENTAL EFFECTS OF LAND USE WITHIN ZARIA CENTRAL BUSINESS DISTRICT, KADUNA STATE, NIGERIA.

By

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DECLARATION

I declare that the work in this thesis titled 'Environmental Effects of Land Use within Zaria Central Business District, Kaduna State, Nigeria' has been performed by me in the Department of Geography, under the supervision of Dr I. J. Musa and Dr I.A Abdulhameed.

The information derived from literatures has been duly acknowledged in the text and a list of references provided. No part of this thesis has been previously presented for another degree or diploma elsewhere.

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CERTIFICATION

This thesis titled 'Environmental Effects of Land Use within Zaria Central Business District, Kaduna State, Nigeria' meets the regulations governing the award of the degree of M. Sc Environmental Management of Ahmadu Bello University, and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This research work is dedicated to Allah (SWT), and also to my parents Dr. Gidado Halilu and Haj. Aishatu, and also to my beloved husband Arch. M.M. Zia-ul-haq.

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ABSTRACT

The proper functioning of the Central Business District (CBD) is a crucial requirement for a healthy and prosperous city. Land uses are dynamic particularly for CBDs and their complexity contribute to the overall development of the CBD but they equally produce negative impacts on the environment, the negative impacts imply abuse of the environment due to improper resources management. The CBD of Zaria urban area face a number of these negative environmental problems, the study assesses the environmental problems of commercial land use in Zaria Central Business District (CBD). The objectives include the identification and mapping of different land-use types existing within the study area, describing the types of activities within the different land uses, identifying the environmental problems associated with the different commercial land uses in the CBD, and determining the relationship between different commercial land use activities and environmental problems. Both primary and secondary data were used for the study, the type of data collected include land use map of the study area, land use types, activity types, field and social survey information, physical observation. The data were analyzed using a high resolution image of the study area that was obtained from Google Earth and various land use activities within the CBD were identified the land use activities were mapped out. Simple descriptive statistics was used for the analysis of data obtained. Correlation analysis was used to determine the relationship between land use activities and environmental problems. Several environmental problems associated with commercial land use activities were identified in all the Zones, which are 16.7% air pollution, 21.3% noise pollution, 46.4% land pollution and 15.3% traffic congestion and general sanitation problems. Conclusively, to reduce the rate of these environmental problems within Zaria CBD, a prompt legislative framework should be put in place to tackle the issue of indiscipline; Provision of commercial infrastructure/facilities; Strengthened administrative mechanism are some of the few recommendations highlighted.

DECLARATION - i

CERTIFICATION - ii

DEDICATION - iii

ACKNOWLEDGEMENT - iv

ABSTRACT - v

TABLE OF CONTENT - vi

LIST OF FIGURES - xi

LIST OF TABLES - xiii

LIST OF APPENDICES - xiv

TABLE OF CONTENT

CHAPTER ONE: INTRODUCTION

1.1 BACKGROUND TO THE STUDY- 1

1.2 STATEMENT OF THE RESEARCH PROBLEM - - - - - - - - - - - - - 4

1.3 AIM AND OBJECTIVES - 6

1.4 JUSTIFICATION FOR THE STUDY - - - - - - - - - - - - - - - - - - 7

1.5 SCOPE OF THE STUDY - 7

CHAPTER TWO: LITERATURE REVIEW

2.1 CONCEPT OF LAND USE - 9

2.1.1 Type of Urban Land use - 10

2.2 LAND USE PATTERN - 12

2.2.1 Factors defining the pattern on Urban Land use - - - - - - - - - - - - - - 14

2.3 THEORIES OF URBAN GROWTH AND URBAN LAND USE PATTERN -16

2.3.1 Concentric Zone Model - 17

2.3.2 Sector Model - 18

2.3.3 Multiple Nuclei Model - 19

2.4 URBAN ENVIRONMENTAL PROBLEMS - - - - - - - - - - - - - - - - - - 20

2.4.1 Urbanization - 21

2.4.2 Overpopulation - 22

2.4.3 Pollution - 23

2.5 ENVIRONMENTAL PROBLEM AND LAND USE ACTIVITIES WITHIN CENTRAL BUSINESS DISTRICTS IN NIGERIA - 29

CHAPTER THREE: THE STUDY AREA AND METHODOLOGY

3.1 STUDY AREA - 33

3.1.1 Location - 33

3.1.2 Climate - 33

3.1.3 Relief - 34

3.1.4 Zaria as an urban and commercial center - - - - - - - - - - - - - - - - - 36

3.1.5 Zaria central business district - 38

3.1.7 Existing land use structure - 40

3.2 RESEARCH METHODOLOGY - 42

3.2.1 Data types and sources - 42

3.2.2 Classification of land use activities - 43

3.2.3 Sampling technique - 44

3.2.4 Techniques of data analysis - 47

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 LAND USE ACTIVITIES WITHIN ZARIA CENTRAL BUSINESS DISTRICT - 49

4.1.1 Zone A - - - - - - -- 49

4.1.2 Zone B - 50

4.1.3 Zone C - 52

4.2 SOCIO ECONOMIC CHARACTERISTICS OF RESPONDENTS - - - - - 55

4.3 LAND USE ACTIVITIES AND ASSOCIATED ENVIRONMENTAL PROBLEMS -56

4.3.1 Land use activities and environmental problems in zone A - - - - - - - - - - 56

4.3.1.1 Land pollution in zone A - 57

4.3.1.1.1 Pollution from solid waste - 57

4.3.1.1.2 Pollution from liquid waste - 59

4.3.1.2 Air pollution - 60

4.3.1.3 Noise pollution - 61

4.3.1.4 Traffic congestion - 61

4.3.2 Land use and environmental problems in zone B - - - - - - - - - - - 62

4.3.2.1 Land pollution in zone b - 63

4.3.2.1.1 Pollution from solid waste - 63

4.3.2.1.2 Pollution from liquid waste - 65

4.3.2.2 Air pollution - 66

4.3.2.3 Noise pollution - 67

4.3.2.4 Traffic congestion - 67

4.3.3 Land use activities and environmental problems in zone C - - - - - - - 68

4.3.3.1 Land pollution - 69

4.3.3.1.1 pollution from solid waste - 69

4.3.3.1.2 Pollution from liquid waste - 71

4.3.3.2 Air pollution - 72

4.3.3.3 Noise pollution - 73

4.3.3.4 Traffic congestion - 73

4.4 CORRELATION MATRIX BETWEEN ENVIRONMENTAL PROBLEMS AND LAND USE ACTIVITIES - 79

4.4.1 Results of correlation matrix between environmental problems and land use activities - 87

CHAPTER FIVE: SUMMARY, RECOMMENDATION AND CONCLUSION

5.1 SUMMARY - 91

5.2 CONCLUSION - 92

5.3 RECOMMENDATION - 92

REFERENCES - 94

LIST OF FIGURES

Figure 3.1 Zaria local government within Kaduna Context - - - - - - - - - - - 35

Figure 3.2 Location of CBD in Zaria urban area - - - - - - - - - - - - - - - - - 37

Figure 3.3 Aerial photograph of Zaria Central Business District - - - - - - - - - - - 39

Figure 3.4 Land use pattern of Zaria Central Business District - - - - - - - - - - 41

Figure 3.5 Zones of the Central Business District - - - - - - - - - - - - - - - - - 46

LIST OF TABLES

Table 4.1 Land Use activities along Park Road - - - - - - - - - - - - - - - - - - - 50

Table 4.2 Land Use Activities Along Waff Road - - - - - - - - - - - - - - - - - 50

Table 4.3 Land Use Activities Along Main Street - - - - - - - - - - - - - - - - - 51

Table 4.4 Land Use Activities Along Sokoto Road - - - - - - - - - - - - - - - 53

Table 4.5 Land Use Activities Along Manchester Road - - - - - - - - - - - - - 54

Table 4.6 Land Use Activities Along Theresa Bowyer Road - - - - - - - - - - - 54

Table 4.7 Land use Activities Along IBB - 54

Table 4.8 Socio-economic Characteristics - - - - - - - - - - - - - - - - - - - 56

Table 4.9 Environmental Problems within Zone A - - - - - - - - - - - - - - - - 57

Table 4.10 Solid Waste Characteristics in Zone A - - - - - - - - - - - - - - - 58

Table 4.11 Liquid Waste Characteristics in Zone A - - - - - - - - - - - - - - - - 59

Table 4.12 Air Pollution in zone A - 61

Table 4.13 Noise Pollution Characteristics in zone A - - - - - - - - - - - - - - - 61

Table 4.14 Traffic Congestion in Zone A - 62

Table 4.15 Environmental problems within Zone B - - - - - - - - - - - - - - - - 62

Table 4.16 Solid Waste Characteristics in Zone B - - - - - - - - - - - - - - - - - 64

Table 4.17 Liquid Waste Characteristics in Zone B - - - - - - - - - - - - - - - - - - 66

Table 4.18 Air Pollution in Zone B - 67

Table 4.19 Noise Pollution in Zone B - 67

Table 4.20 Traffic Congestion in Zone B - 68

Table 4.21 Environmental Problems within Zone C - - - - - - - - - - - - - - - - 69

Table 4.22 Solid Waste Characteristics in Zone C - - - - - - - - - - - - - - - - - 70

Table 4.23 Liquid Waste Characteristics in Zone C - - - - - - - - - - - - - - - - 71

Table 4.24 Air Pollution in Zone C - 72

Table 4.25 Noise Pollution in Zone C - 73

Table 4.26 Traffic Congestion in Zone C - 74

Table 4.27 Correlation Coefficient Matrix between Land Use Activities and Air Pollution in Zone A - 79

Table 4.28 Correlation Coefficient Matrix between Land Use Activities and Noise Pollution in Zone A - 80

Table 4.29 Correlation Coefficient Matrix between Land Use Activities and Land Pollution in Zone A - 80

Table 4.30 Correlation Coefficient Matrix between Land Use Activities and Traffic Congestion in Zone A - 81

Table 4.31 Correlation Coefficient Matrix between Land Use Activities and Air Pollution in Zone B - 82

Table 4.32 Correlation Coefficient Matrix between Land Use Activities and Noise Pollution in Zone B - 82

Table 4.33 Correlation Coefficient Matrix between Land Use Activities and Land Pollution in Zone B - 83

Table 4.34 Correlation Coefficient Matrix between Land Use Activities and Traffic Congestion in Zone B - 84

Table 4.35 Correlation Coefficient Matrix between Land Use Activities and Air Pollution in Zone C - 84

Table 4.36 Correlation Coefficient Matrix between Land Use Activities and Noise Pollution in Zone C - 85

Table 4.37 Correlation Coefficient Matrix between Land Use Activities and Land Pollution in Zone C - 86

Table 4.38 Correlation Coefficient Matrix between Land Use Activities and Traffic Congestion in Zone C - 86

LIST OF PLATES

Plate 4.1 Illegal Convenience behind Shops along Sokoto road - - - - - - - - - - 75

Plate 4.2 Traffic Congestion along Sokoto Road - - - - - - - - - - - - - - - - - 75

Plate 4.3 Clogged Drainage with Solid Waste along Sokoto road - - - - - - - - - 75

Plate 4.4 land Pollution due to Mechanic activities along Main street - - - - - - - 75

Plate 4.5 Disposed liquid waste along Park road - - - - - - - - - - - - - - - - - - 76

Plate 4.6 Clogged Culvert with Solid Waste along Sokoto/Park road - - - - - - - - 76

Plate 4.7 Open Dumping of Solid waste along Railway tracts in PZ area - - - - - - 76

Plate 4.8 Air Pollution from road side food joints along Sokoto road - - - - - - - - 77

Plate 4.9 Land Pollution from road side food joints along Sokoto road- - - - - - - 77

Plate 4.10 Air pollution from Suya joint along Sokoto road- - - - - - - - - - - - - 77

Plate 4.11 Solid Waste from Furniture activities along Sokoto road- - - - - - - - - 77

Plate 4.12 Solid Waste dump in Drainages along Sokoto road- - - - - - - - - - - - 78

Plate 4.13 Clogged drainage with liquid waste along Manchester road - - - - - - - - 78

Plate 4.14 Open dump in front of shops along Main street - - - - - - - - - - - - - - 78

LIST OF APPENDICES

Appendix I. - 107

CHAPTER ONE: INTRODUCTION

1.1 BACKGROUND TO THE STUDY

Environment encompasses the interaction of population, economic growth, urban structures and the built environment with the natural environment or ecological system in which a city is located (Burra, 2005). Environmental management is the process by which environmental health is regulated, it does not involve managing the environment itself, but it is the process of taking steps and behaviors to have a positive effect on the environment and reducing negative environmental impacts (McGraw-Hill, 2007).

The level of urbanization in the developing world indicates that more people live in cities than before. Most people move into the urban areas because they are 'pushed' out by factors such as poverty, religious strife, political persecution, food insecurity and lack of basic infrastructure and services in the rural areas among others (Tarver, 1996). The last 25 years of development has led to major increases in the percentage of the population living in urban areas, from 40% in 1980 to 50% in 2000 and an estimated 66% in 2030 (UN 2003). The number of 'mega-cities' is growing, but also medium sized and smaller urban agglomerations are experiencing explosive growth with consequent pressure on the urban areas exhibited as environmental problems.

In the last 30 years, despite allocations of vast funds to environmental commitments based on policies from the Earth Summits in Rio and Johannesburg and the Millennium Development Goals (MDGs); progress has not met expectations because the effects have been

harshly felt by the increasing number of poor in the urban areas (Millennium Project 2005). This development has led to an increase in the absolute and relative number of urban poor and an increase in inequality (Hasan, Patel, Satterthwaite, D, 2005). The provision of services (water, sanitation, waste management, health and education) has not been sufficient and issues of housing and land are left unsolved.

The 1972 UN environmental conference in Stockholm outlined the need for a global environmental program. The Rio Conference in 1992 highlighted more specific environmental issues regarding biodiversity, the role of local government (local agenda 21) and the role of the private sector and industry. A certain emphasis was on the recognition of the link between economic development, environment and poverty. The Earth Summit in Johannesburg in 2002 emphasized the importance of the urban environment to the poor and marginalized groups in developing countries. In particular, issues concerning infrastructure and service provision (water, sanitation and housing or slum upgrading) and improved air quality were highlighted as areas of priority (UN, 2002). One change in emphasis has been to focus directly on the conditions of the poor and to pursue initiatives that should improve the provision of water, waste management and improved housing. While initiatives with an indirect effort, such as targeting industries in reduction of pollution and enhancement of cleaner production, have received less attention and funds over recent years.

Developed countries are also faced with a number of environmental challenges, although the scale and intensity of the problems vary. These comprise poor air quality; traffic volumes and congestion; high levels of ambient noise and scarcity of quiet areas for sport, play and recreation; neglect of the built environment; high level of greenhouse gas emissions; urban sprawl and generation of large volumes of waste and waste water. These environmental challenges are

serious and have significant impacts on health, the environment and economic performance. These problems are caused, in part, by changes in lifestyle and demography (growing dependence on the use of private car and increasing resource use per capita).

The Central Business District (CBD) is the focal point of the city's activity system and therefore the heart of the city (Yahaya, 2005). It is the commercial, administrative, retail and cultural center of the city and usually is the center point for transportation activities. The Central Business District developed as the market square in ancient cities and as cities grew and developed, CBDs became fixed locations where retail and commerce took place. By the beginning of the 21st century, the CBD had become a diverse region of the metropolitan area and included residential, retail, commercial, universities, entertainment, government, financial institutions, medical centers, and culture. There are no boundaries to the CBD but it is essentially about perception. There have been various attempts at delineating the boundaries of the CBD but, for most part, one can visually or instinctively know when the CBD starts and ends as it is the core and contains a plethora of tall buildings, high density, a lack of parking, transportation nodes, a large number of pedestrians on the street and generally just a lot of activity during the daytime (Matt, 2008).

In Nigeria, the population is more than 126 million (National Population Commission, 2006) yielding high, average and low density of more than 120 persons per square kilometer. Although this density may vary from one region to another, it is obvious that Nigeria is already experiencing the effects of high population density (Omofonmwan and Osa-edor, 2008). The interaction of these millions of Nigerians with their respective environment has left indelible mark on the environment. The manifestation of these impacts includes; urbanization, deforestation, desertification, overpopulation and all kinds of pollutions. These impacts have

both negative and positive effects on the natural environment. It is the negative impacts of man's interaction within the CBD that is of concern in this work.

1.2 STATEMENT OF THE RESEARCH PROBLEM

Environment implies the surrounding conditions that affect people and other organisms (Salau, 1993). Concerns about the environment cannot be understated because the environment is man's natural abode on which he depends for sustenance. Thus, the protection of the environment is also seen as an essential part of development (Salau, 1993). Urban environmental problems are threats to people's present or future well-being, resulting from human-induced damage to the physical environment, originating in or borne into urban areas (PEM Consult, 2003).

The level of urbanization in the developing world indicates that more people now live in cities than before. According to the United Nations (UN) forecasts, cities in the developing world with one million and above increased to over 300 million people by the year 2000 (Ogunbodede, 2006). Rapid growth in population will continue, resulting from improved services and the multifarious functions performed by cities. This and other reasons give rise to increase in the expansion and relevance of CBD.

Central Business District (CBD) is an integral part of cities and their complexities increase with population in cities. Several studies have been carried out on the problems associated with central business district of Nigerian cities. The study by Samson (2012) on the traffic management and parking problems in Lagos CBD showed that transport problems are prevalent as a result of the growing concentration of population, rapid urbanization and economic activities with recommendations made that planning authorities should specify and

enforce the provision of parking space in addition to upgrading buildings and infrastructure. Haruna (1993) linked the problem of Kaduna CBD to the lack of adequate parking indicating that motorists park their vehicles in any available space. Provisions of adequate curbside and off-street parking facilities were made. Kude's contribution (1988) was on the activities of retailers in the Kaduna CBD covering the activities of temporarily fixed retailers and mobile hawkers that were associated with congestion. The study revealed that the high volume of traffic was created by the pull of retail activities and other land uses on the streets. He therefore proposed the stabilization of hawkers and pedestrian walkway. Sokumba's study (1980) attempted to separate vehicular from pedestrian traffic in the CBD of Zaria, with proposals for traffic segregation such that pedestrians would enjoy walking. The researcher also recommended improvement on the roadside meant for the pedestrian so as to eliminate being pushed into the road in the way of vehicles.

