HOUSING CONDITIONS AND WASTE MANAGEMENT IN KARMO SQUATTER SETTLEMENT, ABUJA-NIGERIA.

BY

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REG. NO M.TECH/SSSE/940/2003/2004

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Being a dissertation submitted in partial fulfillment for the award of master of Technology Degree in Remote Sensing Applications in The Department of Geography School of Science and Science Education, Federal University of Technology, Minna Nigeria

DECEMBER, 2005

DEDICATION

This work is dedicated to the Glory of Almighty Allah the fountain of knowledge and unto my dearly beloved families particular Usman (son), Hauwa (wife), Madam Melernu (mother), Late Alh. Usman (farther) and Bonu's families.

ACKNOWLEDGEMENT

Having successfully completed the task of compiling this project, I wish to express my profound gratitude to my project supervisor, Professor J.M. Baba, whose direction and constructive criticisms constituted a tremendous success to this thesis.

I am also grateful to all the staff of Geography Department for their support. It is well appreciating Prof. Adefolalu, Dr.M.T. Usman, Dr. Haliru, Dr. O. Apollonian, Dr. A. S. Abubakar, Dr. P.S. Akinyeye, Dr.G. N. Nsofor, Mallam Salifu and Mr. Ozingi (Dept. of Land survey.

Finally, I must acknowledge the great role played by my friends and well wishes who contributed to the successful completion through encouragement and constructive criticism.

ABSTRACT

The advent of Remote sensing technology and Geographic Information systems consequently improved settlement studies. The use of remote sensing data in settlement studies was limited to building count, population estimation and urban area delimitation among others in the recent past. The use of remote sensing data for urban slum especially in the developing countries has been considered as the heretical alternative to conventional method.

This thesis utilized photographs, topograghmap and satellite images for urban slum assessment and, consequently, classification of slum decay areas over a period of twenty years. (1976 – 2004). In the final analysis the parameters used for urban slum classification from remote sensing data are vegetation characteristic, accessibility characteristics, housing characteristics and roof of building characteristics.

The pattern of settlement changes in the study area was observed from 1975 through 2003. It was observed that the core areas had been in a condition of virtual slum before the year 1976 while old Karmo steadily deteriorated especially since the period of colonial days. The spread of slum is more noticeable in the central and eastern part of the study area.

The results of slum classification through remote sensing data were juxtaposed with the classification obtained through conventional method of questionnaire administration. It was observed that two methods agree largely with the areas classified as squatter settlement.

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CHAPTER ONE

1.0 INTRODUCTION

Squat means "to settle on land or in unoccupied building without legal right or to settle on land with a view to acquiring legal title" (Oxford Dictionary)

Squatter settlements have been given several names in previous studies including, ghettoes, Slums, shanties, blight, uncontrolled, settlement, illegal, unplanned and squalor, among others. While, Payne (1974) believes that these concepts connote different forms, types and conditions of human settlements, Muth (1979) believes that there is uniformity in their conditions.

The squat areas are further defined as homogenous areas of low density, and isolated settlement. One can therefore say that squatter settlements are small homogenous settlements where people depend on primary activities as means of livelihood.

Furthermore, these settlements lack essential public facilities, community services, and are characterized by poverty and illiteracy.

However, certain variables should be measured to find out whether a settlement is a squatter or not as suggested by Schnore (1966). He is of the opinion that in defining squatter or slum areas, one needs to incline to the choice of those variables, which can be statistically measured. These variables include population, type and level of economic activities predominant in the area, migration pattern, heterogeneity and social differentiation and stratification.

Urban slum may be defined as a state of urban squalidness and overcrowdiness characterized by disruption in structure, poor sanitary condition, and inadequate provision of amenities and general deterioration of urban environment. (Okoye, 1979 and Abumere, 1985). Urban slum decay has been associated with increased urbanization (especially in the developing countries). The phenomenal rise in the sizes of Nigerian cities without adequate planning for the improvement and expansion of the facilities and infrastructural development has been advanced as one of the causes of urban decay in Nigerian cities.

Urban slum has become one of the most serious consequences of

urbanization. Urbanization on the other hand is the symbol of the radical physical, economic and social transformation that mankind passes through as a result of development. Other scholars identified some economic externalities as the cause of slum. These include pollution (Robson, 1976) and traffic congestion (Greenther and MieskowskI, 1980).

In his book titled MAN AND HIS ENVIRONMENT, Jones (1963) further defined squatter settlement as a cluster of dwelling housing, often flanked by areas of irregular dispersed cultivation and pasture.

In addition, squatter settlements are extremely less efficient at conserving resources. Open spaces were commonly used to grow food, woodwork, dyeing, weaving and pottery. These human activities alter the topography ; vegetation, and natural drainage pattern, thereby disturbing the national equilibrium or ecological balance.

Due to rapid urbanization and consequent haphazard growth, most of these urban areas have become congested and unhygienic.

In spite of the rapid rate of urbanization, the federal capital areas are still dominated by squatter settlements. The study of these

settlements involves an investigation into their origin, sites, room sizes, location and patterns. The patterns of settlement that emerge in the locality are a reflection of the interplay between physical and human factors.

David and Whinston (1961) argued that slums often result from property speculation of owners who may delay the renovation of existing structures in anticipation of the arrival of more intensive uses, which might bring capital gains. In essence the value of each property is influenced by the condition of the environment and adjoining land uses (Richardson, 1971).

Some authors have identified urban decay as a stage in the cyclic process of urban growth, explaining that the same factors that induce urban growth also contribute to slum. Such authors however differ in their perception and modeling of urban dynamics. This is based on the factors believed to induce the cyclic process of urban growth and slum. London (1980) gave demographic explanation as the primary background theory inducing changes in the urban setting. They thus emphasized population changes as major factors that induce

the study area could be said to have originated due to expansion of Abuja and its environs. From available records, these settlements were of relatively small population and had not the features associated with modern urban centre (Chike, 1975)

1.1.1 The study area.

Karmo is located approximately at the intersection of longitude $7^{0}22'30"$ East of the Greenwich meridian and Latitude 9 03' 45" North of the Equator. To be precise, Karmo is a proposed industrial/commercial estate sited in the Federal Capital Territory (FCT) Abuja. The settlement is boarded to the north by another slum area of Gwagwa, Nnamdi Azikiwe international airport to the west, wuse life camp and Kubwa satellite town to the south and east respectively.

Karmo is subdivided into areas based on the economic activities, transport points and ethnicity i.e. old Karmo, market, Karmo lions, Karmo pump, Extension phase, Karmo GRA, church, bus stop, June 12, Hausa quarter etc

1.1.2 Inhabitants of the slum

The slum was believed to be the abode of 'never do well', those that were on their way up and those that were on their way down, the prostitutes, gamblers, people with deviant behaviors and the like. Sjoberg (1965) and Muth (1979) and other earlier

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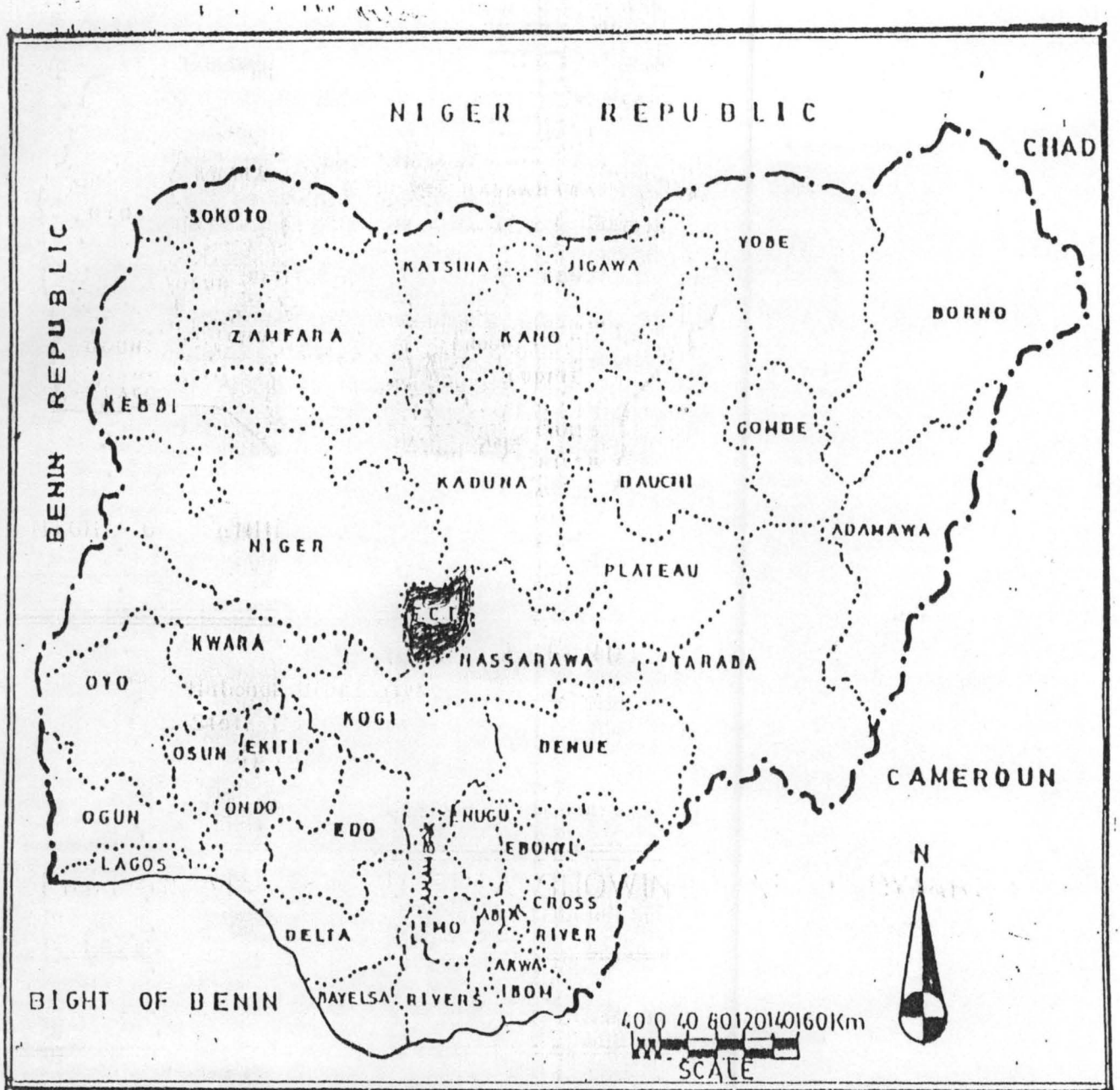


