AN ASSESSMENT OF THE SPATIAL RELATIONSHIP BETWEEN POVERTY AND ENVIRONMENTAL QUALITY IN MINNA METROPOLIS, NIGER STATE, NIGERIA

BY

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CERTIFICATION

This thesis titled: An Assessment of the Spatial Relationship Between Poverty and Environmental Quality in Minna Metropolis, Niger State Nigeria by Yekeen A. Sanusi (Ph.D / SSSE / 1999 / 2000 / 33) meets the regulations governing the award of the degree of Ph.D of the Federal University of Technology, Minna and is approved for its contribution to scientific knowledge and literary presentation.

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DEDICATION

'his thesis is dedicated to my mother, Aishat Sanusi (of blessed memory) and my ıther, Sanusi Raji Akanmu.

ABSTRACT

'he positive view of urban centres has influenced their use as growth centres where development is ıpposed to spread to people and places. This has encouraged high level of urbanization. In the mist of rbanization is an observed failure of cities to sufficiently improve the quality of life of the inhabitants nd the quality of the environment. Hence, continued urbanization is contributing to 'urbanization of overty'. In space term, poverty is manifested in poor housing conditions, poor neighbourhood ınitation, inadequate community facilities and services, use of urban marginal land, inadequate ousing facilities, high housing densities and generally poor neighbourhood environment. Therefore, it understandable to see some linkage between human poverty and low quality environment. The study rea is the capital of Niger State and headquarters of Minna Local Government Area. The study used vo major approaches for data collection. These are direct field data and remote sensing data. In the rst case, both questionnaire administration and physical surveys were conducted. In the questionnaire ırvey, 2120 households, representing 3.2% of total Minna households were surveyed from 25 eighbourhoods. Similarly, 2120 residential buildings were physically assessed for housing conditions 'hile neighbourhood streets were used to assess the general environment of each neighbourhood. In ıe case of remote sensing products; two images of Minna are used. These are SPOT, 1995 and andsat, 2001. The two images yield change in land use development in Minna and provide growth ıtes for each neighbourhood. The growth rates provide the factor for estimating land uses among the eighbourhoods at the end of 2003. By using the 2003 estimated land uses, eight variables were erived. These provide indirect indices for assessing poverty and neighbourhood quality in the study rea. Apart from assessing the environment by simple proportional representation, the quality of the eighbourhood environments are also assessed by the adoption of Environmental Development Index EDI). The technique is based on the use of Linear scaling Technique used in calculating Human evelopment Index (EDI). Both the direct data and remote sensing data are complimentary. Both the overty level and poor environmental quality among the neighbourhoods are high in Minna. Although ere is a statistical linkage between poverty variables and environmental quality, such linkage is oderate and found to be significant consistently in the case of poverty head count. With a large ımber of poverty policies over the years in Nigeria, the existence of poverty and continued poor ıvironmental quality question the relevance, consistence and sustainability of these poverty policies.. hus, it is the submission of this study that for poverty and poor neighbourhood environmental quality be eliminated, the neighbourhoods should be a focus of attention in the application of both onomic and spatial solutions.

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ABBREVIATIONS

BOSTID	Board on Science and Technology for International Development
ECDC:	European Commission for Development and Cooperation.
EDI:	Environmental Development Index
GIS:	Geographic Information System
GDP:	Gross Development Product.
HDI:	Human Development Index
ILO:	International Labour Organization.
LLI:	Level of Living Index
OECD:	Organization for Economic Cooperation and Development
PPP:	Purchasing Power Parity
SAP:	Structural Adjustment Programme.
SPSS:	Statistical Packages for Social Sciences
UN:	United Nations
UNDP:	United Nations Development Programme
UNEP:	United Nations Environment
USAID:	United States Agency for International Development.
UTM:	Universal Traverse Mercarto.
TM	Thematic Mapper

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CHAPTER ONE

1.0 INTRODUCTION

1.1 INTRODUCTION

A wide range of problems is now threatening the propulsive influence of urban centres as nuclei of growth and development; some of which are getting to crises proportions. Cities are seen as centres of hope and desire (Selbborne, 1977), where both production and consumption are affected (Mabogunje, 1974). By this positive view of urban centres, cities present a strong positive force in the development of space, economy and people. Cities represent economic entities (Onimode, 1976) that play significant role in the development of nations and in shaping their destinies (Yankson, 1995).

Globally, the process of urbanization became generalized through the incorporation of large non-commercial areas of the world into European civilized fold through imperialism of European power (Harvey, 1973). In 1900, only 233 million people lived in cities (Mehta, 2001) That is, 14 percent of the worlds population of 2,516 million (UNEP, 1993). By 1950, 30% per cent of worlds population lived in urban centres while in 1980, the rate increased to 39 per cent (Mehta, 2001) and to 43% per cent in 1990 (UNEP, 1993). In 1991, the world urbanization stood at 45% while it was estimated to reach 60% level at the end of 2000 (European Commission, 1996).

In Nigeria, the urban population which stood at 7.2% in 1931, increased to 10.6% in 1952 and 19.1% in 1963 while the number of urban centres with at least 20 000 people rose from 27 in 1931 to 58 in 1952 and to 180 in 1960 (Mabogunje, 1974). By 1980, the level of urbanization stood at 27.1%, 31% in 1985, 35.2% in 1990 (UNO, 1991), and 43.3% at the end of 2000 (Mabogunje, 2001). Further, it is shown that in 1991, the number of urban centres with at least 20 000 people increased to 359 and to 450 in 2000. Similarly, as opposed to the average population growth rate of 3.0%; the urban population within the last three decades (1970 - 2000) grew at an average of 5.8 per cent per annum (Mabogunje, 2001).

In this scenario, greater number of the new additions to urban population takes place in less developed countries. Also, there was a deliberate policy to use the urban centres as a basis for development. This approach has been aided by theoretical proposition of the spatial equilibrium model which holds that growth cannot take place evenly in all areas at the same time (Keeble , 1967,) and that growth spreads from selected and favoured centres (cities) to surrounding areas. The result is the choice of some urban locations as growth centres; a development approach which some analysts have termed, development from above (Hansen, 1981 and Stohr, 1981).

In this application, the cities become exceptionally favoured leading to what has been called urban bias (Lipton, 1977 and Yankson, 1995). However, it has been realized that the bias towards the city is not a balanced one even towards the city itself. Rather, it is in favour of a few people and sector and that in the process, continuous increase of people in these few centres is leading to urbanization of poverty (Heilbrum, 1973, UMP, 1996; Mehta, 2001). The emerging fact therefore, is that the urban centres as growth centres in less developed countries have failed to assure development within and outside their territories.

Poverty is a major contributor to the existing environmental problems in the cities of the Third World countries including Nigeria. Poverty is forcing people to use more environmental resources in largely unsustainable manner. It aggravates the tendency of the people to misuse the environment and reduces the capacity of the people to manage the environment.

Despite the continuous urbanization, the economy of the Nigerian urban centres is not more responsive than that of the other less developed countries. Urban poverty increased from 17% in 1980 to 37.8% in 1985 and 53.2% in 1996 (FOS, 1999). The excruciating poverty situation is equally matched with deteriorating urban environmental conditions. It is safe to say that there is mass poverty in Nigeria (Fafowora, 1998) and that 'poverty is the greatest challenge facing the present civilian administration' (Adefolalu, 2002).

As indicated by UNICEF (1990) the challenge now " is the need for revitalization of economic growth and social development in the developing countries and to address together the problems of abject poverty and hunger that continue to afflict far too many people in the world'. Part of the solution to this monster which the developing countries have carried into the 21st century is a research base and this work is meant to be part of this base.

1.2 STATEMENT OF THE PROBLEM

The level of poverty in Nigerian urban centres has been expressed to be high, continually on the increase; economically unproductive and depressive, and socially threatening. The increasing poverty is taking place against the background of high rate of urbanization. Urbanization then becomes endemically ominous; having serious implications for employment creation, provision of food and housing, social services and protection of the urban environment (Obeirai, 1992). Recent observations have shown that poverty is not confined to ny economic sector; rather, it cuts across all economic sectors and even across socio-economic classes. As Mabogunje (1996) observes 'the ranks of traditionally structurally poor came to be swollen by the masses of the new, conjectural poor'. The new poor consists not only of the low income earners of both the formal sector and the informal sector but also the middle income earners; a class of people said to be de-classed at the peak of the implementation of SAP. So poverty in Nigerian urban centres now 'occurs in many forms and at many levels' (Engelhard and Abdullah, 1992).

The environment is definitely the first casualty of poverty. The poor live in residential neighbourhoods of low quality and their poverty status makes it highly difficult if not impossible to make any appreciable improvement to their living environment. They depend on cheap energy sources that pollute the environment, undertake economic activities that contribute to both indoor and outdoor pollution and live in conditions that belie the high technology often associated with cities. They equally lack the capacity for effective organization to effect any positive changes on their personal lives and the environment. Today, slum, high population density, poor access to residential houses and poor sanitation characterize Nigerian urban residential neighbourhoods. These problems do not only make their condition worse, they also make it impossible to fight poverty out of their lives.

The macro economic conditions have only helped to sustain poverty and to aggravate environmental deterioration. Poor economic performance and dwindling foreign exchange had forced the Federal Government to introduce economic structural adjustment programme (SAP) in 1986. SAP is associated with reduced government expenditure, in particular on social and economic infrastructure. Thus, the SAP period witnessed 'a systematic deterioration in the condition of the country's infrastructure and social services' (UNDP, 1996).

Although SAP depended on the manipulation of macro-economic variables, the macro economic indicators have remained poor for a long time. For example, records published by *Hallmark Weekly* (June 2, 1999) showed that exchange rate which was about 70 kobo to a US dollar in 1986 depreciated to ₦10.00 to a US dollar in 1991; ₦ 35.00 in 1994 and to ₦ 85.00 in 1998. This has depreciated further to ₦ 103.00 in 2000 and to ₦ 120.00 in 2001. Real GDP growth rate fell from 4.7% in 1991 to 1.3% in 1994. It rose to 2.36% in 1998 but below the 1991 rate. Manufacturing capacity utilization dropped from 39.4% in 1991 to 30.4% in 1994 and to 25% in 1998. Similarly, inflation was high within this period. It rose from 13% in 1991 to 57% in 1994 and to 72.8% in 1995. The negative effects of these and other macro-economic indices in the economy in general and on poverty and environmental quality in particular are significant and frightening. Although some attempts were made to cushion the negative effects of SAP, these attempts proved inadequate to address the existing mass poverty. In particular, such efforts came largely from the Federal Government and more importantly, the residential neighbourhoods where the poor reside were untouched. The attempts also lacked spatial touch.

So, in the midst of all these, urban liveability becomes threatened. Insecurity escalated while urban health services deteriorated. Urban centres became centres of extreme violence and increasing number of hoodlums in the name of *area boys* while crowd-related epidemics became rampant.. These problems are evidently observed in the study area, Minna.

Minna is the nearest state capital to Abuja. This proximity also pulls population from Abuja. There are increasing number of people from Abuja who keep their households in Minna. Given its present moderate population, it will continue to attract more people from within and outside the state.

Minna has a weak economic base. The only formal sector of significant employment base in the town is educational institutions; although civil service provides significant employment in Minna. The economy of the town is tied to informal trading. Hence, the central market is the core of the informal labour market. The implication is that given high level of competition and low level of labour rationalisation, low capital base and low capital formation, most people will just be struggling to eke out a living. Industries are grossly few in the town. Some industrial establishments were developed in Minna but under the stifled influence of SAP, most of these industries have collapsed. So, the city is now dotted with abandoned industries.

Poverty in Minna is also forcing increasing number of the people to develop ecologically unstable lands consisting of hilly slopes, riversides and other flood plains. The hitherto floōdable areas meant for rice cultivation are now being converted by poor households into residential land. The hilly slopes of Minna have become easy prey for poor housing. These marginal lands are essentially unserviced by roads and water and are faced with the threat of flood. Similarly, fuel wood consumption is evident by the large depots of fuel wood in the city. This shows increasing dependence on fuel wood as a source of domestic power supply by the households.. Not only does this indicate economic stress on fuelwood-using households, it also has impact on the quality of the urban environment, as the households are exposed to in-door pollution and deteriorating structure.

A large portion of residential housing in Minna are in poor conditions with significant number, particularly, in the core of the city becoming unsuitable for human habitation. There is an observed housing congestion leading to high room occupancy ratio. A large portion of the housing environment also lacks adequate open spaces. Overall, therefore, both room and housing density are high. Similarly, community facilities and services are not available to the majority of urban households. These facilities and services are not increasing with the expansion of the city. Today, there are many neighbourhoods in Minna that are not serviced by municipal water mains while others are provided with low capacity mains. As a result, urban households spend substantial part of their limited incomes on the purchase of water from water vendors.

The poverty situation in Minna has been recognized in a recent study by Baba, Morenikeji and Odafen (2001). They identified the prevalence of economic poverty and low level of human development in Minna. They also show inadequacy of housing facilities and deficiency in housing conditions. However, the study did not apply remote sensing and GIS either in data collection or in analysis. Second, poverty-environment relationship was not the focus of the study. These two issues constitute part of the existing gaps in the understanding of poverty in Minna. This study has attempted to fill these gaps.

1.3 AIM AND OBJECTIVES

The aim of the study is to examine the nature of poverty and to understand the relationship between poverty and environmental problems in Minna.

The objectives of the study are:

1.3.1 To measure poverty and to identify the spatial distribution of urban poverty.

1.3.2 To assess the level of neighbourhood environmental quality.

1.3.3 To examine the perception of the environment by the poor and how this relates to poverty.

1.3.4 To examine the relationship between poverty and the environment.

1.4 RESEARCH HYPOTHESES

1.4.1 There is no significant relationship between poverty and the urban environmental quality.

1.4.2. There is no significant relationship between the perception of the environment and the quality of the environment

1.5 RESEARCH QUESTIONS

1.5.1 How poor are the residents of Minna?

1.5.2 Where do the poor live?

1.5.3 What are the environmental correlates of poverty?

1.6 JUSTIFICATION

The study will help to understand poverty as it occurs in the study area thus helping to know the local variation of poverty. The study will also help to know the link between poverty and environment and how the perception of the environment by the residents has aggravated the poverty-environment linkage. Further, the study will be useful to the governments, agencies responsible for poverty reduction, and environment agencies and civil societies at large. It will assist these people and groups to assess the efficacy of the existing policies and to design and implement relevant policies for the reduction of poverty and improvement of the environment.

1.7 SCOPE

The study will cover the following areas:

1.7.1. The people: socio-economic characteristics of the people, and measures of their welfare.

1.7.2. Housing characteristics as well as neighbourhood facilities and services.

1.7.3. Environmental problems resulting from poor household welfare as available within residential areas

In particular, emphasis will be on neighbourhood-based environmental problems. In addition, the study will be limited to Minna metropolis. This is defined by

a) The old Minna; that is what is traditionally seen as Minna.

b) The new settlements that came as a result of further urbanization of Minna. These include Barkin Saleh, Sauka-Kauta, kpakungu, Dutse-kura Gwari, Dutse-kura Hausa.

c) Other peripheral settlements that have been swallowed up by the expanding Minna. These consist of Bosso town, Tudun-Fulani, Maitumbi, Sango and Chanchaga.

It is recognized that there are some outlying settlements which are not included in the delimitation of Minna. These settlements include Maikunkele and other settlements outside Chanchaga along Abuja road and after Kpakungu along Bida road. They are separated by expanse of rural land from the main town. Minna, as defined in this study is for the purpose of this study.

CHAPTER TWO

2.0 THE STUDY AREA

2.1 INTRODUCTION

Minna is the capital of Niger State, a state in the North-Central geo-political zone of Nigeria. Minna is an important settlement of the Gwari linguistic tribe. Its importance in recent time has been enhanced with the creation of the new Federal Capital Territory, Abuja, to its east; a development that attracts considerable number of people to the town. It remains the largest town in Niger State; although its economic importance in the state is facing competition from Suleja town because of the latter's proximity to Abuja.

2.2 LOCATION

The town lies on latitude 9°.38' N and Longitude 6°.33' East. Minna combines the status of an urban centre with that of a local government area (figures 2.1 and 2.2); spanning from Tudun Fulani in the Northwest to Chanchaga in the South. Minna is about 135 km away from the Abuja Federal Capital Territory and 300km away from Kaduna city. Within Niger state, it is about 90 km away from Bida, 100km away from Suleja and about 130 km from Kotangora.

The town sits on geological base of undifferentiated basement Complex of mainly gneiss and magmatite (Minna Master plan, 1979). The town lies on a relatively high land, with a site height of between 240m-270m above sea level. It is surrounded by a range of hills that stretch from north east westward towards Bosso and Tudun Fulani. It is in this sector that lies the famous Paida hill which with a peak

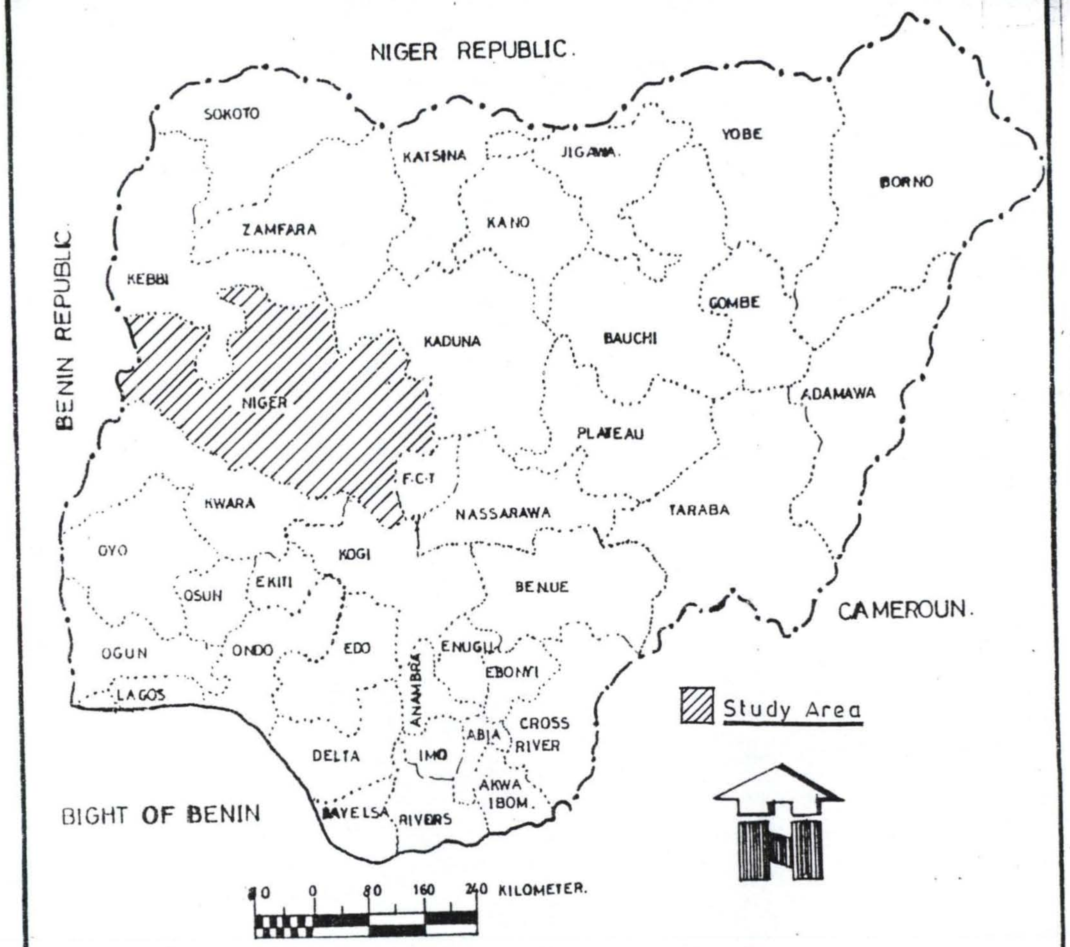


FIGURE 2.1: NIGER STATE AMONG OTHER STATES OF NIGERIA

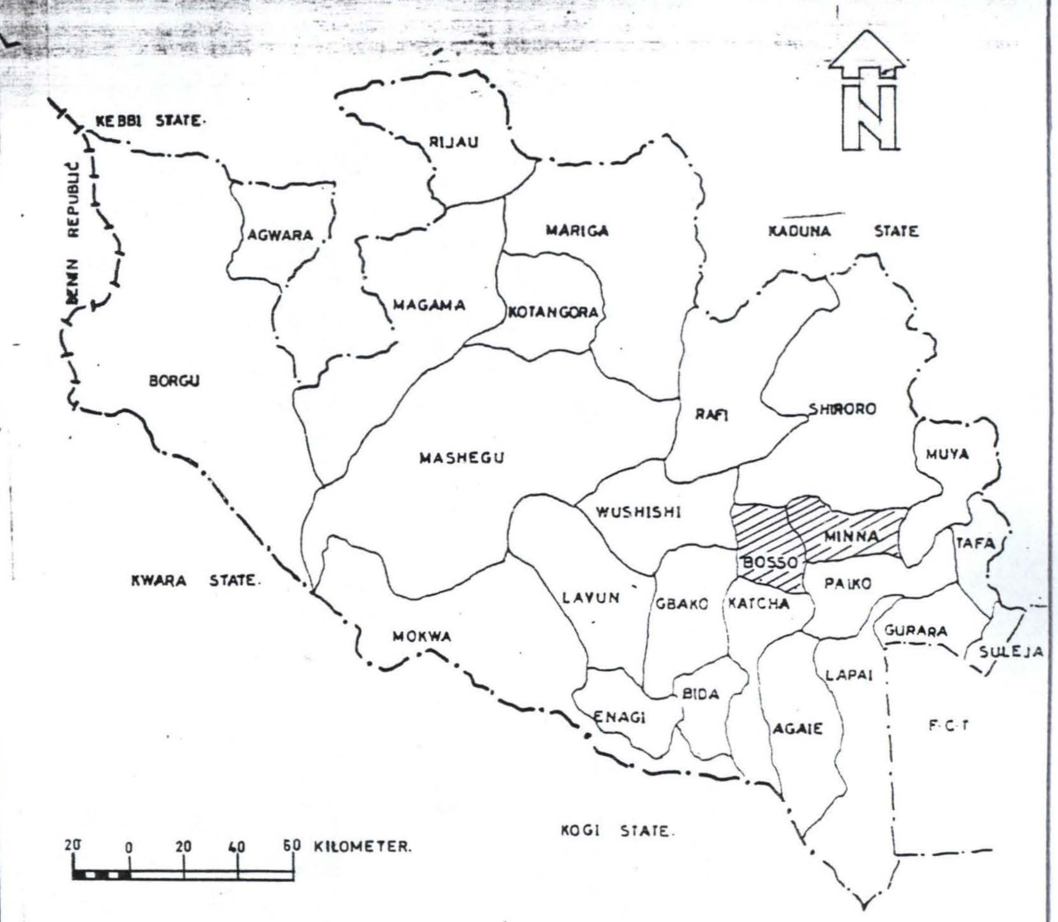


FIGURE 2.2 LOCAL GOVERNMENT AREAS IN NIGER STATE.

LEGEND: International Boundary State Boundary
Local Boundary Study Area

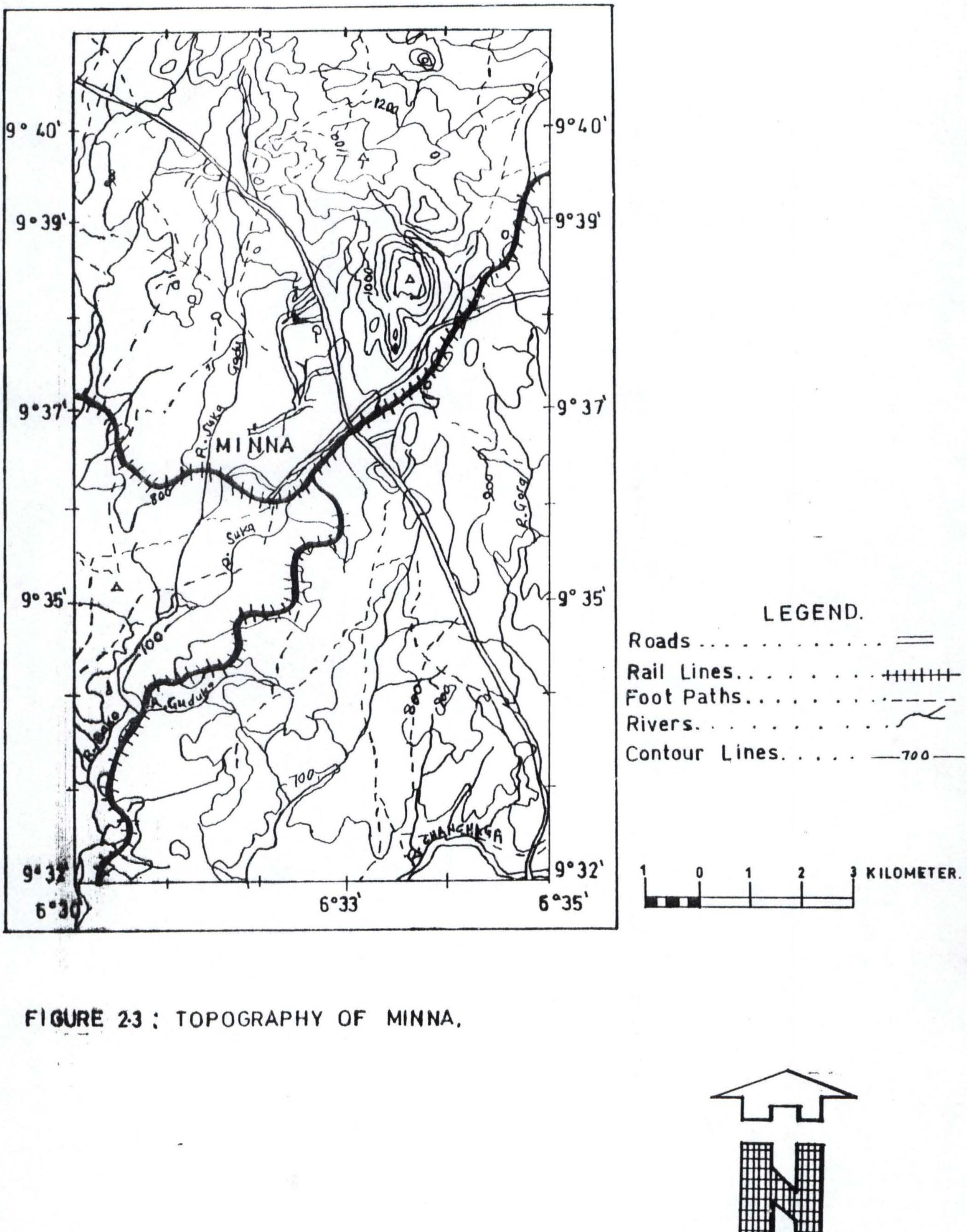


FIGURE 2.3 : TOPOGRAPHY OF MINNA.

of 443m represents the highest point in the town (Figure 2. 3). The lower part of the town is dissected by River Suka and its tributaries. In the far southeast of the town lies River Chanchaga. The river flows westward from the southeast part of the town. River Chanchaga has been dammed to provide community water supply for the greater part of the town. For a significant part of the drainage of River Suka and its tributaries, there are flood plains that for a long period provide ground for flood rice cultivation. Within the relatively flat and developable area of the town, there are also pockets of hills formed by rock outcrops. These are more in the eastern part of the town.

2.3. HISTORY

What appears as the town of Minna today started as a scattered settlement of hill top before the close of the nineteenth century. Minna town derived its name from the term, Myina. Myina itself is derived from (1) a cottage on the hills outside the outskirt of the town; (2) the famous 'zaure' or mud huts on top of Paida hill and (3) the burning of fire. This is associated with the annual ceremony of the Gwaris (Fabiyi, 1984).

The account by Fabiyi (1984) also shows that the origin of Minna is traceable to the settlement by a hunter said to have migrated from Borno. The hunter with his family came to the spot now named Minna in search of game. The hunter, whose name was not given, was later followed by his kinsmen.

While the existence of the town during the period of the Uthman Dan Fodio Jihad of 1802-1810 cannot be ascertained, it is clear that it was already in existence during the expansionist expedition of Umar Nagwamatse, a descendant of Dan Fodio. Nagwamatse was said to have raided Minna on many occasions (Fabiyi, 1984). Perhaps the attacks of the settlement by Nagwamatse made the choice of the secure hilltop attractive to the earlier settlers. The need for protection from external invasion made the hill-top Minna to get military cover from Bosso under which Minna stayed for quite a long time. During this period, the *Esu* (chief) of Minna was answerable to the Chief of Bosso (Kolo, 2002).

Until Colonization, Minna remained an isolated and largely unsecured settlement on hill top. With Colonialism was a relative peace that encouraged settlement on the foot of the hills. However, Colonial transportation system through railway lines encouraged the processes of formation of a new settlement that culminated in what is known today as Minna. The Encyclopeadia Britannica (2001) reports that, following the Kano-to-Baro railway (1911) and the extension of the Lagos-to-Jebba line (1915) to a junction in Minna, the town became a major collecting point for peanuts (groundnuts), cotton, yams, and shea nuts. The town itself was linked with rail lines in 1905. With a railway station sited in the junction, the opportunity for the growth of the hitherto village was set in motion. By 1950, a traditional boost to the status of Minna was established by the appointment of the first chief of Minna in the person of Alhaji Ahmadu Bahago Kuta who doubled then both as Sarkin Minna and Sarkin Kuta-in-Council (Fabiyi, 1984). The emergence of Minna therefore is a combination of preference by the indigenous population who originally preferred hilltop and locational advantage brought about by colonial rail transport system and the attendant privileges conferred on the town both by the colonial administrators and the response of traders to these advantages and privileges.

2.4 URBANIZATION OF MINNA

The urbanization of Minna started with the peace brought about by Colonization. Colonization eliminated the constant invasion, which the settlement witnessed in the hands of the Fulani warriors pioneered by Nagwamatse. The peace encouraged the Gwari settlements on hill top to move downward during which they settled in area called Paida (now a ward in Minna). This action was however enhanced by the locational advantage brought to the settlement through linkage to the railway line in 1905. The sequential urbanization process witnessed by Minna can be seen in Table 2.1

TABLE 2.1 : URBANIZATION OF MINNA, 1905-1933

Date	Urbanizing Event
1905	Railway reached Minna
1909	Southwest expansion of the town.
1910	Town planning was introduced
1917	Township status was given to half of the town
1924	Minna became the headquarters of local Colonial administration
1933	Minna became headquarters of Kuta Division

Source: Complied from Fabiyi, J. A. A. (1984).

The railway lines and colonial administrative activities provided a basis for the urbanization of Minna. The construction of the railway lines, the choice of the town as a railway station and the associated economic activities attracted people from different parts of Nigeria (Maxlock, 1980). So, by 1909, the settlement experienced southward expansion. This event led to an emergence of an ethnically heterogeneous Minna and the development of ethnic-based residential camps which influence is still observable in the town today.

In 1924, the seat of local Colonial administration was moved from Bida to Minna. That event also led to the provision of basic administrative departments and functions that also attracted people into Minna. By 1928, the Zungeru-Paiko road had been constructed. In that year, Minna was an emerging urban center with scattered developments and isolated villages (Figure 2. 4). The process of spatial integration that would ensure the enclosure of hitherto rural land had begun. The larger part of residential development was concentrated around the railway station.

Available figures show that in 1934, Minna had a population of 5000. In 1954, there were 3005 male tax payers in Minna (Fabiyi, 1984). Given a similar number of females and children population of about 40 percent, the population of Minna might have stood at 20 200 in 1954. With the approach of National Independence in late 1950s, Minna became attractive to both the people and governments.. The political activities that preceded and followed independence and their spill-over effects in economic activities attracted people into Minna. In 1956, Minna was connected with electricity supply. Already, from 1949, it had been enjoying water supply from a dam on River Suka in Bosso. The effect is a large population recorded in 1963 National Population Census. So, the town had a population of 59 988. That is between 1934 and 1963, Minna's population multiplied by more than ten times with an average annual growth rate of 9%. In 1979, the population of Minna

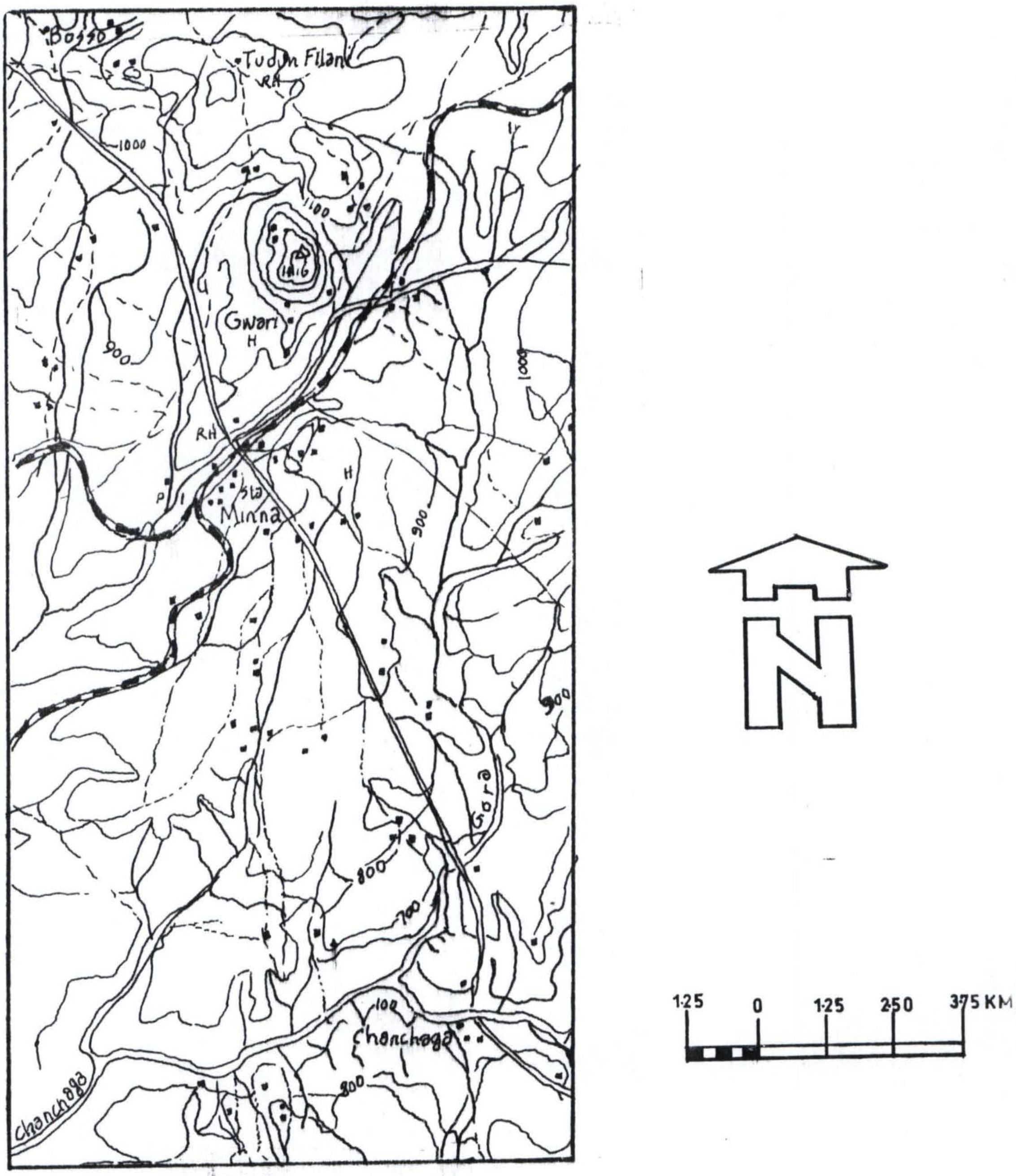


FIGURE 2.4: MINNA AS DEPICTED FROM 1928 AERIAL PHOTOGRAPH
SOURCE: Minna Master Plan, 1979-2000.

was estimated as 76 480. The population census of 1991 gave the population of Minna metropolis as 190 750. With an annual growth rate of 7.9%, the population of Minna between 1979 and 1991 multiplied by about two and a half times. The 7.9% growth rate within this period is well above the national population growth rate of 2.83% given by the National Population Census of 1991. Based on the observed population growth rate of 7.9% and national average of 2.83%, two population estimates of the town could be made as shown in Table 2.2.

The higher growth rate between 1979 and 1991 could be understood against the backdrop of changes in political status of Minna, having become a state capital in 1976; the establishments of the State's College of Education (1976), the Federal University of Technology (1981), other tertiary institutions and federal institutions. All these led to influx of people from within and outside Niger state into Minna. Figure 2.5 shows the extent of Minna in 1976 while figure 2.6 shows its level of urbanization in 1993. As figure 2.6 shows, more road network and facilities (for example, the airport) saw the growth of Minna over the 1976 level.

The estimates in the Table show that the population of Minna metropolis at the end of 2000 stood between 245 213 and 378 144. While the national average population growth rate remains a valid official figure for population estimation, it does not reflect the reality of the local population growth, not only for Minna but also for most urban centers in Nigeria.

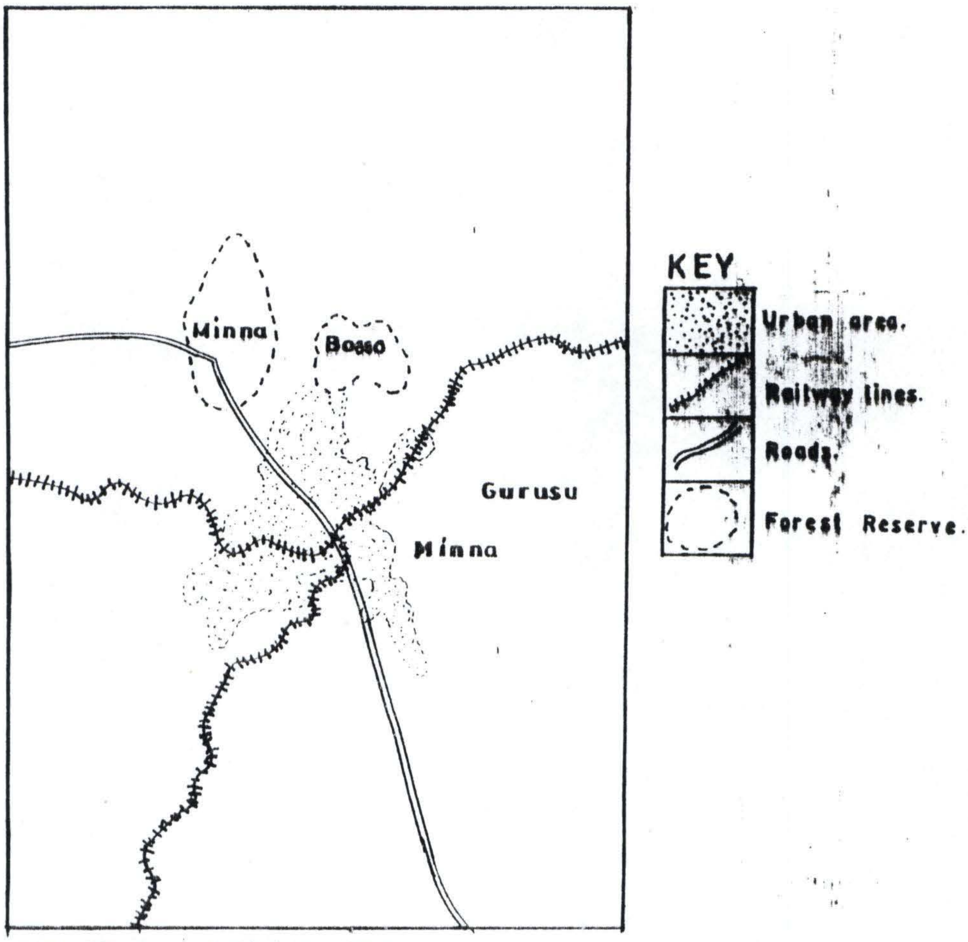


FIGURE 2.5 : MINNA, 1976.

Source: Federal Department of Forestry, Abuja,1995.

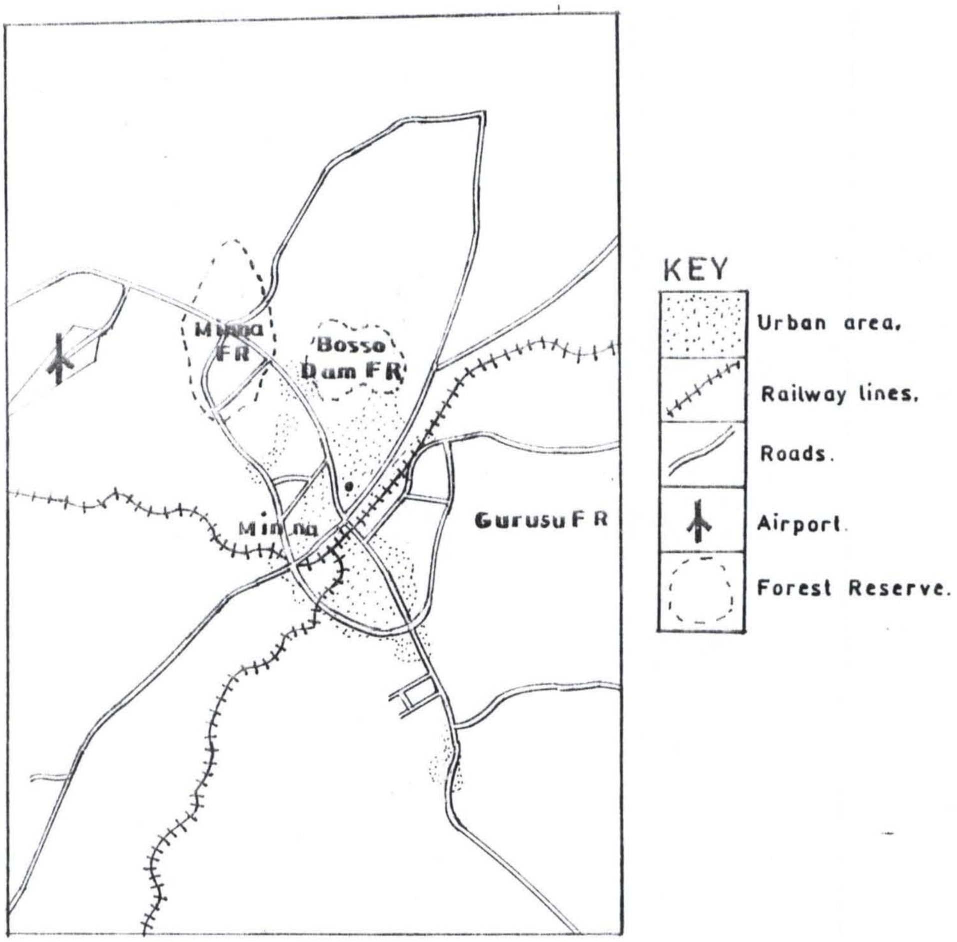


FIGURE 2.6 : MINNA, 1994.

Source: Federal Department of Forestry, Abuja, 1995

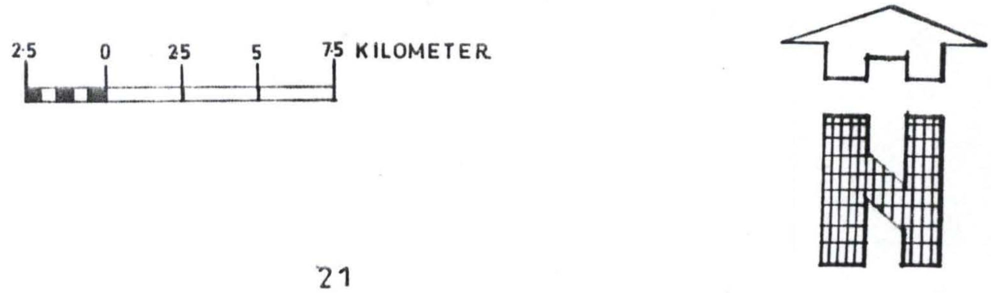


TABLE 2.2: ESTIMATEDPOPULATION OF MINNA METROPOLIS, 1992-2002

YEAR	Population at different growth rate		Average
	At 2.83%	At 7.9%	
1991 *	190 750	190 750	190 750
1992	196 148	205 819	200 984
1993	201 699	222 079	211 889
1994	207 407	239 623	223 515
1995	213 277	258 553	235 915
1996	219 313	278 979	249 146
1997	225 519	301 019	263 269
1998	231 901	324 799	278 350
1999	238 464	350 458	294 461
2000	245 213	378 144	311 679
2001	252 152	408 018	330 085
2002	259 288	440 251	349 770

Source: * NPC, 1991. Others are author's estimates.

It should be emphasized that the practical influence of Abuja on Minna makes the adoption of the higher population estimates for the town more acceptable. Perhaps a middle-range population that averages the higher estimate and the lower estimate as shown in column 4 of Table 2.2 will be more preferable. Further, whichever estimates that is preferred, the fact is that the population of Minna is expanding rapidly and may continue to do so for the foreseeable future.

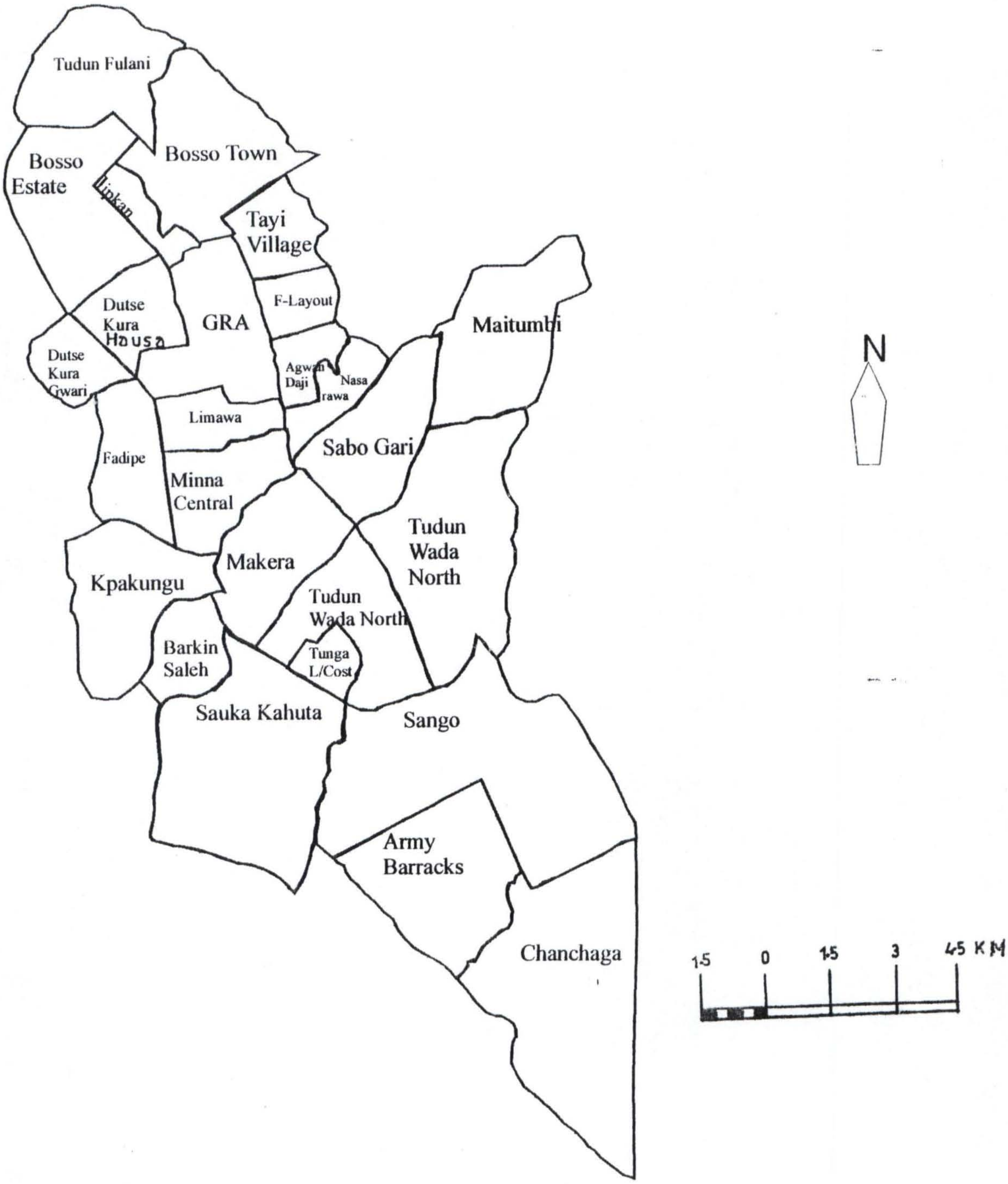


FIGURE 2.7: MINNA NEIGHBOURHOODS

In term of built-up area, Minna area extent increased from 884 hectares in 1979 to 5336 hectares in 1983 and to 7070 hectares in 1993 (Bashir, 2001). The phenomenal growth of Minna after its choice as a state capital can be seen in the difference between its built-up area in 1979 (three years after its choice as a capital) and 1983 (seven years after). With additional land area of 4452 hectares, the town witnessed an annual growth rate of 30% in its area coverage within 1973-1983 period while between 1983 and 1993 Minna land area grew at the rate of 2.9%.

The urbanization of Minna is also observable in the increase in the number of its administrative wards from six in 1950 to 11 by the end of 1990s. The eleven wards are Rafin Yashin, Limawa A, Limawa Ward, Minna Central, Sabon Gari, Tudun Wada North, Tudun Wada South, Maitumbi, Nassarawa A, Nassarawa B, Minna South, Chanchaga. These are broad divisions for urban administration. A more detailed division based on neigbourhoods shows that Minna contains 26 neighbourhoods (Figure 2.7).

2.5 ECONOMIC BASE

The initial push that modernized the essentially subsistence farming economy of the pre-colonial hill-top settlement of Minna was the railway. The construction of the railway lines and the running of the rail lines attracted a new set of manpower who participated in the construction and trading sub-sectors. However, with increasing urbanization and changes in the political status of the town, what constitute the economic activities of the town also kept on changing. The attention of this section is on these economic activities.

2.5.1 Public Service Sector

With the various reformation that touched the town in its political evolution, some section of the people have always been constantly involved in public service. However, over time such persons have always been few in number and often non-salaried particularly within the traditional set-up. With colonization, the tradition was modified to give chance to career tax collectors, jurists and other servicing staff to the European Resident Officer who was first appointed for the town in 1924 (Fabiyi, 1984). So public service could be said to date back to that year.

Whatever advantage the improved political status could have conferred on Minna did not become significant until 1976 when the town became a state capital. The first implication of this was the establishment of state governing institutions and the employment of people to fill these institutions. Second is the creation of an independent local government of which Minna also became the headquarters. This gave Minna a dual-role in the dispensation of authority and power.

2.5.2 Informal Employment

The scenario presented about the formal employment means that a large number of the Minna labour force are outside the formal employment system. A significant number of these people are engaged in economic activities of the now popular informal sector. Informal activities are the unregulated micro economic activities whose labour absorption is not regularized. Informality is part of the economic system of Minna like we have in the other cities in Nigeria. Before colonization and even as part of the rural economy of the initial village, there occurred micro economic activities of the informal sector type. The original owners of the town, the Gwari, were farmers with some engagement in secondary activities such as blacksmithing, weaving of cloth and mats.

Today, while farming is still practiced in the town traditional industrial activities cannot be located in the town again. The traditional industrial sub-sector has been replaced by micro industrial activities localized in what is locally called *Panteka*. The *Panteka* is an informal industrial area that specializes in imitation technology to produce a wide range of household goods and farm implements. The participants in this sector today are however not Gwaris. They are largely the Hausa migrants. The Panteka occupies a sizeable area of Gwari Market, Minna. Informal manufacturing is also seen in the processing of agricultural products, particularly grains and tubers. The activities in this area form a tangible part of the manufacturing sub-sector of informal sector. Closely related with this sub-sector is service sub-sector characterized by repairs. Today, auto repairs constitute a significant part of the urban economy. This phenomenon has attracted specialized service area in the name of *Mechanic Village* in the town. .Each village consists of all aspects of auto repair and in addition offers opportunity for service activities like sale of spare parts and restaurant services.

2.5.2.1 Primary Production

Primary production, especially farming, is an important component of informal production in Minna. This is aided first by the environmental resources, and the willing population. Farming is the only traditional occupation that has stood the test of time in Minna. Minna is surrounded by well fertile soil which favours the cultivation of short span crops and grains. The river system with its flood plains also provide suitable area for farming, especially irrigation farming. Farming therefore offers employment for people and constitutes a significant aspect of the urban economy. Minna has at its command a wide area of land under both intensive and extensive cultivation. According to Minna Master Plan, agricultural land constitutes 80% of net land area after deducting rocky area and built-up areas (Marx Lock, 1980).

A recent study by Bashir (2001) indicates that in 1983 farmland occupied 78.34% of the total land area of 75 948 hectares. This proportion increased to 86.93% in 1993, out of the same total land area. Within the period 1983 to 1993, forest land declined from 11.45% (8694.92 hectares) to 6.88% (5231.84 hectares) to accommodate more demand for farm land. Intensive cultivation is important to urban farmers. In addition to arable farming, fishing and animal husbandry are also important economic activities of Minna.

2.5.2.2 Trading:

Tertiary activities as evident in trading are a visible component of the economy of Minna. Trading cannot be said to be a serious part of the local economy of the indigenous people and the settlers of the hilltop. However, the colonial transportation system and economy transformed agriculture from subsistence one to fairly commercial one that involved commodity trading. Since the establishment of colonial administration in Minna in the early 20th century trading has become part of the local economy. With increase in the size of Minna, market development became inevitable. Thus, the central market that now becomes the center of trading in Minna was established in 1910s. Since then the market has expanded in size tremendously.

The Central market has developed to form a complex of markets. There are in addition within the same vicinity the Gwari (New) market and Odunoye market. In addition, there is a periodic market, Gwadabe market, which also has some fair proportion of daily market activities. Together these markets constitute the core of employment and economic activities in Minna. From the Central market, a clear cut Central Business District has developed for Minna. Within the CBD, apart from banking, most activities are of the informal sector type. Minna represents a city whose CBD is well dominated by informal sector activities. Central market trading is characterized by regular traders who own shops, squatters (locally called attachment users) and street traders; consisting of people who occupy fairly fixed locations and those who move freely from one location to the other.

Although the central market is eminently dominant, there are a few neighbourhood markets in Minna. These are located at Bosso, Tunga, and Chanchaga. An emerging one is also noticed in Kpakungu. These neighbourhood markets are generally underdeveloped; made up largely of makeshift materials and open stalls. Similarly, there are emerging Business Thoroughfare (Onokerhoraye and Omuta, 1985) in Minna. These main roads provide linear avenue for various combination of informal sector activities; although some time there may be within them formal activities of professional services such as legal services; estate and architectural consultancy; among others.

CHAPTER THREE

3.0. DESIGN OF THE STUDY

3.1 METHODOLOGY

The phenomena of poverty and environment are complex. This makes any attempt to understand them a complex undertaking. As a result, multi methods of study and analyses are adopted in this study. The essence is to utilize the complementary contributions from different methods to understand the breadth and complexity of the reality of the problems at hand.

In this respect, the combination of the following data gathering methods were adopted

1. Remote sensing products and 2. Reference data.

3.1.1 Remote Sensing:

Remote sensing is the act of feeling an object from a far distance without any direct physical contact with the object being sensed. It is defined as "the science of and act of obtaining information about an object, area, or phenomenon through the analyses of data acquired by a device that is not in contact with the object, area or phenomenon under investigation (Lillesand and Kiefer, 1979). Details are discussed in the literature review. Suffice it to say here that remote sensing products include aerial photography and satellite remote sensing.

The study is based on the use of satellite remote sensing data. Two satellite images are used. These are SPOT image of 1995 and Landsat TM image of 2001. The SPOT has a resolution of 20 metres while the Landsat TM has a resolution of 30metres. Specifically, the images provide data on open space and built-up areas. These offer indirect indices of environmental deterioration and assist in assessing poverty among the people.

3.1.2 Reference Data.

In general, reference data refers to supplementary data to support remotely sensed data. This is important since the issue of poverty is human-specific. The essence of reference data is to aid the analysis and interpretation of remotely sensed data and to verify information extracted from sensed data (Lillesand and Kiefer, 1979).

In this study, the reference data used include the following:

3.1.2.1 Geometric Data

Control Points. The control points are defined as landmarks which are in sharp contrast to their surroundings. They are often road interceptions, field boundaries the edges of water bodies and airport runways (Curran, 1985). The control points are chosen to help in geo-referencing the satellite images. Three control points were chosen.

(b) Topographical map.

(c) Base map of Minna showing in particular, the various neighbourhoods and their demarcations.

3.1.2.2 Household Questionnaire Survey

Though its spatial manifestations are visible and detectable, poverty characteristics relating to the people can neither be sensed nor recorded by remote sensing facilities. These issues need to be known, assessed and understood. As a result, the second method of data acquisition is household questionnaire survey.

Details of the data provided by the questionnaire survey are :

a Household member roster

b Education

c. Livelihood and income.

d. Household perception of poverty, the environment and attitudes to the environment

e. Household housing characteristics, housing facilities and services and housing conditions.

f. Perception of the environment.

3.1.3 . Physical Survey.

3.1.3.1 Environmental Condition Survey.

Within each neighbourhoods, detailed field survey was conducted to assess the nature of the environment. The relevant data collected are

(a) Environmental problems within the neighbourhoods; flood and floodable, areas, soil erosion, sanitation and solid waste.

(b) Housing conditions.

3.1.3.2. Community Facilities and Services.

Each residential community is supposed to possess certain facilities and services that match its population. The survey here focused on the adequacy of the existing facilities and services against planning standards. Standards are minimum desirable requirements for comfortable living for a specific population (over a specific time). The essence of this is to understand the level of supply of these facilities; the ease of their consumption and to assess deviation from the prescribed standard. While the standards represent the expected situation, the existing facilities will represent the observed situation. Standards here refer to the unit of facility or service that should be provided per unit of specified population. Facilities covered are primary health centre, primary school and neighbourhood market. They are critical in the measurement of health, literacy and economic power of people and their neighbourhoods. Standards applied in the study are as provided by Obateru (1981) and Morenikeji, Sanusi and Jinadu (2002).

3.1. 4. **Sampling Techniques.**

Data collection is based on systematic area sampling technique. The unit of area is the neighbourhood. The conception of neighbourhood is a definite area of an urban centre; a social entity with a certain degree of homogeneity. According to its proponent, Arthur Perry, neighbourhood is a unit area, with distinct physical boundary, limited extent and population. Such an area is also served with all basic requirements. By this formulation, neighbourhood embodies both a service area concept and the principle of nostalgia for the rural way of life (Dewey, 1950).

By its original conception, a neighbourhood is a planned area unit of an urban area. This approach may not be entirely applicable to Nigeria where most parts of the urban centres have emerged through organic process. For this reason, a neighbourhood is seen as an area defined by its organic evolution and specifically designated by reference (name) by the people. By this, twenty six neighbourhoods have been identified in Minna. Out of these, twenty five (96%) are selected for study. The 26th neighbourhood is the Army barrack. It is recognized but, it is not chosen for the study. Questionnaire administration was by systematic sampling. On each street, one out of every five house was chosen. And from each house, one household each was covered.

With regard to the number of questionnaire, this is based on the household number in each neighbourhood. The sample sizes are graduated between 2% to 10% of the household size. No neighbourhood has less than 30 sample size. The lower the household size, the higher the proportion chosen as sample size. This pattern was provided by Mathia (1996). She outlined layered sample sizes for different population sizes. Table 3.1 shows the respective sample sizes for each neighbourhood. In all 2120 households are covered. That is, 3.2% of the total households in Minna at the end of 2003.

TABLE 3.1: MINNA NEIGHBOURHOODS AND SAMPLE SIZES

S/N	Neiighbourhood	Population (2003)	Household Size (2003)	Sample Size
1	Agwan Daji	13 440	2 535	80
2	Barkin Saleh	5 216	984	30
3	Bosso Estate	1 637	306	30
4	Bosso Town	35 603	6 717	140
5	Chanchaga	23 878	4 505	120
6	Dutse Kura Gwari	8 154	1 538	50
7	Dutse Kura Hausa	12 229	2 307	70
8	Fadipe	4 077	769	30
9	F-Layout	4 374	825	30
10	Tayi Village	8 795	1 659	50
11	GRA	3 080	581	30
12	Jikpan	7 820	1 475	50
13	Minna Central	23 825	4 495	140
14	Kpakungu	15 817	2 984	100
15	Limawa A	24 647	4 650	140
16	Maitumbi	12 600	2 377	130
17	Makera	24 287	4 582	140
18	Nasarawa	27 451	5 179	150
19	Sabo Gari	30 464	5 748	170
20	Sango	2 713	512	50
21	Sauka Kahuta	2 797	527	50
22	Tudun Fulani	9 478	1 788	50
23	Tudun Wada North	21 251	4 809	150
24	Tudun Wada South	19 187	3 620	90
25	Tunga Low Cost	3 850	726	50

Source: Estimates of 2003 population was based on the 1991 population figures.

3..1.5 **Data Analysis**

The analysis of data takes many forms. These are:

3.1.5.1. Remote Sensing and Geographical information System (GIS)

Geographical information system is a digital information processing and storage system. It is defined as "a suite of methods for capturing, storing, analysing and communicating georeferenced information' (Miller, 2003).

For this study, the unit of reference is the neighbourhood; that is polygon. Two GIS soft wares are used. These are ERDAS Imagine and ILWIS 3.0 Academic. The GIS soft wares are used in respect of the following:

3.1.5.2 *Image Slicing*

In this study, the emphasis is on what happens in each neighbourhood. Thus, each neighbourhood had to be sliced out of the city image. ERDAS Imagine GIS soft ware was used to slice the neighbourhoods. Each neighbourhood was depicted on the image by super-imposing the vector data, Minna neighbourhood boundary map, on the image. The neighbourhood image so sliced is a sub-set of the larger Minna image. Slicing is done separately for the two images and for all the neighbourhoods.