The proper functioning of the Central Business District (CBD) is a crucial requirement for a healthy and prosperous city. Land uses are dynamic particularly for CBDs and they also undergo changes. The changes could be either planned or unplanned, or results from government policy and economic forces that also help attract even higher economic activities to the CBD's. The land uses and their complexity contribute to the overall development of the CBD but they equally produce negative impacts on the environment, the negative impacts imply abuse of the environment due to improper resources management. The CBD of Zaria urban area face a number of these negative impacts/environmental problems, some of which includes congestion, vehicular-pedestrian conflict, lack of harmony between adjoining land uses, poor functional relationship between component activity areas, pollution, solid waste disposal, drainage blockage, unorganized structures of food hawkers and vendors, defections and littering of

environment to mention but a few. Such environmental issues have generally been ignored in previous studies that have been based on analysis of traffic congestion, parking and traffic management. The sensitive nature of the CBD, environment and its implication for the sustainable development of the city justifies the need for dealing with the CBD impacts. This consideration is what is covered in this study with focus on establishing unpleasant environmental consequences generated by land use activities within Zaria CBD. The study differs from others and will serve as a viable reference tool in addressing CBD problems.

This study seeks to answer the following research questions;

i what are the various types of activities within Zaria CBD?

ii. What are the major environmental problems generated by the different land use?

iii which of these activities generate the most environmental problems?

iv. How can the problems be addressed?

1.3 THE AIM AND OBJECTIVES

The aim of this study is to examine the environmental problems of Commercial land use activities within the Zaria Central Business District (CBD). The aim was achieved with the specific objectives which are to:

(i) Identify and map out the different land-use types existing within the study area.

(ii) Describe the types of activities within the different land uses.

(iii) Identify the environmental problems associated with the different commercial land uses in the CBD.

(iv) Determine the relationship between different commercial land use activities and environmental problems.

1.4 JUSTIFICATION

In Nigeria, land use activities in CBDs constitute the major proportion of environmental problems in urban areas (Yahaya, 2005). This is reflected in poor solid waste and sanitation management, pollution (air, noise and water), crowding without green areas, poor transport system-accessibility and degradation of ecologically sensitive areas. It is known that improper management of solid waste is one of the main causes of environmental pollution (Kimani, 2007). Generally, environment is a global community concern that affects different aspects of man's socioeconomic livelihood such as health and environmental productivity.

Zaria is rapidly growing structurally and functionally; the commercial activities of Zaria and its surrounding villages largely depend on Zaria Central Business District (CBD) which is reflected in daily conversion of various land uses to commercial land uses. There is therefore the need to have an inventory of the type of commercial land use activities within the CBD as well as to identify the type of environmental problems each of the activities creates, and also have an in-depth understanding of environmental issues at a micro scale which can be an input at macro planning decisions. The study compliments previous efforts of researchers in establishing ways of making our urban environment functional, flexible and friendly to inhabitants.

1.5 SCOPE AND DELIMITATION

The study was conducted in Zaria CBD, it covers all the major land uses, the of the land use in the area of concern are mainly commercial land uses (such as banks, filling stations, shops, eateries, warehouses etc.). The CBD extends from Paterson and Zochonis (PZ) to Sabon

Gari market. However, due to the intensity of activities in the study area, the study was limited in terms of data acquisition and analysis to only commercial land uses.

CHAPTER TWO: LITERATURE REVIEW

2.1 CONCEPT OF LAND USE

Land use has been defined in many ways by different people. According to Deblij (1974), land use refers to the actual use being made of any given parcel of land, which means the spatial distribution or geographical pattern of the city.

According to Vinks (1975), land use is any kind of permanent or cyclic human needs either material or spiritual or both, from the complex of natural artificial resources which together are called land. Land use is the application of human controls, in a relatively systematic manner, to the key elements within an ecosystem in order to derive benefit from it. Vink's definition recognizes the dynamic nature of land and land use and emphasizes the importance of man within the ecosystem. The efforts of man are crucial determinants of what happens to land for his influence may have favorable or adverse effects on land, Man influences and is also influenced by what he set out to exert on the land and thus man brings upon the land his own customs, beliefs, ideology, politics, and so on (Vinks, 1975).

Land use is also the management of land to meet specified socio-economic objectives and is described by the purpose for which the land is used and the types and sequences of development, conservation and environmental management activities carried out upon the land (Salako, 1999). Within the broadest context, land use is capable of being classified into: rural land use (agriculture, forestry, fisheries; livestock including wild life management); and urban Industrial land use (towns, villages, highways, industrial complexes and mining and quarrying) (Vinks, 1975).

Land use has become an important issue in the planning and organization of modern cities. Government officials, business people, and the general public are interested in this topic

for different reasons. Local government councils/authorities for example, might think that setting parameters in land use could be an effective way to solve problems of congestion and increase productivity in their cities. Business people would also like to know about land use to locate their businesses in convenient locations where products could reach valuable markets and generate higher revenues. The public in general has Interests in land use when choosing a place to live or work.

2.1.1 Types of urban land use

There are about eight primary types of urban land uses (MIRIS, 1980). These are;

i. Open Space/ recreational land use; is a term used loosely, and refers to all land which is used for purposes which do not involve a substantial proportion of the site being covered with buildings and which enable it to be left substantially in its natural state or to be treated so that it has visually pleasant qualities. e.g Green areas.

i. Industrial land use area; Land uses that deal with the processing and storage of raw materials and the production, storage, and distribution of manufactured goods. It is considered to have industrial usage if most of the businesses in that area are engaged in industrial occupations. This may be splitted into a number of parts and it is the area in which manufacturing industry and the largest service industries are located and large scale warehousing with bulky goods. E.g. factories, warehouses.

ii. Commercial land use area; is the area in which the commercial life of a town take place in their highest and most complicated form, and in which the most important central services supplied by the town are made available. The essential constituents are central business district, retail center, other retail, services, office, public assembly and institutional buildings. The CBD

is the historic commercial and business center of an incorporated city that usually consists of a high-density mixture of commercial, business, and institutional uses. Retail center Includes shopping centers of all sizes and regional shopping malls, it also includes large discount retail establishments that are associated with national or regional chain stores, other retail services include Individual establishments involved with the sale of consumer goods and services. These activities most commonly occur in strip commercial development along major roads, although not limited to that setting includes historic "neighborhood" business districts as well as banks, restaurants, motels, hotels, funeral homes, household storage facilities, and junkyards. Also included are entertainment and indoor recreational facilities that are frequently associated with commercial development, such as indoor or drive-in movie theater, miniature golf, driving range, go-cart racing, tennis club, bowling alley, indoor ice rink, and recreation hall.

iii. Residential land use: Residence is the most important urban function and the areas with residential usage occupy the greatest area of the city. Anywhere people live, houses apartment buildings, condominiums, townhouses, detached houses etc. Residential land use mostly takes up 40% of a cities area.

iv. Transportation land use: made up of 3 parts, Vehicles travels paths and terminal facilities, roads and mass transit systems. E.g. roads, bridges, railways, ports

v. Institutional land use: Institutional Facilities provides governmental, cultural, educational, religious and health services. Includes schools, community colleges, universities, churches, indoor community recreation centers, government buildings, fire stations, libraries, museums, art galleries, civic centers, hospitals, correctional centers, mental health facilities, government buildings and military bases.

vi. Recreational land use: Includes recreational land uses where elements of the natural landscape, such as vegetation or topography, or use of a natural resource, such as water, are an integral part of the activity or setting. 7% of land is used for parks, playgrounds, golf courses, Arenas, Parks and Rec. centers.

2.2 LAND USE PATTERN

The rapid changes in the trend of urbanisation indicate possible impacts on urban land use patterns. In many respect, urban land use theory is a logical extension of agricultural location theory (Isard, 1956). It means that each urban area has one focal point which is the centre, this centre on the isotropic plain, is the most accessible location in the urban area. According to Alonso (1964) functions which gain the greatest advantage from locating at the point of maximum accessibility from the inner most zones must be close to the market while the other uses are arranged in sequence according to their location rents. The influx of people into urban areas, mostly for economic reasons, demand for urban land becomes high, the high demand leads to competition among land users. Land uses therefore attract higher prices due to the importance and ability to pay for the land. Land located at the centre of the city therefore goes for commercial and service uses while industrial, residential and agricultural lands are found at the periphery.

The way in which urban development unfolds causes major problems in the development and management of urban land. This phenomenon is unfolding in different forms and intensities in different countries and cities as a result of variation in population growth, levels of technology, land tenure systems and planning. Higher population and economic activities in the urban environment causes land uses to change variously to suit the demands of urbanisation; Urbanisation changes the uses to which urban land is put. Through the growth and expansion of

business activities, residential and recreational land uses especially those along the major roads are converted into various forms of land uses particularly commercial and other small scale industrial activities (Ahyigyina, 1999).

Residential land use is particularly giving way to others because of the high degree of commercial and industrial functions performed by most urban centres. This change from residential land use to other uses is occurring because the economic returns on residential land uses is less compared to that of commercial and industrial uses. Urbanisation also converts urban land at the rural-urban fringe to uses such as residential development. The movement of people to the periphery of urban centres mean marginal clearing of the already limited agricultural land for building homes and other infrastructure constructions such as roads, parking lots among others. Zaria urban area like any other cities of the developing countries exhibit similar characteristics of land use pattern. The central business districts of Zaria was initially 60% residential land use, as population and economic activities increases, the residential land uses are being converted to commercial and mixed land uses, and this conversions are done mostly for profit making motive. Though there are some that are converted to other uses depending on the functions performed by surrounding uses.

This land use change may affect land which is regarded as an environmental asset, such as remnant bush land or a well-managed private holding or land which is economically valuable with agricultural or mineral potential. As land towards the fringes is exhausted, residential land use tends to become the next target since urban land does not increase with population and human activities. This problem is disturbing and the net effect culminates into serious land use problems such as development of squatter settlements, urban sprawl, encroachment on reserves

and open spaces (Emmanuel, 2004). Hence, it is appropriate to examine the factors that define the pattern of urban land use.

2.2.1 Factors defining the patterns of urban land use

Cities are distinctive ensembles of people, businesses and institutions (Campbell, 1998). They are easily distinguished by the number and density of economic, social and cultural activities that take place within them. The most visible characteristic of cities is the form of their built environment. This includes tall buildings located at the city's centre, outlying areas of manufacturing and distribution, and residential areas with greater density near the centre of the city, it is the location of these and other activities that define patterns of urban land use. Cities, and the associated process of urbanisation, are the product of industrialisation and changes in technology (Cohen, 2003). As industrialisation proceeds, many types of businesses find it advantageous to cluster together and form agglomerations of economic activities, Benefits from agglomeration are important concept in understanding why cities develop. Technological changes for example changes in industry present the essential conditions for urban growth. While the form of urban places has changed dramatically, the basic structure of cities has been remarkably flexible (Cohen, 2003).

The core of urban places typically has evolved around the nexus of transportation routes such as roads, railroads and ports. These routes are critical in shipping and receiving industrial products. The same lines of transportation that radiated from the city's Central Business District also bring people to the centre for work and shopping (Chauncy and Ullman, 1945). Innovation in building practices, including the use of reinforced concrete, allowed large structures to be erected, many of which survive to this day. This has helped shape the built environment and

defines the function and patterns of urban land use. However, many of these innovations have changed the patterns of urban land use of today. For instance, the widespread use of trucks and automobiles travelling on interstate highways and beltways has allowed households and businesses to locate outside the central city. Most households and businesses are now within suburban locations where densities and land costs are lower. Over time, suburban growth changes the form of urban areas, as a result, urban development has changed from being homocentric with most economic activities located in the centre of the city, to being polycentric forms with several nodes in the urban area around which businesses and households locate (Bracken, 1981).

The choice of location of any activity is normally a rational decision made after an assessment of the relative advantages of various locations for the performance of the activities in question, given the general frame work and knowledge prevailing. This usually portrays the importance of land use decisions in any urban area and tends to locate activities in places best suited for them. A process of competition sets in and leads to a situation where activities seek out and segregate themselves in that part of the urban centre in which their optimum conditions are found. In the long run, all activities tend to locate where they enjoy their greatest relative advantage. In this case, land is put to its highest and best use, the spatial differentiation of land use pattern becomes more marked and complex as the corresponding linkages and degree of specialisation increases (Bracken, 1981).

Essentially, urban land use within any locality is conditioned by two factors. These include non-profit use of land particularly for the construction of roads, parks, gardens, playgrounds, educational buildings and government offices. The other factor includes land which

is developed with profit making motive. It includes the development of sites for offices, residence and industries. The profit use of land is highly dependent on the non-profit use of land (Rangwala, 2002). These factors which condition the urban area form the structure and function of the urban economy as it fits into the broader economy of the region and nation. The outcome of numerous location decisions by businesses, households and governments produce a complex urban mosaic of business districts, shopping centres, government centres and residential neighbourhoods characterized by different land use patterns (Bracken, 1981).

2.3 THEORIES OF URBAN GROWTH AND URBAN LAND USE PATTERN

The study of urban land use generally draws from three different descriptive models. These models were developed to generalize the patterns of urban land use found in early industrial cities of the developed countries. Due to changes in the shape and form of cities over time, new models of urban land use patterns were developed to describe urban landscape that was becoming increasingly complex and differentiated. Furthermore, it must be stated that these are general models devised to understand the overall pattern of land use. Hence, none of them can accurately describe patterns of urban land use in all cities. In fact, all of these models have been criticized for being more applicable to cities in the United States of America than to cities of other nations (Graham, 1993). Critics argue 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. Despite the criticisms, these models continue to be useful generalizations of the way in which land is devoted to different uses within the city. Described below are the Concentric Zone Model, Sector Model and Multiple Nuclei Model of urban land use.

2.3.1 Concentric-Zone Model

The Concentric Zone Model is among the early descriptions of urban form. Originated by Ernest Burgess in the 1920s, the model depicts the use of urban land as a set of concentric rings with each ring devoted to a different land use. It explains the process of urban growth by a series of concentric circles which expand radically from the core of the city or the CBD. The CBD has most economic activities because it is the focus of an intra-city transport (Chauncy and Ullman, 1945). The foregoing gives the CBD a locational advantage in terms of greatest accessibility to the whole of the urban area. There are no such distinctions however, in the rural areas. The advantage of accessibility makes the demand for site in the CBD very great. In addition, the supply of land in this area is restricted which leads to high land values. 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.

In this case, the concentric theory asserts that all activities of similar characteristics which are functionally related will cluster at the same location at a certain distance from the centre of an urban area. This important feature of the model implies 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 centre of the city, as the city grows and develops over time, the CBD will exert pressure on the zone immediately surrounding it. Outward expansion of the CBD will 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.

It is however argued that where variations occur in such factors as topography of the physical landscape, the ideal symmetry would be disturbed. Again, the fact that residential areas may further be sub-divided by race can affect the model. Nevertheless, critics 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 importance of accessibility to the CBD. Notwithstanding these criticisms against the theory, it is of importance in explaining how land use in an urban area is structured.

2.3.2 The Sector Model

Hoyt (1939) revisited the concentric ring model and recognized the value of it, He also 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 and also, commercial establishments have been found along business thoroughfares. Therefore, Hoyt modified the concentric zone model to account for major transportation routes. Recognizing that these routes represented lines of greater access, Hoyt theorized that cities would tend to grow in wedge-shaped patterns or sectors emanating from the CBD and centred on major transportation routes (Chauncy and Ullman, 1945).

Hoyt observes that higher levels of access translate to higher land values. This means that many commercial functions remain in the CBD whilst manufacturing activities develop in a wedge surrounding transport routes. Then residential land use patterns would grow in wedge-

shaped patterns with a sector of lower-income households bordering the manufacturing/warehousing sector. This is because traffic, noise and pollution make these areas less desirable locations to live. However, a sector of middle-and-higher income households would be located away from the industrial sites. 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.

2.3.3 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 will combine 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.

Zaria land use pattern is a combination of both sector and multi nuclei model. The central business district evolve as a result of transportation node (rail transport) that falls along the area, business activities started from petty buying and selling and rapidly expanded to major commercial activities. Industrial land uses are found at a separate nucleus but near the CBD, this is because it performs a specialized activity with specific requirement. Residential land uses develop along the periphery of these land uses.

2.4 URBAN ENVIRONMENTAL PROBLEMS

Environmental problem is referred to as; the presence of pathogens or toxic substances in the human environment, which can damage human health or physical resources such as, forests, fisheries or agricultural land. It may be looked at as inadequate supply of resources essential to human health or urban production like having no sufficient fresh water (Hardoy et al., 1992). They have identified the different problems that could be found in cities in relation to the level of development. Some part of developed cities in Europe, Japan and North America are experiencing high levels of air and water pollution, solid waste including toxic or hazardous wastes. These are the major environmental problems that dominate the big cities in the developed countries. They further explain that industrialization is the main cause of air and water pollution, followed by increase in vehicle usage through congested traffic, inefficient and poorly maintained engines in most road vehicles and therefore increased gas emissions from the fossil fuels. There is a possibility of land and water pollution resulting from high proportions of households and business not served by sewers, drains and garbage collection.

While Silitshena (1993) defines an urban environmental problem in the same way and outlines the problems found in developing countries mostly in Sub-Saharan Africa as being

minor to developed countries. Cities are growing at a faster rate and due to the urban growth, most cities are characterized by poor living conditions such as air water and noise pollution, inadequate basic services, poor infrastructure, dangerous and unhealthy sites of some neighbourhoods like irregular collection of garbage from storage points ,traffic jam etc. The researcher explains further that, massive rural-urban migration is seen as the main factor behind urbanization in developing countries whereby this movement of people is attributed to high population growth rates in both rural and urban areas, search for job opportunities due to the high rate of unemployment in rural areas, search for better social services including educational, health services and water, and finally civil strife in some parts of the countries and this builds pressure on the urban environments.

2.4.1 Urbanization:

Urbanization is caused by high population growth rate and rural- urban migration. Urbanization in Nigeria is characterized by city slums with serious environmental consequences. The problem has been described as acute and exemplifies the inability of development measures to keep pace with the rate of population growth. Environmental conditions in cities have gradually deteriorated due to the rapid growth of the cities and the attendance inability of social services and infrastructures to keep pace with the rate of growth. Inadequate storm drains, dumping of refuse in drainage lines and construction of houses close to and even on the natural water channels have been shown to be responsible in that order for the increasing cases of flood in the urban centres. Environmental problems associated with the increasing growth of urban slums including overcrowding in squalid housing conditions, poor quality or unavailability of

basic infrastructures and social services, such as water and sewage facilities and even lack of access routes (NEST, 1992).