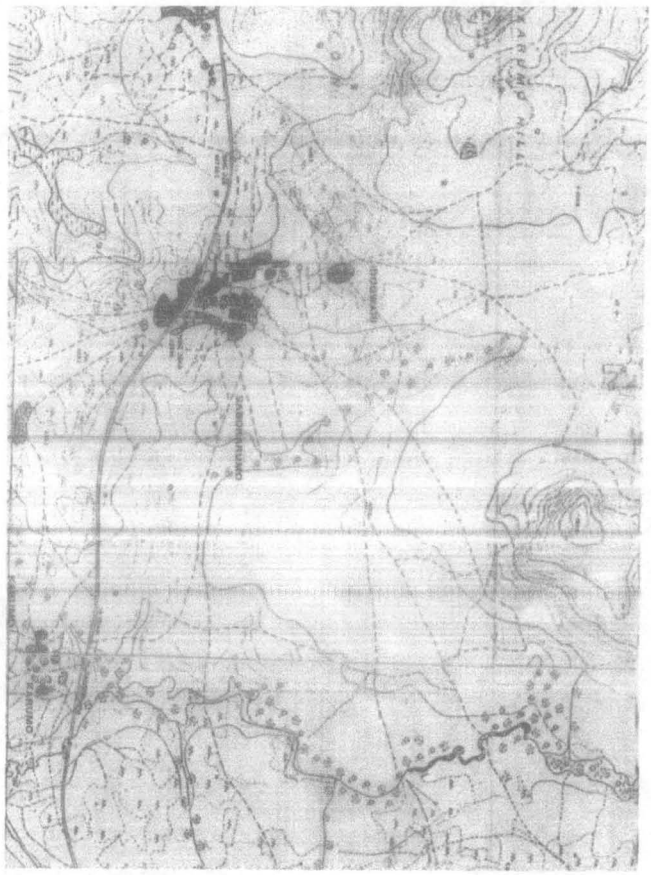
LEGEND

National Boundaries. . . . . .

State Boundaries. . . . . .

Study Area. . . . . .

Fig. 1.0 MAP OF NIGERIA SHOWING THE STUDY AREA.



N

Scale

2000 4000

Fig. 1.1 Topographic Map of Karumo in 1976

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However, recent studies reveal a different picture. For instance, in a study of Khartoum North Sudan, it was revealed that squatter's settlements accommodated a wide spectrum of inhabitants with different backgrounds and professions, such as animal herders, farmers, military personnel, workers and university professional. (Abdel-Hadis, 1992).

1.1.3 Population:

According to National Population Commission (NPC) 1991, the settlement of Karmo had head counts of over 60,000 residents made up of various ethnic groups across the country and beyond.

Historically, the Gwaris are the original settlers migrating from Niger state and Kaduna in search of land for farming.

Civilization tends to threaten the Gwaris traditions and farming with establishment of Federal Capital Territory

During the regime of President Shehu Shagari a reasonable sum of money was provided to resettle the people of Karmo with population of 8,240 (NPC, 1991). The resettlement project is part of a national effort to build an industrial estate in the area.

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populations remain illiterate, but also because of the overriding impact of poverty.

1.1.6 Social economic activities;

The growth of commerce and trade is said to be foremost reasons for migration and creation of settlement. Religion also inhibited economic activity, by prohibiting the charging of much interest and by insisting that goods be bought and sold at a stable and affordable price.

Superstition hampered socio-economic development as much as religion did, because people were naïve about cause and effect relationships. Instead of solving problems by systematic analysis, they tend to explain what they did not understand in term of magical on supernatural events. The manners in which things are explain in terms of magic rather than cause and affect prevented the economic growth in Karmo.

Another limiting condition on socio – economic development was that few traders did not travel much. As a consequence they were not exposed to the different ways of life of other people.

The development of trade was also inhibited by lack of transportation. Transportation routes are inadequate, currently only one major road is in operation. The road is a good 'c' standard and extends from old Karmo forest.

1.1.7 Ethnic and trader organization:

As of April 1992 there were 32 groups (Abuja Municipal Gazette, 1992). The word "Meeting" was phonetically devised meaning a grouping. Meeting is an age-old concept and, in local usage, it denotes a politico-socio-economic grouping. Thus the various dialect groups are more often referred to as the various meetings.

1.1.8 Climatic Conditions:

Karmo, Abuja is located in the Guinea Savanna belt that falls between the rain forest and Sudan Savanna. As a result, temperatures are generally high throughout the year. Although mean temperatures are relatively lower in southern Nigeria, the higher night temperatures in the forest zone reduce potential photosynthesis below those of the Savannah (Kassam and Kowal, 1973).

Table 1.0 Some Daily Temperatures values in 2003 and 2004

DAY	TEMPERATURE [O^{OC}]
30/11/2003	31^{OC}
15/12/2003	31^{OC}

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plays in agriculture includes the supply of moisture to the soil to activate plant growth, the replacement of water in streams and rivers to make irrigation possible, and seepage and percolation, the building up of underground water reserves which are later tapped by wells in drier areas like main Karmo.

Excessive rainfall in Karmo, leads to runoff, soil erosion and leaching, nutrient losses, water logging, and vigorous vegetative growth which render the clearing of agricultural land difficult, and weeding laborious. High rainfall intensity also has a general disruptive effect on agricultural work. By contrast, too little rainfall in parts of this country supports agricultural practices for eight to ten months of the year except with the aid of irrigation. The timing of planting operations, and the number and types of crops, which can be grown, are influenced by the onset of the rains and the regime and duration of the wet season. (Agboola, 1979).

The harmattan air, which is inconsistence and develops over the Sahara, also appears in Abuja between the month of December and January. The harmattan air is dusty and warm

during the daytime, but cool at night as a result of rapid radiation cooling through the cloud. During this time, complete dryness and low humidity prevail over greater part of the country. Relative humidity reaches 80% in the morning in the southern area, but falls to 50% (Acheampong, 1982).

1.1.9 Topography

The land use in Nigeria has to rely on the 1955-60 agricultural sample census, which provide the most recent data (Agboola, 1979).

Before the pre-colonial era, Karmo environment was subjected to intense farming. These days, the proportion of cultivated land has been reducing tremendously due to expansion of Wuse, Garki, Maitama and Asokoro, all located in the FCT.

One of the outstanding features of land use is the dominant position occupied by residential buildings and cultivated land. The low plain areas are mainly devoted to transport and commercial areas i.e. the only major road connecting old Karmo to Idu. Sabo-Karmo is dominated by ranges of hills,

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1.3 SCOPE AND LIMITATION

The study will concentrate on monitoring the process and pattern of slum growth and its environmental effect in Karmo, Abuja.

This study also attempts to use other means or method to investigate the levels, patterns and trends in deterioration of land use, housing facilities, physical and social infrastructure, roof sanitary facilities, water and sewage system.

1.4 JUSTIFICATION OF THE STUDY

Carp (1966) asked elderly respondents what they liked about their new residential environment in India and what they thought should be avoided in future facilities for old people. They mentioned security, cleanness, modern apartment by, access to other people, access to down town facilities and access to public transportation.

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The negative activities they named are lack of security, soot and dirty, inability to control temperature, and ventilation, absence of decent places to eat, dangerous part of the town, lack of privacy, noise and noisiness of neighbours, part of the town with bad reputation, poor

physical characteristics of the slum in Karmo, Abuja-Federal Capital Territory.

OBJECTIVES OF THE STUDY:

The study will focus on the following specific objectives:

1. To investigate the factors that promotes the growth of slums in the Study area.
2. To analyses the spatial characteristics of slums.
3. To develop a classification scheme for identifying squatter Settlements.
4. To advance a theoretical basis for the spatial and temporal pattern of Squatter settlements.

1.6 STRUCTURE OF THE THESIS:

The introductory chapter explains the justification for the study and briefly highlights the gap in urban slum settlement study especially those that relate to its environmental impacts. Consequently the research questions were outlined. The description of the study area was also mentioned in this chapter.

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Chapter two is a review of relevant literature on the integration of remote sensing and geographic information systems in urban slum settlement studies.

Chapter three describes the methodology used in this study. It also sets out to list the instruments and data sets used for the study with brief presentation on methodological procedure in carrying out data collection and analysis. It provides a qualitative way of describing urban slum using the conventional method of questionnaire administration and further examines the socio – economic characteristics of the inhabitants. Using some discrete score, the chapter categories the study area into six levels.

The chapter also presents the trend analysis of urban slum using geographic information systems to select areas classified as different quality levels and examines the spatial characteristics. It presents a comparative analysis of the results obtained from the questionnaire, topographic map and the remote sensing data.

CHAPTER TWO

2.0 LITERATURE REVIEW

Drakakis-Smith (1981) is of the view that, there is no single and accepts definition of what a slum area is. He further stated that, there are various definitions, which reflect the different orientations of various disciplines such as sociology, demography, economics, medicine and physical planning. At the same time, different societies define slum in different ways, even among people in the same discipline. Thus, the physical planner's definition of a slum in the United States of America or Great Britain is bound to be different from that of a developing country such as Nigeria. This is a reflection of the varying levels of socio-economic development, which characterize different countries in the world.

Despite this lack of agreement, Drakakis provide an overview of what constitutes slum areas in the context of Third World countries in general and Nigeria in particular. Third World cities are known to have two types of environmentally degraded areas. The

first is the squatter settlement that comprises uncontrolled or temporary dwellings largely inhabited by immigrants from outside the city concerned. Often, such areas are occupied illegally since building plans are not approved before dwellings are built. The second type is the slum proper that can be defined as legal, permanents that have become substandard through age, neglect and /or subdivision into micro-occupational units such as rooms, cubicles (Onokerhoraye, 1988).