3.1.5.3 *Image classification*

Image classification is a way of imposing order on remotely sensed data. It is a means of differentiating features according to their spectral reflectances. It is the product of remote sensing with which further analysis of remotely sensed data can be done. To achieve this by the ILWIS software, supervised classification was adopted. Below is the detailed procedure used to undertake the land use classification for the two images.

3.1.5.3.1 Geo-referencing of the images. The two images were geo-referenced by using the Universal traverse Mecarto (UTM), Clarke 1880 Ellipsoid and the Minna Datum (Nigeria), zone 32 within the Northern hemisphere.

3.1.5.3.2 The neighbourhood map of Minna was digitized and overlaid on each of the two images of Minna. That is Spot, 1995 and Landsat TM, 2001.

3.1.5.3.3. Each neighbourhood is used to subset the satellite images.

3.1.5.3.4 Training sites were developed for each subset based on the following representations: Heavily built up areas, Built up areas, Lightly built up, bare surface and green areas. Training sites were chosen with the aid of topographic map and street maps of Minna and familiarity with the neighbourhoods.

3.1.5.3.5 The training sites were then used to classify the different neighbourhood subset.

3.1.5.3.6 Each subset was then aggregated to get the classification for the city.

3.1.5.4. *Indices of Decay and Poverty*

Indices of decay extracted from physical survey are

3.1.5.4.1. Household-based indices. These include housing facilities, housing adequacy, housing space and solid waste disposal.

3.1.5.4.2 Housing conditions. These show access to buildings, conditions of walls, doors, windows, building roofs, drainage and foundation.

3.1.5.4.3. Neighbourhood environmental conditions: These consist of nature of access roads, refuse on the streets, the condition of liquid and solid waste and existing environmental problems.

3.1.5.4.4. Community facilities. These cover education (primary schools), primary health centre and neighbourhood market. The emphasis is on the adequacy of these facilities vis-à-vis the neighbourhood population and standards for their provisions.

On the other hand, indices of decay derived from remote sensing data include are proportion of built-up areas, gross and net densities in relation to population and housing, open space loss, open space per head and proportion of open space. The consideration of these indices of decay yields environmental poverty as opposed to income or human poverty derived from household income and access to education and health. In these and other relevant relational analysis, the computer-based statistical analysis-Statistical Packages for Social Sciences (SPSS) is used. The SPSS is endowed with a large range of statistical tools; regression analysis, correlation analysis and factor component analysis, among others. Regression analysis and correlation analysis are used to examine and test relationship between indices of poverty and that of environmental quality.

3.2 CONCEPTUAL FRAMEWORK

The complexity of the two key subjects involved in this study, environment and poverty, make the use of appropriate conceptual framework necessary. There are very few existing theories for explaining poverty and environment relationship. Attempts are made in this section to improvise two concepts which may serve the present purpose. These are the concept of Environmental Boundary and the concept of Environment-Poverty Trap. The two concepts are located within the broad framework of sustainable development. It is pertinent to examine this broad theoretical framework of sustainable development, first.

3.2.1 Sustainable Development.

Both the destruction of the environment and prevalence of mass poverty are unsustainable. Sustainable development is a balance view between the extreme position of pro-environment writers who want a significant, if not total, halt to development and the other extreme view of pro-development activists who would want to continue at a substantially high growth level irrespective of damages to the environment, on the other.

The term was popularized by a report of Brundtland Commission for Environment and Development. The report titled *Our Common Future* defines sustainable development as 'development that meets the needs of the present generation without compromising the ability of the future generation to meet their own needs' (Brundtland Commission, 1987). This definition implies that sustainable development 'involves policies, strategies, and programmes that do not make it more difficult for the development process to be continued by future generations than it is for present generations' (Okigbo, 1996).

The premise of sustainable development is that development should be pursued for the benefit of the environment and for enhancing the quality of lives of the people. Divergences from this amount to unsustainable practices. According to the Brundtland Commission (1987), sustainable development contains two key principles; the concept of needs and the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs.

These concepts reveal two major components of sustainable development, economic and environmental sustainability. Economic sustainability implies 'meeting the basic needs of all and extending to all the opportunity to satisfy their aspirations for a better life' (Brundtland Commission, 1987). By this component, sustainable development 'embodies the notion and ideal of a development process that is equitable and socially responsive, recognizing the extensive nature of poverty, deprivation, and inequality between and within nations, classes and communities' (NEST, 1991).

Economic sustainability, according to Hardoy, et al (1992) includes (1) access to adequate livelihood, (2) choice, which includes choice of appropriate technology, self-reliance; (3) participation in politics (which include good governance) and (4) access to adequate shelter, healthy environment and basic services. Therefore sustainable development is a management system by which the society increases its capacity for dealing with the environment and by which the well being of the people is held supreme. In summary, it is ' a feature of both wealth and poverty' (Blower, 1993).

On the other hand, ecological sustainability 'requires that we have regard to earth's regenerative capacity, the ability of its system to recuperate and maintain productivity' (Blowers, 1993). It also means that we avoid overburdening the regenerative capacity of the natural systems. Ecological sustainability seeks to preserve the ecological base of the society and involves that developmental activities take cognizance of the limited absorptive capacity of the environment on one hand and the restrictions to renewability of its resources. While avoiding the rigidity of environmental determinism, ecological sustainability dictates that development activities live with the environment, recognize the limitation of technology in recreating a destroyed environment and in reclaiming a depleted natural stock of resources.

Equity is a cord in the explication of sustainable development. It links the two concepts of economic sustainability and ecological sustainability. 'Sustainability implies a concern for social equity between generations, a concern that must logically be extended to equity within each generation' (Brundtland Commission, 1987). Equity becomes an arbiter; reconciling individual interest with that of the society (nation), national interest with global interest, present exigency with future contingency and reconciling the need of the deprived with the wants of the rich. Thus sustainable development is consistent with (1) justice in respect of the society; (2) justice between generations; (3) justice to nature;

(4) aversion to risk arising from low margins of resilience to external shocks and (5) economic efficiency (Pearce, et al, 1990).

Viewed from its components of ecology and economy, sustainable development becomes interpretable in respect of sustainable living, social sustainability, sustainable health, sustainable community and sustainable city, among others. This study fits into sustainable urban development. This is defined as 'the achievement of urban development aspirations, subject to the condition that the natural and human-made stocks of resources are not so depleted that the long term future is jeopardized; (Brehey, 1992). A sustainable urban development involves that not only the ecological capacity of the urban environment is maintained but also that the economic capacity should be sufficiently large and be maintained.

3.2.2 Environmental Boundary

This concept is derived from the traditional concept of environmental carrying capacity. The concept holds that the environment has limited resources beyond which the use of the environment becomes dangerous both to the existence of the environment itself and to the people as the users of the environment. The concept has borrowed from the features of the concept of carrying capacity. Carrying capacity relates population either in term of density (Whittaker, 1970), the total population (Mitchel, 1993) to the available environmental resources. As demonstrated by Meadows, et al (1974) and (Ugbozurike (1981) carrying capacity places a limit to population growth.

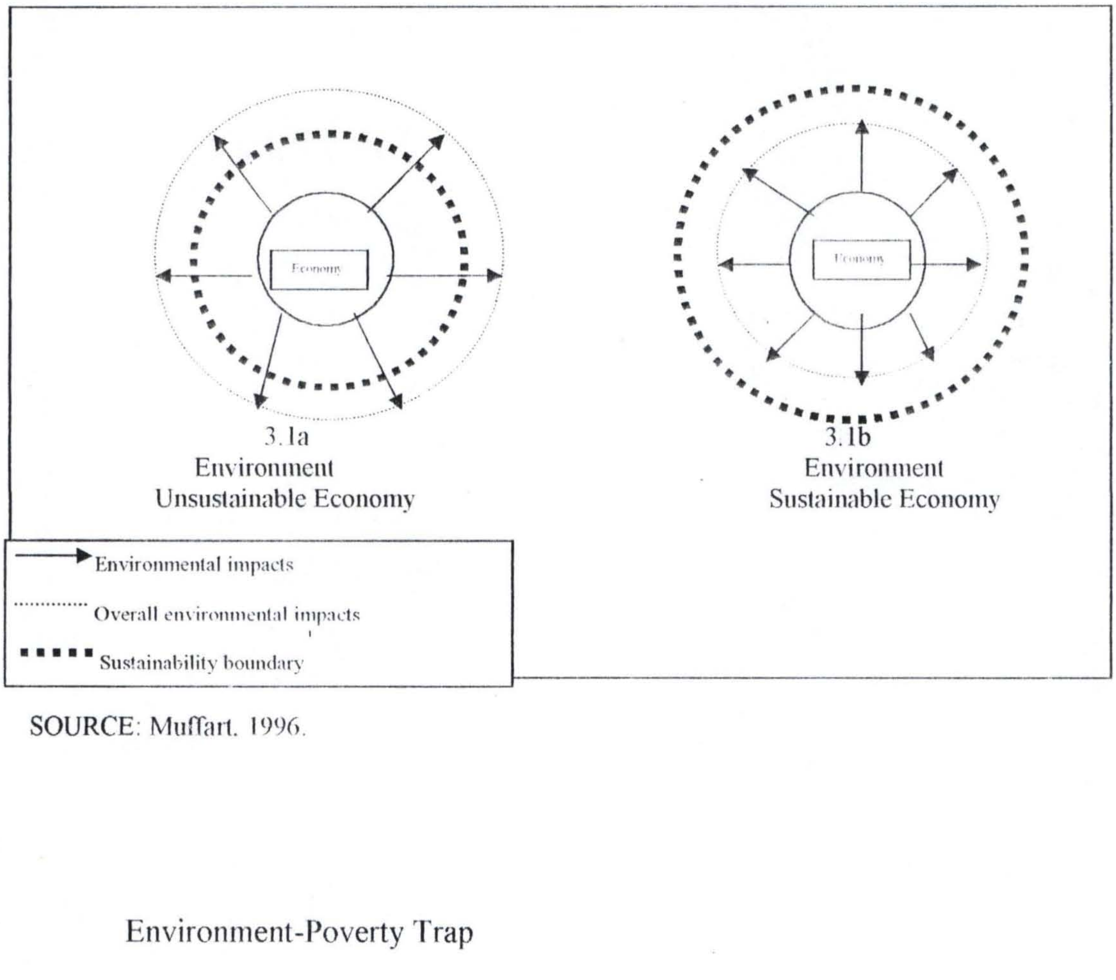
By the circumstance of vulnerability, deprivation and continuous attempts to balance poverty, the poor impinge on and exceeds the environmental sustainability limits . Sustainability requires that economic activities be conducted within the limits of the sustainability boundary. Exceeding the boundary through poverty balance will lead to more poverty.

This concept can be represented as shown in Figure 3.1. The first circle represents an unsustainable economy while the second one represents sustainable economy. There are three rings in each circle. The inner ring represents the economy; the second one, marked by thick dotted line is the substantiality boundary. The sustainability boundary is the threshold which cannot be crossed without endangering the basic integrity of the system (Brundtland Commission, 1987). The third ring marked by thin dotted line is the overall environmental impacts. That is, the sum total of the impacts of human activities that impinge on sustainability boundary. The arrows indicate the environmental impacts of human activities. These are the centripetal forces emanating from the operation of economic activities and which impinge on the environment.

Where the environmental impacts exceed the sustainability boundary an unsustainable economy is obtained as shown in Figure 3.1a. However, where the environmental impacts are within the sustainability boundary as represented by Figure 3.1b, a sustainable development is achieved. The contention is that 'if economic activity is operating beyond these sustainable bounds then sooner or later the economic and ecological systems will become unsustainable and both will collapse' (Muffart, 1996).

Where unsustainable development leads to the collapse of economy and ecology, poverty prevails.

FIGURE 3.1: ENVIRONMENTAL IMPACTS, WELFARE AND SUSTAINABLE BOUNDARY



SOURCE: Muffart, 1996.

3.2.3 Environment-Poverty Trap

in the Environment-Boundary concept, the relationship between poverty and environment is inferred. The concept has not shown specific relationship between a given level of wealth or lack of it on the environment. This weakness makes exploring another concept necessary.

Poverty is said to lie at the root of unsustainable development (Morgan, 1996). The interpretation is that poverty is antithetical to sustainable development; it is against equity and it impinges on environmental limits. Indeed, 'sustainability is not just about economy or a given social condition, but about coping with stress and insuring against stress (Morgan, 1996).

Within the framework of sustainable development is the emphasis on the interaction between poverty and the environment. This interaction has been summed up in the term, 'environment-poverty trap' (Pearce et al, 1990) which while taking cognisance of broad theoretical underpinnings of sustainable development provides specific conceptual background for the understanding of poverty and environmental problems. According to Brundtland commission (1987) 'poverty is a major cause and effect of global environmental problems'.

Therefore, at one end of the spectrum is the position that a degraded environment, depleted of its resources and subject to all forms of abuse could lead to poverty. On the other hand, poverty arising from whatever cause, makes people to eke out a living in an unsustainable manner and in the process degrade the environment. Hence, 'as poverty increases, natural environments are degraded to obtain immediate food supplies. As environments degrade, so the prospects for future livelihoods decrease; environmental degradation generates more poverty, thus accelerating the cycle' (Pearce et al, 1990). So, poverty is not just a product of environmental degradation, it is also a cause of it (Okpala, 1993).

Sustainable development entails availability of alternatives and the capacity to make the choice. Poverty restricts alternatives available to people, on one hand, and restricts capacity for choice making, on the other. In this respect, 'pressure on resources increase when people lack alternatives' (Brundtland Commission, 1987). The low capacity of the poor forced them to destroy the environment (Hannock, 1995) and increases their vulnerability to environmental hazards, and as a result suffer tremendously from environmental hazards.

Therefore, the interpretation is that the environment-poverty trap represents a spatial dimension to the traditional poverty cycle concept which holds that the poor are poor and remain poor because they are poor (Soyombo, 1995). The notion is premised on the fact that the poor exhibit a set of traits, which constitute a sub-culture of the general cultural system in which the poor is located. Gilbert and Gugler (1982) note that the culture of poverty recognizes similarities among the urban poor in different societies and emphasize that the behaviour and values of the poor are not determined by their circumstance but constitute a culturally evolved response. These authors emphasize that the culture of poverty 'designates common cultural elements found among poor people in different societies' (Gilbert and Gugler, 1982).

As poverty reduces the capacity to use the environment and its resources sustainably so does the environmental destruction entrapped the people into poverty. The cyclic operation of this phenomenon is shown in Figure 3.2. The Figure demonstrates graphically the concept of environment-poverty trap. Box 1 represents the state of poverty while box 2 represents various adaptations to poverty. Because of the inadequacies and deficiencies of these adaptations, a lot of stress is exacted on the environment. The stress gives rise to the various types of environmental degradation represented by Box 3. These degradations send impulse to the poverty indices by way of feedback. This leads to the situation shown in Box 4. This situation includes low productivity, declining income, high health risk and hazards and increasing expenditure on health care. These results consolidate the poverty position of the poor. Each stage within this cycle is associated with environmental degradation, economic deprivation and intensive use of environmental resources.

Within this context, poverty and environmental degradation become self-consolidating; one leading to the other, reinforcing each other in a cyclical manner. The environment-poverty trap explains the predicament of the urban poor, the frustration of their daily struggle, the inadequacy of their actions and the spatial inefficiency and manifestations of their attitude, disposition and activities.

The utility of this concept is that it indicates the interlocking relationships between economic status of poverty and environmental degradation. It also incorporates the idea of environmental limits. For, all degradation happens once the limit to ecological boundary of the environment is exceeded. These merits give the environment-poverty trap concept an advantage over environment boundary concept and hence makes it more applicable to this study.

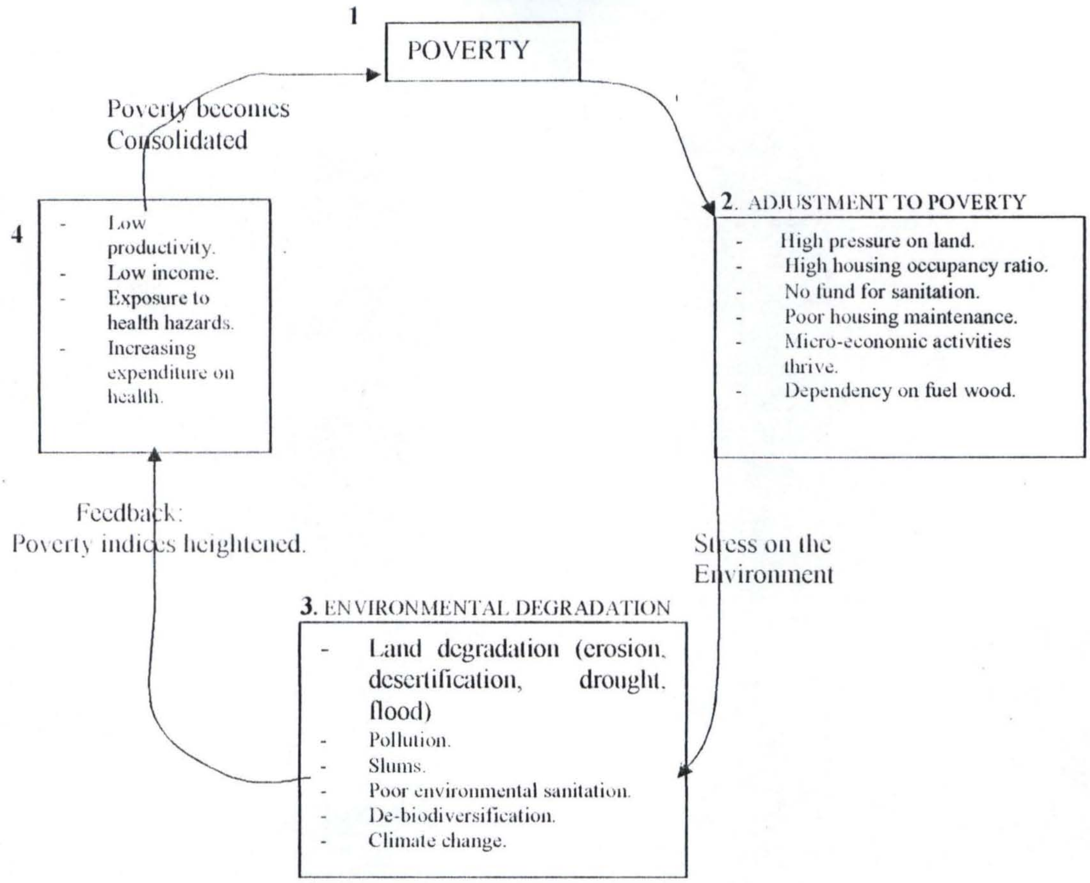


FIGURE 3.2: ENVIRONMENT –POVERTY TRAP

SOURCE: Author, 2005.

CHAPTER FOUR

4.0 LITERATURE REVIEW

4.1. INTRODUCTION

Both the concept of poverty and the issue of environmental degradation have attracted attention of scholars over the years. The academic attention on these subjects has not only enhanced their understanding, it has also assisted theoretical formulation for modelling and solution to the problems of poverty and environmental deterioration. In this chapter attempts are made to examine these two issues from theoretical and practical points of view. In addition, literature works on remote sensing and its application to urban studies in general and urban poverty in particular are reviewed.

4.2 CONCEPTUALISING POVERTY

Many authors (Coser, 1965; Yankson, 1995 and European Commission, 1996) have expressed difficulty in defining poverty. Thus, it is better described than defined. (Aboyade,1976). Instead of seeking a universal definition, it is advisable to define it within a particular social setting (ILO, 1976). In spite of this warning, attempts have been made to define poverty.

Baratz and Grisgby (1972) define poverty as 'a condition involving severe deprivations and adverse occurrence that are closely (but not necessarily exclusively) associated with inadequate economic resources'. Aboyade, (1975) defines it as "a state of households' command over resources at a level which is insufficient to obtain a basket of goods and facilities judged to be minimum necessaries in the contemporary circumstances of the society under study".

'he traditional approach is to define poverty in term of income. Hence, it is seen as the minimum ɛvel of income required for a decent standard of living (Yankson, 1995). This is the poverty line or he bread line approach. The poverty line is the income level below which a minimum nutritionally ıdequate diet and other essential non-food requirements are not affordable (World Bank, 1990, Morgan, 1996, Mabogunje, 2001). Below this minimum income a humane standard of living ɔecomes threatened. The income line approach has brought about distinction between absolute poverty and relative poverty. Absolute poverty definition indicates some level of income per person or per family that is deemed sufficient to buy a minimum of life's necessities (Heilbrun, 1977, UNDP, 1997). On the other hand, by relative poverty, people are poor in relation to others (David, 1994). It 'classifies households as living in poverty if their income falls below some fraction of the national median or mean' (Heilbrun, 1977). It connotes the inability of some sections of the society to satisfy their basic needs (UNDP, 1997). While absolute poverty holds that poverty is an objective phenomenon, relative poverty holds that poverty can only be defined in relation to a place and time. While it is preferable to accept relative poverty instead of absolute poverty, it is also true that relativist conception has been grossly exaggerated (Akeredolu-Ale , 1976).

Many authors have shown the limitations of the income approach (Soyombo, 1995; Satterthwaite, 1997). According to Satterthwaite, (1) it is impossible to define a single income that will be practically applicable to all urban centres (2) the poverty line established by the income variable simplifies and standardize a visibly complex and varied issue; (3) the approach reduces the poor to statistics and figures (4) income approach fails to pay sufficient attention to social services; (5) equating poverty with income level can obscure the underlying causes and miss the extent to which households face other forms of deprivation and (6) in less developed countries, determination of income for the many people in unenumerated informal jobs is difficult. In spite of these criticisms, some analysts still believe the relevance of income in defining poverty; for, it summaries the 'command' which individuals have over resources. To be meaningful, income should be broad enough to include income from every member of the household, inputted income, unmarketted self produced commodities, dividends from shares and gifts. Also, multiple poverty lines has also been suggested (Soyombo, 1995).

In most cases, national income is often used to get a mean income to which relative poverty can be measured. But the truth is that the national income itself has been criticised on many grounds (Lipton, 1977). Thus, attempts have been made to bypass the income criterion. The first of such attempts is the basic need approach initiated by India and Bariloche scholars (Hoeven, 1986) but popularised by ILO (ILO, 1976). Basic needs are actual tangible interdependent necessities and represents the first phase of development which once satisfied leads people into effective participation in the social dynamics of development and can never be assessed in monetary term (Bernis, 1986).

From sociological point of view, some have seen poverty as 'a social category that emerges through societal definition; (Coser, 1965). Hence, poverty is seen as a socially recognised condition,, as a social status and as a property of the social structure. As a result 'those who receive assistance are defined as being poor' (Coser, 1965).

n recent time poverty is being redefined to include lack of assets, deprivation, powerlessness and vulnerability (UNCHS, 1996). While assets possession relates to the income component of accessibility, deprivation, powerlessness and vulnerability describe particular social-political conditions which poverty may bring. According to Swift (1989), assets include investments, stores and claims. Deprivation occurs when basic needs are lacking. In relation to power poverty "weakens people's capacity to bargain for political and legal rights, access to services and goods allocated by overnments" while by vulnerability, the poor are characterised by defencelessness, insecurity and posure to risk, shocks and stress (UNCHS, 1996).

or a long time attempts have been made to develop a composite indices of well-being. Smith 1979) reviewed four of such attempts by the UN in 1954, Smith in 1973, Drewnowski in 1974 and)ECD in 1976. The UN's attempt was to provide an acceptable international catalogue of the components of level of living while the OECD concentrated on areas of social concern that would serve as a basis for compiling set of social indicators. These indicators largely reflect the idea of basic needs and are meant to provide Level of Living Index (LLI). The LLI is defined as 'the level of satisfaction of the needs of the population as measured by the flow of goods and services enjoyed in a unit of time' (Drewnowski and Scott (1966).

An attempt at a comprehensive definition of poverty led to the idea of entitlement which later gave rise to the concept of livelihood security (Leach et al, 1997 and Maxwell et al, 2000. Entitlement as shown by its proponent, Sen (1981) is premised on food. Sen had argued that aggregate food availability can blur the scale of differences in command people have over food (Leach et al, 1997).

Entitlement is seen as 'the range of possibilities that people can have (Leach et al, 1997). and represents the legal means by which people gain access to their basic needs (Maxwell et al, 2000).

While Sen's proposition is commendable, Leach et al (1997) noted that Sen concerned himself too much with entitlement mapping, legal entitlement and less on endowments. An expanded approach to this gives rise to livelihood security approach. This is meant to provide a holistic view of the options available to individuals. Livelihood is seen as an organizing principle for the understanding of income, access to food and basic welfare needs (Maxwell et al, 2000). Livelihood security resources include both capabilities (skills, education, and ability to work) and assets (natural, physical, human, financial and social

In an attempt to explore the comprehensive approach further, the UNDP in 1990 formalised the concept of human development index (HDI). The HDI is a refinement of basic needs approach. Its presentation in the present UNDP format can be seen in the work of Morris (1977) and Stewart (1986). Morris used three indicators with equal weights to measure fulfilment of minimum human needs; life expectancy at age one, infant mortality and literacy. The HDI is designed 'as a critique of income-based measures and a recognition of the absence of any perfect correlation between per capital income and such indicators of well being as longevity, health, literacy, etc' (UNDP, 1997).

The HDI represents ' a vista to measuring and analyzing development in a more human-centred and economistic manner' (UNDP, 1997). It is an aggregate of longevity, knowledge and the command over resources needed for a decent life. These three variables are measured by average life expectancy, level of literacy and real gross domestic product (Lester et al, 1991).

he GDP is adjusted to local living condition to get purchasing power parity (PPP) (Morgan, 996). The PPP measures the output of each country at some common price level, usually nternational prices (Hicks and Streeten, 1981).

'he HDI is said to summarize the gross accessibility of individuals to the basic needs and the ulfilment of acceptable standard of living by the people. It fairly overcomes the problem of per apital income as a measure of standard of living, modifies the superficial image of gross national ncome and emphasises the realities occurring to individuals. Within a nation, the gross HDI will nceal the deference among the component units. However, these differences are known once the)I for the different units are computed and same can go for the units within a state or region.

is noted from the foregoing that what actually constitute human welfare have gone through volution from a narrow conception to a fairly more comprehensive ones. It is also noted that each vel of definition gives rise to a more refined one. In general, it is a current understanding that ncome alone will not sufficiently measure welfare and that in the measurement of welfare both ndices that are specific to individuals and those that derive from community are important.

4.3 URBAN POVERTY AND THE ENVIRONMENT

Urban centres form a particular spatial configuration of poverty. Urban poverty is seen as a chronic problem of almost every contemporary developing country (Sada, 1976) which introduces a new dimension into poverty discussion (Mabogunje, 1976). Mabogunje (1976) defines urban poverty as a form of poverty involving area segregation or area concentration of the poor. Adeniji-Adele (1995) sees it as a state of disability of the urban dweller, to acquire the essentials of life.

Sada (1976) distinguished between two groups of the urban poor; the old and unskilled indigenous class and migrants who constitute the hopeless poor and the unemployed new migrants who form the hopeful poor. While Mabogunje (1976) shares the view that the old indigenous residents are prone to poverty and that new migrants are desirous to succeed, he also holds that the old migrants have initial advantage that make them to attain special economic facilities better than others.

Differentiating between rural and urban poverty, UNCHS (1996) and Maxwell et al (2000) observed that urban poverty is characterized by (1) higher costs of living due to purchase of many items and reliance on income; (2) greater vulnerability to changes in income; (3) support assistance from kinship and neighbourhood members is less effective and (4) urban poor face more environmental hazards than rural dwellers. While it is true that poverty is more rural than urban, urban poverty is also real and growing (Olowu and Akinola, 1995) and will continue to increase (Hurley, 1990).

It is in the city that inequality raised a significant moral issue. Gilbert and Gugler (1982) remarked that the contrast between the rich and the poor within urban centres exposes man's insensitivity to the plight of his fellow men. It is in the urban centre that poverty-environment relationship becomes immediately observed and expressed daily. The spatial configuration represented by the city is expressed in such terms as slums, ghettos, shanty-town or bidonvilles (Mabogunje, 1976). These spatial summary of poverty do not only signal the failure of humankind's urban endeavour (Gilbert and Gugler, 1982), it is also the clearest evidence of poverty (Browne, 1981). The slums and the-like visibly demonstrate the linkage between poverty and urban environmental decay. The slums represent specific econo-environmental problem which existence points to a lack of efficiency in allocating the limited economic resources and an inequitable distribution of resources among the various segments of the population (Shefer, 1981). In the opinion of Smith (1979), urban slums reflect penalties of being at the other end of socio-economic scale.

The urban environment represents a sub-set of the general spatial configuration. Its conception is said to vary from simple to complex (Egunjobi, 1995). Accordingly, Egunjobi, identified three conception of the urban environment (1) a various interpretation concerned with the appearances of the urban areas to include buildings, design conservation, townscape and planning; (2) a wider conception which include traffic safety, the condition of buildings and infrastructure, sustainability and resource consumption and (3) the physical elements such as water and air quality, waste disposal, noise levels, neighbourhood conditions, landscape and urban amenities. This composite nature of the urban environment is also recognized by Esset (1995).

4.4. GENERAL VIEWS ON POVERTY

The universality of poverty as a global socio - economic problem is observed in its names in different languages. It is long considered to be part of the natural order of things' (David, 1994); an invention of civilization (Sahlin, 1992) The original thinking of the civilization - induced poverty is that it was a residual phenomenon which would soon disappear. (David, 1994). Thus, although, the ILO had noted the global nature of poverty as early as 1944, the developed countries still believed that poverty would be eliminated by economic growth (David, 1994). The concept of global poverty was tied to the gradual and now generalized economization of life and the integration of Third World into the World economy. Yet, the global dimension to poverty has revealed two things: (i) that economic development by the western lines did not mean a higher standard of living for people in less developed countries (ILO, 1972, ILO, 1976, Mabogunje, 1978) and (ii) that the traditional ideas are changing as new forms of poverty and marginality have followed economic crises and economic, technological and social change (David, 1994).

As already shown, defining poverty has remained a fundamental problem in the discussion of poverty. This problem of definition is centred on the fact that what constitutes normal participation in social and productive activities of an economy varies according to the complexity of that economy (David, 1994). The defects of income - poverty have actually led to searches for alternatives and more human - centred approaches to defining poverty. The approaches as already outlined centred around housing - poverty (Pugh, 1995). (UNCHS, 1996).

UNCHS also notes that there are correlations between those people with low incomes and those with poor quality housing.

A discussion of poverty should also reflect a discussion of inequality. Akeredolu - Ale (1976) undertook an elaborate explanation of the distinction between the two. It is noted that inequality exists even in economically backward societies. It is possible to have either one or both of the two in varying degree at the same time in the same place. Thus, a society could be characterized by a low - level of inequality and by widespread poverty just as another could have both a high level of inequality and limited poverty (Akeredolu, Ale, 1976).

There is a consensus among analysts that poverty is not only complex but that it is also multi dimensional (Duranleau, 1995, European commission, 1996 and that poverty has deleterious effects on the society. As far as 1944, the ILO maintained that 'poverty anywhere is a threat to prosperity everywhere' (David, 1994), while in 2000, the UN Secretary General, in his Millennium Report declared that 'extreme poverty is an affront to our common community' (in Mehta,, 2001). According to David (1994), poverty undermines development possibilities , constitutes a break on world growth, and serves as a source of instability and one of the determinants of environmental deterioration. It is also a major cause of urban violence (UNCHS, 1996 and Pinheiro, 1993).

1.5 THEORIES OF POVERTY/ EXPLANATION OF POVERTY.

The complexity of poverty means that it has many parts and as a result there seems to be a number of theories to explain it. Sometimes such theories relate to different components of poverty, the interrelationship between the poor and the poverty characteristics (culture of poverty; poverty - environment trap). However, any theory of poverty 'must identify the forces which govern and determine the pattern of ownership of the factors of production since it is that pattern which, in turn, determines the structures of interpersonal and inter group differentials in wealth and income in the society' (Akeredolu – Ale, 1976). Such theory, Akeredolu maintains must also account for increasing poverty in a situation of aggregate economic progress and resource abundance. Based on these he outlined four groups of theories. They are the Necessity Theory, the Individual – Attributes Theory, Natural - Circumstantial Theories and the Power Theory.

There are three variations of Necessity Theory (i) the functionalist theory which posits that poverty arises as a result of differences in value which society places on a position attracted by an occupation; certain positions are valued higher than the others. So low - valued position may be subject to vagaries of poverty. (2) The evolutionist variant which also holds that the poor evolve spontaneously; although such poverty is not inevitable as believed by the functionalists. (3) Capitalist Entrepreneurial Theory. This holds that poverty is associated with early stages of development. The existence and exploitation of the poor is the engine of high profit and savings that gave rise to industrial revolution.

The Individual Attributed Theory holds that the individuals are responsible for their poverty; since the position of an individual in the hierarchy of income and wealth is determined by his motivations, aptitudes and abilities. The Natural Circumstantial Theories have, on one hand, used geographical location and natural endowment of the environment in which persons live to explain poverty. On the other hand, the poverty of people will also be determined by unemployment, old age and physical disabilities, among others. The Power Theory believes that the pattern of political power will determine accessibility of individuals to economic resources which influence the prevalence of poverty in the society. This is an exploitative theory in which the ruling class is said to establish a property system by which it determines the allocation of opportunities, income and wealth.

In explaining the prevailing mass poverty in the less developed countries today, a combination of these theories will be required. In doing these, both macro and micro factors have been recognised. Macro factors such as natural disasters, low level pf production, gradual fall in international trade figures, population growth , political upheavals, the impact of Structural Economic Adjustment Programme (SAP) have been variously used to explain in less developed countries by Anton (1995), David (1996), Monley (1993) and Weeks (1993), among others. Similarly, micro factors such as unemployment, migration and attitude of the poor people to spending have been variously used to explain poverty at local levels by Akinola (2000), Bienefeld (1979), Kowarick (1979), Olowu and Akinola (1995), Sada (1987). and Soyombo (1987 and 1995).

Using the poor's attitude to spending, a distinction is made between primary and secondary poverty (Soyombo, 1987, Soyombo, 1995 and Akinola, 2000). Primary poverty arises when the income of the poor is insufficient to cater for his needs while secondary poverty arises from mismanagement of available income. This latter group, Soyombo (1987) calls deserved poor. Sada, (1976) also wrote about shared poverty where poverty becomes a common good to be distributed perhaps fairly among members of the accommodated extended family. Poverty has also been associated with occupational groups, in particular, the informal sector (Bienefeld,1979, Kowarick,1979 and Sada, 1987) . According to Stewart (1974), it is within the informal sector that real poverty in developing countries is to be found. Bromley and Jerry (1979) submitted that majority of the informal sector workers are casual workers leading to casual poverty. The casual poor are people "who combine low average earnings with considerable instability and insecurity of income and employment (Bromley and Jerry, 1979).

On the other hand, is a group of scholars who hold the view that poverty is not confined to the informal sector (Hurley, 1990 and Como, 1995). To these people, not all the participants of the informal sector are poor, Hence, it is fallacious to believe that the informal sector reflects poverty; given especially increasing poverty among employees of the formal sector (UNCHS, 1996).

Irrespective of the merits or otherwise of the two views, what is certain is that poverty in the less developed countries has become worsened in recent time. The truth is that the informal sector represents a particular adaptation to poverty by all employment groups

(Olowu and Akinola, 1995, Yankson, 1999, Mabogunje, 2000, Dijk, 1995 and, Lopez,1993). Some analysts have also associated this with the nature of governance That is "a set of rules which is based on the values of the people approved by the people and allowed to operate freely in the society (Olowu and Akinola, 1995). There is a growing consensus that whatever factors that could be used to explain poverty, they are subdued under bad governance (Olowu and Akinola, 1995, Soyombo, 1995, Yankson, 1995, Egunjobi, 1995, Enemuno and Tomori, 2000 and Akinola, 2000). Good governance, they variously submitted is efficient, accountable, responsive, transparent and participatory. All these are significantly absent in the governance of the state in less developed countries. There exist therefore, the crises of governance in the less developed countries. Bad governance is associated with undemocratic and self - seeking style where the society suffers from 'great expectation-minimal capacities paradox' (Massood, 2000).

4.6. URBAN POVERTY IN NIGERIA

Among the first indications of urban poverty and associated environmental problems can be seen in the report of a 1972 conference on local governments, *Management Problems of Rapid Urbanization in Nigeria,* published in 1973. In the report, Adedeji talked of great social problems such as inadequate job opportunities, growing crime due to lack of jobs, acute shortage of housing leading to overcrowding or use of sub-standard housing. In the same report, Oladosu talked of marked inequalities in water distribution, absence of efficient sewage system, and growing slums while Sada talked of development of shanty settlements at the sub-urban fringe. All these problems were not only seeds of poverty, they were sufficient evidence that urban poverty is not a new phenomenon in Nigeria.

In the following year, 1973, a conference of the Nigerian Geographical Society also centred on urban problems. In that conference, the then Minister of Works and Housing presented the existing urban problems as including high density concentration of people, unprecedented environmental crises, dislocation of people and increasing deterioration of shanty town. In more specific form, Mabogunje identified four major urban problems- employment, liveability, manageability and serviceability. He identified alarming rate of urban unemployment, and worsening living conditions. While the contributors to the conference did not deal with poverty per se, some of the papers presented reflected on issues that showed endemic poverty conditions in Nigerian urban centres. Salau outlined poverty-induced pollution in the cities of Kano, Enugu and Lagos.

Perhaps if the two conferences already referred to were not categorical about urban poverty, the 1975 conference of the Nigerian Economic Society did. The conference report which was published in 1976 was themed *Poverty in Nigeria*. In that conference, Onimode talked of 'grinding syndrome of under development and mass misery' (Onimode, 1976) while Edozien (1976) noted that poverty in less developed countries including Nigeria is a majority problem. By 1975, Nigeria was described as a low income-per capital country characterised by a great degree of income-wealth inequality and by widespread poverty (Akeredolu-Ale, 1976). Four of the papers in the conference proceedings were devoted to urban poverty. Mabogunje (1976) having recognized close affinity between poverty and environment identified three types of residential areas in Ibadan; two of these were slums (areas of bad slum where 70 per cent of the buildings had deteriorated and slums where the structures were deteriorating rapidly). In addition, two types of poor were recognized: the traditional urbanites who lacked necessary informational capacity and the migrants who were unemployed because of slow rate of growth of the urban economy.

This dual face of urban poor was also emphasized by Adepoju (1976) in Osogbo and Ife. Sada (1976) also recognized that poverty as reflected in unemployment, underemployment, disguised employment as well as the associated living conditions were due largely to rural-urban migration. In particular, he identified poverty syndrome which reflects the poor's 'inability to develop any sense of environmental decency'.

The lesson that could be drawn from these early studies is that poverty in Nigeria is not a new phenomenon. Rather, the present condition of poverty in Nigeria represents a cumulative effect of a long period of poverty progression. The poverty progression was heightened during the period of economic reforms of 1985-1992. Within this period, 'the incidence and depth of poverty in the country were on the increase, and became even more pervasive. It was a period of increased economic inequality when the rich became richer and the poor became poorer- a period when the fabric of society was almost torn apart' (UNDP, 1997). It is not surprising therefore that poverty has taken on a new dimension. This was recognized by another conference themed , *Urban Poverty in Nigeria*, in 1987. The build-up of the poverty conditions from the mid-1980s culminated in the crisis of the 1990s which effects are still present in the system now. This crisis was ardently demonstrated by the participants at an international conference held in Ibadan in 1995; the proceeding of which was published in the same year.

While the participants at the conference recognized the indices of poverty presented in previous works, they in addition hinged the problem of poverty on the crisis of governance. Elements of bad governance with serious implications for poverty include corruption, poor accountability, institutional malfunctioning (Olowu and Akinola, 1995), poor revenue base of urban governments (Bello-Imam, 1995 and Egunjobi, 1995) and personnel problem (Egunjobi, 1995). The governments do not only lack adequate capacity for good governance, they also operate the machinery of government in such a way that it remains 'remote from the basic needs of Nigerians' (Nwosu, 1977) and creating a situation of alienation and mistrust between the government and the people (Mabogunje, 2001). Hence, bad governance is at the root of urban poverty in Nigeria (Agbola, 1995). As a result, the cities have continued to show evidence of decay as well as outright decay (Egunjobi, 1995).

Adaptations to poverty in the urban centres have continued to have serious negative consequences on the urban environment. Duru (1981) described dysfunctional use of urban land in Nigeria. In Enugu, he recognised misuse of public right of way by all shades of artisans of the informal sector. By 2000, the problem had escalated as shown in the study of Okeke (2000) for the same city. He showed the unbridled capacity of the informal sector to generate land use problems such as sprawl development, incompatible land uses, building alterations, the menace of temporary structures, alteration of land use functions, open space conversion and land degradation Sule, (1981 and 1986) also identified a similar trend in Calabar where extension to buildings constituted environmental problem which has rendered urban development plans as ' a parody of reality rather than an urban development instrument' (Sule, 1986)

While the informal sector provides jobs for increasing number of urban dwellers in Nigeria, it is true that poverty is due 'not only to growth in urban population but also as a result of worsening employment situation which has driven an increasing proportion of the population into informal employment' (Mabogunje, 2001). A particular case of adaptation to growing economic crisis by all levels of social classes was given by Oriade (1995) for Festac Town, Lagos. The town was a planned settlement occupied by low middle and upper middle level civil servants. This model modern town has fallen into the state of disrepair. Oriade recognized development of commercial outlets as a major contributor to the destruction of the original layout of the town Poverty-related environmental decay in urban Nigeria was demonstrated by Abumere (1981). He studied decay in 40 towns based on 18 variables. Applying multivariate analysis, five dimensions of decay were identified: overcrowding, old age, dirty/degraded environment dimension, derelict housing dimension and residual environmental dimension; all of which accounted for 86% of the decay in these towns. Abumere had remarked that 'there is no doubt that poverty is a major causal factor for the five aspects of slums exposed' in the study. This definitely confirms an old held view that 'poor people and slum dwellers meant the same thing' (Haworth, 1963).

A major recent study on poverty in Minna is that of Baba, et al (2001). In this study, two broad categories of poverty measurements are employed. These are income poverty and human welfare poverty. In the latter group, six indices are used to determine poverty in Minna. These are education, nutrition status, access to medical services, housing conditions and environmental condition. On the basis of income, the authors used both the mean and median per capital income to define poverty. The study revealed that the use of the median value as the minimum income desirable is more useful than using the mean per capita income. The use of the median per capita income as poverty line shows that poverty level in Minna varies among residential wards. It is as high as about 94 per cent in Sauka-Kauta, 73 per cent in Minna South and about 67 per cent in Chanchaga. Overall, with an average household median monthly income of ₦6 000.00, about 49 per cent of the people live below poverty line while combined consideration of human poverty indices shows that 45.3 per cent of the people live below poverty line.

Another study on Minna (Baba and Jinadu, 2001) on housing quality and health also shows the depth of environmental deterioration in Minna. The study (1) classifies the residential wards into three quality areas of high, medium and low, (2) identifies existing diseases among the people and (3) relates residential quality with health. The study shows that low quality residential areas exhibit high incidence of disease as opposed to high quality residential areas. A linear regression analysis between environmental quality and disease occurrence shows a strong association between the two variables; with 69 per cent of disease occurrence being explained by environmental quality. It is noteworthy that the low quality residential wards identified in this study-Bosso township, Minna Central and Minna Southwest- coincide with high poverty incident areas of Minna Central, Minna South, Sauka-Kauta and Sabo Gari recognized by Baba et al (2001).

4.7. REMOTE SENSING IN RESEARCH PROCESS

The acceptance which remote sensing has had among analysts and even policy makers is the immense application it has for varied aspects of human activities. This utility becomes particularly unique since these activities derive either directly or indirectly from the environment.

4.7.1 General Applications

The interpretation therefore is that remote sensing offers opportunities for the monitoring, management, use and protection of the environment. Lo (1986), BOSTID (1987, 1990), Goldsmith (1992), and Engelhard (1992) among others have emphasized the application of remote sensing to various aspects of environment and settlement management. Goldsmith submitted that remote sensing is routinely applied to vegetation monitoring, agriculture, forestry, geology, hydrology, land use, cartography and glaciology while Subramanian and Ramachadra (1992) noted that remote sensing can be used to collect information on the environment at a wide range of scale. At local scale, it can be used to study small areas in considerable spatial detail.

4.7.2 Atmospheric applications

The first series of remote sensing, geostationary remote sensing have had long period of applications to weather recording and monitoring. Mabbut and Wilson (1980), BOSTID (1987), Goldsmith (1992) Skidmore et al (1997) and Okhimambe (2000) have all demonstrated various ways by which remote sensing could be applied to atmospheric studies. For example, Skidmore et al (1997) reported that the system, Total Ozone Mapping System is being used to monitor the status of atmospheric ozone. The satellite raised the awareness of ozone depletion while Okhimambe (2000) showed that three types of electromagnetic radiation; visible, thermal infrared and microwave radiation; are important in developing rainfall estimation models.

4.7.3 Vegetation and Agricultural Study.

The application of remote sensing to vegetation and agricultural study has been demonstrated by Walsh (1980), Lo (1986) and BOSTID (1987). Lo showed how remote sensing was applied to identification of tree species in Michigan, USA in 1972 while Walsh showed how Landsat, aerial photograph supported with digitized topographic maps were applied to classify conifers in Crater Lake National Park, USA. Remote sensing has been applied to agricultural production process. In India, remote sensing was applied to estimate oilseeds, rabi crops (wheat and mustard) (Aneja, et al, 1992). In 1985, growing season, the United States Agency for International Development (USAID) used Landsat data to forecast sorghum and millet crop failures in Sudan and for planning relief operations (Joshi and Krishna, 1996). Ramalho-Filho et al (1997) undertook a land suitability for Brazil. Their study showed that 65 per cent of the Brazilian land is good for crops. For the rest of the land, 12 per cent is suitable for improved pasture, 11 per cent for forestry and rangeland while 12 per cent is unsuitable for agricultural practices.

4.7.4. Application to Mineral, Soil and Water resources

Remote sensing has also been applied to the understanding of other resources apart from agriculture. It has been applied to mineral exploration, water resources and soil, among others. Remote sensing was used, for example, to estimate available habitat for migrating birds in the Yucatan of southern Mexico (Green et al., 1987). In Thailand, Vibulsresth (1986) was able to differentiate "disturbed" from "undisturbed" dry dipterocarp forests. Radar remote sensing has been applied to the study of Amazon and its resources through a programme called RADAM (for Radar Amazon) (CERES, 1977).

RADAM project has also identified fertile soil and rare earth's, deposits of tin, iron, bauxite and other minerals. In Niger Republic, aerial photography was applied to soil classification (White, 1977). Analysts have pointed to the utility of remote sensing for mineral exploration and development. BOSTID (1987) reported that in 1977, USAID and US Geological Survey assisted the government of Bolivia in the discovery of some of the world's richest lithium deposits in the Salr de Uyuni. Landsat data were used to detect salt drives with extremely high concentration of lithium. The subsequent ground samples taken by investigators confirmed the concentrations.

4.7.5 Disease Monitoring

The utility of remote sensing in disease monitoring and control has also been demonstrated ((Reader, 1995, Bailey, Loslier, 1995, Connor, 1995 and Bretas, 1995). Rogers and Randolph (1991) indicated the use of remote sensing for, identifying environmental conditions known to favour tsetse fly reproduction while Linthicum et al. (1990) showed its use for detecting flooding of the breeding sites of Rift Valley Fever vectors. Connort (1995) noted that both spatial and temporal changes in environmental conditions may be important determinants of vector-borne disease transmission and as such remote sensing is capable of identifying these changes. Satellite imagery may be able to define and predict areas and periods of high transmission. Similar applications are also reported by Wood et al (1991).

4.7.6. General Application of Remote Sensing In Nigeria.

Remote sensing in Nigeria has found applications in various aspects as found in some other parts of the world; although against the background of local inhibitions as found in most less developed countries (Adefolalu, 1999). The overall impression therefore is that remote sensing has had limited applications, particularly, applications based on satellite. In spite of this remark some studies on the application of remote sensing in Nigeria can be cited.

Adefolalu (1999) has identified forestry and land use as main areas of remote sensing applications in Nigeria. The first major application by Nigeria was aerial photographic coverage of the vegetation of Nigeria (Lo, 1986). However, the project, was not particularly successful due to cloud interference with the flight coverage. This prompted the shift to the use of radar for the vegetation survey. Data was acquired with Side Looking Airborne Radar (SLAR). For interpretation, rectified SLAR images at the scale of 1: 250 000 were employed while tone and texture were used as basic interpretative criteria. The vegetation classification was based on physiognomy. This gave three tiers of classification: 10 main formations (grassland, woodland, forest and farmland); 20 sub-formations (for example, mature forest, immature forest, and riparian forest or swamp forest) and 3 species for the sub-formations. In total, 69 maps showing land use and vegetation were produced (9Lo, 1986).

Hussaini (1995) applied aerial photograph to classification of arable land in Kotonkarfi local government area of Kogi State. Using aerial photographs on the scale of 1: 40 000 and vegetation as a distinguishing criterion, Hussaini identified nine land uses in the local government area. Two German geographers (Fricke and WolfbeiB, 1996) used a combination of aerial photograph and Spot satellite images to monitor land use changes, settlement, population growth and environmental degradation in parts of Gombe state between 1964 and 1991. The study covered two areas in Ture Hill-Kaltungo Plain in the south of Gombe. Using a 1991 Spot image, the land use and vegetation pattern in East Tangale area was undertaken. A manual interpretation gave 7 classes as opposed to 6 classes given by digital interpretation; although some misplacements were noted for some old permanent farmlands in the two approaches. Similar studies are that of Oloyode, 1998). Abubakar and Abdulkadir (1995) who emphasized degradation from erosion in their study of Southeast of Katsina State.

4.8 URBAN STUDY APPLICATIONS OF REMOTE SENSING

4.8.1 Global Perspective

The scope of the applications of remote sensing is widening to include its application to the analysis of settlements in general and that of the urban centres in particular. It has been found useful for urban management in various ways.

Remote sensing is useful in delineating the urban centres, mapping of urban land use and to study urban pollution.

Lo (1986) reported many ways in which remote sensing had been applied in urban analyses. These include study of settlement pattern, estimate of land or built-up area, in estimating dwelling units and land use assessment. He reported the use of Shuttle Imaging Radar for the study of settlement pattern in part of the North China Plain. The radar image gave a synoptic coverage of settlements of various sizes in the sub-region; showing the distribution of hamlets, villages, towns and cities. Thus it was applied in testing the validity of Walter Christaller's Central Place Theory. The settlements were found to exhibit random cluster pattern, thus showing lack of conformity to the theory. This finding was in contrast to what was obtained for Egypt (Lo, 1986). In this case aerial photograph of a part of the Nile Delta was employed. This gave a distinct hierarchical arrangement of settlements. To calculate built-up area in this study, it was suggested that the built-up area should be proportional to the population. That is

$$r = aP^{b} \qquad \text{Equation 4.1}$$

where r is the radius of a circle of the same area of settlement, P is the population, a is a coefficient and b is an exponent. This equation was modified to linear regression equation in the form

$P = a + b A$ Equation 4.2

Where A is the area of the urban centre. Yet a more complex equation inform of multiple regression that will take care of more variables measurable from remote sensing images is still more preferable (Lo, 1986) this is given as

$P_i = a + b_1L_1 + b_2P_j - b_3D_{ij} + b_4A_i$ Equation 4.3

Where P_i is the population of urban area I

L_1 is the number of direct lines L between I and other urban area

P_j is the population of the nearest larger urban centre j

D_{ij} is the highway distance between urban area I and the nearest larger urban area j and

A_i is the observable occupied dwelling area of urban area i.

Lo reported that equation 3 was applied to the estimate of 40 urban centres in the Tennessee valley in 1953 and 1963. An interesting application of remote sensing application here is the estimation of squatter population by Lo (1979). He had applied aerial photographs of the scale of 1; 10 000 to estimate squatter population in Kai Tak district of Hong Kong. By superimposing a dot grid, the area extent of the squatter settlement was determined and measured within an accuracy range of ±5 per cent while the squatter population estimate achieved accuracy level of ±2 per cent.

In applying remote sensing to urban study, Lindgren (1974) differentiated between directly observable and indirectly observable data. For the directly observable data he grouped area of application into four; urban land use mapping , transportation studies, engineering projects and municipal inspection. One of the earliest application of satellite to land use classification is that of Rhode Island, (Lindgren, 1974). The study based on Landsat-1 image led to eight land use classes for Rhode Island. Lindgren noted that aerial photography is particularly unique in urban transportation study; as related to highway maintenance by identifying degraded parts of roads and areas of heavy traffic.

Application of remote sensing to poverty analysis is by surrogate. Even then, poverty studies based on the use of remote sensing are very few. For example, housing quality can be indirectly identified by the remotely sensed data (Lindgren, 1974). The approach here is based on correlative photo-interpretation or inventory-by-surrogate (Lo, 1986). Lo cited the study of housing density of Birmingham, USA. The author extracted four indices from aerial photograph with which he identified the existing residential densities. Ground checks indicated accuracy level of 99 per cent for the residential structures. Another area of surrogate application of remote sensing is in poverty analysis. Lindgren, (1974) and Lo (1986) also reported the use of aerial photograph to delineate poverty areas in Lexington Kentucky. Urban poverty was found to be closely associated with residential areas located adjacent the CBD, industry and major urban arteries. These were found to be strongly correlated with low income, unemployment, low educational level, family crowding, crime, low health status and lack of community facilities.

4.8.2 Urban Application of Remote Sensing in Nigeria

Apart from general application remote sensing has also been applied to urban analysis in Nigeria. Kawka (1996) undertook an application of satellite remote sensing for urban land use classification of Maiduguri. His study was based on the use of Landsat TM. The Landsat image was processed by digital method. Using maximum likelihood classification method, the land use of Maiduguri region was obtained. In all, 25 classes were obtained; eight of these covered Maiduguri urban while 17 cover the surrounding rural land.

Duru (1981) had earlier conducted a similar urban land use classification for Nsukka. He however, used aerial photograph for his study. Using a base map of 1: 125 000, he produced the land use map of Nsukka from aerial photo on a scale of 1; 4 800. Ground truthing was based on field check and a checklist table as reference point for use naming. Eight land uses were identified; open forest, rock outcrop or barren land, grassland, mixed oil palm grove, compound land crop garden, farm and early fallow land, plantation and commercial. Only one use, commercial is an urban use. But, given that commercial will not usually occur without settlement, the interpretation is that the commercial use is interlaced with by residential use.

Application of remote sensing to changes in the urban setting found expression in the study of Akure by Balogun (1995). The study used sequential aerial photographs of 1974 (1: 25 000) and 1983 (1: 6 000). Land use types on these aerial photos were identified. A change map was produced from the two aerial photos. The map showed that the gross area of residential land use in Akure had increased by 75.3 per cent between 1974 and 1983 (nine years), commercial by 9.85 per cent, industrial by 5.28 per cent, institutional use by 56.11 per cent, transportation and utility by 22.20 per cent and recreation by 17.05 per cent.. The urban flood phenomenon attracted the attention of Odemeroh (1988) in his study of Benin. The aerial photographs supported by land use map provided urbanization parameters such as proportion of built-up area, percentage of vacant plots, length of roads and catchment area. The study showed not only outward shift in the dominance of the flood areas, it also showed progressive deterioration of the city; flood areas increased from four in 1965 to 45 in 1985. Similar environmental deterioration in Benin is also observed by Ikhoria (1988) who used aerial photographs to depict buiding density types within the city. He discovered that 4.1% of the existing buildings were unsuitable for human habitation.

The literature review has shown the trend in the study of poverty and urban environmental problems. The review has shown the followings: (1) often the two issues of poverty and environmental problems are treated separately; (2) where relationship between poverty and the environment is examined, it is descriptive without statistical demonstration of relationship; (3) studies based on remote sensing applications to poverty-environment relationship are few and (4) application of the concept of human poverty is also few. These issues are addressed in this study.

CHAPTER FIVE

5.0 POVERTY AND ENVIRONMENTAL STATUS

5.1 INTRODUCTION

In the analysis of poverty, a beginning point is the definition of poverty and the identification of the poor. These are not too easy task to do given the complexity of the phenomenon of poverty. In this chapter, the focus is on the definition of poverty based on the available data from the field and the measurement of poverty. It also covers a presentation of environmental deterioration, inequality in environmental amenities among households and the perception of the environment by the people.

5.2 DEFINING POVERTY:

As it has been variously stated poverty has many dimensions; representing a specific life situations of a country's population (May, 2002). The World Development Report, 2000/2001 defines poverty as 'pronounced deprivation in wellbeing' (UNDP, 2000). Hence, the Report sees wellbeing in three dimensions; opportunity, empowerment and security. Similarly, Mehrotra (2003) identifies five dimensions of poverty. These are consumption, control, capability, capital and commerce. These views, among others have influenced the definition and measurement of poverty over the years. Alkire (2000) reviewed 15 works and approaches which have attempted to assess the components of human wellbeing. The summary is that there is a gradual shift from definitions dependent on mono-factor approach to definitions dependent on multiple-factor approach.

In this work, definition of poverty is based on (1) income poverty (poverty line approach) and (2) human poverty. These give the criteria for poverty definition and the identification of the poor.

5.2.1 Income Poverty:

Analysts have pointed out the problems associated with the use of income to determine poverty. At the same time, it has become difficult to run away from the use of income in order to define poverty in any place and at any time. Perhaps, the caution is that 'poverty can no longer be adequately defined in terms of income alone. It must be recognized as a multifaceted phenomenon' (Mabogunje, 2002). Similarly, the caution also extends to the components of income. It is not enough to use just one dimension of income. As many dimensions as the situation demands should be used in the definition of poverty in a locality. As a result, it is safe to qualify income-related poverty simply by saying income poverty.

5.2.1.1 Setting Poverty Line and Headcount Poverty

Poverty line is the benchmark for the classification of the society into the poor and the non poor. It represents an income level believed to offer the minimum leverage for the satisfaction of basic needs by households. Hence, the poor are the percentage of people below the poverty line (May, 2002). Poverty line connotes an idea of absolute poverty, 'Even when the shortcomings of an absolute poverty are acknowledged, this remains a basic building block for further analysis' (May, 2002). Poverty line occupies a central role in poverty analysis because of its use in monitoring poverty, developing poverty profile, serving as a threshold for entitlements and in providing a focus for public debate (UNDP, 1997).

In determining poverty line, as many variables as the definition of poverty connotes may be used. For example, in the study of poverty in Pakistan, Naseem (1977) Irfam and Amjam(1984) used required food intake while Akhtar (1988) used per capital expenditure as poverty lines respectively. Baba et al (2002) in their study of poverty in Minna used various aspects of income; mean income and median income as poverty lines. The Federal Office of Statistics (FOS, !999) in its 1990-1996 poverty study of Nigeria used total real per capita Expenditure as poverty line where the poor are determined by total expenditure on food and on non-food items.

In the present study, attempts are made to define poverty by using three elements of income. These are income from the main job of the household heads, total personal income including income from secondary jobs and total household income. The total household income is the total sums of the income of the household head and that of the other members of the household in particular that of the spouses.

Table 5.1 shows the profile of the various components of income. The table shows the minimum, maximum, mean and the mode of each component of income . It also shows the proportion of the households who fall below the mean of each component. The minimum monthly income from the main job and for the total personal income is ₦ 800 each as opposed to ₦ 1 000 for the total household income. Similarly, while the maximum for the income from the main job is ₦ 230 000, it is ₦ 299 000 for the total personal income and ₦ 410 000 for the total household income. For the three, the means are ₦ 26 706, ₦ 30 636 and ₦ 37 002 for income from the main job, total personal income and total household income respectively.

TABLE 5.1: HEAD COUNT INDEX OF POVERTY

	Income Variables in Naira per Month				
Element	Minimum	Maximum	Mean	Mode	Poverty headcount
Income from main job	800	230 000	26 706	15 000	70
Total personal income	800	299 000	30 636	10 000	73
Household income	1 000	410 000	37 002	10 000	64

Source: Author's Field Survey, 2004.

Similarly, while by using income from the main job, 70% of the people fall below the mean, by using total personal income, 73% fall below the mean and by using the total household income, 64% fall below the mean. It is observed that the values of the elements of the total personal income stay fairly between those of the income from the main job and the total household income. Using the income parameter, the lower limit of the mean income stands at ₦ 26 706 while the upper limit stands at ₦ 37 002. Hence, the total poor range between 64% to 70%. However, the average of the three gives the headcount proportion of the poor as 70%.

In determining poverty line, it may be important to achieve a fairly universally comparable figure. In this case, attempt is made to look at the United Nations poverty line.. The UN defined the poor as an individual who lives below US $1.0 daily. (Vandemoortele, 2002 and May, 2003). The UN poverty line is based on studies conducted in the 1980s in 33 countries of the World. It has been updated. The new poverty line is US $1.08 daily. This represents the median value of the lowest 10 poverty lines among the 33 countries (Vandemoortele, 2002). With an average household size of 8.2 in the study area (see 5.10 in this chapter), this translates to ₦ 37 195 per month. Using this poverty line, average headcount poverty stands at 66% of the households in Minna. The poverty line of ₦ 37 195 per month per household is thus adopted for further analysis in this work. Gupta, Narain and Velda (2004) used 1 US $ per person per day in their study of relationship between households income and assets (both private and natural).

5.2.1.2 Poverty Headcount among the Neighbourhoods:

It is important to see how poverty headcount varies from one neighbourhood to the other. This is shown in Table 5.2.