2.4.2 Overpopulation

Population is a major factor in all environmental-related issues. Overpopulation causes stress on the environment. Environmental problems such as overpopulation, degradation, erosion, desertification, etc. are caused by man's misuse of environmental resources. Until very recently, Nigerians regard their "large population size" as a symbol of greatness, power and prestige and tend to resist attempts to reduce it drastically. It is only just becoming clear, that over population is forcing traditional societies to abandon age old production systems and resources management techniques that allowed them to produce enough food for themselves at minimal impacts on the environment. There is an evidence everywhere of rapid decline in environmental quality and human living conditions occasioned by rapid increase in human numbers. In 1986, Mabogunje reasoned that because of the economic emergency that was declared in the country, the next few years were going to witness tremendous efforts at increased production and enhanced productivity in the country. Under such stressful situation, "it will be easy for people to become so exigent, worrying only about what to get out of the environment for their own immediate needs and uses, without caring very much for the consequence, especially for succeeding generations. Therefore this rapidly growing population with growth in economy, increase in the market size and people standard of living as well as purchasing power has its direct multiplier effect on central business districts (CBD).

2.4.3 Pollution

Environmental pollution can be categorized into three groups. These are air or atmospheric pollution, aquatic or water pollution and land or surface area pollution. The World Health Organization (WHO) (1990) defined air pollution as "limited to situation in which the outer ambient atmosphere contains materials in concentrations which are harmful to man and his environment". Man's activity on the earth surface has largely degraded the quality of the lower atmosphere. The growth and development of industries and Urbanization has contributed greatly to the excess carbon monoxide produced by combustion and other human activities. Carbon monoxide reacts with the blood vessel and prevents it from taking up oxygen and the people are suffocated.

In Nigeria, several rural towns that had in the past enjoyed fresh and dry air are currently experiencing air pollution problems (Obajimi, 1998). This is due to industrialization process and expansion in human activities. Aquatic or water pollution is the discharge of unwanted biological, chemical and physical materials into water bodies from man's environment. The pollutants are usually chemical, physical and biological substances that affect the natural condition of water. This incidence is responsible for the wide spread water contamination in most Nigeria cities. Also solid wastes have equally flooded the water ways in these urban centres. Land surface pollution is the occurrence of unwanted materials or waste on land. The commonest pollutant on land is the waste products that are often scattered on land area in the cities. According to Onwioduokit (1998), most environmental problems are due to the production or consumption of goods whose waste products translate easily into pollutant. Ayeni (1978) and

Sada (1981) believed that the emergence of urbanization is responsible for the rapid accumulation of solid waste.

The significance of environmental factors to the health and well-being of human populations is increasingly apparent (Rosenstock 2003; World Health Organization [WHO]) Environmental pollution is a worldwide problem and its potential to influence the health of human populations is great (Fereidoun *et al*, 2007; Progressive Insurance, 2005.). Pollution reaches its most serious proportions in the densely settled urban-industrial centres of the more developed countries (Kromm, 1973). In poor countries of the world more than 80% polluted water have been used for irrigation with only 70% to 80% food and living security in industrial urban and semi urban areas (Mara and Cairncross, 1989). Industry, clustered in urban and semi-urban areas surrounded by densely populated, low-income localities, continues to pollute the environment with impunity (Government of Pakistan, 2009).

Over the last three decades there has been increasing global concern over the public health impacts attributed to environmental pollution (Kimani, 2007), Human exposure to pollution is believed to be more intense now than at any other time in human existence (Schell *et al*, 2006). Pollution can be made by human activity and by natural forces as well (Fereidoun *et al*, 2007). Selfish private enterprise and their lack of awareness of public well-being and social costs (Carter, 1985) and natural disasters (Huppart and Sparks, 2006) e.g. volcanic ash from Iceland (World Health Organization [WHO]) are the one of the main reason of pollution. British Airways (1993) expresses their concern about environment in their general goal to be a good neighbour, concerned for the community and the environment. Sharp and Bromley (1979) posit that pollution control program evolves as a nationwide fixed cost-sharing effort relying upon

voluntary participation. There is no doubt that excessive levels of pollution are causing a lot of damage to human & animal health, plants & trees including tropical rainforests, as well as the wider environment (Tropical Rainforest Animals, 2008).

According to Fereidoun *et al* (2007), Tehran is one of victim cities in terms of environmental pollution. Gautam *et al* (2009) nominated Indian cities, among the most polluted cities in the world. Carter (1985) found pollution in formally known Czechoslovakia (now Czech Republic and Slovakia) a serious issue which ultimately affects soils and vegetation. As Debarteleven (1992) postulates that environmental pollution and degradation are serious problems in Eastern and Central Europe. Kan (2009) originated the fact about China that, it has environmental problems, including outdoor and indoor air pollution, water shortages and pollution, desertification, and soil pollution, have become more pronounced and are subjecting Chinese residents to significant health risks.

Environmental pollution is tangled with the unsustainable anthropogenic activities, resulting in substantial public health problems (Khan, 2004). McGeehin *et al*, (2004) reported that U.S. population from infectious diseases to diseases such as cancer, birth defects, and asthma, many of which may be associated with environmental exposures. There is virtually no check on some 8,000 industrial units in USA that are contributing to high rates of pollution (Kaufman, 1993). Pollutions generally are categorized under:

a. Air Pollution

The air we breathe is an essential ingredient for our wellbeing and a healthy life. Unfortunately polluted air is common throughout the world (EPHA, 2009) especially in

developed countries from 1960s (Kan, 2009). South of Poland (Krześlak and Korytkowski, 1994), Ukraine (Avdeev and Korchagin, 1994), China (Kan, 2009), and Pakistan (Government of Pakistan, 2009; Khan, 2010) even famous crowded cities and countries are facing air pollution. Polluted air contains one, or more, hazardous substance, pollutant, or contaminant that creates a hazard to general health (Health and Energy, 2007). The main pollutants found in the air we breathe include, particulate matter, PAHs, lead, ground-level ozone, heavy metals, sulphur dioxide, benzene, carbon monoxide and nitrogen dioxide (European Public Health Alliance, 2009).

Air pollution in cities causes a shorter lifespan for city dwellers (Progressive Insurance, 2005). Holland *et al*, (1979) illustrated that British scientists concluded that particulate and related air pollution at high levels pose hazards to human health. According to Mishra (2003) rapid growth in urban population, increasing industrialization, and rising demands for energy and motor vehicles are the worsening air pollution levels. He added other factors, such as poor environmental regulation, less efficient technology of production, congested roads, and age and poor maintenance of vehicles, also add to the problem. He further added that air pollution is caused of ill health and death by natural and man-made sources, major man-made sources of ambient air pollution include tobacco smoke, combustion of solid fuels for cooking, heating, home cleaning agents, insecticides industries, automobiles, power generation, poor environmental regulation, less efficient technology of production, congested roads, and age and poor maintenance of vehicles. The natural sources include incinerators and waste disposals, forest and agricultural fires (European Public Health Alliance, 2009). In most of the Nigerian cities CBD's increase in concentration of automobiles and electrical generating sets emit gases

into the atmosphere, this creates a unique micro climate at the CBDs that differ with immediate surrounding residential neighbourhood.

b. Water pollution

The water we drink is essential ingredients for our wellbeing and a healthy life. Unfortunately polluted water and air are common throughout the world (European Public Health Alliance, 2009). The WHO (World Health Organization) states that one sixth of the world's population; approximately 1.1 billion people do not have access to safe water and 2.4 billion lack basic sanitation (European Public Health Alliance, 2009). Polluted water consists of Industrial effluents, sewage water, rain water pollution (Ashraf, M. A., Maah, M. J., Yusoff, I. & Mehmood, K, 2010) and pollution by agriculture or households cause damage to human health or the environment (European Public Health Alliance, 2009). This pollution affects the health and quality of soils and vegetation (Carter, 1985), Some water pollution affects are recognized immediately, whereas others do not show up for months or years (Ashraf *et al*, 2010).

Estimation indicates that more than fifty countries of the world with an area of twenty million hectares area are treated with polluted or partially treated polluted water including parts of all continents (Avdeev and Korchagin, 1994; Carter, 1985; Kan, 2009; Khan, 2010; Krześlak and Korytkowski, 1994; Wu, 1999) and this poor quality water causes health hazard and death of human being, aquatic life and also disturbs the production of different crops (Scipeeps, 2009; Ashraf *et al*, 2010). In fact, the effects of water pollution are said to be the leading cause of death for humans across the globe, moreover, water pollution affects our oceans, lakes, rivers, and drinking water, making it a widespread and global concern. A drinking water contained a

fluoride content ranging from 5.26 to 26.32 milligrams per litre and this is too high as compared to the World Health Organization's standard of 0.6 to 1.7 milligram per litre (Rizvi, 2000).

In Nigeria, due to increased population and industrialization, solid and liquid waste generated from commercial activities and public convenience in CBDs are washed into rivers and canals by flowing rain water. The untreated industrial and municipal wastes have created multiple environmental hazards for mankind, irrigation, drinking and sustenance of aquatic life. The drainage water contains heavy metals in addition to biological contaminations. This water pollution infected our food in addition to groundwater contamination when used to irrigate crops

c. Land Pollution

Land pollution is one of the major forms of environmental catastrophe our world is facing today (Khan, 2004). As Bulgaria and the Slovak Republic, heavy metal industries have produced wastes that are deposited into landfills without special precautions (Lenkova and Vargova, 1994). Cucu *et al* (1994) posit that approximately half of the population lives in the vicinity of waste sites that do not conform to contemporary standards in Romania. Czech Republic's coal and uranium mines have produced serious pollution problems, and much of the solid industrial waste containing heavy metals is disposed of, without pre-treatment, in open dumps (Rushbrook, 1994). Harvath and Hegedus (1994) concluded as the worst pollution of Hungary comes from open cast mines, lignite-based power plants, chemical factories, and the aluminium industry. The Silesia district in the south of Poland has severe contamination from mining and industry (Krześlak and Korytkowski, 1994). Avdeev and Korchagin (1994) conceived soil pollution is critical issues in Ukraine. World Bank (2002) found Particulate matter is the most serious pollutant in large cities in South Asia.

Solid wastes comprise all the wastes arising from human and animal activities that are normally solid, discarded as useless or unwanted. Also included are by- products of process lines or materials that may be required by law to be disposed of (Okecha 2000). Solid waste can be classified in a number of ways, on the basis of sources, environmental risks, utility and physical property. On the basis of source, solid wastes are again classified as: municipal solid wastes, industrial solid wastes and agricultural solid wastes. Nigeria's major urban centres are today fighting to clear mounting heaps of solid waste from their environments. As a result, urban residents are often confronted with the hazardous impact to their collective health and safety. The hue and cry over the health consequences of exposed and fermenting rubbish have not been quantified, although their impact is noticeable, especially in times of epidemic in congested activity nuclei civic centres, CBDS, neighbourhoods', etc. Generally, it would appear that the growth of urbanization and industrial development coupled with improper wastes management control have added a great dimension to land area pollution in Nigeria's CBDs .

2.5 ENVIRONMENTAL PROBLEM AND LAND USE ACTIVITIES WITHIN THE CENTRAL BUSINESS DISTRICT IN NIGERIA

Land is a convenient measure of space, and land use provides a spatial accounting framework for urban development and activities. The distribution of land uses within a city varies greatly, but in general, cities consume about 3 percent of the total landmass at the global level. Although, variation exists on the distribution of land uses depending on the city, residential land-use is the most common occupying between 65 – 75 percent of the surface of a city. Commercial and industrial land uses occupy 5 – 15 percent and 15 – 25 percent of the surface

respectively. Each type of land-use has its own specific activities; transportation is a factor of activity location and is therefore associated intimately with land use (Aderamo, 2012).

One of the most visible features of global cities and their supremacy in national economies are Central Business Districts (Sassen, 2001 and 2002; Drozdz and Appert, 2010). Originating in industrial America, the term CBD was used to describe the downtown of American cities in the 19th century (Pitzl, 2004) but was diffused to the rest of the western world in the following decades. Although settled as a geographic concept, the CBD is difficult to define. Definitions are qualitative such as the CBD is "the nucleus … of an urban area that contains the main concentration of commercial land use" (McColl, 2005, p. 159) or a "unique area of massive concentration of activities and focus for the polarisation of capital, economic and financial activities in cities" (Drozdz and Appert, 2010, p.2).

Central Business District (CBD) is the hub of business and civic life and it exhibits certain distinct physical and human features, which distinguishes it from surrounding areas. CBD always shows dynamic nature in its morphology, structure, shape and size and in social patterns to meet the changing economic conditions. This dynamic nature of the CBD can be seen through the zone of assimilation and the zone of discard at the centre (Sidharta and Mukherjee 2009). The Central Business District is referred to as the heart of the city; it is the most highly urbanized area which ideally should contain a complete range of the highest productive use and the most significant urban functions. Here one finds the greatest concentration of offices and retail stores reflected in the city's highest land values and its tallest buildings, chief focus of pedestrian and auto-mobile traffic. In any large urban community the central business district (CBD) plays a vital role. It would be impossible to understand the functioning of such a community without

analysing in some detail the ways in which the CBD serves as an integrating mechanism in such vital areas as communication, transportation, trade, finance and government (Donald and Gerald 1951). Physical and environmental problem of CBDs include conflicting land uses such as the infiltration of commercial land use into areas allocated for housing, complete metamorphosis of residential land use into commercial land use; poor aesthetics and unsightly cityscapes; Infrastructure problems include narrow and poorly constructed roads, mostly without provision for drainage. Other environmental problems include traffic congestion, pollution (noise, atmospheric and water) and land degradation.

In Nigeria, an increased level of consciousness is observable with regard to the complex relationship that exists between development and the quality of the environment. However, there remains much to be done by way of actually developing the mechanism and legislative backing for reconciling environmental imperatives with developmental goals. Urbanization has been the dominant demographic trend in the entire world, during the last half century; Nigeria is one of the countries in the developing world with rapid urbanization and fast growing cities with the high pace of social and economic development. Nigeria, like many other developing countries, is beset with environmental problems, Mba et al (eds) (2004) identified several types of environmental problems associated with rapid urbanization and classified them as ecological, poaching and habitat loss, increasing desertification and soil erosion. These are further subdivided into pollution, deforestation, global warming and slum development, lack of infrastructure, congested traffic, environmental degradation and housing shortage. It has been established that these problems emanate mainly from human activities created in the quest to achieve a higher level of development. The implication is that sufficient precautions have not

been taken to balance development objectives against the need to maintain desirable environmental quality.

Nigerian cities and towns CBDs are associated with several environmental problems generally caused by rapid urbanization process, general population growth, economic activities and planning issues, beyond the carrying capacity of facilities and services. These among other factors result into conjunction cause by inadequate and in some case total lack of parking space, as such facilities are not been provided. The roadside commercial activities encroaching into the right of way thus pushing pedestrians into road space, coupled with on street/ off-street parking reducing road width, street hawkers further complicate the problem. These result into serious traffic delay, vehicle emissions, Solid waste, and Noise pollution among other related issues (Sokumba 1980, Kude 1988, Haruna 1993 and Samson 2012).

CHAPTER THREE: THE SYUDY AREA AND METHODOLOGY

3.1 STUDY AREA

3.1.1 LOCATION

Zaria is located on the vast undulating plain of northern Nigeria at a height of about 670 meters above mean sea level in the center of northern Nigeria, (Mortimore, 1970). It geographical position is located between longitude of 7^0 36' 00''E and latitude of about 11^0 02' 00'' – 11^0 12' 00'' N. Zaria is the second largest city in Kaduna state and lays northeast of Kaduna main town (see fig. 1), it has become a nodal point both in terms of rail and road transportation. It covers a total area of about 6100 hectares of arable land (Ajibade 1999). In terms of population by the demographic census of 1952 the region has a total population of about 92,434 people and the population rose to about 695,069 people in 2007 (NPC, 2007).

3.1.2. CLIMATE

Zaria region lies within the tropical savannah (Koppens classification) which is a tropical continental climate and according to Thorntwaite's moisture index, dry sub humid climate. It has a distinct wet (rainy) season which last from May – October, coinciding with high sun period and cool dry (harmattan) season from November – March respectively. The seasonality of the climate is ensured by the movement of the inter-tropical discontinuity (ITD). The rhythm of the dry and rainy season is controlled by the interplay of the tropical continental air mass which comes from the northeast and across the Sahara, and the tropical maritime air mass which comes from the southwest across the Atlantic Ocean. The boundaries between these two air masses forms the inter-tropical between two are masses forms the inter-tropical discontinuity (ITD) Hore (1970).

There are four seasons within the year (Hore, 1970). Dry/ Harmattan season (November - February), Heat season (March -April), Thunder storm and squalls (May- June), Rainy season

(July - October). The mean daily minimum temperature also rises from its lowest value of 11^0c in December, to January with the highest in July to August having 40^0c.

3.1.3 RELIEF

The major relief of Zaria shows the presence of residual granite inselberg, the largest being the Kufena and Hanye hills which rise abruptly above the infinite falling plain. The landscape of Zaria is dissected portion of the Zaria – Kano plain which developed on the crystalline rock of the ancient basement complex rocks (Wright and Mercury, 1972). This undulating plain encompasses the colonial settlement which is presently the Sabon Gari area. The basement complex which made up the bedrock is chiefly of gneisses and older granites. Furthermore, the vast gentle undulating plain has become highly dissected by the Galma River and its tributaries which comprise of the Kubanni, shika, saye and Yashi rivers.