Odongo, (1979) noted that, most contemporary attitudes and interpretation of the nature and origin of slums are derived from the Victorian era. During the Victorian period, slum dwellers were viewed as a socio-spatially isolated group whose separation was attributed variously to preferred deviance, the rejection of the work ethics, and other anti-social value. In his words, slum areas were viewed as generations of host deviant behaviors such as criminality, prostitution and juvenile delinquency. McKenzie and Biogess (1976).

Economically, slum/squatter areas are viewed as areas inhabited by the poor in the urban system. The economic perception of slum areas is thus largely that of a people who are unskilled and therefore cannot be employed. Since there is no employment, there is no source of income for the vast majority of the dwellers of slum/squatters areas. Thus, Portes (1971) in a not untypical passage has described urban slums in Chile as housing the poorest of the poor, the unemployed, the vagabond, unskilled, illiterate and often the alcoholic.

There is the political perspective, which views slum/squatters areas as the breeding ground of political radicalism and violence. This perspective stems from the basic assumption that slum dwellers, experiences poor living conditions and a variety of socio-economic hardship (Portes, 1971).

Abrams, (1966) is of the view that over-crowding is generally regarded as a hazard to health and, in particular, encourages the spread of infections diseases, such as typhoid and tuberculosis. This is most pronounced in a residential situation in which sleeping accommodation is congested and the verification facilities poor.

Thus, the theory that a filthy and decaying environment is indeed a health hazard of slum in India and Lagos, Marris (1961) and Clinard (1966) have independently observed that the often supposed poor health of slum dwellers is not exclusively a consequence of housing conditions as such, as poor health could also be attributed to unbalanced diet, inadequate medical facilities and conflux disregard of personnel hygiene.

In Nigeria (Lagos State) public Health Bye-law of April 1972 recommends room occupancy of 2 persons per room, Only the high-income areas conform to this standard, while residents of low income areas live in overcrowded rooms with occupancy ratios ranging from 8 people per room in a defined area of squatters settlement (Mabogunje, 1974)

Maboguneje views the grossly inadequate essential services of water supply, storm drainage, roads, electricity, waste removal and disposal system.

Reviewing studies carried out in Ghana, Uganda, the Philippines and Venezuela, Clinard and Abbot (1973) have noted a significant degree

of correlation between slum/squatter housing and deviant behaviors.

The survey conducted by the Nigerian Institute of social and economic research (NISER) in 1982, shows that vigorous definition and identification of slum/squatter areas was attempted. The selected slum/squatter areas in each urban area were made after a thorough reconnaissance survey of all the worst residential areas with respect to their physical characteristic. In addition, the questionnaire administered focused on the social and economics of the households and dwellings in which the inhabitants live. However, the analysis includes the physical characteristics of the dwellings and the overall environments in which they are located.

In the opinion of a British writer Schnore (1966), certain variables should be measured to find out whether a settlement is a slum/squatters or not. He says to defined squatters settlement one needs to incline to the choice of those variables, which can be statistically measured. These variables include population, type and level of economic activity predominant in the area, migration pattern, heterogeneity and social differentiation and stratification.

According to Chike (1965), the Nigerian squatter's settlement has always been dominant scenery in the country. Virtually the settlement spaces of the country in pre-colonial era were few and far apart. From available records these settlements were of small population and had not the features associated with modern urban centre.

Hagget,(1979) is of the view that uncontrolled squatters settlement often lie around the periphery of the built-up areas, and are made up of temporary buildings(built-by the squatter themselves) with few social infrastructure. He went further to say that their names vary from country to country. In Jamaica they may be called Ghetto; In Latin America ranchos of favelas; In Asia, bustees or Kampongs; In Africa, Boonville's or shantytowns.

Hagget (1979) further articulated that the uncontrolled squatter settlements are largely a third world problem. That, the term ghetto originally described Jewish areas within the medieval cities of eastern and southern Europe. In such cities the Jews lived apart from the rest of the community and in some cases even a wall separating their area from the rest of the city.

2.1 THE USE OF REMOTE SENSING DATA

Moore (1970) suggested the use of remote sensing data as alternative means of effectively measuring housing quality. He noted the growing concern on the inadequacies in urban data. The two types of contribution which remote sensing can make in an applied context are: the acquisition of data and the execution of tasks.

Remotely sensed images are being increasingly used to derive information on land use (Fuller et al, 1994). Many techniques have been developed for deriving land use change statistics from remotely sensed raster images such as overlay (Howarth and Wickware, 1981) and image differencing (Jensen and Toll, 1982).

Even with the increased spatial resolution of the sensors the problems of land use may increase because discrete scene elements e.g. building roads may dominate detected reflectance of individual pixels. This results in heterogeneity of spectral responses thus making consistent classification difficult (Woodlock and Strahler, 1987).

Agboola and Onibokun (1985) stipulated that slum develops at the periphery of the city where the rural migrants who are unable to pay

for accommodation in the city proper decide to locate at the urban fringes thus developing shantytowns. The other states that squatters and slum dwellers can also be found in the city (either the centre or any other part of the city). In the study of poor quarters of Delhi. Payne (1974) observes that such settlement can also be found near the city centre in government owned land, which was considered unsuited for settlement either because of poor drainage, inaccessibility, location next to obnoxious areas or the unsuitability of the area. Generally, slums developed on lands with low economic values.

In a study of Khartoum North, of Sudan it was revealed that slum settlement existed widely among inhabitant with different backgrounds and professions, such as animal herders, farmer, military personnel, blue and white collar workers and even university professors (Abdel – Hadis, 1992). Similar study in Lusaka, Zambia, revealed that not all the squatters are from those who have newly migrated to the city, but some of the poor inhabitants of the city proper might find themselves compelled to live in squatter settlement because of high rent. At the same time some of the new migrants to

the city might live first with relatives and friends in the city and start moving to the squatter settlement later after they have secured a job or asked their families to join them (Andrew and Martin, 1974).

Baumol (1963) sees urban slum decay as a decreasing function that can be manifested in the inability to maintain property, out – migration of high-income, residents and neighborhood tax receipts, and expenditure on services. Other theorists argue that slums manifest from inadequate planning and inhuman application of planning models to settlement design. The principles of zoning advocate locating lower income people to places in and around the urban centers. The reality is that land value is high in the central business district and adjacent areas. Thus, they pay higher ground rent than their counterparts in the higher income zone. Though the inhabitants of transition zone/the central business district enjoy lower transport cost, they pay higher for accommodation. Hence little is left to maintain good housing and decent environment.

Orishino (1987) attempted finding explanation to urban decay occurrence by identifying the factors responsible for urban spatial

changes. From the context of these results, the characteristics of population and change in population structures coupled with the changes with the value of land is responsible for the formation of urban decay. While these results well explained the formation of the slums in the core of most old cities, especially in the western countries, they do not fully capture the background forces causing the specific spatial pattern of the slum occurrence in third world cities. These cities are characterized by younger age with slums at the peripheries of any other part of the settlement.

Abumere (1985) however observed that this is not the case According to him, slum is based on poverty rather than a waiting game for more remuneration on housing. In essence, the value of each property is influenced by the condition of the environment and other adjoining land uses (Basset and Hauser, 1975). These authors are of the opinion that the market value of a particular property is dependent on the quality of the neighborhood in which it is located. This explanatory emphasized the economic principles as the main background forces that encourage the formation and the growth of slum.

Abumere (1987) noted that since slum is a multi-component problem, it couldn't be measured adequately by one variable. He chose 18 variables, which were collapsed into 5 dimensions after subjecting the data to principal component analysis. These dimensions were observed to account for 98% of the 40 Nigerian towns. He used composite index of focus variable, which were derived by adding each city factor scores on the found variables. The variables used are percentage of derelict and new-derelict house; which include the physical condition of the houses that is, an assessment of building materials and the conditions of the walls, floor, roof and ceiling of the houses. The second variable, percentage of dirty or degraded neighborhood; this measures the condition of the environment surrounding the houses. The third and fourth are waste water disposal that are not ideal, which means that waste water from the houses is discharged into open –spaces rather than some form of soak away or pit; no water variable, which means that there is no water closet or any hygienic form of disposal of human waste and that households rely on either the pail or pit system.

2.2 Urban Environmental Indicators

The increasing importance of the world urban slum areas, and subsequent need to evolve universal tools to help interpret urban dynamics, provide means to measure changes in urban conditions and assist in policy-making process at the city regional and national levels. These are the main foci of **HABITAT II** Conference on human settlement held in 1996. The conference attempted to develop sets of urban slum indicators. The indicators were arrived at after series of testing from a wide choice of countries. Consequently, 11 sub sectors were identified as basis or indicators for measuring, monitoring and policy sensitive programmed formulation. These are: Socio- economic background, housing conditions, health conditions, natural environment, land use, urban transport, energy use, air pollution, noise pollution, water and sanitation, solid and hazardous wastes. The questionnaire from which the indicators were derived was developed in 1989/1990 by an international technical working group including, United Nation Scientific Organization (UNSO), United Nation Development Programme (UNDP), United Nation Environment Programme (UNEP), World Health Organisation (WHO) and the

World Bank (WHO). The working group drew on earlier analytical approaches and survey instruments developed by the UN statistical office EEC and World Bank. It was recommended that the indicators be used to gauge the magnitude of a particular urban sector problem and whenever possible provide a quantitative rather than qualitative statement of a particular urban condition. This should enhance the change monitoring potential in the incidence of urban problem over space and time.

The report however, insists that urban indicators should be structured to allow comparisons between different time periods for a given urban area within and between countries. While the arrival at uniform indicators would be adequate for interregional comparison of urban condition, the paucity of data in many developing countries and low level of integrity of data where available will result to in – accurate and inconsistent estimate of urban conditions. The socio – economic and cultural variations in each settlement may introduce difficulty in applying common denominators to the urban condition. Further problem identified in applying a common discriminators or indicators of urban condition by HABITAT 11 conferences is that

urban indicators which apparently address s common urban problem across regional or national boundaries may not capture different perceptions of the problem resulting from unique local cultural socio – economic or other variations.