The Table shows that poverty exists among all neighbourhoods; although it is higher in some than others. The highest poverty head count is found in Sauka Kahuta where all the households are found to be poor. Other neighbourhoods with very high headcount poverty index are Agwan Daji (83%), Barkin Saleh (89%), Fadipe (86%), Jikpan (92%), Minna Central (93%), Kpakungu (97%) and Tudun Fulani (85%). On the other hand, only two neighbourhoods, F-Layout and Tunga Low Cost have index below 20% (17% and 12%

respectively). Even the GRA has a poverty headcount of more than 20%. The figure from Tayi Village will be understood against the background that the area is an expanding neighbourhood with emerging middle income people. Similarly, although Tunga Low Cost is meant for low income earners, the fact is that it is largely occupied by middle income professionals. In general, 11 neighbourhoods have index value above that of the city's 66%. The occupation of the Tunga Low Cost by middle income people is one of the deficiencies in government housing programmes. It demonstrates the incapacitation associated with low income and poverty status. In this case, very low financial resources prevented low income people from enjoying what was basically meant for them.

TABLE 5.2: SPATIAL VARIATIONS IN HEADCOUNT POVERTY INDEX

S/N	Neighbourhood	Headcount poor (%)	S/N	Neighbourhood	Headcount poor (%)
1	Agwan Daji	83	14	Kpakungu	97
2	Barkin Saleh	89	15	Limawa A	72
3	Bosso Estate	46	16	Maitumbi	67
4	Bosso Town	35	17	Makera	35
5	Chanchaga	67	18	Nasarawa	61
6	Dutse Kura Gwari	54	19	Sabo Gari	59
7	Dutse Kura Hausa	67	20	Sango	79
8	Fadipe	86	21	Sauka Kahuta	100
9	F-Layout	15	22	Tudun Fulani	74
10	Tayi Village	57	23	Tudun Wada North	85
11	GRA	23	24	Tudun Wada South	50
12	Jikpan	92	25	Tunga Low Cost	12
13	Minna Central	93			

Source: Author's Field Survey, 2004.

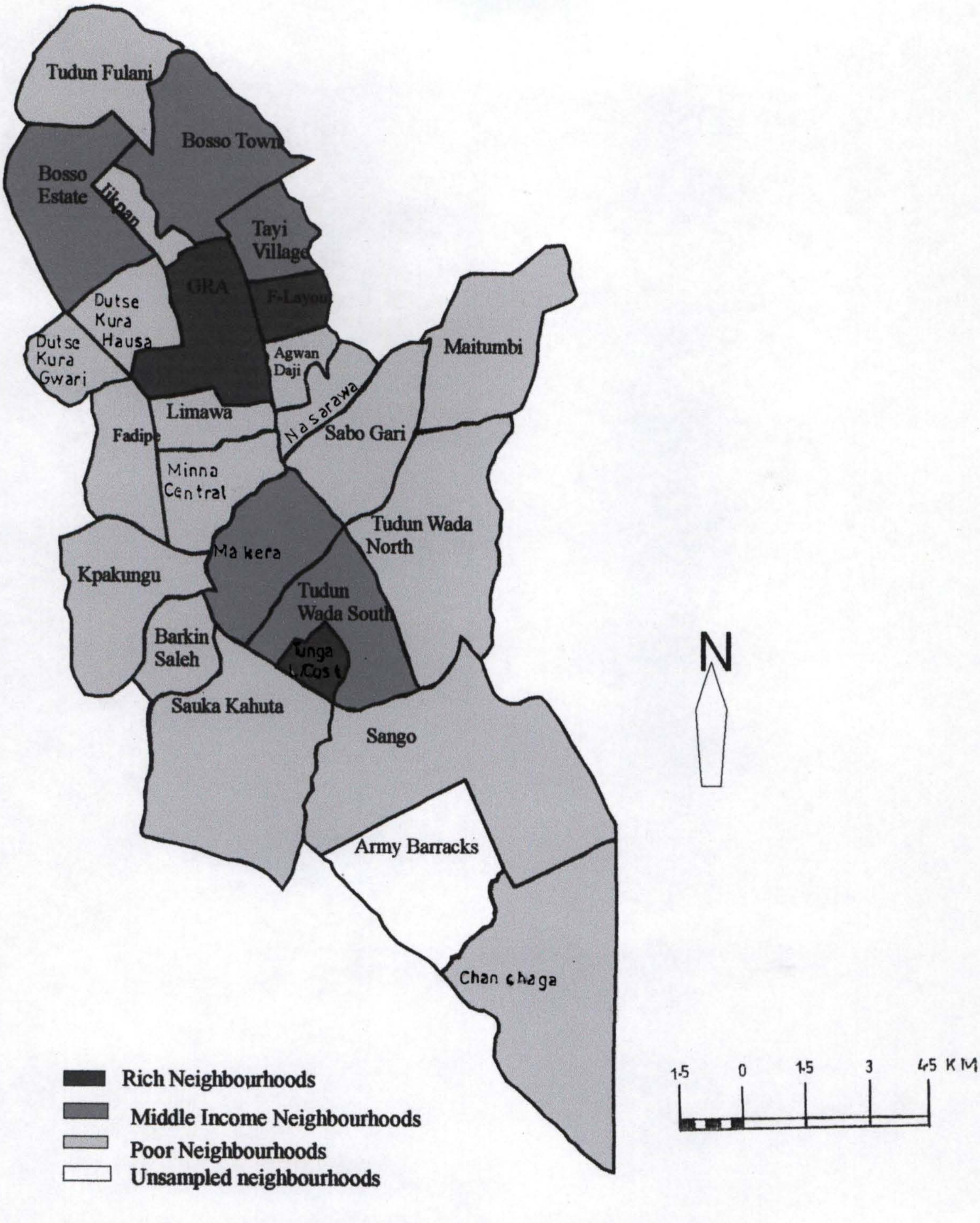


FIGURE 5.1: CLASSIFICATION OF THE NEIGHBOURHOODS BY POVERTY HEADCOUNT INDEX

Figure 5.1 classifies the neighbourhood based on the poverty headcount index. It shows that three of the neighbourhoods, F-Layout, GRA and Tunga Low Cost have less than 30% headcount index and are therefore classified as rich neighbourhoods; five others, Bosso estate, Bosso Town, Tayi Village, Makera and Tudun Wada South that have between 31%-50% headcount index are middle income neighbourhoods while the remaining 17 neighbourhoods with more than 50% headcount index are poor.

The pattern of poverty observed among neighbourhoods does not vary too much from earlier finding by Baba et al (2002). By using a relatively lower poverty line, the median income of N1286.00 per person per month, they found that the average poverty level in Minna was 53%. Among the neighbourhoods, the highest poverty headcount was available in Sauka Kahuta with poverty level of 93% while the least was found in Nasarawa B/C with headcount poverty level of 20%.

5.2.3 Poverty Gap

The head count index presented so far measures who are the poor. However, it is also important to understand the depth of poverty in the study area. This is also called poverty gap. The poverty gap measures the distance between the consumption level of the poor and the poverty line (Mckinley, 1997). It accounts for how far the poor are below the poverty line. Simply put, poverty gap is the mean shortfall from the poverty line expressed as a percentage of the poverty line (UNDP, 2003). It is interpreted to mean 'how much below the poverty line is the average poor person' (FOS, 1999). It is calculated by the formula

Poverty Gap = $\frac{\text{Poverty line- Average income of people below poverty line}}{\text{Poverty line}}$

The poverty gap indicates the severity of poverty among the poor. That is, the extent to which low income status among the poor weighs the poor down. So, even when the level of poverty may be generally low in a territory, excessively low income among the poor will generate high poverty gap index and vice versa.

5.2.3.1 City-Level poverty Gap

The poverty gap may be squared to give the spread of poverty. The poverty gap in relation to the three elements of income is shown in Table 5.3. The table shows that the poverty gap by using income from the main job is 52%, 47% where total personal

income is used and 56% where household income is used. On the other hand, the average for the square of the poverty gap is 52%.

TABLE 5.3: POVERTY GAP

Element	Income-Expenditure Variables in Naira			Number of people	PG(%)
	Mean	Total income of people below poverty	average		
Income from main job	26 706	16 662 000	12 896	1328	52
Total personal income	30 636	22 035 300	16 286	1402	47
Household income	37 002	20 737 800	16 406	1264	56

Source: Author's Field Survey, 2004.

5.2.3.2 Spatial Variations in Poverty Gap

As in the case of head count poverty index, it is important to see how the poverty gap varies among the neighbourhoods. The performance of the neighbourhoods in this regard is shown in Table 5.4. The table shows that poverty gap among the neighbourhoods vary from 18% in Tunga Low Cost to 76% in Sango.. Other neighbourhoods with relatively low poverty gap index are Dutse Kura Gwari, 23%, GRA, 24% and Dutse Kura Hausa, 26%. On the other hand, high poverty gap is experienced in Sabo Gari, 70%, Sauka Kahuta and Tudun Wada North, 65% each.

TABLE 5.4: SPATIAL VARIATIONS IN POVERTY GAP INDEX

S/N	Neighbourhood	Poverty Gap (%)	S/N	Neighbourhood	Poverty Gap (%)
1	Agwan Daji	37	14	Kpakungu	57
2	Barkin Saleh	53	15	Limawa A	47
3	Bosso Estate	42	16	Maitumbi	46
4	Bosso Town	36	17	Makera	56
5	Chanchaga	57	18	Nasarawa	57
6	Dutse Kura Gwari	23	19	Sabo Gari	70
7	Dutse Kura Hausa	26	20	Sango	76
8	Fadipe	48	21	Sauka Kahuta	65
9	F-Layout	31	22	Tudun Fulani	51
10	Tayi Village	30	23	Tudun Wada North	65
11	GRA	24	24	Tudun Wada South	37
12	Jikpan	51	25	Tunga Low Cost	18
13	Minna Central	64			

Source: Author's Field Survey, 2004.

Figure 5.2 shows the classification of the neighbourhoods according to poverty gap index. It is shown that five neighbourhoods are classified as having less severe poverty status. They have less than 30% poverty gap. These neighbourhoods are Tunga Low Cost, Dutse

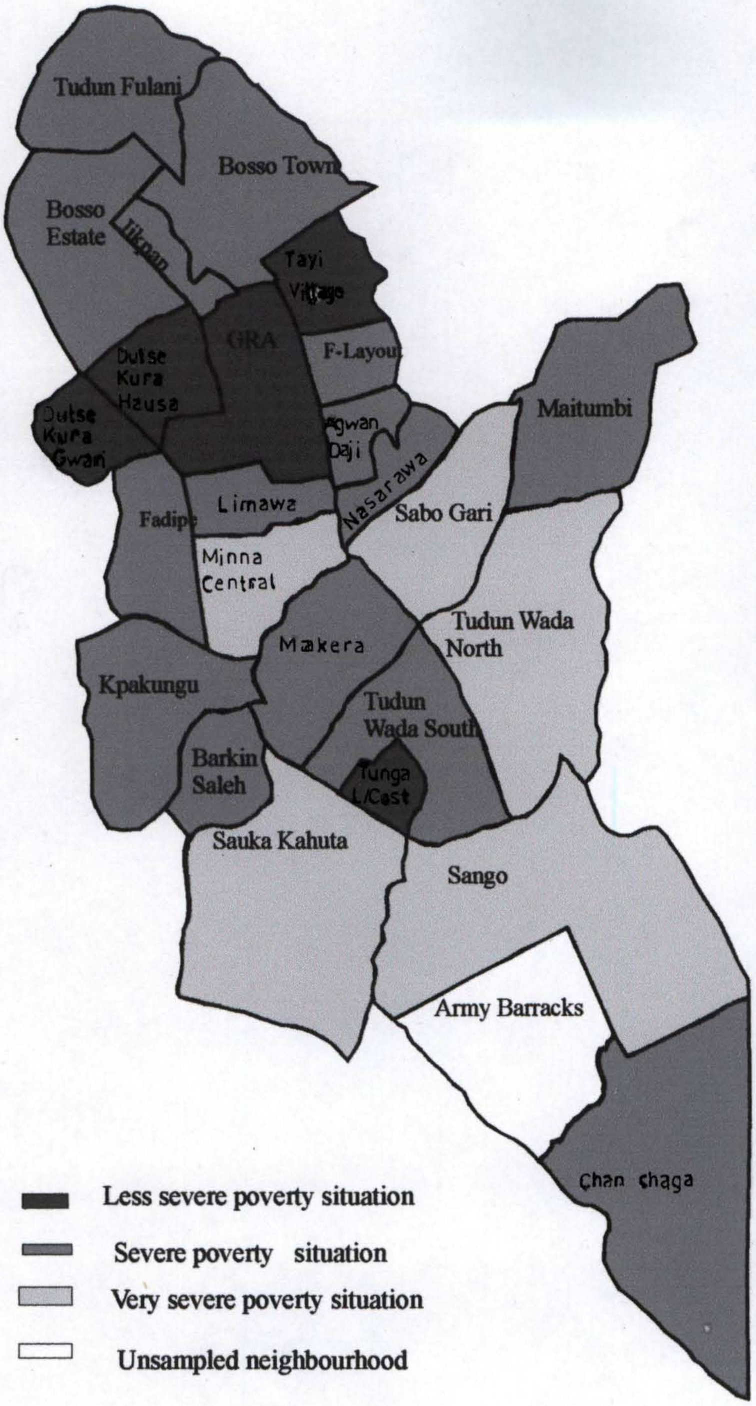


FIGURE 5.2: CLASSIFICATION OF THE NEIGHBOURHOODS BY POVERTY GAP INDEX

Kura Gwari, GRA, Dutse Kura Hausa and Tayi Village. Similarly, Agwan Daji, Bosso Estate, Bosso Town, Fadipe, F-Layout, Limawa, Maitumbi, Tudun Wada South, have severe poverty status while in the remaining neighbourhoods, the poor experience very severe poverty condition. Severe poverty conditions occur where poverty gap ranges between 31-60% while very severe condition occurs where poverty gap is above 60%.

5.3 MEASURING HUMAN POVERTY

Attempts have been intensified in recent times to take a broader and more comprehensive look at poverty. Smith (1979) reports Liu's quality of life criteria for American cities and Maloney's Measures of Social Vulnerability. All these are composite methods of poverty analysis and are variously applied to the understanding of urban poverty, inequality and deprivation in America. Smith also reports Holtermann's Indicators of Urban Deprivation which he (Holtermann) applied to the study of urban poverty in Britain.

Recent development at using composite approach to the evaluation of poverty has resulted in the concept of the basic need approach (ILO, 1976), Sen's Capability Approach (Sen, 1985,), Dimensions of Well-Being (Narayan 2000) and Allardt Components of Well-Being. The UNDP's now popular Human Development Index and all its variations such as Human Vulnerability Index and Human Poverty Index, Living Conditions Index (May, 2002) are all reflective of composite approach to the definition, understanding and assessment of poverty.

The global acceptance of the UNDP's Human Development Index (HDI) formally introduced in 1992 has generally addressed the difficulty of measuring human development. It has also overcome the problems associated with a measure based essentially on income.

It has been reiterated that income and expenditure alone do not adequately account for the welfare or the deprivation of the people. Rather, income component should be combined with other reflections of welfare measure along a common scale to determine the welfare of the people. In this section, an attempt is made to measure human development in Minna. There are three variables used to compute HDI. These are health (measured by life expectancy), literacy and income measured by purchasing power parity (PPP) (UNDP, 1997).

The HDI adopts the Linear Scaling Technique (LST) (Osberg and Sharpe, 2003). The LST is used to standardize the range of a variable. If a value increases correspondent to an increase in overall welfare, the variable VALUE is scaled according to the formula:

$$\frac{\text{Value} - \text{Minimum}}{\text{Maximum} - \text{minimum}}.$$

If the minimum is 0, the formula is reduced to Value/ maximum.On the other hand, if an increase in VALUE corresponds to decrease in overall welfare, the VALUE is scaled according to the complementary formula

$$\frac{\text{Maximum} - \text{Value}}{\text{Maximum} - \text{Minimum}}$$

In this case, increases in VALUE corresponds to decrease in scaled VALUE. The formula reduces to Maximum-value/ Maximum when the minimum is 0.

In both cases, the range of values is 0-1; 0 corresponds to lowest level of welfare and 1 corresponds to the highest level. Countries or communities with an HDI of less than 0.5 have low level of human development; those between 0.051-0.80 medium level and those above 0.80 a high level (UNDP, 1997). In addition to the HDI of the UNDP, the Index of Social Health produced by Human Resources Development of Canada, the Index of Economic Freedom developed by Heritage Institute and Economic Freedom produced by Cato Institute have all used LST (Osberg and Sharpe, 2003)..

5.3.1 City- Level HDI

In the present study, the available data from the field survey could fit into two of these three components of HDI. These are education and income. Details of the calculation are shown in Table 5.5. The HDI value for education is 0.730 while that of the income is 0.094. The aggregate HDI is 0.412. According to the HDI scale, Minna is a poor society. What the index does in this case is to affirm the high level of poverty shown by the use of head count and poverty gap indices.

TABLE 5.5: HUMAN DEVELOPMENT INDEX

Component	Value	Minimum	Maximum	HDI	REMARK		
					0.0-0.5 Low	0.51-0.80 Medium	0.81-1.0 High
Income	(37 002) 12= 444 024	1 000 * 12 = 12 000	(410 000) 12 = 4 920 000	0.094	✓		
Education literacy	96	0	100	0.96			✓
Years spent schooling	12 (mean)	1	23	0.50	✓		
				0.96+0.50/2 = 0.73		✓	
Aggregate	0.094+ 0.73 = 0.84/2 = 0.412				✓		

Source: Estimates By the Author, using the data from the field survey.

Not only is the level of poverty high, the stress of poverty is also high. While large numbers of the people are poor by headcount poverty index (66%), their level of welfare is also seriously low on the HDI scale. Although only two out of the three components of HDI are used, it is doubtful if the addition of the third component will make any significant difference. For example, on the health matter, it is discovered that only eight out of the expected 23 primary health centres in Minna are provided. This means that even on the health level, majority of the people are deprived and they are likely to be vulnerable to health vagaries that may depress their weight on the HDI scale.

5.3.2 Variations in HDI among the Neighbourhoods

The two variables used in estimating the HDI for the city are also used to estimate HDI for the neighbourhoods. With regard to education; the literacy level per neighbourhood and the average years spent in school by the household heads are used to get the HDI for literacy. The respective literacy level and average years spent in schools are shown in Appendix 1.

The aggregate average HDI for literacy shows that the neighbourhoods fair a little well on this index. The least HDI for literacy is 0.56 obtained by Makera as opposed to the highest of 0.88 obtained by Tunga Low Cost (Table 5.6). By using the city minimum income of ₦ 1 000 per month, the maximum of ₦410 000 and the average income per neighbourhood, the HDI for income is estimated for the neighbourhoods. The results are also shown in Table 5.6. As shown in the Table, the performance of the neighbourhoods on the income is poor; 16 of them (64%) have HDI of less than 0.1 each while the highest value, obtained by Tudun Wada South , is 0.2. The composite HDI for the neighbourhoods is also shown in the last column of the Table. The highest HDI is 0.51 obtained by Tunga Low Cost. All the neighbourhoods except Tunga Low Cost have less than 0.5 on the HDI scale. These neighbourhoods are generally poor by the HDI scale. So, only Tunga Low Cost belongs to medium income group while none is found in high income group (Figure 5.3).

TABLE 5.6 : VARIATIONS IN HDI AMONG THE NEIGHBOURHOODS

S/N	Neighbourhood	HDI		
		Literacy	Income	Composite HDI
1	Agwan Daji	0.54	0.06	0.30
2	Barkin Saleh	0.72	0.05	0.39
3	Bosso Estate	0.84	0.09	0.47
4	Bosso Town	0.86	0.11	0.49
5	Chanchaga	0.76	0.08	0.42
6	Dutse Kura Gwari	0.69	0.12	0.41
7	Dutse Kura Hausa	0.76	0.11	0.44
8	Fadipe	0.81	0.08	0.45
9	F-Layout	0.82	0.1	0.46
10	Tayi Village	0.87	0.11	0.49
11	GRA	0.85	0.12	0.47
12	Jikpan	0.76	0.05	0.41
13	Minna Central	0.79	0.05	0.42
14	Kpakungu	0.79	0.04	0.42
15	Limawa A	0.74	0.07	0.41
16	Maitumbi	0.68	0.07	0.38
17	Makera	0.56	0.11	0.34
18	Nasarawa	0.79	0.08	0.44
19	Sabo Gari	0.72	0.06	0.39
20	Sango	0.71	0.04	0.38
21	Sauka Kahuta	0.67	0.03	0.35
22	Tudun Fulani	0.76	0.07	0.42
23	Tudun Wada North	0.76	0.06	0.41
24	Tudun Wada South	0.62	0.2	0.41
25	Tunga Low Cost	0.88	0.14	0.51

Source: Calculated From Appendix 1.

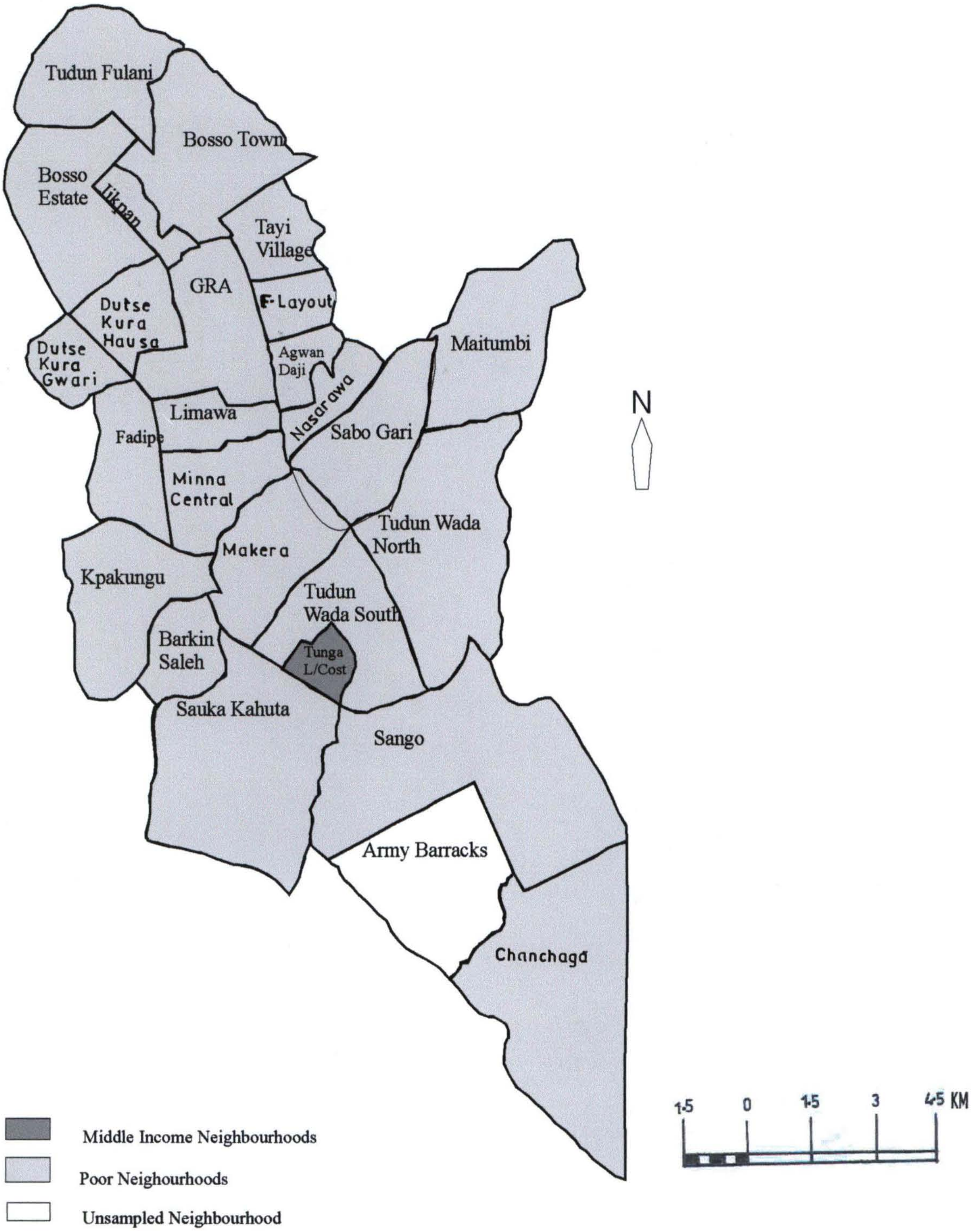


FIGURE 5.3: CLASSIFICATION OF THE NEIGHBOURHOODS BY HUMAN DEVELOPMENT INDEX

5.4 NEIGHBOURHOOD ENVIRONMENTAL POVERTY/DEPRIVATION

While the attempts at composite definitions of poverty are commendable, they have been to emphasize social dimension of welfare with issues relating to the environment either subsumed under health matter, social indicators or even neglected.

There is no doubt that poverty is not only a matter of economy, it is also a matter of serious social importance. The trends in the environmental development, the continuous deterioration of the human settlements and the realization that development and environment are related is bringing environmental consideration into focus daily. If this is accepted, it becomes imperative that attempts to understand and even to eradicate poverty may be fraught with limited success without having to see poverty from the point of the environment. That is, as it is possible to define economic or social poverty, it should also be possible to define environmental poverty. This approach is important first because, the poor are located within the environment and their continuous interaction with the environment generate a specific interactive pool which cannot be captured by economic or social definition alone.

Second, policies directed at economic solution alone will not likely achieve results without considering the elements of environmental poverty. Third, it is also true to say that poverty has spatial dimension. Environment-based poverty definition will also yield opportunities for comparing social or economic well-being with environmental well-being. Some analysts have made attempts at presenting some environmental variables in their assessment of social deprivation. While such attempts are commendable, they are inadequate in explaining the complexity of environmental poverty with which cities are now faced. For the urban centres, environmental poverty is more visible than the economic or social poverty.

Environmental poverty may not proclaim an entirely different type of poverty. Rather, it emphasizes that aspect of poverty which in policy cycle may be assumed away and therefore unattended to. It represents a deficiency in the environmental amenities which add to the quality of life and the productive capacity of the people. Environmental poverty reflects a low level environmental utility arising from poor status and inadequacy of environmental amenities. Such amenities will include housing, housing facilities, housing environment (conditions), residential neighbourhood quality, community facilities and services. Each of these may also consist of a variety of components which will give further meaning to its relevance in explaining human well-being.

In this section, attempts will be made to understand environmental poverty in Minna. The following indices will be used in the presentation.

1. Household-based indicators: these are housing adequacy, housing space, housing facilities and services
2. Housing conditions.
3. Neighbourhood environmental quality.
4. Community facilities and services.

In explaining these components, attention is on those measures that demonstrate poor environmental quality. In the following sections, the environmental conditions of the 25 neighbourhoods are examined by looking at the four major indicators, one after the other.

5.4.1 HOUSEHOLD-BASED DEPRIVATION

The focus here is housing as related to each household. The emphasis is on services and amenities available to each household from its own house. The housing variables covered are housing facilities, housing adequacy, housing space, solid waste and sanitation. Deprivation in respect of these variables are called household-based deprivation. Data on housing were collected through questionnaire survey. In all 2120 copies of questionnaire were administered in the 25 neighbourhoods.

5.4.1.1 Housing Facilities:

Discussions here examine deprivations in housing facilities. Table 5.7 shows this mode of deprivation as it varies among the neighbourhoods. Nine indices are derived from three housing facilities of toilet, bathroom and kitchen. The nine variables are

1. households who use pit toilet (PL).
2. households with toilet outside dwelling unit (TODU);
3. households with no bathroom (NBR);
4. households with bathroom outside the dwelling units (BOD);
5. households without kitchen (NK);
6. households with kitchen outside the dwelling units (KODU);

7. households who share one of the three facilities (SOF);

8. households who share all the facilities (SAF) and

9. households who share the combination of facilities (SCP).

Table 5.7 shows the proportion of deprivation per variable per neighbourhood. The last column of the table shows the average level of deterioration in the nine variables by each neighbourhood.

In respect of toilet facility, in four neighbourhoods; Bosso Estate, F-Layout, GRA and Tunga Low Cost no household use pit larine and no household has toilet facilities outside the dwelling units. However, as many as 83% of the households in Barkin Saleh and 72% in Sango depend on pit larine while 77% and 72% of their households respectively have their toilet facilities outside the dwelling units. In term of possession, majority of the neighbourhoods fare well; in 21, and nine neighbourhoods no household lack bathroom and kitchen respectively. However, most households share facilities. In Agwan Daji, as many as 65% of the households share one facility or the other while 10% share all the facilities. In Sango, 46% share one facility or the other, 26% share all the facilities while 28% share the facilities in various combinations.

TABLE 5.7: HOUSEHOLD-BASED ENVIRONMENTAL QUALITY: DEPRIVATION IN HOUSING FACILITIES BY NEIGHBOURHOODS

S/N	Neighbourhood	PL	TODU	NBR	BODU	NK	KODU	SOF	SAF	SCF	AVERAGE
1	Agwan Daji	35	34	26	28	11	44	65	10	0	28
2	Barkin Saleh	83	77	0	77	7	77	20	53	3	44
3	Bosso Estate	0	0	0	0	0	3	0	0	0	0.3
4	Bosso Town	26	46	0	47	11	43	0	0	67	27
5	Chanchaga	42	67	26	58	5	67	27	37	5	37
6	Dutse Kura Gwari	40	40	0	40	18	60	30	8	46	31
7	Dutse Kura Hausa	39	56	0	56	0	67	39	27	26	34
8	Fadipe	33	63	0	63	7	67	10	0	27	30
9	F-Layout	0	0	0	0	0	0	17	0	0	2
10	Tayi Village	2	3	8	30	4	42	20	14	16	15
11	GRA	0	0	0	0	0	0	0	0	0	0
12	Jikpan	15	36	2	34	2	34	0	0	100	25
13	Minna Central	48	64	0	58	19	72	14	44	25	38
14	Kpakungu	46	85	0	100	24	92	3	15	82	50
15	Limawa A	61	76	0	72	0	64	26	39	22	40
16	Maitumbi	24	55	9	61	15	74	66	15	16	37
17	Makera	20	42	0	40	0	55	3	20	22	22
18	Nasarawa	36	72	0	73	0	93	51	27	7	40
19	Sabo Gari	36	68	4	85	11	71	20	21	32	39
20	Sango	72	72	0	72	0	82	46	26	28	44
21	Sauka Kahuta	56	42	0	42	14	42	42	0	58	33
22	Tudun Fulani	30	50	0	38	22	58	50	0	28	31
23	Tudun Wada North	14	47	0	42	4	46	27	16	17	24
24	Tudun Wada South	27	43	0	43	0	50	0	23	0	21
25	Tunga Low Cost	0	0	0	0	0	0	0	0	0	0

Source: Author's Field Survey, 2004.

5.4.1.2 Housing Adequacy.

Indices of housing adequacy employed in the work are house renting, squatting, excess population (spill-over population) and housing occupancy ratio. While house renting emphasizes non-house owners who pay for their occupation of houses, squatters are non-rent users who live with renters. Excess population defines the population above the designed population of a neighbourhood. It is used by planners to determine population for whom a new land layout is desired. The excess population refers to people who remain after deduction of expected population by standard has been made from the existing population. It is calculated by:

Excess population (Exp) = Actual population (Ap) - expected population (Ep) where

- Actual population (Ap) = Number of households * Average household size
- Expected population (Ep) = standard occupancy ratio * total number of habitable rooms.

In this study, the respective values are as substituted below:

Ap = (2120) (8.2) = 17 384

Ep = (2) (7103) = 14 206

Exp = 17 348 – 14 206 = 3 178

Proportion of excess population (PExp) = 3 178 / 14 384 = 18.%.

Room occupancy ratio defines the average number of people per room. The standard occupancy ratio is two persons per room. The existing ratio indicates the pressure of living in a house. Table 5.8 shows deprivation in relation to housing adequacy among the 25 neighbourhoods.

The proportion of renters is as high as 86% in Sabo Gari, 76% in Tayi Village and 72% in Kpakungu (Table 5.8.). Similarly, the proportion of excess population is as high as 41% each in Bosso Town and Sauka Kahuta, 33% in Sango and 31% in Sabo Gari.

TABLE 5.8: HOUSEHOLD-BASED INDICATORS OF ENVIRONMENTAL QUALITY:DEPRIVATION IN HOUSING ADEQUACY

S/N	Neighbourhood	Renters (I)	Spill-over population (II)	Occupancy ratio	Average (I+II)/2
1	Agwan Daji	59	31	2.9	45
2	Barkin Saleh	53	26	2.7	40
3	Bosso Estate	27	41	3.4	34
4	Bosso Town	35	4	2.1	20
5	Chanchaga	59	0	1.7	30
6	Dutse Kura Gwari	12	24	2.6	18
7	Dutse Kura Hausa	77	9	2.2	43
8	Fadipe	37	0	1.8	19
9	F-Layout	60	0	1.8	30
10	Tayi Village	76	7	2.1	42
11	GRA	3	10	2.2	7
12	Jikpan	44	0	2	22
13	Minna Central	**53**	**23**	2.5	38
14	Kpakungu	72	0	1.3	36
15	Limawa A	23	45	2.5	34
16	Maitumbi	52	33	3	43
17	Makera	58	27	2.8	43
18	Nasarawa	43	0	1.36	23
19	Sabo Gari	86	31	2.5	59
20	Sango	6	33	3	20
21	Sauka Kahuta	67	41	3.9	54
22	Tudun Fulani	49	23	2.6	36
23	Tudun Wada North	42	8	2.2	25
24	Tudun Wada South	67	23	2.6	45
25	Tunga Low Cost	18	21	2.5	20
City level value (%)		49	18	2.5	

Source: Author's Field Survey, 2004.

No spill-over population is observed in Chanchaga, Fadipe, f-Layout, Jikpan, Kpakungu and Nasarawa. With regard to room occupancy ratio; neighbourhood values vary from as low as 1.7 in Chanchaga to as high as 3.9 in Sauka Kahuta. In relation to the standard of 2 persons per room, 17 neighbourhoods (68%) fall above the standard, one has 2.0 while seven (28%) have occupancy ratio below the standard (Figure 5.5). The meaning is that, overcrowding in rooms is more stressful in these 17 neighbourhoods than in others.

Average level of deprivation in housing adequacy is calculated by the average of the proportion of renters and spill-over population per neighbourhood. The result shown in the last column of Table 5.8. The Table indicates that housing adequacy deprivation is high in Sabo Gari with 59%, Sauka Kahuta (54%) and 45% in Agwan Daji.

5.4.1.3 Housing Space:

Housing space explains the spatial aspects of housing as related to activity units within dwelling units. Data for indices of housing space are collected through questionnaire administration and field observations. There are five indices of housing space examined in this section (Table 5.9). These are

1. percentage of total households who live in room and parlour per neighbourhood (RP)
2. percentage of total households who have no sitting room. (NSR)
3. percentage of total households who use sitting room as bedroom (SRBR).
4. percentage of total rooms without cross ventilation (NCV)
5. percentage of total dwelling units without internal open space (NOS).

TABLE 5.9: HOUSEHOLD-BASED INDICATORS OF ENVIRONMENTAL QUALITY: HOUSING SPACE DEPRIVATION

S/N	Neighbourhood	RP	NSR	SRBR	NCV	NOS	Average
1	Agwan Daji	44	0	46	27	0	23.4
2	Barkin Saleh	43	17	36	29	7	26.4
3	Bosso Estate	0	0	45	0	3	9.6
4	Bosso Town	43	0	70	0	7	24.0
5	Chanchaga	50	9	41	26	0	25.2
6	Dutse Kura Gwari	14	28	0	12	12	13.2
7	Dutse Kura Hausa	40	17	34	11	6	21.6
8	Fadipe	30	9	65	13	37	30.8
9	F-Layout	0	0	27	0	0	5.4
10	Tayi Village	26	6	10	10	56	21.6
11	GRA	0	0	3	0	16	3.8
12	Jikpan	56	0	41	25	6	25.0
13	Minna Central	41	9	37	17	32	27.2
14	Kpakungu	65	35	88	0	72	52.0
15	Limawa A	69	45	98	29	79	64.0
16	Maitumbi	32	13	58	16	26	29.0
17	Makera	26	4	36	19	0	17.0
18	Nasarawa	44	7	46	41	7	29.0
19	Sabo Gari	53	18	51	6	44	34.4
20	Sango	26	18	44	16	28	26.4
21	Sauka Kahuta	42	14	16	7	0	15.8
22	Tudun Fulani	20	80	61	73	86	64.0
23	Tudun Wada North	34	3	37	31	14	23.8
24	Tudun Wada South	37	3	43	7	20	22.0
25	Tunga Low Cost	18	16	76	0	0	22.0

Source: Author's Field Survey, 2004

In three of the neighbourhoods, no households live in room and parlour. These are Bosso Estate, F-Layout and GRA. On the other hand, residents of room and parlour are as high as 69% in Limawa, 65% in Kpakungu and 53% in Sabo Gari. All households in Agwan Daji, Bosso Estate, Bosso Town, F-Layout and Jikpan claimed to have no sitting room while 80% in Tudun Fulani, 45% in Limawa and 35% in kpakungu have no sitting room.

5.4.1.4 Solid waste:

There are two major ways of waste disposal by the households. These are the organized means through the Niger State Urban Development Board and the various informal means through self disposal by the households and cart pushers. The informal means are classified as poor means of waste disposal. This is found to be dominant among the households. The informal means consist of burning, throwing of waste into surroundings and drains and dumping of waste at illegal sites within neighbourhoods.

Table 5.10 shows the proportion of households who dispose waste poorly. In ten of the neighbourhoods, all the households dispose their solid waste poorly. In six others, more than 90% of the households poorly dispose waste; 99% in Maitumbi, 97% each in Makera and Tudun Wada South, 93% each in Fadipe and Tudun Wada South and 92% in Chanchaga. Three neighbourhoods with relatively low proportion of households with poor solid waste disposal are covered by the organized waste disposal system introduced by the Niger State Urban Development Board. These neighbourhoods are Bosso Estate (10%), F-Layout (17%) and GRA (3%).

The large scale problem of solid waste is traceable to capacity weakness of the waste management agency. The Niger State Urban Development Board does not have enough capacity to deal with the huge problem of waste management. For example, in 2000, the Board had only eight tippers and two pay loaders for waste management for the whole state (Sanusi, 2001). The situation has not improved since that year. Attempts to build its capacity brought about the policy of participation by the private waste collectors. However, this has also not helped the situation.

TABLE 5.10: HOUSEHOLD-BASED INDICATORS OF ENVIRONMENTAL QUALITY; POORLY DISPOSED SOLID WASTE

S/N	Neighbourhood	Households who Poorly disposed waste (%) *	S/N	Neighbourhood	Households who Poorly disposed waste (%) *
1	Agwan Daji	88	14	Kpakungu	100
2	Barkin Saleh	100	15	Limawa A	75
3	Bosso Estate	10	16	Maitumbi	99
4	Bosso Town	100	17	Makera	97
5	Chanchaga	92	18	Nasarawa	100
6	Dutse Kura Gwari	88	19	Sabo Gari	100
7	Dutse Kura Hausa	41	20	Sango	74
8	Fadipe	93	21	Sauka Kahuta	100
9	F-Layout	17	22	Tudun Fulani	100
10	Tayi Village	100	23	Tudun Wada North	97
11	GRA	3	24	Tudun Wada South	93
12	Jikpan	100	25	Tunga Low Cost	100
13	Minna Central	88			

Sources: * Author's Field Survey;

First, the number of the private waste collectors (PWC) declined from six in 2001 to two in 2005. Secondly, the capacity of the PWCs is also low. For example, pick-up vans for waste collection by all PWCs remained three between 2001 and 2005. Thirdly, the PWCs operate only in selected neighbourhoods. While their presence is felt in these neighbourhoods,

neighbourhoods that are not covered by any form of organized waste collection have more problems of solid waste. While the partnership with private collectors is commendable, the dual policy of that exclude the majority of the neighbourhoods and operates organized collection in very few others is not helpful in confronting the problem of solid waste.

5.4.2. COMPOSITE MEASURE OF HOUSEHOLD-BASED DEPRIVATION/ ENVIORNMENTAL QUALITY

Aggregate performance of the neighbourhoods in all the four variables considered under household-based deprivation is shown in Table 5.11. The Table shows that on the aggregate there is a considerable level of deprivation among the neighbourhoods with respect to the four major variables; housing facilities, housing adequacy, housing space and solid waste disposal.

As the average performance (column 7of Table 5.11) shows, only one neighbourhood, the GRA, has an average below 10%. Except two others, F-Layout (14%) and Bosso Estate (19%), the other neighbourhoods have deprivation level of more than 30%. In seven of these, it is above 50%, 53% in Agwan Daji, 56% in Barkin Saleh, 51% in Minna Central, 55% in kpakungu, 64% in Sabo Gari and 55% each in Sauka Kahuta and Tudun Fulani.

For 22 (88%) out of the 25 neighbourhoods to demonstrate high average value as has been shown shows that a large number of the households exist under unacceptable level of deprivation in the variables under account. It also shows the serious environmental problems available among households and within neighbourhoods. The neighbourhoods of Bosso Estate, F-Layout and the GRA are among the planned areas of Minna. The advantage of planning and higher socio-economic characteristics of the people is reflected in their performance on this deprivation scale

TABLE 5.11 : HOUSEHOLD-BASED DEPRIVATION/ENVIRONMENTAL QUALITY

S/N	Neighbourhood	Housing facilities	Housing Adequacy	Housing Space	Solid waste	Composite (%)
1	Agwan Daji	28	45	39	88	53
2	Barkin Saleh	44	40	30	100	56
3	Bosso Estate	0.3	34	29	10	19
4	Bosso Town	27	20	22	100	44
5	Chanchaga	37	30	34	92	45
6	Dutse Kura Gwari	31	18	38	88	43
7	Dutse Kura Hausa	34	43	27	41	39
8	Fadipe	30	19	7	93	42
9	F-Layout	2	30	35	17	14
10	Tayi Village	15	42	6	100	48
11	GRA	0	7	30	3	10
12	Jikpan	25	22	40	100	44
13	Minna Central	38	38	33	88	51
14	Kpakungu	50	36	45	100	55
15	Limawa A	40	34	28	75	49
16	Maitumbi	37	43	29	99	52
17	Makera	22	43	28	97	48
18	Nasarawa	40	23	56	100	48
19	Sabo Gari	39	59	42	100	64
20	Sango	44	20	33	74	45
21	Sauka Kahuta	33	54	54	100	55
22	Tudun Fulani	31	36	29	100	55
23	Tudun Wada North	24	25	26	97	44
24	Tudun Wada South	21	45	27	93	46
25	Tunga Low Cost	0	20	22	100	36

Source: Author's Field Survey, 2004.

5.4.3 HOUSING CONDITIONS

The study of housing conditions in urban housing and environmental study depends on direct physical observations and the assessment of the observed conditions. In this study, this approach is followed. Trained field assistants inspected each building in relation to the given criteria. The major indicators of housing quality covered are accessibility, building material (types and condition), liquid sanitation, sewage conditions. Assessment is done through a structured questionnaire (Appendix 11). Details of the survey results in all the 38 variables covered by the questionnaire on housing conditions are shown in Appendix 4. Table 5.12 shows the pattern of housing conditions among the neighbourhoods. The 18 indices shown in the Table are:

1. inaccessible residential buildings- IR;
2. untarred and rugged roads- URR;
3. buildings more than 25 years old- AGB;
4. mud walls- MW;
5. total deteriorated walls- DW;
6. rusty roofs- RR
7. total deteriorated roofs, DR;
8. mat window- MW;
9. total deteriorated window- DWD;
10. mat door- MD;
11. deteriorated doors- DD;
12. no drainage- ND;

TABLE 5.12: HOUSING CONDITIONS AND ENVIRONMENT AMONG THE NEIGHBOURHOODS (PERCENTAGE OF THE BUILDINGS)

S/N	Neighourhood	IR	URR	AGB	MW	DW	RR	DR	MW	DWD	MD	DD	ND	BD	PDW	VS	EEP	NF	TPF
1	Angwan Daji	30	40	0	11	9	60	0	0	0	0	0	58	15	86	55	40	0	100
2	Barkin Saleh	83	67	0	57	57	33	47	10	77	0	93	100	0	100	73	100	0	77
3	Bosso Estate	0	0	0	0	3	0	3	0	0	0	3	3	0	0	0	10	0	0
4	Bosso Town	16	48	40	53	53	16	15	9	57	16	26	65	55	73	42	100	13	65
5	Chanchaga	0	10	20	3	15	46	6	0	8	0	14	37	27	85	15	89	0	5
6	Dutse Kura Gwari	50	0	72	38	52	52	6	0	52	0	58	100	0	90	48	72	16	72
7	Dutse Kura Hausa	0	26	6	6	32	44	0	0	3	0	3	37	40	68	47	39	0	16
8	Fadipe	0	100	0	0	30	17	23	40	10	3	50	100	0	70	13	97	0	87
9	F-Layout	0	0	37	7	33	37	0	0	23	0	10	3	14	3	3	0	0	0
10	Tayi Village	24	24	0	28	8	30	2	0	8	0	8	84	100	78	52	96	0	8
11	GRA	0	0	2	0	0	0	0	0	0	0	0	23	0	40	0	0	0	0
12	Jikpan-Hayan Gwari	52	70	10	48	56	46	2	0	40	0	30	76	67	74	6	100	10	44
13	Minna Central	13	56	57	42	60	64	24	0	48	0	56	61	67	88	25	56	0	55
14	Kpakungu	60	69	5	40	71	37	7	6	33	0	26	100	0	78	56	99	0	44
15	Limawa	20	14	74	100	72	53	18	14	21	0	17	40	0	74	63	74	0	63
	Maitumbi	11	65	5	19	47	79	1	1	6	0	5	95	0	47	32	100	8	18
	Makera	32	100	0	0	74	100	0	0	0	0	6	87	60	95	26	100	0	34
	Nasarawa	0	13	58	32	41	47	0	0	28	0	0	21	27	57	16	87	7	23
	Sabo Gari	11	47	42	18	66	62	10	0	38	0	31	51	58	91	75	90	56	53
	Sango	54	58	46	48	69	54	12	0	24	4	28	60	4	100	12	100	4	30
	Sauka Kahuta	72	42	0	66	72	34	36	6	66	0	78	34	46	98	0	100	0	64
	Tudun Fulani	12	38	9	24	36	38	21	0	12	0	12	100	0	100	12	100	52	44
	Tudun Wada North	0	13	45	53	39	33	0	3	45	5	30	48	0	80	21	100	27	61
	Tudun Wada South	0	32	8	0	33	13	18	7	0	0	0	34	44	58	13	48	4	27
	Tunga Low Cost	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	100	0	0

Source: Author's Field Survey, 2004.

13. blocked drains- BD;

14. domestic waste poorly disposed- PDW;

15. buildings with visible sewage from within- VS;

16. exposure to visible environmental problems- EEP;

17. buildings without foundation- NF and

18. total poor Foundation (TPF)

All the eighteen indices are shown in percentages of buildings affected per neighbourhood. The Table shows that for the inaccessible residential buildings, the highest value of 83% occurs in Barkin Saleh while in nine neighbourhoods no building is inaccessible. These neighbourhoods are Bosso Estate, Dutse Kura Gwari, Fadipe, F-Layout, Tayi Village, GRA, Nasarawa, Tudun Wada North, Tudun Wada South and Tunga Low Cost. The nature of the roads present a different picture. Some of the neighbourhoods with all the buildings being accessible indeed have poor roads. For example, all buildings covered in Fadipe are fronted by untarred and rugged roads This is also the case in Makera although in four other neighbourhoods, Bosso Estate, Dutse Kura Gwari, F-Layout, GRA and Tunga Low Cost none of the buildings front untarred and rugged roads

Access road is a basic need of every residential building. But the pattern demonstrated by this study reveals that many residential buildings are inaccessible. Observations show that most peripheral settlements suffer from this problem. These are villages swallowed up by the urbanizing Minna. Similarly, some neighbourhoods within the core of the town also experience this problem. These are neighbourhoods that form the nucleus of the town. Their existence predates town planning. However, the prevalence of the problem of low access in peripheral neighbourhoods shows the weakness of development control in the town. In these neighbourhoods, most developments do not have planning permit and the planning agency lacks the capacity to constantly monitor developments. Similarly, urban management is very slow in responding to providing access roads to new development areas. The result is adaptive mechanism that leaves most buildings in such new areas without access roads. These reasons will also account for the poor housing conditions and the general poor neighbourhood environment of Minna

In term of sanitation around the houses, it is found that the level of sanitation is low. For example, in Barkin Saleh, Sango and Tudun Wada North, liquid waste is poorly disposed in all the buildings covered by the survey. It is only in Bosso Estate and Tunga Low Cost is waste water not found to be poorly disposed. The level of deterioration in building components is also high. The highest level of building wall deterioration is found in Sauka Kahuta where 72% of the building walls suffer one form of deterioration or the other. In five of the neighbourhoods, Barkin Saleh, Fadipe, Kpakungu, and Tudun Fulani, all the buildings have no drainage channels outside.

A summarized feature of the quality of housing conditions is presented by finding the average for the 18 indicators for each neighbourhood. This is shown in Table 5.13. The Table shows that the highest level of poor quality in housing conditions occurs in Sauka Kahuta (45%) and followed by Minna Central (43%). On the other hand, the lowest proportion of poor quality housing conditions (1.2%) occurs in Bosso Estate. In all, four neighbourhoods have less than 10% level of poor quality housing conditions. These are Bosso Estate, F-Layout, GRA and Tunga Low Cost.

TABLE 5.13: AVERAGE LEVEL OF POOR HOUSING CONDITIONS AMONG THE NEIGHBOURHOODS

S/N	Neighbourhood	Average percentage of poor quality	S/N	Neighbourhood	Average percentage of poor quality
1	Agwan Daji	28	14	Kpakungu	41
2	Barkin Saleh	54	15	Limawa A	40
3	Bosso Estate	1.2	16	Maitumbi	30
4	Bosso Town	21	17	Makera	40
5	Chanchaga	42	18	Nasarawa	25
6	Dutse Kura Gwari	43	19	Sabo Gari	44
7	Dutse Kura Hausa	20	20	Sango	39
8	Fadipe	36	21	Sauka Kahuta	45
9	F-Layout	9	22	Tudun Fulani	34
10	Tayi Village	31	23	Tudun Wada North	34
11	GRA	4	24	Tudun Wada South	19
12	Jikpan-Hayan Gwari	41	25	Tunga Low Cost	6
13	Minna Central	43			

Source: Derived from Table 5.12

5.4.4. NEIGHBOURHOOD ENVIRONMENT

In examining neighbourhood quality through a system of primary data, questionnaire survey alone is not adequate. Therefore, to complement the questionnaire survey, direct physical observation and recording of the existing environmental problems within the neighbourhoods are undertaken. In urban renewal exercise, this approach is employed by urban planners (Makinwa, 1988 and Abumere, 1987). This approach is also becoming popular with the UN-Habitat' Rapid Appraisal Technique in urban analysis.

Data collected through this direct observation technique include both qualitative and quantitative indicators of neighbourhood environmental quality. While the qualitative measures give description of the respective indicators, the quantitative give numerical values of the respective indicators. The data are collected through the streets. In the quantitative measures, the problems are counted per street as compared to ordinary noting of problems per street in the qualitative measures. So, in this section, analysis of environmental quality is examined by looking at qualitative and quantitative indicators of deterioration differently. The problems recorded do not signify magnitude of the unit of problem. For example, the attempt is not to classify erosion spots by depth, width or area. Rather, it is to show that a street within a neighbourhood experiences erosion at some identified spots. The premise is that, that a problem exists at whatever magnitude is worrisome enough.

5.4.4.1 Qualitative Indicators

There are eleven qualitative indicators of environmental deterioration. These relate to the nature of streets, solid waste, sewage and liquid waste. These variables are

1. proportion of non motorable roads, NM,
2. proportion of greatly pot-holed roads, GPG,
3. proportion of untarred and rugged roads, URR,
4. proportion of partly pot-holed roads, PPH,
5. , proportion of streets with scattered refuse; SRS
6. proportion of streets with refuse concentrated on some spots on the streets; CR,
7. proportion of streets with refuse scattered on the streets and concentrated on some parts; SCR,
8. proportion of streets with sewage in some parts; SSP,
9. proportion of streets with sewage in most parts; SMP,
10. proportion of streets with domestic waste water in some parts; DWSP and
11. proportion of streets with domestic waste water found in most parts; DWMP.

Table 5.14 shows percentage of streets in each neighbourhood that suffer from each of these problems. The Table shows that Sango has the highest proportion of streets (41%) that are partly motorable. Highest level of greatly pot-holed roads are found in Tudun Fulani and Tudun Wada North where 27% and 28% of the neighbourhood roads are greatly pot-holed. Similarly, all the roads in Dutse Kura Gwari and Jikpan are untarred and rugged.

Similar road feature is observed in Kpakungu and Sango where 93% and 89% of the roads are untarred and rugged. On the other, hand F-Layout does not experience any of these poor road features.

TABLE 5.14: QUALITATIVE INDICES OF NEIGHBOURHOOD ENVIRONMENTAL QUALITY

S/N		NM	GPH	URR	PPH	SRS	CR	SCR	SSP	SMP	DWSP	DWMP	Average
1	Agwan Daji	27	15	31	39	50	30	8	65	12	62	15	33
2	Barkin Saleh	0	9	82	9	9	36	27	27	45	6	18	24
3	Bosso Estate	0	4	4	46	39	0	0	0	0	8	0	14
4	Bosso Town	33	12	72	12	26	19	9	61	26	51	9	33
5	Chanchaga	8	8	58	25	25	25	20	25	50	50	17	29
6	Dutse Kura Gwari	0	0	100	0	0	42	8	91	0	75	0	38
7	Dutse Kura Hausa	0	0	30	40	30	10	60	10	0	90	10	27
8	Fadipe	25	0	75	25	75	13	0	0	13	12	0	23
9	F-Layout	0	0	0	66	0	68	0	0	0	17	0	14
10	Tayi Village	0	0	67	33	17	33	0	33	0	33	17	24
11	GRA	0	0	0	63	25	24	6	0	0	0	0	11
12	Jikpan-Hayan Gwari	4	0	100	0	86	14	0	43	29	71	0	32
13	Minna Central	15	14	37	29	16	22	18	41	27	38	10	27
14	Kpakungu	21	0	93	2	14	14	69	14	50	17	31	36
15	Limawa	5	15	15	40	10	0	0	50	40	20	35	21
16	Maitumbi	11	0	82	7	20	28	52	32	39	30	37	32
17	Makera	0	14	43	0	50	14	14	7	0	7	14	15
18	Nasarawa	0	0	29	0	0	0	0	0	0	23	0	5
19	Sabo Gari	17	9	52	22	4	22	4	4	0	17	26	17
20	Sango	41	0	89	7	41	48	11	52	33	59	15	38
21	Sauka Kahuta	40	10	80	0	20	30	20	40	0	60	0	32
22	Tudun Fulani	9	27	46	18	18	9	73	73	27	27	18	35
23	Tudun Wada North	16	28	52	4	48	8	28	12	60	24	44	36
24	Tudun Wada South	0	0	62	8	69	30	0	69	31	85	0	32
25	Tunga Low Cost	24	6	82	9	15	27	0	27	12	29	3	28

Source: Author's Field Survey, 2004

Nasarawa is the only neighbourhood whose streets are not filled with refuse while in others the streets are filled with refuse to various levels. While the proportion of streets filled with scattered refuse is as low as four percent in Sabo Gari, it is as high as 86% in

Jikpan and 69% in Tudun Wada South. Tudun Wada North has the highest proportion of streets (44%) where sewage is found in most parts. It is followed by Maitumbi, Limawa and Kpakungu where sewage is found in most parts of 37%, 35% and 31% of the streets respectively. The last column of Table 5.14 shows average performance of the neighbourhoods in the 11 qualitative indicators of environmental quality. Nasarawa is seen to have performed quite well; having the least average of five percent. It is followed by the GRA with 11%. On the other hand, Sango performed very poorly, with the average of 38%.

5.4.4.2 Quantitative Indicators of Neighbourhood Environmental Quality

There are seven quantitative indicators considered in this section. These as shown in Table 5.13 are:

1. unkempt vacant plots-UVP;
2. refuse dumps along the streets-RDAS;
3. floodable areas-FA;
4. erosion spots-ES;
5. grinding machines within the houses-GMIH;
6. grinding machines outside the houses-GMOH;
7. unkempt refuse dumps-URD.

Unlike the qualitative measures, the quantitative measures are meant to take the counting of spots that experience specific problem through the streets of the neighbourhoods. Table 5.15 gives the number of spots where each problem is observed while Table 5.16 shows the percentage of total streets in each neighbourhood where these problems are present. Table 5.15 shows that the highest number of unkempt vacant plots (91) are found in Kpakungu, followed by Bosso town with 59 spots and Minna Central with 50 spots.

TABLE 5.15: QUANTITATIVE MEASURES OF NEIGHBOURHOOD ENVIRONMENTAL QUALITY

	NEIGHBOURHOOD	Number of problem spot per indicator							Streets number	Average per street
		UVP	RDAS	FA	ES	MWH	GOH	URD		
1	Agwan Daji	5	18	0	0	0	0	6	26	1.1
2	Barkin Saleh	28	20	38	18	11	12	21	25	5.9
3	Bosso Estate	10	0	12	16	32	8	38	26	4.5
4	Bosso Town	59	68	22	39	10	11	72	43	6.5
5	Chanchaga	57	51	25	39	10	17	62	12	21.8
6	Dutse Kura Gwari	30	18	10	7	6	6	11	12	7.3
7	Dutse Kura Hausa	20	20	1	7	1	0	18	10	6.7
8	Fadipe	38	5	6	9	1	2	6	8	8.4
9	F-Layout	13	26	7	0	6	0	27	6	13.2
10	Tayi Village	8	9	4	15	0	2	9	6	7.8
11	GRA	26	29	2	2	4	0	19	16	5.1
12	Jikpan	9	36	3	3	3	2	31	7	12.4
13	Minna Central	50	105	64	93	53	68	75	89	5.7
14	Kpakungu	91	36	18	48	16	53	83	42	8.2
15	Limawa A	2	2	0	0	0	0	4	20	0.4
16	Maitumbi	26	30	14	46	14	23	33	28	6.6
17	Makera	30	34	6	32	2	2	21	25	5.1
18	Nasarawa	0	4	2	3	1	1	0	17	0.7
19	Sabo Gari	15	4	6	25	49	3	24	23	5.5
20	Sango	44	59	14	51	18	8	93	27	10.6
21	Sauka Kahuta	31	14	28	45	6	8	12	10	14.4
22	Tudun Fulani	11	5	5	11	13	0	19	11	5.8
23	Tudun Wada North	28	55	40	37	4	11	69	25	9.8
24	Tudun Wada South	19	33	31	20	0	4	39	25	5.8
25	Tunga Low Cost	38	23	6	13	3	8	12	34	3.0

Source: Author's Field Survey, 2004.

On the other hand, in Nasarawa, no unkempt vacant plot exists while it is also as low as five in Agwan Daji and 8 in Tayi Village. No refuse dump is found along the streets of

Bosso Estate while in Minna Central, total refuse dumps along the streets is equal to 105. Minna Central maintains an unacceptably large number of problem spots; 64 floodable areas, 93 erosion spots, 53 grinding machine within the houses, 68 grinding machines outside the houses and 75 unkempt refuse dumps located in various parts of the neighbourhood. This should however be understood against the backdrop of its large number of streets, 89 in all. Bosso Town, Chanchaga, Kpakungu, Maitumbi and Tudun Wada North also maintain large number of problem spots Table 5.15 also shows that average problem spot per street is as high as 21.8 in Chanchaga, 14.4 in Sauka Kahuta, 12.4 in Jikpan and 10.6 in Sango. However, the average per street is low in Agwan Daji (1.12), Limawa (0.4), Nasarawa (0.6) and Tunga Low Cost (3.0).

The large number of unkempt vacant plots within the neighbourhoods in general and the GRA in particular could be attributed to resource limitation on the part of the plot owners, which hinders developments. Whatever may be the source, the truth is that these plots constitute environmental disutility within the neighbourhoods.

A uniform base for comparing the neighbourhoods on the basis of quantitative indicator is provided by looking at the percentage of neighbourhood streets affected by each measure of deterioration as shown in Table 5.16. The Table shows that all streets in Sauka Kahuta are faced with the problem of unkempt vacant plots. It is followed by Chanchaga (92%), Dutse Kura Gwari (92%), GRA (88%) and Jikpan (86%). On the other hand no street in Nasarawa harbours unkempt vacant plot. In the same vein, all streets in Barkin Saleh and

Chanchaga have refuse dumps along them. A similar thing exists in Sango where 93% of the streets have refuse along them. Indeed Barkin Saleh maintains a consistent 100% of all its streets demonstrating all the quantitative indicators of environmental deterioration. On the other hand, the streets of Limawa are free from signs of floodable areas, erosion spots and grinding machines whether within or outside the houses.

TABLE 5.16: PROPORTION OF STREETS EXPERIENCING QUANTITATIVE INDICATORS OF ENVIRONMENTAL QUALITY BY NEIGHBOURHOODS

	NEIGHBOURHOOD	Proportion of Streets per indicator							Average percentage of streets
		UVP	RDAS	FA	ES	MWH	GOH	URD	
1	Angwan Daji	58	77	0	0	0	0	15	21
2	Barkin Saleh	19	100	100	100	100	100	100	88
3	Bosso Estate	26	0	19	27	50	16	61	28
4	Bosso Town	44	77	35	44	23	23	79	46
5	Chanchaga	92	100	92	92	92	50	100	88
6	Dutse Kura Gwari	83	58	25	25	25	33	42	42
7	Dutse Kura Hausa	80	80	10	60	10	0	70	44
8	Fadipe	100	38	50	50	13	25	38	45
9	F-Layout	83	100	67	0	100	0	100	64
10	Tayi Village	50	83	33	83	0	33	83	52
11	GRA	88	94	13	13	25	0	63	42
12	Jikpan-Hayan Gwari	86	100	43	43	43	27	100	63
13	Kwangila (Minna Central)	33	54	43	51	44	37	42	43
14	Kpakungu	67	43	43	59	26	64	69	53
15	Limawa A	10	10	0	0	0	0	15	5
16	Maitumbi	53	53	50	57	50	54	61	54
17	Makera (Railway Quarters)	50	64	14	79	7	7	43	38
18	Nasarawa	0	24	12	18	6	6	0	9
19	Sabo Gari	26	9	26	91	83	13	44	42
20	Sango	73	93	41	78	67	22	93	67
21	Sauka Kahuta	100	70	80	80	40	60	80	73
22	Tudun Fulani	36	36	46	100	27	0	91	48
23	Tudun Wada North	52	88	76	72	12	24	100	61
24	Tudun Wada South	61	85	92	77	100	40	92	78
25	Tunga Low Cost	29	21	14	21	9	18	27	20

Source: Author's Field Survey, 2004

The gross average proportions of streets which exhibit the quantitative measures of deterioration at various levels per neighbourhood are shown in the last column of Table 5.16. The Table shows that the proportion of streets which suffer quantitative measures of deterioration vary from as low as five percent in Limawa and nine percent in Nasarawa to as high as 88% each in both Barkin Saleh and Chanchaga and 78% in Tudun Wada South.