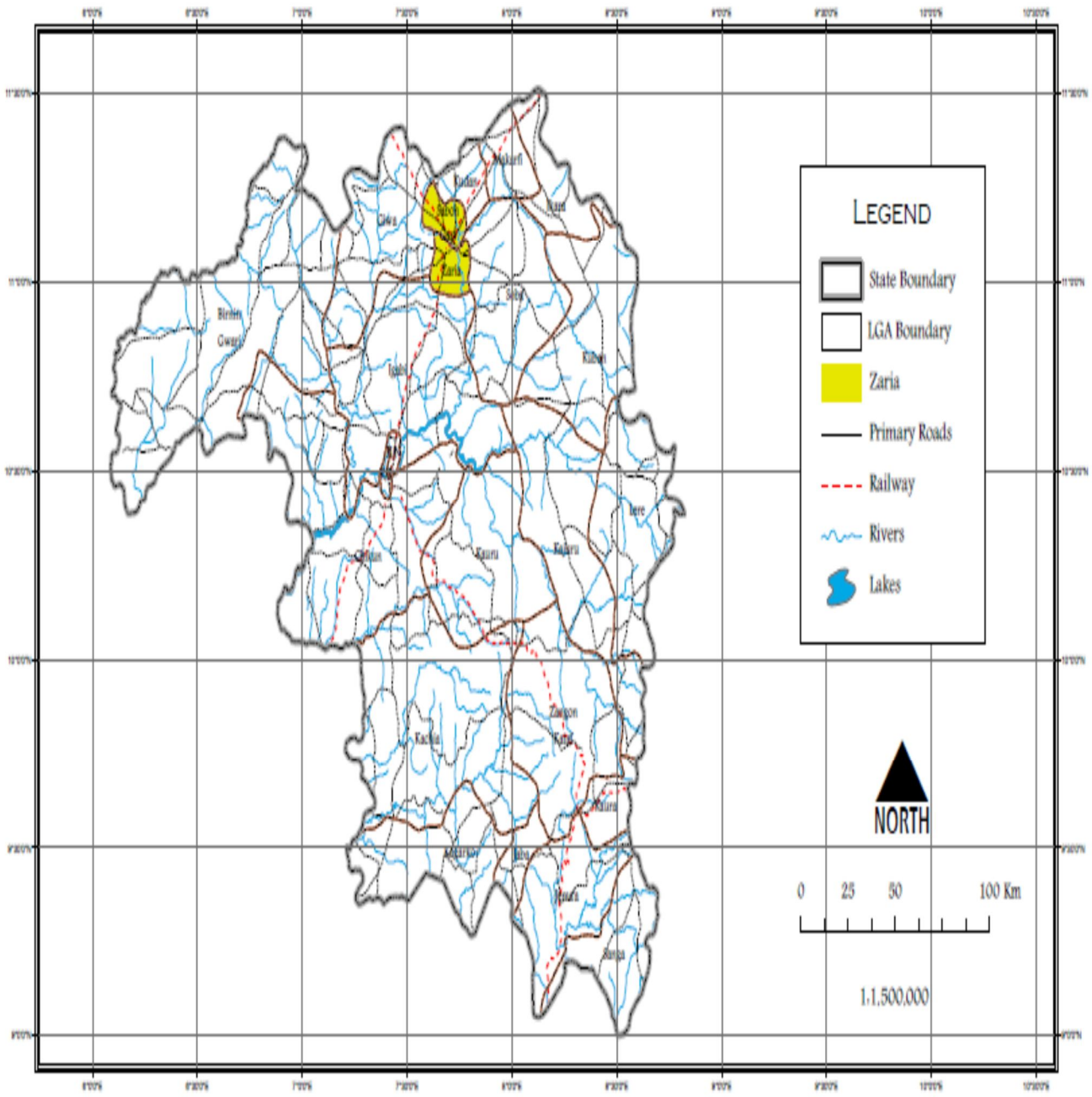


FIG. 3.1: LOCATION OF ZARIA IN KADUNA STATE

3.1.4 ZARIA AS AN URBAN AND ECONOMIC CENTRE

The relationship between Zaria and its hinterland is based in both the Emir's personality and the town's central position to northern Nigeria as a whole; Zaria's position was confirmed after the British occupation in 1902. In recent time, Zaria has also become an important center for marketing and processing of agricultural products as well as educational and research center. This has reflected in the steady growth in size and population of the urban area. Some of the educational institutions found in Zaria include, the Barewa College, College of Arts and Social Science currently known as Nuhu Bamalli Polytechnic, Nigerian College of Aviation and Technology, Nigeria institute of Transport and Technology, Ahmadu Bello University Zaria, Federal College of Chemical and leather Technology and Federal College of Education Zaria etc. Zaria also serves as a center for other functions that include administrative activities, although Zaria has two local government areas, that is, Zaria Local Government and Sabon Gari Local Government Areas, each having a separate headquarter. Commercial functions include banks, industries (British American Tobacco, Oil Mill, pioneer seeds, UAC seeds, Alheri brand seeds), shops, eateries, hotels etc. All these functions are located within the central business district, which is the hub of commercial activities (see fig 2). All these contributed in one way or the other to explain the centrality of Zaria in relation to it's environ and neighboring rural communities, (Mortimore 1970).

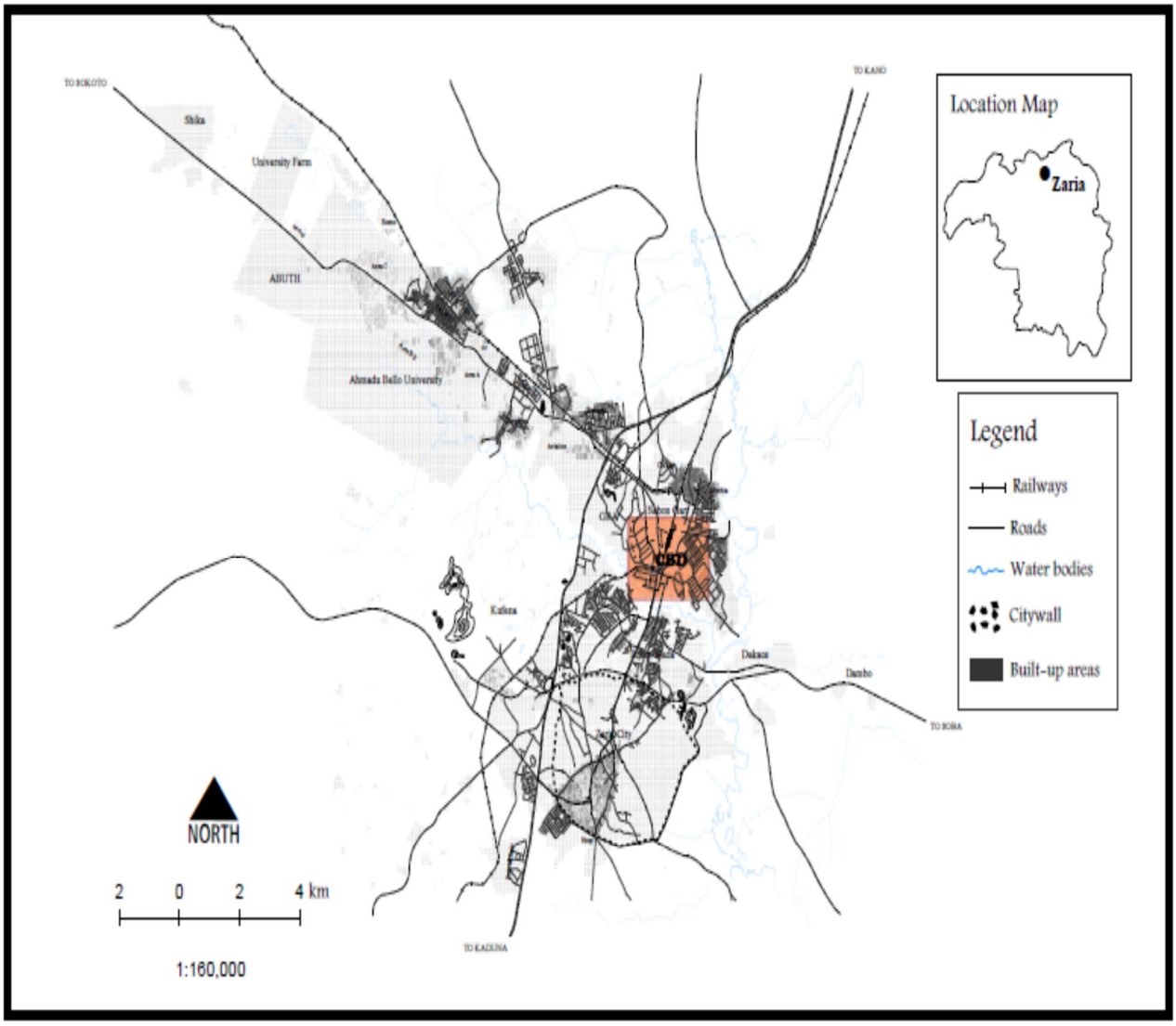


FIG. 3.2: LOCATION OF CENTRAL BUSINESS DISTRICT IN ZARIA URBAN AREA

3.1.5 ZARIA CENTRAL BUSINESS DISTRICT

The Zaria central business district area lies within the Sabon Gari district between latitude 11°N and 11°w of the equator and longitude 7°50`E and 7°40` west of the Greenwich meridian. It is bounded on the north by the Park Road, in the south by the Kubanni River. From the west is Bank Road and from the east by crescent and park roads which are lined by an array of retail shops (see fig 3). It covers a total area of 205.04 hectares (Emmanuel, 2004). The historical development of the CBD can be traced back to the arrival of railway to Zaria in February 1911. The colonial administration laid out of the area for whole sale and retail shops managed by large commercial firms. The first commercial interest in the area was the British cotton growing association (BCGA), it was followed by the Niger Company with a ware house near the BCGA. Both companies were concerned with buying local products for exports.

The new railway, ginnery and the trading firm all required laborers to build their facilities. To supply the need of those laborers many traders came, especially from the south. All these contributed to the growth of the area and also at that time, it was envisaged that Zaria will be the future capital of northern Nigeria so more and more traders came to the central area anticipating boom in business. Administrative functions were built at the central area in 1913 such as agricultural department, public works department now ministry of works. With more commercial activities in the area, banks establishes branches such as the British bank of west Africa now first bank, firms expanded on either sides in 1926, such as PZ office.

In the 1950's, several firms occupied warff road, main street, park roads extended to Main street making it a commercial area. More commercial and institutional offices have been established among these were NITEL, post office and police station (Emmanuel, 2004).

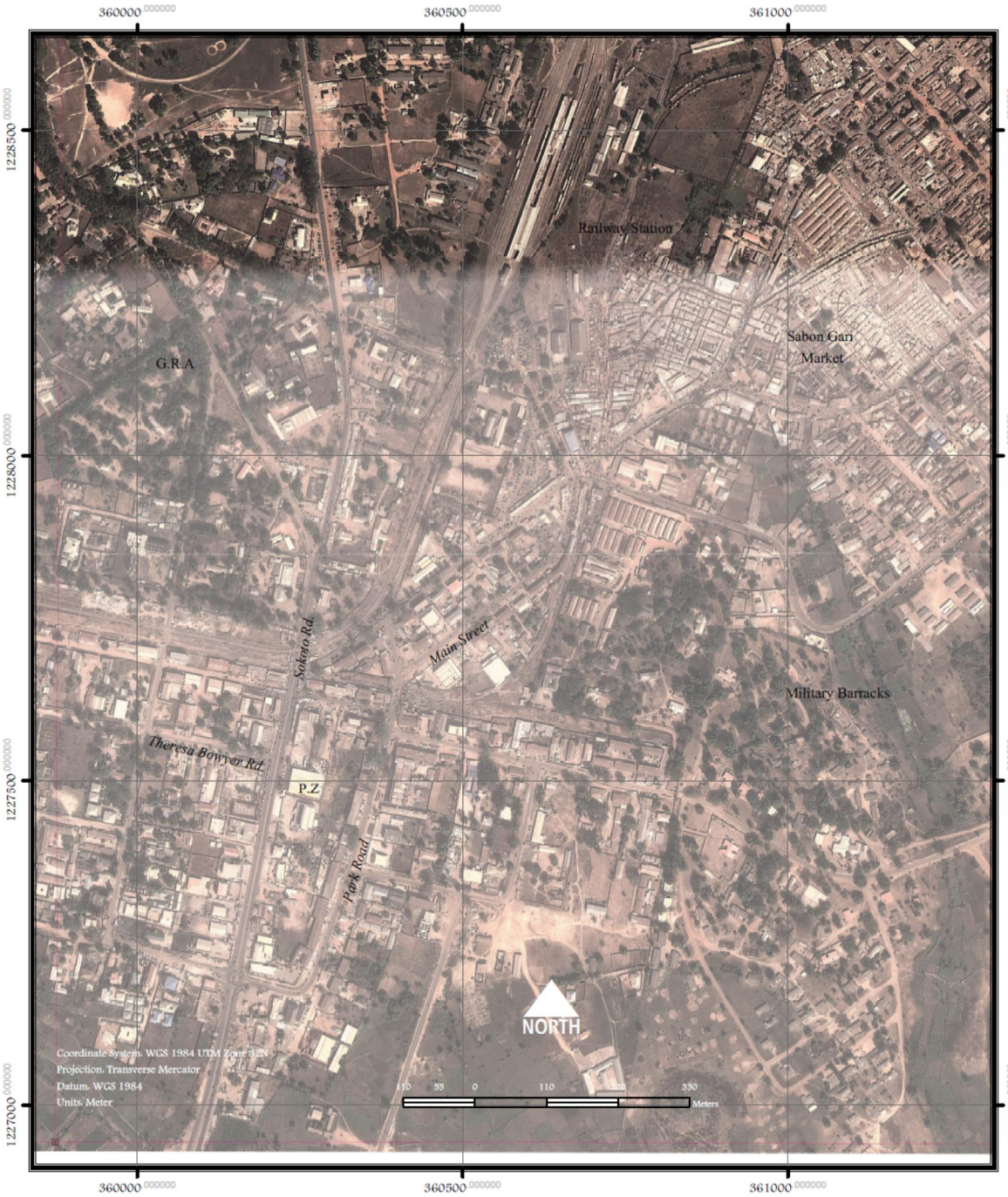


FIG.3.3: AERIAL PHOTOGRAPH OF CENTRAL BUSINESS DISTRICT, ZARIA

3.1.7 EXISTING LAND USE STRUCTURE

There are four major land uses in the Zaria central area, they include; commercial land use, public and semipublic, mixed land use and residential land use (see fig 4).

I. Commercial land use

This is the major land use in the CBD, it consists of the modern market which falls between Aminu road and hospital road junction and major shopping streets of Crescent Street, waff road, Main Street and Sokoto road, park road and IBB road. Over 80% of the land use in the area is commercial. The major commercial uses are engage in retail and whole sale activities.

II Public and semi public

There are few public and semipublic land uses within the central area, post station, police stations, NEPA, NITEL, ministry of works, primary and secondary schools.

III mixed land use

The mixed land use is commercial and residential. Shops are used both for commercial and residential purposes, in a few shops surveyed some had beds behind counter, such shops have single room while others have two rooms, the first room is used as shop while the second room is used for storage and living purpose. In other cases, it is a two storey building, ground floor is used for commercial purposes and the first floor is used for residential purposes.

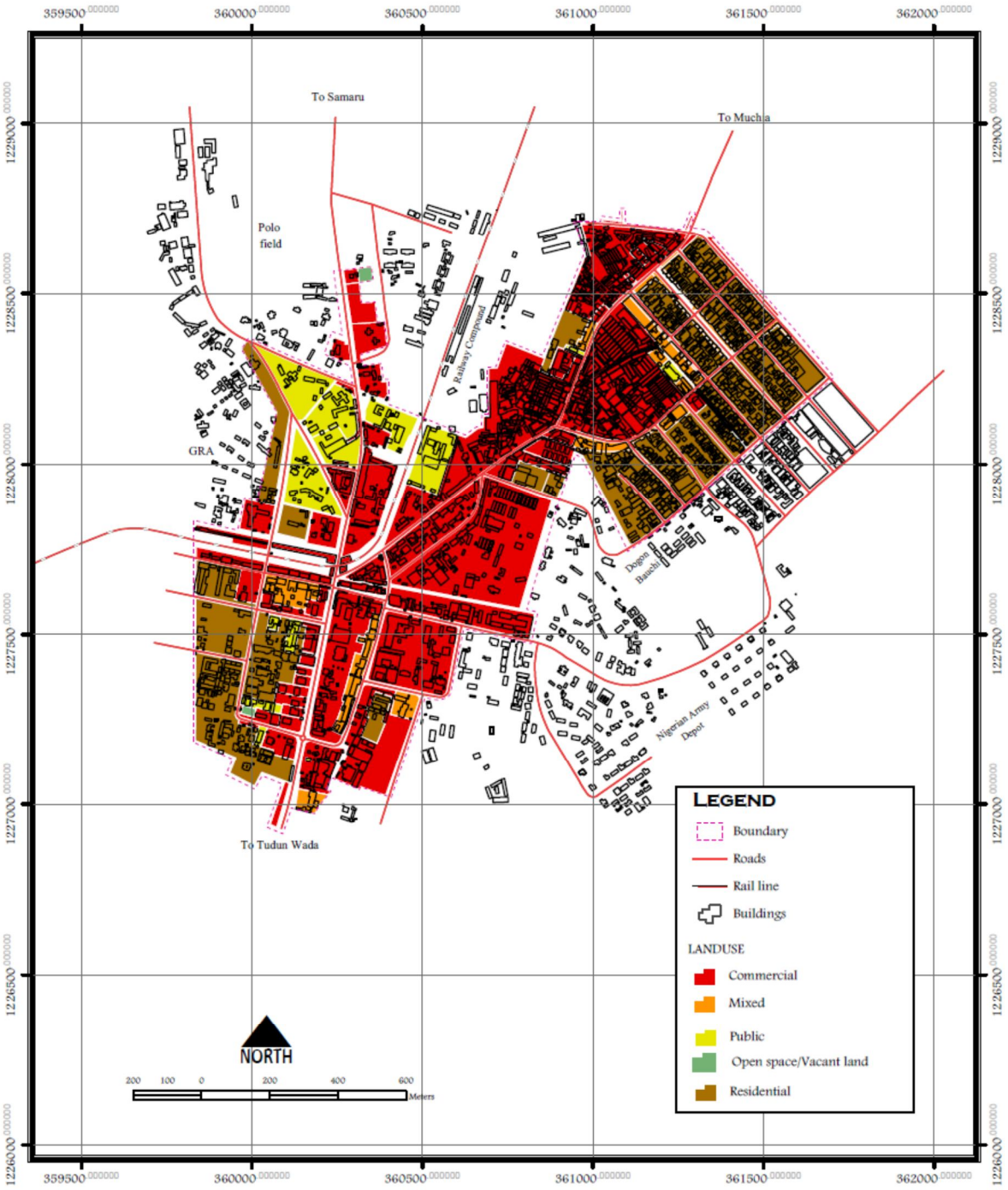


FIG.3.4: LAND USE PATTERN OF THE CENTRAL BUSINESS DISTRICT, ZARIA

3.2 METHODOLOGY

This section provides explanation of the nature of data required, sources and methods of data collection for effective results and analysis.