The UNDP Human Development index builds on only a few quart table indicators and this is at the national level without any desegregation by urban/rural share. HABITAT 11 noted also that many aspects of urban development in most developing countries are not well understood. From the above, it became necessary to derive parameters to measure urban quality at neighborhood level in developing countries.

The parameter selected in this study confirmed the dimensions arrived at by Abumere (1986), More (1970) and the UNDP indicators. Moore chose street parking, street width, street grade, traffic access to building, refuse, loading and parking. The first five relate to accessibility condition while the last two are representatives of sanitary and density conditions.

Abumere (1986) however chose the following dimensions in factor

analysis percentage derelict houses, percentage dirty and degraded neighborhood, ideal wastewater disposal and water variable. They were the main yardsticks of classification of the study area into different quality zones for the different time periods from which measurement were taken.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 INTRODUCTION.

This chapter presents a brief account of the procedure used in carrying out this research and the methods of data collection. It identified some limitations of the methodology due to the problems often associated with conventional methods of data collection.

a. Acquisition and Development of Data Base.

b. Questionnaire Administration.

c. Other Spatial and Non-spatial Data.

d. Ground truth and Validation of remote sensing Data.

e. Instrumentation.

3.2 Acquisition and Development of Data Base.

The relevance of adequate data for the realization of a study like this cannot be over-emphasized. For the purpose of data collection the study area was divided into six zones. The criteria for zoning include

3.3 Questionnaire Administration.

The study is limited to Karmo, comprising six Zones which are (1) old Karmo (2) Sabo Karmo (3) Forest (4) Market (5) Karmo pump in order to allow accurate juxtaposition of the data collected through questionnaire with those collected from remote sensing and to ease the subsequent Geographic information system analysis.

The administration of the questionnaire took the following form: we recognized that it was impossible to achieve a full coverage of Karmo; therefore a suitable sample frame was sought. The available and more reliable sample frame obtained in the study area is the number of roads in each zone.

The number of roads in each zone was obtained from Abuja municipal council, Estate and valuation department.

It was realized during the pilot study that multi tenanted housing are predominant in the study area, therefore a random sampling technique was used to select the household to the interviewed in a house. The greatest difficulty discovered in the course of questionnaire administration was the apathy

displayed by some of the respondents, as they appeared suspicious of the purpose of the survey. We also discovered that some houses refused to be interviewed neither could their housing characteristics be assessed. Some respondents were found to be sensitive to questions pertaining to their socio – economic profile, particularly family size, among others. Overall, averages of thirty questionnaires per zone were used for the analysis.

3.4 OTHER SPATIAL AND NON-SPATIAL DATA

Three types of geographic data sets were collected for the purpose of this research. They include:

1. Raster based data in the form of remotely sensed data.
2. Vector based data in the form of analogue map and
3. Attribute data

3.4.1 RASTER BASED DATA.

The research used the following data sets:

1. Aerial photographs of the study area (Karmo) taken in May 1978 on the scale: 1.10,000 other parameters of the scene are as follows:

* Date of acquisition 1978

* Co-ordinate Long 7^0 21' 10" E - 7^0 22' 30" E

Lat. 9^0 03' 45" N

* Sheet no 186SE/4a 186SE/ 3C, 186SE 4D

186SE/3F

2. Land SAT. Images of FCT (Karmo) obtained in 2001 with the following parameters

Scale. 1:100,000

* Date of acquisition 2001

* Satellite altitude (km) 832.6km

* Incident angle (o) 4.97

* Number of bands 8

3. Nigeria sat-1 image of Abuja FCT (karmo) obtained in 2003 with the following parameters

Scale: 1:50,000

Date of acquisition 2003

Number of band 3

Satellite altitude (km) 750km

The coordinates are the same as the aerial photographs.

3.4.2 VECTOR BASED DATA

In addition to the raster – based data, other maps were acquired from the respective agencies, which include the following.

1. Base maps of Abuja containing Karmo and other local government boundaries and Rating zones delineation.
2. Location map of all the illegal collection points of solid waste in the study area.

3.4.3 ATTRIBUTE DATA

This data set can be divided into sub – categories, which are: attribute data from secondary sources and primary data generated from geographic analysis.

Attribute data from secondary sources are data from various related agencies. It was also discovered that zones are dynamic; they change with time in response to the contemporary politics in the country. Therefore the researcher used the rating zones, which are relatively stable and the boundaries, could be easily delimited. The rating zones were

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3.5 GROUND TRUTH AND VALIDATION OF REMOTE SENSING DATA.

Two sets of satellite scene; Topographic map and aerial photographs were obtained containing spectral information of the study area at different time periods. The spatial resolution of the aerial photographs is higher than the resolution of the satellite images. The six zones, which are delimited by roads and major streams, were properly demarcated on the Topographic map and aerial photographs.

The result of the ground truth from aerial photographs was also used as training sites for supervised classification of the satellite images. Having demarcated the study zones with the boundary roads and major streams the zones could be identified on the scene. With the aid of on – screen digitizing module of archview and Idrisi software, the zone boundaries were marked and stored as factor file. The map was superimposed over the result of the raster-based image processing analysis. The aerial photographs are too many and judging from the scale of the photographs, it is practically difficult to use digital image processing on the entire scene at a sweep. Idrisi, which is the main

software for raster analysis, has limited capacity for concatenating (mosaic of) images.

Consequently, the research used visual interpretation for the analysis of aerial photographs while digital image interpretation/analysis was used for satellite images. The results of the analysis were converted to vector dåta structure in form of maps and this was used to estimate changes with time of urban slum decay in the study area. The parameters used for estimating urban quality at each time period were arrived at through factor analyses on the 28 variables. Three dimensions were obtained as adequate for delimiting urban quality in the study area. This was expanded to four based on the literature search.

The parameters chosen are accessibility, which includes access, type of access, width of access, density of building, that is number of buildings per unit area, roof of buildings, which include type of roof and its condition.

The environmental quality levels from each zone identified on the field were juxtaposed with the quality levels assessment obtained from the aerial photographs and the satellite scenes. The level of spectral recognition of urban elements in both aerial photographs and satellite scenes were found satisfactory based on the level of details required by this study.

3.6 INSTRUMENTATION

The list of tools used for the execution of this research is presented on the basis of stages of use and can be thus grouped as follows.

3.6.1 Hardware:

1. Digitizer tablet: This was used to transfer the analogue data (paper maps) into the Computer format.
2. A personal computer with Pentium 200, 32 Meg RAM, and 4.3 Gigabytes of Hard disk.
3. Mirror stereo-pair was used for visual interpretation that made the ground truth exercise easier. A pair of mirror stereoscope with magnifying power of at least 3 xs.

DeskJet printer: This was used for the paper output production of the results.

CHAPTER FOUR
DATA PRESENTATION, ANALYSIS AND RESULTS

4.1 HOUSING AND ENVIRONMENTAL CONDITIONS IN KARMO ABUJA.

The types of buildings surveyed reveal that, majority of the buildings fall into two categories namely, the Brazilian type, popularly known as face-to-face and compound type. The compound type, are more predominant in the native areas. This further confirms the result of Ayeni (1982). He used detached bungalow to represent face to face. Accessibility to building is generally poor and the state of drainage is also very bad.

The study shows that majority of buildings have no motorable access and can only be reached through footpaths.

4.1.1 Age of Buildings.

Respondents were asked about the ages of buildings in which they live. A good number of them gave the date that the houses were built; however some tenants could not estimate the age of their buildings. The researcher estimated the age of buildings by observing and monitoring the physical attributes of the

buildings and structure. In the final analysis, majority of the buildings were built or rebuilt within the last 20 years, i.e. plate 4.1

4.1.2 Wall Materials

The buildings within Karmo were either built with mud or mud plastered with cement while few were built with sand Crete blocks i.e. plate 4.2. Though the quality of the materials for the walls are in bad condition and not durable.

4.1.3 Roof Material.

On the condition of roof tops, corrugated iron sheets which cover the highest percentage of the roofing material in the study area is noted with considerable rusting, leaking and sagging i.e. plate 4.3. On the ceiling condition, the study shows that asbestos tiles wood, mat and cardboard were commonly in use. The survey on the condition of the ceiling reveals that ceilings are in bad condition with some leaking and missing parts.

4.1.4 Floor Materials.

The floor material is a reflection of the quality level of housing in a place and usually it is one of the area researchers do focus