5.4.5 COMMUNITY FACILITIES

Community facilities and services are not only part of the neighbourhood amenities; they also reflect the ease of satisfaction of certain basic amenities and services by the households. Therefore, their presence in adequate quantity contributes to human welfare. In this study attention is given to three community services; primary school education, primary health care and neighbourhood markets. These services are important to all classes of neighbourhood residents. For example, markets offer two broad roles; one as access to purchase of goods and services and second as avenue for employment. They generate immense multiplier effects that have impacts on the welfare of the people. On the other hand, from the environment point of view, their presence forestalls illegal adaptation through street trading and creation of illegal trading outlets that rather than enhance environmental quality diminish it.

In this section, details of the deficiency in community facilities are discussed. Application of service allocation standards demonstrate that all the 25 neighbourhoods will require 47 primary schools, 18 neighbourhoods markets and 23 primary health centres (see notes at the end of Table 5.17). With the present level of public provision of these services, it means that shortage levels of 62%, 62% and 65% are observed respectively in the provision of primary school, neighbourhood markets and primary health centre (Table 5.17).

TABLE 5.17: DISTRIBUTION AND DEFICIENCY IN COMMUNITY FACILITIES

S/N	Neighbourhood	Primary School			Primary health centre			Market		
		O	E	D	O	E	D	O	E	D
1	Angwan Daji	2	2	0	2	1	+1	0	1	-1
2	Barkin Saleh	1	1	0	0	1	-1	0	1	-1
3	Bosso Estate	0	1	-1	0	1	-1	0	1	-1
4	Bosso Town	1	4	-3	1	1	0	1	1	0
5	Chanchaga	2	3	-1	1	1	0	1	1	0
6	Dutse Kura Gwari	1	1	-2	0	1	-1	0	1	-1
7	Dutse Kura Hausa	0	2	-2	0	1	-1	0	1	-1
8	Fadipe	0	1	-1	0	1	-1	0	*	*
9	F-Layout	0	1	-1	0	0	*	0	*	*
10	Tayi Village	0	1	-1	0	1	-1	0	*	*
11	GRA	1	1	0	1	1	0	0	1	-1
12	Jikpan-Hayan Gwari	0	1	-1	0	1	-1	0	1	-1
13	Kwangila (Minna Central)	1	3	-2	1	1	0	1	1	0
14	Kpakungu	1	2	-1	0	1	-1	1	0	-1
15	Limawa A	0	3	-3	0	1	-1	0	1	-1
16	Maitumbi	1	2	-1	0	1	-1	1	0	0
17	Makera (Railway Quarters)	2	3	-1	0	1	-1	0	1	-1
18	Nasarawa	1	4	-3	0	1	-1	0	0	*
19	Sabo Gari	0	4	-4	0	1	-1	1	11	0
20	Sango	1	0	0	0	1	-1	0	1	-1
21	Sauka Kahuta	1	0	0	0	1	-1	0	1	-1
22	Tudun Fulani	1	1	0	0	1	-1	0	1	-1
23	Tudun Wada North	0	3	-3	1	1	0	1	1	0
24	Tudun Wada South	1	3	-2	1	1	0	0	1	-1
25	Tunga Low Cost	0	1	-1	0	0	0	0	*	*

NB: *, facility not required yet; +, surplus of the facility; - shortage of the facility. O, observed number; E, expected number and D, remark on deficiency or otherwise.

Source: Observed value as obtained from the field by the Author; others are estimates based on planning standards. Standards recommend 1 primary school to between 3500-7000 population; 1 primary health centre to 7500-15000 population; 1 market to 7500-15 000 population (Rame-undated and Obateru, 1981). These standards are adapted in assessing the adequacy or otherwise of these facilities.

Except for the central market located in Sabo Gari, all other markets are display centres with makeshift sheds and located over very small space. Most of the markets represent an adaptation by communities to fulfil their immediate retail needs. The inadequacy in the number of public primary schools is seen in the fact that two sessions are run by all the public primary schools in Minna, morning and afternoon sessions. Running two sessions for children under ten years of age is highly unhelpful to the health, physical and mental development of the children.

The distribution of these facilities and their adequacy are assessed in Table 5.17. The Table shows the observed distribution (O), the expected distribution (E) and the balance of these (D) for all the three services for the 25 neighbourhoods. The 18 primary schools are located in 15 neighbourhoods; three neighbourhoods have two each while others have one each. Similarly, the seven markets are distributed in seven neighbourhoods while the eight primary health centres are distributed among seven neighbourhoods; one has two centres.

The inadequacy of public primary health centre will not only make it compelling for most households to patronize private clinics, it will also make it possible to patronize medical quacks and to practice self medication. For the low income people, the patronage of private schools and clinics exert significant pressure on their lean financial resources and diminish their capacity to save for productive activities. It may be safe to say therefore that the current state of public service provision in Minna is not sensitive to the needs of the low income people and could in some respect signify poverty situation. The truth is that community facilities and services constitute part of environmental resources the presence of which enhances individual well-being and social development. People who are deprived of these facilities and services constitute a category of the poor; the infrastructure poor.

It may be appropriate to demonstrate further the level of the deficiency in publicly provided services in Minna. Table 5.18 gives the level of deficiency in primary school, health centre and neighbourhood market.

TABLE 5.18: DEFICIENCY LEVEL IN THE PROVISION OF PUBLIC SERVICES

S/N	Neighbourhood	PERCENTAGE DEFICIENCY IN FACILITY PER NEIGHBOURHOOD			
		Primary School	Health Centre	Market	Average deficiency
1	Agwan Daji	0	0	100	33
2	Barkin Saleh	0	100	100	67
3	Bosso Estate	100	100	100	100
4	Bosso Town	75	0	0	25
5	Chanchaga	33	0	0	11
6	Dutse Kura Gwari	0	100	100	67
7	Dutse Kura Hausa	100	100	100	100
8	Fadipe	100	100	100	100
9 -	F-Layout	100	100	100	100
10	Tayi Village	100	100	100	100
11	GRA	0	0	100	33
12	Jikpan-Hayan Gwari	100	100	100	100
13	Minna Central	67	0	100	56
14	Kpakungu	50	100	100	83
15	Limawa A	67	100	100	89
16	Maitumbi	50	100	100	83
17	Makera	33	100	100	78
18	Nasarawa	75	100	100	92
19	Sabo Gari	100	100	0	67
20	Sango	0	100	100	67
21	Sauka Kahuta	0	100	100	67
22	Tudun Fulani	0	100	100	67
23	Tudun Wada North	100	0	100	67
24	Tudun Wada South	67	0	100	56
25	Tunga Low Cost	1 00	100	100	100

Source: Calculation Based on Table 5.17

In respect of primary schools, nine neighbourhoods of the total are 100% deficient; two are 75% deficient while four are 67% deficient. In the case of health centre and market, 18 and 22 neighbourhoods each respectively are 100% deficient. On the average, seven neighbourhoods are 100% deficient, seven are 67% deficient, four are between 70 to 80% deficient while six are less than 60% deficient while one (Nasarawa) is 92% deficient. The general deficiency in community facilities and services in the neighbourhoods has shown in the performance of the high class neighbourhoods of Bosso Estate, F-Layout, GRA and Tunga Low Cost. Perhaps low population of these neighbourhoods which do not provide threshold for these services affect the presence of the services.

Deficiency in facility is often compensated for by the people; first, by patronizing private providers and second, by cross neighbourhood journeys. The middle and high income earners may patronize private providers across the neighbourhoods while the low income and poor people are likely to patronize public facility across the neighbourhoods. However residents suffer difficulty in obtaining these facilities over longer distance. For example, in the case of primary schools, children could go to schools in other neighbourhoods. However, the truth is that the children suffer by having to walk over longer distances to their schools. Often, the range of a service becomes longer than the acceptable standards when majority of the people have to obtain a service outside their neighbourhoods.

5.4.6 AGGREGATE LEVEL OF ENVIRONMENTAL POVERTY: COMPOSITE NATURE

In the preceding discussions, it has been shown that the neighbourhoods experience various forms of deterioration in housing, environmental quality, both in qualitative and environmental terms and in the availability of public services that have relevance in the community and the daily life of the people. In each component of deprivation/environmental quality, attempt has also been made to show the average level of performance by each neighbourhood. In this section all these averages are brought together to demonstrate aggregate level of environmental quality in all the indicators. These averages and the composite index derived from them are shown in Table 5.19.

The last column of the Table shows the average level of deterioration from the five indices. It represents the composite index of deterioration. It is seen that the least level of poor quality is 19% and is obtained by the GRA. On the other hand, the highest level of poor quality is 58% obtained by Barkin Saleh. Other neighbourhoods with more than 50% level of quality are Tayi Village (51%), Jikpan (56%), Kpakungu (57%) and Sango (51%).

The summary of this presentation is that poor quality environment is observed in all neighbourhoods of Minna and that in the majority of them, environmental quality is very poor. Only the GRA has a composite quality index of less than 20%, five others have between 20% to 40% while the remaining 19 have more than 40% each.

TABLE 5.19: COMPOSITE ANALYSIS: AGGREGATE AVERAGE LEVEL OF ENVIRONMENTAL QUALITY AMONG NEIGHBOUHOODS

S/N	Neighbourhood	Average percentage of qualitative environmental quality	Average percentage of quality of housing condition	Average percentage of streets experiencing quantitative environmental quality	Average deficiency in public service provision (community facilities)	Average percentage in household-based deprivation	Composite index of environmental poverty
1	Angwan Daji	33	28	21	33	53	34
2	Barkin Saleh	24	54	88	67	56	58
3	Bosso Estate	14	1.2	28	100	19	32
4	Bosso Town	33	21	46	25	44	34
5	Chanchaga	29	42	88	22	45	45
6	Dutse Kura Gwari	38	43	42	67	43	47
7	Dutse Kura Hausa	27	20	44	100	39	46
8	Fadipe	23	36	45	100	42	49
9	F-Layout	14	9	64	100	14	40
10	Tayi Village	24	31	52	100	48	51
11	GRA	11	4	42	33	4	19
12	Jikpan-Hayan Gwari	32	41	63	100	44	56
13	Minna Central	27	43	43	56	51	44
14	Kpakungu	36	41	53	100	55	57
15	Limawa A	21	40	5	100	49	43
16	Maitumbi	32	30	54	83	52	50
17	Makera	15	40	38	78	48	44
18	Nasarawa	5	25	9	58	48	29
19	Sabo Gari	17	44	42	67	64	48
20	Sango	38	39	67	67	45	51
21	Sauka Kahuta	32	45	73	67	55	54
22	Tudun Fulani	35	34	48	67	55	48
23	Tudun Wada North	36	34	61	67	44	48
24	Tudun Wada South	32	19	78	56	46	46
25	Tunga Low Cost	28	6	20	100	37	38

Source: Author's Field Survey, 2004

5.5 INEQUALITY IN ENVIRONMENTAL WELFARE

It has been demonstrated that there is poverty in the study area in income, human welfare and environmental terms. However, the existence of poverty may not necessarily indicate prevalence of inequality. Inequality represents a unique form of poverty. In the measurement of poverty, the measurement of inequality is also important. The traditional way of measuring inequality is the use of Lorenz Curve/ Gini Coefficient. The Curve has been found useful in the analysis of income and income inequality. The Curve establishes a relationship between a percentile of the population and the correspondent income to each percentile (Todaro, 1977 and Smith, 1979). The curve is achieved by using the cumulative population and the commutative income; each expressed in percentage.

The Lorenz Curve has four attributes. These are

5.10.1 The line of equality. This is the diagonal that runs from the left corner of the x and y intersections to the top right corner.

5.10.2 The curve. This is derived directly from the cumulative percentile population and the cumulative share of income by each percentile.

5.10.3 Gini coefficient. This establishes quantitative relationship between the curve and the line of equality. It is the ratio of the area between the diagonal and curve and the triangle formed by the diagonal against the horizontal line.. 'The Gini coefficients are aggregate inequality measures' (Todaro, 1977). It ranges from 0 to 1.0. The closer the coefficient to 0, the lower the inequality. As inequality increases, the value of the coefficient increases. A highly unequal distribution will have a coefficient of between 0.5-0.7; a relatively equitable distribution ranges between 0.2- 0.35 while below 0.2 will give a situation of perfect to a near perfect equality.

5.10.4 Ratio of the cumulative percentage share between the top 20% and the bottom 40%.

Inequality in environmental amenities could also be demonstrated by using the Lorenz curve. Two variables of environmental amenity relating to housing space are used to examine environmental inequality among households in the study area. These variables are open space within houses and habitable rooms. The sizes of open space are estimates of available open space within the dwelling units covered by the study.

Figures 5.4 and 5.5 show Lorenz curve for the two variables respectively. Spatial inequality is observed in the distribution of the sizes of open space. The Gini coefficient of 0.64 is quite high. It is also found that the top 20% of the households share 68% while the bottom 40% share six percent. This gives ratio of 1: 11.3 between the bottom 40% and the top 20% of the households.

In the case of the habitable rooms, the inequality in the housing space possession declines achieving a visually close curve to the line of equality. The Gini coefficient here is 0.32. The bottom 40% of the households share 17% of the total habitable rooms while the top 20% share 43%, giving rise to a ratio of 1:2.5 between the bottom 40% and the top 20%.

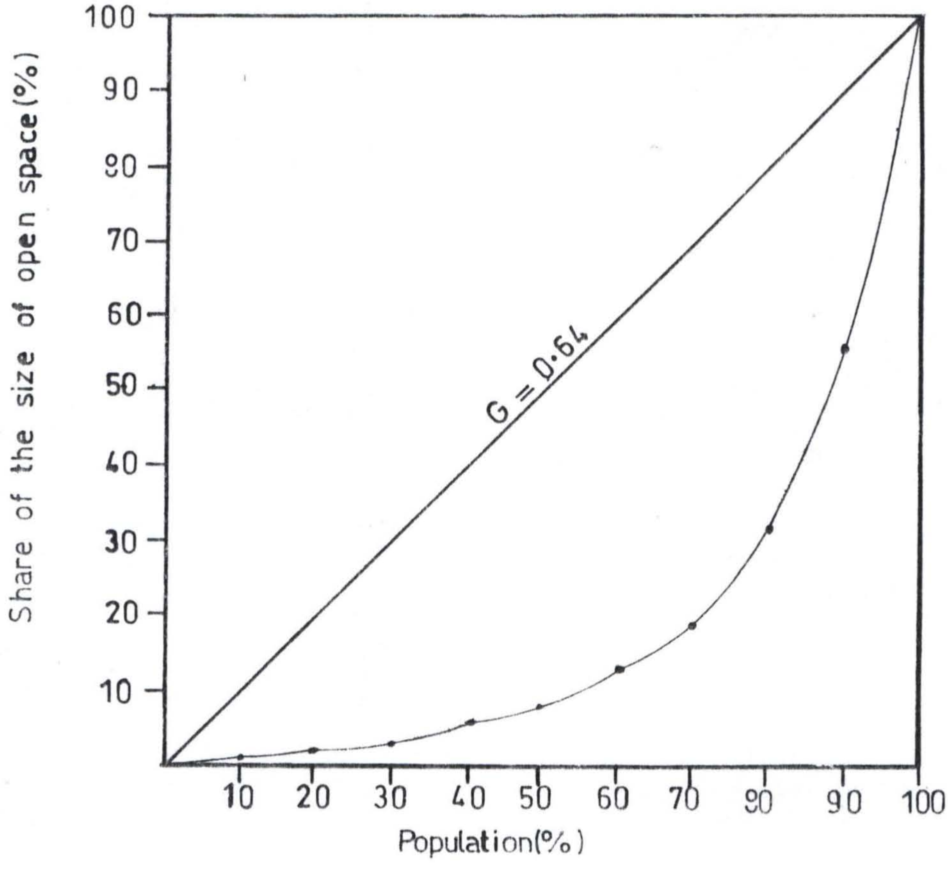


FIGURE 5.4: LORENZ CURVE SHOWING DISTRIBUTION OF OPEN SPACE.

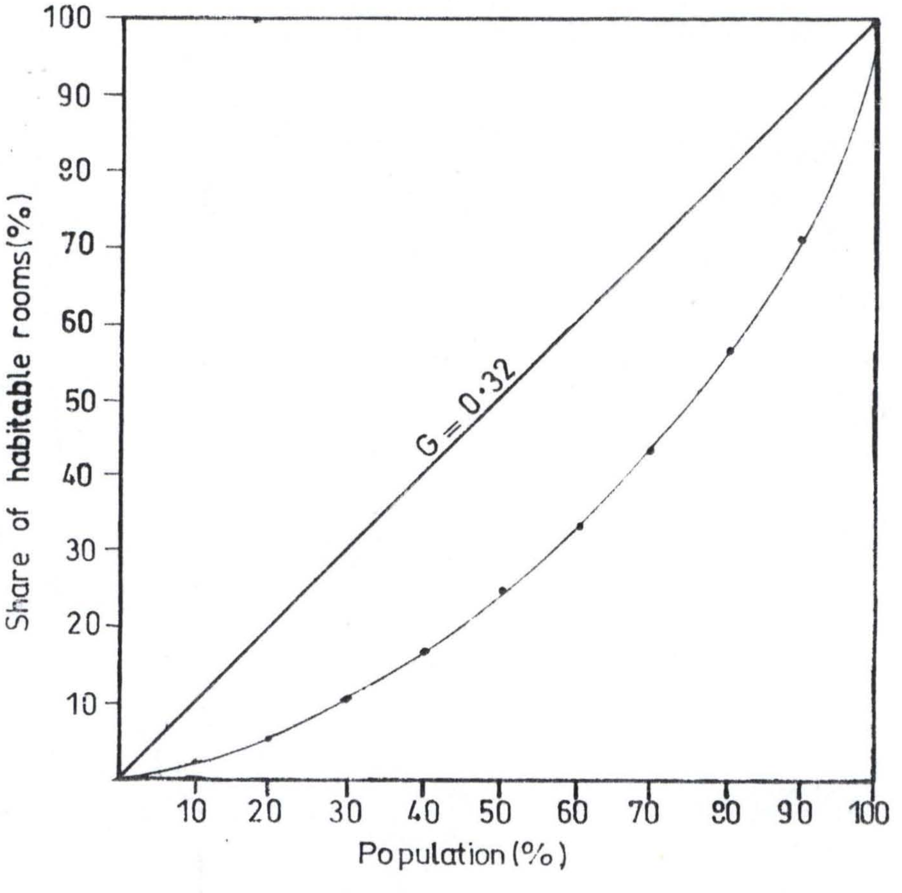


FIGURE 5.5: LORENZ CURVE SHOWING DISTRIBUTION OF HABITABLE ROOMS.

TABLE 5.20: DISTRIBUTION OF AVERAGE HOUSEHOLD SIZE AMONG THE NEIGHBOURHOODS

S/N	Neighbourhood	Average household size	S/N	Neighbourhood	Average household size
1	Agwan Daji	7.0	14	Kpakungu	9.0
2	Barkin Saleh	8.0	15	Limawa A	14.5
3	Bosso Estate	8.6	16	Maitumbi	8.3
4	Bosso Town	10.1	17	Makera	8.6
5	Chanchaga	8.0	18	Nasarawa	8.9
6	Dutse Kura Gwari	11.9	19	Sabo Gari	6.0
7	Dutse Kura Hausa	6.6	20	Sango	9.1
8	Fadipe	5.9	21	Sauka Kahuta	9.0
9	F-Layout	7.5	22	Tudun Fulani	9.0
10	Tayi Village	6.4	23	Tudun Wada North	8.4
11	GRA	8.7	24	Tudun Wada South	7.8
12	Jikpan	8.9	25	Tunga Low Cost	8.1
13	Minna Central	6.7			

Source: Author's Field Survey, 2004.

It is possible to see the proportion of privileged and underprivileged in the consumption of these two space facilities from the two curves. This is done by projecting a line at 50% along the Y-axis against the Lorenz curve across the diagonal. Doing this for size of open space within houses shows that 87% percent are underprivileged as opposed to 13% who are privileged. Similarly, 73% are underprivileged while 27% are privileged in the case of habitable rooms. Thus, while an unacceptably high inequality exists in the distribution of open space within houses (G= 0.64), the distribution of habitable room reflect a fairly equitable pattern (G= 0.32). The inference here is that households emphasize living space (habitable rooms) rather than leisure space (open space). They require high number of rooms to accommodate the large household members. The average household size of 8.2 is higher than the national average of 4.20 and the Niger state's average of 4.65 (FOS, 1999). Table 5.20 shows the distribution of average household size per neighbourhood. Thirteen of the neighbourhoods have average each above the city average. Limawa has the highest average household size of 14.5 while Tayi Village has the least of 6.4.

To some extent, inequality exists in the distribution of some aspects of environmental amenities. Inequality compounds poverty. So, the observed inequality in some aspects of environmental amenities cannot be seen as complementary to the welfare of the people. It is likely to diminish it more.

5.6 INCOME AND ENVIRONMENTAL PERCEPTION

It is quite easy to interpret poverty from a given set of data. But there is always a contention that what is often described as poverty by analysts may not be considered so by the people. It is also believed that the perception of self in relation to income and the environment influence attitude to the environment and even to self. In the evolving technique of participatory poverty assessment, perception has become a tool of investigation. Perception also represents an external factor in the poverty-environment relationship. Therefore, in this study an attempt is made to understand the perception of the household heads in relation to their income and the environment.

Perception is examined in relation to

1. Housing adequacy.
2. Quality of housing facilities.
3. Income satisfaction.

4. Factors affecting attitude to the environment.

5. Grading of the various aspects of the environment.

5.6.1. Housing Adequacy:

More than half of the household heads claim that their housing is adequate; 58% claimed adequate housing while 42% claim inadequate housing. Accounting for continuous stay in inadequate housing, 81% of the people who claim inadequate housing say that there is no money to get a larger house; 13% say that they cannot get a large house while six percent say that they cannot get houses close to their place of work.

5.6.1.1 Income, Housing and Neighbourhood Quality:

The household heads grade the quality of the housing facilities and the dwelling units. The result is shown in Table 5.21. The grades range from very good to very poor. In respect of income, only two percent of the household heads feel very satisfied about their income, 36% feel satisfied while 35% feel that their income condition is unsatisfactory. Another seven percent feel that they are very unsatisfactory with their income.

TABLE 5.21: GRADING OF INCOME AND ENVIRONMENTAL QUALITY BY HOUSEHOLDHEADS

Grade	Income and environmental components and proportion of household heads			
	Income	Environmental quality	Housing quality	Housing facilities
Very good	2	8	9	11
Good	36	48	59	47
Poor	35	30	19	18
Very poor	7	10	4	15
Cannot say	20	4	9	9

Source: Author's Field Survey, 2004.

With respect to facilities within the house, 11% percent believes that their housing facilities have very good quality, 47% believe that the qualities are good 18% believe that they are poor in quality while 15% believe that the quality of their housing facilities is very poor. In total, 33% of the households (18% + 15%;) believe that their housing facilities are below acceptable quality.

In the same way, eight percent of the household heads feel that the quality of their neighbourhood is very high, 48%% feel that their neighbourhood is good in quality, 30% feel that it is poor while 10% feel that the quality is very poor.

In addition to the assessment of income and environment is the perception of specific environmental problems particular to various residential neighbourhoods. In this case, the attempt is to attach some weight to these problems to reflect their gravity according to the perception of the household heads.

Household heads attach weight ranging from very heavy; heavy, moderate; light and not at all. Table 5.22 shows the results of the grading by the household heads. Nine items are graded. These are indoor pollution, poor sanitation, noise from micro manufacturing activities, overcrowding, inadequate open space within houses, poor access to houses, poor housing conditions, inadequate housing facilities and foul odour.

TABLE 5.22: PERCEPTION OF ENVIRONMENTAL PROBLEMS

›blem	Responses in percentage						
	Very Heavy (I)	Heavy (II)	Moderate (III)	Slight (IV)	Not at all (V)	Total	Total concern (I-IV)
loor pollution	19	15	18	21	27	100	73
ıitation	14	16	25	27	18	100	82
ise from micro nufacturing activities	21	22	15	20	22	100	78
ercrowding	16	16	18	30	20	100	80
dequate open space hin houses	16	20	17	30	17	100	83
ɔr access to houses	20	12	17	32	19	100	81
ɔr housing conditions	20	12	26	24	18	100	82
dequate housing facility	21	19	18	21	21	100	79
ıl odour	19	19	15	27	20	100	80
erage	18	17	19	26	20	100	

Source: Author's Field Survey, 2004.

The picture that emerges from the Table is that households appreciate these environmental problems and consider them to be of great concern to them. The Table shows that a small proportion of the households do not feel concerned by these problems since they do not exist in their neighbourhoods. These are 27% in the case of indoor pollution, 18% each in the case of sanitation and poor housing conditions while 20% each in the case of overcrowding and foul odour also feel that these problems do not exist as to require any grading concern.

On the other hand, 21% each of the household heads grade noise pollution and inadequate housing facility as being very heavy; 20% each grade poor access and poor housing conditions as being very heavy while 19% each also grade indoor pollution and foul odour as very heavy. In the same vein, 16% each grade overcrowding and inadequate open space within houses as very heavy while another 14% also grade sanitation as very heavy.

A summary of the perception that attaches some strength to the problems is shown as total concern in the last column of Table 5.22. The table shows in total that 83% of the household heads attach some value to the problem of inadequate open space within houses; 82% each attach some grades to sanitation and poor housing conditions while another 81% also attach some grades to poor access to houses. The message from this grading is that it reflects the exposure to these problems. Therefore, it follows that ranking of these problems among households can be achieved; first by ranking the percentages that attach very heavy weight to the problems and second by ranking the overall concern (Table 5.23.).

As shown in the Table, while both noise and inadequate housing facility rank first by considering very heavy weight, they rank 8^{th} and 7^{th} respectively when the total perception of these problems as of some concern is taken into account. Similarly, inadequate open space within residential houses which rank 7^{th} on the very heavy grade, ranks 2^{nd} when total grading is considered.

TABLE 5.23: RANKING OF THE PERCEIVED GRAVITY OF ENVIORNMENTAL PROBLEMS

Problem	Very heavy		Total perceived concern		Average rank	Average rank
	Percent	Rank	Percent	Rank		
Indoor pollution	19	5	73	9	7	8
Sanitation	14	9	82	2	5.5	7
Noise from micro manufacturing activities	21	1	78	8	4.5	5
Overcrowding	16	7	80	5	6	7
Inadequate open space within houses	16	7	83	1	4	3
Poor access to houses	20	3	81	4	3.5	2
Poor housing conditions	20	3	82	2	2.5	1
Inadequate housing facility	21	1	79	7	4	3
Fowl odour	19	5	80	5	5	6

Source: Derived from table 7.35.

To rank the average of the two rankings gives the ranking in the last column of the Table. The new rank shows that poor housing conditions weigh first among the nine problems before the people. This is followed by poor access to houses and inadequate open space within houses and inadequate housing facilities which rank 3rd each respectively. On the other hand, indoor pollution is the least in the ranking of these environmental problems as perceived by the people.

Furthermore, majority of the household heads believe that the quality of the environment varies with the quality of the income status of the residents; 66% feel that income status influences the quality of the environment as opposed to 30% who feel otherwise and four percent who are undecided. As a result, 76% believe that an improved income will guarantee an improved environment; 16% do not think so while eight percent are undecided. On the whole, the people also account for attitude to the environment; 36%

say that income affect attitude to the environment, 15% choose rental status while 30% say that the combination of income and rental status affect attitude to the environment while other factors account for 19%.

6.6.1. Spatial Variations in Perception

As it is done in the discussions of poverty situation, it is also possible to see spatial variations in the perception of the environment and poverty by households among the neighbourhoods. Nine indicators of perception are considered (Table 5.24). They are

1. percentage of household heads who feel that their housing is inadequate, HI,
2. percentage of household heads who feel that their housing facilities are of high quality, HFHQ;
3. percentage of household heads who feel satisfied with their income, SI;.
4. percentage of household heads who feel that they are poor, POOR;
5. percentage of household heads who feel that they are rich, RICH
6. percentage of household heads who feel that the quality of their housing is high, HQH;
7. percentage of household heads who feel that the quality of their housing is poor, PQH
8. percentage of household heads who feel that the quality of their neighbourhoods is high, HQND;.
9. percentage of household heads who feel that the quality of their neighbourhoods is poor; LQND.

With regard to the perception of income, columns 3 to 5 in Table 5.24 show the perception of the household heads on income and poverty.

TABLE 5.24 : VARIATIONS IN INCOME AND ENVIRONMENTAL PERCEPTION AMONG NEIGHBOURHOODS

S/N	Neiighbourhood	HI	HFHQ	SI	POOR	RICH	HQH	PQH	HQND	LQND
1	Agwan Daji	61	55	46	25	54	95	5	69	9
2	Barkin Saleh	20	80	73	23	70	100	0	87	7
3	Bosso Estate	60	90	50	30	43	70	27	90	7
4	Bosso Town	73	60	41	58	33	50	50	34	76
5	Chanchaga	34	42	32	76	15	65	26	79	9
6	Dutse Kura Gwari	72	56	54	34	52	60	28	52	38
7	Dutse Kura Hausa	54	54	60	27	71	73	27	73	27
8	Fadipe	53	40	43	47	43	97	3	80	20
9	F-Layout	60	73	83	0	100	100	0	100	0
10	Tayi Village	76	62	48	58	32	62	34	60	36
11	GRA	96	100	68	3	97	100	0	100	0
12	Jikpan	56	84	2	82	0	86	12	38	62
13	Minna Central	71	34	64	33	35	57	22	60	32
14	Kpakungu	67	28	62	0	0	0	0	0	78
15	Limawa A	74	34	64	75	21	21	46	29	71
16	Maitumbi	45	86	59	50	48	71	27	52	48
17	Makera	71	74	46	44	42	71	23	63	37
18	Nasarawa	64	72	57	42	44	79	21	72	28
19	Sabo Gari	27	53	34	44	13	38	28	37	64
20	Sango	80	68	72	8	92	20	80	92	8
21	Sauka Kahuta	70	42	42	44	42	86	14	72	28
22	Tudun Fulani	42	28	40	46	26	74	26	88	12
23	Tudun Wada North	49	59	31	40	35	85	13	56	44
24	Tudun Wada South	60	70	57	43	50	87	10	30	70
25	Tunga Low Cost	46	100	84	6	58	90	0	100	0

Source: Author's Field Survey, 2004.

The first item concerns income satisfaction. Income satisfaction is fairly evenly distributed among the households in the neighbourhoods. The only extreme value is obtained by Jikpan where only two percent of the household heads feel satisfied with their incomes. No other neighbourhood has less than 20% level of satisfaction. The level of satisfaction with income is as high as 84% in Tunga Low Cost, 83% in F-Layout, 73% in Barkin Saleh and 72% in Sango.

A fair level of distribution also exists in the perception of poverty. In one neighbourhood, Kpakungu, household heads neither accept to be poor nor rich. In F-Layout, all household heads do not feel they are poor. On the contrary, 76% of the household heads in Chanchaga, 82% in Jikpan and 75% in Limawa feel that they are poor. Conversely, lower proportion of the households in these neighbourhoods feel that they are rich; 0 percent in Jikpan and 15% in Chanchaga.

Dissatisfaction with the current habitable rooms per household is seen in the high level of the households who feel that their housing is inadequate. Even in the GRA, 96% of the households feel that their housing is inadequate. Similarly, 73% of the households in Dutse Kura Gwari, 74% in Limawa, 76%b in Tayi Village and 80% in Sango feel that their housing is inadequate. In terms of housing and environmental quality; the perception of the households also vary among the households. In three neighbourhoods, neither the housing environment nor the neighbourhood is seen to be of poor quality. Even in Barkin Saleh, all household heads feel that the quality of the housing is high though seven percent feel that the neighbourhood environment is poor. The perception of housing environment as poor is quite high in Sango where 80% of the households feel that their housing is of low quality, 50% in Bosso Town and 46% in Limawa. Similarly, household heads who perceive their neighbourhoods as having poor quality are as high as 78% in Kpakungu, 76% in Bosso Town, 71% in Limawa and 70% in Tudun Wada South.

TABLE 5.25 : AVERAGE PERCEPRION OF HOUSING AND ENVIRONMENT AS POOR QUALITY

S/N	Neighbourhood	Average perception level (%)	S/N	Neighbourhood	Average perception level (%)
1	Agwan Daji	7	14	Kpakungu	39
2	Barkin Saleh	4	15	Limawa A	59
3	Bosso Estate	17	16	Maitumbi	38
4	Bosso Town	63	17	Makera	30
5	Chanchaga	18	18	Nasarawa	25
6	Dutse Kura Gwari	33	19	Sabo Gari	46
7	Dutse Kura Hausa	27	20	Sango	44
8	Fadipe	12	21	Sauka Kahuta	21
9	F-Layout	0	22	Tudun Fulani	19
10	Tayi Village	35	23	Tudun Wada North	29
11	GRA	0	24	Tudun Wada South	40
12	Jikpan	37	25	Tunga Low Cost	0
13	Minna Central	27			

Source: Derived from table 7.36.

In order to see the variations in the quality of housing and neighbourhoods according to the perception of the people, average of the perception of housing and the environment as poor is taken (Table 5.25). This average gives environmental perception level per neighbourhood. By this presentation, the lower the proportion of households who perceive their environment as poor the higher the quality of the environment.

Hence, neighbourhoods where the perception level is less than 20% are classified as good (Figure 5.6). The neighbourhood is of poor quality where the perception level varies

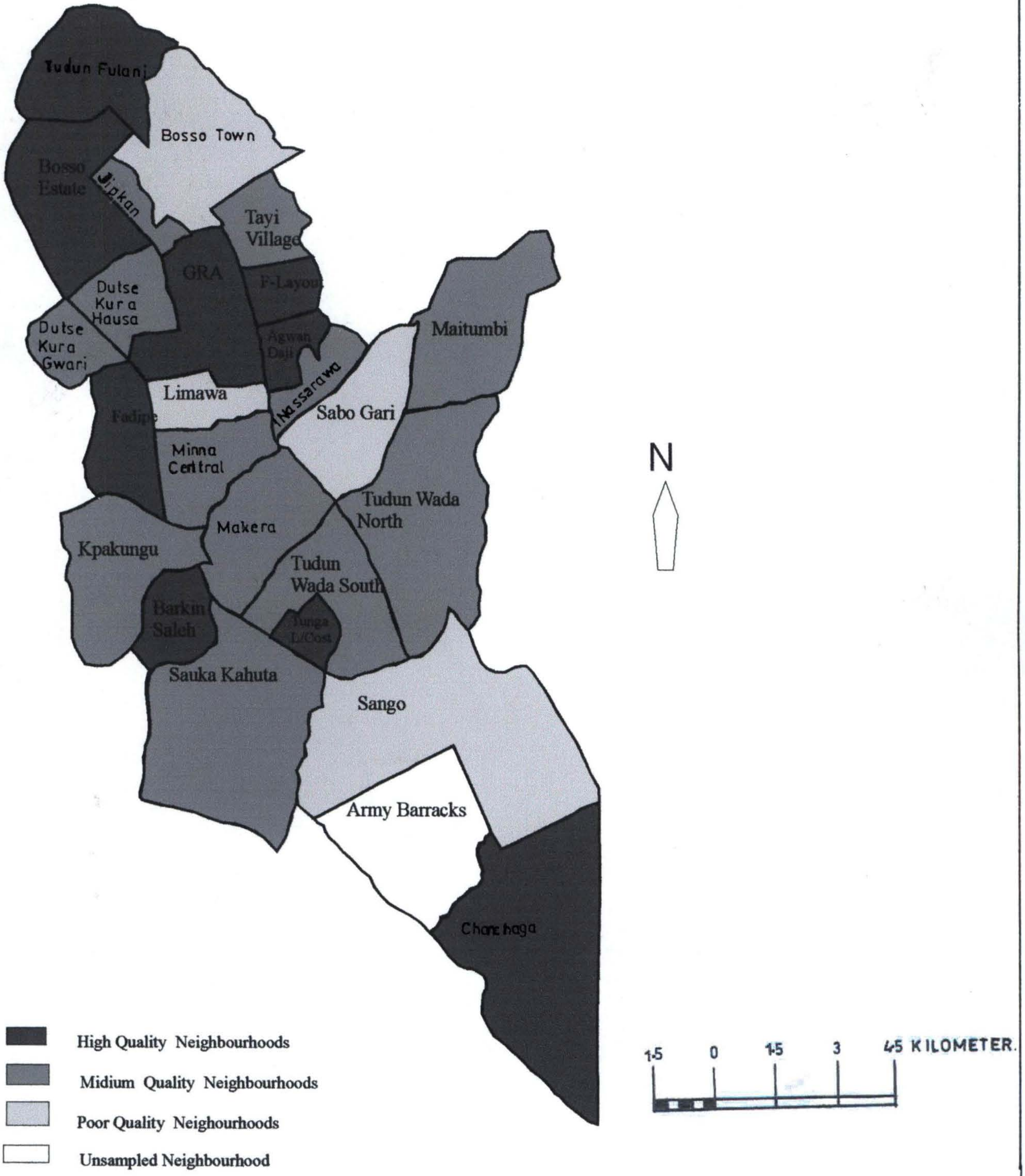


FIGURE 5.6 CLASSIFICATION OF THE NEIGHBOURHOODS BY THE PERCEPTION OF THE ENVIRONMENT

between 21-40% while the neighbourhood quality is very poor where more than 40% of the households judge the quality of their housing and environment as poor. As shown in the Figure, nine neighbourhoods are perceptually good, 12 are poor and four are very poor. In all, by the perception of the people, 16 of the neighbourhoods exhibit poor quality in housing and the environment.

The perception of the income and environmental amenities by the households presents a good instrument of assessment from within. It is important to see how this is linked with the observed environmental quality and income of the households. This relationship will be part of the analysis in chapter seven.

In this chapter, the focus has been on the assessment of the welfare of the people and the environment based on the data directly collected from the field. It has been shown that poverty in economic and human terms exists in all neighbourhoods; although, the stress is more in some than others. A similar pattern exists among the neighbourhoods with respect to environmental deterioration. All neighbourhoods exhibit one form of deterioration or the other; although very few maintain consistent fair performances on the environmental variables. These neighbourhoods, the GRA, F-Layout, Bosso Estate and Tunga Low Cost, experience planning and are occupied by relatively high income people. It is also found that some measure of spatial inequality exists among the neighbourhoods. The people also see their environment and income status in very different dimensions. This yields variations in the perception of income status and neighbourhood environmental quality.

CHAPTER SIX

6.0 ANALYSIS OF NEIGHBOURHOOD ENVIRONMENTAL QUALITY FROM REMOTE SENSING DATA

6.1 INTRODUCTION

In the last chapter, attempts are made to demonstrate existing environmental problems through the primary data collected from the field. The discussions in chapter five yield information on level of environmental poverty among the neighbourhoods. In this chapter, attempts are made to present the remote sensing data and show how they signify environmental poverty.

Remote sensing application to the study of urban neighbourhood quality lends objectivity to the quality variables to be used. Although remote sensing aids the study of urban quality through a more objective approach, this is done indirectly by using surrogates of poverty (Lo, 1986). The interpretation is that the direct physical data from the remotely sensed data has sociological correlates. In other words, variables that demonstrate presence of poverty are deduced from the remotely sensed data and used to analyze poverty. Such exercise is made more complex where the image used for analysis is not a product of high resolution remote sensing instrument. Once the surrogates are obtained, it is possible to derive other poverty-related indices in order to elaborate the existing environmental quality characteristics.

In the past, the tendency was to depend on aerial photo for assessing urban environmental quality. Lo (1986) reported the use of area photo to identify socio areas of cities. Physical features such as deterioration of houses, debris, lack of vegetation, walks and paved streets to identify poverty areas in Lexington Kentucky. It was discovered that urban poverty was closely related to residential areas adjacent to the central business district, industry and major urban roads. Barnes (2001) studied urban sprawl in Towson University. He used built-up area as an index of urban sprawl. According to him, the proportion of an area covered by impervious surfaces is an index of development and hence, developed area have greater impervious surface as opposed to lesser developed area. He identified sprawl by classifying the city into five land uses; excluded area, vegetation, water bodies, open land and built up.

6.2 THE DATA

The interpretation is that analysis of poverty through remote sensing data is inferred from land use analysis. In this case, an analyst depends on spatial attributes that indicate low income status and poverty condition. Key among these features are built up area coverage, the open space proportion and density. The use of the combination of open space and built up areas in assessing welfare has been pointed out by Fabiyi (1999). Using a combination of satellite and aerial photographs he classified residential areas in Ibadan into residential quality areas.

The use of density in urban analysis was first popularized by Wirth's Theory of Urbanism. Wirth identified density as one of the three indices of urban definition. He states that 'the urban community is distinguished by a large aggregation and relatively dense concentration of population'. As a result, a city is 'a relatively large, dense and permanent settlement of socially heterogeneous individuals' (Wirth, 1938).

Wirth notes that increasing number of inhabitants in a settlement beyond a certain limit will affect relationship between them and that the greater the number of individuals participating in a process of interaction, the greater is the potential differentiation among them. In particular, Wirth notes that density in a limited space leads to certain consequences in the city. 'Density thus reinforces the effects of numbers in diversifying men and their activities and in increasing the complexity of the social structure' (Wirth, 1938). Density largely intensifies existing problems.

Housing density as an index of poverty is reflected in the study of poverty in Ibadan (Mabogunje, 1976) and Osogbo and Ife (Adepoju, 1976). The two authors emphasized housing density and accommodation density (that is, room occupancy ratio). In Lagos, spatial indices of poverty identified by Ogunpola and Ojo (1976) also include densities of buildings on the ground, overcrowding of large number of persons into buildings and lack of open space between buildings.

SPOT IMAGE OF MINNA (1995)

FIGURE 6.1: SPOT IMAGE OF MINNA, 1995

LANDSAT IMAGE OF MINNA (2001)

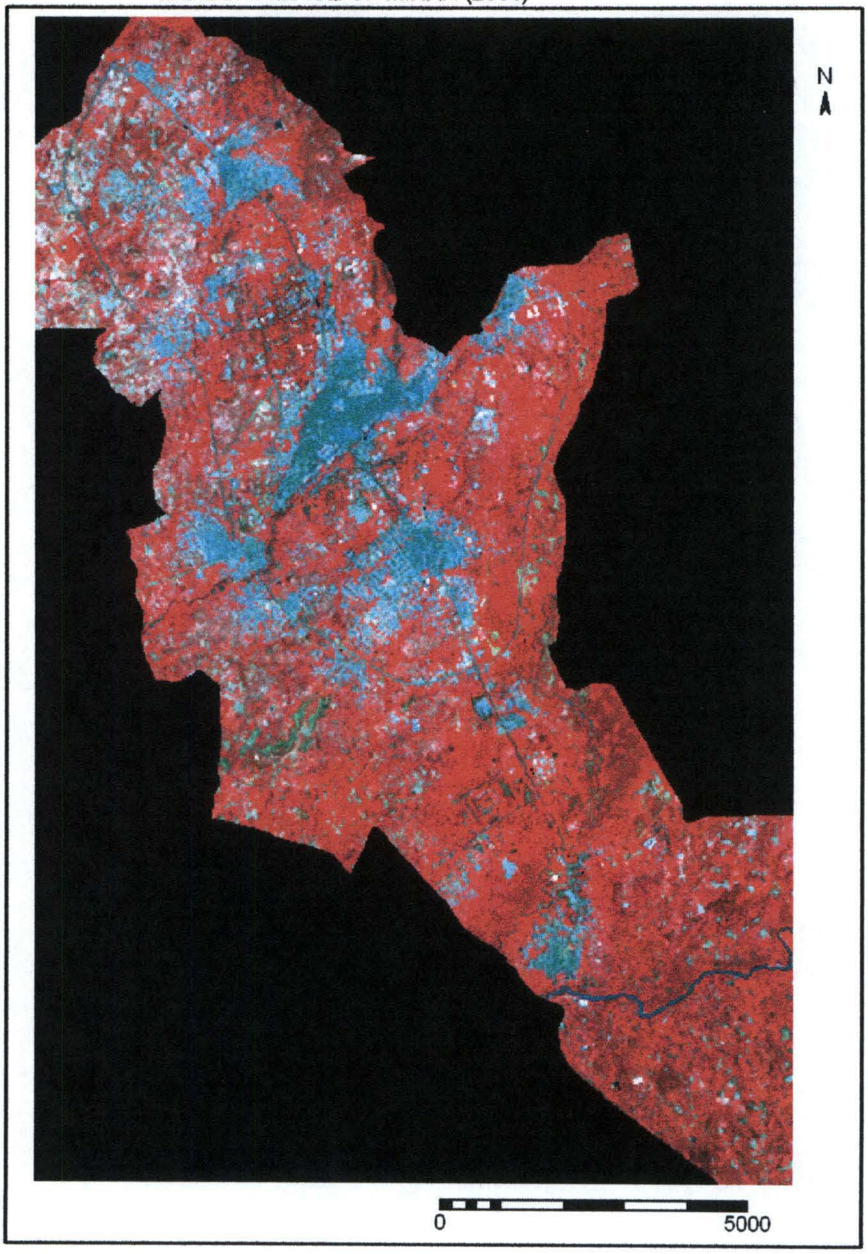


FIGURE 6.2: LANDSAT IMAGE OF MINNA, 2001

The concepts of gross and net residential densities are explicated by Lean (1969). Similarly, six types of densities are identified by Obateru (1978). These are housing density, accommodation density, floor space rate, bed space density, population density and occupancy rate.

For the purpose of this study, two satellite images are used to extract poverty-related variables in the study area. These are Spot multi-spectral image of Minna, 1995 and Landsat TM image of Minna, 2001. The two images (Figures 6.1 and 6.2) provide baseline data to project environmental poverty-related variables into 2003. The projection of these variables to 2003 provide the input of analysis of environmental quality in the study area.

The acquisition of the remote sensing data started by the classification of the land use of Minna. Two broad categories of land use are recognized. These are open space and built up areas. For open space, two uses are identified, bare surface and green areas while for built up areas three levels of built up are identified; lightly built up, built up and heavily built up. Heavily built up reflects higher concentration of buildings as opposed to lightly built up where buildings are developed in a dispersed manner. These features are examined differently for the two images.

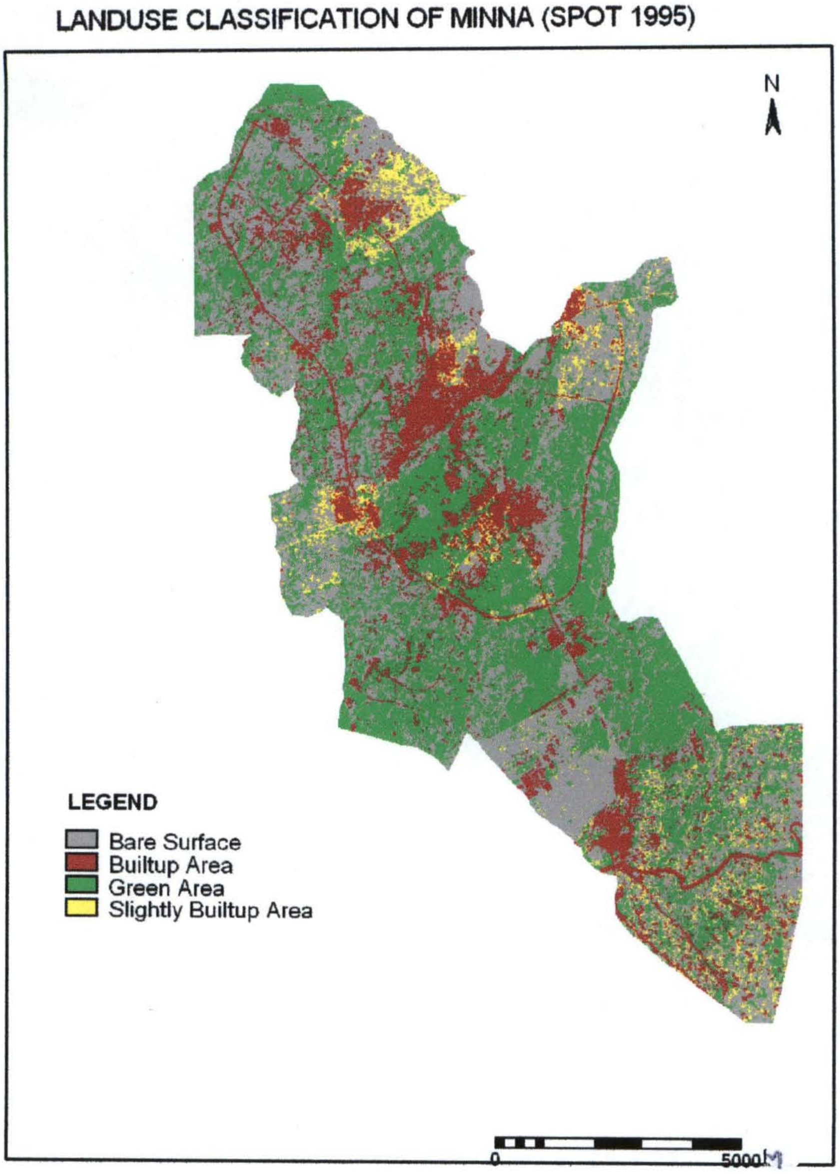
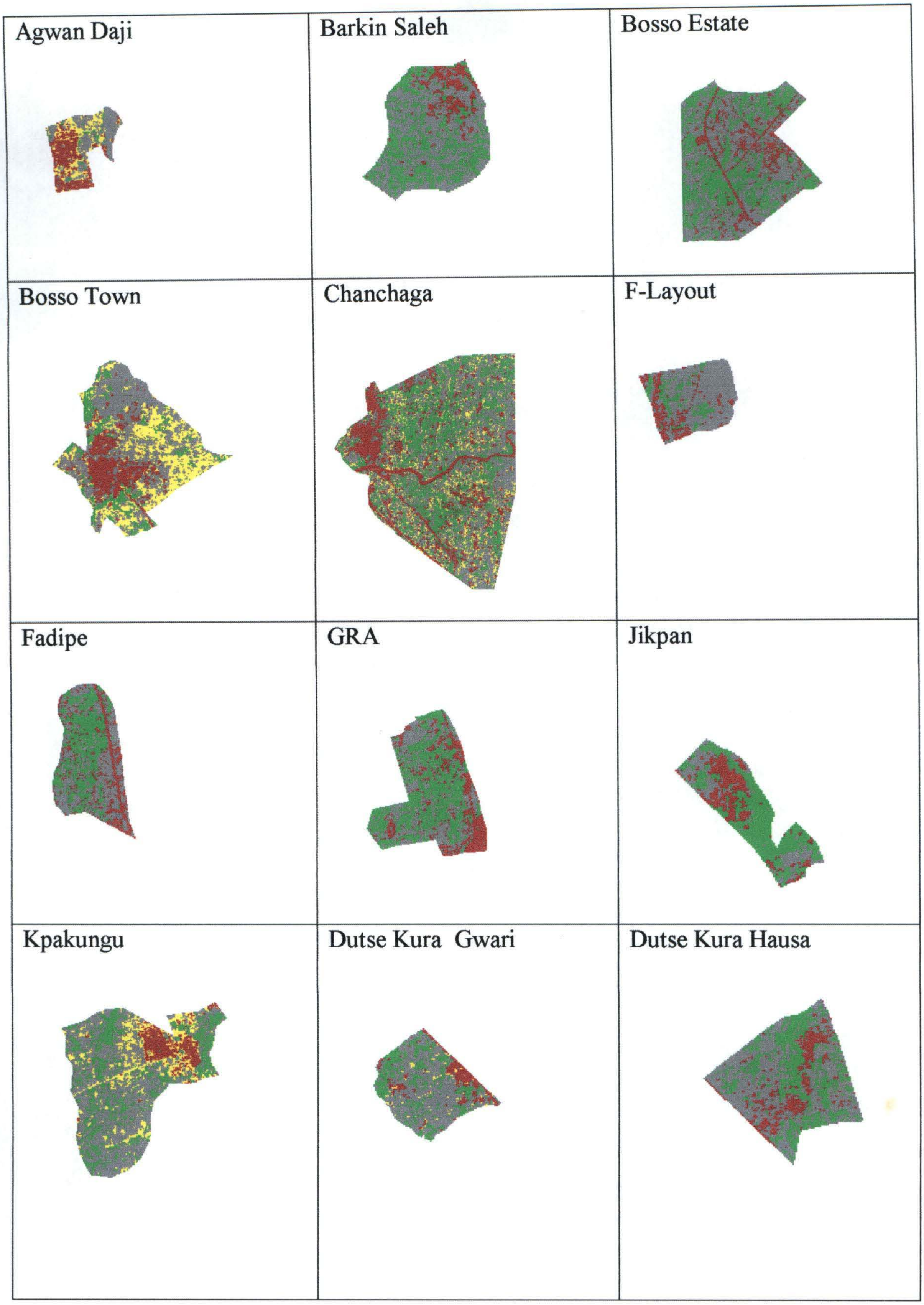


FIGURE 6.4: LANDUSE CLASSIFICATION OF MINNA; SPOT, 1995


Agwan Daji
Barkin Saleh
Bosso Estate
Bosso Town
Chanchaga
F-Layout
Fadipe
GRA
Jikpan
Kpakungu
Dutse Kura Gwari
Dutse Kura Hausa

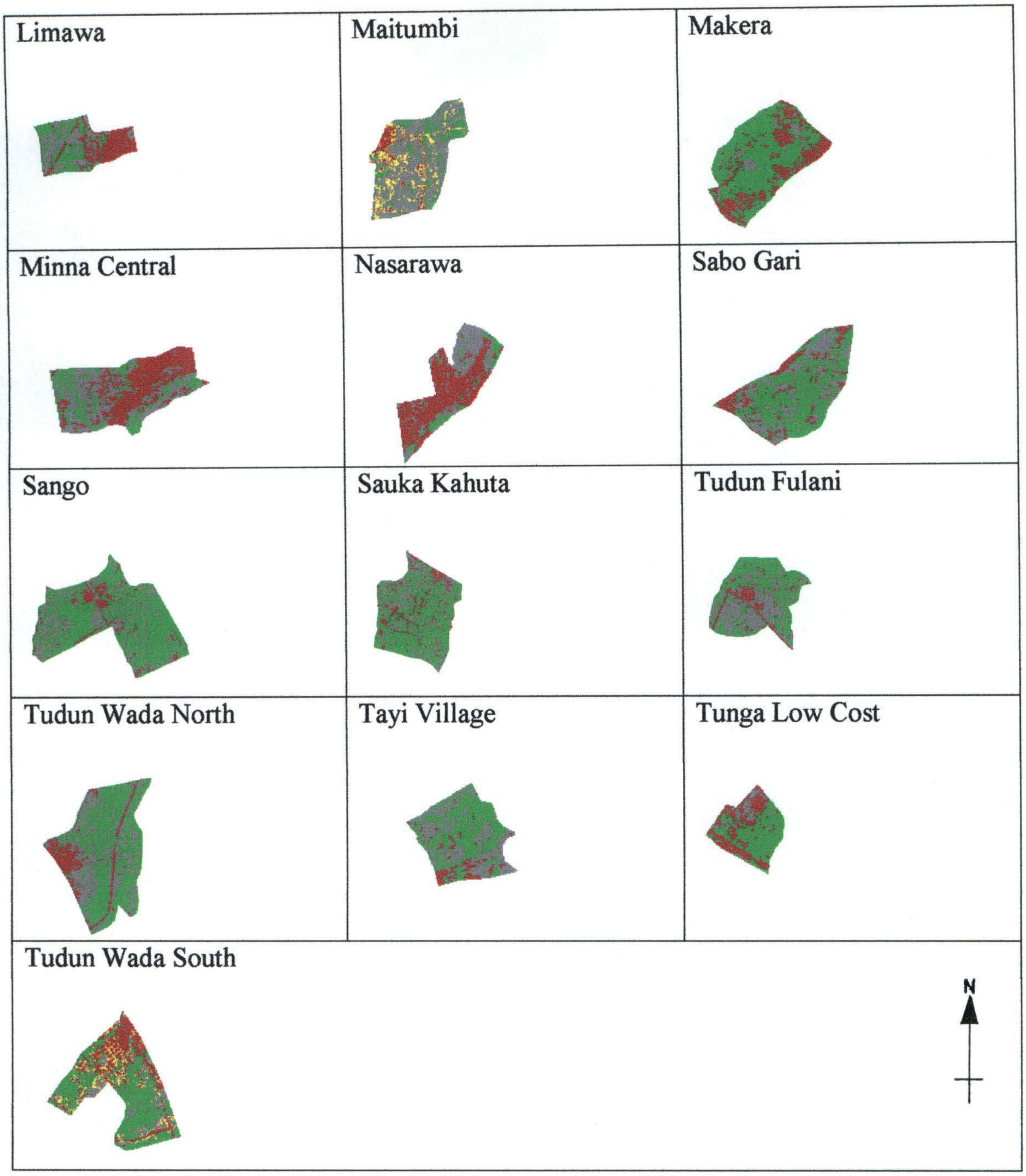


FIGURE 6.4 : LANDUSE CLASSIFICATION OF THE NEIGHOURHOODS IN MINNA, SPOT 1995.

Source: Cut From ILWIS Analysis of 1995 Spot Image of Minna
NB: The Cuttings are not to scale.

6.3 NEIGHBOURHOOD ENVIRONMENTAL QUALITY

In this section, the quality of the neighbourhoods are examined from the two images; first from the SPOT image and then from Landsat image.

6.3.1 NEIGHBOURHOOD ENVIRONMENTAL QUALITY FROM SPOT, 1995

The classification of 1995 image of Minna is shown in Figure 6.3 while Figure 6.4 shows land use for each neighbourhood. In this classification four land use categories are identified. These are bare surface, green area, lightly built up and built up areas. The distribution and location of these uses in each neighbourhood is shown in Table 6.1. The Table shows the distribution of land uses among the neighbourhoods and the total land area for each neighbourhood. Bare surface among the neighbourhoods vary from 13 hectares in Tunga Low Cost to a maximum of 812 hectares in Chanchaga while green area varies from three hectares in Agwan Daji to 666 hectares in Sango. Lightly built up areas are available only in seven neighbourhoods. These are Agwan Daji, Bosso Town, Chanchaga, Dutse Kura Gwari, Kpakungu, Maitumbi and Tudun Wada South.

TABLE 6.1: LAND USE DISTRIBUTION AMONG THE NEIGHBOURHOODS IN MINNA, SPOT, 1995

S/N	Neighbourhood	Land use distribution in hectares						
		Bare Open Space	Green Area	Total Open Space	Lightly Built Up Area	Built Up Area	Total Built Up area	Total land Area
1	Agwan Daji	39	3	42	25	32	57	99
2	Barkin Saleh	90	61	151	0	17	17	168
3	Bosso Estate	393	271	664	0	89	89	753
4	Bosso Town	212	54	266	128	75	203	469
5	Chanchaga	812	540	1352	227	307	534	1886
6	Dutse Kura Gwari	86	39	125	5	17	22	147
7	Dutse Kura Hausa	108	64	172	0	26	26	198
8	Fadipe	112	87	201	0	44	43	245
9	F-Layout	81	17	98	0	19	19	117
10	Tayi Village	75	85	160	0	14	14	174
11	GRA	144	165	309	0	68	68	377
12	Jikpan	23	50	73	0	21	21	94
13	Minna Central	83	45	128	0	76	76	204
14	Kpakungu	222	110	332	71	37	108	440
15	Limawa A	51	48	99	0	45	45	144
16	Maitumbi	292	82	374	76	33	109	483
17	Makera	36	219	255	0	81	81	336
18	Nasarawa	49	15	64	0	70	70	134
19	Sabo Gari	121	191	313	0	46	46	359
20	Sango	310	666	976	0	60	60	1036
21	Sauka Kahuta	280	450	730	0	64	64	794
22	Tudun Fulani	157	178	335	0	33	34	369
23	Tudun Wada North	246	356	602	0	69	69	672
24	Tudun Wada South	72	165	237	46	77	123	360
25	Tunga Low Cost	13	46	59	0	25	25	84

SOURCE: From Analysis of Spot Image of Minna, 1995.

While the lightly built area is as low as 5.3 hectares in Dutse Kura Gwari, it is as high as 128 hectares in Bosso Town and 27 hectares in Chanchaga. Similarly built up areas vary between 13.5 hectares in Tayi Village to 307 hectares in Chanchaga. Except Chanchaga, all other neighbourhoods have less than 100 hectares of built up area each.

Table 6.2 shows the total land area in respect of the two major land uses, open space and built up areas. The proportions of total area of each neighbourhood occupied by each of these two major uses are also shown.

The Table shows a generous possession of open space by all the neighbourhoods. There is no neighbourhood with less than 40% of its land area devoted to open space. The least of 42% is found in Agwan Daji. On the other hand, six neighbourhoods have their land area each occupied by open space by 90% or more. These are Barkin Saleh (90%), Sango (94%), Sauka Kahuta (93%), Tudun Fulani (91%) and Tudun Wada North (90%).