3.2.1 Data types and sources

Type of data collected for this study consist of land use map of the study area, land use types, activity types, field and social survey information, observation.

The information required for this study was acquired through primary and secondary sources.

i. Primary Sources: A reconnaissance survey of the study area was carried out in order to identify the different types of land use categories, within the CBD using the existing land use map of the area as a guide. The activities carried out by individual land uses was also determined so as to ascertain the type and level of environmental problems it impacts.

A well-structured questionnaire was administered to individual owners/users of land use to obtain information on environmental problems created by land use activities in the study area. The questionnaire was divided in two sections, Section A consist of the socio economic characteristics of respondents and Section B of the questionnaire consist of data on the type of land uses, its activities and the environmental problems it generate.

Oral Interviews with land users/owners within the study area was also conducted to obtain information to support and supplement information obtained from the questionnaire so as to aid finding.

ii. Secondary Source: The information required for the review was collected through the following sources;

i. Published National and International Journals.

ii. Published and Unpublished Reports, Projects, Thesis and Dissertation.

iii. Seminar papers, Annals of statistical record, textbooks and internet.

This was done to obtain relevant information to develop literature review, study area and to support findings.

3.2.2 Classification of land use activities

The commercial land use activities in the study area are very large in terms of number and types of activities, hence a need for classification. The commercial land use activities are classified into ten (10) class base on its industrial and production system. These classes are;

1. Food and food stuff: these include all activities related to food such as provision, drinks, whole grains, perishables, cool houses etc.
2. Construction and building materials: activities related to this class are building materials, cement, block industry, paints, aluminum product, steel products, toilet fittings, doors and window fittings etc.
3. Hotels and eateries: activities in this class comprise of guest inn, hotels, restaurants, roadside food joint etc.
4. Electronics: activities related to this class include mobiles phones, accessories and repairs, computers products and repairs, electronics, electrical fittings, repairs etc.
5. Petrochemicals: activities related to this class are filling station, fertilizer dealers, agro chemicals, rubber and leather industry, industrial gas etc.

6. Services: these activities are banks, cyber café, telecommunications, consultancy services, photo shop, bureau de change, electrical engineering etc.
7. Fabrics and design: This class includes activities like boutiques, fabrics, baby items, cosmetics etc.
8. Automobiles: activities in this class includes motor spare parts and repairs, scrap items, vulcanizer etc.
9. Furniture and household utilities: activities include kitchen ware, furniture and furniture factory, etc.
10. Stationary: books and school related materials.

3.2.3 Sampling technique

For the purpose of this research, the central business district is divided into three zones based on the intensity and type of activities. These zones are zone A, zone B and zone C (see fig. 5).

I. Zone A is the area around Sabon Gari central market. It is basically a commercial area where 90% of shopping is done; it falls between Aminu Road and Hospital Road.

II. Zone B is the area around crescent road, Main Street, park road and Rwarff road. The area is predominantly commercial and mixed land use, the commercial activity is 80% business/banking activity. While the mixed land use is residential /commercial and schools/shops.

III. Zone C is the area around Sokoto road, IBB Street, Theresa Bowyer Street and Manchester road. The area is comprised of public/semi-public land use, commercial land use and residential land use. Public/semi-public include post office, PHCN, FRSC, schools etc. commercial land use include banks, eateries, shopping mall, shops etc.

The population of zone A is very large having 2500 individual population according to tax offices figures, thus there is no available detail information on individual commercial land use activities. Therefore sample within this zone was selected from each of the land use classification, the total sample selected from each class is proportional to its size, where individual samples was selected at the count of every 25^{th} individuals where 1% of the total population was selected as sample. Therefore in case of zone B and C where the sample frame is not known, 100 samples were selected from each zone and were issued questionnaires, but a total number of 97 and 94 questionnaires were filled adequately in zones B and C respectively. Purposive sampling technique was used for these zones, questionnaires were issued to banks and filling stations which involve the selection of every alternative bank/filling station on both sides of the streets because all the banks render the same service. As well as to other activities such as furniture factory, kitchen ware shops, electronics shop etc. that do not render same services in order to cover all the activities as some of the activities within the CBD are not organized.

The population for the research consists of all the stakeholders relevant to the study, these include the owners and users of individual land uses within the CBD.

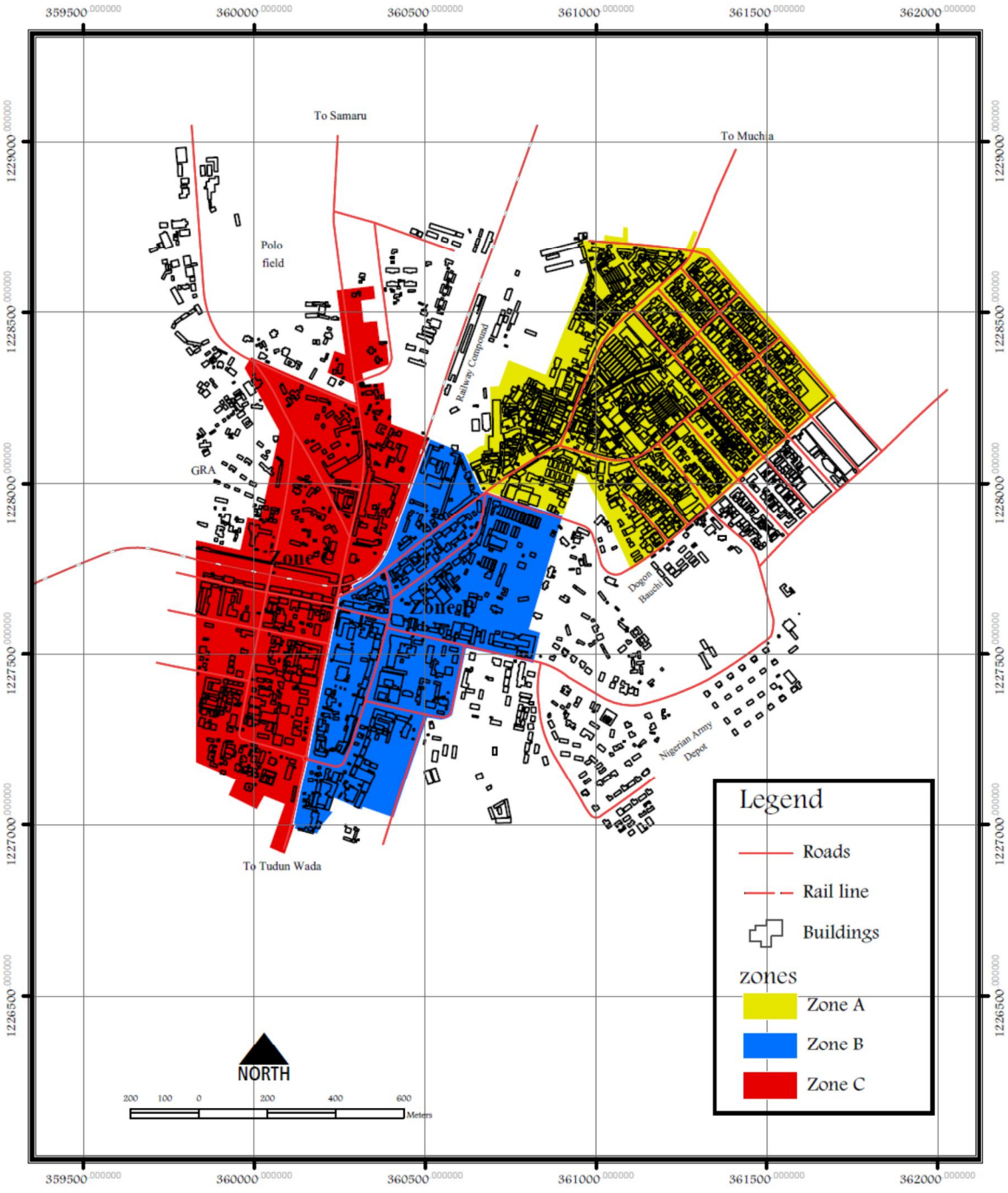


FIG.3.5: ZONES OF THE CENTRAL BUSINESS DISTRICT, ZARIA

3.2.4 Data analysis

Different analytical techniques aimed at achieving the specific aim and objectives of this study were adopted, objective one involved the use of a high resolution image of the study area which was obtained from Google Earth, the image was imported into ArcGis for the analysis. The downloaded high resolution image was geo-referenced to WSG 1889, UTM, Minna Zone 32 datum. Various land use activities within the CBD were identified through ground truthing, the land use activities were mapped out and the area measures of various land use type was calculated.

Simple descriptive statistics was used for the interpretation of the data for objectives two and three. The data obtained from questionnaires such as socio economic characteristics, land use activities and the environmental condition of the CBD was analyzed using tables.

While objective four was analyzed using the inferential statistic, correlation analysis was used to determine the relationship between land use activities and environmental problems. Correlation analysis was used to determine the relationship between different commercial land use activities and environmental problems in Zaria central business district. Correlation coefficient is a single summary number that tells whether a relationship exists between two variables and how strong that relationship is and whether the relationship is positive or negative (Chap, 2003). Land use activities and environmental problems are considered as individual variables in which a relationship would be determined between these two variables. Land use activities which was categorized into 10 categories each will be measured to environmental problems, the environmental problems identified in the course of these study is four which are land pollution, air pollution, noise pollution and traffic congestion. Each of these problems will be associated with individual land use categories to establish if a relationship exists between the

two variables, how strong the relationship is and whether the relationship is positive or negative. The formula below is used for the correlation coefficient.

$$r = \frac{\sum x_1 x_{2--------} x_n - \frac{\sum x_1 x_{2--------} x_n}{n}}{\sqrt{\left[\sum x_1^2 - \frac{(\sum x_1)^2}{n}\right]\left[\sum x_2^2 - \frac{(x_2)^2}{n}\right]}}$$

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 LAND USE ACTIVITIES WITHIN THE CENTRAL BUSINESS DISTRICT

4.1.1 Zone A

Zone A is basically the area around the main central market that falls between Hospital Road and Aminu Road within the Zaria CBD. This is the largest market in Zaria and it has a lot of influence in all the neighborhoods in Zaria and surrounding villages. This market supports bustling commercial activities and generates a lot of revenue to the government. Commercial activities are found in areas close to the market like Lagos Street, Benin Street, Yoruba street, Club Street and Main Street.

Virtually all kinds of house hold products, foodstuffs, pharmaceuticals, textile materials, footwear, jewelries, clothing, second hand clothes, plastics, simple farm implements and building materials are sold in this market. Most of the goods sold in this market like textile materials, footwear, jewelries and clothing are bought from Kano. Some other goods come from Lagos, Onitsha, Enugu and Port Harcourt. Printing presses are found along Lagos Street, Benin Street, Yoruba street and Liquors are sold around Club Street, and also a cold room fish depot is also located in this area. The goods sold in this area come from mainly Onitsha, Lagos and Enugu.

According to the tax revenue office in the central market, there are about 2,500 shops in the market, and the market is divided into segment A and B for easier identification.

4.1.2 Zone B

This zone comprised of Main Street, Park road and Waff road as shown in table 4.1, 4.2 and 4.3.

Table 4.1 Land use activities along Park road

Category of land use	Types of activities on land use	Number of land use activities
Mixed land use	Block of flats and shops	11
	School (pace setter Nur, primary & sec.) and shops	
Commercial land use	Banks; sky bank, fidelity	125
	Petrol filling station; Oando	
	Hotels; immaculate hotel, royal guest inn	
	Shops; furniture, cyber café, electronics, electrical fitting, provision, bookshop, boutique, photo shop, barbing shop, paint, computer business center, telecommunication shops, building materials, cd shops.	

Source; Author (2013)

Table 4.2 Land use activities along Waff road

Category of land use	Type of activities on land use	Number of land use activities
Public and semi-public land use	Hospital; Nana specialist hospital	1
Mixed land use	Houses and offices	8
Commercial land use	Shops; fertilizer, provision Temporary stalls; suya joint, fruit.	30

Source; Author (2013)

Table 4.3 Land use activities along Main Street

Category of land use	Type of activities on land use	Number of land use activities
Public and semi-public land use	MJM Nur. & pri. school Youngster Academy New era Intrl. school Savannah school Mayfair clinic	5
Mixed land use	Residential houses and shops	8
Commercial land use	Banks; first bank, unity bank, FCMB	147
	Petrol stations; MRS, Fasada, Total, Mobil	
	Company; albabello trading company (building materials) African alliance insurance company. Shops; cool houses, paint, computers, bookshops, building materials, provisions, electrical equipment, cement, boutique, agrochemicals, aluminum doors, motor spare part, scrap items, electronics and electrical fittings, consultancy services, baby items, bureau de change, motor cycle repairs, spare part, break/engine fluids, motor cycles, bikes, furniture, phone services and accessories, telecommunication, vulcanizer, used items such back packs and shoes, bus stop, (temporary stall)	

Source; Author (2013)

Land use categories in zone B include commercial land use, public/semipublic land use and mixed land use. Mixed land use within this zone ranges from 2 to 3 storey buildings, with shops at the ground floor and residential flats or in some cases schools and offices at the first/second storey. Public/semipublic land use within the zone comprise of hospitals, nursery, primary and secondary schools. Number of hospital and clinics are two, number of schools

within the zone are 5. Commercial land use is the dominant land use in the zone, this constitute banks, filling stations, hotels, companies and shops. Number of banks within this zone are 5, 2 hotels and 2 companies. Shops comprise of furniture factory/ furniture show room, cyber café, electronics/electrical fittings, provisions, bookshops, boutique, computer business center, building materials, barbing saloon, photo studio, agrochemicals, suya joint, agrochemicals, baby items, bureau de change and motor cycle repairs/spare parts.

4.1.3 Zone C

This zone comprised of Sokoto road, Manchester road, Theresa Bowyer road and IBB street as shown in table 4.4, 4.5, 4.6 and 4.7.

Table 4.4 Land use activities along Sokoto road

Category of land use	Types of activities on land use	Number of land use activities
Public and semipublic use	Kaduna state board of internal revenue	**7**
	FRSC (federal road safety corps)	
	PHCN	
	Nigerian association of road transport owners (NATO)	
	Nigerian security and civil defence	
	Sigma pension	
	Post office	
Commercial land use	Banks; Union, first city monument bank, keystone bank, Ecobank, Stanbic IBTC, U.B.A, Diamond, Zenith and Maintreet bank.	110
	Petrol Filling station; Oando, Total and Mobil	
	Eateries; Mr biggs, Chop house, Las vegas, chicken republic and el-hayat	
	Shopping mall; city plaza	
	Shops; Cyber café, boutique, industrial gas, electronics and electrical fittings, steel products, fabrics, furniture, kitchen ware, mobile phones and accessories, cosmetics, construction materials, block industries, fruits. Temporary stalls; shoe sellers, vulcanizer, food joint,	

Source; Author (2013)

Table 4.5 Land use activities along Manchester road

Category of land use	Types of activities on land use	Number of land use activities
Residential land use	Flats and duplex	10
Public and semi-public land use	FIRS, Globacom office	6
	School; therbow school, great hallmark.	
	Hospital; pal clinic, ultra scan diagnostic.	
Commercial land use	Banks; Gtbank, Diamond, Access	12
	Shops; perfume, computer engineering, media consultants, drinks, block industry.	
	Roadside hawkers; recharge cards, engine oil.	

Source; Author (2013)

Table 4.6 Land use activities along Theresa Bowyer Street

Category of land use	Types of activities on land use	Number of land use activities
Public and semi-public land use	School; Therbow school	2
	Starcoms telecommunication office	
Commercial land use	Red onions garden and club	15
	Milton bicycle distributors	
	Shop; perfumes, furniture, media consultants, computer engineering, cyber café.	
	Temporary stalls; perishables (tomatoes), fish joint.	

Source; Author (2013)

Table 4.7 Land use activities along IBB Street

Category of land use	Type of activities on land use	Number of land use activities
Commercial land use	Restaurant; peters, beer parlors	8
	Shops; drinks, provisions, block industry	

Source; Author (2013)

Land use categories within zone C are residential, public/semipublic land use and commercial land use. The residential land uses are majorly flats and duplex and are located at the periphery of the CBD along Queen Elizabeth road. Public/semipublic are government institution, private institutions, schools and hospitals. Number of schools are 2, government/private institutions are 7 in number. Commercial land use within this zone comprise of banks, filling stations, eateries, shopping mall and shops. Number of banks are 11, number of filling stations are 3, eateries are 7 in number. Shops comprise of cyber café, boutiques, furniture, electrical fittings and electronics, fabrics, kitchen ware, construction materials, block industries, media consultants, temporary stalls, provisions and mobile phones and accessories.

4.2 SOCIO-ECONOMIC CHARACTERISTICS OF RESPONDENTS

The reconnaissance survey indicates that the majority of respondents within the study area attained secondary school as presented in table 4.8 with 40% in zone A, 35.8% in zone B and 42.2% of respondent in zone C. While 32%, 35.8% and 31.1% of respondents in the three zones attained tertiary education. The income level is highest in zone A and B with 48% and 40.2% of respondents respectively earn a monthly income of N41,000 and above monthly. While in zone C 40% of the population's income ranges between N31,000- N40,000 monthly. The survey indicates that the majority of population within the CBD are educated in one form of education or the other, so is expected that they should know the consequences or effects of their activities on the environment, but so is not the case, even with the prior knowledge of the effects, their activities still generate environmental problems.

Table 4.8: Socio-economic characteristics

S/N	BIO-DATA	ZONE A		ZONE B		ZONE C	
		FRQ	%	FRQ	%	FRQ	%
1	EDUCATION						
A	Non formal education	8	8	23	23	18	18
B	Primary education	20	20	26	26	38	38
C	Secondary education	40	40	24	24	19	19
D	Tertiary education	32	32	24	24	14	14
E	Others	-	-	3	3	11	11
2	INCOME						
A	Less than 10,000	8	8	2	3	3	6.7
B	11,000 - 20,000	8	8	6	9	2	4.4
C	21,000 - 30,000	12	12	6	9	9	20
D	31,000 - 40,000	24	24	26	38.8	18	40
E	41,000 and above	48	48	27	40.2	13	28.9

Source; Author (2013)

4.3 LAND USE ACTIVITIES AND ASSOCIATED ENVIRONMENTAL PROBLEMS

Zaria Central business district like any other CBD is the hub of business as well as the heart of city. Greatest concentration of land uses especially commercial land use is the dominant type of land use found within the CBD. These land uses generally contributes to the economic development of Zaria as a whole, but its activities affects the environment negatively. The negative effects of land use activities on the environment within the CBD was analyzed and discussed according to Zone A, B and C.