monitoring the physical attributes of the

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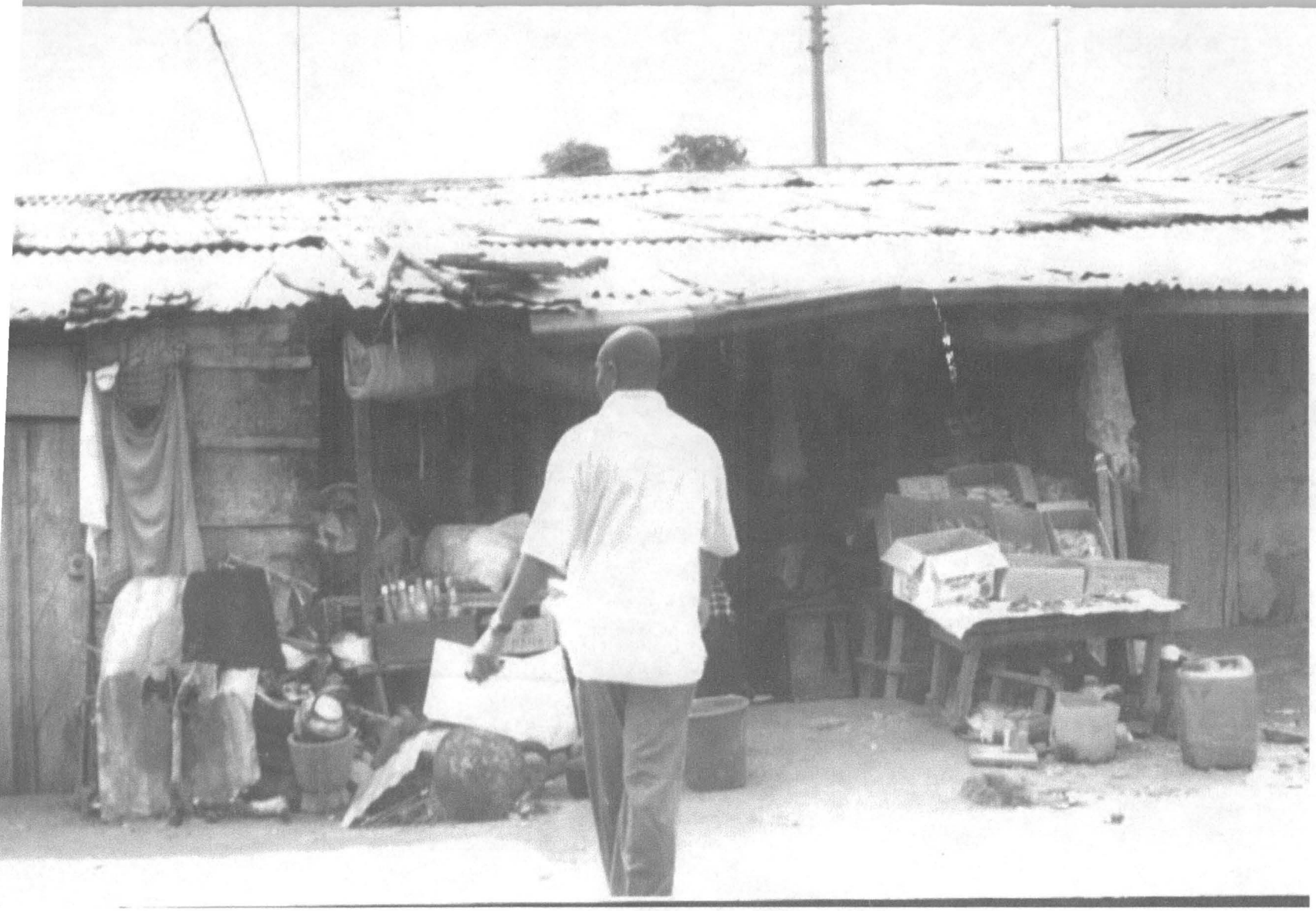
Plate 4.1 Age of Building

Plate 4.2 Wall Materials



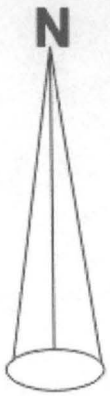


Plate 4.3 Roof Materials

4.1.4 Floor Materials.

The floor material is a reflection of the quality level of housing in a place and usually it is one of the area researchers do focus during survey. The cement, terrazzo, tile and timber are the common materials used in flooring in the study area. The conditions of floors was further investigated, the results revealed that some of the floors are cracked while those with lower foundation belts are permanently damp for most parts of the year, due to the depth of substructure.

4.1.5 Window Materials

The study shows that majority of the buildings have louvers windows, which are closely followed by wood materials, mat and other window materials. Generally, the window materials can be regarded as being in bad condition i.e. plate 4.4.

4.1.6 Door Materials.

The materials used for door are metal, wood and glass. Wood seems to be used more than other materials. The observations of door conditions shows that they are either broken or falling off and in a bad condition i.e. plate 4.5.

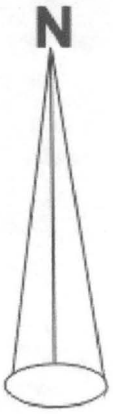


Plate 4.4 Window Materials

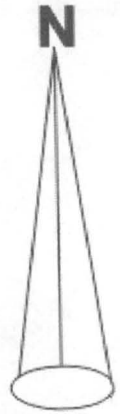


Plate 4.5 Door Materials

4.1.7 Facilities in Buildings.

The types and conditions of facilities in buildings explains the quality levels of the buildings/residential structures in an area. The study reveals that bathroom facilities in the study area are either located mainly within the house or outside the buildings. The bathrooms are made – up of zinc kiosks, outside the building. The type of bathroom commonest in the study area is a general bathroom where users carry buckets into the bathroom, which may be outside or within the house. I.e. plate 4.6.

The drainage condition of the study area shows a very deleterious condition, the drainage in Karmo is open with the stench polluting the environment. There is no covered type of drainage while majority of the housing have no drainage at all. However, many of the drainages are blocked. This explains the incessant flood problems prevalent in Karmo especially along the stream.

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However, the time of the survey is also significant on the condition of the drainage. The time happens to be in the onset period of the rain; therefore the storm water from the rain has cleared most of the debris on the path of the drainage.

4.1.8. Kitchen and Parking Facilities.

The commonest types of kitchen in the study area are those that are situated outside the house; while some use open places others use stove or modern cooker. I.e. plate 4.7

The parking facilities for those who have cars shows that, majority use open space outside their premises and others park their along the road.

4.1.9 Water Supply

This is a major indicator of measuring the quality of residential environment. In Karmo open wells and boreholes were used in the supply of domestic water. The public tap water is connected to only one out of six zones. It was also discovered during the survey that houses connected to public tap water have no

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4.2 WASTE MANAGEMENT

The respondents were asked on the methods and procedure of managing the domestic waste generated from the households. Dustbin of one type or the other, buckets and bags were used to collect wastes while a few use newspaper. The impression generally on the waste management in Karmo is that available open spaces are used to store waste and this gives the impression of the frequency that waste disposal will require in the study area. Respondents were further asked on the method of waste disposal. They claimed that the inhabitants either dispose the waste by piling in an open space or burn them. I.e. plate 4.9 and 4.10.

4.3 SPATIAL VARIATION IN HOUSING AND HOUSING ENVIRONMENTAL QUALITY LEVELS.

The aim of this section is to examine the spatial pattern of urban quality in the study area based on the results of data

Plate 4.8 Sources of Acquiring Water

4.2 WASTE MANAGEMENT

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4.3 SPATIAL VARIATION IN HOUSING AND HOUSING ENVIRONMENTAL QUALITY LEVELS.

The aim of this section is to examine the spatial pattern of urban quality in the study area based on the results of data collected through the questionnaires. The research applied discrete scores, which were developed through examination of past literature and intuitive judgment, legislative minimum standard and the cultural standard in the study area.

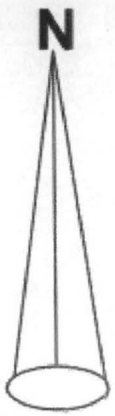


Plate 4.9 Disposal Points

Plate 4.10 Open Drains

It has been variously observed that standard can be divided into two major categories; the legislative standard which was adopted by the government and handed down to the populace as the set of rules to be observed by every citizen. There are minimum standards for every component of building in Nigeria. On the other hand, there is cultural standard that develops with time and is commonly accepted as the norm by the society. They may not be minimum standards but every member of the society aspires to have such level of quality and judge the same as good environment.

The discrete score was applied on the basis of serious consideration of past studies and the two types of standard, which represent minimum legislative standard and the socially accepted ideal in the study area. The value of each variable in the questionnaire were given discrete scores ranging from 0 to 10, While 0 represents no score, 1 represents the least and 10 represents the highest quality score. Consequently, aggregate score for each zone was used to group area into different quality zones.

The data collected through the questionnaires were grouped on zone

basis and this grouping was used to categorise building qualities using the quality scores. Table.4.6 presents the scores for the value in the questionnaire.

Table 4.0 List of score attached to each value in the questionnaires

Variable	Values	Score
1. Types of Building	Face to face	1
	Blocks of flat	3
	Storey – building	3
	Bungalow detached/ Duplex	5
	Others	1
2. Access to building	Foot path	1
	Motor able road	5
	No access	0
3. Condition of access	Untarred	1
	Tarred	5
	Cemented	5
4. Age of Building	Above 30 years	0
	21 – 29 years	3
	11 – 20years	4
	Below 10 years	5

5. Wall Materials	Timber / Iron sheet	0
	Mud brick	0
	Mud brick(plastered)	1
	Sand Crete	5
	Others	5
6. Wall condition	Dilapidated	0
	Cracking	0
	Good	5
7. Roofing Material	Corrugated iron sheet	1
	Others	1
	Asbestos/clay root	5
	Concrete Decking	5
8. Condition of roofing materials	Part missing	0
	Sagging	0
	Rusty	1
	Leaking	1
	Good shape	5
	Others	1
9. Flooring materials	Timber	1
	Cement concrete	2
	Terrazzo	5
	Modern tiles	5

10. Condition of Floor	Cracked	1
	No cracks	3
	Damp	1
	Dry	3
11. Window materials	Mat	0
	Wood	2
	Glass /tainted louvers	5
12. Condition of window	Falling off	0
	Broken	1
	Good	5
13. Types of doors	No door	0
	Others	1
	Wooden	3
	Metal	4
	Metal glass	5
14. Condition of doors	Falling off	0
	Broken	1
	Good	5
15. Types of ceiling	Card board	1
	None	0
	Mat	0
	Wood	3
	Asbestos / tiles	5

drainage	Free	5
23. Kitchen facilities	Open fire place Kitchen detached Kitchen within the house	0 2 5
24. Parking facilities	Others Open space Garage outside Garage within	0 1 4 5
25. Source of water supply	Others (specify) Stream Well Bore hole Tap water	0 1 2 3 5
26. Method of waste storage	Others Bags Bucket Dust bin Drum	1 1 2 3 5
27. Method of waste disposal	Burnt outside by self Disposed by self Private firm Local Govt.	1 2 4 5
28. Ownership of	Family house	1

building	Public house	2
	Rented	2
	Owner occupier	5

Source: Committee for resettlement and relocation (FCDA 2003)

4.3.1 Age of Building

From Table 4.1 showing the age of building per zone in the study area, zone 1 had over 60% of the building, above 21 years; zone 2 had over 30%. Zones that have majority of houses below the age of 20 are zone 3,4,5,6 while zones that had majority of their houses above twenty years are zones 1 and 2. The application of rating score on these zones yields the following average scores for each zone as presented in Table 4.1.

Table 4, 1 Quality Scores on age of Buildings in Karmo, Abuja.

Zone	Mean Score
1. Old Karmo	2.5
2. Sabo Karmo	1.4
3. Market area	2.0

4. Karmo Extension	1.5
5. Karmo pump	1.4
6. Karmo forest	1.2

Source: Author's fieldwork 2004.