On the other hand, no neighbourhood shows heavy concentration of built up areas. The highest proportion of built up area of 58% is found in Agwan Daji. Bosso Town has 43% of built up areas, Minna Central has 37% while Tudun Wada South has 34%. No other neighbourhood has more than 30% of its land area devoted to built up. Against the premises of open space-built up area analysis, these neighbourhoods do not show any serious sign of poor quality.

TABLE 6.2 : PROPORTIONAL DISTRIBUTION OF LAND USE AMONG THE NEIGHBOURHOODS IN MINNA, SPOT, 1995

S/N	Neighbourhood	Open Space		Built-up Areas	
		Area in hectare	Percent of total land area per Neioghburhood	Area in hectare	Percent of total land area
1	Agwan Daji	42	42	57	58
2	Barkin Saleh	151	90	17	10
3	Bosso Estate	664	88	89	12
4	Bosso Town	266	57	203	43
5	Chanchaga	1352	72	534	28
6	Dutse Kura Gwari	125	85	22	15
7	Dutse Kura Hausa	172	87	44	13
8	Fadipe	201	73	19	27
9	F-Layout	98	84	14	16
10	Tayi Village	160	93	68	7
11	GRA	309	82	21	18
12	Jikpan	73	78	76	22
13	Minna Central	128	63	108	37
14	Kpakungu	332	76	45	24
15	Limawa A	99	69	109	31
16	Maitumbi	374	77	81	23
17	Makera	255	76	70	24
18	Nasarawa	64	48	46	52
19	Sabo Gari	313	87	46	13
20	Sango	976	94	64	6
21	Sauka Kahuta	730	93	34	7
22	Tudun Fulani	333	91	69	9
23	Tudun Wada North	602	90	34	10
24	Tudun Wada South	237	66	123	34
25	Tunga Low Cost	59	70	25	30

SOURCE: From Analysis of Spot Image of Minna, 1995.

6.3.2: NEIGHBOURHOOD ENVIRONMENTAL QUALITY FROM LANDSAT 2001

The Landsat image of Minna, 2001 shows that Minna has grown in built up areas between 1995 and 2001 (Figure 6.5). For example, changes have occurred to the pattern of distribution of the two major land uses among the neighbourhoods in Minna.

TABLE 6.3: LAND USE DISTRIBUTION AMONG THE NEIGHBOURHOODS IN MINNA, LANDSAT, 2001

S/N	Neighbourhood	Land Use Distribution in Hectares					
		Bare open space	Green area	Total open space	Lightly built up area	Built up area	Heavily built up area
1	Agwan Daji	22	12	34	5	37	23
2	Barkin Saleh	89	43	132	13	23	0
3	Bosso Estate	12	274	286	177	290	0
4	Bosso Town	142	94	236	86	735	12
5	Chanchaga	184	784	968	717	28	273
6	Dutse Kura Gwari	0	10	10	71	66	0
7	Dutse Kura Hausa	0	66	66	57	75	0
8	Fadipe	29	29	58	46	141	0
9	F-Layout	29	31	60	50	7	0
10	Tayi Village	62	23	85	70	19	0
11	GRA	2	178	180	163	34	0
12	Jikpan	24	14	38	35	21	0
13	Minna Central	0	14	14	8	148	34
14	Kpakungu	81	76	151	199	50	34
15	Limawa A	2	47	49	57	16	22
16	Maitumbi	4	334	338	85	60	0
17	Makera	48	65	114	144	79	0
18	Nasarawa	0	18	113	17	45	54
19	Sabo Gari	33	71	104	202	49	4
20	Sango	154	128	282	590	164	0
21	Sauka Kahuta	107	172	279	340	174	0
22	Tudun Fulani	52	53	103	186	78	0
23	Tudun Wada North	224	208	432	177	59	4
24	Tudun Wada South	0	22	22	237	94	0
25	Tunga Low Cost	24	10	34	22	28	0

SOURCE: From Analysis of Landsat Image of Minna, 2001.

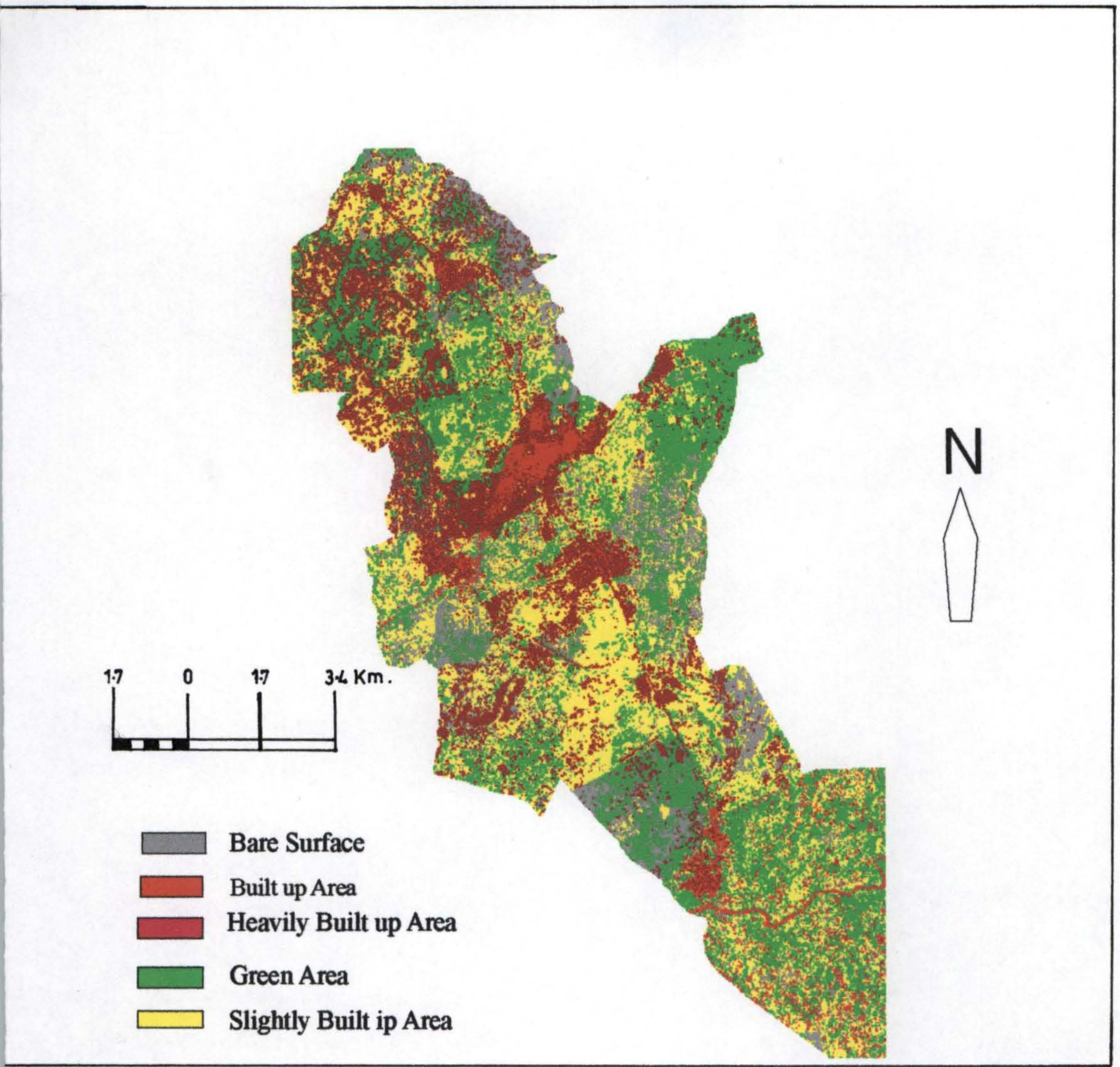


FIGURE 6.5: LANDUSE CLASSIFICATION OF MINNA,, LANDSAT, 2001

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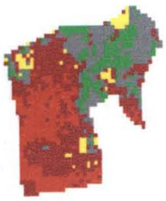
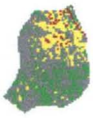
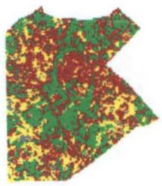
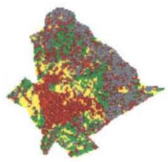
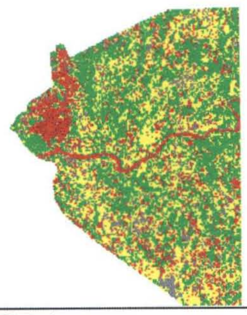
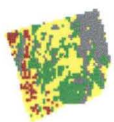
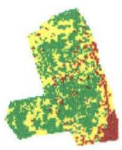
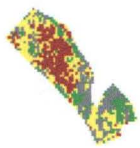
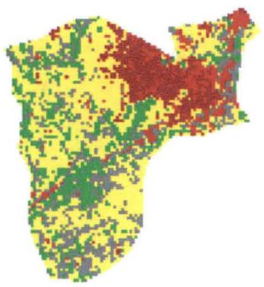
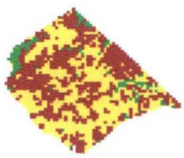
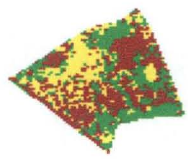
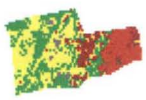
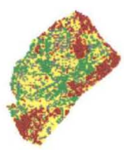
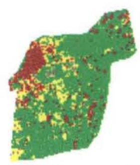
First, there emerged another variation of built up area. This is the heavily built up (Table 6.3.).. Detailed land use distribution for each of the neighbourhoods in 2001 is shown Figure 6.5a. The emergence of heavily built up area signifies intensification of development within the built up area thus leading to excessive concentration of buildings within these areas. Ten neighbourhoods demonstrate presence of heavily built up areas.. These as Figure 6.6 shows are Agwan Daji, Bosso Town, Chanchaga, Minna Central, Kpakungu, Limawa, Nasarawa,, Sabo Gari and Tudun Wada North and Tudun Wada South. With a tendency towards degradation as concentration of development increases, the presence of heavily built up area within any neighbourhood is a direct evidence of environmental stress and declining quality..

TABLE 6.4: DISTRIBUTION OF HEAVILY BUILT-UP AREAS

S/N	Neighbourhood	HEAVILY BUILT		
		In hectares	As % of total area	As % of total built up area
1	Agwan Daji	23	23.0	35.0
2	Bosso Town	12	2.6	5.1
3	Chanchaga	272	14.0	26.7
4	Minna Central	34	16.7	17.9
5	Kpakungu	34	7.7	11.9
6	Limawa	22	15.0	23.2
7	Nasarawa	54	40.0	46.6
8	Sabo Gari	4	1.1	1.6
9	Tudun Wada North	4	0.6	1.7
10	Tudun Wada South	7	1.9	2.1

Source: Derived from Table

Examination of these heavily built up areas indicate that in relation to gross areas of each neighbourhood, the heavily built area is 23% of total area in Agwan Daji, 40% in Nasarawa and 16.7% in Minna Central (Table 6.4). Similarly, the heavily built area constitutes 46.6% of the total built up area in Nasarawa, 35% in Agwan Daji, 26.7% in

Agwan Daji 	Barkin Saleh 	Bosso Estate 
Bosso Town 	Chanchaga 	Fadipe 
F-Layout 	GRA 	Jikpan 
Kpakungu 	Dutse Kura Gwari 	Dutse Kura Hausa 
Limawa 	Makera 	Maitumbi 

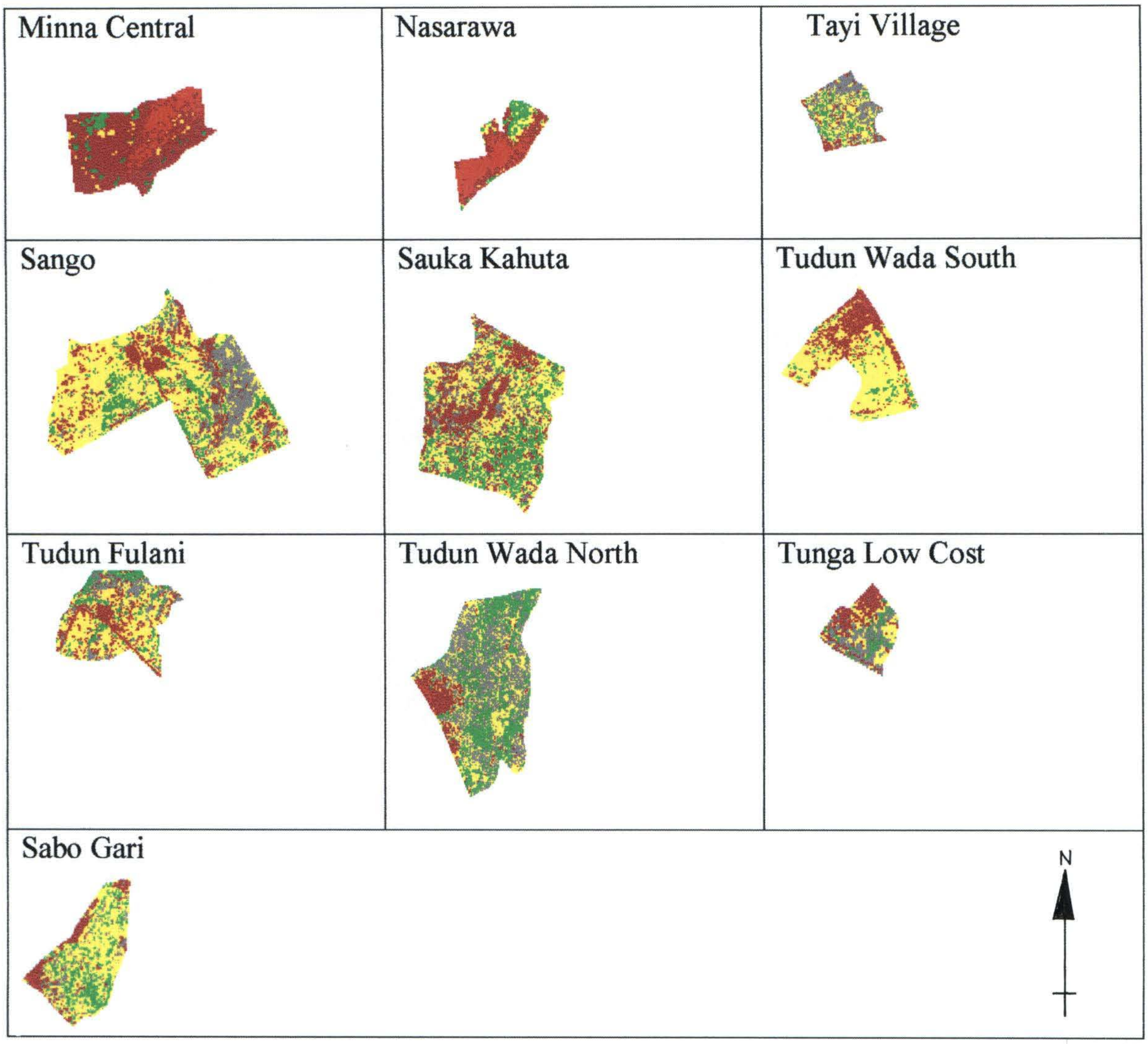


FIGURE 6.5a : LANDUSE CLASSIFICATION OF THE NEIGHBOURHOODS IN MINNA, LANDSAT 2003.

Source: Cut From ILWIS Analysis of 2001 Landsat Image of Minna.
NB: The cuttings are not to scale.

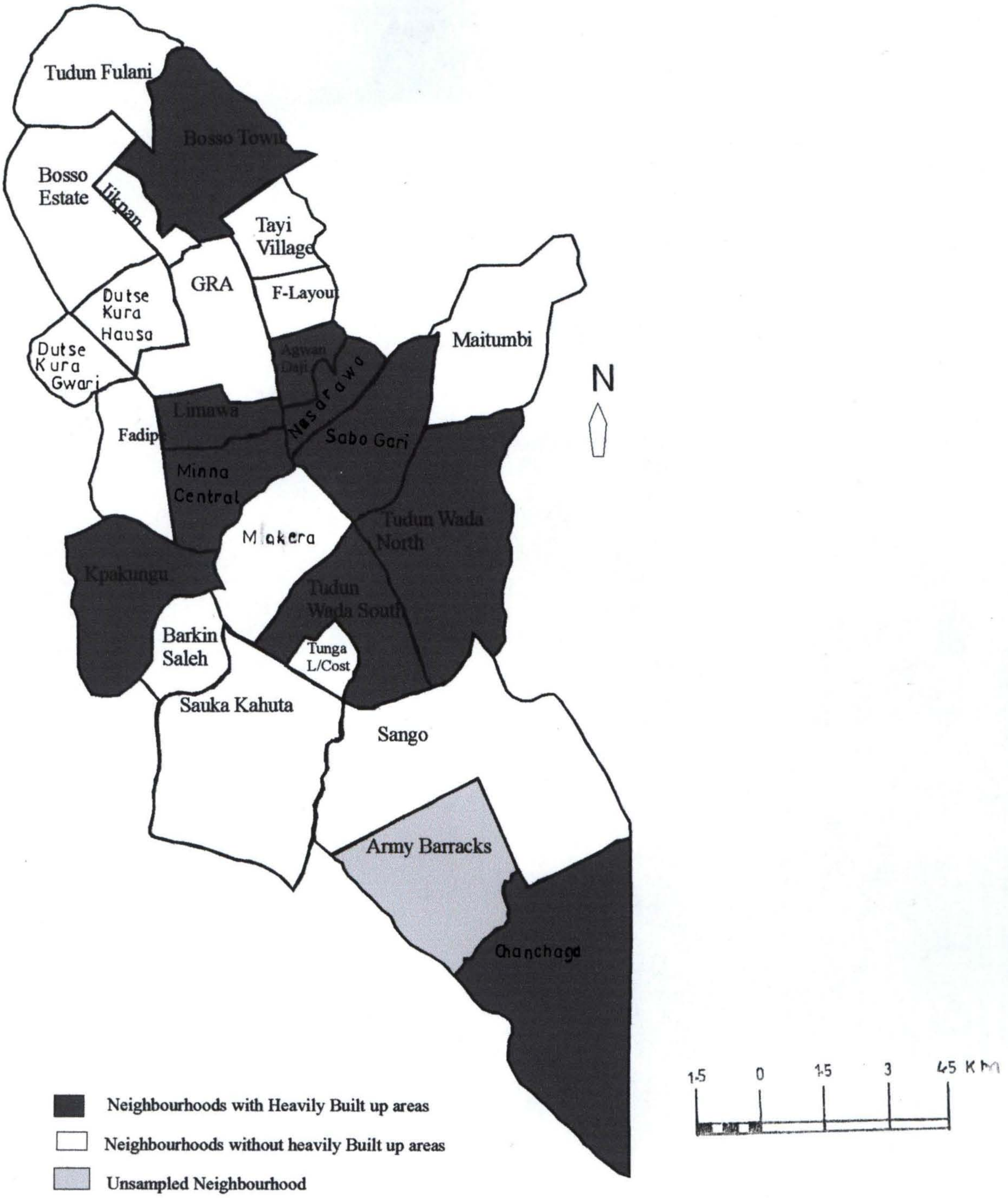


FIGURE 6.6: NEIGHBOURHOODS WITH HEAVILY BUILT UP AREAS

Chanchaga and 23.2% in Limawa. In these four neighbourhoods, there is significant presence of heavily built-up area.

Second, all the neighbourhoods are under the influence of light development unlike in 1995 when only seven of the neighbourhoods had land area under light development. This is evidence that more areas are coming under the influence of development in each of the neighbourhoods. Areas occupied by light development varies from five hectares in Agwan Daji, eight hectares in Minna Central and 17 hectares in Nasarawa to as high as 199 hectares in Kpakungu, 203 in Sabo Gari and 237 in Tudun Wada South.

With respect to open space, five neighbourhoods show no sign of bare surface. These are Dutse Kura Gwari, Dutse Kura Hausa, Minna Central, Nasarawa and Tudun Wada South. Bare surface area is also as low as two hectares in the GRA, four hectares in Maitumbi and 12 hectares in Bosso Estate. On the other hand, it is as high as 154 hectares in Sango, 142 hectares in Bosso Town and 224 hectares in Tudun Wada North. With respect to open space, low hectare-age is found in Tunga Low Cost (10 hectares), Agwan Daji (12 hectares), Dutse Kura Gwari (10 hectares) and Minna Central (14 hectares). On the other hand high hectare-age of green areas is found in Chanchaga (774 hectares), Bosso Estate (275 hectares), Maitumbi (334 hectares) and Tudun Wada North (202 hectares). All these areas demonstrate substantial presence of green areas.

The general picture of the relative distribution of open space and built up areas is presented in Table. 6.5. In respect of the open space, the Table shows that four of the neighbourhoods have less than 10% of their land areas occupied by open space. These are

Dutse Kura Gwari (7%), Dutse Kura Hausa (3%), Minna Central (7%) and Tudun Wada South (6%).

TABLE 6.5: PROPORTIONAL DISTRIBUTION OF LAND USES AMONG THE NEIGHBOURHOODS IN MINNA, LANDSAT 2001

S/N	Neighbourhood	OPEN SPACE		BUILT UP AREAS		Built up: Open space Ratio
		Open Space (hectares)	Percent of total land area per neighbourhood	Built up area (hectares)	Percent of total land area per neighbourhood	
1	Agwan Daji	34	34	65	66	1: 0.52
2	Barkin Saleh	132	79	36	21	1:3.67
3	Bosso Estate	286	38	467	62	1:0.61
4	Bosso Town	236	50	232	50	1:1.01
5	Chanchaga	968	49	1018	51	1:0.95
6	Dutse Kura Gwari	10	7	137	93	1:0.07
7	Dutse Kura Hausa	66	3	132	97	1:0.5
8	Fadipe	58	24	187	76	1:0.31
9	F-Layout	60	51	57	49	1:1.05
10	Tayi Village	85	51	89	49	1:0.51
11	GRA	180	48	197	52	1:0.91
12	Jikpan	38	40	56	60	1:0.4
13	Minna Central	14	7	190	93	1:0.77
14	Kpakungu	157	34	283	66	1:0.53
15	Limawa A	49	34	95	66	1:0.34
16	Maitumbi	338	70	145	30	1:2.33
17	Makera	113	34	223	66	1:0.51
18	Nasarawa	18	13	116	87	1:0.16
19	Sabo Gari	104	41	255	59	1:0.41
20	Sango	282	27	754	73	1:0.37
21	Sāuka Kahuta	279	35	515	65	1:0.54
22	Tudun Fulani	105	28	264	72	1:0.39
23	Tudun Wada North	432	65	240	35	1:1.45
24	Tudun Wada South	22	6	338	94	1:0.07
25	Tunga Low Cost	34	40	50	60	0.68

Source: Analysis of Landsat Image of Minna, 2001

The relationship between built up areas and the open space is further demonstrated by looking at the built up area-open space ratio (last column Table 6.5). The Table shows that in five of the neighbourhoods, the ration is 1:1 and above. These are Barkin Saleh, Bosso Town, F-Layout, Maitumbi and Tudun Wada North. It is as high as 1:3.67 in Barkin Saleh and 1:2.33 in Maitumbi. On the other hand, it is as low as 1:0.07 each in Minna Central, Tudun Wada South and Dutse Kura Gwari and 1:0.16 in Nasarawa.

6.4 CHANGE IN USE AND DECLINE IN NEIGHBOURHOOD QUALITY, 1995-2001

Between 1995 and 2001, land uses in Minna underwent considerable changes. More importantly, the changes have shown intensification of uses within the built up areas. These changes can be seen in Table 6.6. It is noted that the loss in open space is the equivalent gain in built up area in each neighbourhood. The strength of loss and gain respectively will depend on the respective area lost and gained relative to the size of each neighbourhood. The table shows that the percentage decline in open space among the neighbourhoods vary between 11% in Bosso Town to 92% in Dutse Kura Gwari. Other neighbourhoods with exceptionally high loss of open space to built up activities are Tudun Wada South (91%), Minna Central (89%), Nasarawa (72%), Sango (71%) and Tudun Fulani (69%).

On the other hand, many of the neighbourhoods have expanded the built areas within the six years tremendously. Increase in built up areas over the 1995 base is as high as 1157% in Sango, 731% in Sauka Kahuta, 676% in Tudun Fulani and 523% in Dutse Kura Gwari.

Only two neighbourhoods have less than 20% expansion in built up areas over 1995 base among the 25 neighbourhoods. On the other hand, 20 neighbourhoods have more than 100% expansion in built up areas over the 1995 base.

TABLE 6.6 : CHANGE IN MAJOR LAND USES AMONG NEIGHBOURHOODS IN MINNA, 1995-2001

S/N	Neighbourhood	OPEN SPACE			BUILT UP AREAS		
		Reduction in (hectares)	Percentage reduction	Annual rate of reduction	Increase (hectares)	Percentage increase	Annual rate of change
1	Agwan Daji	8	19	3.5	8	14	2.2
2	Barkin Saleh	19	13	2.2	19	112	13.3
3	Bosso Estate	378	57	13.1	378	425	31.8
4	Bosso Town	30	11	1.8	30	15	2.3
5	Chanchaga	384	28	5.4	384	91	11.4
6	Dutse Kura Gwari	115	92	34.4	115	523	35.6
7	Dutse Kura Hausa	106	62	14.8	106	408	31.1
8	Fadipe	143	71	18.7	143	335	27.7
9	F-Layout	38	39	7.9	38	200	10.0
10	Tayi Village	75	47	9.6	75	536	36.1
11	GRA	129	42	8.6	129	195	19.4
12	Jikpan	35	48	10.3	35	167	17.8
13	Minna Central	114	89	30.6	114	150	6.5
14	Kpakungu	175	53	11.9	175	162	17.6
15	Limawa A	50	51	11.1	50	111	13.3
16	Maitumbi	36	10	1.7	36	33	4.9
17	Makera	142	56	12.7	142	175	18.3
18	Nasarawa	46	72	19.1	46	66	8.8
19	Sabo Gari	209	67	16.8	209	454	33.0
20	Sango	694	71	18.7	694	1157	52.5
21	Sauka Kahuta	451	61	14.7	451	731	42.3
22	Tudun Fulani	230	69	17.8	230	676	40.7
23	Tudun Wada North	170	28	5.2	170	248	23.1
24	Tudun Wada South	215	91	32.7	215	175	18.4
25	Tunga Low Cost	25	36	8.8	25	100	12.23

Source: Derived from Tables 6.1 and 6.3..

The high expansion in built up areas and reduction in open space is reflected in the high annual growth rate in built up areas and reduction in open space among the neighbourhoods. Table 6.6 also shows these rates. The rate in respect of open space shows the annual rate of reduction in the open space per neighbourhood while in respect of the built up areas, the rate shows the rate of growth per annum

In respect of the open space, no area shows a gain in open space within this period. No neighbourhood also shows a sign of preservation of its open space. Rather, the open space in all neighbourhoods have come under the influence of urban land development with highly minimum or no control. The rate of loss of open space is as high as 34.4% in Dutse Kura Gwari, 30.6% in Minna Central, 32.7% in Tudun Wada South and 19.1% in Nasarawa.

6.5 PROJECTIONS

The essence of this work is to understand the level of deterioration existing among the neighbourhoods and to link this up with the welfare of the people. To establish the link between environmental deterioration and poverty, the status of deterioration has to be established. In the presentation and analysis of the remotely sensed data attempts have been made to assess the quality of the neighbourhood environment as shown in each of the two images used for the study. The results have shown some decline in the quality of all neighbourhoods.

TABLE 6.7 : GROWTH RATE OF BUILT UP AREAS AND PROJECTION OF BUILT UP AREAS, 2003

S/N	Neighbourhood	Growth rate		Land use projections, 2003		
		Observed growth rate 1995-2001	Adopted growth rate	Total Built up area, 2003	Institutional land, 2003 (total land*0.45)	Residential land (total Built up-Institutional land)
1	Agwan Daji	2.2	2.2	82	37	45
2	Barkin Saleh	13.3	13.3	46	21	25
3	Bosso Estate	31.8	13.4	601	270	331
4	Bosso Town	2.3	2.3	243	109	134
5	Chanchaga	11.4	11.4	1263	568	695
6	Dutse Kura Gwari	35.6	2.2	143	64	79
7	Dutse Kura Hausa	31.1	13.4	170	77	93
8	Fadipe	27.7	2.2	195	88	107
9	F-Layout	20.0	13.4	73	33	40
10	Tayi Village	36.1	13.4	114	51	63
11	GRA	19.4	13.4	253	114	139
12	Jikpan	17.8	13.4	72	32	40
13	Minna Central	16.5	2.2	198	89	109
14	Kpakungu	17.6	13.4	368	166	202
15	Limawa A	13.3	13.3	121	54	67
16	Maitumbi	4.9	4.9	160	72	88
17	Makera	18.3	13.4	287	129	158
18	Nasarawa	8.8	2.2	121	54	67
19	Sabo Gari	33	13.4	328	148	180
20	Sango	52.5	2.2	788	355	433
21	Sauka Kahuta	42.3	2.2	538	242	296
22	Tudun Fulani	40.7	13.4	339	153	186
23	Tudun Wada North	23.1	13.4	309	139	170
24	Tudun Wada South	18.4	2.2	353	159	194
25	Tunga Low Cost	12.2	12.2	63	28	35

Source: Growth rate is derived from the built up area, 1995 and 1995. Others are estimates based on the adopted growth rate vis-à-vis the estimated built up areas for 2003.

To pursue the analysis further, 2003 is chosen as a projection year. In this regard land use distribution among the neighbourhoods is projected by using the growth rate of the built up areas.

By looking at the respective growth rate for the neighbourhoods, it is discovered that the rates are so high that a steady maintenance of such growth will lead to unprecedented concentration of built up activities within these neighbourhoods. It is expected that the annual growth rate will decline after a certain level of growth is achieved. Thus while the respective growth rate is recognized for all neighbourhoods whose growth rate is above the standard deviation of the growth rates for all the neighbourhoods, the standard deviation is adopted while in some cases the minimum existing growth rate is adopted (Table 6.7.). The growth rate has been varied to reflect a natural tendency that growth is likely to decline after certain level is reached. Given abnormal figures in the application of observed growth rates in 16 of the neighbourhoods, the use of moderated growth rates become important and realistic. The moderated growth rates is not meant to deny the observed trend rather, it is only meant to show that growths rates in these neighbourhoods are likely to slow down within the confines of their land areas. Even then the moderation does not prevent excessively high proportion of built up area in relation to the total area. For example, the application of moderated growth rates only shows that 97% of the land area in Minna Central, 90% in Nasarawa and 91% in Sabo Gari were under built up area in 2003.

The result of this adaptation is the estimated built up areas and the open spaces for the neighbourhoods. This is also shown in Table 6.7. In nine of the neighbourhoods, the standard deviation of 13.4 is applied, in seven neighbourhoods; the minimum observed growth rate of 2.2% is applied while in the remaining nine, their respective observed growth rate is observed.

Barnes (2001) applied projection method in his study of sprawl through remote sensing in Towson University. Having identified two key variables, POPADEN and POPBDEN, he projected land uses within the town to 2051 and 2101, the POPADEN is the proportion of the population in every village in relation to built up area of that village while the POPBDEN is the proportion of the population in every village in relation to the total area of that village.

.6 ANALYSIS OF NEIGHBOURHOOD ENVIRONMENTAL QUALITY: THE USE OF DERIVED VARIABLES

As earlier stated, the use of remotely sensed data in the analysis of urban poverty depends essentially on the use of surrogate variables. These variables reflect poverty. The assumption is that once these variables are present in any urban setting, there is likelihood of poverty.

In order to examine these variables in the study area, the land use estimates for 2003 based on the observed changes between 1995 and 2001 are used. In this case, eight variables are derived from the two broad category of land uses. That is open space and built-up area. For the built-up area distinction is also made between (1) the gross built up area including the institutional land and (2) the residential area excluding the institutional land. According to Minna Master Plan, 45% of the built up area in Minna is institutional land (Max Lock, 1980). This is applied to the present land use distribution in Minna, with the underlying assumption that the city maintains this proportion of institutional land (Table 6.8).

The eight variables are:

6.6.1 proportion of the built up area to the total area (BUA/TA)

6.6.2 Gross population density (GSDEN). This is the relationship between the population of each neighbourhood to the total built up area.

6.6.3 Net population density (NTDEN). This is defined as the relationship between the residential land and the population of each neighbourhood.

6.6.4 Gross housing density (GSHDEN). This is the unit of residential building per hectare in relation to the total built up area.

6.6.5 Net housing density (NTHDEN). This measures the number of residential units per hectare of the residential land.

6.6.6 Open space per head (OS/HD). That is the open space available to each person per neighbourhood in square metres.

6.6.7 Proportion of open space in relation to the total area (OS/TA) and

6.6.8 Open space loss (%OSLOS). That is the proportion of the open space lost between 1995 and 2003.

As has been shown in section 6.5, density tends to intensify existing spatial problems. From the remote sensing data, the importance of density in assessing environmental quality is observable in the number of density-related variables among the derived variables. Four of the eight variables are on density.

TABLE 6.8 : REMOTE SENSING INDICES OF ENVIRONMENTAL QUALITY, 2003

S/N	Neighbourhood	BUA/TA	GSDEN	NTDEN	GHSDEN	NTHDEN	OS/HD	OS/TA	%OSLOS
1	Agwan Daji	83	164	299	9	17	13	17	57
2	Barkin Saleh	27	113	209	6	11	23	73	19
3	Bosso Estate	80	3	5	1	1	3120	20	23
4	Bosso Town	52	147	266	6	11	63	48	15
5	Chanchaga	67	19	34	1	2	303	37	47
6	Dutse Kura Gwari	97	57	103	2	4	5	3	96
7	Dutse Kura Hausa	86	72	131	4	8	20	14	84
8	Fadipe	80	21	38	1	3	120	20	75
9	F-Layout	62	60	109	3	6	100	38	55
10	Tayi Village	66	77	140	5	9	70	34	61
11	GRA	67	12	22	1	2	400	33	60
12	Jikpan	77	109	196	5	9	30	23	70
13	Minna Central	97	120	219	7	13	10	3	95
14	Kpakungu	83	43	78	2	4	50	17	77
15	Limawa A	84	204	368	6	10	10	16	77
16	Maitumbi	33	79	143	4	7	260	67	14
17	Makera	85	85	154	4	7	20	15	81
18	Nasarawa	90	227	410	10	18	10	10	70
19	Sabo Gari	91	93	169	6	11	10	9	90
20	Sango	76	3	6	1	1	910	24	75
21	Sauka Kahuta	68	5	10	1	1	620	32	65
22	Tudun Fulani	92	28	51	1	2	30	8	91
23	Tudun Wada North	46	69	125	3	6	170	54	40
24	Tudun Wada South	98	54	99	3	5	10	2	97
25	Tunga Low Cost	75	61	110	8	14	50	25	64

Source: derived from Table 6.7

6.6.1 **Proportion of Built Up Area:** This examines the total built up area in relation to the total land area of each neighbourhood. It shows the proportion of total land area committed to built up activities. Table 6.8 shows that land committed to built up activities vary from 27% in Barkin Saleh, 33% in Maitumbi to 98% in Tudun Wada South, 97% in Minna Central, 91% in Sabo Gari to 90% in Nasarawa. In general, 16 of the 25 neighbourhoods committed more than 70% of their respective land area to built up activities. Only three neighbourhoods, Barkin Saleh, Maitumbi and Tudun Wada North have between 25-50% of their respective land area under built up. These neighbourhoods are of high quality by this variable (Figure 6.7). Seven neighbourhoods fall into medium environmental quality group by having between 51%-75% of their land area under built up while 15 neighbourhoods that have more than 75% of their land area committed to built up fall into poor quality neighbourhoods.

6.6.2 **Gross Population Density**: Gross population density among the neighbourhoods vary between 3 to 227 persons per hectare.. Low gross population density is observed in Bosso Estate (3), Sango (3), Sauka Kahuta (3) and GRA (12). On the other hand, population density is high in Limawa (204) and Nasarawa (224). Grouping the neighbourhoods into quality areas shows that eight neighbourhoods that have less than 50 persons per hectare are high quality neighbourhoods; six that have between 50-75 persons per hectare are of medium environmental quality while 11 that have more than 75 persons per hectare of the total built up area are poor quality neighbourhoods (Figure 6.8).

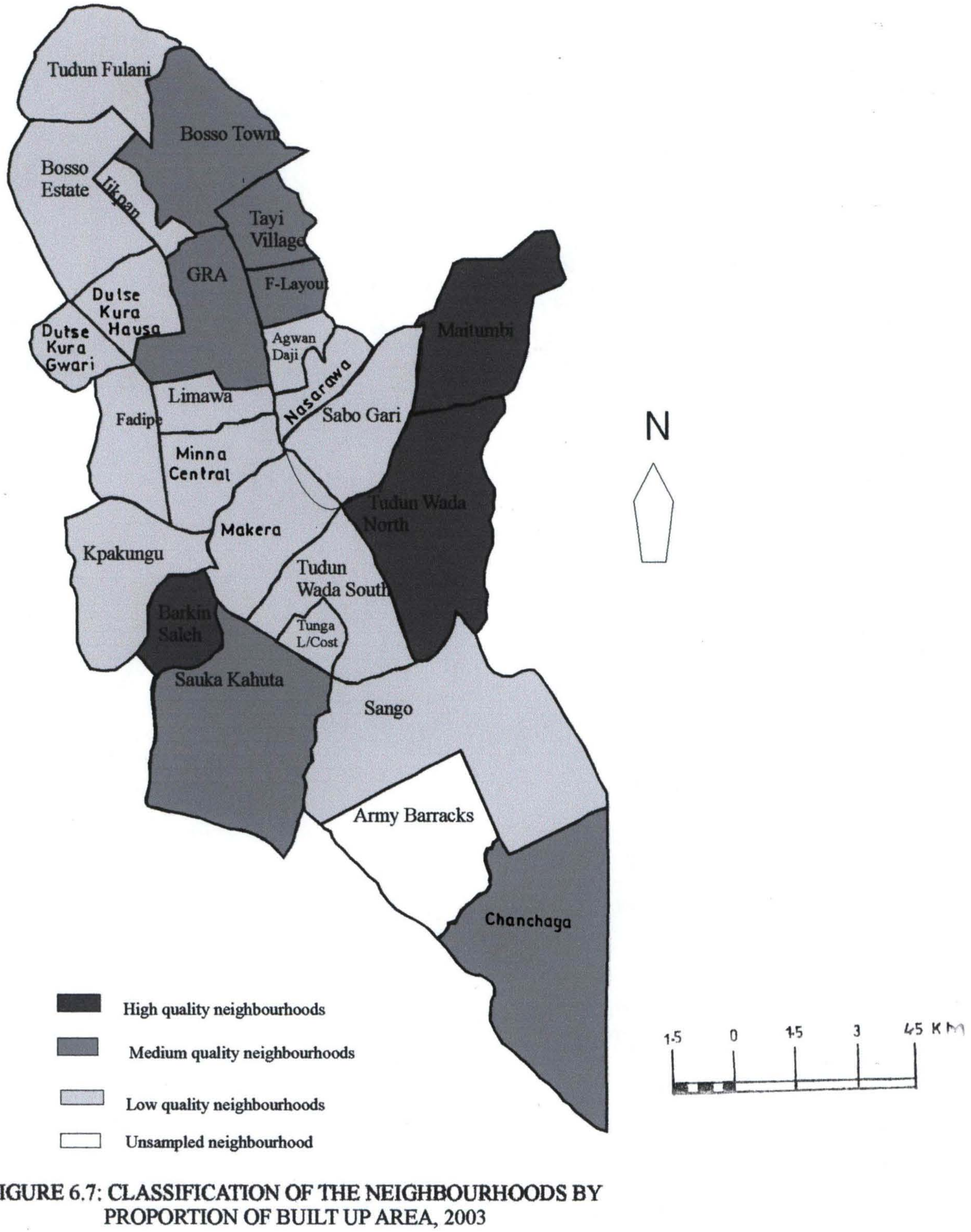


FIGURE 6.7: CLASSIFICATION OF THE NEIGHBOURHOODS BY PROPORTION OF BUILT UP AREA, 2003

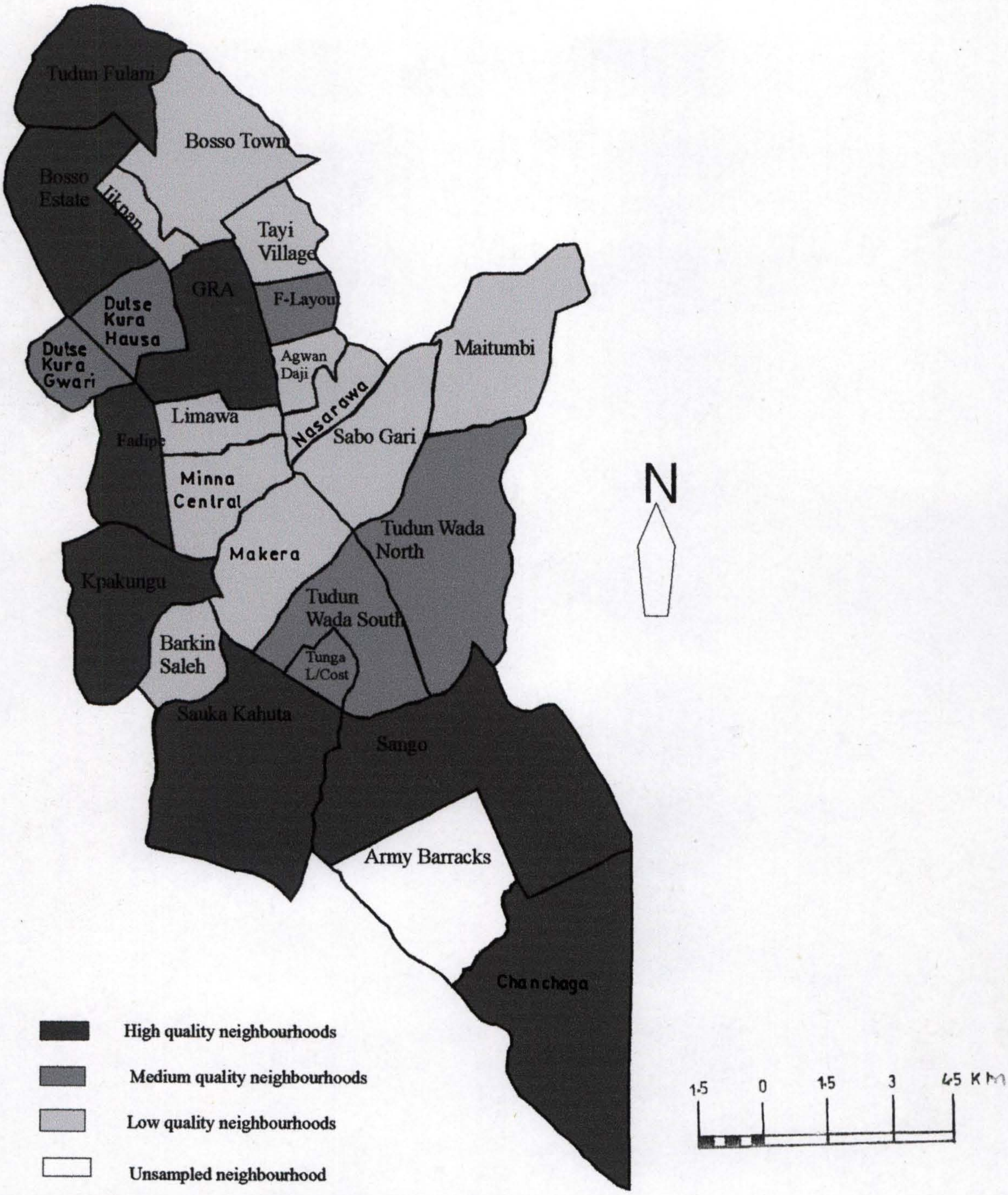


FIGURE 6.8: CLASSIFICATION OF THE ENIGHBOURHOODS BY GROSS POPULATION DENSITY

6.6.3 **Net Population Density**: This variable is meant to reveal the pressure in the residential area as opposed to the gross population density. While the gross population density spreads people over the total built-up area, the net population density looks at people within the residential land area only. Thus while the lowest net population density is 5, the highest is 410. High net population density is also observed in Limawa (368), Agwan Daji (299), Bosso Town (266) and Minna Central. In general, seven neighbourhoods qualify as high quality neighbourhoods based on their low net population density (Figure 6.9). These neighbourhoods have less than 75 persons per hectare. Similarly, two neighbourhoods are of medium quality by their population density condition while 16 have deteriorated net population density condition. While medium quality neighbourhoods have between 75-100 persons per hectare, the poor quality neighbourhoods have more than 100 persons per hectare.

6.6.4 **Gross Housing Density.** This is similar to the gross population density in that it examines the number of dwelling units in relation to total built up area. The gross housing density is estimated by the following formula:

$$\frac{\text{Gross population density}}{\text{People per compound.}}$$

People per compound is the product of average household size per neighbourhood and the city's average household per compound. The average number of households per compound is 2.5. This density varies between 1 and 10 houses per

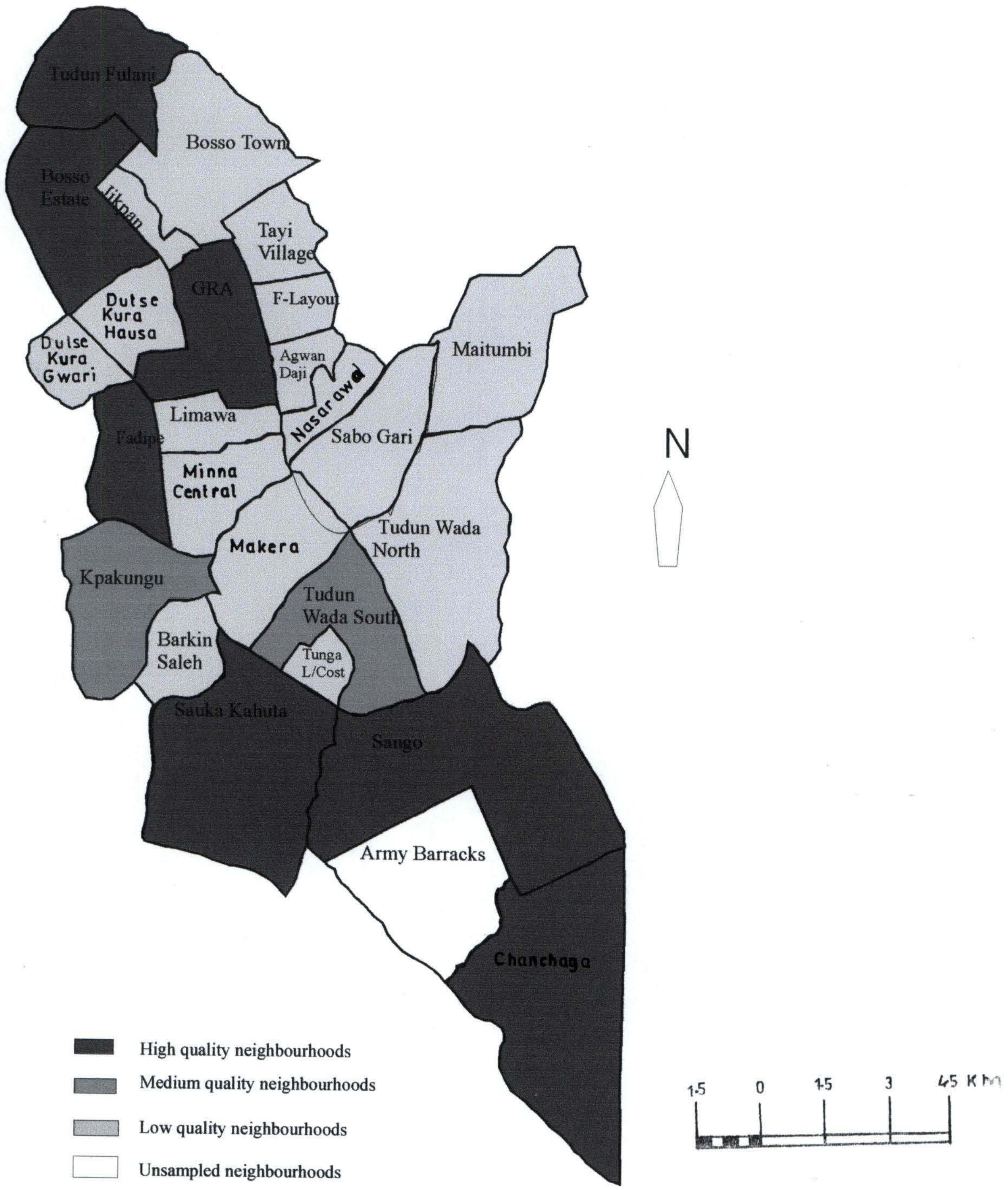


FIGURE 6.9: CLASSIFICATION OF THE ENIGHBOURHOODS BY NET POPULATION DENSITY, 2003

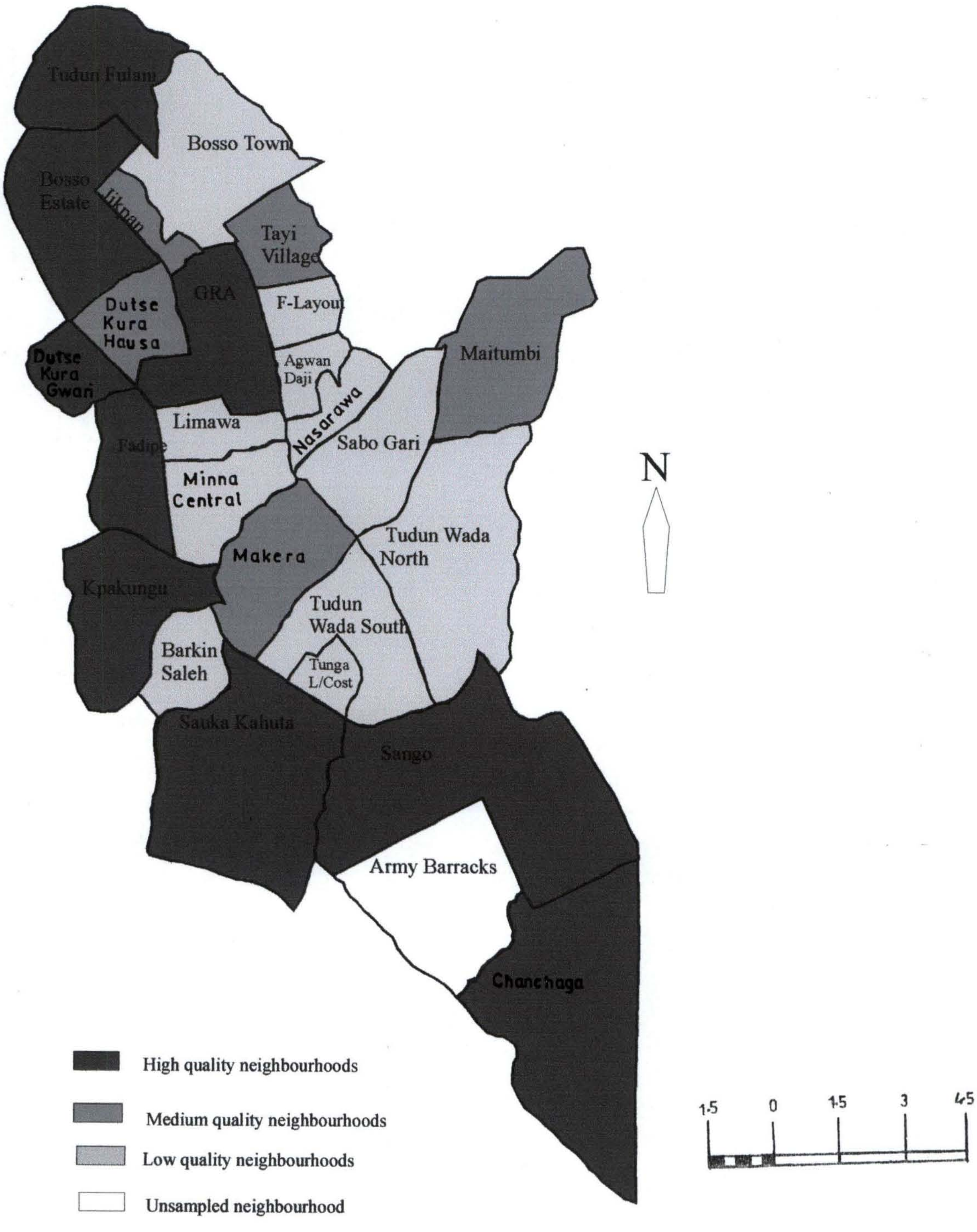


FIGURE 6.10: CLASSIFICATION OF THE NEIGHBOURHOODS BY GROSS HOUSING DENSITY, 2003

hectare. Seven neighbourhoods have an average of one house per hectare each while one neighbourhood had 10 houses per hectare. In general, 12 neighbourhoods have good housing density and hence qualify as high quality neighbourhoods (Figure 6.10). They have less than three dwelling units per hectare each. Five other neighbourhoods that have between 4-5 dwelling units per hectare are of medium quality while eight neighbourhoods that have more than five dwelling units per hectare are poor quality neighbourhoods.

6.6.5 **Net Housing Density.** This is similar to the net population density. It measures the number of dwelling units per hectare in the actual residential land area. This index relates the net population density to people per compound. The distribution of net housing density shows that three neighbourhoods have one dwelling unit per hectare each while another three have 11 dwelling units per hectare each. In general, nine neighbourhoods that have less than five houses per hectare are grouped as high quality neighbourhoods (Figure.6.11.). Another three that have between 5-6 dwelling units per hectare are of medium quality while the remaining 13 with more than 6 dwelling units per hectare are of poor environmental quality.

6.6.6 **Open Space per Head:** This measures the amount of pervious surface available to an individual. This constitutes the void within each neighbourhood and reflects the available space for air circulation, for recreation and for maintaining urban ecosystem. While this index is as high as 3120 square metres in Bosso Estate, 910 square metres in Sango and 620 square metres in Sauka Kahuta, it is as low

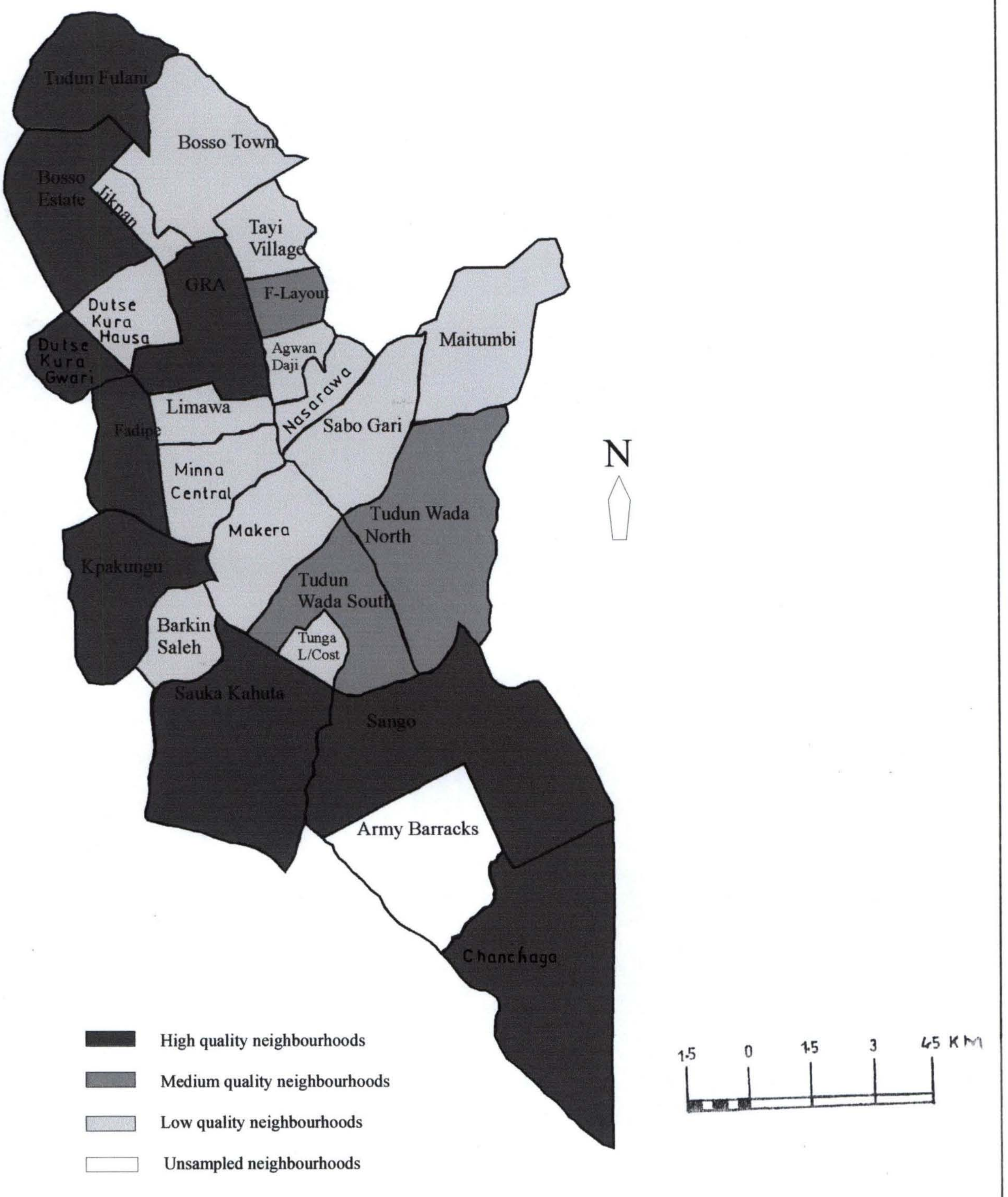


FIGURE 6.11: CLASSIFICATION OF THE NEIGHBOURHOODS BY NET HOUSING DENSITY, 2003

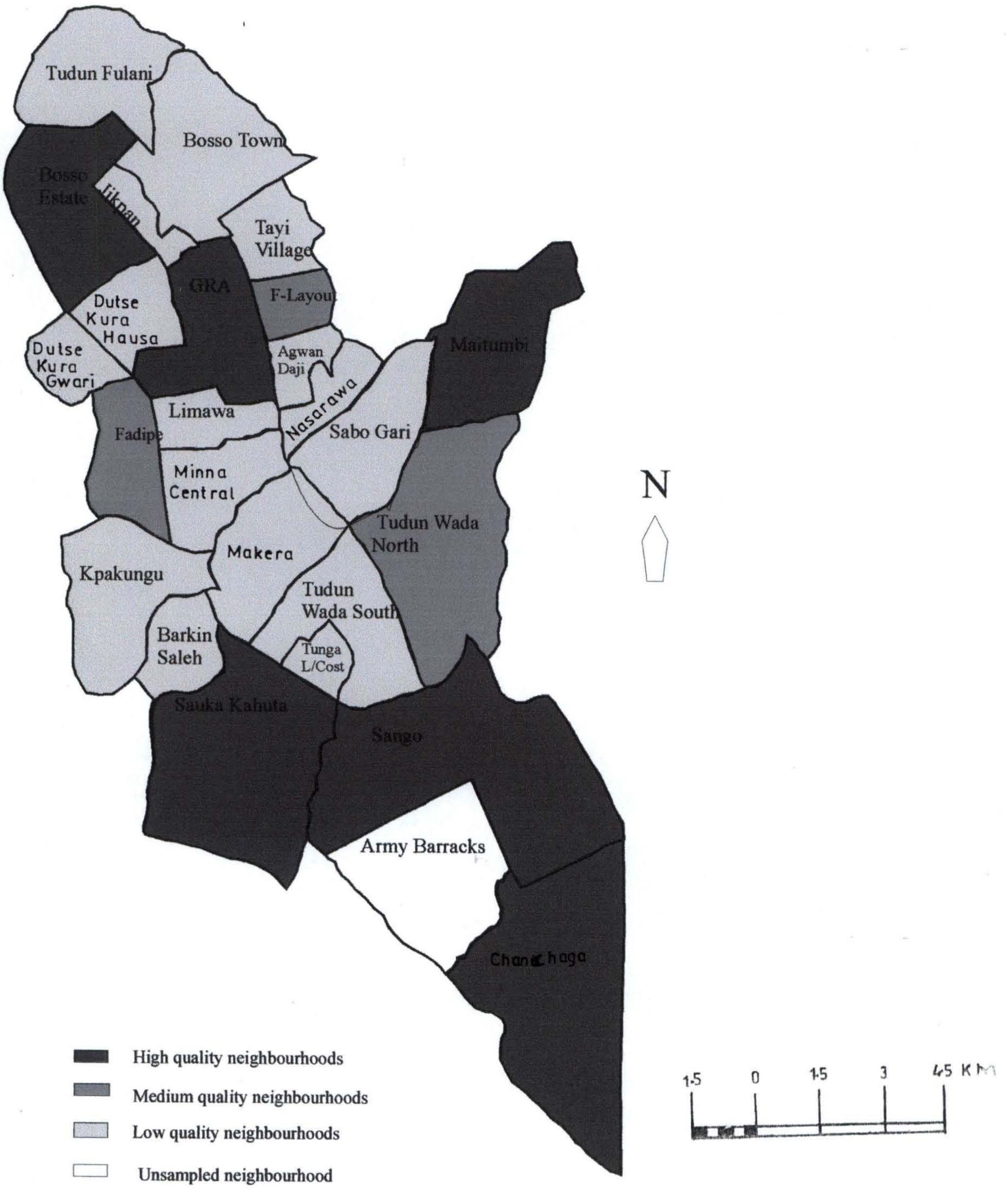


FIGURE 6.12: CLASSIFICATION OF THE NEIGHBOURHOODS BY OPEN SPACE PER HEAD

as 5 square metres in Dutse Kura Gwari and 10 square metres each in Minna Central, Limawa, Nasarawa, Sabo Gari and Tudun Wada South. Figure 6.12 shows that six neighbourhoods are classified as high quality with per head open space of more than 200 square metres; three are classified as medium quality while 16 are classified as poor quality neighbourhoods. While medium quality neighbourhoods have between 100-200 square metres of open space per head, the poor quality neighbourhoods have less than 100 square metres per head each.