4.3.1 Land use activities and environmental problems in zone A

Zone A is the zone that comprise of the Sabon Gari market within the Zaria CBD. Land use activities within this zone affect the environment in one way or the other negatively resulting to environmental problems. Environmental problems within zone A ranges from land pollution, air pollution, noise pollution and traffic congestion. These are presented in table 4.9.

Table 4.9 Environmental problems within zone A

S/N	ENVIRONMENTAL PROBLEMS	FRQ	%
1	Land pollution	64	53.3
2	Air pollution	20	16.7
3	Noise pollution	20	16.7
4	Traffic Congestion	16	13.3
		120*	100

*Multiple respondents/options

Source; Author (2013)

4.3.1.1 Land pollution

The oral interview conducted with the market officials revealed that a daily sanitation is carried out every morning before the start of business activities. Despite this sanitation, liters of waste can be seen all around the zone. The land pollution generated by land use activities within this zone comes in two forms; solid and liquid waste. Solid waste generated within this zone can be attributed partly by lack of adherence to daily sanitation as seen by some of the land users especially at the periphery of the market and partly by the customer's attitude as revealed by the survey.

4.3.1.1.1 Pollution from solid waste

It was observed that the nature of solid waste within this zone ranges from iron scraps, polythene, can/plastics, and cartons among others. 39% of land use activities generate polythene waste as presented in table 4.10. While 14% of the land use activities generates can/plastics.

Method of waste disposal is an important issue in every environment. About 42.2% of respondents within this zone indicate that their method of waste disposal is through packing and burning, the burning is done at designated points. While 35.9% of respondents indicate open dumping, open dumping is a good method of waste disposal if properly coordinated and equally

adds more problems to the environment if not properly coordinated. Open dumping as surveyed in this zone is not properly coordinated as indiscriminate dumping are seen around the zone, though it was revealed that a point of collection is made where the waste should be dump, but many do not make use of it. These acts do not just breathe disease but also hinders the aesthetic appearance of the zone.

Quantity of waste generated on a daily basis within this zone is less than 25kg as the waste are disposed off on a daily basis as indicated in table 4.10, while 28.9% of respondents dispose their waste weekly and 9.4% dispose their waste fortnightly. Also 7.8% of the respondents dispose their waste into gutters, this act eventually clogs the drainage and resulting to flooding during wet season.

Solid waste whether packing and burning or open dumping generally has effects on the environment, decomposition of waste into constituents chemicals is a common source of local environmental pollution. A major environmental concern is gas release by the decomposition of this garbage which is Methane, is a by-product of the anaerobic respiration of bacteria, and these bacteria thrive in landfills with high amounts of moisture. Another problem with the gases is their contribution to the enhanced greenhouse gas effects and climate change.

Table 4.10 Solid waste characteristics in zone A

S/N	SOLID WASTE	FRQ	%
1 A	Nature of waste Iron scrap	 5	 7.8
B	Polythene	25	39
C	Can/plastics	9	14
D	All	10	15.6
E	Other	15	23.4

2	Method of disposal	FRQ	%
A	Packing and burning	27	42.2
B	Open dumping	23	35.9
C	Dumped in gutters	5	7.8
D	Disposal bin	10	15.6
E	Others	-	-

3	Frequency of disposal	FRQ	%
A	Daily	40	62.5
B	Weekly	18	28.1
C	Fortnightly	6	9.4
D	Monthly	-	-

4	Quantity of waste daily	FRQ	%
A	Less than 25kg	48	75
B	50kg	12	18.8
C	100kg	4	6.2
D	150kg	-	-
E	Above 150kg	-	-

Source; Author (2013)

4.3.1.1.2 Pollution from liquid waste

Liquid waste in this zone is highly minimal compared to other zones within the CBD. The major source of liquid waste in this zone is discharge from broken drainages according to 75% of respondents in the table 4.11. This broken drainage results mostly from waste dump and sand fill of the drainages. While 25% of respondents indicates that their source of liquid waste is from discharge of particular activities, such as oil spills from mechanic repairs, spills from food stuffs such as vegetable /palm oil sellers, discharge from road side food joint etc. this discharge is mostly dispose in open spaces. But nevertheless it can have effect on the environment by way of unpleasant appearance as well as breeder ground for diseases to humans such as malaria and cholera.

4.11 liquid waste characteristics in zone A

S/N	LIQUID WASTE	FRQ	%
I A	Source of waste Discharge from sewerage	 -	 -
B	Discharge from particular activity	12	25
C	Discharge from broken drainages	36	75
D	Discharge from industrial waste	-	-

2	Method of disposal	FRQ	%
A	Open dumping	28	58.4
B	Drainage	12	25
C	Sewerage	4	8.3
D	Septic tank	4	8.3

3	Improper drainage function	FRQ	%
A	Dirt's dump	4	8
B	Sand fill	4	8
C	Broken drainage	20	42
D	Absence of drainage	20	42

Source; Author (2013)

4.3.1.2 Air pollution

The Survey revealed that source of air pollution within Zone A includes automobile discharge, smoke from refuse burning, smoke from particular activity and others. From table 4.12, it can be seen that the major source of air pollution is smoke from particular activity with 50%, these activities include smoke from heavy machineries, use of alternative source of electricity which is the generator set, most of the generator set used generates toxic fumes, these fumes when it accumulates in the air in high concentration, it pollutes the surrounding inform gaseous substance such as carbon dioxide, carbon monoxide, hydrocarbons, nitrogen oxides, sulfur oxides as well as causes discomfort and disease to humans such as heart problems, irritation to body, chest tightness and breathing difficulties.

Table 4.12 Air pollution in zone A

S/N	SOURCE OF POLLUTION	FRQ	%
A	Automobile discharge	6	30
B	Smoke from refuse burn	2	10
C	Smoke from particular activity	10	50
D	Others	2	10

Source; Author (2013)

4.3.1.3 Noise pollution

Noise pollution within zone A is mostly generated by passersby according to 60% of respondents in table 4.13, Though these sources of noise do not have much impact on the environment, it only causes discomfort to the human ears' as such noise is expected within the zone because it is a market zone. While 40% of respondents indicates that automobile engine is the source of noise pollution within the zone. Noise pollution regardless of high or low can be annoying and disturbing to the human environment, noise results in hearing difficulties and interpretation to the clarity of words.

Table 4.13 Noise pollution characteristics in zone A

S/N	SOURCE OF NOISE POLLUTION	FRQ	%
A	Automobile engine	8	40
B	Passers by	12	60
C	Others	-	-

Source; Author (2013)

4.3.1.4 Traffic congestion

Land use activities contribute to traffic congestion within this zone especially land use activities along roads, their activities encroached unto the road reducing the road width, thereby limiting movement of vehicles. Another factor responsible for traffic congestion in this zone is the issue of unreserved parking facilities; this facility is not made available and instead indiscriminate parking is seen all around the zone which results to go slow and traffic jam. Table

4.14 indicates that indiscriminate parking and undefined bus stop are the major causes of congestion within the zone according to 43.8% of the respondents. While 6.3% of the respondents present that lack of parking space and street hawkers are the causes of congestion within the zone. The resultant effects of this congestion on environment are air pollution according to 50% of the respondent as well as accidents and travel delay time to humans.

Table 4.14 Traffic congestion in zone A

S/N	TRAFFIC	FRQ	%
1	Causes		
A	Indiscriminate parking	7	43.8
B	Undefined bus stop	7	43.8
C	Lack of parking space	1	6.3
D	Street hawkers	1	6.3
E	Others	-	-

2	Effects	FRQ	%
A	Accidents	4	25
B	Air pollution	4	25
C	Noise pollution	-	-
D	Travel delay time	8	50

Source; Author (2013)

4.3.2 Land use activities and environmental problems in zone B

Land use activities within this zone have negative effects on the environment resulting to some environmental problems. These environmental problems generated by these activities are presented in table 4.15.

Table 4.15 Environmental problems within zone B

S/N	ENVIRONMENTAL PROBLEMS	FRQ	%
1	Land pollution	43	44.3
2	Air pollution	18	18.6
3	Noise pollution	20	20.6
4	Traffic congestion	16	16.5

Source; Author (2013)

4.3.2.1 Land pollution

The survey revealed that land pollution within this zone constitute solid waste and liquid waste.

4.3.2.1.1 Pollution from solid waste

The nature of solid waste within zone B ranges from polythene, can/plastics, iron scraps, cartoons etc. 40% of respondents generates can/plastics, while 17% of respondents generates polythene and other land use activities within this zone generates most of solid waste, though some of the activities manages it by properly disposing it accordingly while others don't, piles and liters of waste all around the surrounding environment, resulting to unhygienic environment and destroying the aesthetic appearance of the environment.

The survey revealed that the method of waste disposal within this zone is mostly through open dumping with 18.6%, these are seen from some activities along main street road such as fish sellers, mechanic repairs, and local food joint (see plate 4.14). While 41.9% of respondents revealed that their method of waste disposal is through packing and burning, this is done indiscriminately without getting a designated point whereby they can burn their refuse and it's been done at any given time of the day, the resulting effect of these to the environment is pollution i.e. air and noise pollution as well as discomfort to humans. Another method of waste disposal used in this zone is dumping of refuse in drainages according to 9.3% of respondents (see plate 4.12); this method eventually blocks the drainage over time and resulting to flooding of the area during wet season. The frequency of waste disposal within this zone is daily disposal according to 51.2% of respondents, and 34.9% of respondents dispose their waste weekly and the quantity of waste generated daily is less than 25kg with 74.4% of respondents as presented in table 4.16.

Impact of these solid wastes on the environment is that waste breaks down in landfills to form methane, which is a potent greenhouse gas that destroys the ozone layer due to waste biodegrable. As well as leaching, this is a process by which solid waste enters soil and ground water and contaminates them.

Table 4.16 Solid waste characteristics in zone B

S/N	SOLID WASTE	FRQ	%
1	Nature of waste		
A	Iron scrap	5	7.8
B	Polythene	11	17.2
C	Can/plastics	26	40.6
D	All	11	17.2
E	Others	11	17.2

*multiple option

2	Method of disposal	FRQ	%
A	Packing and burning	18	41.9
B	Open dumping	8	18.6
C	Dumped in gutters	4	9.3
D	Disposal bin	13	30.2
E	Others	-	-

3	Frequency of disposal	FRQ	%
A	Daily	22	51.2
B	Weekly	15	34.9
C	Fortnightly	6	13.9
D	Monthly	-	-

4	Quantity of waste daily	FRQ	%
A	Less than 25kg	32	74.4
B	50kg	11	25.6
C	100kg	-	-
D	150kg	-	-
E	Above 150 kg	-	-

Source; Author (2013)

4.3.2.1.2 Pollution from liquid waste

The survey revealed that the major cause of liquid waste within the zone is flooding during wet season, this flooding results from blockage/breakage of drainages according to 23.3% of respondent, or absence of drainages according to 14.7% of respondents. This blockage of drainage as earlier discussed is due to refuse dump from some land use activities as evidently shown on plate 4.3 and in table 4.17, 37.2% respondents indicate that their source of liquid waste is from broken drainage, Also activities such as mechanic repairs/vulcanizers generate liquid waste in form of oil spills on the surrounding according to 46.5% of respondent (see plate 4.4), and these have serious consequences on the environment because it destroys the vegetation cover as it is not easily washed off.

Also liquid wastes around this zone are also seen in form of human waste due to lack of convenience/ toilet facilities (see plate 4.1). Most of the land users do not have provisions for toilet facilities according to 60% of respondents, instead they convert the rear back of their shops for convenience, and this act creates an unpleasant environment. 46.5% of respondents admit that their source of liquid waste is discharge from particular activity and method of disposal is open dumping according to 39.5% of respondents (see plate 4.5). During the survey, it was revealed that land use activities such as food/food stuff (fresh fish sellers), local food joint mechanics are the land use activities that generates most of this waste. While 37.2% of respondents indicate that source of liquid waste is from broken drainages results from dirt's dump into drainages or sand fill drainages.

Table 4.17 Liquid waste characteristics in zone B

S/N	LIQUID WASTE	FRQ	%
1	Source of waste		
A	Discharge from sewerage	2	4.6
B	Discharge from particular activity	20	46.5
C	Discharge from broken drainages	16	37.2
D	Others	5	11.6

2	Method of disposal	FRQ	%
A	Open dumping	17	39.5
B	Drainage	19	44.3
C	Sewage	3	6.9
D	Septic tanks	4	9.3

3	Improper drainage function	FRQ	%
A	Dirt's dump	18	41.9
B	Sand fill	10	23.3
C	Broken drainage	10	23.3
D	Absence of drainage	5	14.7

Source; Author (2013)

4.3.2.2 Air pollution

The survey revealed that source of air pollution within this zone includes automobile discharge, smoke from refuse burning, smoke from particular activity and others. The major source of air pollution within this zone is automobile discharge with 50% of respondent as presented in table 4.18. while 27.8% of respondents indicate that source of air pollution is other activities such as dust particles from furniture factory, fumes from alternative source of electricity which is generator set, and 16.7% of respondents indicate their source of air pollution is smoke from particular activity such as cooking from roadside food joint (see plate 4.10), and exhaust from vehicles. The general effect of this pollution to the environment is the production of toxic pollutants in gaseous form such as carbon dioxide, carbon monoxide, hydrocarbons, nitrogen oxides, and sulfur oxides which destroys the environment. The most commonly recognized

type of air pollution is smog which generally refers to a condition caused by the action of sunlight on exhaust gases from motor vehicles and factories.

Table 4.18 Air pollution in zone B

S/N	SOURCE OF POLLUTION	FRQ	%
A	Automobile discharge	9	50
B	Smoke from refuse burn	1	5.6
C	Smoke from particular activity	3	16.7
D	Others	5	27.8

Source; Author (2013)

4.3.2.3 Noise pollution

The survey revealed that the source of noise pollution within this zone is largely through automobile engines according to 50% of respondents as presented in table 4.19, noise from automobile engines is mostly as a result of traffic congestion/traffic jam especially along park road where congestion is witnessed almost every day of the week. 35% of respondents indicate that their source of noise pollution from other activities such as loud music from CD, electronics shops, use of generator sets, and other equipment/machineries. While 15% of respondents indicate that source of noise pollution is from passersby. Noise pollution is generally disturbing to human environment; it causes temporary disruption in the natural balance of human being.

Table 4.19 Noise pollution in zone B

S/N	SOURCE OF POLLUTION	FRQ	%
A	Automobile engine	10	50
B	Passers by	3	15
C	Others	7	35

Source; Author (2013)

4.3.2.4 Traffic congestion

Land use activities contribute to traffic congestion problems within zone B, the major cause of traffic congestion within this zone is lack of parking space according to 43.8% of

respondents in table 4.20. Most of the land use activities do not make provision for parking space/facility, and in some cases whereby the parking facility is provided is insufficient and thus results to on-street parking and indiscriminate parking. Other factors responsible for traffic congestion include undefined bus stop according to 25% of respondents as well as street hawkers according to 6.9%. The effects of this congestion on the environment are air pollution and noise pollution according to 35.5% and 6.3% of respondents respectively.

Table 4.20 Traffic Congestion in zone B

S/N	TRAFFIC	FRQ	%
1 A	Causes Indiscriminate parking	 3	 18.7
B	Undefined bus stop	4	25
C	Lack of parking space	7	43.8
D	Street hawkers	2	12.5
E	Others	-	-

2	Effects	FRQ	%
A	Accidents	3	18.7
B	Air pollution	6	35.5
C	Noise pollution	1	6.3
E	Travel delay time	6	35.5

Source; Author (2013)

4.3.3 Land use activities and environmental problems in zone C

Zone C is the zone that comprise of Sokoto road, Manchester road, Queen Elizabeth road. Land use activities within this zone create environmental problems by affecting the environment negatively. These environmental problems are presented in table 4.21.

Table 4.21 Environmental problems within zone C

S/N	ENVIRONMENTAL PROBLEMS	FRQ	%
1	Land pollution	40	42.6
2	Air pollution	14	14.9
3	Noise pollution	25	26.6
4	Traffic congestion	15	16

Source; Author (2013)

4.3.3.1 Land pollution

Land pollution generated by land use activities is categorized into solid and liquid waste.

4.3.3.1.1 Pollution from solid waste

The survey revealed that the nature of solid waste within this zone ranges from polythene, paper boxes, cans/plastics, iron scraps etc. land use activities within this zone generates almost all the listed solid waste. Mobile phone and accessories are the dominant land use activities along Sokoto road, and their activities generate waste such as polythene and paper boxes. These wastes are seen all around the drainages and surrounding of these activities. When oral interview was conducted with the land users, it was revealed that it is the customers that litter the environment. Also activities such as furniture factories generates solid waste in form of saw dust and wood pieces (see plate 4.11), this tiny dust particles accumulates in air space resulting to air pollution, these waste have effects on the environment by creating unhygienic environment.

Method of waste disposal within this zone is majorly open dumping according to 45% of respondents (see plate 4.7). Some of the activities do not make provision where to dispose their waste instead waste are dumped at any given space within the environment. When conducted an oral interview with these land users, they claimed that most of the waste found within their surrounding are not generated by them, instead they are waste from other activities. While 27.5%

of respondent uses the packing and burning system to dispose their waste. The quantity of waste generated daily within this zone is less that 25kg according to 75% of respondent as indicated in table 4.22. And these wastes are disposed on a daily basis as presented with 57.5% of respondents. While 27.5% of respondent dispose their waste weekly, during the survey, it was revealed that the activities that dispose their waste weekly make provision where waste are collected daily either inform of incinerators or large containers, and then dispose it weekly.

Effects of this pollution on the environment are their contribution to the enhanced greenhouse gas effect and climate change. And also when these land pollution gets really bad, it damages the soil. This means that plants may fail to grow thereby, robbing the eco-system of a food source for animals.