4.3.2. Access to Building:

The level of access to buildings in the study area was also examined on zonal basis. Footpath and no access group were categorized together as footpath since at least a path must reach every building. It was observed that most zones have bad roads but zone 1 has 60% of the building reachable only by foot path, zone 2 has 40%, zone 3 38%, zone 4 35%, zone 5 40% and zone6 35%. In fact, from zones 1 to 6, motorable roads cannot access majority of the buildings. The score is therefore attached to these areas on the basis of accessibility as shown in Table 4.2.

Table 4.2 Accessibility score for zones in the study area.

Zone	Score
1. Old karmo	2.0

2. Sabo karumo	2.0
3. Market area	1.0
4. Karumo extension	1.0
5. Karumo pump	1.0
6. Karumo forest	3.0

Source: Authors field work 2004.

4.3.3 Types of Buildings

The values used to measure these variables are face-to-face Bungalow, detached compound type, storey building and row building. It was discovered that some buildings fall into two categories for example, a row building and face-to-face that is very common in the study area.

In almost all the zones, face-to-face is the most prominent building type. Only few zones have significant portion of flat and bungalow detached. These include zone 4 and 6. When applying the score rating of 1-5, the average score for each zone is presented in Table 4.3.

Table 4.3 Rating Score on the types of Buildings per Zone in Karumo

Zone	Score
1. Old karmo	1.5
2. Sabo karmo	1.7
3. Market area	3.0
4. Karmo extension	1.3
5. Karmo pump	1.0
6. Karmo forest	1.5

Source: Authors' fieldwork 2004

4.3.4 Wall Materials

The materials used for wall construction have implication on the quality of the housing structure and subsequent life span of the housing. The wall materials used in the study area were observed at zonal levels and the following results were obtained. It was discovered that building were built with mud either plastered or unplastered, but some zones have sizeable percentage of buildings being constructed with sandcrete block both plastered and unpiastered. For instance, zone 1 has 30%,

zone 2 has 40.4%, zone 4 has 50%, zone 5 60%, zone 6, 45%. The rating score was applied to each zone on the basis of percentage of building found there.

Table 4.4 Rating Score per Zone on Wall materials

Zone	Score
1. Old karmo	1.2
2. Sabo karmo	1.0
3. Market area	2.6
4. Karmo extension	1.0
5. Karmo pump	2.4
6. Karmo forest	1.8

Source: Author's fieldwork 2004.

4.3.5. CONDITIONS OF THE WALLS

The walls of the buildings in the study area were observed on the basis of whether they were cracking, dilapidating, dilapidated or in good condition. The results were presented on zonal basis. The buildings with any crack at all irrespective of the insignificance of the crack were categorized as cracked. It was observed that few zones have considerable buildings

without cracks, these include zones 5 and 6, others are found to have significant portions of their walls ranging from cracking to dilapidate. From the field assistants' assessment, the building walls with cracks can be categorized as being in fair condition and majority of the buildings in the study area fall into this category.

The zones with majority of the buildings dilapidated or dilapidating are zone 1 , with 60%, zone 2,60%, zone 3 , 50%. Table 4.5 shows the quality rating of zones based on condition of wall.

Table 4.5 Quality Rating of Wall Condition by Zone.

Zone	Score
1. Old karmo	2.4
2. Sabo karmo	1.3
3. Market area	1.2
4. Karmo extension	1.4
5. Karmo pump	2.4
6. Karmo forest	1.3

Source: Authors field work 2004.

4.3.6. Roof Materials.

The materials used for roofing were also examined among the zones. Quality-wise corrugated iron sheet was judged as the least quality and was given 1 score while concrete decking was given 5 as the highest quality. The study showed that generally majority of the buildings have corrugated iron sheet. This looks like the main roofing material. The zones with low percentage of their buildings having corrugated iron sheet roof (i.e. less than 30% of their buildings have corrugated iron sheets) are zone 3 with 28.6%, and zone 6, with 29.7%.

It was observed that apart from the listed zones the areas remaining have over 45% of the buildings covered with corrugated iron sheets. The quality score was applied to them and the results is presented in the Table 4.6.

Table 4.6 Table Showing Scores of Zones on Roof Types.

Zone	Score
1. Old karmo	1.0
2. Sabo karmo	1.3

3. Market area	1.0
4. Karmo extension	2.9
5. Karmo pump	2.8
6. Karmo forest	1.0

Source: Author's field survey 2004.

4.3.7 Roof Conditions

The questionnaire was structured under this heading to examine whether the roof of the building is leaking, rusty, sagging, part missing or in good condition. Zones where very few buildings have good roof include zone 1, with 43.8%, zone2, 39.6%, zone 4 44.1%, zone5 17.4%, and zone 6, 43.9%.

When the scoring technique was applied to the roof condition of the buildings in the study area the area could be categorize into three major groups based upon the quality score. Table 4.7 shows the roof quality.

Table 4.7. Score on the Roof conditions.

Zone	Score
1. Old karmo	2.0
2. Sabo karmo	1.0
3. Market area	1.0
4. Karmo extension	3.0
5. Karmo pump	1.8
6. Karmo forest	1.2

Source: Authors field work 2004

4.3.8. Floor Materials

The floor material is an essential variable to measure the quality of a building. The values in this variable are cement concrete type, terrazzo, timber, and modern tile. However, the field staffs were instructed to estimate the prominent floor type of a building to determine the type of floor to enter for such a building. For instance a building may have modern tile only in the one sitting room while other rooms, corridor and steps are cementing concrete. Such buildings will be scored cement concrete since most part of the floor has this type.

It was observed that cement concrete is the major floor type in the study area with over 60% of sampled houses having cement concrete as the floor type. The quality score was applied to this per unit of housing and table 4.8 presents the score on zone basis.

Table 4.8. Table showing scores of floor types on zonal basis.

Zone	Score
1. Old karmo	1.0
2. Sabo karmo	2.0
3. Market area	1.5
4. Karmo extension	3.0
5. Karmo pump	1.0
6. Karmo forest	1.5

Source: Authors fieldwork 2004

4.3.9 Waste Collection Material.

Past studies have revealed that waste collection technique is one of the major parameters of urban quality studies (Abumere,

1986), therefore scores was attached to the techniques of waste collection. This is presented in the Table 4.9

Table 4.9. Quality Score for waste collection techniques

Zone	Score
1. Old karmo	1.0
2. Sabo karmo	2.2
3. Market area	1.8
4. Karmo extension	2.6
5. Karmo pump	1.4
6. Karmo forest	1.0

Source: Authors field work 2004

Table 4.15 indicates that most inhabitants of different zones in Karmo have poor technique of waste disposal. It indicated that the core areas of zones 1, 2, 3 and 4 are among the worst areas in terms of waste disposal problems.

.3.10. Ceiling type.

The ceiling types in each zone were observed and the result of the scoring exercise is presented in Table 4.11.

Table 4.11. Showing the Quality Score of Ceiling Materials by zones.

Zone	Score
1. Old karmo	1.6
2. Sabo karmo	1.8
3. Market area	1.4
4. Karmo extension	3.0
5. Karmo pump	1.1
6. Karmo forest	1.1

Source: Authors field work 2004

The table reveals that generally in each of the zones the ceiling types are of fairly good quality. The house facilities were relatively difficult to estimate so the research assistants used the response made by the respondent as a conclusion.

4.3.11. Condition of Ceiling

This was also observed on zonal basis and the result is as follows:

Table 4.12 showing the quality scores of condition of ceiling by zones.

Zone	Score
1. Old karmo	1.5
2. Sabo karmo	1.1
3. Market area	1.5
4. Karmo extension	3.3
5. Karmo pump	1.0
6. Karmo forest	1.6

Source: Authors fieldwork 2004

All the zones score very high in terms of condition of ceiling of roofs. I

4.3.12. Drainage

The drainage available in each zone was examined in terms of whether they are open or covered or not available. The sampled buildings were examined and their respective accesses were considered whether there is drainage where waste water and excess storm water can pass through. The

scoring technique was also applied and the score per zone presented in Table 4.13.

Table 4.13. Showing the quality scores of drainage types by zones.

Zone	Score
1. Old karmo	1.1
2. Sabo karmo	1.3
3. Market area	1.5
4. Karmo extension	2.8
5. Karmo pump	1.1
6. Karmo forest	1.2

Source: Authors fieldwork 2004

Generally it shows Karmo has drainage problems. This may be one of the causes of the perennial flooding problems common in the study area.

4.3.13. Condition of Drainage

The drainage condition was further investigated to reveal whether the existing drainage is blocked or free (that is where available) the score of each zone is presented.

Table 4.14 showing quality score by condition of drainage by zones.

Zone	Score
1. Old karmo	1.2
2. Sabo karmo	2.5
3. Market area	1.4
4. Karmo extension	2.5
5. Karmo pump	1.2
6. Karmo forest	1.2

Source: Authors fieldwork 2004

From Table 4.20 Many of the drainage systems have conditions below average and other areas score highly in terms of condition of drainage system.

4.3.14 Kitchen

The kitchen as one of the house facilities that explain the quality level of a house was also examined on the zonal basis in the study area. Table 4.15 presents the result.

Table 4.15 Showing the Quality Score of Kitchen Type by Zones.

Zone	Score
1. Old karmo	1.2
2. Sabo karmo	2.2
3. Market area	2.0
4. Karmo extension	1.8
5. Karmo pump	1.7
6. Karmo forest	1.1

Source: Author's fieldwork 2004

From the table, the zone with kitchen in good shape. Those that score poorly in terms of quality and type of kitchen facility are zone 1,3,4,5 and 6. It was also observed that areas in both the traditional core and commercial core have kitchens and some use fireplace, which are built, as part of the house.

4.3.15. Bathroom type

The bathrooms available in the study area range from wooden, thatched cloths, cardboard and open spaces.

Table 4.16. Showing quality score of bath type by zones.

Zone	Score
1. Old karmo	1.4
2. Sabo karmo	2.0
3. Market area	1.0
4. Karmo extension	2.3
5. Karmo pump	1.7
6. Karmo forest	1.6

Source: Authors fieldwork 2004.

The score for bath facility is generally low in the study area. This may be attributed to the fact that field assistants were informed that absence of water in a place has rendered these facilities useless even if they are installed, therefore a house with bath, but where pipes are without water supply or powered drawn well / bore hole will make such baths to be categorized as others.