6.6.7 Proportion of Open Space. Although the proportion of the open space per neighbourhood is the balance of 100% of the proportion of built up area per neighbourhood, it yields its own utility in assessing quality. Thus, as shown in Figure 6.13, 13 neighbourhoods have open space proportion of less than 20%. These have shown poor quality open space proportion as compared with four neighbourhoods classified as high quality. They have open space proportion of more than 40% each. In between these two groups are eight medium quality neighbourhoods that have between 21-40% of their land area under open space.

6.6.8 Proportional Loss in Open Space. Table 6.8 shows that loss in open space between 1995-2003 in each of the neighbourhoods is high. There is no neighbourhood with less than 10% loss in open space between 1995-2003. Five neighbourhoods lost 90% and above each of their open space to built up activities. Figure. 6.14 shows that nine neighbourhoods are classified as poor quality as a result of the high loss of open space. These neighbourhoods lost more than 75%

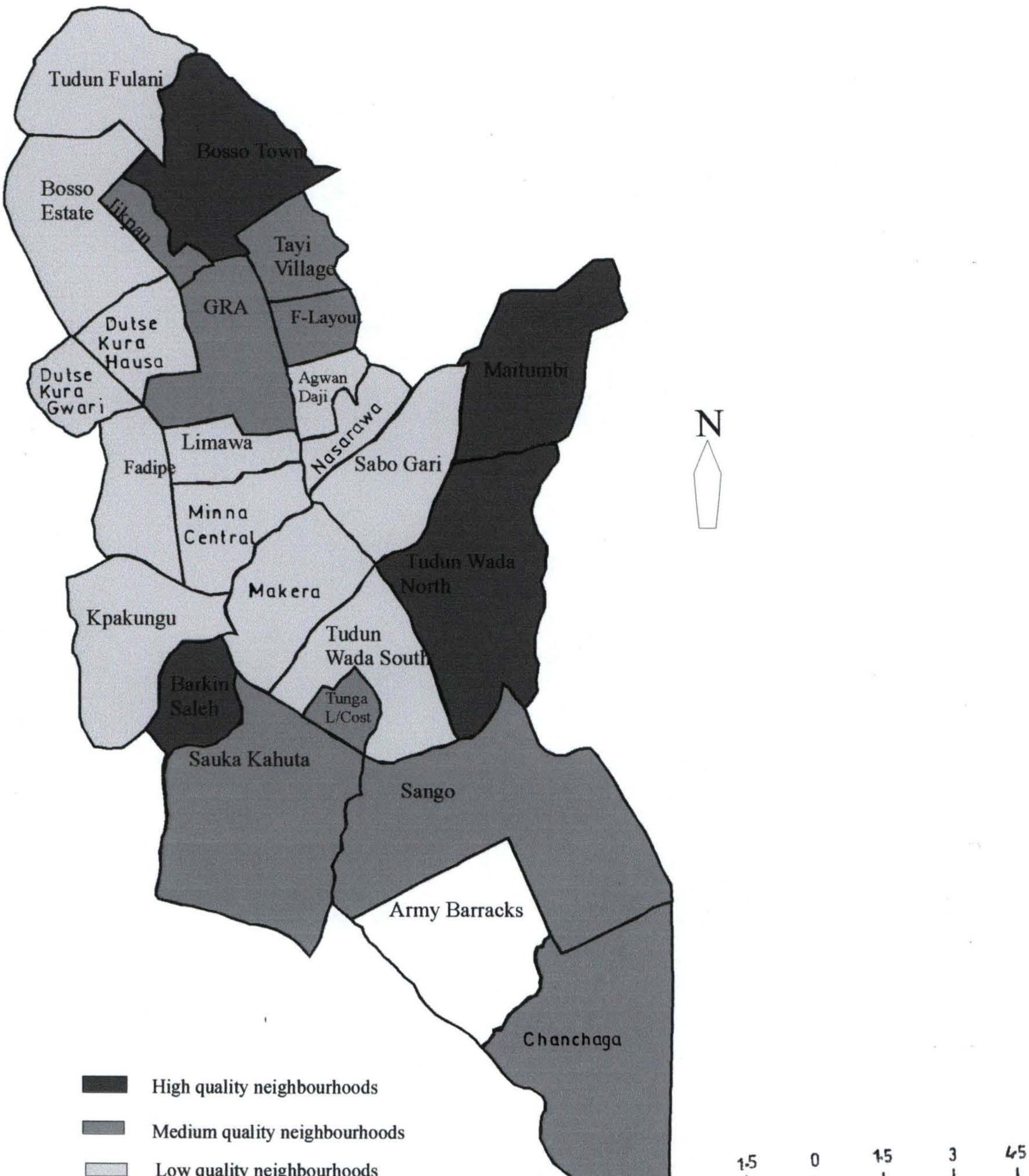


FIGURE 6.13: CLASSIFICATION OF THE NEIGHBOURHOODS BY PROPORTION OF OPEN SPACE, 2003

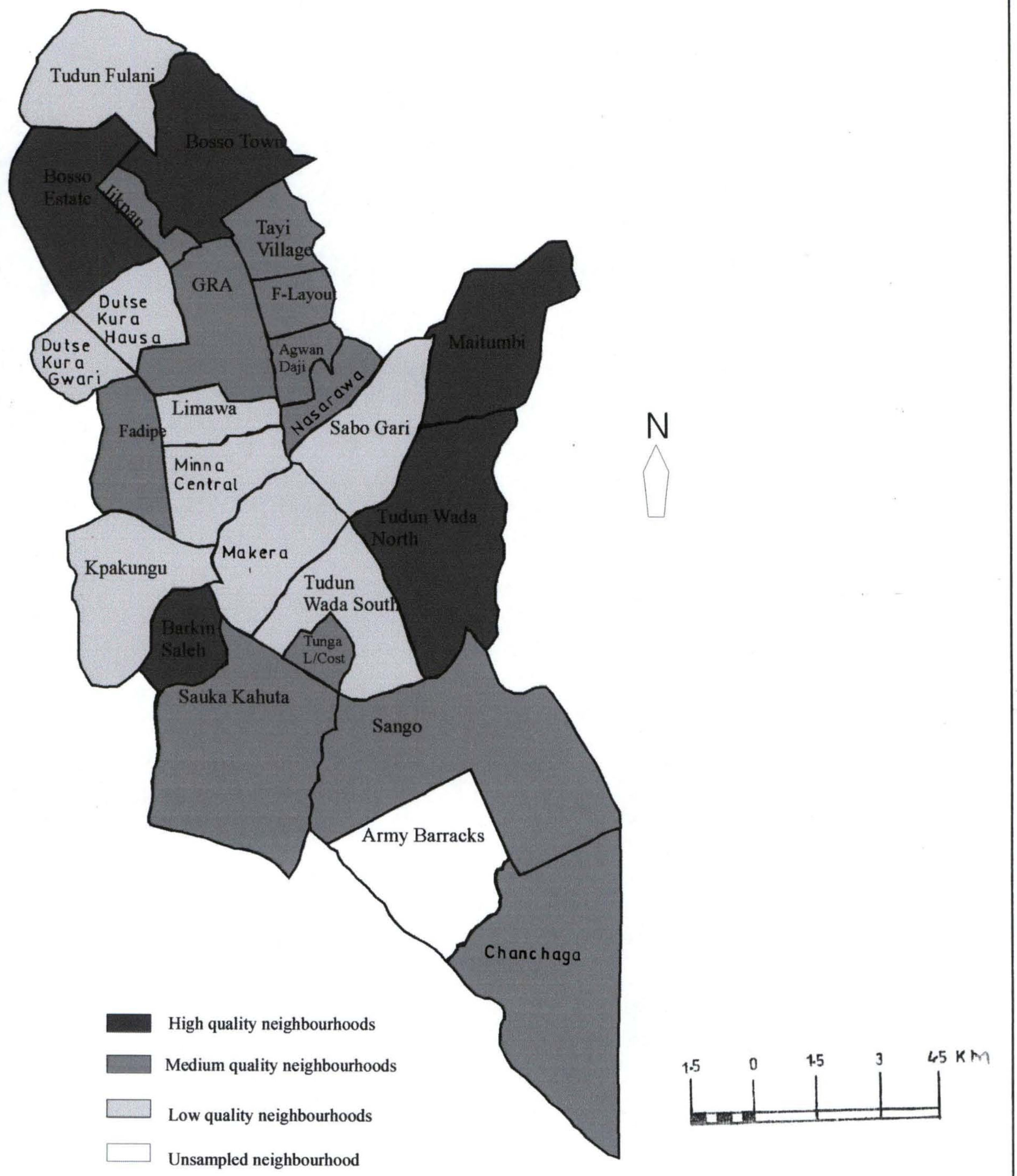


FIGURE 6.14: CLASSIFICATION OF THE NEIGHBOURHOODS BY PROPORTIONAL LOSS IN OPEN SPACE, 2001-2003

of their respective open spaces in 1995 to development activities at the end of 2003. Similarly, 11 others are experiencing medium quality condition in open space loss while only five neighbourhoods are classified as high quality for their relatively low loss of open space. The medium quality neighbourhoods lost between 45-75% of their open spaces while high quality neighbourhoods lost between 15-45% of their open space each to development activities.

6.7 AGGREGATE LEVEL OF NEIGHBOURHOOD QUALITY

Generally, most of the neighbourhoods demonstrate deteriorating conditions on the derived variables of quality. The deteriorating conditions show continuous land use intensification among the neighbourhoods in Minna. This condition has been observed in the core areas of Benin City and Ibadan by Onokerhoraye (Onokerhoraye, 1984). The intensification is also linked to concretization of neighbourhood land area. This clearly increases the impervious surfaces within the neighbourhoods. Increased concretization leads to increased diminution in neighbourhood environmental quality.

In concluding this section, it is important to see the summary of the quality of the neighbourhoods according to the derived variables from the remotely sensed data. Table 6.9 shows this summary. It shows that for all the eight variables, more than 30% of the neighbourhoods fall into poor environmental quality group. It is noted that some neighbourhoods maintain a consistent poor performance on the quality variable measures. To see these neighbourhoods clearly, a ranking of the neighbourhoods based on their class placement in each of the eight indices is undertaken. This is shown in Table 6.10. Environmental quality varies indirectly with ranks. The higher the rank , the lower the quality, and vice versa.

TABLE. 6.9: SUMMARY OF THE CLASSIFICATION OF THE NEIGHBOURHOODS BY THE DERIVED VARIABLES

S/N	Variable	CLASS					
		NUMBER IN EACH GROUP			PERCENTAGE IN EACH GROUP		
		High quality	Medium Quality	Poor quality	High quality	Medium Quality	Poor quality
1	Proportion of built up area	2	1	22	8	4	88
2	Gross population density	8	6	11	32	24	44
3	Net population density	7	2	16	28	8	64
4	Gross housing density	12	5	8	48	20	32
5	Net housing density	9	3	13	36	12	52
6	Open space per head	6	3	16	24	12	64
7	Proportion of open space	3	8	13	12	32	52
8	Proportional loss in open space	4	5	16	16	20	64

Source: Derived from Table 6.8.

The Table shows that four neighbourhoods, Minna Central, Limawa, Nasarawa and Sabo Gari maintain a consistent poor performance in the eight indices. They have average ranking of 3 each. A classification of these neighbourhoods based on average performance is undertaken The three classes of neighbourhoods are high quality ones with average rank of between 1-1.5; medium quality neighbourhoods with average rank of 1.51-2.25 and poor quality neighbourhoods with average rank of between 2.26-3.0.

TABLE 6.10: RANKING OF NEIGHBOURHOODS ACCORDING TO PERFORMANCE ON THE DERIVED VARIABLES

S/N	Neighbourhood	BUA/ TA	GS DE N	NTDE N	GHS DEN	NTHDEN	OS/ HD	OS/T S	%OSL OS	Average Rank
1	Agwan Daji	3	3	3	3	3	3	3	2	2.88
2	Barkin Saleh	1	3	3	3	3	3	1	1	2.25
3	Bosso Estate	3	1	1	1	1	1	3	1	1.50
4	Bosso Town	2	3	3	3	3	3	1	1	2.38
5	Chanchaga	3	1	1	1	1	1	2	2	1.50
6	Dutse Kura Gwari	3	2	3	1	1	3	3	3	2.38
7	Dutse Kura Hausa	3	2	3	2	3	3	3	3	2.75
8	Fadipe	3	1	1	1	1	2	3	3	1.88
9	F-Layout	3	2	3	1	2	2	2	2	2.13
10	Tayi Village	3	3	3	2	3	3	2	3	2.75
11	GRA	3	1	1	1	1	1	2	2	1.50
12	Jikpan	3	3	3	2	3	3	2	3	2.75
13	Minna Central	3	3	3	3	3	3	3	3	3.00
14	Kpakungu	3	1	2	1	1	3	3	3	2.13
15	Limawa A	3	3	3	3	3	3	3	3	3.00
16	Maitumbi	1	3	3	2	3	1	1	1	1.88
17	Makera	3	3	3	2	3	3	3	3	2.88
18	Nasarawa	3	3	3	3	3	3	3	3	3.00
19	Sabo Gari	3	3	3	3	3	3	3	3	3.00
20	Sango	3	1	1	1	1	3	2	3	1.88
21	Sauka Kahuta	3	1	1	1	1	1	2	3	1.63
22	Tudun Fulani	3	1	1	1	1	1	3	3	1.75
23	Tudun Wada North	3	2	3	1	2	3	1	2	2.13
24	Tudun Wada South	3	2	2	1	2	2	3	3	2.25
25	Tunga Low Cost	3	2	3	3	3	3	2	3	2.75

Source: Derived from Table 6.8

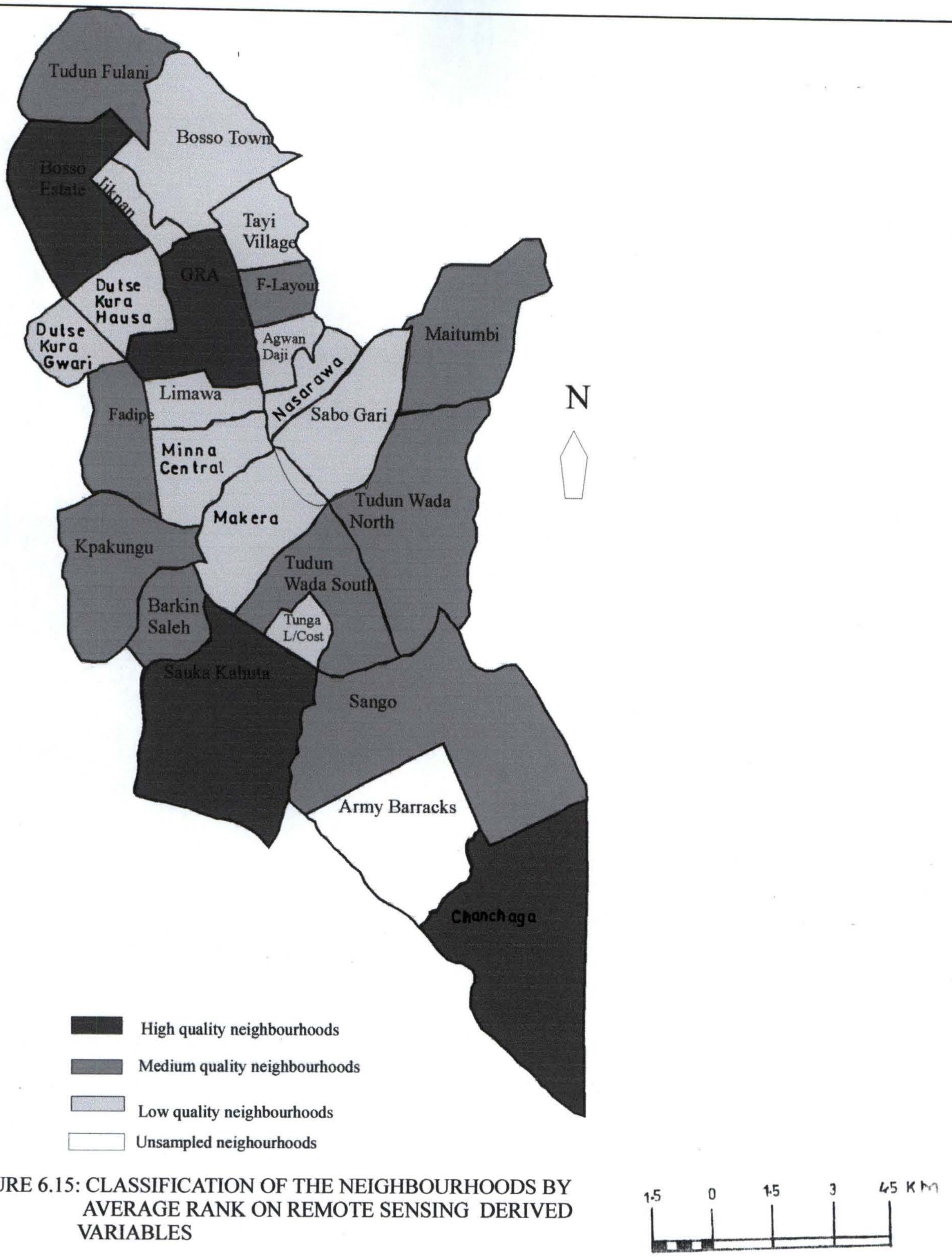


FIGURE 6.15: CLASSIFICATION OF THE NEIGHBOURHOODS BY AVERAGE RANK ON REMOTE SENSING DERIVED VARIABLES

As shown in Figure 6.21, three neighbourhoods qualify as high quality neighbourhoods. These are Bosso Estate, Chanchaga and GRA. While 10 neighbourhoods have medium quality, the remaining 12 are poor quality neighbourhoods. In the medium quality group are Barkin Saleh, Fadipe, F-Layout, Kpakungu, Maitumbi, Sango, Sauka Kahuta, Tudun Fulani, Tudun Wada North and Tudun Wada South. The 12 poor quality neighbourhoods are Agwan Daji, Bosso Town, Dutse Kura Gwari, Dutse Kura Hausa, Tayi Village, Jikpan, Minna Central, Limawa, Nasarawa, Sabo Gari, Makera and Tunga Low Cost.

It is noted that six out of the 12 poor quality neighbourhoods are found in the centre of Minna town. These are Agwan Daji, Minna Central, Limawa, Nasarawa and Sabo Gari and Makera. All the four neighbourhoods with average of 3 score each are also in this group. While the observed deterioration among the neighbourhoods in the centre of the town may conform to some expectation, the good performance of Chanchaga and the poor performance of Tunga Low Cost may also show some deviations from expectation. It is possible that while Chanchaga has the advantage of land area that subdues influence of population, restricted land area magnify the influence of density in the case of Tunga Low Cost.

CHAPTER SEVEN

7.0 MEASUREMENT OF NEIGBOURHOOD ENVIRONMENTAL QUALITY AND ANALYSIS OF RELATIONSHIPS

7.1 INTRODUCTION

In the last two chapters, attempts have been made to present the status of both the economic and environmental poverty. The discussions have also shown the profile or the characteristics of the poor; yielding along the line classes of the neighbourhoods according to level of deterioration. However, it is important to show the scale of environmental poverty being experienced by the people either through lack of environmental amenities directly within their houses or indirectly through the housing and neighbourhood environment. The argument is that it is not enough to say that the environment is degenerated at a certain percentage but that it is also important to put scale to the existing environmental poverty. In this chapter attempts will be made to measure the observed environmental poverty and classify level of environmental degradation based on a fairly uniform basis. This will yield objective approach to comparison of degradation on one hand and to the comparison of poverty and degradation on the other hand.

7.2 MEASURING ENVIRONMENTAL POVERTY

The traditional way of measuring degradation is the Minimum Standard Approach. However, it is possible to use other methods. These are examined below.

7.2.1 The Minimum Standard Approach:

The measurement of deterioration has always been based on the concept of scoring. That is the indicators of environmental quality are given some scores which reflect the standard of such measures of quality and the direction of scale by the analysts. The scores are found in the work of Rao (1979) and Smith (1979). In Nigeria, the scoring approach was reported to have been first applied by Sule (1980) and has been popularized by Ozo (1987) and later adopted by Caleb (1997) and Fabiyi (1999). Ozo, citing the procedure of Sule based his presentation on the idea of minimum standard. The minimum standard provides a baseline for the scoring of each indicator and often it becomes the reference point for measuring environmental performance. In practice therefore, the total baseline score may not represent minimum standard but a baseline standard beyond which most neighbourhoods may not exceed even at the best of quality. Further, there is also no uniform basis for the baseline score; that is, the minimum score. What is clear is that an expected score line exists for each component of quality for the purpose of examining the existing situation. The score varies directly with the quality of the environment; the higher the score, the closer the neighbourhood to the desired quality and vice versa.

7.2.2 The Depth of Deterioration:

In the analysis of income poverty, analysts have also used the depth of poverty. This. As the depth of poverty is applicable to income poverty, it is also applicable to environmental deterioration. Since the Minimum Standard establishes a kind of quality line, it is possible to find a depth of deterioration. This measures the difference between the observed score and the expected score. It is calculated by using the formula:

$$DEP = \frac{Ees - Oes}{Ees}$$

where DEP is the depth of environmental deterioration; Ees, expected environmental score and Oes, the observed environmental score. Hence, the depth of environmental deterioration is an adaptation of the depth of economic poverty. On one hand, it gives a uniform base for comparison of the outcome of environmental scores and on the other, it gives a mark of the gravity of deterioration. Unlike the minimum score, the higher, the depth of deterioration, the higher the level of environmental deterioration.

7.2.3. Environmental Development Index (EDI)

The introduction and popularization of HDI has not only made the measurement of human welfare easy, it has also made it comparable. It has summarized a lot of things in one single index. One major advantage of HDI is the objective means it has provided in measuring welfare. It provides a generally replicable technique. It is therefore pertinent to see if this technique could be adopted to the measurement of environmental poverty.

As explained in chapter five, the HDI adopts the Linear Scaling Technique (LST) (Osberg and Sharpe, 2003). Details of the estimation of HDI by the LST have already been discussed in chapter five. In addition to the HDI of the UNDP, the Index of Social

Health produced by Human Resources Development of Canada, the Index of Economic Freedom developed by Heritage Institute and Economic Freedom produced by Cato Institute have all used LST (Osberg and Sharpe, 2003). It will not be out of place therefore to adopt this technique to the measurement of environmental welfare.

It will be safer to believe that the so-called Minimum Standard Approach does not establish a minimum base but rather a maximum score or base line score. The baseline score is graded to reflect each problem. The scores range from 1.0 to 3.0. Although the baseline score approach is subjective, it has provided a useful tool for measuring environmental quality. The DEP is graded in percentage and is derived from the environmental scores. On the other hand, the EDI is developed to adopt all features of LST with a maximum of 1 and a minimum of zero. Where the indicator is an objective material to be possessed by all, the minimum will always be zero. Also, where the indicator is a negative material not desirable for anybody, the minimum will also be zero. The LST gradation will also be adopted. In this case; 0-0.5 will be qualified as deprived/poor quality neighbourhood, 0.51-0.8; medium quality neighbourhood and 0.81-1.0; high quality neighbourhood. This gradation has been adopted to fit into high income, medium income and poor countries defined by the UNDP through the HDI.

7.3 SPATIAL VARIATIONS IN ENVIRONMENTAL DEVELOPMENT INDEX

The EDI is applied to both field data and remote sensing data. The first will be referred to as EDI field while the second will be called EDI remote sensing.

7.3.1 EDI FIELD.

In order to examine poverty measurements in Minna in relation to the data directly collected from the field, the six broad indicators of environmental poverty; household-based indicators, housing conditions, drainage and sanitation, neighbourhood environmental quality, visible environmental problems and community services are examined in relation to the 25 neighbourhoods.

7.3.1.1 Household-Based EDI

Three variables are examined to measure environmental poverty as available within households in the study area. These are housing facilities, housing space and solid waste. There are eight indicators of housing facilities, five indicators of housing space and one indicator of sanitation used in the calculation of the EDI for the three major variables. These indicators for the respective variables are:

(a) Housing facilities and

(b) Housing space.

7.3.1.1.1 Housing Facilities:

The indices of housing facilities considered are

1. proportion of households who have toilet (toilet);.
2. proportion of households who use water closet (WC users);
3. proportion of households who have bathroom (Brm);.
4. proportion of households who have kitchen (kitchen);
5. proportion of households who have tap water within their dwelling units (tap within);
6. proportion of households who have access to tap water (access to tap);.
7. proportion of households who share housing facilities (shared facilities);
8. proportion of households who are connected to electricity (electricity);

7.3.1.1.2 Housing Space:

The indices of housing space considered are

1. possession of sitting room by households (SRM);
2. availability of open space within the house (OS);
3. spill-over population (SOPOP);
4. the use of sitting room as bedroom (SRBR) and
5. rooms with cross ventilation (CV).

Details of the EDI calculated for each of these indicators are shown in Appendixes 7 and 8. The aggregate value for each of the three variables are shown in Table 7.1.With respect to housing facilities, full EDI value of 1.00 is obtained by the GRA, followed by Bosso Estate with 0.991 and F-layout with 0.945.

With respect to housing space, the GRA has highest score. Its EDI stands at 0.942. The lowest value of 0.210 is obtained by Kpakungu. The worst performance by the neighbourhoods is in respect of solid waste. Ten neighbourhoods have 0.00 EDI each. Both the GRA and F-Layout have high values of 0.970 and 0.830 respectively.

Grouping of the neighbourhoods by the EDI scale is shown in Table 7.2 while details of the neighbourhoods in each EDI group are shown in Figures 7.1 and 7.2. With respect to housing facilities, the Table shows that while 17 neighbourhoods are deprived, eight are good **(Figure 7.1).** No neighbourhood is seriously deprived. The general impression therefore is that the neighbourhoods fare well on the EDI scale in respect of the possession of facilities within homes. The eight neighbourhoods that perform exceptional are Bosso Estate, F-Layout, Tayi Village, GRA, Makera, Tudun Wada North, Tudun Wada South and Tunga Low Cost. They all have aggregate EDI on housing facilities of between 0.81-1.0. In term of housing space, the Table shows that three of the neighbourhoods are seriously deprived, 11 each are deprived and good. These correspond to poor, medium quality and high quality neighbourhoods respectively.

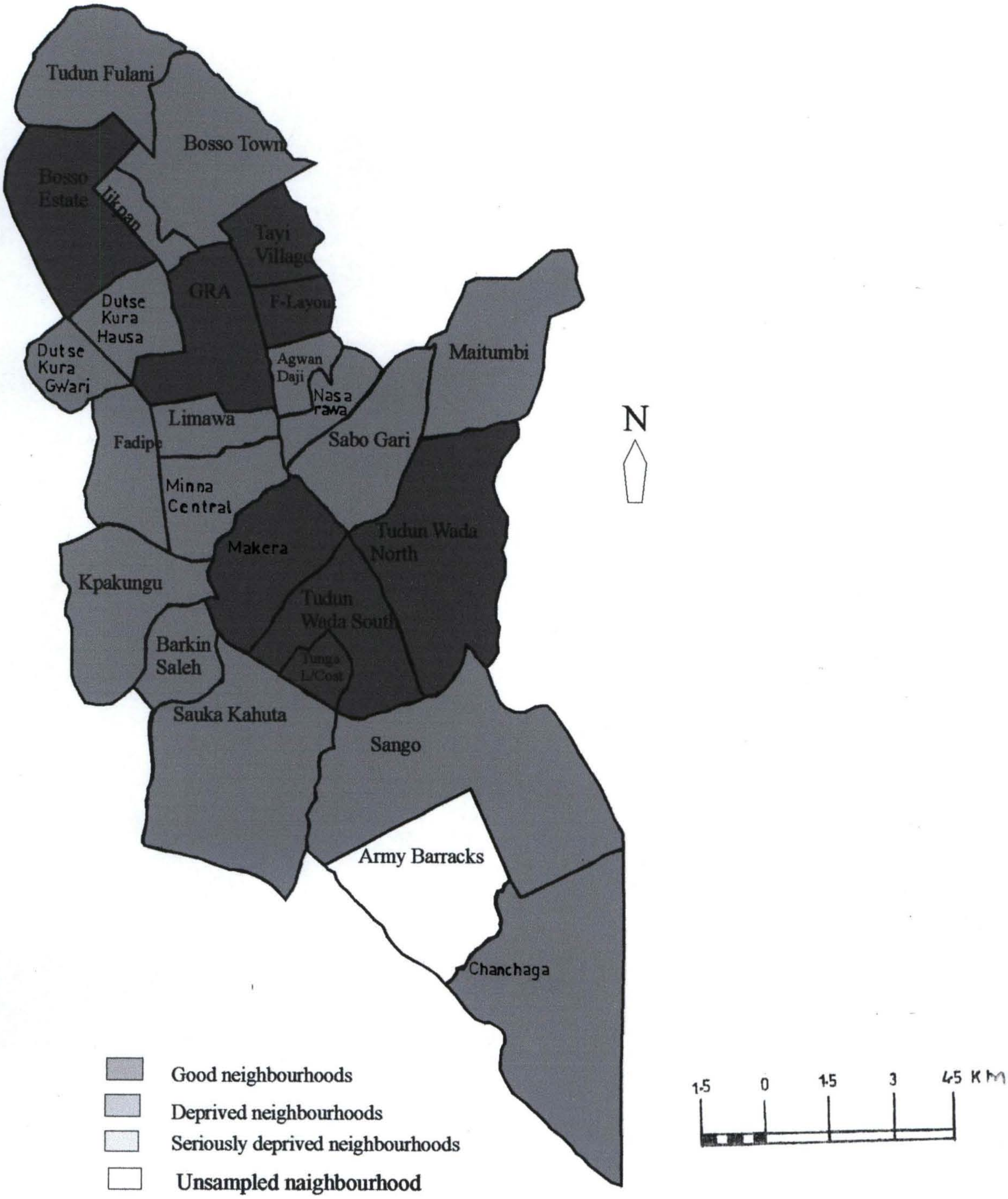


FIGURE 7.1 CLASSIFICATION OF THE NEIGHBOURHOODS BY EDI ON HOUSING FACILITIES:

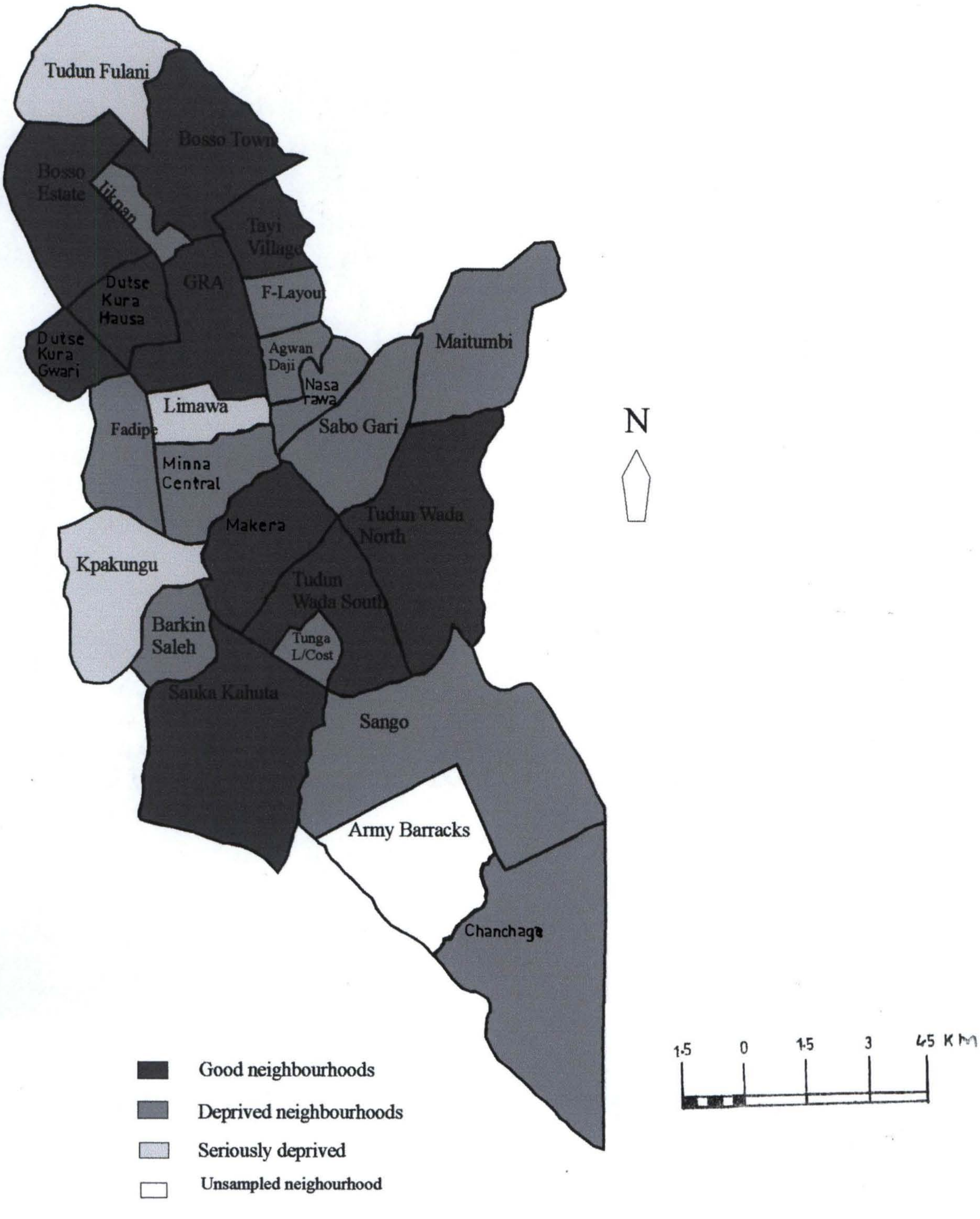


FIGURE 7.2: CLASSIFICATION OF THE NEIGHBOURHOODS BY EDI ON HOUSING ADEQUACY/SPACE

TABLE 7.1. : HOUSEHOLD-BASED INDICATORS OF DEPRIVATION ; SUB- AGGREGATE EDI

S/N	Neighbourhood	Sub aggregate EDI Housing facilities	Housing Adequacy/Space	Solid waste
1	Agwan Daji	0.741	0.786	0.120
2	Barkin Saleh	0.671	0.770	0.000
3	Bosso Estate	0.991	0.822	0.900
4	Bosso Town	0.800	0.834	0.000
5	Chanchaga	0.759	0.648	0.080
6	Dutse Kura Gwari	0.693	0.848	0.120
7	Dutse Kura Hausa	0.691	0.846	0.590
8	Fadipe	0.670	0.752	0.070
9	F-Layout	0.945	0.946	0.830
10	Tayi Village	0.845	0.822	0.000
11	GRA	0.998	0.942	0.970
12	Jikpan	0.646	0.656	0.000
13	Minna Central	0.699	0.764	0.120
14	Kpakungu	0.659	0.210	0.000
15	Limawa A	0.716	0.408	0.250
16	Maitumbi	0.675	0.708	0.010
17	Makera	0.910	0.828	0.030
18	Nasarawa	0.778	0.798	0.000
19	Sabo Gari	0.729	0.700	0.000
20	Sango	0.675	0.722	0.260
21	Sauka Kahuta	0.645	0.844	0.000
22	Tudun Fulani	0.713	0.354	0.000
23	Tudun Wada North	0.839	0.814	0.030
24	Tudun Wada South	0.904	0.808	0.070
25	Tunga Low Cost	1.000	0.774	0.000

Source: Calculated from Appendix 7, Appendix 8 and Table 5.10.

TABLE 7.2 : SUMMARY GROUPING OF THE NEIGHBOURHOODS ACCORDING TO SUB-AGGREGATE EDI ON HOUSING

S/N	Variable	EDI RANGE AND GROUP		
		0.00-0.40 Seriously deprived	0.41-0.80 Deprived	0.81-.1.00 Good
1	Housing facility	0	17	8
2	Housing adequacy/space	3	11	11
3	Solid waste	21	1	3

Source: Derived from Table 7.1.

Only one index is considered for the measurement of environmental quality in relation to solid waste. This covers the proportion for households who dispose waste poorly. That is, households who dispose of waste by themselves or depend on cart pushers. This index summarises all unsanitary waste disposal methods by the households.

The EDI performance of the neighbourhoods on solid waste is found to be generally poor; 10 neighbourhoods have 0.0 EDI each while five others have EDI of less than 0.1 (Table 7.1). In general, 21 neighbourhoods (84%) have between 0.0-0.5 EDI (Figure 7.3). These are poor quality neighbourhoods. One neighbourhood with EDI of between 0.51-0.8 is of medium environmental quality while three neighbourhoods that have between 0.81-1.0 EDI are high quality neighbourhoods. The high quality neighbourhoods are Bosso Estate, F-Layout and GRA.

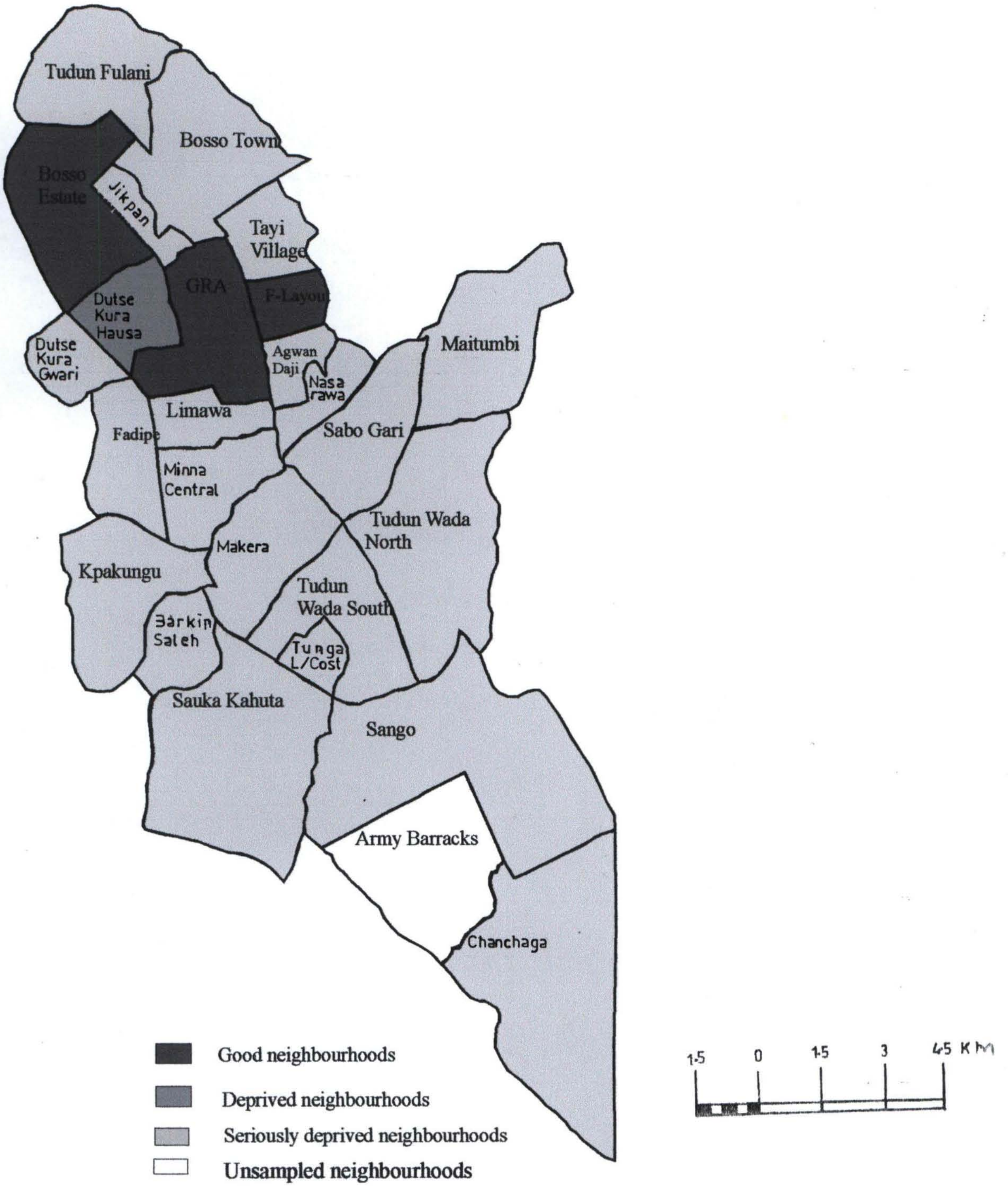


FIGURE 7.3: CLASSIFICATION OF THE NEIGHBOURHOODS BY EDI ON SOLID WASTE

7.3.1.1.3. Household-Based Indicators of Environmental Quality/Deprivation: Aggregate EDI

In order to see the general picture of deprivation and deterioration that exist among households, it is important to bring the average performance of the neighbourhoods together and derive one common EDI which may be a general reference point. This aggregate is shown Table 7.3.

TABLE 7.3. : HOUSEHOLD-BASED INDICATORS OF DEPRIVATION; AGGREGATE EDI

S/N	Neighbourhood	Aggregate EDI (%)	S/N	Neighbourhood	Aggregate EDI (%)
1	Agwan Daji	0.549	14	Kpakungu	0.289
2	Barkin Saleh	0.480	15	Limawa A	0.458
3	Bosso Estate	0.904	16	Maitumbi	0.464
4	Bosso Town	0.545	17	Makera	0.589
5	Chanchaga	0.496	18	Nasarawa	0.525
6	Dutse Kura Gwari	0.554	19	Sabo Gari	0.476
7	Dutse Kura Hausa	0.709	20	Sango	0.552
8	Fadipe	0.497	21	Sauka Kahuta	0.496
9	F-Layout	0.907	22	Tudun Fulani	0.356
10	Tayi Village	0.556	23	Tudun Wada North	0.561
11	GRA	0.970	24	Tudun Wada South	0.594
12	Jikpan	0.434	25	Tunga Low Cost	0.591
13	Minna Central	0.528			

Source: Derived from Table 6.1

The aggregate average from the three groups of indicators indicates a relatively even performance of the neighbourhoods in the possession of housing facilities, housing adequacy and housing space and in solid waste disposal. The highest EDI of 0.970 is obtained by the GRA while the least of 0.356 is obtained by Tudun Fulani.

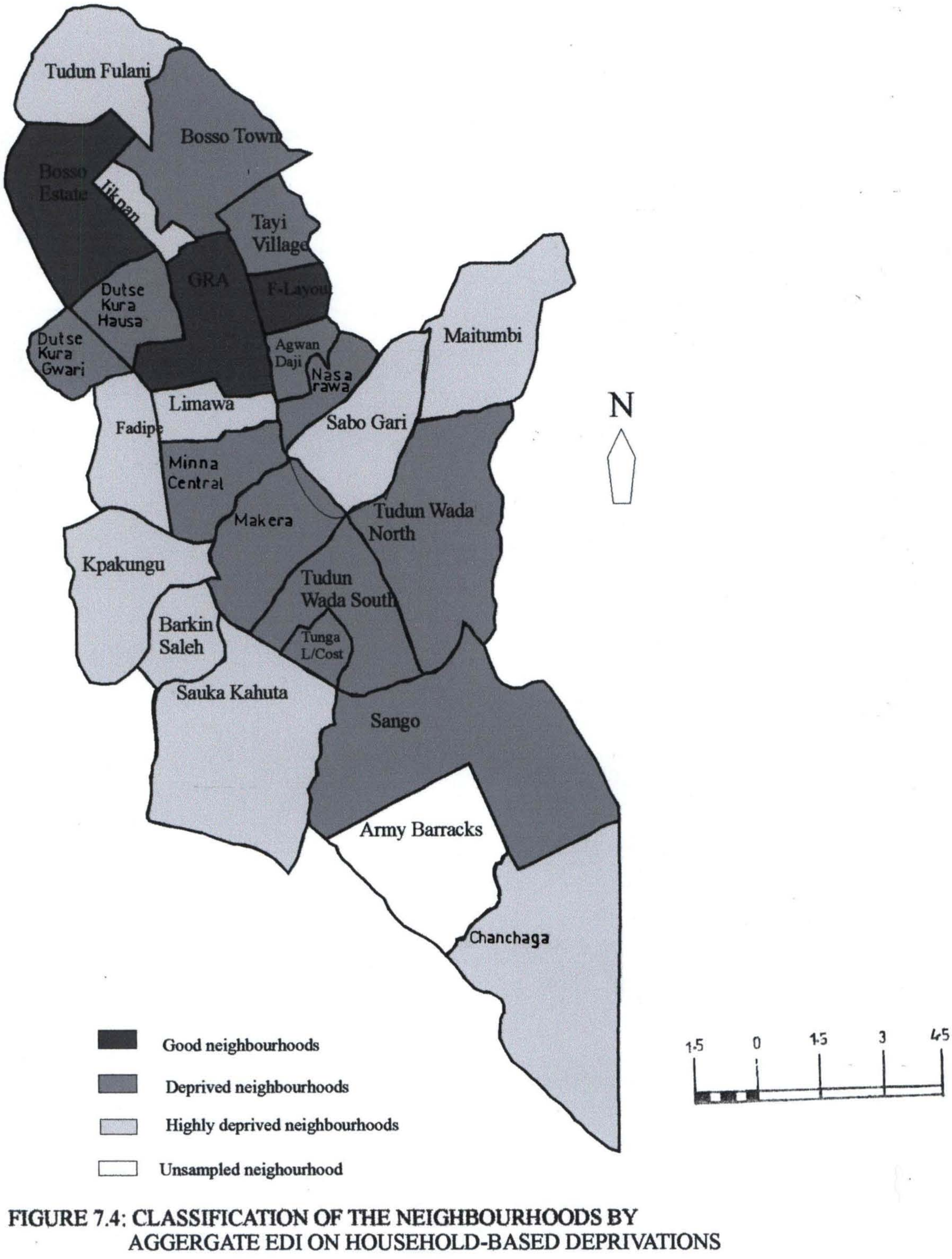


FIGURE 7.4: CLASSIFICATION OF THE NEIGHBOURHOODS BY AGGERGATE EDI ON HOUSEHOLD-BASED DEPRIVATIONS

In general, on the scale of the EDI, 10 neighbourhoods each qualify as seriously deprived (poor quality neighbourhoods), 12 are deprived (medium quality neighbourhoods) respectively. Only three neighbourhoods have aggregate EDI of between 0.81-1.0. These are Bosso Estate, F-Layout and the GRA. These three neighbourhoods are of high quality and are better served with the housing facilities and environmental amenities in question. The distribution of the neighbourhoods into the three EDI classes according to the aggregate value is shown in Figure 7.4.

7.3.1.2. HOUSING CONDITIONS

With respect to housing conditions, Table 7.4 reveals the performance of each neighbourhood on the EDI scale. The indices of housing conditions considered are:

1. houses with access roads (A)
2. houses facing good roads (GR);
3. houses with intact walls (IW);
4. houses with intact roofs (IR);
5. houses with intact windows (IWD);
6. houses with intact doors (ID);
7. houses with intact floor (IF) and
8. houses with intact foundation (IFD).

For accessibility to residential buildings, while ten neighbourhoods have the maximum EDI of 1.0; one neighbourhood, Barkin Saleh has only 0.170. Two neighbourhoods, GRA and Tunga Low Cost maintain a constant EDI of 1.0 each for all the eight variables while

Agwan Daji maintains EDI of 1.0 for four variables, intact windows, intact doors, intact roofs and intact foundations.

TABLE 7.4: ENVIRONMENTAL DEVELOPMENT INDEX: HOUSING CONDITIONS BY NEIGHBOURHOODS

S/N	Neighbourhoods	A	GR	IW	IR	IWD	ID	IF	IFD	Aggregate EDI
1	Agwan Daji	1.000	0.870	0.910	1.000	1.000	1.000	1.000	1.000	0.973
2	Barkin Saleh	0.170	0.330	0.200	0.200	0.230	0.700	0.200	0.230	0.283
3	Bosso Estate	1.000	1.000	0.970	0.970	1.000	0.970	0.930	1.000	0.980
4	Bosso Town	0.840	0.510	0.410	0.690	0.460	0.740	0.370	0.350	0.546
5	Chanchaga	1.000	0.900	0.860	0.470	0.890	0.830	0.810	0.920	0.835
6	Dutse Kura Gwari	0.500	0.240	0.480	0.420	0.480	0.420	0.420	0.280	0.406
7	Dutse Kura Hausa	1.000	0.740	0.670	0.560	0.970	0.970	0.770	0.840	0.815
8	Fadipe	1.000	0.000	0.700	0.600	0.900	0.700	0.430	0.130	0.558
9	F-Layout	1.000	1.000	0.670	0.630	0.770	0.900	1.000	1.000	0.871
10	Tayi Village	0.760	0.560	0.920	0.680	0.920	0.920	1.000	0.920	0.835
11	GRA	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
12	Jikpan-Hayan Gwari	0.520	0.160	0.440	0.420	0.600	0.700	0.540	0.520	0.488
13	Minna Central	0.870	0.440	0.510	0.180	0.590	0.640	0.390	0.490	0.514
14	Kpakungu	0.400	0.300	0.380	0:390	0.510	0.440	0.400	0.440	0.408
15	Limawa A	0.800	0.860	0.270	0.390	0.790	0.830	0.600	0.570	0.639
16	Maitumbi	0.890	0.380	0.530	0.200	0.940	0.950	0.620	0.880	0.674
17	Makera	0.680	0.000	0.260	0.000	1.000	0.940	0.730	0.660	0.534
18	Nasarawa	1.000	0.870	0.550	0.490	0.680	0.930	0.430	0.720	0.709
19	Sabo Gari	0.890	0.540	0.320	0.280	0.620	0.690	0.320	0.470	0.516
20	Sango	0.460	0.420	0.280	0.300	0.760	0.720	0.280	0.700	0.490
21	Sauka Kahuta	0.280	0.580	0.280	0.300	0.340	0.220	0.300	0.360	0.333
22	Tudun Fulani	0.880	0.620	0.640	0.380	0.880	0.880	0.240	0.480	0.625
23	Tudun Wada North	1.000	0.870	0.610	0.550	0.550	0.700	0.420	0.390	0.636
24	Tudun Wada South	1.000	0.680	0.670	0.680	1.000	1.000	0.830	0.730	0.823
25	Tunga Low Cost	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Source: Derived from Appendix 5

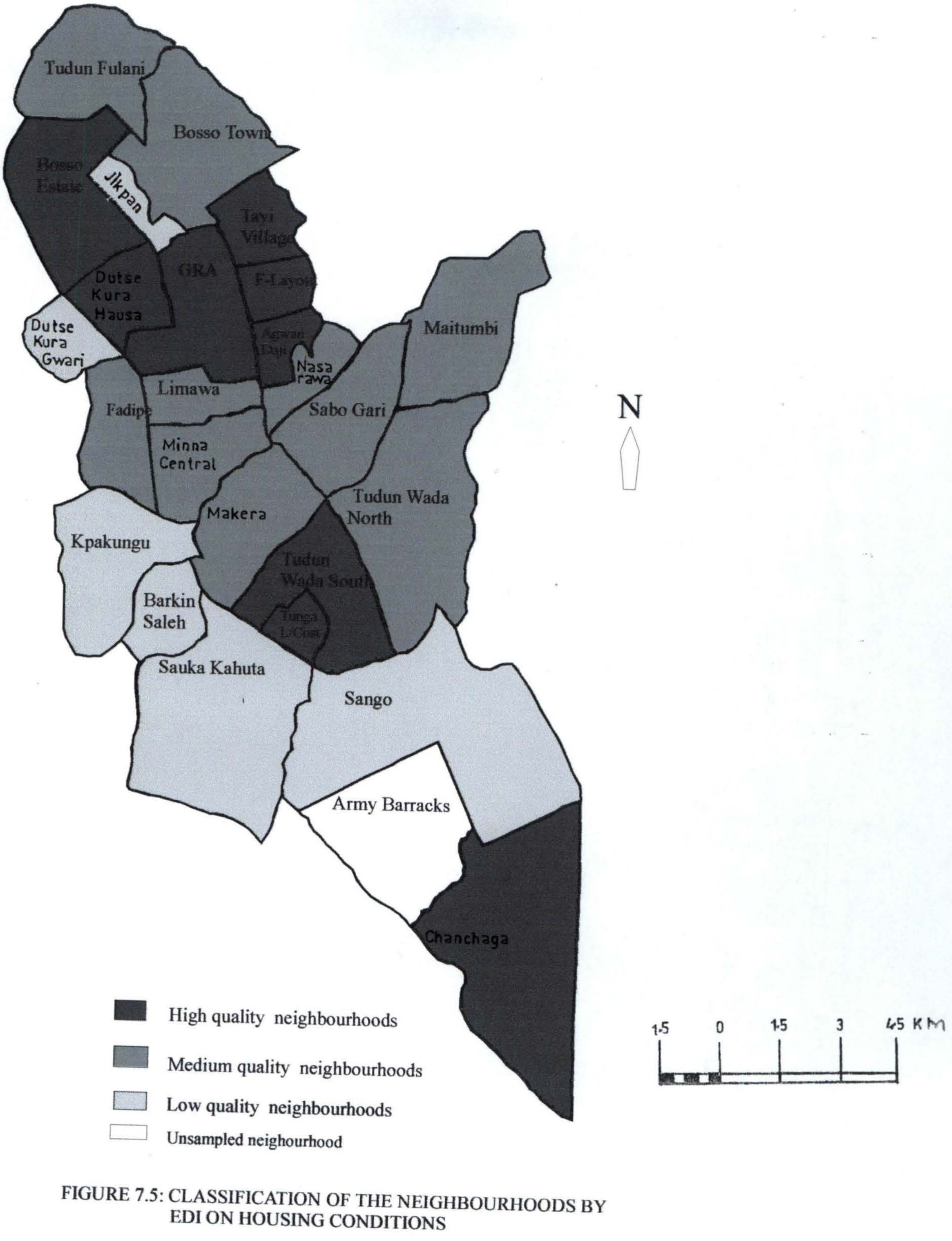


FIGURE 7.5: CLASSIFICATION OF THE NEIGHBOURHOODS BY EDI ON HOUSING CONDITIONS

The last column of Table 7.4 shows the aggregate average EDI for the eight variables for each of the neighbourhoods.

As shown in the Table, Tunga Low Cost maintains a maximum of 1.00 EDI. It is closely followed by Bosso Estate and Agwan Daji which have EDI for housing conditions of 0.980 and 0.973 respectively. The EDI classification arising from this distribution is shown in Figure 7.5.

As shown in the Figure, six neighbourhoods (24%) have aggregate EDI of between 0-0.5; 10 (40%) have between 0.51-0.80 while nine (36%) have between 0.81-1.0. That is, by the housing conditions, six neighbourhoods are of poor quality, 10 are of medium quality while nine are of high quality. The poor quality neighbourhoods are Barkin Saleh, Dutse Kura Gwari, Jikpan, Sango and Sauka Kahuta. The medium quality are Bosso Town, Fadipe, Minna Central, Limawa, Maitumbi, Makera, Nasarawa, Sabo Gari, Tudun Fulani and Tudun Wada North while the high quality ones are Agwan Daji, Bosso Estate, Chanchaga, Dutse Kura Hausa, F-Layout, Tayi Village, GRA, Tudun Wada South and Tunga Low Cost.

7.3.1.3 DRAINAGE AND SANITATION

Four variables are considered for drainage and sanitation. These are

1. Houses with drainage (HD);
2. Free drainage (FD);
3. Well disposed sewage (WDS) and
4. Well disposed waste water (WDW).

Table 7.5 shows the EDI for each neighbourhood in relation to the four variables.

TABLE 7.5: ENVIRONMENTAL DEVELOPMENT INDEX: DRAINAGE AND SANITATION BY NEIGHBOURHOODS

S/N	Neighbourhoods	HD	FD	WDS	WDW	Aggregate EDI
1	Agwan Daji	0.430	0.800	0.450	0.790	0.618
2	Barkin Saleh	0.000	0.000	0.270	0.000	0.068
3	Bosso Estate	0.970	1.000	1.000	1.000	0.998
4	Bosso Town	0.350	0.450	0.580	0.270	0.413
5	Chanchaga	0.500	0.540	0.850	0.140	0.508
6	Dutse Kura Gwari	0.000	0.000	0.520	0.100	0.155
7	Dutse Kura Hausa	0.630	0.430	0.530	0.330	0.480
8	Fadipe	0.000	0.000	0.870	0.300	0.293
9	F-Layout	0.930	0.830	0.970	0.970	0.925
10	Tayi Village	0.160	0.840	0.480	0.200	0.420
11	GRA	0.760	0.970	1.000	0.600	0.833
12	Jikpan-	0.240	0.330	0.940	0.200	0.428
13	Minna Central	0.000	0.110	0.640	0.110	0.215
14	Kpakungu	0.660	0.620	0.440	0.100	0.455
15	Limawa A	0.530	0.260	0.370	0.370	0.383
16	Maitumbi	0.500	0.520	0.690	0.530	0.560
17	Makera	0.870	0.130	0.740	0.500	0.560
18	Nasarawa	0.730	0.530	0.790	0.430	0.620
19	Sabo Gari	0.490	0.210	0.250	0.900	0.463
20	Sango	0.400	0.960	0.880	0.000	0.560
21	Sauka Kahuta	0.660	0.540	0.020	0.740	0.490
22	Tudun Fulani	0.380	0.620	0.880	0.000	0.470
23	Tudun Wada North	0.550	0.830	0.150	0.790	0.580
24	Tudun Wada South	0.630	0.370	0.870	0.370	0.560
25	Tunga Low Cost	1.000	0.940	1.000	1.000	0.985

Based on Data in Appendix 10.

Two neighbourhoods, Barkin Saleh and Fadipe perform very poorly. For three out of the four variables, Barkin Saleh has 0.0 while Fadipe has EDI of 0.0 in two. On the contrary, two other neighbourhoods, Bosso Estate and Tunga Low Cost also perform well on the

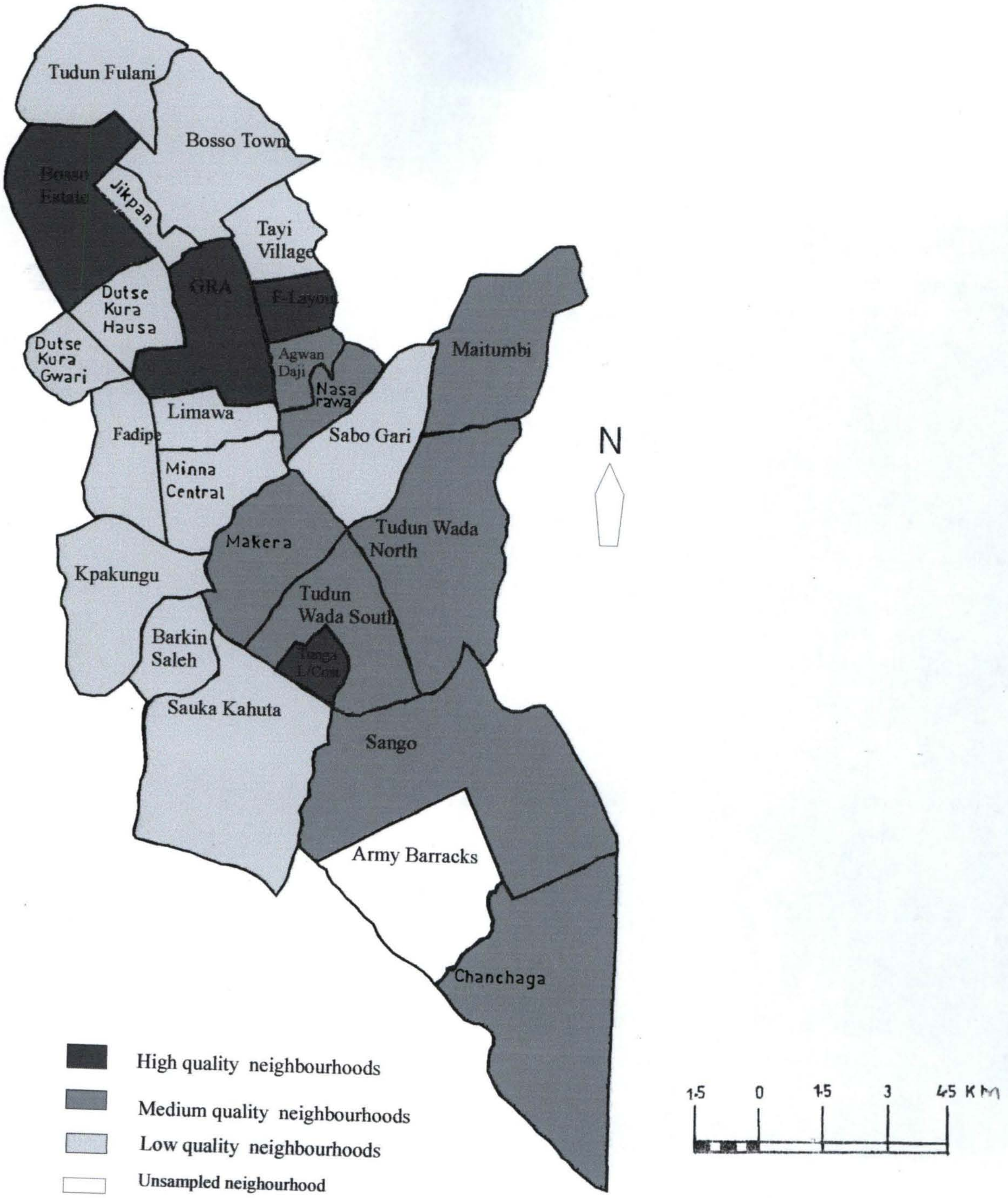


FIGURE 7.6: CLASSIFICATION OF THE NEIGHBOURHOODS BY EDI ON DRAINAGE AND SANITATION

EDI scale. In three of the four variables the two neighbourhoods have 1.0 each. On the average level, most of the neighbourhoods fall into the poor group.