Table 4.22 Solid waste characteristics in zone C

S/N	SOLID WASTE	FRQ	%
1	Nature of waste		
A	Iron scrap	-	-
B	Polythene	9	20.9
C	Can/plastics	18	41.8
D	All	7	16.4
E	Others	9	20.9

*multiple option

2	Method of disposal	FRQ	%
A	Packing and burning	11	27.5
B	Open dumping	18	45
C	Dumped in gutters	4	10
D	Disposal bin	7	17.5
E	Others	-	-

3	Frequency of disposal	FRQ	%
A	Daily	23	57.5
B	Weekly	11	27.5
C	Fortnightly	6	15
D	Monthly	-	-

4	Quantity of waste daily	FRQ	%
A	Less than 25kg	30	75
B	50kg	10	25
C	100kg	-	-
D	150kg	-	-
E	Above 150kg	-	-

Source; Author (2013)

4.3.3.1.2 Pollution from liquid waste

According to the survey conducted, the major source of liquid waste is discharge from broken drainages according to 50% of respondent as presented in table 4.23. Most of the drainages along Manchester road and Queen Elizabeth road are broken either as a result of sand fill or absence of drainage, and these results to flooding during rainy season (see plate 13). 38.9% of respondents indicate that source of liquid waste is discharge from particular activity, and the method of disposal is open dumping according to 43.8% of respondents. Such activities include mechanics; lubricating fluids are seen around the surrounding. Sometimes oil spills and lubricants and heavy metals get washed off into water channels destroying the aquatic life as well as causing canceric disease which consequently have effects on the environment.

Table 4.23 liquid waste characteristics in zone C

S/N	LIQUID WASTE	FRQ	%
1	Source of waste		
A	Discharge from sewerage	2	11.1
B	Discharge from particular activity	7	38.9
C	Discharge from broken drainages	9	50
D	Discharge from industrial waste	-	-

2	Method of disposal	FRQ	%
A	Open dumping	9	50
B	Drainage	9	50
C	Sewerage	-	-
D	Septic tanks	-	-

3	Improper drainage function	FRQ	%
A	Dirt's dump	5	27.7
B	Sand fill	-	-
C	Broken drainage	9	50
D	Absence of drainage	4	22.2

Source; Author (2013)

4.3.3.2 Air pollution

Source of air pollution in this zone ranges from automobile discharge, smoke from refuse burning, smoke from particular activity and others. Major source of air pollution is automobile discharge just like zone B according to 42.9% of respondent as presented in table 4.24. 35.7% of respondents indicate that source of air pollution is from other activities such as dust particle from carpentry/furniture factory, smoke from generator set, 7.1% of respondents indicate their source of pollution is from refuse burning, while 14.2% indicates that source of air pollution is smoke from particular activity such as cooking from restaurants (see plate 8). Air pollution can harm human when it accumulates in the air in high concentrations, people expose to high levels of certain air pollutants may experience increased risk of heart attack, wheezing, coughing, chest tightness and breathing difficulties. And also affects the environment in form of greenhouse effect as well as acid rain.

Table 4.24 Air pollution in zone C

S/N	SOURCE OF POLLUTION	FRQ	%
A	Automobile discharge	6	42.9
B	Smoke from refuse burn	1	7.1
C	Smoke particular activity	2	14.2
D	Others	5	35.7

Source; Author (2013)

4.3.3.3 Noise pollution

Noise pollution within this zone is mostly automobile engines according to 56.6% of respondent from table 4.25 noise from automobile engines is highly associated with traffic congestions. 13.2% indicates that noise pollution is generated through other activities such as use of heavy machineries, equipment's as in the case of carpentry, mechanics and noise from generator sets. While 30.2% of respondents identified passersby as the source of noise pollution in the area. Noise pollution may lead to effects such as hearing impairment, interference with spoken communication, sleep disturbance and cardiovascular disturbances, and sometimes may lead to mental health, negative social behavior and annoyance reactions.

Table 4.25 Noise pollution characteristics in zone C

S/N	SOURCE OF POLLUTION	FRQ	%
A	Automobile discharge	30	56.6
B	Passers by	16	30.2
C	Others	7	13.2

Source; Author (2013)

4.3.3.4 Traffic congestion

Land use activities contribute to traffic congestion problems within this zone in one way or the other, one of the causes of this congestion problem is lack of parking space which is a general problem in the whole of the CBD, according to 33.3% of respondent, lack of parking space is one of the major sources of traffic congestion (see plate 4.2). According to the survey conducted within zone, there are some land use activities that makes provision for parking facility but such facilities are insufficient and results to on-street parking, such activities are banks and eateries especially along Sokoto road. Other causes of this congestion are indiscriminate parking according to 46.7% of respondents and undefined bus stops according to 20% of the respondents. The effects of these congestion to the environment is noise and air

pollution according to 13.3% and 33.3% of the respondents as well as accidents and travel delay time according to 33.3% and 22% of the respondents in table 4.26.

Table 4.26 Traffic congestion in zone C

S/N	TRAFFIC	FRQ	%
1	Causes		
A	Indiscriminate parking	7	46.7
B	Undefined bus stop	3	20
C	Lack of parking space	5	33.3
D	Street hawkers	-	-
E	Others	-	-

2	Effects	FRQ	%
A	Accidents	5	33.3
B	Air pollution	2	13.3
C	Noise pollution	5	33.3
D	Travel delay time	3	20

Source; Author (2013)



Plate 4.1 illegal convenience behind shops along Sokoto Road
Source: Filed survey, 2013



Plate 4.2 Traffic congestion along Sokoto Road.
Source: Field survey, 2013



Plate 4.3 Clogged drainage with Solid waste along Park Road.
Source: Field survey, 2013



Plate 4.4 Land pollution from mechanic activity along Main street.
Source; Field survey, 2013



Plate 4.5 disposed liquid waste in front of shops along Park Road.
Source: Field survey, 2013



Plate 4.6 Clogged culverts with solid waste along Sokoto Road/ Park Road.
Source: Field survey, 2013



Plate 4.7 Open duping of Solid waste along railway tracks in PZ area.
Source; Field survey, 2013



Plate 4.8 Air pollution from road side food sellers along Sokoto Road/ IBB street.
Source: Field survey, 2013



Plate 4.9 Land pollution from road side food sellers along Sokoto Road/ IBB street.
Source: Field survey, 2013



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Plate 4.10 Air pollution from Suya spot along Sokoto Road.
Source: Field Survey, 2013



Plate 4.11 Solid waste from furniture activities along Sokoto Road.
Source; Field survey, 2013



Plate 4.12 solid waste dump in drainages along Sokoto Road.
Source; field survey, 2013



Plate 4.13 Clogged drainage with Solid waste along Manchester Road.
Source; Field survey, 2013



Plate 4.14 Open dump in front of shops along Main street,
Source; Field survey, 2013

4.4 CORRELATION MATRIX BETWEEN ENVIRONMENTAL PROBLEMS AND LAND USE ACTIVITIES

Table 4.27 the matrix of correlation coefficient between land use activities and Air pollution in zone A

	1	2	3	4	5	6	7	8	9	10	11
1	1.00										
2	-0.236	1.00									
3	0.325*	-0.169	1.00								
4	-0.142	-0.106	-0.102	1.00							
5	0.236*	-0.176	-0.106	-0.106	1.00						
6	0.251*	-0.093	-0.176	-0.060	-0.040	1.00					
7	-0.099	-0.074	-0.093	-0.044	-0.074	-0.083	1.00				
8	-0.217	-0.162	-0.074	-0.098	-0.162	-0.472	-0.068	1.00			
9	0.314*	0.092	-0.165	-0.214	-0.274	-0.269	0.013	0.059	1.00		
10	0.368*	-0.132	-0.127	-0.079	-0.132	-0.099	-0.055	-0.122	-0.023	1.00	
11	-0.166	-0.124	-0.119	-0.075	-0.124	-0.139	-0.052	-0.114	0.193	-0.093	1.00

*- Significant at 0.005 % level of probability, **- significant at 0.001% level of probability

1. Air pollution
2. Food and food stuff
3. Construction/ building materials
4. Hotel and eateries
5. Electronics
6. Petrochemicals
7. Services
8. Fabrics/ design
9. Automobiles
10. Furniture/ household
11. Stationaries

From table 4.27, The correlation matrix of air pollution and land use activities in zone A, shows positive and highly significant correlation between air pollution and some of the land use activities such as construction/ building materials (0.325*), Automobiles (0.314*) and furniture/household (0.368*).

Table 4.28 the matrix of correlation coefficient between land use activities and Noise pollution in zone A

	1	2	3	4	5	6	7	8	9	10	11
1	1.00										
2	0.324	1.00									
3	0.245	-0.169	1.00								
4	0.101	-0.106	-0.102	1.00							
5	0.432*	-0.176	-0.169	-0.169	1.00						
6	0.213	-0.093	0.531*	-0.060	0.040	1.00					
7	0.121	-0.074	-0.071	-0.044	-0.074	-0.083	1.00				
8	0.265*	-0.162	0.187	-0.098	-0.162	0.472	-0.083	1.00			
9	0.322*	0.092	0.013	0.165	-0.214*	-0.274	-0.269*	-0.590*	1.00		
10	0.216*	-0.132	-0.127	-0.079	-0.132	-0.099	-0.055	-0.122	-0.023	1.00	
11	0.202	-0.024	-0.119	-0.075	-0.124	-0.139	-0.052	-0.114	0.192	-0.093	1.00

*- Significant at 0.005 % level of probability, **- significant at 0.001% level of probability

1. Noise pollution
2. Food and food stuff
3. Construction/ building materials
4. Hotel and eateries
5. Electronics
6. Petrochemicals
7. Services
8. Fabrics/ design
9. Automobiles
10. Furniture/ household
11. Stationaries

Table 4.28 shows the correlation matrix of Noise pollution and land use activities in zone A. There was positive and significant correlation between noise pollution and all the land use activities in the zone, however, some activities are highly significant.

Table 4.29 the matrix of correlation coefficient between land pollution and land use activities in zone A

	1	2	3	4	5	6	7	8	9	10	11
1	1.00										
2	0.286*	1.00									
3	0.256	-0.169	1.00								
4	0.270	-0.106	-0.102	1.00							
5	0.465	-0.176	-0.169	-0.106	1.00						
6	0.315*	-0.093	-0.531*	-0.060	-0.040	1.00					
7	0.254	-0.074	-0.071	-0.044	-0.074	-0.083	1.00				
8	0.310	-0.162	0.187	-0.098	-0.162	0.472*	-0.068	1.00			
9	0.450	0.092	0.013	0-165	-0.214	-0.274*	-0.269	0.590	1.00		
10	0.430	-0.132	-0.075	0.079	-0.132	-0.099	-0.055	-0.122	-0.023	1.00	
11	-0.021	-0.124	-0.119	-0.075	-0.124	-0.139	-0.052	-0.114	0.193	-0.093	1.00

*- Significant at 0.005 % level of probability, **- significant at 0.001% level of probability

1. Land pollution
2. Food and food stuff
3. Construction/ building materials
4. Hotel and eateries
5. Electronics
6. Petrochemicals
7. Services
8. Fabrics/ design
9. Automobiles
10. Furniture/ household
11. Stationaries

Table 4.29 shows the correlation matrix of land pollution and land use activities in zone A, only food and food stuff and petrochemical are positive and significant correlated but all other land use activities were not significant.

Table 4.30 the matrix of correlation coefficient between Traffic congestion and land use activities in zone A

	1	2	3	4	5	6	7	8	9	10	11
1	1.00										
2	0.223*	1.00									
3	0.064	-0.169	1.00								
4	0.134	-0.106	-0.102	1.00							
5	0.223	-0.176	-0.169	-0.106	1.00						
6	0.315**	-0.093	-0.176	-0.060	-0.040	1.00					
7	0.093	-0.074	-0.093	-0.044	-0.074	0.083	1.00				
8	0.082	0.162	-0.074	-0.098	-0.162	0.472*	-0.590**	1.00			
9	0.021	0.092	-0.162	-0.165	-0.214	-0.274*	-0.269*	0.590**	1.00		
10	0.295	-0.132	0.092	-0.127	-0.079	-0.132	-0.099	-0.055	-0.122	1.00	
11	0.157	-0.124	-0.119	-0.079	-0.124	-0.139	-0.052	-0.114	-0.193	-0.093	1.00

*- Significant at 0.005 % level of probability, **- significant at 0.001% level of probability

1. Traffic congestion
2. Food and food stuff
3. Construction/ building materials
4. Hotel and eateries
5. Electronics
6. Petrochemicals
7. Services
8. Fabrics/ design
9. Automobiles
10. Furniture/ household
11. Stationaries

Table 4.30 shows the correlation matrix of traffic congestion and land use activities in zone A. There was positive and significant correlation between traffic congestion and land use activities. However the correlation is highly significant in food/ food stuff (0.223) and petrochemicals (0.315**).

Table 4.31 the matrix of correlation coefficient between land use activities and Air pollution in zone B

	1	2	3	4	5	6	7	8	9	10	11
1	1.00										
2	0.462**	1.00									
3	0.262	-0.093	1.00								
4	0.230	-0.079	-0.093	1.00							
5	-0.190	-0.116	-0.079	-0.093	1.00						
6	0.419**	0.127	-0.116	-0.150	-0.063	1.00					
7	-0.130	-0.079	-0.127	-0.064	-0.093	-0.007	1.00				
8	0.020	-0.064	-0.079	-0.052	-0.075	-0.035	-0.052	1.00			
9	0.568**	-0.077	-0.128	-0.138	-0.052	-0.075	-0.035	-0.052	1.00		
10	0.490**	-0.116	-0.109	-0.093	-0.136	-0.115	-0.093	-0.075	-0.202	1.00	
11	-0.152	-0.093	-0.087	-0.075	-0.109	-0.175	-0.075	-0.075	-0.060	0.014	1.00

*- Significant at 0.005 % level of probability, **- significant at 0.001% level of probability

1. Air pollution
2. Food and food stuff
3. Construction/ building materials
4. Hotel and eateries
5. Electronics
6. Petrochemicals
7. Services
8. Fabrics/ design
9. Automobiles
10. Furniture/ household
11. Stationaries

Table 4.31 shows the correlation matrix of air pollution and land use activities in zone B. positive and highly significant relationship was observed in most of the land uses as seen in food and food stuff (0.462**), automobiles (0.568**) and furniture/ household (0.490**) as well as petrochemical (0.419**).

Table 4.32 the matrix of correlation coefficient between land use activities and Noise pollution in zone B

	1	2	3	4	5	6	7	8	9	10	11
1	1.00										
2	0.225*	1.00									
3	0.304*	-0.093	1.00								
4	-0.097	-0.079	-0.075	1.00							
5	0.597**	-0.116	-0.109	-0.093	1.00						
6	-0.080	-0.127	0.013	-0.150	-0.063	1.00					
7	-0.185	-0.079	-0.075	-0.064	-0.093	-0.007	1.00				
8	-0.043	-0.064	-0.128	-0.052	-0.075	-0.035	-0.052	1.00			
9	0.498**	-0.077	-0.074	-0.138	-0.129	-0.042	-0.138	-0.112	1.00		
10	0.313*	-0.116	-0.109	-0.093	-0.136	-0.115	-0.093	-0.075	-0.202*	1.00	
11	-0.062	-0.093	-0.087	-0.075	-0.109	-0.175	-0.075	-0.060	0.014	-0.109	1.00

*- Significant at 0.005 % level of probability, **- significant at 0.001% level of probability

1. Noise pollution
2. Food and food stuff
6. Petrochemicals
7. Services
11. Stationaries

3. Construction/ building materials
4. Hotel and eateries
5. Electronics
8. Fabrics/ design
9. Automobiles
10. Furniture/ household

Table 4.32 shows the correlation matrix between noise pollution and land use activities in zone B. There was positive and highly significant relationship between noise pollution and land use activities in electronics (0.597**), automobiles (0.498**), furniture/ household (0.313*), food and food stuffs (0.225) and construction and building materials (0.304).

Table 4.33 the matrix of correlation coefficient between land use activities and Land Pollution in zone B

	1	2	3	4	5	6	7	8	9	10	11
1	1.00										
2	0.616**	1.00									
3	0.435*	-0.093	1.00								
4	0.473**	-0.079	-0.075	1.00							
5	0.590**	-0.116	-0.109	-0.093	1.00						
6	0.384**	-0.127	0.013	-0.150	-0.112	1.00					
7	0.297	-0.079	-0.075	-0.064	-0.075	-0.202*	1.00				
8	0.279	-0.064	0.128	-0.052	-0.075	-0.035	-0.052	1.00			
9	0.680**	0.077	-0.074	-0.138	-0.129	-0.042	-0.138	-0.112	1.00		
10	0.580**	-0.116	-0.109	-0.093	-0.136	-0.115	-0.093	-0.075	-0.202	1.00	
11	0.223	-0.093	-0.087	-0.075	-0.109	-0.175	-0.075	-0.060	0.014	-0.109	1.00

*- Significant at 0.005 % level of probability, **- significant at 0.001% level of probability

1. Land pollution
2. Food and food stuff
3. Construction/ building materials
4. Hotel and eateries
5. Electronics
6. Petrochemicals
7. Services
8. Fabrics/ design
9. Automobiles
10. Furniture/ household
11. Stationaries

Table 4.33 shows the correlation matrix of land pollution and land use activities in zone B. There was positive and highly significant correlation between land pollution and all the land use activities in the zone.

Table 4.34 the matrix of correlation coefficient between land use activities and Traffic Congestion in zone B

	1	2	3	4	5	6	7	8	9	10	11
1	1.00										
2	0.390	1.00									
3	0.367*	-0.093	1.00								
4	0.342	-0.079	-0.075	1.00							
5	0.350	-0.116	-0.109	-0.093	1.00						
6	0.343	-0.127	0.013	-0.150	-0.063	1.00					
7	0.354*	-0.079	-0.075	-0.064	-0.093	-0.007	1.00				
8	0.374	-0.064	0.128	-0.052	0.075	-0.035	0.052	1.00			
9	0.382	0.077	-0.074	-0.138	-0.129	-0.042	-0.138	-0.112	1.00		
10	0.390	-0.116	-0.109	-0.093	-0.136	-0.115	-0.093	-0.075	-0.202*	1.00	
11	0.303	-0.093	-0.087	-0.075	-0.109	-0.175	-0.075	-0.060	0.014	-0.109	1.00

*- Significant at 0.005 % level of probability, **- significant at 0.001% level of probability

1. Traffic congestion
2. Food and food stuff
3. Construction/ building materials
4. Hotel and eateries
5. Electronics
6. Petrochemicals
7. Services
8. Fabrics/ design
9. Automobiles
10. Furniture/ household
11. Stationaries

Table 4.34 shows the correlation matrix of land use activities and traffic congestion in zone B. There was positive and high significant correlation between traffic congestion and land use activities. However, the correlation is highly significant at 0.05% in hotels, eateries and services.