4.4 URBAN SLUM LEVELS FROM REMOTE SENSING DATA.

These parameters earlier identified above are judged immensely important in time series analysis of the urban slum

delimitation of decay from the distant past till present and thus enhance future prediction potential using the geographic information systems.

Essentially, four parameters were used as the feature definable from remote sensing data for measuring urban slum level in the study area. The parameters are as follows:

1. Accessibility: Type of access, condition of access, and the width of the access.
2. Building density: The level of agglomeration of building in a given zone, which is determined, by the aggregate number of buildings per unit area.
3. Roof: Type of roof materials and the condition of roof materials, which also explain the age of the roof and subsequently the building.
4. Vegetal, impervious surface and water interaction.

Armed with these parameters of measurement, the following remote sensing data were obtained and were used for the time series analysis of the slum in the study area of 1976 Aerial photographs covering the entire study area. 2003 Nigeria satellite image, 2001 Land sat image of Karumo, Abuja.

photographs covering the entire study area. 2003 Nigeria satellite image, 2001 Land sat image of Karmo, Abuja.

4.5 Interpretation of 1976, 2001 and 2003 aerial photographs, topomap, satellite images and photograph classification of the study area.

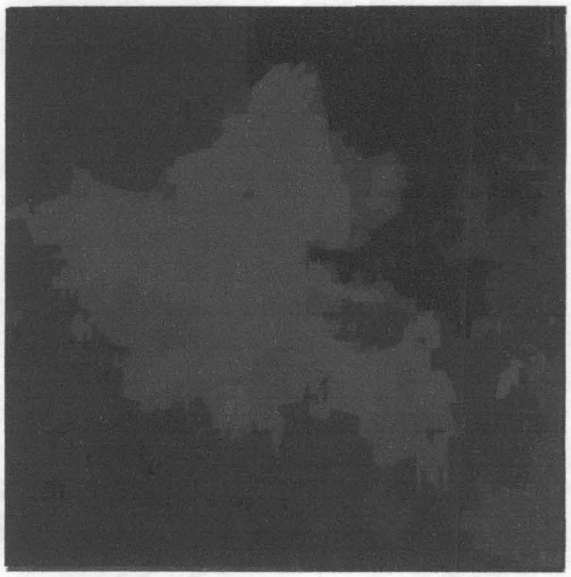
A sets of topomap, aerial photographs and satellite images covering the entire study area (Karmo) were obtained at scale 1:25,000,1:10,000 and 1:100000 respectively. The data were available for the year 1976,2001 and 2003. A total of 12 photographs were used for data. These were analyzed together to produce mosaics and to improve the visual quality of the data.

These are cloudless periods in the northern part of Nigeria where the study area falls. This in a way enhanced the quality of the photographs and their interpretation.

The first analysis that was performed on the image was general classification, which is VIW classification (vegetation,

KARUMO

N



Meters

500 1000 1500

Fig. 4.0 Nigeria Satellite - 1Images of 2003

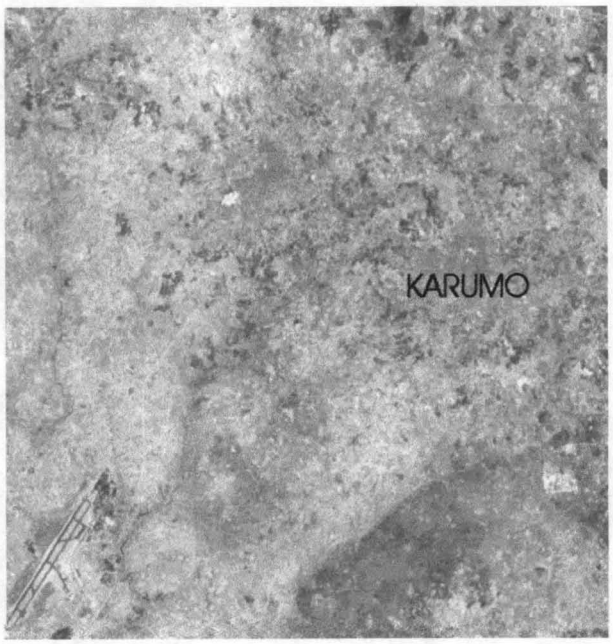
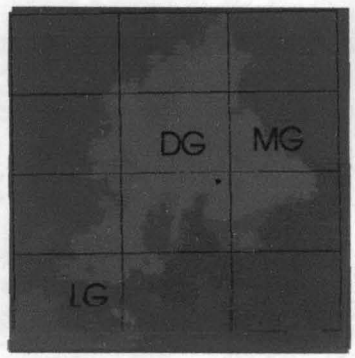


FIG. 4.1 Land Satellite images of 2001



N

Meters

3000 6000

Low Growth LG
Medium Growth MG
Deteriorating Growth DG

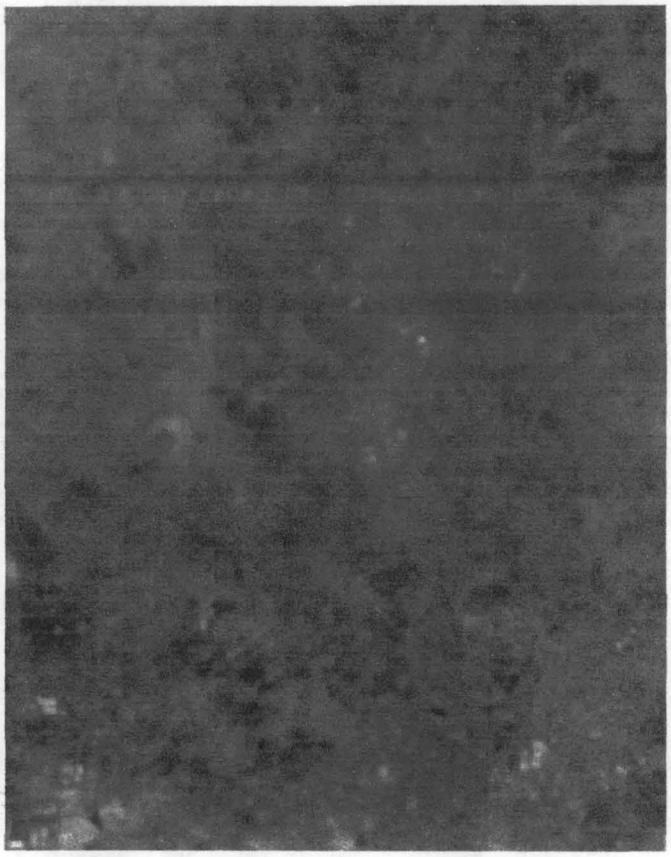
Fig. 4.2 Level of Growth in 2003

4.5.1 Vegetation, impervious surface and water Analysis in 2001 and 2003

The VIW analysis revealed that the whole area has been fully developed except some pockets of areas where fairly extensive vegetation was allowed to grow i.e. Figure 4.4 and 4.5. The next level of analysis was the classification of the study area into three different levels of densities, which was used to categorize the study area.

4.5.2 Density

The densities of various zones were estimated through the following procedure. A set Grids was drawn over the face of the satellite images and using random sampling, 30% of the grids that fell within a zone of study were selected, i.e. Figure 4.6, 4.7 and 4.8. The total number of buildings in these areas were counted and divided by the total dimension of grids used.

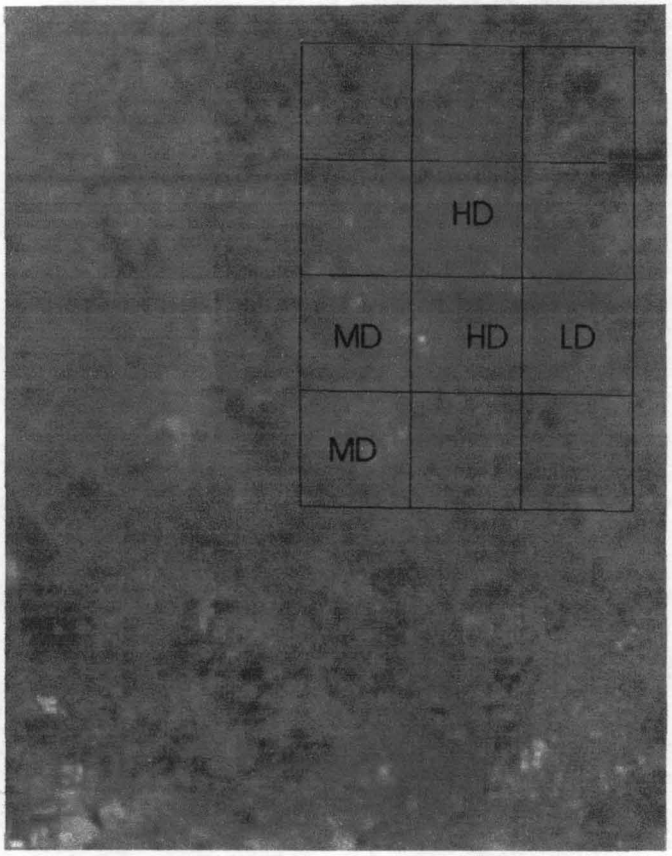


N

Scale

3000 6000

Fig. 4.4 Vegetation, impervious surface and water of 2001

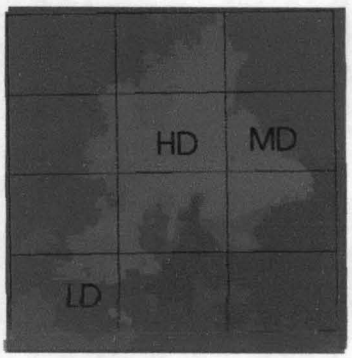


High Density [HD]

Medium Density [MD]

Low Density [LD]

Fig. 4.6 Building Density Analysis of 2001 Landsat Images



N

Meters

3000 6000

Low Density LD
Medium Density MD
High Density HD

Fig. 4.8 Building density analysis of 2003

i.e.

$$\frac{\text{Total number of building}}{\text{Dimension of a gird } X \text{ total number of grid}}$$

This gives the number of buildings per unit area. The number of buildings counted from the aerial photographs was confirmed on the ground through random selection of zones. The grids were identified through the boundary roads and a hand held GPS (Global Positioning Systems).