As shown in Figure 7.6, 13 neighbourhoods have EDI on drainage and sanitation scale of between 0-0.5 (poor quality neighbourhoods); eight have between 0.51-0.8 (medium quality neighbourhoods) while four have between 0.81-1.0 (high quality neighbourhoods). In the first category are Barkin Saleh, Bosso Town, Dutse Kura Gwari, Dutse Kura Hausa, Fadipe, Tayi Village, Jikpan, Minna Central, Kpakungu, Limawa, Sabo Gari, Sauka Kahuta and Tudun Fulani. The medium quality neighbourhoods are Agwan Daji, Chanchaga, Maitumbi, Makera, Nasarawa, Sango, Tudun Wada North and Tudun Wada South. On the other hand, high quality neighbourhoods are Bosso Estate, F-Layout, GRA and Tunga Low Cost. As found in the case of housing conditions, most of the neighbourhoods have low EDI for drainage and sanitation.

7.3.1.4 VISIBLE ENVIRONMENTAL PROBLEMS

The third component of environmental development for consideration is visible environmental problems. Table 7.6 shows the EDI of each neighbourhood on this component. Ten neighbourhoods each has 0.0 while on the contrary, three have the maximum EDI of 1.0. A further breakdown shows that 16 of the neighbourhoods have between 0-0.50, five have between 0.51-0.8 while four have between 0.81-1.0 These represent the poor quality, medium quality and high quality neighbourhoods respectively (Figure 7.7). The four neighbourhoods that demonstrate low environmental problems by

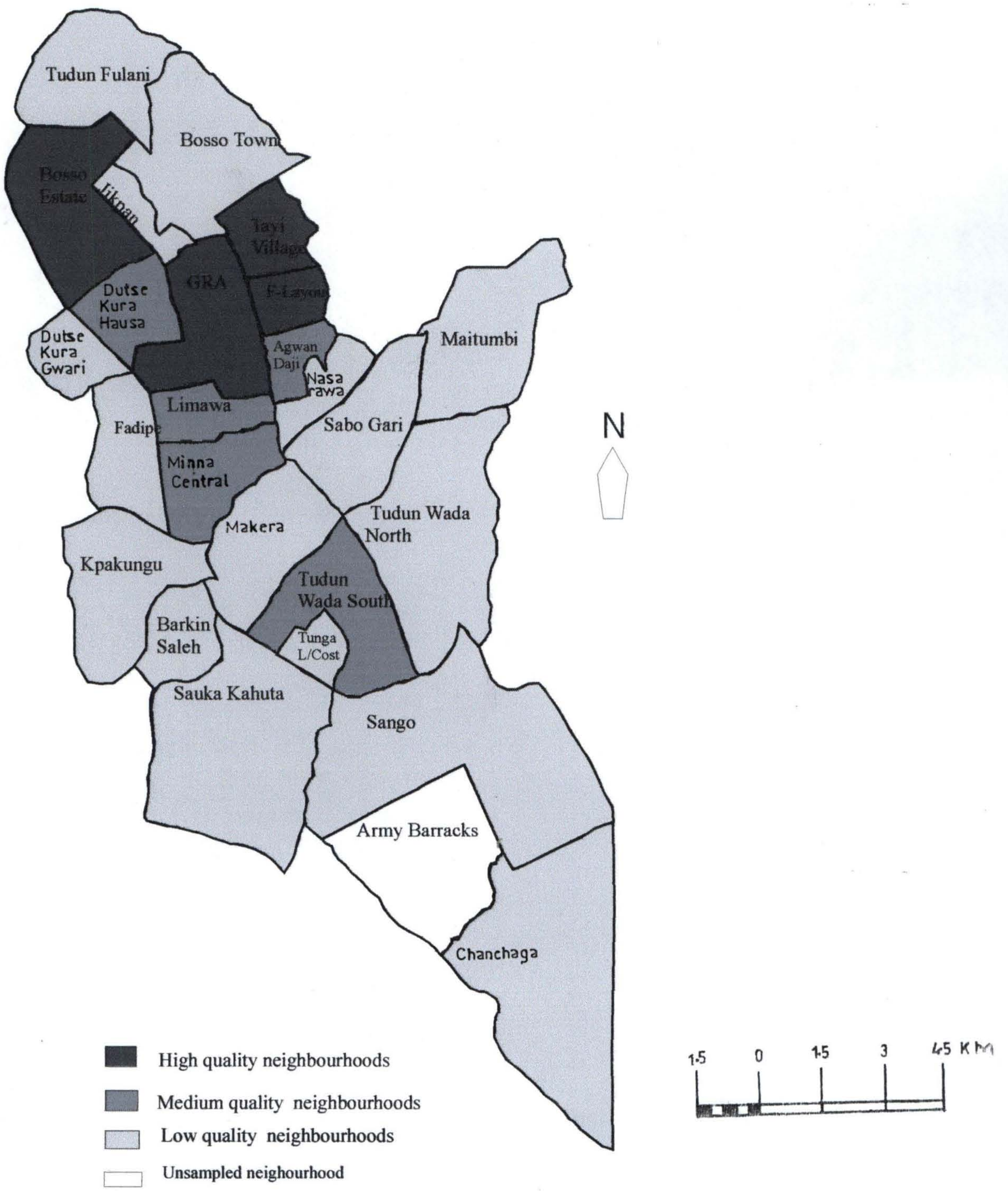


FIGURE 7.7: CLASSIFICATION OF THE NEIGHBOURHOODS BY EDI ON VISIBLE ENVIRONMENTAL PROBLEMS

their EDI performance are Bosso Estate, F-Layout, Tayi Village and GRA. As shown in the Table, they all have EDI of between 0.81-1.0.

TABLE 7.6: NVIRONMENTAL DEVELOPMENT INDEX: VISIBLE ENVIRONMENTAL PROBLEMS BY NEIGHBOURHOODS

S/N	Neighbourhoods	Visible Environmental problems	S/N	Neighbourhoods	Visible Environmental problems
1	Agwan Daji	.0600	14	Kpakungu	0.010
2	Barkin Saleh	0.000	15	Limawa	0.740
3	Bosso Estate	0.900	16	Maitumbi	0.000
4	Bosso Town	0.000	17	Makera	0.000
5	Chanchaga	0.110	18	Nasarawa	0.130
6	Dutse Kura Gwari	0.000	19	Sabo Gari	0.100
7	Dutse Kura Hausa	0.610	20	Sango	0.000
8	Fadipe	0.030	21	Sauka Kahuta	0.000
9	F-Layout	1.000	22	Tudun Fulani	0.000
10	Tayi Village	0.960	23	Tudun Wada North	0.000
11	GRA	1.000	24	Tudun Wada South	0.520
12	Jikpan-Hayan Gwari	0.000	25	Tunga Low Cost	0.000
13	Minna Central	0.560			

Source: Based on data in Appendix 10 (last column)

7.3.1.5. NEIGHBOURHOOD ENVIRONMENTAL QUALITY:

There are nine indices used in the calculation of EDI for the environmental quality of the neighbourhoods. These, as shown in Table 7.7, are

1. unkempt vacant plots (UVP);
2. refuse dumps along the streets (RDAS);
3. floodable areas (FA);

TABLE 7.7: EDI ON ENVIROMENTAL QUALITY BY NEIGHBOURHOOD

S/N	Neighbourhoods	UVP	RDAS	FA	ES	GMIH	URD	SOS	DLW	DRD	Aggregate EDI
1	Agwan Daji	0.420	0.230	1.000	1.000	1.000	0.810	0.230	0.230	0.150	0.563
2	Barkin Saleh	0.810	0.000	0.000	0.000	0.000	0.000	0.280	0.760	0.090	0.216
3	Bosso Estate	0.740	0.000	0.810	0.730	0.500	0.390	1.000	0.920	0.920	0.668
4	Bosso Town	0.560	0.230	0.650	0.530	0.770	0.210	0.130	0.400	0.040	0.391
5	Chanchaga	0.080	0.000	0.080	0.080	0.080	0.000	0.250	0.330	0.090	0.110
6	Dutse Kura Gwari	0.170	0.420	0.750	0.750	0.750	0.580	0.090	0.250	0.000	0.418
7	Dutse Kura Hausa	0.200	0.020	0.900	0.400	0.900	0.300	0.900	0.000	0.300	0.436
8	Fadipe	0.000	0.620	0.500	0.500	0.870	0.620	0.870	0.880	0.000	0.540
9	F-Layout	0.170	0.000	0.330	1.000	0.000	1.000	1.000	0.830	0.340	0.519
10	Tayi Village	0.500	0.170	0.670	0.170	1.000	0.170	0.670	0.500	0.000	0.428
11	GRA	0.120	0.060	0.870	0.870	0.750	0.370	1.000	1.000	0.370	0.601
12	Jikpan-Hayan Gwari	0.140	0.000	0.570	0.570	0.570	0.000	0.180	0.290	0.000	0.258
13	Minna Central	0.670	0.460	0.570	0.490	0.560	0.580	0.320	0.520	0.200	0.486
14	Kpakungu	0.330	0.560	0.570	0.410	0.740	0.310	0.360	0.520	0.050	0.428
15	Limawa	0.330	0.900	1.000	1.000	1.000	0.850	0.100	0.450	0.300	0.659
16	Maitumbi	0.470	0.470	0.500	0.430	0.500	0.390	0.290	0.330	0.11	0.388
17	Makera	0.500	0.360	0.860	0.210	0.930	0.570	0.930	0.790	0.530	0.631
18	Nasarawa	1.000	0.760	0.880	0.820	0.940	1.000	1.000	0.770	0.710	0.876
19	Sabo Gari	0.740	0.910	0.740	0.090	0.170	0.560	0.960	0.570	0.170	0.546
20	Sango	0.270	0.070	0.590	0.220	0.330	0.070	0.150	0.260	0.040	0.222
21	Sauka Kahuta	0.000	0.300	0.200	0.200	0.600	0.200	0.600	0.400	0.100	0.289
22	Tudun Fulani	0.640	0.640	0.540	0.000	0.730	0.090	0.000	0.550	0.090	0.364
23	Tudun Wada North	0.480	0.120	0.240	0.280	0.880	0.000	0.180	0.340	0.160	0.298
24	Tudun Wada South	0.390	0.150	0.080	0.230	0.000	0.080	0.000	0.150	0.300	0.153
25	Tunga Low Cost	0.710	0.790	0.860	0.790	0.910	0.730	0.610	0.680	0.050	0.681

Source: Based on data in Appendix 6.

4. erosion spots (ES);
5. grinding machine inside the houses (GMIH);
6. unkempt refuse dumps (URD);
7. sewage on streets (SOS);

8. domestic liquid waste on streets (DLW) and

9. degraded roads (DRD).

Table 7.7 presents the performance of each neighbourhood on EDI with relationship to the nine indices of neighbourhood environmental quality. For all the nine indices there are some neighbourhoods that record as low as 0.0 EDI. For example, for the unkempt vacant plots, Sauka Kahuta has 0.0; for the refuse dumps along the streets. Barkin Saleh, Bosso Estate and Jikpan have EDI of 0.00 each while in the case of sewage disposal, Tudun Wada South has EDI of 0.0.

At the aggregate level, the least EDI is experienced by Chanchaga with EDI of 0.110. It is followed by Tudun Wada South with 0.153 and Barkin Saleh (0.216) and Sango (0.222). The general performance of the neighbourhoods on the EDI scale is shown in Figure 7.8. There are fifteen neighbourhoods that have between 0.0-0.5. That is 60% of the neighbourhoods are of poor quality while nine neighbourhoods with EDI of between 0.51-0.8 are of medium quality. The poor quality neighbourhoods are Barkin Saleh, Bosso Town, Chanchaga, Dutse Kura Gwari, Dutse Kura Hausa, Tayi Village, Jikpan, Minna Central, Kpakungu, Maitumbi, Sango, Sauka Kahuta, Tudun Fulani, Tudun Wada North and Tudun Wada South. Similarly, the medium quality neighbourhoods are Agwan Daji, Bosso Estate, Fadipe, F-Layout, GRA, Limawa, Makera, Sabo Gari and Tunga Low Cost. On the other hand, only Nasarawa with 0.876 qualify as high quality neighbourhood by the incidence of visible environmental problems. Nasarawa's high quality by this index might be due the fact that households might have internalized their

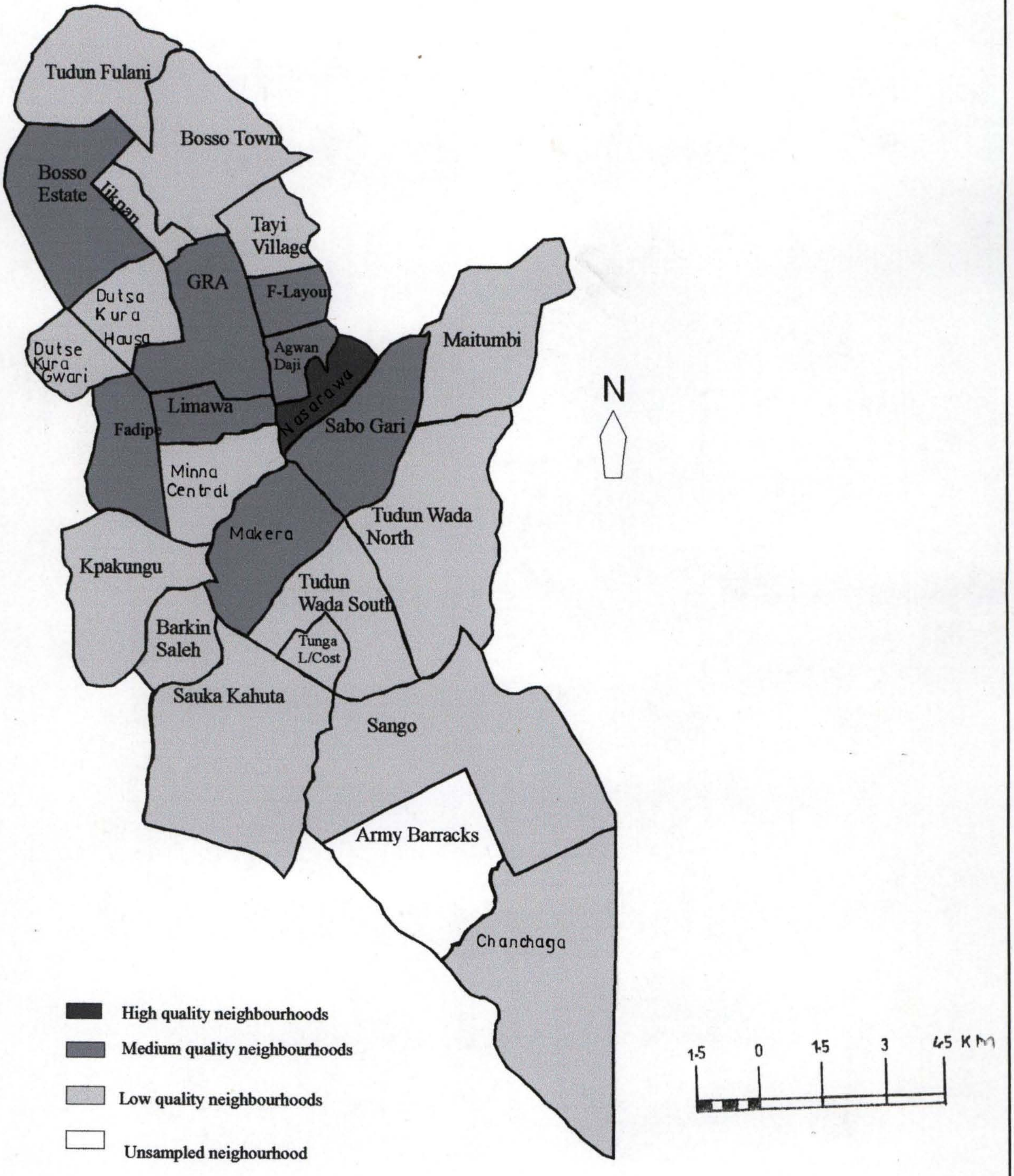


FIGURE 7.8: CLASSIFICATION OF THE NEIGHBOURHOODS BY EDI ENVIRONMENTAL QUALITY

problems. The neighbourhood has tarred roads and is highly built up with no vacant plots that could be abused.

7.3.1.6 PUBLIC SERVICES:

The fifth component of environmental quality deserving measurement is public services. Three types of public services are considered. These are primary school, primary health centre and market. The first two are directly related to human development while market also reflects opportunities for capacity building by the neighbourhood residents. The performance of each neighbourhood on the EDI scale is shown in Table 7.8. For primary schools, 10 neighbourhoods have 0.0 each while six have the maximum score of 1.0 each. In the case of primary health centre, 16 neighbourhoods have 0.00 each while seven have 1.00 each. Similarly, for market, 22 neighbourhoods score 1.00 each while three have 1.00 each.

The neighbourhoods seem to perform quite poorly by this component of environmental development. Deprived neighbourhoods with EDI of between 0-0.50 are dominant in all the three services; 17 neighbourhoods in the case of primary school, 18 in the case of primary health centre and 22 in the case neighbourhood market. In the case of primary school, only Makera shows an improving status with EDI of 0.670. On the other hand, seven good neighbourhoods with EDI of between 0.81-1.0 in case of the primary school, seven for health centre and three for neighbourhood market.

Consideration of the average EDI performance of the neighbourhoods in relation to the three indices will also be important. The last column of Table 7.8 shows the average EDI for public services for each of the neighbourhoods. Seven neighbourhoods have EDI of 0.00 each. In general, 21 of the neighbourhoods with EDI of between 0-0.5 are of poor quality while four with EDI of between 0.51-0.80 each are of medium environmental quality (Figure 7.9). On the other hand, none of the neighbourhoods is of high quality by this index.

TABLE 7.8: ENVIRONMENTAL DEVELOPMENT INDEX: PUBLIC SERVICES BY NEIGHBOURHOODS

S/N	Neighbourhood	EDI per public service per neighbourhood			
		Primary School	Health Centre	Market	Average deficiency
1	Agwan Daji	1.000	1.000	0.000	0.667
2	Barkin Saleh	1.000	0.000	0.000	0.333
3	Bosso Estate	0.000	0.000	0.000	0.000
4	Bosso Town	0.250	1.000	1.000	0.750
5	Chanchaga	0.330	1.000	1.000	0.777
6	Dutse Kura Gwari	1.000	0.000	0.000	0.333
7	Dutse Kura Hausa	0.000	0.000	0.000	0.000
8	Fadipe	0.000	0.000	0.000	0.000
9	F-Layout	0.000	0.000	0.000	0.000
10	Tayi Village	0.000	0.000	0.000	0.000
11	GRA	1.000	1.000	0.000	0.667
12	Jikpan-Hayan Gwari	0.000	0.000	0.000	0.000
13	Minna Central	0.330	1.000	0.000	0.443
14	Kpakungu	0.500	0.000	0.000	0.167
15	Limawa	0.330	0.000	0.000	0.110
16	Maitumbi	0.500	0.000	0.000	0.167
17	Makera	0.670	0.000	0.000	0.223
18	Nasarawa	0.250	0.000	0.000	0.083
19	Sabo Gari	0.000	0.000	1.000	0.333
20	Sango	1.000	0.000	0.000	0.333
21	Sauka Kahuta	1.000	0.000	0.000	0.333
22	Tudun Fulani	1.000	0.000	0.000	0.333
23	Tudun Wada North	0.000	1.000	0.000	0.333
24	Tudun Wada South	0.370	1.000	0.000	0.457
25	Tunga Low Cost	0.000	0.000	0.000	0.000

Source: Based on data in Table 5.18

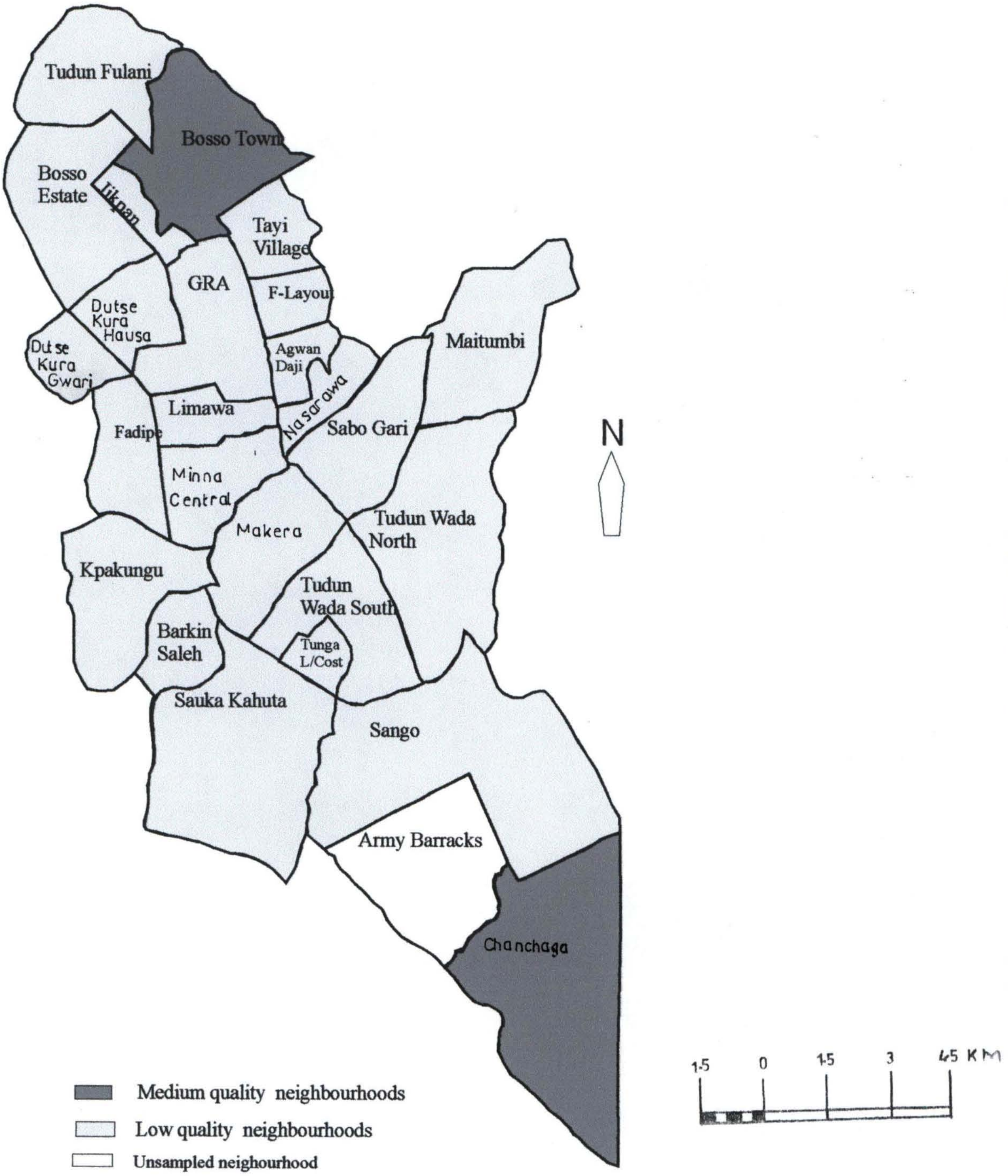


FIGURE 7.9: CLASSIFICATION OF THE NEIGHBOURHOODS BY EDI COMMUNITY FACILITIES

The poor quality neighbourhoods are Barkin Saleh, Bosso Estate, Dutse Kura Gwari, Dutse Kura Hausa, Fadipe, F-Layout, Tayi Village, Jikpan, Limawa, Makera, Minna Central, Kpakungu, Maitumbi, Nasarawa, Sabo Gari, Sango, Sauka Kahuta, Tudun Fulani, Tudun Wada North and Tudun Wada South and. Tunga Low Cost. Similarly, the medium quality neighbourhoods are Agwan Daji, Bosso Town, GRA and Chanchaga.

7.3.1.7. COMPOSITE ENVIRONMENTAL DEVELOPMENT INDEX

As it is done in the case of human development index (HDI), the overall welfare of the environment and the assessment of environmental amenities is portrayed by the use of the aggregate or the composite value of EDI. This is an average of the sum of all EDIs derived for all indices measuring the environmental welfare.

The composite or the aggregate EDI for all the six groups of indicators considered for the examination and analysis of environmental development is shown in the last column of Table 7.9.

The Table shows a generally poor performance of the neighbourhoods on the EDI measurement. The highest EDI of 0.845 is obtained by GRA. That is, GRA is the best in terms of environmental development in the study area. It has the most favourable housing conditions, drainage and sanitation, the least visible environmental problems, has high neighbourhood quality, a fair provision of community facilities and services and a fair availability of household-based facilities and environmental amenities. On the other hand, the least EDI of 0.230 is available in Barkin Saleh. Barkin Saleh, by this shows very poor housing conditions, poor drainage and sanitation facilities, high level of visible environmental problems, poor neighbourhood quality, very low level of community facilities and services and inadequate household-based facilities and environmental amenities

TABLE 7.9: AGGREGATE EDI

S/N	Neighbourhoods	Aggregate EDI						
		Household-Based Deprivation	Housing Condition	Drainage and Sanitation	Visible Environmental problems	Neighbourhood Environmental Quality	Average deficiency in Public Services	Aggregate EDI
1	Agwan Daji	0.549	0.973	0.618	0.600	0.563	0.667	0.662
2	Barkin Saleh	0.480	0.283	0.068	0.000	0.216	0.333	0.230
3	Bosso Estate	0.904	0.980	0.998	0.900	0.668	0.000	0.742
4	Bosso Town	0.545	0.546	0.413	0.000	0.391	0.750	0.441
5	Chanchaga	0.496	0.835	0.508	0.110	0.110	0.777	0.473
6	Dutse Kura Gwari	0.554	0.406	0.155	0.000	0.418	0.333	0.311
7	Dutse Kura Hausa	0.709	0.815	0.480	0.610	0.436	0.000	0.508
8	Fadipe	0.497	0.558	0.293	0.030	0.540	0.000	0.319
9	F-Layout	0.907	0.871	0.925	1.000	0.519	0.000	0.704
10	Tayi-Village	0.556	0.835	0.420	0.960	0.428	0.000	0.533
11	GRA	0.970	1.000	0.833	1.000	0.601	0.667	0.845
12	Jikpan	0.434	0.488	0.428	0.000	0.258	0.000	0.268
13	Minna Central	0.528	0.514	0.215	0.560	0.486	0.443	0.458
14	Kpakungu	0.289	0.408	0.455	0.010	0.428	0.167	0.293
15	Limawa	0.458	0.639	0.383	0.740	0.659	0.110	0.498
16	Maitumbi	0.464	0.674	0.560	0.000	0.388	0.167	0.376
17	Makera	0.589	0.534	0.560	0.000	0.631	0.223	0.423
18	Nasarawa	0.525	0.709	0.620	0.130	0.876	0.083	0.491
19	Sabo Gari	0.476	0.516	0.463	0.100	0.546	0.333	0.406
20	Sango	0.552	0.490	0.560	0.000	0.222	0.333	0.359
21	Sauka Kahuta	0.496	0.333	0.490	0.000	0.289	0.333	0.324
22	Tudun Fulani	0.356	0.625	0.470	0.000	0.364	0.333	0.358
23	Tudun Wada North	0.561	0.636	0.580	0.000	0.298	0.333	0.401
24	Tudun Wada South	0.594	0.823	0.560	0.520	0.153	0.457	0.518
25	Tunga Low Cost	0.591	1.000	0.985	0.000	0.681	0.000	0.543

Source: Aggregate EDIs in Tables 7.3, 7.4, 7.5, 7.6, 7.7 and 7.8

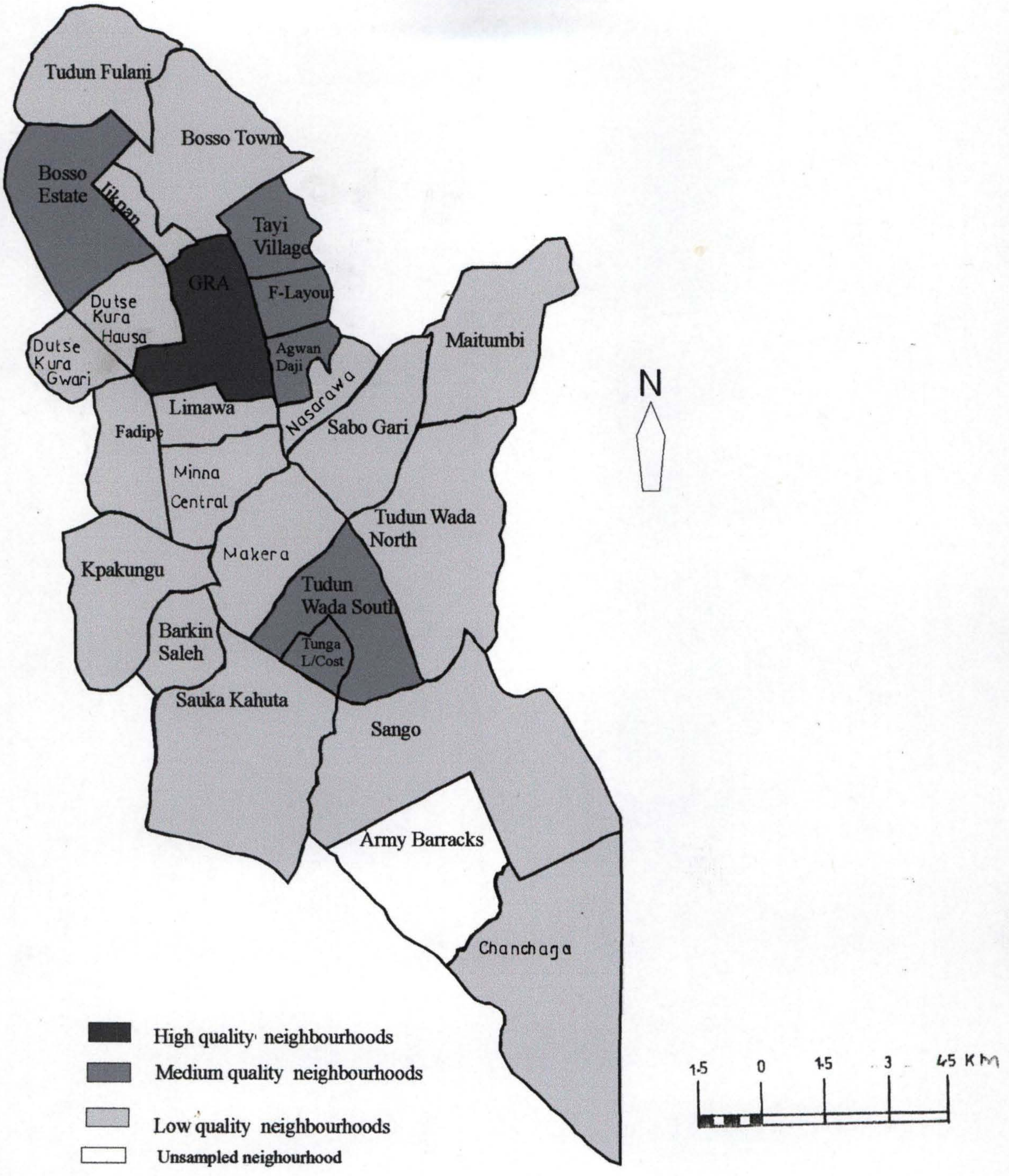


FIGURE7.10: CLASSIFICATION OF THE NEIGHBOURHOODS BY COMPOSITE EDI ON FIELD DATA-BASED ENVIRONMENTAL QUALITY INDICATORS

A classification of the neighbourhoods on the EDI scale by this composite performance is shown in Figure 7.10. The figure shows that only the GRA demonstrates exceptionally high environmental quality and therefore qualifies to belong to high quality neighbourhood. On the other hand, 18 have EDI of between 0.0-0.5 and are therefore, of poor environmental quality. There are six medium quality neighbourhoods whose EDI vary between 0.51-0.8. The picture is that nearly all the neighbourhoods experience one form of deterioration or the other. This demonstrates the type of debilitating environment in which the majority of the urban residents live.

7.3.2 MEASURING ENVIRONMENTAL DEVELOPMENT INDEX FROM REMOTELY SENSED DATA

As it is done in the case of the data collected directly from the field, it is also possible to apply the concept of environmental development index (EDI) to the variables derived from the remote sensing data. In this case, five variables have been chosen for the analysis. These are

1. proportion of built up areas (BUA)
2. net population density (NTPDEN),
3. net housing density (NTHDEN),
4. proportion of open space (OSO) and
5. proportional loss in open space, 1995-2003 (OSLOSS).

TABLE 7.10: ENVIRONMENTAL DEVELOPMENT INDEX AS APPLIED TO DERIVED VARIABLES OF THE REMOTE SENSING DATA

S/N	Neiighbourhood	BUA	NTPDEN	NTHDEN	OSP	OSLOSS	Aggregate EDI
1	Agwan Daji	0.170	0.290	0.160	0.170	0.430	0.244
2	Barkin Saleh	0.730	0.500	0.470	0.730	0.810	0.648
3	Bosso Estate	0.200	0.990	1.000	0.200	0.770	0.632
4	Bosso Town	0.480	0.370	0.470	0.480	0.850	0.530
5	Chanchaga	0.330	0.920	0.940	0.370	0.530	0.618
6	Dutse Kura Gwari	0.030	0.750	0.840	0.030	0.040	0.338
7	Dutse Kura Hausa	0.140	0.690	0.630	0.140	0.160	0.352
8	Fadipe	0.200	0.910	0.890	0.200	0.250	0.490
9	F-Layout	0.380	0.740	0.740	0.380	0.450	0.538
10	Tayi Village	0.340	0.670	0.560	0.340	0.390	0.460
11	GRA	0.370	0.950	0.940	0.330	0.400	0.598
12	Jikpan	0.230	0.530	0.560	0.230	0.300	0.370
13	Minna Central	0.030	0.480	0.370	0.300	0.050	0.248
14	Kpakungu	0.170	0.820	0.840	0.170	0.230	0.446
15	Limawa A	0.160	0.120	0.530	0.160	0.230	0.240
16	Maitumbi	0.670	0.660	0.680	0.670	0.860	0.708
17	Makera	0.150	0.630	0.680	0.150	0.190	0.360
18	Nasarawa	0.100	0.020	0.050	0.100	0.300	0.114
19	Sabo Gari	0.090	0.600	0.470	0.090	0.100	0.270
20	Sango	0.240	0.990	1.000	0.240	0.250	0.544
21	Sauka Kahuta	0.320	0.980	1.000	0.320	0.350	0.594
22	Tudun Fulani	0.080	0.880	0.940	0.080	0.090	0.414
23	Tudun Wada North	0.540	0.700	0.740	0.540	0.600	0.621
24	Tudun Wada South	0.020	0.770	0.790	0.020	0.030	0.326
25	Tunga Low Cost	0.250	0.740	0.380	0.250	0.360	0.396

Source: Derived from Table 6.8

The respective EDI for these variables among the 25 neighbourhoods are shown in Table 7.10. The Table shows that in the case of the built up area proportion, the EDI is as low as_0.020 in Tudun Wada South, 0.030 in Dutse Kura Gwari and 0.090 in Sabo Gari. On the other hand, it is as high as 0.730 in Barkin Saleh and 0.670 in Maitumbi. Based on the

EDI scale, 22 of the neighbourhoods fall into low quality group by having EDI of between 0-0.5; three are of medium quality while none is of high quality (Figure 7.11).

By using the net population density, it is found out that, few neighbourhoods perform poorly; only six of the neighbourhoods have less than 0.5 EDI and so qualify as poor quality neighbourhoods (Figure 7.12). Another 11 of the neighbourhoods have between 0.51-0.8 and so are of medium quality as compared with eight high quality neighbourhoods that have between 0.81-1.0. Similar pattern is also observed in the case of net housing density where seven of the neighbourhoods qualify as poor quality neighbourhoods while nine are of medium quality. Similarly, nine belong to high quality neighbourhood.

TABLE 7.11: SUMMARY OF EDI AMONG THE NEIGHBOURHOODS

Variable	EDI Scales and number of neighbourhoods		
	0.0-0.5 poor quality	0.51-0.80 Medium Quality	0.81-1.00 High Quality
Proportion of built up area	21	3	0
Net population density	6	11	8
Net housing density	7	9	9
Proportion of open space	22	3	0
Proportional loss in open space	19	3	3
Aggregate EDI	15	10	0

Source: Derived from Table 7.10.

The neighbourhoods poor performance on the EDI scale is also observed in the case of proportion of open space and loss of open space. With regard to proportion of open space, 22 neighbourhoods are of poor quality, three are of medium quality and none is of high quality (Figure 7.14). Similarly, with respect to loss of open space, 19 neighbourhoods are of poor quality; three each are of medium quality and another three

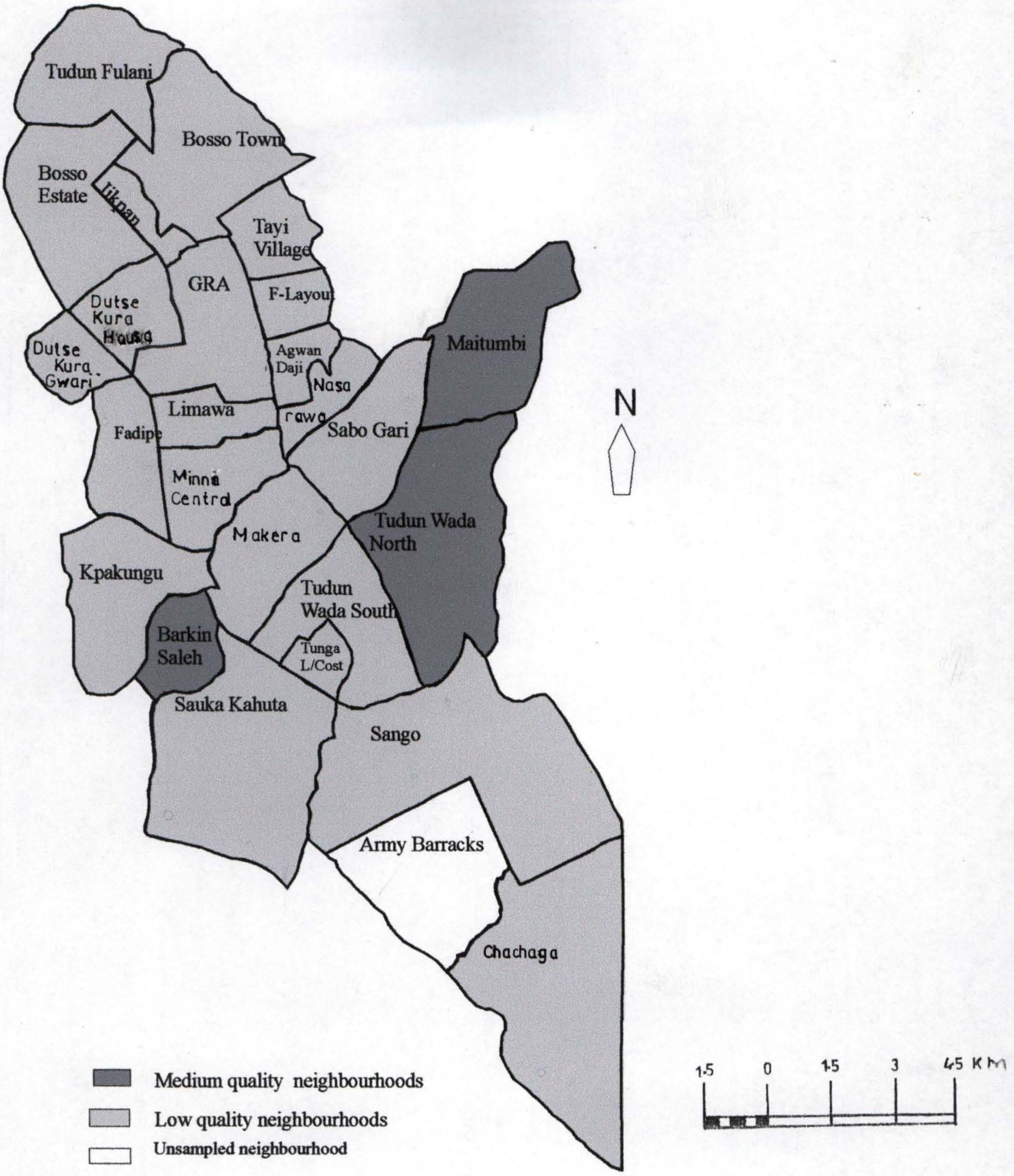


FIGURE 7.11: CLASSIFICATION OFTHE NEIGHBOURHOODS BY REMOTE SENSING DATA: BUILT UP AREA

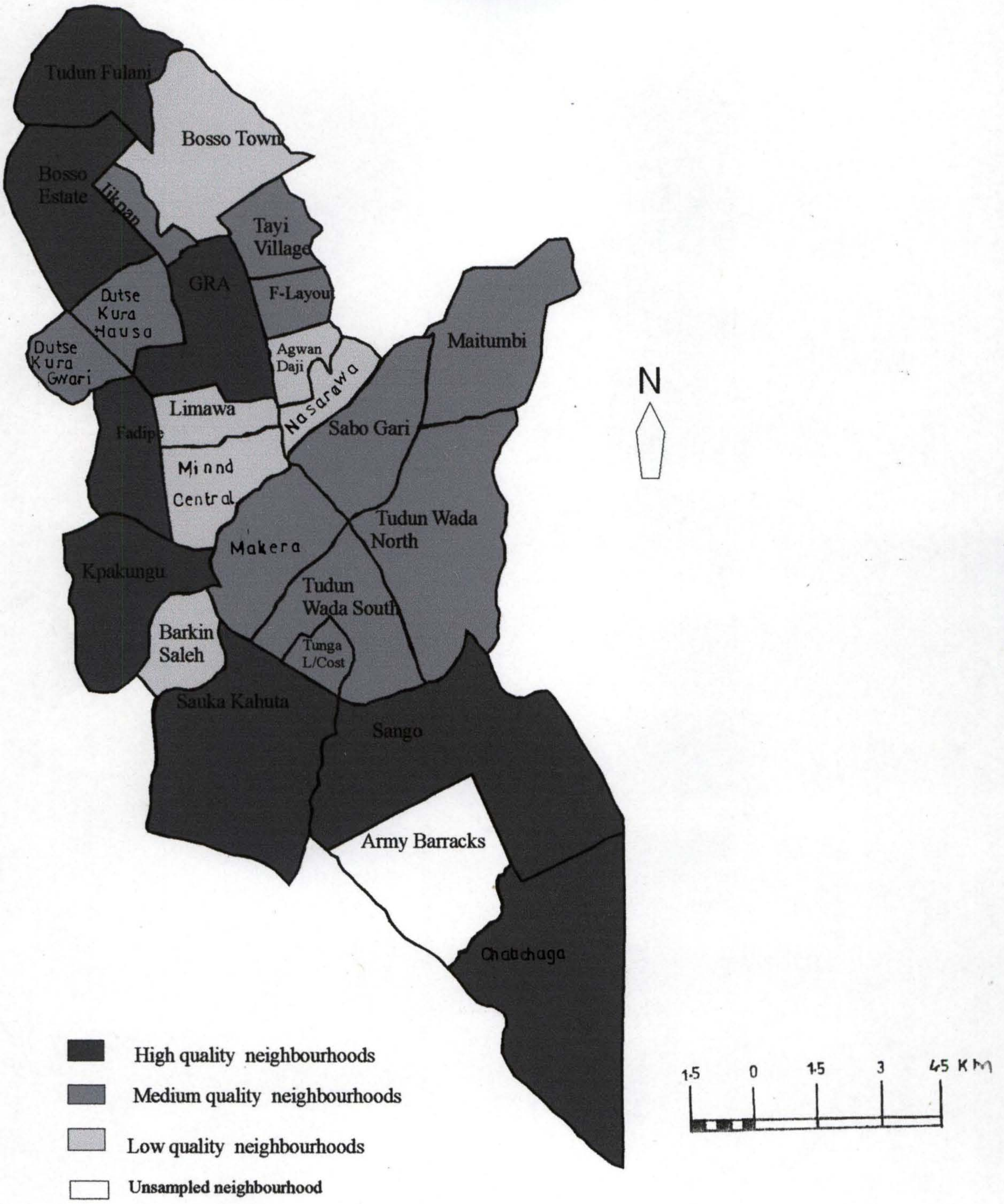


FIGURE 7.12: CLASSIFICATION OF THE NEIGHBOURHOODS BY EDI REMOTE SENSING: NET POPULATION DENSITY

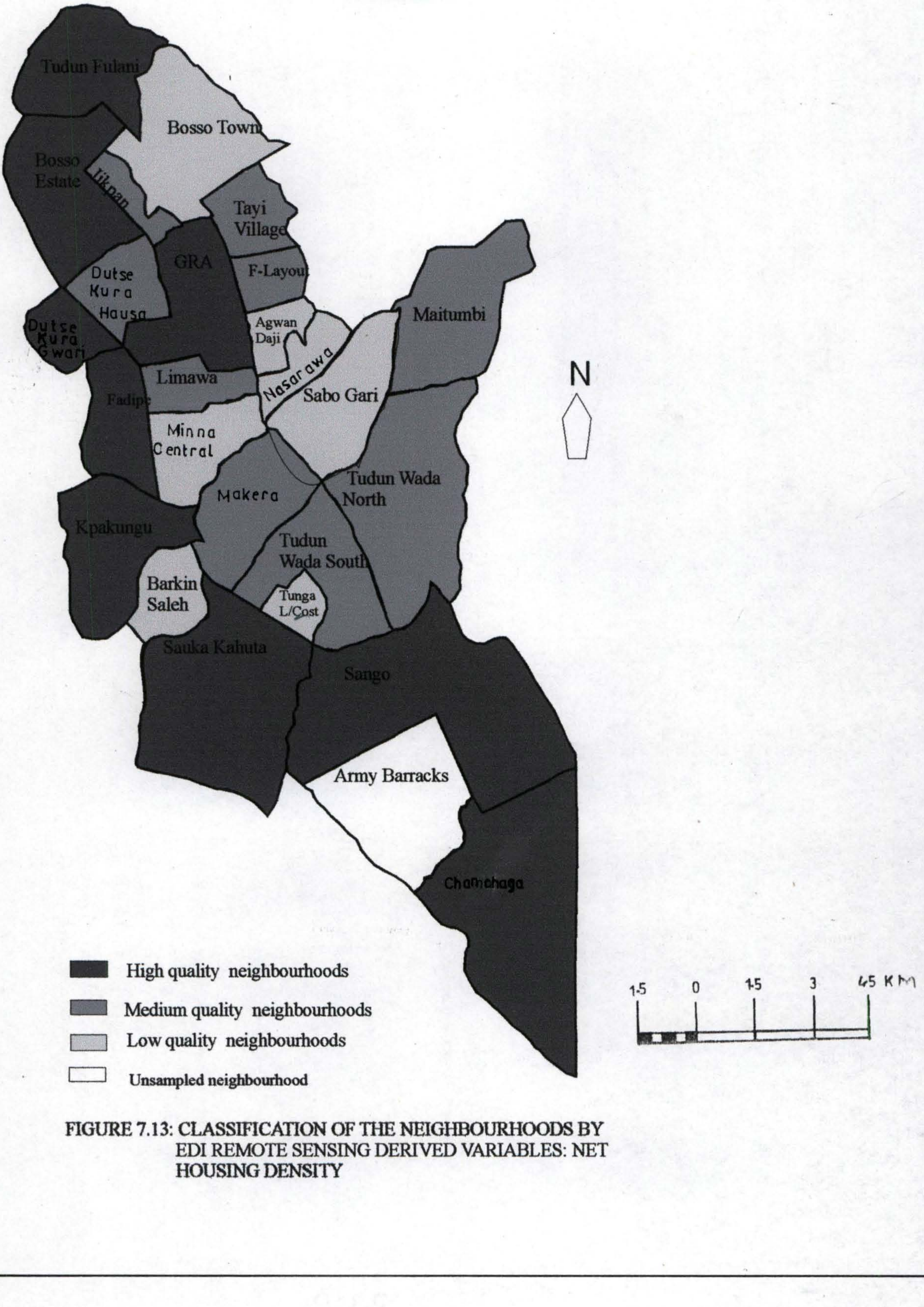


FIGURE 7.13: CLASSIFICATION OF THE NEIGHBOURHOODS BY EDI REMOTE SENSING DERIVED VARIABLES: NET HOUSING DENSITY

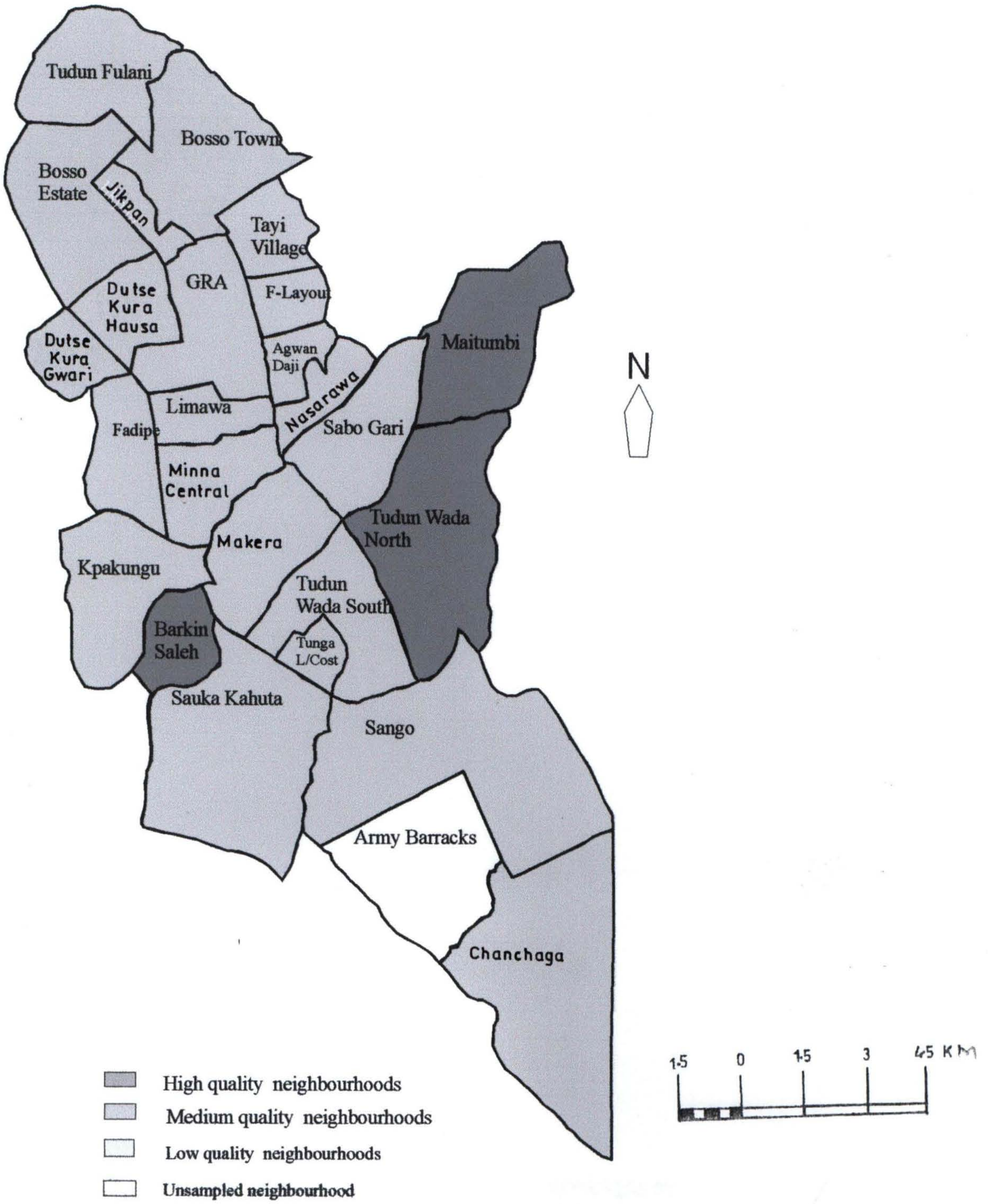


FIGURE 7.14: CLASSIFICATION OF THE NEIGHBOURHOODS BY EDI REMOTE SENSING DERIVED VARIABLES: OPEN SPACE PROPORTION

Table 7.12 brings the EDI from the two sets of data together while Table 7.13 summarizes the pattern shown by the two EDI.

TABLE 7.12 : GRAND COMPOSITE EDI FROM FIELD AND REMOTE SENSING DATA

S/N	Neighbourhood	EDI FIELD	EDI REMOTE SENSING	GRAND EDI
1	Agwan Daji	0.662	0.244	0.453
2	Barkin Saleh	0.230	0.648	0.439
3	Bosso Estate	0.742	0.632	0.687
4	Bosso Town	0.441	0.530	0.486
5	Chanchaga	0.473	0.618	0.546
6	Dutse Kura Gwari	0.311	0.338	0.325
7	Dutse Kura Hausa	0.508	0.352	0.430
8	Fadipe	0.319	0.490	0.405
9	F-Layout	0.704	0.538	0.621
10	Tayi Village	0.533	0.460	0.497
11	GRA	0.845	0.598	0.722
12	Jikpan	0.268	0.370	0.319
13	Minna Central	0.458	0.248	0.353
14	Kpakungu	0.293	0.446	0.369
15	Limawa A	0.498	0.240	0.369
16	Maitumbi	0.376	0.708	0.545
17	Makera	0.423	0.360	0.392
18	Nasarawa	0.491	0.114	0.303
19	Sabo Gari	0.406	0.270	0.338
20	Sango	0.359	0.544	0.452
21	Sauka Kahuta	0.324	0.594	0.459
22	Tudun Fulani	0.358	0.414	0.386
23	Tudun Wada North	0.401	0.621	0.511
24	Tudun Wada South	0.518	0.326	0.422
25	Tunga Low Cost	0.543	0.396	0.469

Source: From Tables 7.9 and 7.10

Table 7.13 shows that on the EDI scale, 18 neighbourhoods according to the field data EDI and 14 according to remote sensing EDI are poor quality neighbourhoods. While there are six medium quality neighbourhoods by the field data EDI, there are 11 by remote sensing EDI. Similarly, while no neighbourhood qualified as high quality in the case of remote sensing EDI, one neighbourhood is of high quality by the field EDI.

The Table also shows that while the lowest EDI is 0.230 by field data, it is 0.114 by remote sensing data and that while the highest EDI is 0.845 by field data, it is 0.708 by remote sensing data. Neighbourhoods that have the lowest and the highest EDI from the two sets of data also defer. While the neighbourhood with the lowest EDI by field data is Barkin Saleh, it is Nasarawa by remote sensing data and while the neighbourhood with highest EDI by field data is GRA, it is Maitumbi by remote sensing data.

TABLE 7.13: SUMMARY OF REMOTE SENSING AND FIELD DATA

		Field Data	Remote Sensing Data	Grand Composite EDI
EDI scale and number of neighbourhoods	0.0-0.50	18	15	19
	0.51-0.80	6	10	6
	0.81-1.00	1	0	0
Lowest EDI		0.230	0.114	0.303
Highest EDI		0.845	0.708	0.722
Neighbourhood with lowest EDI		Barkin Saleh	Nasarawa	Nasarawa
Neighbourhood with highest EDI		GRA	Maitumbi	GRA

Source : Derived from Table 7.12.

A one by one comparison of the deteriorated neighbourhoods from the two sets of data reveal some similarities in the performance of the neighbourhoods in the two EDIs (Table 7.14). Eleven of the neighbourhoods are of poor environmental quality on the two EDIs.

TABLE 7.14: EDI FIELD EDI REMORE SENSING CLASSIFICATION COMPARED

S/N	Neighbourhood	EDI FIELD CLASSES			EDI REMOTE SENSING CLASSES		
		High Quality Neighbourhood	Medium quality Neighbourhood	Poor Quality Neighbourhood	High Quality Neighbourhood	Medium quality Neighbourhood	Poor Quality Neighbourhood
1	Agwan Daji		✓				✓
2	Barkin Saleh			✓		✓	
3	Bosso Estate		✓			✓	
4	Bosso Town			✓		✓	
5	Chanchaga			✓		✓	
6	Dutse Kura Gwari			✓			✓
7	Dutse Kura Hausa			✓			✓
8	Fadipe			✓			✓
9	F-Layout		✓			✓	
10	Tayi Village		✓				✓
11	GRA	✓				✓	
12	Jikpan			✓			✓
13	Minna Central			✓			✓
14	Kpakungu			✓			✓
15	Limawa A			✓			✓
16	Maitumbi			✓		✓	
17	Makera			✓			✓
18	Nasarawa			✓			✓
19	Sabo Gari			✓			✓
20	Sango			✓		✓	
21	Sauka Kahuta			✓		✓	
22	Tudun Fulani			✓			✓
23	Tudun Wada North			✓		✓	
24	Tudun Wada South		✓				✓
25	Tunga Low Cost		✓				✓

Source: Derived from Table 7.12

By extension, only seven of the poor quality neighbourhoods by EDI field are not of poor quality by the EDI remote sensing. In the EDI remote sensing data, these seven neighbourhoods are rather of medium quality. Similarly, only four of the 15 poor quality neighbourhoods by the EDI remote sensing are not of poor quality by the EDI field. The four neighbourhoods are of medium quality by the EDI field. The 11 neighbourhoods that are of poor quality in the two EDIs are Dutse Kura Gwari, Dutse Kura Hausa, Fadipe, Kpakungu, Jikpan, Minna Central, Limawa, Makera, Nasarawa, Sabo Gari and Tudun Fulani. The summary is that there is a close link in the results from the two sets of data (field and remote sensing). Differences are minimal. So, the data complement each other; the two emphasize different aspects of neighbourhood environmental quality.

While the field data record visible micro issues affecting neighbourhoods and invisible socio-economic characteristics that reflect poverty, remote sensing records visible macro aggregation of environmental quality.

Table 7.12 also shows grand composite EDI averaging the EDI from both the field and remote sensing data. Similarly, Table 7.13 shows the summary of this grand EDI. In all, 19 neighbourhoods are of poor quality while six are of medium quality (Figure 7.17). No neighbourhood is of high quality. Similarly, the GRA maintains the highest EDI of 0.722 while Nasarawa also has the lowest EDI of 0.303. Out of the 19 poor quality neighbourhoods, six are from the centre of Minna. These are Agwan Daji, Minna Central, Limawa, Makera, Nasarawa and Sabo Gari.

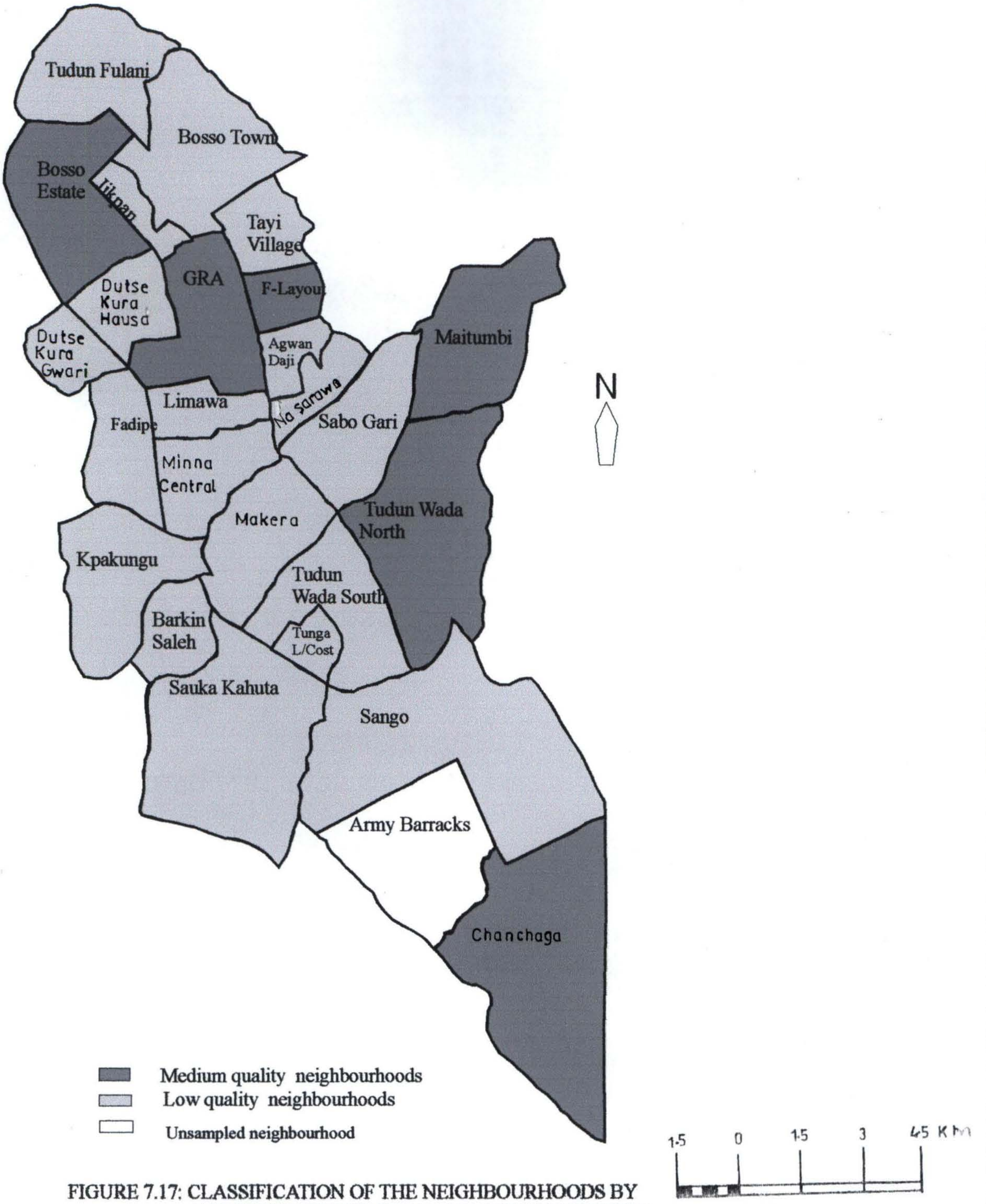


FIGURE 7.17: CLASSIFICATION OF THE NEIGHBOURHOODS BY COMPOSITE EDI ON FIELD AND REMOTE SENSING DERIVED DATA

Although, there are some differences in the results of data from the field and remote sensing, the two emphasize the fact that the neighbourhoods demonstrate no exceptional environmental quality. Most of the neighbourhoods oscillate between medium and poor environmental quality.