Table 4.35 the matrix of correlation coefficient between land use activities and Air Pollution in zone C

	1	2	3	4	5	6	7	8	9	10	11
1	1.00										
2	0.255	1.00									
3	0.582**	-0.130	1.00								
4	0.530**	-0.093	-0.089	1.00							
5	0.255*	-0.255	-0.214*	-0.154	1.00						
6	0.055	-0.042	-0.067	-0.093	-0.017	1.00					
7	0.232	-0.116	-0.111	-0.079	-0.191	-0.116	1.00				
8	-0.005	-0.101	0.029	-0.069	-0.167	0.019	-0.086	1.00			
9	0.462**	0.132	-0.041	-0.098	-0.169	0.132	-0.122	-0.106	1.00		
10	0.529**	-0.155	-0.148	-0.106	-0.255*	-0.155	-0.132	-0.115	-0.162	1.00	
11	-0.060	-0.053	-0.050	-0.036	-0.087	-0.053	0.045	-0.039	0.370**	-0.060	1.00

*- Significant at 0.005 % level of probability, **- significant at 0.001% level of probability

1. Air pollution
2. Food and food stuff
3. Construction/ building materials
4. Hotel and eateries
5. Electronics
6. Petrochemicals
7. Services
8. Fabrics/ design
9. Automobiles
10. Furniture/ household
11. Stationaries

Table 4.35 shows the correlation matrix of air pollution and land use activities in zone C. Positive and significantly correlation was observed in all the land uses except fabrics/ design (-0.005) and stationaries (-0.060) that not significant and show negative correlation respectively.

Table 4.36 the matrix of correlation coefficient between land use activities and Noise Pollution in zone C

	1	2	3	4	5	6	7	8	9	10	10
1	1.00										
2	0.263	1.00									
3	0.254	-0.130	1.00								
4	0.210*	-0.093	-0.089	1.00							
5	0.257**	-0.225	-0.214*	-0.154	1.00						
6	0.230	-0.042	0.067	-0.093	-0.017	1.00					
7	0.240	-0.116	-0.111	-0.079	-0.191	-0.116	1.00				
8	-0.089	-0.101	0.029	-0.069	-0.167	0.019	-0.086	1.00			
9	0.590**	0.132	-0.041	-0.098	-0.168	0.132	-0.122	-0.106	1.00		
10	0.598**	-0.155	-0.148	-0.106	-0.255*	-0.155	-0.132	-0.115	-0.162	1.00	
11	-0.067	-0.053	-0.050	-0.036	-0.087	-0.053	-0.045	-0.039	0.370**	-0.060	1.00

*- Significant at 0.005 % level of probability, **- significant at 0.001% level of probability

1. Noise pollution
2. Food and food stuff
3. Construction/ building materials
4. Hotel and eateries
5. Electronics
6. Petrochemicals
7. Services
8. Fabrics/ design
9. Automobiles
10. Furniture/ household
11. Stationaries

Table 4.36 shows the correlation matrix of noise pollution and land use activities in zone C. positive and significant correlation was observed in all the land use activities except also fabrics/ design (-0.089) and stationaries (-0.067).

Table 4.37 the matrix of correlation coefficient between land use activities and Land Pollution in Zone C

	1	2	3	4	5	6	7	8	9	10	11
1	1.00										
2	0.590**	1.00									
3	0.586**	-0.130	1.00								
4	0.598**	-0.093	-0.089	1.00							
5	0.590**	-0.225*	-0.214	-0.154	1.00						
6	0.241*	-0.042	0.067	-0.093	-0.017	1.00					
7	-0.132	-0.116	-0.111	-0.079	-0.191	-0.017	1.00				
8	0.453*	-0.101	0.029	-0.069	-0.167	-0.019	-0.116	1.00			
9	0.580**	0.132	-0.041	-0.098	-0.168	-0.132	-0.019	-0.106	1.00		
10	0.604**	-0.155	-0.148	-0.106	-0.255*	-0.155	0.132	-0.115	-0.162	1.00	
11	-0.112	-0.053	-0.050	-0.036	-0.087	-0.053	-0.045	-0.039	0.370**	-0.060	1.00

*- Significant at 0.005 % level of probability, **- significant at 0.001% level of probability

1. Land pollution
2. Food and food stuff
3. Construction/ building materials
4. Hotel and eateries
5. Electronics
6. Petrochemicals
7. Services
8. Fabrics/ design
9. Automobiles
10. Furniture/ household
11. Stationaries

Table 4.37 shows the correlation matrix of land pollution and land use activities in zone C. Positive and significant correlation was observed in all the land use activities except fabrics/ design (-0.132) and stationaries (-0.112) as well.

Table 4.38 the matrix of correlation coefficient between traffic congestion and land use activities and Traffic congestion in zone C

	1	2	3	4	5	6	7	8	9	10	11
1	1.00										
2	0.193	1.00									
3	0.283*	-0.130	1.00								
4	0.526**	-0.093	-0.089	1.00							
5	0.283**	-0.225*	-0.214*	-0.154	1.00						
6	0.256**	-0.042	-0.067	-0.093	0.017	1.00					
7	0.581**	-0.116	-0.111	-0.079	-0.191	0.116	1.00				
8	0.109	-0.101	0.029	-0.069	-0.167	0.019	-0.860	1.00			
9	0.504*	0.132	-0.041	-0.098	-0.168	0.132	-0.122	-0.106	1.00		
10	0.204*	-0.155	-0.148	-0.106	-0.255*	-0.155	-0.132	-0.115	-0.162	1.00	
11	-0.090	-0.053	0.050	-0.036	-0.087	-0.53	-0.045	-0.039	0.370**	-0.060	1.00

*- Significant at 0.005 % level of probability, **- significant at 0.001% level of probability

1. Traffic congestion
2. Food and food stuff
3. Construction/ building materials
4. Hotel and eateries
5. Electronics
6. Petrochemicals
7. Services
8. Fabrics/ design
9. Automobiles
10. Furniture/ household
11. Stationaries

Table 4.38 shows the correlation matrix of traffic congestion and land use activities in zone C. positive and significant correlation was observed between traffic congestion and all the land use activities in this zone except stationaries with -0.090.

4.4.1 Relationship between land use activities and environmental problems in Zaria CBD

Central Business District is an essential component of every urban environment. The survey in Zaria CBD reveals that the land use activities have negative effect on the environment, these effects ranges from land pollution, air pollution, noise pollution and traffic congestion. It was observed that every land use activity has its peculiar problems and the intensity of these problems ranges. These problems were discussed according to the three zones.

According to the interview conducted with some of the stakeholders in the area around central market, it was revealed that land pollution within the main market is well managed and coordinated to an extent, daily sanitation is carried out every mornings before the start of activities and waste are disposed using packing and burning technique . However it was observed that activities at the periphery of the main market and some of the activities within the area do not abide by this, litters of waste are found all around these land uses, and in some cases whereby sanitation is done, it is disposed into drainages and this act leads to blockage of the drains in condition of wet season, the area around these activities easily floods. Electronics has a correlation coefficient of 0.465, automobiles with 0.450 and furniture with 0.430, these are the land use activities that generate the highest level of land pollution within the area.

Air and Noise pollution in this zone constitute a problem, the general source of air and noise pollution is through the use of alternative means of electricity which is the generator set, almost all the land use activities make use it. However the level of air and noise pollution in

certain activities under furniture with correlation coefficient of 0.368 and 0.216, electronics with 0.236 and 0.432, food/food stuff (whole grains) with 0.324 generates higher form of pollution, these pollution are in form of dust from food stuffs, saw dust particles form carpentry works, loud noise from electronics e.tc.

Traffic congestion in zone A is associated with the activities at the periphery, it was observed that lack of defined bus stop and indiscriminate parking at various activities are the main source of traffic congestion within this zone.

The survey conducted in zone B revealed that activities in this zone generate various environmental problems ranging from land pollution, traffic congestion and all sorts of pollution. All the activities in this zone generate land pollution in the form of solid waste except in few activities like stationaries, the intensity of these waste generation varies from one activities to other, it was observed that activities like food/ food stuff (fish sellers along main street road) with correlation coefficient of 0.616 and Automobiles (vulcanizers and car repairs) with correlation of 0.680 generates the highest level of both solid and liquid waste within the zone, as seen in plate 4.4 and 4.11 . Moreover these wastes are seen to be dumped into drainages, open space and part of the activities premises as seen in plate 4.12. Furthermore, more than 70% of the activities within this zone do not make provision for toilet facilities, instead they make use of their rear side of their premises for convenience as seen in plate 4.1, and this act increases the rate of land pollution within the zone.

Air and noise pollution are also some the environmental problems observed within this zone, it was revealed that almost all the activities makes use of generator set as a source of alternative electricity, exhaust and noise from this equipment causes these pollution. More so,

activities like furniture (carpentry) with correlation coefficient of 0.313, petrochemicals (fertilizers) with 0.380, hotels and eateries (road side food joint) with 0.304 and automobiles with 0.498 generates air pollution in the form of dust particles and smoke. As for noise pollution, Automobiles with correlation coefficient of 0.568, and furniture with 0.490 are the land use activities that generate the highest level of pollution.

Traffic congestion in this zone causes serious environmental problems and is associated with all the activities in the zone. The major cause of traffic congestion is lack of parking facilities and indiscriminate parking, most activities do not make provision for parking facilities and where by provision is made, it's inadequate and thus results to off-street and on-street parking, this act reduce the flow of traffic and subsequently results to congestion. These acts are seen in furniture/ household activities with correlation coefficient of 0.390, food/ food stuff with 0.390 as well as automobiles with 0.382 and services with 0.354. Traffic congestion leads to so many problems ranging from Air pollution (exhaust from engine), inconveniences and travel delay time, noise pollution etc.

Zone C comprise of Sokoto road, Manchester road, IBB road and Theresa Bowyer Street. It was observed that the activities in this zone generate similar environmental problems with zone B. land pollution; air pollution; Noise pollution and traffic congestion are the most observed problems associated with this zone. Land pollution is the most serious problem and affects almost all activities except in some few organized activities such as banks with correlation of -0.132, and some of the eateries such as Mr Biggs and Chicken republic within the zone. It was observed that furniture factory generates the highest level of solid waste with a correlation coefficient of 0.604, and electronics with 0.590, the solid waste generated are mostly in form of polythene and cartoons and are disposed into drainage channels. The survey also

revealed that automobiles with correlation of 0.580, roadside food joint with 0.590 and fabrics with 0.453 all generate land pollution.

Furthermore, Air and Noise pollution were also observed within the study area, land use activities such as building/ construction material with correlation coefficient of 0.582, furniture with 0.529, and hotels and eateries with 0.582 are the land use activities that generates the highest level of air pollution within this zone. Sources of this air pollution are dust particles, exhaust from generator set, smoke from road side food joint and exhaust from automobiles.

However source of Noise pollution within this zone is mostly through automobile running engine and from use of machineries as observed in automobiles with correlation coefficient of 0.590 and 0.598 for furniture.

The land use activities in this zone is associated with traffic congestion as seen in plate 4.2, due to lack of provision for parking facility in most of the land uses, even though some land use make provision for it but it's not adequate. Land use activities such as services generate high level of congestion with correlation coefficient of 0.581 and hotels and eateries with 0.526.

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 SUMMARY

This study was aimed at examining the environmental problems of land use within the Zaria CBD. Both primary and secondary data were used for the study, the type of data collected include land use map of the study area, land use types, activity types, field and social survey information, physical observation. The data were analyzed using a high resolution image of the study area that was obtained from Google Earth and various land use activities within the CBD were identified the land use activities were mapped out, the study area was further zoned into Zone A, B, and C for easy understanding. Simple descriptive statistics was used for the interpretation of data obtained from questionnaires which are land use activities and the environmental condition of the CBD was analyzed using tables. Correlation analysis was used to determine the relationship between land use activities and environmental problems.

Several environmental problems associated with commercial land use activities were identified in all the Zones, which are 16.7% air pollution, 21.3% noise pollution, 46.4% land pollution and 15.3% traffic congestion and general sanitation problems.

The findings of this study also revealed that Zaria CBD is rapidly expanding and comprises of residential, public/ semipublic, mixed and commercial land uses. The CBD of Zaria radiates from the main railway station to areas around PZ, main central market, Park Road, Main Street, Sokoto Road, IBB Street, Manchester Road, Theresa Bowyer Street and Waff Road and is rapidly encroaching the surrounding residential areas. The study identified several commercial activities which are large in terms of number and types of activities, therefore they are classified into 10 classes this are; food/ food stuff, Building/ Construction material, Hotels and Eateries,

electronics, Petrochemicals, Services, Fabrics/ Design, Automobiles, Furniture/ household and Stationary.

5.2 CONCLUSION

Zaria Central Business District generates serious environmental problems as a result of density of various unplanned and unorganized commercial activities. However, different commercial activities generate different environmental problems in terms of types and intensity. Thus, some are as result of planning issues, social behavioral attitude and other multiplier effects.

5.3 RECOMMENDATIONS

- In the cause of this study, it was discovered that lack of discipline (behavioral attitude) from both the land users and customers are the major causes of environmental problems within Zaria Central Business District. During the oral interview conducted within the CBD, it becomes obvious that the stakeholders are aware of the implication and the negative effects of some of the environmental problems they create. In view of this, a prompt legislative framework should be put in place to tackle the issue of indiscipline within the CBD.
- Before the approval of any commercial development within the CBD by authorities concern, emphasis on EIA report should be mandatory and issues such as parking facility and convenience/toilet facility on every development should be made so as to reduce some of these environmental problems to at least a minimal level.
- Provision of commercial infrastructure/facilities**,** Adequate commercial infrastructures/facilities like warehouses, fires fighting devices and equipment, public conveniences should be provided in all commercial areas, parking space should be provided in all major commercial especially

where the nature of business and the location of site warrant. This would help reduce parking difficulties and on street parking.

- Strengthened administrative mechanism**,** presently, the Kaduna State Urban Planning Development Authority **(KASUPDA)** has inadequate manpower and equipment's to carry out its legal functions. Also, political interference slows down the activities of Town planners and other professionals while doing their work. The Kaduna State government should employ qualified town planners and other allied professionals to consolidate the existing ones. The government should equip the planning authority with the necessary and modern planning tools and also create more conducive environment where planners can operate without any interference.
- Strict adherence to daily/weekly sanitation within the CBD should be reinforced to apprehend and prosecute offenders.
- Regular check by authorities concern to ensure effectiveness and efficiency in carrying out responsibilities.
- Government should collaborate with the major stakeholders of the CBD to clear the entire heap of solid waste in the area as well as make provision for drainage facilities.

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APPENDIX I

QUESTIONNAIRE

DEPARTMENT OF GEOGRAPHY, FACULTY OF SCIENCE

AHMADU BELLO UNIVERSITY, ZARIA.

I'm a student of the above department undertaking a study titled: Environmental problems of land use activities within Zaria Central Business District (CBD). You are one of the carefully selected respondents and I solicit your support to respond truthfully. All information will be used for academic purpose and treated as confidential.

Thanks for your assistance.

Please tick your response or write as appropriate.

SECTION A: SOCIO-ECONOMIC CHARACTERISTICS OF RESPONDENTS

1. Name of community……. Distirct……...
2. Educational Background? No formal education [ ] primary education [ ] Secondary education [ ] Tertiary education [ ] others (specify) ……
3. What is your monthly income? Less than 10,000 [ ] N11,000-N20,000 [ ] N21,000-N30,000 [ ] N31,000-N40,000 [ ] N41,000 and above [ ]

SECTION B: ENVIRONMENTAL ISSUES

4. Please indicate the type of land use? Commercial [ ] Residential [ ] Public/semi-public [ ] Industrial [ ] others ……..
5. What is the type of activities in the stated land use? ……..

6. How did you acquire this space? Lease [ ] inheritance [ ] outright buying [ ] others ……
7. Why did you decide to locate your business in this area? ..... ……. ……
8. How many years have you been in this business? 0-5 years [ ] 6-10 years [ ] 11-15 years [ ] 15 years & above [ ]
9. Is your activity generating any of these environmental problems? land degradation [ ] air pollution [ ] noise pollution [ ] land pollution [ ] water pollution [ ] traffic congestion [ ] others (specify) ……
10. If pollution, what is the Nature of pollution? Air [ ] water [ ] land [ ] noise [ ] others (specify) ……
11. Do you generate waste during your operations? Yes [ ] No [ ]
12. If yes, what kind of waste do you generate? Solid [ ] Liquid [ ] Others (specify) ……..
13. What is the nature of solid waste? Iron scrap [ ] polythene [ ] cans [ ] plastic materials [ ] All of the above [ ] other's (specify)……
14. What is the mode of storage? Refuse bins [ ] buckets [ ] polythene [ ] cartons [ ] drums [ ] sacks [ ]
15. What quantity of waste do you collect every week? < 25 kg [ ] 50 kg [ ] [ ] 100 kg [ ] 150 kg [ ] >150 kg [ ]
16. What is the method of waste disposal? Packing and burning [ ] open dumping [ ] dumped in gutters [ ] disposal bin [ ] others (specify) …….
17. How often is it being disposed? daily [ ] weekly [ ] fortnightly [ ] monthly [ ]

18. What is the nature of liquid waste? Discharge from sewage [ ] discharge from particular activity [ ] discharge from broken drainages [ ] discharge from industrial waste [ ] others (specify) ……
19. What is the method of disposal? Open dumping [ ] drainage [ ] sewage [ ] septic tank [ ] others (specify) ……
20. Is the drainage in your surrounding area adequate/properly channeled? Yes [ ] No [ ]
21. If no, why …….
22. What is the cause of noise pollution? Automobile engine [ ] passersby [ ] others (specify) …… ……
23. What is the nature of air pollution? Automobile discharge [ ] smoke from refuse [ ] offensive smell [ ] others (specify)……..
24. What are the causes of traffic congestion? Indiscriminate parking [ ] undefined bus stops [ ] street hawkers [ ] others (specify) …….
25. What are the effects of this traffic congestion? …….
26. What are the possible ways do you suggest to reduce the effects of these problems to the environment?

    A……..

    B…….
27. Any recommendation? …….....