The study area was categorized into three quality zones on the basis of density as follows:

a). All area with density of building between 10 to 15. Buildings per hectare are classified as good quality.

b). All areas with buildings ranging from 16-25 per hectare were classified as deteriorating.

c). All areas with building densities above 25 buildings per hectare were classified as urban decaying.

...a town planning standards adopted in the study

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(Based on Nigeria town planning standards adopted in the study area).

4.5.3 Access to Building.

The types and condition of roads are assessed from the aerial photographs. The procedure used was essentially the same with the method used to determine the density variation in the study area. In the grid drawn across the face of the mosaic pieces of aerial photographs the types of roads predominant in all the selected grids for each zone were examined. This is used to aggregate the data for all the zones. From the aerial photographs as they have dark tones, the un- tarred roads have the same tonal quality as bare soil or site for building project or quarry. Pattern recognition of features however was used to determine those that are roads, and other features with similar reflectance property.

Roads are linear and long in shape; these qualities differentiate them from other features having the same spectral properties. The quality of good roads network was used to classify the study area into 3 different quality zones. Three quality levels of road network were observed to estimate the level of environmental quality.

1. Level of accessibility (denoted by the average number of roads per

unit area in relation to the number of buildings)

2. Types and condition of roads (either tarred or untarred).

2. Average width of roads (judged in relation to the standard of each category of roads).

These three parameters were used essentially to measure the quality value of each zone. Level of accessibility was given the highest value score of 5 while types and condition of roads were given 3 points; the average width of roads was given 2 points. The purpose of attaching value score to each parameter was to develop a quality rating value that is measurable and comparable (Ozo 1980).

4.5.4 Roof materials

The roof of a building is a good indicator of the quality and age of building. From the aerial photographs and photograph taken, three categories of roofs could be observed. The first class is the asbestos roof which has grey reflectance properties, the corrugated iron sheets are relatively new and have a very bright light tone while and the rusty iron sheets could be observed with varying grades of light tone to dark grey tone.

The area of study was divided into group of cells from which samples were taken to represent each zone for observation. The type of roof that appears more frequently in the zone is used to aggregate the data for the zones. Therefore, high quality zones are areas where a high percentage of the buildings have asbestos roofs and new corrugated iron sheets. Deteriorating zones represent areas where corrugated iron sheet predominate but are fairly in good condition, for example if they are still very new. The third zone represents areas with visible decay; where rusty buildings predominate. We noted during the ground truth exercise that some roofs have shades of colour that are different from our classified levels of roof 1.e.plate 4.3. These are discarded from being used for the analysis since they form an insignificant portion of the data.

4.5.5 Vegetation/Impervious surface interaction.

This was used to determine the level of urban slum quality based on the assumption that the level of landscape/vegetal cover in an area is an indication of the quality level of the settlement. The rate of disappearance of the vegetal cover in Karumo suggests several things

4.5.5 Vegetation/Impervious surface interaction.

This was used to determine the level of urban slum quality based on the assumption that the level of landscape/vegetal cover in an area is an indication of the quality level of the settlement. The rate of disappearance of the vegetal cover in Karmo suggests several things including increased congestion, which may be evidence of slum growth, as shown in Figure 4.6,4.7 and 4.8. The level of vegetal cover in each zone of study was examined as follows:

Areas with little or no air space or vegetal cover are classified as decay zone, while areas with less than 20% of vegetal cover in the surrounding are classified as deteriorating while areas having vegetal cover in more than 20% of the zones are classified as good environmental quality. From the analysis however, it was observed that Karmo environment in 1976 still had a rural setting especially in areas around Old karmo and Sabo karmo, which had only few buildings identified in the area (Figure 1.1).

Chapter 5

Summary of finding, recommendation, conclusion and future research.

5.1 Summary of finding

The acute problem of slum formation and development is found not only in the big cities but also in medium and small cities and towns. Due to rapid urbanization and consequent haphazard growth, most of these cities have become congested and unhygienic. It is clear that rapid processes of accretion as a result of increment flows of immigrants or migration caused the present changes in Karmo. In most of the Abuja municipal reports proper up to date maps of slums (karmo) along with proper database and genesis of its growth are not available which create problem in developmental process.

The slum expansion is due to the pressure of the population mostly on un-used and unprotected government land. But there is a tremendous growth in the existing slum located along the linear features like drainage channels, roads and streams.

In the central zones slum pockets do not expand, as the land is not available for expansion. The slums in the inner area are less in extent and are in stagnant situation than the slums in peripheries (as no provision for further growth is there). That's to say the area did not register any increase in number between 2000-2003, whereas the slums in the peripheral area registered a high growth rate.

In the area under study, it has been observed that houses don't have any drainage facility. Wherever drainage channels are is available, all of them are open.

It has been observed that houses in the study area are poorly accessible. The internal streets are neither paved nor sufficiently wide for introducing any kind of basic municipal service. The surfaces of the streets are uneven and become unapproachable in monsoon.

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municipal service. The surfaces of the streets are uneven and become unapproachable in monsoon.

House condition is one of the determinant factors regarding the slum environment. The houses in this environment fall under bad conditions because they are without the following services; waters, good sanitation, etc.

5.2 *Recommendations*

It is important to analyze the slum formation, slum morphology and impact on surroundings to improve quality of life of slum dwellers. Under these circumstances, remote sensing plays a leading role by virtue of its repetitive and synoptic coverage that may become a base map for government and organisation in a very rapidly growing urban slum area.

However, on the basis of results of the questionnaire survey coupled with other studies of the physical environment, some policy issues can be identified. These policies can be divided into four categories.

(1) Long team policy issues relating to the prevention of slum/squatter settlement area.

(2) While in the second category are the short-team policy issues relating to the physical improvement of slum area.

(3) For the purpose of risk vulnerability in slum, between 50m and 100m buffer have to be drawn around drainage and streams.

(4) Lastly, the entire environment may have to be incorporated. That's to say. The infrastructure should be provided i.e. roads, water, drains, electricity, streets etc.

5.3 *Conclusions*

Most of the slums have developed in the periphery along the natural drainage channels. This factor raises an important issue regarding the safety of the slums i.e. The Slums are subject to environmental risks like flash floods & erosions. Regarding the study area it has been observed that although most of the slums are marginal slums, but the condition is not so bad in terms of living. The large number of mud houses, better sanitation condition, available electricity, access to houses etc. gives us a picture of a slum area having mixed socio-economic conditions.

It has also been concluded that the slum houses located in the western part are better than that of the eastern area because the slum in the western area are more stabilized because of it's nearness to the important commercial centre grown along life-camp and idu, and there is less provision for further construction of slum houses. On the contrary, in the eastern past, slum houses are developing fast and the important services like water, drainage, electricity, are lacking. Access to houses and

sanitation condition is very poor along with street lighting. This is mostly due to the barriers of streams between slums and the main area.

From the above study it may be concluded that encroaching the major drainage channel and avoiding the high cost of renting houses in Abuja city formed the slums in Karumo. So proper care, planning and management should be taken to mitigate the flood risk vulnerability and erosion in slums. The urban planner therefore, has to take these facts into consideration and also monitor the vulnerable areas for checking the growth and expansion of slums.

5.4 Future Research

I plan to pursue a number of research activities. Most of these will concentrate on refining the methods described above so that they are applicable to a wider range of urban slum and development conditions. In all cases, however, the basic modelling assumption remains the same, i.e. the physical dimensions of a slum by quantifying its footprint. Same of the more notable activities include:

(a). Creating a regional index to measure slum building density and development.

(b). Depending on the success in creating these regional slum buildings indices, the next step is to test whether it is possible to recognize these "slum building signatures" using remote sensed data.

QUESTIONNAIRE

TO BE ANSWERED WITHOUT FEAR OR FAVOUR.

Name.....

Occupation..... Place of work.....

Contact Address .....

.....

Are you a native of Karimo? (YES) OR (NO)

SECTION A

1. Types of Building

- Face – to face
- Bungalow detached
- Block of flats (row bldg)
- Storey bldg.
- Other

2. Accessibility to Buildings

- Foot Path
- Motorable road
- No access

3. Condition of access

- Tarred
- unterred
- Cemented

4. Age of Building

- Below 10 years
- 11 –30 years
- 21-29 years
- Above 30 years

5. Wall Material

- Brick (plastered)
- Mud brick (unplastered)
- Sandcrete block
- Timber/iron sheet

6. Condition of floor

7. Wall condition

- Cracking
- settlement

8. Roofing Material

- Concrete (decking)
- Asbestors/clay roof
- Corrugated iron sheet
- Others

9. Cond. Of roofing materials

- Leaking
- Rusty
- Sagging
- Part missing
- Good shape
- Others

10. Flooring Materials

- Cement concrete
- Terrazo
- Timber
- Modern tiles

11. Wall condition

- Water closet

- Cracked
- No Cracks
- Damp
- Dry

11. Window materials
- Glass/tainted & louvers
- Wood

12. Condition of Window
- Broken
- Falling off
- Good

13. Types of doors
- Metal
- Metal & glass
- Wooden
- Others
- No door

14. Condition of doors
- Broken
- Falling off
- Good

15. Types of ceiling
- Asbestors/tiles
- Wood
- Mal
- Cardboard
- None

16. Condition of ceiling
- Good
- Leaking
- Fait missing

17. Number of habitable room
- Below 1 rooms

Section B;

25. Source of water supply

31. Highesteducat attainment

- Well
- Bore hole
- Tap water
- Stream and river
- Others (specify)

26. Method of waste storage

- Bega
- Dust bin
- Buckets
- Drum
- Others

27. Method of waste disposal

- Local Govt.
- Private firm
- Disposed by self
- Burnt outside by self

28. Ownership of building

- Ownol occupier
- Rented
- Public
- Family house

29. Occupat of house head

- Professional
- Manageria
- Artisan
- In training/student
- Unskilled
- Applicant

30. Employment sector of head

- Public
- Private
- Self emp_oyed
- Un-employed

36. Rent paid on house per year

- Delow #12,000
- #12,000 – N15000
- #15,000 - #30000
- #30,000 - #45,000

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