The poor condition of the neighbourhoods in Minna has long been recognized by the Minna Master Plan (Max Lock, 1980). The following passages from the Master Plan will suffice here

1. A simple walk round the streets of Minna ....will tell you that the majority of the people are living in squalid, dirty, unhealthy houses, streets and drainage.
2. What the survey has shown is the wide-spread extent of these poor conditions and the number of people affected.
3. Over three fifths of the population live at more than two persons per room. From the public health point of view, this factor alone must contribute to a high incidence of contagious as well as infectious diseases and respiratory troubles.
4. Minna has some of the worst sanitary arrangements found in any of the many urban areas studied by Max lock in Northern Nigeria.

A recent study by Baba and Jinadu (2001) show poor housing conditions among the neighbourhoods in Minna. Only three of the 12 residential zones are of high quality. These are the GRA, Bosso estate and Oduoye Quarters. Most others are either low quality or medium quality residential areas. In addition, the prevalence of diseases among these neighbourhoods is greatly associated with poor housing conditions. This re-affirm the fear expressed by Max Lock (1980). The conclusion by Baba et al (2001) reflects not only the debilitating condition of housing in Minna but also poverty. They observe that ' it appears that housing is the most critical manifestations of poverty in Minna as all the wards had over 50% of their inhabitants occupying sub-standard housing. Only Bosso estate and F-layout are said to demonstrate good housing quality. The concentration of low quality neighbourhoods in the centre of Minna is also evident in their work..

In general, the environmental problems are external effects of urbanization process to which the poor are disproportionately affected (Moser et al, 1996). These authors outlined the characteristics of the poor's environment as (1) inadequate access to environmental services (water, sanitation, drainage, solid waste management; (2) poor quality housing; (3) overcrowding and (4) settlement on marginal or degraded land.

7.4 STATISTICAL TESTS

In chapters five and six, attempts are made to expose the nature of human welfare and environmental quality in Minna. These two have been treated separately. The premise of this work is the relationship between poverty and the environment. The objective is to discover the proportion of poverty status that could be explained by poor environmental quality and through this determine the strength of the relationship between the two. In this section, this assertion is examined. There are two hypotheses for testing in this study. These are

1. There is no significant relationship between poverty and the urban environmental quality.
2. There is no significant relationship between the perception of the environment and the quality of the environment.

7.4.1 HYPOTHESIS ONE

In the first hypothesis, the attempt is to establish a statistical linkage between poverty and the environment. Two statistical techniques are adopted. These are linear regression and correlation analyses. In the case of regression analysis, three indices of poverty and four indices of environmental quality are used. The three indices of poverty are poverty headcount, poverty gap and HDI. The measures of environmental quality are the EDI field data, EDI remote sensing, environmental poverty level and environmental score by remote sensing data.

The two EDIs give the composite EDI for both the data directly collected from the field and remote sensing data as treated in this chapter while environmental poverty level is the composite index for measures of environmental quality derived in chapter five. Similarly, the environmental score by remote sensing data is the average rank of the neighbourhoods on their performances on remote sensing data.

In the case of correlation analysis, five indicators of environmental quality in addition to the four used in the regression analysis are used. The additional five indicators are housing conditions, qualitative environmental problems, proportion of streets with quantitative environmental problems, deficiency in public facilities and household-based deprivation. The nine indices are correlated against the three indices of poverty.

7.4.1.1 Regression Analysis

7.4.1.1.1 Poverty Headcount:

The results of the four regression analysis conducted by using the poverty headcount as independent variable are shown in Table 7.15. The Table shows that headcount poverty index. is statistically significant at 0.05 level with three of the four variables of environmental quality. These are EDI field, environmental poverty index and environmental score by remote sensing data. The headcount index explains 35%, 57% and 27% of the variations in these variables respectively. While the level of association as explained by R is high in the three cases; the level of explanation (R^2) offered is only moderate in the case of environmental poverty and weak in other cases.

TABLE 7.15: REGRESSION ANALYSIS BETWEEN POVERTY HEADCOUNT INDEX AND INDICES OF ENVIORNMENTAL QUALITY

Dependent Variable	R	R^2	Test value		Significance		Constant		Regression Equation
			F-test	t-test	F-test	t-test	t-test	Significance	
EDI field	0.593	0.352	12.467	-3.521	0.002	0.002	10.189	0.000	0.68-0.003x
EDI remote sensing	0.348	0.121	3.142	-1.782	0.088	0.088	9.548	0.000	0.55-0.002x
Environmental poverty	0.755	0.571	30.558	5.528	0.000	0.000	5.258	0.000	21.52 +0.33x
Environmental score by remote sensing data	0.522	0.273	0.179	0.423	0.676	0.676	4.364	0.000	0.48-0.001x

Source: SPSS Data Analysis Output

7.4.1.1.2 Poverty Gap

Poverty gap is also statistically significant at 0.05 level with three of the environmental quality indices (Table 7.16). That is, EDI field, environmental poverty index and average rank environmental score by remote sensing data. However, the amount of explanation offered by this poverty index for all the indices of environmental poverty is low. It is about 26% each in the case of EDI field and environmental score of the neighbourhoods by remote sensing data and 31% in the case of environmental poverty level.

TABLE 7.16: REGRESSION ANALYSIS BETWEEN POVERTY GAP INDEX AND INDICES OF ENVIORNMENTAL QUALITY

Dependent Variable	R	R^2	Test value		Significance		Constant		Regression Equation
			F-test	t-test	F-test	t-test	t-test	Significance	
EDI field	0.506	0.255	7.863	-2.804	0.010	0.010	8.173	0.000	0.68-0.005X
EDI remote sensing	0.012	0.000	0.003	0.056	0.956	0.956	4.069	0.000	0.45+0.0001x
Environmental poverty	0.559	0.313	10.407	3.235	0.004	0.004	4.087	0.000	24.33+0.40x
Environmental score by remote sensing data	0.508	0.258	8.009	-2.830	0.009	0.009	18.071	0.000	0.49-0.0002x

Source: SPSS Data Analysis Output

7.4.1.1.3 Human Development Index (HDI)

The HDI has a surprising perfect fit relationship with environmental score of the neighbourhoods by remote sensing data. Both the R and R^2 are 1.000 (Table 7.17). That is, HDI explains 100% of the variations in the average score of the neighbourhoods by remote sensing data. The level of explanation is not only high it is also statistically significant at 0.05 level. The HDI also has a statistically significant relationship with environmental poverty level. At about 24% level, the level of explanation is weak.

TABLE 7.17: REGRESSION ANALYSIS BETWEEN HUMAN DEVELOPMENT INDEX AND INDICES OF ENVIORNMENTAL QUALITY

Dependent Variable	R	R^2	Test value		Significance		Constant		Regression Equation
			F-test	t-test	F-test	t-test	t-test	Significance	
EDI field	0.318	0.101	2.589	1.608	0.121	0.121	0.235	0.316	0.06+0.95x
EDI remote sensing	0.178	0.032	0.753	0.644	0.394	0.394	0.644	0.526	0.19+0.62x
Environmental poverty	0.489	0.239	7.226	-2.688	0.013	0.013	5.116	0.000	89.12-110.97x
Environmental score by remote sensing data	1.00	1.00	-	-	0.000	0.000	-	0.000	0+1.00x

Source: SPSS Data Analysis Output

7.4.1.2 Correlation Analysis

For a more straight forward analysis of relationship, Spearman's Rank Correlation is used to examine relationship between poverty and environmental quality. The result is shown in Table 7.18. The Table shows that poverty headcount has high and significant correlation with two of the variables (above 70% each) and moderate in five cases. While the correlation is positive in six cases, it is negative in one. High positive correlation of 74% and 76% are recorded with housing condition index and environmental poverty index. Poverty gap has moderate and positive correlation with housing condition, household-based deprivation index and environmental poverty level. The respective correlation coefficients are 65%, 54% and 56%. On the other hand, poverty gap is negatively correlated with EDI field and environmental score of the neighbourhoods by remote sensing data where the coefficient is 51% each respectively.

The HDI is negatively correlated with the housing condition, household-based deprivation index and environmental poverty index and environmental score of the neighbourhoods by remote sensing data. While the correlation coefficient is moderate in the first three cases (58%, 53% and 49% respectively), it is very high in the case of the environmental score of the neighbourhoods by remote sensing data where the coefficient is 100%. On one hand, the environmental score by remote sensing reflects the quality of the environment demonstrated by the remote sensing data and on the other hand, the coefficient reflects the relevance of the HDI in showing the linkage between the macro-environmental variables and human welfare.

TABLE 7.18: CORRELATION ANALYSES BETWEEN POVERTY INDICES AND ENVIRONMENTAL QUALITY INDICES

S/N	Environmental Quality Index	Correlation Values Against Poverty Index		
		Poverty Headcount	Poverty Gap	Human Development Index
1	Proportion of streets with qualitative environmental problems	0.461**	0.104	-0.264
2	Housing condition	0.753**	0.649**	-0.583**
3	Proportion of streets with quantitative environmental problems	0.263	0.209	-0.149
4	Proportional deficiency in community facilities	0.484*	0.283	-0.210
5	Household-based deprivation	0.633	0.542*	-0.531**
6	Environmental poverty index	0.755**	0.559*	-0.489*
7	ED-I field	0.593**	-0.505	0.318
8	EDI remote sensing	0.088	0.012	0.178
9	Environmental score by remote sensing data	-0.522	-0.508	1.000**

** Significant at 0.01 level
* Significant at 0.05 level.
Source: SPSS data Analysis Output.

In concluding this section, it is noted that the tests have demonstrated that there are relationships between poverty and the environment. The statistical relationship and the strength of the relationship will depend on both the indices of poverty and environmental quality. The tests have shown that the three indices of poverty are relevant in explaining variations in environmental quality; although poverty headcount is more advantageous than the others. The exceptional case of the relationship between HDI and environmental score of the neighbourhoods by remote sensing data consolidates the poverty-environment linkage further. In spite of this, the truth is that there are gaps in the level of explanation offered by poverty indices in the variations in the indices of environmental quality. This gap will make a re-visitation of the environment-poverty trap cycle necessary. While the cycle remains relevant, the external factors affecting the cycle should be recognized. These external factors are shown in Box 5 at the extreme left corner of Figure 7. 18. These factors are perception of income status, perception of housing conditions and perception of neighbourhood quality.

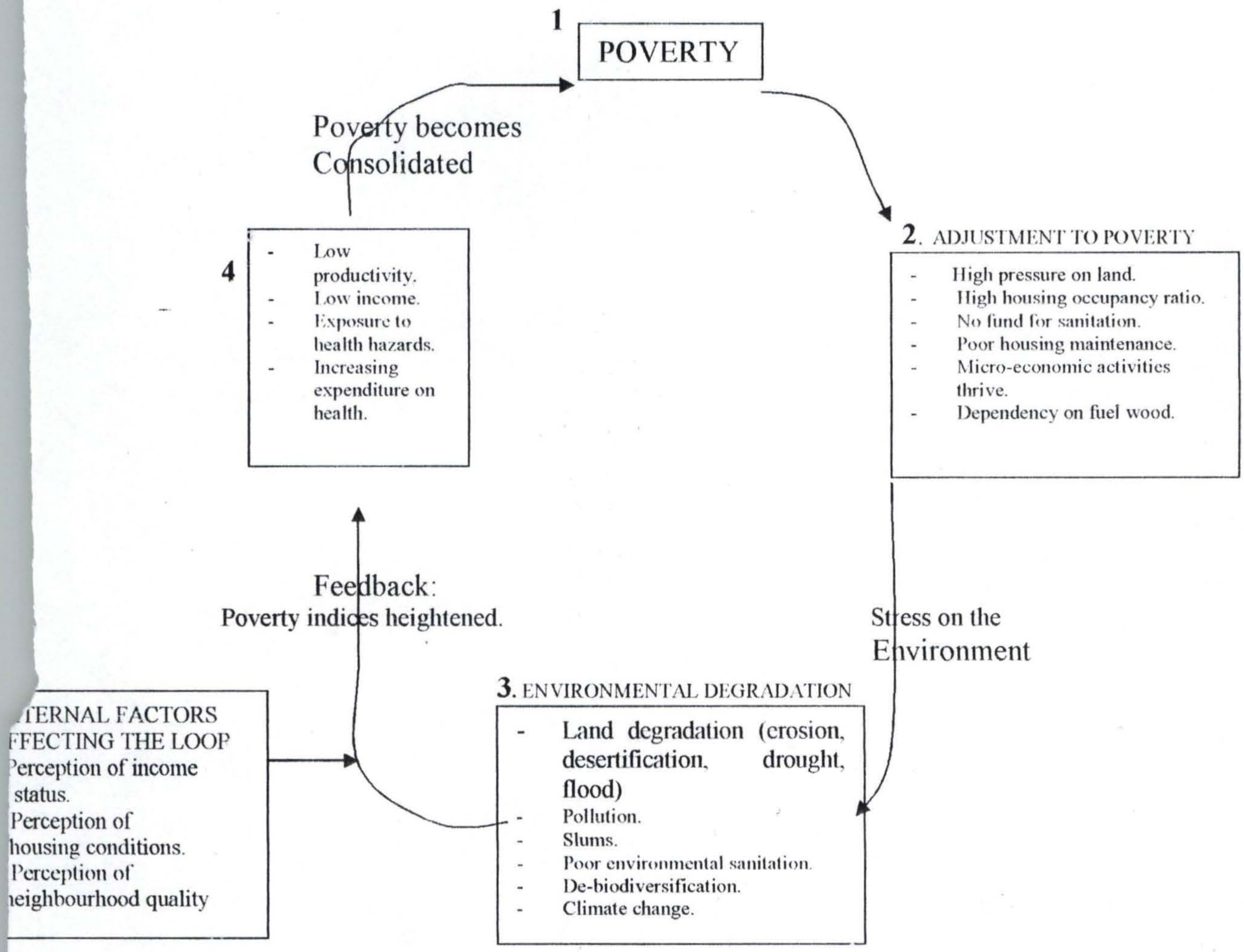


FIGURE 8.1: MODIFIED ENVIRONMENT –POVERTY TRAP

SOURCE: Author, 2005.

7.4.2 HYPOTHESIS TWO

In establishing link between perception and poverty and environmental conditions, the average perception of households on housing and environment (see Table 5.22) is used. The measures of welfare and environmental quality are as applied in Hypothesis One above.

Two tests are also conducted to show the relationship between the perception of poverty and environmental quality. The first test is between average level of perception and poverty while the second is between average level of perception and environmental quality. The summary of the two tests are shown in Tables 7.19 and 7.20. In the first case, the regression shows an R of 65% and R^2 of 42%. This shows a moderately high association between perception and poverty. Indices of poverty explain 42% of the variations in perception.

TABLE 7.19: SUMMARY OF REGRESSION TEST: PERCEPTION AND POVERTY

Independent variables	R	R^2	SIGNIFICANCE		Description of association
			F-TEST	T-TEST	
Constant	0.648	0.419	0.009	0.283	
Poverty head count				0.010	
Human development index				0.711	
Mean income				0.051	
Regression equation	$-0.851+1.133\ x_1-0.845\ x_2-0.02807\ x_3$				

Source: SPSS Data Analysis Output

TABLE 7.20: SUMMARY OF REGRESSION TEST: PERCEPTION AND ENVIRONMENTAL QUALITY

Independent variables	R	R^2	SIGNIFICANCE		Description of association
			F-TEST	T-TEST	
Constant	0.743	0.552	0.002	0.004	Strong
EDI field				0.417	
EDI remote sensing				0.0.118	
Average score remote				0.530	
Environmental poverty level				0.002	
Regression equation	$-3.629-0.812\ x_1+3.061\ x_2+1.729\ x_3-2.405\ x_4$				

Source: SPSS Data Analysis Output

The observed relationship is statistically significant. That is to say that poverty influences the perception of the people and by extension influences the attitude of the people. Similarly, the second test also shows a strong association between perception and environmental quality. With an R of 74%, environmental quality explains 55% of the variations in the perception level. This relationship is also statistically significant. The conclusion is that there is a statistical relationship between perception of the environment and the quality of the environment. The conclusion is that as poverty influences the perception of the environment, so does it affect attitude to the environment. Poor perception also generates poor quality of the environment. Similarly, poverty and attitude are important in explaining variations in the quality of the environment.

8.0 CHAPTER EIGHT

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

8.1. INTRODUCTION

In the last three chapters, attempts are made to show the welfare of the people and the nature of the environment. In this chapter, the summary of findings, explanations for the prevalence of poverty and low environmental quality and implications of these for poverty reduction are examined. In conclusion, directions for future research on this subject are also presented.

8.2 SUMMARY OF FINDINGS

In this section, the summary of the findings of this work is presented according to each objective.

8.2.1. Measurement of Poverty:

The study shows that poverty level is very high in Minna. This is evident in the three criteria of poverty used. For the city, headcount poor are 64%, poverty gap is 52% while the HDI is 0.42. Not only has the study confirmed high level of poverty existing in the country, it has also shown the constant presence of poverty in the society. Not only are people poor by income definition, they also have very low human development index. Similarly, it is also established that, poverty exists in all neighbourhoods. While the scale is low among the high class residential neighbourhoods, poverty level in these neighbourhoods is also worrisome. For example, the minimum headcount poverty index of 12% found in Tunga Low Cost is also an uncomfortable level. Furthermore, while the difference between the maximum headcount poor (100%) and the minimum (12%) is 88%, the difference between the minimum HDI (0.3) and the maximum (0.51) is .021. What this means is that HDI achieves some levelling up among neighbourhoods as opposed to income poverty demonstrated by the headcount poverty index. It is also seen that the influence of income on welfare remains dominant even in the calculation of HDI. For example, while high literacy level among the people gives a high HDI for literacy, considerably low income depressed the composite HDI for all the neighbourhoods and the city. In term of the socio-economic classes arising from the indices of poverty applied in the study, it is found that three neighbourhoods belong to high income by headcount poverty index; four are in the middle income class while 18 belong to poverty group. Similarly, by the HDI, one neighbourhood belongs to middle income group while the rest belong to the poor group.

8.2.2. Neighbourhood Environmental Quality

Based on the field data collected, in considering the status of the environment, four broad indicators of quality are used in the study. Each of these also has other variables which show detailed conditions of each neighbourhood in respect of each indicator. These indicators are household-based measures of deprivation with 18 variables, housing conditions (18 variables) neighbourhood environmental problems (19 variables); and community facilities and services with three variables. So, a total of 58 variables from four indicators are used to assess the quality of the neighbourhoods in the study area. The emerging picture of spatial variations in quality among the neighbourhoods also show that poor environmental quality is as high as poverty among the neighbourhoods. Only four neighbourhoods are seen to have demonstrated consistent high quality in respect of environmental poverty index. These are F-Layout, GRA, Tunga Low Cost and Nasarawa.

Poor quality is a synthesis of deprivations and deterioration; deterioration in terms of physical appearance and visible environmental problems and deprivations in terms of facilities within the houses and within the neighbourhoods. Thus, poor quality signifies another form of poverty; environmental poverty. It is found that twelve of the neighbourhoods demonstrate high level of environmental poverty.

Not only is environmental poverty high among the neighbourhoods, there is also spatial inequality in the consumption of environmental amenities. In particular, there is sharp inequality in open space within buildings as opposed to habitable rooms. The implication is that households/developers emphasize habitable rooms rather than leisure space. Room occupancy ratio among the neighbourhoods is higher than both the national and the state averages.

The complementary role which remote sensing offers in revealing environmental quality is also shown in the study. The remote sensing data shows a reduction in the quality of the neighbourhoods environment in the study area over the years. High level of land development is witnessed by all neighbourhoods between 1995 and 2001. Thus while great loss was experienced in open space, great gain was made in built up area. But increased built up activities led to diminution in environmental quality. The continued diminution in quality is more pronounced from the analysis of the estimated 2003 land uses. Intensified development led to emergence of heavily built up areas. Analysis of the level of environmental quality from the remote sensing data shows that only three of the neighbourhoods are of good quality as opposed to 22 that of low and medium quality. The remote sensing data shows the impact of intensified development on the quality of the environment. The derived variables from the remote sensing data show diminution in the consumption of environmental amenities of space. This reflects in high population density, high housing density, low open space per head and low proportion of open space per neighbourhood.

Furthermore, it is shown in the study that the concept of Linear Scaling Technique with which HDI is calculated can be applied to assessing environmental deterioration. This gives rise to Environmental Development Index (EDI). The EDI summarizes the status of amenities within and around residential houses. The application of the EDI to field data and remote sensing data shows that the neighbourhoods demonstrate low EDIs. For the field data, there is only one neighbourhood classed as good while none qualified as good by the remote sensing data. A comparison of EDI field and ED remote sensing shows that 10 neighbourhoods from the two sets of EDI are of poor quality. . However, the composite EDI from the two sets of EDI show that seven neighbourhoods have poor quality environment.

8.2.3 Perception of Poverty and the Environment

The people also see poverty and the quality of housing and environment in different forms. Very few people see themselves as very rich; although considerable proportion believe that they are rich. Similarly, while about 40% believe that they are poor, 23% and 33% believe that their housing quality and housing facilities are of poor quality, respectively. The perception of the people of F-Layout, GRA and Tunga Low Cost reflects their rating on the environmental poverty index. All the residents believe that their neighbourhoods are of good quality. The people also believe that income and the combination of income and tenancy status affect attitude to the environment

8.2.4 Relationship Between poverty and Environmental Quality

It has also been shown that not all indices of poverty are useful in establishing relationship between poverty and the environment. It is found that poverty headcount demonstrates moderate linkage with environmental quality variables. The HDI proved exceptional in establishing poverty-environment linkage by having a 100% relationship with the average rank by the neighbourhoods by the remote sensing data. Not only does this reflect the relevance of HDI in measuring welfare, it also shows that remote sensing data can also reflect realities existing within urban neighbourhoods. Although there is a significant link between poverty and environment, it is discovered that perception is statistically stronger in explaining poverty and environmental quality. The impression here is that, there is not just one loop explaining the relationship between economic status and the environment, but rather many loops. The attitude and perception of the people constitute an external factor which impinges on the interaction loop between poverty and the environment.

8.3 IMPLICATIONS

It is important to see some efforts at poverty reduction in Nigeria and to assess same in order to understand the sources of the observed poverty and poor neighbourhood environmental quality.

The stress of economic adjustment in the mid-1980s forced the then Federal Government to initiate a range of micro-credit facilities targeted at the poor and the economic activities of the poor. The development of micro-financial system represents a deliberate official *push* to enhance the performance of the micro enterprises, generate employment and increase personal income. These micro facilities include the establishment of Peoples' Bank, Community Bank, Family Economic Advancement Programme (FEAP), Nigerian Agricultural Co-operative and Rural Development Bank (NACRDB), Small and Medium Industries Equity Investment Scheme (SMIEIS) and Micro Credit Facilities by State Governments.

A range of employment programmes have also been initiated by the governments. For example, the National Directorate of Employment (NDE) was created by the federal government in 1986 as a response to the prevailing high rate of unemployment in the country then. In 1999, the Federal government established the National Poverty

Alleviation programme. This was replaced with the National Eradication Programme (NAPEP) in 2001. The NAPEP operates in similar way as NDE with responsibilities for training of people and loan facilities for the trainees. In addition, there are other measures which have impacts on poverty which have been initiated by all levels of government within the last five years. At the Federal level, attention has been drawn to forgotten agricultural products. Thus, special attention has been focused on cassava, rice, cotton, cocoa and fisheries.

All these programmes have spatial relevance and where well meshed with residents within neighbourhoods could have generated sufficient multiplier effects. Therefore, given these various poverty programmes; it is pertinent to find out why poverty level is still high among residents of the urban centres.

(i) **Low capacity of the people.** The major source of poverty is traceable to the capacity of the poor; in particular, as related to income. The poor rely on low-paid job and largely engage in micro enterprises with little diversification that can guarantee multiple income sources. Livelihood creation and expansion is low while official assistance is highly limited. The efforts of poverty-related agencies have not been widespread enough to sufficiently cover the majority of the poor. In general, efforts of the governments at eliminating poverty appears unsuccessful. Such efforts have not only been inadequate, poverty agencies are found to concentrate attention on activities where they are well equipped while in other cases, results are far less than the declared monetary inputs.

(ii) **Little attention to human development**: For years, issues of human development attracted little attention. This explains the dearth of social and environmental amenities that deepen the level of deprivation among the urban residents.

(iii) **Neglect of urban residential neighbourhoods:** The persistent and large scale poor neighbourhood quality could be explained by the neglect of the neighbourhoods by governments at all levels. The neglect does not only perpetrate poverty, it perpetrates environmental decay, prevents area-based investments and the expected multiplier effects. The self adjustment that result from private sector operators do not only farther marginalize the poor, it also widens the economic and spatial amenity inequality amongst the people. Most other problems facing poverty programmes could be addressed within a more space-focused poverty programmes. By all means, a way of confronting the existing poverty is to make space the centre of all poverty programmes.

(iv) **Deficiency of urban planning activities**: We can also understand from the study that inadequacy of urban physical planning activities contributes to the poor state of urban neighbourhood environment. First is the issue of development control. Evidence of haphazard development indicates low level of development control even in new areas of the town. Those components of development control relevant to high quality environment are highly neglected. Second is the issue of development plan. Existing development plans are outdated. For example, the Minna Master Plan is already outdated since 2000. Third is the problem of implementing physical development plans. Often Master Plans are not implemented to the letter. For example, the Minna Master Plan contains action plans for renewal of Agwan Daji, Limawa and Minna Central Business District. However, these renewal plans were not implemented.

(v) **Little attention to urban environmental management**: The management of urban environment to involve proper attention to the totality of the environment and with special focus on environment-development interactions is lacking. Hence, the negative effects of these interactions have overshadowed the positive effects. The concept of sustainable city environmental management has not found expressions in most Nigerian towns. Thus, the experiment of Sustainable City Project in Nigeria has been restricted to Ibadan, Kano, Enugu and Karu in Abuja.

(vi) **Lack of environmental education:** There is also the problem of the neglect of environmental education. The result is the uncomfortable acceptance of poor environmental quality by urban residents. This explains high rating of poor quality environments by the people. People have remained passive to take action and to call the attention of institutions charged with the management of the environment.

(vii) **Poor urban governance:** Poor governance will also explain the poverty of people and the poor neighbourhood environmental quality. For example, Egunjobi (1995) remarks that ' all evidences appear to point to the fact that city authorities have proved incapable of providing enabling environment for the fast growing population to make a living and to maintain a desirable quality of life'. Elements of bad governance are low capacity of government and its agencies, excessive centralization of government machinery, low financial base, exclusion of the poor and low income from major decisions that affect urban governance, lack of deliberate policy of engagement of the civil societies in urban management and weak local government system.

8.4 CONCLUSION

The study has shown that both human welfare and environmental quality among the people and urban neighbourhoods are low. The low human welfare and poor environmental quality are in spite of considerable efforts by all governments over the years to address poverty. The government programmes have ranged from credit facilities to skill development and micro enterprise generation. These have not succeeded in reducing poverty. This might be due to many reasons. First is the focus of anti-poverty programmes. The emphasis is often on poverty alleviation rather than elimination. The tendency is that efforts are often too small and marginally relevant to the basic requirements of poverty. Another dimension of poor focus of poverty programmes is the activities of poverty agencies. These agencies direct attention at activities for which they are ill-equipped to handle or that have little impacts on poverty elimination. There is also the problem of input-output ratio. Over the years, large amount of money is declared to be devoted to poverty programmes. However, few people benefit from these.

Above all, the poverty programmes have focused attention on sectoral rather than spatial approach or even a combination of the two. In this case, residential neighbourhoods where the majority of the poor live are often neglected. The neglect does not only perpetuate, it intensifies environmental decay, prevents area-based investments and the expected multiplier effects. The self adjustment that result from private sector operators does not only further marginalize the poor, it also widens the economic and spatial amenity inequality amongst the people. Most other problems facing poverty programmes could be addressed within a more space-focused poverty programmes.

8.5 RECOMMENDATIONS

The current level of human and environmental poverty in the country is unacceptable. It is therefore important that more vigorous and sustainable attention be focused on poverty. Poverty is the focus of the United Nations Millennium Development Goals. Out of the eight goals, six are related to issues of poverty and environment. These are (1) to eradicate extreme poverty and hunger; (2) to achieve universal primary education; (3) to promote gender equality and empower women; (4) to reduce child mortality; (5) to improve maternal health and (6) to ensure environmental sustainability ((ILO, 2003). These goals are meant to reduce poverty by half by 2015.

In Africa, the tool for the implementation of the UN Millennium Goals is New Partnership for African Development (NEPAD). Two of the four objectives of NEPAD also relate to poverty and human development. These are (1) to eradicate poverty and (2) to accelerate empowerment of women. In the same vein, Nigeria's National Economic Empowerment and Development Strategy (NEEDS) is also directed at poverty eradication. The lesson of all these attempts is that there is a global concern about poverty and the conditions of the poor people. Therefore, to make these actions relevant, it is important that firm actions be taken to engrain the policies and programmes into development programmes and projects.

At this point, it is important to advance some suggestions for the elimination of poverty and improving of the urban environment. The suggestions are in two groups. The first are general suggestions arising from the findings of the study while the second are suggestions meant to widen the depth of research on poverty-environment relationship within the urban centres.

(a). General Recommendations:

(i) **Improvement in human conditions**: Efforts should be directed at providing facilities and services that will improve the wellbeing of the poor. There is an urgent need to provide more educational and health facilities and to improve supply of drinkable water to the residential neighbourhoods.

(ii). **Improvement of neighbourhood economy**: The economy of the neighbourhoods need to be improved. Central to this improvement effort is the provision of neighbourhood market and other lower level retail outlets within the neighbourhoods. Similarly, most of the few existing markets need to be upgraded in term of their physical structures, the available space and facilities.

(iii). **Renewal of residential neighbourhoods:** The renewal of deteriorated neighbourhoods should be undertaken with focus on both the people and the physical environment. The renewal programmes for the deteriorated neighbourhoods must include capacity building for the poor, increasing neighbourhood facilities and services, creating employment and increasing private sector investment within the neighbourhoods

(iv). **Improvement of neighbourhood sanitation and roads:** The partnership arrangement for solid waste management should be strengthened to include informal waste collectors and to cover neighbourhoods currently excluded from private sector participation. The roads within the neighbourhoods should be improved. Both district roads and access roads will have to be provided in most of the neighbourhoods.

(v) **Institution and practice of effective urban planning:** First, the issue of urban plans should be given more attention. Not one level of plan will be required but rather multiple level plans that will involve urban physical development plan, district and neighbourhood or community plan. Second, the implementation of the plans should also be given serious attention. Third, the control of land development should also receive higher attention. All institutions of urban ~~planning and management should be strengthened to make planning as effective~~ as desired.

(vi) **Housing ownership and improvement:** Having noticed a link between ownership and care of housing and housing environment, it is also suggested that all efforts should be made to ensure housing ownership by the people. This may mean increasing access to land and livelihood sources that could guarantee sufficient income for people to finance their own houses with minimal assistance.

(vii) **Institution and practice of environmental education**: This should incorporate the five basic elements of environmental education. Environmental education is meant to re-orient urban residents towards a better attitude to the environment and collective actions to improve the quality of the residential environment.

(b) Suggestions for Future Research

In this study, attempts have been made to identify the poor people by combining income criterion with that of human development. On the other hand, attempts have also been made to combine direct physical survey with remote sensing data to understand the environment of the poor.

(i) To make the data from remote sensing more relevant, higher resolution remote sensing products such as IKONOS and quick bird will have to be used. Higher resolution products will yield direct indices of decay instead of using surrogates of decay.

(ii) The adaptation of Linear Scaling Technique in assessing the quality of the neighbourhood environment is novel. This will have to be applied in as many cases as possible to ascertain its validity in assessing environmental quality.

(iii) Research attention should also be focused on other external factors that influence the poverty-environment relationship.

(iv) Future attention may also focus on relationship between density and neighbourhood development.

8.6 CONTRIBUTIONS TO KNOWLEDGE

The contributions to knowledge by this study include the following

i. Often, the use of Lorenz Curve and Gini coefficient are to show income inequality. But the study has demonstrated that these tools could be used to also show inequality in environmental amenities.

ii. Adaptation of Linear Scaling Technique to analysis of environmental quality and the emergence therefrom of Environmental Development Index (EDI).

iii. Application of multi-source data type in the analysis of poverty and the environment; in particular the integration of direct survey data and remote sensing data.

iv. Often, the Human Development Index has been applied to country level. The study undertook micro area application of HDI; to city and its neighbourhoods.

v. In general, the study provides objective and scientific basis for urban renewal.

REFERENCES

Abdul-Razak, N. T. A. (2000), 'Partnership in Urban Facilities Management; A Case Study of Water Supply in Minna', B. Tech. Final Year Project Submitted to Department of Urban and Regional Planning, Federal University of Technology, Minna..

Aboyade O. (1976), 'On Need for an Operational Specification of Poverty in the Nigerian Economy' in Nigerian Economic Society (NES) *Poverty in Nigeria* , Proceedings of the 1975 Conference of NES, pp 25-34.

Abubakar, S. M. and Abdul-Kadir, (1996), Monitoring of Vegetation Cover Dynamics in a Semi - Arid Area of Nigeria, Using Remote Sensing Techniques" in Daura, M. M. (eds) *Issues in Environmental Monitoring in Nigeria*, Nigerian Geographical Association, Maiduguri: pp 15-22.

Abumere, S. (1987), 'Urbanization and Urban Decay in Nigeria', in Onibokun, A.G., Olokesusi, F. and Egunjobi, L. (eds.) *Urban Renewal in Nigeria;.* Center for Urban and Regional Planning, University of Ibadan and NISER. Ibadan, pp19-32.

Adedeji, A. (1973), 'Urbanization Challenge in Nigeria: A Race Against Time' in Adedeji, A and Rowland, L (eds.) *Management Problems of Rapid Urbanization in Nigeria.* University of Ife Press. Ife. Pp xi-xvi.

Adefolalu, D. O. (1999), 'Remote Sensing as a Tool for Geo-Environmental Monitoring; Case Study Report on Africa', Paper Presented at the First National Summit on Ecology and Environment, The Presidency, Abuja.

Adefolalu, D. O. (2000) 'Removal of Barriers to Renewable Energy Resources in Nigeria- Case Studies on Kainji, Jebba and Shiroro Hydro-Dams. Paper Presented at the First National Training Workshop on *Climate Change and National Disasters in Nigeria,* Minna, 2-15 April.

Adeniji-Adele, A.A. (1995), The Politics of Urban Local Governance in Lagos and Its Implications on Urban Poverty and Urban Social Structure: A real Life Experience' Nigeria' in Onibokun, A.G. and Faniran, A. (eds.) *Governance and Urban Poverty in Anglophone West Africa*, CASSAD, Ibadan,; pp 187-198.

Adepoju, A. (1976), 'Migration and the Urban Poor in Nigeria's Medium-Size Towns' in Nigerian Economic Society (NES) *Poverty in Nigeria* , Proceedings of the 1975 Conference of NES, pp 125-148.

Aina, T. (1996), 'Environmental Management and Social Equity', in Uitoo, J.I. and Morgan, W.B. (Eds) *Sustaining the future: Economic and environmental change in Sub-Sahara Africa.*. United Nations University. New York.*

Akeh, L. E. (2000) 'Poverty Alleviation, Crop Failures and Nigeria's Integrated Monitoring Programmes. Paper Presented at the First National Training Workshop on *Climate Change and National Disasters in Nigeria,* Minna; 2-15th April.

Akeredolu-Ale, E. O. (1976), 'Poverty as a Social Issue : A Theoretical Note' in Nigerian Economic Society (NES) *Poverty in Nigeria* , Proceedings of the 1975 Conference of NES, pp 43-62.

Akinola, S. R. (2000), 'Balancing the Equation of Governance at the Grassroots' Nigeria' in Adedeji, A. and Ayo B. (eds.) *People-Centred Democracy: The Search for Alternative Systems of Governance at the Grassroots.* Heinemann Educational Books and African Centre for Development and Strategic Studies, Ijebu-Ode; pp171-198.

Amalho-Filho, A.; Oliveira, R.P. and Pereira, L.C. (1997), 'Use of GIS in (Planning) Sustainable Land Management in Brazil : Potentials and User Needs, *ITC Journal*, Vol. 3 No 4, pp295-301.

Aneja, R. P., Krishna, K. V. S. M., Phansdkar, S. J. and Gulati, V.P. (1992), *Oilseed and Vegetal Economy of India: Sectoral Policy Issues.* IRMA. Anand.

Anton, J. D. (1995), Diversity, Globalization and the Ways of Nature., Ottawa IDRC.

Aschmann, H. and Bowdin, L. W. (1974), ' Remote Sensing of Environmental Quality: Problems and Potentials' in Estes, J. E. and Senger, L.M. (eds), *Remote sensing: Techniques for Environmental Analysis.* Hamilton. Publishing company, Santa Babara, pp 293-301.

Baba, J. M., Morenikeji, O. O. and Odafen, A. E. (2001), *Poverty Profile in Minna,* A Research Report Prepared for the Development Policy Centre, Ibadan and the Urban management Programme (Regional Office), Abidjan.

Baba, J. M. and Jinadu, A. M. (2001), Analysis of Spatial Variations in the Occurrence of Housing Environment-Related Diseases in Minna Metropolis: A Final Research Report Submitted to The University Board of Research, Federal University of Technology, Minna.

Babalola, J. A. (1991), 'The people's Bank of Nigeria, Review and Update', *Bullion,* vol.15 No 3, pp2-13.

Babangida, I. B. (1987), *Budget Speech.* Lagos

Bailey, T. (1994) 'A Review of Statistical Spatial Analysis in Geographical Information System' in Fotheringham, S.F. and Rogerson, P. (Eds) *Spatial Analysis and Geographical Information System,* Taylor and Francis. London. Pp 13-44.

Balogun, T. F. (1995) 'Application of Sequential Aerial Photography in the Acquisition of Data on Land Use Change: Implications for Sustainable Urban Development and Planning'; A Paper Presented at the 38th Conference of Nigerian Geographical Association, Benin City.

Baratz, M. S. and Grsby, W. G. (1972), Thoughts on Poverty and Its Elimination' Journal of Social Policy, pp 119-134.

Barnes, K. B., Morgan, J.M., Robert, M.C. and Lowe, S. (2001), *Sprawl Development: Its Patterns, Consequences and Measurements*; Towson, Towson University.

Bartone, C.,Bernstein, J., Leitman, J. and Eigen, L., (1994) *Toward Environmental Strategies for Cities,* Washington, D. C. World Bank.

Batelmus, P. (1986), *Environment and Development.* Boston; .Allen and Unwin.

Beal, J. and Kanji, N. (1999) *Households, Livelihoods and Urban Poverty.* Working Paper 3 on Urban Governance, Partnership and Poverty, London, IDD/IIED.

Beal, J., Grankshaw, O. and Parnel, (2000), 'Local Governance, Poverty Reduction and Inequality in Johannesburg', *Environment and Urbanization,* vol. 11 No 2, pp107-122.

Bello-Imam, I.B. (1995), 'Urban Governance and Revenue Mobilization in Nigeria- The Issue and the way Forward Nigeria' in Onibokun, A.G. and Faniran, A. (eds.) *Governance and Urban Poverty in Anglophone West Africa,* CASSAD, Monograph Series 4; pp 94-115.

Benjamin, S. (2000), 'Governance, Economic Settings and Poverty and Bangalore, *Environment and Urbanization,* vol. 11 No 2, pp 35-56.

Benson, C. And Clay, E.J. (1999), "What is the True Cost" *Urban Age,* Summer, 1999, pp14-15.

Bernis, G. D. (1986) 'Basic Needs and Dynamics of Development' in JASPA, *The Challenge of Employment and Basic Needs in Africa.* Oxford University Press. Nairobi Pp 28-37.

Bertaud, M. (1989), *The use of satellite images for urban planning: A case study of Karachi, Pakistan,* Washington, D.C, The World Bank,.

Bidani, B and Ravallion, M (1993), 'A New Regional Poverty Profile for Indonesia'; *Bulletin of Indonesian economic Studies,* vol. 29 No 3, pp 37-68.

Bienefeld, M. (1979), 'Urban Employment: A Historical Perspective' in Bromley, R and Gerry, C. (eds.) *Casual Work and Poverty in Third world Cities,* John Wiley, pp 27-44.

Binns, T. and Lynch, K. (1998), 'Feeding Africa's Growing Cities into the 21st Century: The Potential of Urban Agriculture', *Journal of International Development*, vol.
Birdsall, N. (1994), Macroeconomics Reform: Its Impacts on Poverty and Hunger in Serorgeldin, I. and Landell-Mills, P. (eds.) *Overcoming Global Hunger*.*
Blowers, A. (1993), 'The Time for Change' in Blowers, A. (ed.) Planning for a Sustainable Development: A Report by the Town and Country Planning Association. London. Pp 1-18.
Blumenfeld, H. (1972), *The Modern Metropolis: Its Origin, Growth, Characteristics and Planning. Selected Essays*, Massachusetts, MIT.
BOSTID (1992) *Conserv ing Biodiversity*. Washington, D.C., National Academy Press.
BOSTID; (1987), *Science and Technology for Development: Entering the 21st Century*; Washington, D.C., National Academy Press.
BOSTID, (1990), *The Improvement of Tropical and Subtropical Rangeland*.;Washington, D.C. National Academy Press.
Brehey, M. J. (1992), ' Towards Sustainable Urban Development' in Mannion, A. M. and Rolly, S. R. (eds.) *Environmental Issues in the 1990s*. John Wiley and Sons. New York. Pp 277-290.
Bretas, G. (1995), 'Geographical Information System for the study and control of malaria', in Savigny, D. and Wijeyaratne (Eds) *Geographical Information System for health and the environment*. IDRC. Canada.
Bromley, R and Gerry, C. (1979), "Who are the casual poor" in Bromley, R. and Gerry, C. (Eds.) *Casual Work and Poverty in Third World Cities*: John Wiley, New York
Brookfield, H., Potter, L. and Byron, Y. (1996), *In Place of the Forest, Environmental and Socio-Economic Transformation in Borneo and the Eastern Malay Peninsula*.
Browne, E. (1981), 'Temporary Actions in Cities', in IFS, *Traffic, Transportation and Urban Planning*, vol. 1. George Godwin. New York. Pp 43.
Brundtland Commission (1987), *Our Common Future;* Oxford, Oxford University Press.
Burgsdoff, S.K.V. (1992), 'Ten Years of Structural Adjustment', *Development and Cooperation*, No 3, pp17-21.
Caleb, B. S. (1997), 'Housing Quality in Ilorin Traditional Area: Case of Balogun Ward, Ilorin; A B.Tech Project Submitted to Department of Urban and Regional Planning, Federal University of Technology, Minna.
CERES (1977), 'RADAM Discovers Unknown World', No 58; July-Aug. 1977.
Chambers, R (1983), *Rural Development: Putting the Last First*.; London and New York. Longman.
Chambers, R. and Cornway, G.R. (1992), *Sustainable rural livelihoods: Practical Concepts for the 21st Century*. Institute of Development Studies. Discussion Paper 296.
Como, O. (1995), 'The Increasing Informality of African Economies'. in *The Courier* , No 151, May-June..
Connor, S.J., Thomson, M.C., Flasse, S. and Williams, J.B. (1995), 'The use of low cost remote sensing and Geographical Information System for identifying and Monitoring the Environmental Factors Associated With Vector-Borne Disease Transmission' in Savigny, D. and Wijeyarantne (eds) *Geographical Information System for Health and the Environment*. IDRC, Canada.
Conway, E (1993) 'Farming in the City: the Rise of Urban Agriculture' in *International Development Research Council (IDRC) monthly and weekly reports*.
Corm, G. (1993), The New World Economic Disorder.*
Coser, L. A. (1965) 'The Sociology of Poverty' in Social Problems, vol. 13 No 2. Pp140-148.

Costanza, R. (1991), 'The Ecological Economics of Sustainability: Investing in Natural Capital' in Goodland, R and Duly, H., Seraty, S and Druste, B. von (Eds.) *Environmentally Sustainable Economic Development: Building on Brundtland,* UNESCO. Paris. PP 83-92.

Curran, P. J. (1985), *Principles of Remote Sensing.* Longman scientific and Technical.

Daura, M. M. (1996), 'Floodplain Encroachment and Hazard Awareness in Urbanized Catchments', A Paper Presented at the 40 Annual Conference of Nigerian Geographical Association, Held in Kano Between 4-7 May, 1997.

Dasgupta, P. and Weale, M. (1992), 'On Measuring the Quality of Life', *World Development*, vol. 20, No 1, pp 119-131.

David, D (1994), 'Fighting poverty and exclusion' in *The Courier*, No 143, Jan-Feb.*

David, D (1994), 'Poverty control policies in the developing world' in *The Courier*, No 143, Jan-Feb.*

David, D (1994), 'Poverty in the developing world: the main trends' in The Courier, No 143, Jan-Feb.*

David, R. (1996), 'Structural Adjustment, the Environment and Sustainable Development' in *The Courier*, No 159. Sept-Oct.

Devas, N. and Korboe (2000), 'City Governance and Poverty: the Case of Kumasi', *Environment and Urbanization*, vol. 11 No 2, pp123-136.

Dikj, M. P. (1995), 'The Urban Informal Sector Making a Dynamic Contribution to Development', in *The Courier* , No 151, May-June.

Drewnowsk, J. and Wolf, S. 91996), *The Level of Living Index*, UN Research Institute for Social Development; report No 4; Geneva.

Duranlean, D. (1995), 'Poverty: Culture as a Response', in *The Courier* , No 151, May-June.

Duru, R. C. (1981), 'A Photographic Approach to Land Use and Resource Surveys', in Ugbozurike, U. M. (ed.) *Land Use and Conservation in Nigeria.* University of Nigeria Press. Nsukka. Pp 57-67.

Duru, R. C. (1981), 'Dysfunctional Uses of Urban Land in Nigeria', in Ugbozurike, U. M. (ed.) *Land Use and Conservation in Nigeria.* University of Nigeria Press. Nsukka. Pp 109-118.

Eberlee, J. 'The Neglected Industry in Kenya' in *International Development Research Council (IDRC) monthly.*

Edozien, E. C. (1976), 'Poverty: Some Issues in Concept and Theory', in Nigerian Economic Society (NES) *Poverty in Nigeria* , Proceedings of the 1975 Conference of NES, pp 35-42.

Egunjobi, L. (1987), 'Urban Renewal; Issues, Policies, Strategies and Planning' in Onibokun, A.G., Olokesusi, F. and Egunjobi, L. (Eds.) *Urban Renewal in Nigeria,* Center for Urban and Regional Planning, University of Ibadan, Ibadan, pp 33-43.

Egunjobi, L. (1995), 'Urban Governance and the Quality of Urban Environment in Nigeria' Nigeria' in Onibokun, A.G. and Faniran, A. (eds.) *Governance and Urban Poverty in Anglophone West Africa,* CASSAD, Ibadan; pp 127-144.

Encyclopaedia Britannica, 2001.

Enemuo, C.F and Tomori, S. (1995), Local Governance in Nigeria: Bridging the Formal and Indigenous Structures' Nigeria' in Adedeji, A. and Ayo B. (eds.) *People-Centred Democracy: The Search for Alternative Systems of Governance at the Grassroots.* Heinemann Educational Books and African Centre for Development and Strategic Studies; Ijebu-Ode, pp157-170.

Engelhard, M. (1992), 'Strengthening of Local Advice Capacity', *GATE*, NO 4.

Engelhard, P. and Abdullahi, T.B. (1992), 'Environment, Development and Poverty', in *The Courier* , No 133, May-June.*

Eshett, E. T. (1995), 'Urban Governance and Environmental Quality in Nigeria', in Onibokun, A.G. and Faniran, A. (eds.) *Governance and Urban Poverty in Anglophone West Africa*, CASSAD, Ibadan; pp 154-166

European Commission (1993); *The developing countries' policies on poverty and their Shortcomings;* Luxembourg; European Commission.

Fabiyi, O.O. (1995), 'Computerizing Development Control for effective urban land Administration in Nigeria', A paper presented at *the 3 National workshop on Land administration in Nigeria*; held at Bayero University, Kano.

Fabiyi, O.O. (1999), Analysis of Urban Decay in Ibadan Metropolis Using Geographic Information Systems; Ph.D. Thesis Submitted to School of Post Graduate Studies, Federal University of Technology, Minna.

FAO (1987) 'Finding Best Places for Aquaculture' in *CERES* No 118 July-August.

Fafowora, O. (1998), 'Building a Compassionate Society in Nigeria through Poverty Alleviation', Convocation Lecture Delivered at Lagos State University, February 19.

Fapohunda, O. J (1984), Urban Employment in Lagos' in Sada, P. O. and Osirike, A. B. (eds.) *Case Studies in Migration and Urbanization in Nigeria; Perspectives in Policy Issues.* Geography Department, University of Benin, Benin City. Pp 66-84.

Fricke, W. and WolfeiB, A. (1996), 'Monitoring Land Use and Change Caused by Population Development in the Nigerian Savanna from the 1960s till the 1990' Examples from Bauchi State', in Daura, M. M. (ed.) *Issues in Environmental Monitoring in Nigeria*, NGA, Maiduguri pp 47-54.

Frommlet, W. (1992), 'The First Victims of the Crisis', *Development and Cooperation*, No , pp24-26.

FOS (1999), *Poverty Profile for Nigeria, 1980-1996*. Abuja, FOS..

Fox, M.L. and Monley, S.A. (1993),'Poverty and Adjustment in Brazil: Past, Adjustment and Future' in Lipton, M. and Gaag (eds.) *Including the Poor*. IBDR/World Bank, Washington, D.C.

Gilbert, A. and Gugler, J. (1982), *Cities, Poverty and Development; Urbanization in the Third World* Oxford; Oxford University Press.

Goldsmith, P. (1992) Development and Environmental Monitoring by satellites' in *The Courier* No 1333, May-June.

Green, K.M.; Lnych, J.F.Sircar, J. and Greenber, (1987), 'Landsat Remote Sensing to Assess Habitat for Migratory Birds in the Yucatan Peninsula, Mexico'. *Vida Silvestre Neotropical.* Vol. 1 No 2, pp27-38.

Gregoire, R. 'Remote Sensing and Rural Development: a Better Grasp of the Phenomena of Desertification', *The Courier*, No 128, July-August.*

Guardian, August 21, 2001.

Hallmark Weekly News Magazine, June 2, 1999, p29.

Hancock, T. (1995), 'Planning and Creating Healthy and Sustainable Cities: the Challenge' in WHO, *Healthy Cities: Our Cities, Our Future*. WHO.*

Hanson, N.M. (1981), Development from Above: the Centre-Down Development Paradigm in Stohr, W. B. and Taylor, d. R. F. (Eds.) Development from Above or Below? The Dialectics of Regional Planning in Developing Countries. Pp 15-38.

Hardoy, J. et al (1992), *Environmental Problems in Third World Cities;* London ,Earthscan.

Harris, R. (1987), *Satellite Remote sensing: An introduction*; London, Routledge and Kegan Paul.

Haworth , L. (1963), *The Good City*. Fawcett Publications, Inc. New York.

Harvey, D. (1973), *Social Justice and the City*, London.

Heilbrum, J. (1977), *Urban Economics and Public Policy;* New York, Saint Martin's Press.

Hicks, N. and Streeten, P. (1981), 'Indicators of Development: The Search for a Basic Needs Yardstick', in Streeten, P. and Jolly, R. (eds.) *Issues in World Development: A Collection of Survey Articles*, World Bank, Washington, D. C. pp 53-66.

Hoeven, R. (1986),' Planning for Basic Needs still a Relevant Framework or a Slogan Overtaken by Events?' in JASPA, *The Challenge of Employment and Basic Needs in Africa.* Oxford University Press. Nairobi. Pp 69-80.

Horton, F. E. (1974), " Remote sensing techniques and urban Data Acquisition : Selected Examples" in Estes, J. E. And Senger, L.W. (eds), *Remote sensing: Techniques for Environmental Analysis*, Hamilton Publishing company, Santa Barbara. pp 243-275.

Huang, Y. and Nicholas, P. (1987), 'The Social Costs of Adjustment: How Adjustment Programmes Affect the Poor, and How the World Bank is Helping Ameliorate Their Effects' *Finance and Development*, June pp22-24.

Hurley, D. (1990), *Income generation schemes for the urban poor;* Oxford, Oxfam.

Hussaini, M. A. (1995), 'The Land Systems Approach: A Tool for Land Surveys?', A Paper Presented at the Third national Conference *on Land Administration and Development* in Northern Nigeria, Held in Kano Between March 13-15.

IDRC, (1992) 'Remote Sensing for Artesenal Fisheries', in *One Hundred and One Technology*. IDRC. Ottawa, Canada.

Ikhuoria, I. A. (1988) 'Use of Remote Sensing to Determine Urban Blight in Benin City' in Sada, P. O. and Odemerho, F. O. (eds.) *Environmental Issues and Management in Nigeria*. Evan Brothers (Nigeria Publishers) Ltd. Ibadan. Pp 537-365.

ILO (1976), *Employment, Growth and Basic Needs; A One-World Problem*. Geneva, ILO.

Inyang, P. E. B. (1981), 'Environmental Pollution in Some Nigerian Towns' in Sada, P.O and Oguntoyinbo, J. S. (eds) *Urbanization process and Problems in Nigeria*. Ibadan University Press, Ibadan.

Irfam, M. and Amjad, R. (1984); 'Poverty in Pakistan' in Khan, A. R. and Lee, E. (eds.), Poverty in Rural Asia; ILO/Asian Employment Programmes; Bangkok.

IRMA (1993), Design and development of Multimedia Information Systems. Working Paper 78.

Jaycox, E.V. (1993), 'The World Bank View: The Benefits of Adjustment', *CERES*, NO 143, Sept-Oct.

Jenkins, P. (2000), 'Urban management, Urban Poverty and Urban Governance: Planning and Land Management in Maputo', *Environment and Urbanization*, vol. 11 No 2, pp 137-152.

Jolly, R. (1986), 'JASPA-Evolution of an Approach from Employment to Basic Needs in Economies Under Pressure' in JASPA, *The Challenge of Employment and Basic Needs in Africa.* Oxford University Press. Nairobi. Pp 3-8.

Joshi, N. V. and Krishna, M. B. (1996), *Studying Water Pollution through Fish Assessment;* Jawaharlal; Indian Institute of Science.

Kakwari, N (1993), ' Measuring Poverty: Definitions and Significance tests with Application to Cote d'Ivoire' in Lipton, M. and Gaag (Eds.) *Including the Poor*. IBDR/World Bank. Washington, D. C. *

Kawka, R.(1996), "African urban land classification using satellite imageries: The example of Maiduguri, N. E. Nigeria,' in Daura, M. M. (ed.) *Issues in Environmental Monitoring in Nigeria*, NGA, Maiduguri, pp23-28.

Keeble, L. (1968), *Principles and Practice of Town and Country Planning*, The Estates Gazete Ltd, London.

Kowarick, L. (1979), 'Capitalism and Urban Marginality in Brazil', in Bromley, R and Gerry, C. (eds.) *Casual Work and Poverty in Third world Cities*, John Wiley, pp 69-85.

Kufoniyi, O.; Aliyu, Z. O. and Soumah, M. (2003), 'The Application of Remote Sensing and GIS in Ecosystem and Water Resources Management: A Regional Perspective'; A paper presented at UNESCO Sponsored Multi-Stakeholders National Workshop on *The Application of Remote Sensing for The Integrated Management of Ecosystem and Water Resources in Nigeria*; Held in Minna, 4th September, 2003.

Lachance, E. (1993), 'Chasing away hunger in Bolivia' in *International Development Research Council (IDRC) monthly.*

Leach, M., Mearns, R. and Scoonees, I. (1997), 'Challenges to Community-Based Sustainable Development- Dynamics, Entitlements and Institutions', *IDS Bulletin*, vol. 28 No 4, pp 4-14.

Lean, W. (1969), Economics of Land Use Planning: Urban and Regional; The estate Gazette Ltd, London.

Lee, M. 'Breaking new ground in Dar-es-Salaam' in *International Development Research Council,* (IDRC) Monthly.*

Lester, R. B. et al (1991), *State of the World.* W. W. Norton. New York.

Lillesand, T. M. and Kiefer, R. R. (1979), *Remote sensing and image interpretation*: John Wiley and Sons, New York.

Lindgren, D. T. (1974), Urban Applications of Remote sensing" in Estes, J. E. and Senger, L.W. (eds), *Remote sensing techniques for Environmental Analysis*, Hamilton. Publishing company, Santa Barbara. pp 225-241.

Linthicum (1990), 'Application of Polar-orbiting Meteorological Satellite Data to Detect Flooding of Rift Valley Fever Virus Vector in Mosquito Habitat' in *Kenya Medical and Veterinary Entomology*, vol. 4 pp 739-741.

Lionel Demery, 'Cote d'Ivoire: fettered Adjustment' in *Adjustment in Africa: Lessons from case Studies*. World Bank. Washington, D. C. pp 72-153.

Lipton, M. (1977),*Why Poor People Stay Poor; Urban Bias in World Development*. Temple Smith. London.

Lipton, M. and Gaag (1993), 'Poverty L: A Search and Policy framework' in Lipton, M. and Gaag (eds.) *Including the Poor*. IBDR/World Bank. Washington, D.C.

Lo, C. P. (1986), *Applied Remote Sensing*. Longman Scientific and Technical. London.

Lopez, P. B. (1993), ' A Latin View: The Genius of the Fourth Dimension' *CERES* No 143 Sept.-Oct.

Loslier, L. (1995), Geographical Information System from a health perspective', in Savigny, D. and Wijeyaratne (Eds) *Geographical Information System for health and the environment*. IDRC. Canada.*

Maathai, W. (1995) *Bottlenecks of Development in Africa.* UNCHS. Nairobi.

Mabogunje, A. L. (1974), *The City and the Social Order,* Ibadan university Press, Ibadan.

Mabogunje, A. L. (1976), Prolegomenon to Urban Poverty in Nigeria' in Nigerian Economic Society (NES) *Poverty in Nigeria* , Proceedings of the 1975 Conference of NES, pp 96-91.

Mabogunje, A. L. (1981), 'Towards an Urban Policy in Nigeria' in Sada, P.O and Oguntoyinbo, J. S. (eds) *Urbanization process and Problems in Nigeria*. Ibadan University Press, Ibadan. Pp 7-20.

Mabogunje, A. L. (1988), 'The Debt to Posterity: Reflections on a National policy on Environmental management' in Sada, P. O. and Odemerho, F. O. (eds.) *Environmental Issues and Management in Nigeria*. Evan Brothers (Nigeria Publishers) Ltd. Ibadan. Pp 17-26.

Mabogunje, A. L. (1992), 'New Dimensions in Banking: A Focus on Community Banks' *National Concord,* Wednesday, Wednesday, October 28; p A3.

Mabogunje, A. L. (1996), *Environmental Challenges of Sub-Saharan Africa,* CASS Monograph No 7. Malthouse Press Ltd. Lagos.

Mabogunje, A. L. (2001), Nigeria and the *Urban Governance Campaign* . A Paper Presented at the Launching of the Global Campaign for Good Urban Governance, Abuja., April 10-12.

Mabogunje, A. L. (2002), 'Poverty and Environmental Degradation: Challenges Within the Global Economy'; *Environment*, January-February.

Mabbut, J. A. and Wilson, A.W. (eds.), Social and Environmental Aspects of Desertification, IGU. New York.

Magwire, D. J. (1989) *Computers in Geography*, Longman Scientific and Technical and John Wiley and Sons. New York.

Makinwa, P. K. (1988), Managing the Urban Environment: A Strategy for Upgrading Olaleye-Ipanrin Slum in Lagos' in Sada, P. O. and Odemerho, F. O. (eds.), *Environmental issues and Management in Nigerian Development*, Evans Brothers (Nigeria Publisher) Limited, pp132-148

Malhotra, M.S. and Srivastava, A. (1995), 'Diagnostic Features of Malaria Transmission in Nadiad Using Remote Sensing and Geographical Information System', in Savigny, D. and Wijeyaratne (Eds) *Geographical Information System for health and the environment*. IDRC. Canada.*

Massoud, O. (2000), 'Local Elites, Democracy and Community Empowerment in Nigeria' Nigeria' in Adedeji, A. and Ayo B. (eds.) *People-Centred Democracy: The Search for Alternative Systems of Governance at the Grassroots.* Heinemann Educational Books and African Centre for Development and Strategic Studies.pp67-72.

Mathia, E. (1996), Indigenous Knowledge and Development' in International Institute of Rural reconstruction, (IIRR), Recording and Using Indigenous Knowledge. A Manual

Max Lock (1980), *Master Plan of Minna, 1980-2000*. Max Lock, Minna.

Maxwell, D, et al (2000), urban Livelihoods and Food and Nutrition security in Greater Accra, Ghana. IFPRI /NMIMR and WHO.

May, J. (2003), An Exclusive Consensus: Definitions, Measurement and Analysis of Poverty' World Bank, Washington, D. C.

Mckinley, T. (1997), 'Beyond the Line: Implementing Complementary Methods of Poverty Measurement' in UNDP, *Poverty measurement: Behind and Beyond the Poverty Line*; World Bank, Washington, D.C.

Mehta, D (2001), 'Urbanization of Poverty' in *Habitat Debate*, vol. 6 No 4. Pp1-5.

Mehrotra, R. A. (2003), *Poverty and the Environment; Linkages and Lacunae*; World Bank, Washington, D.C.

Miller, H. J. (2003), 'Potential Contributions of Spatial Analysis to Geographic Information Systems for Transportation (GIS-T)', *Map India Project.**

Miner, K. and Onkalo, P. (2000), The Use of GIS and Satellite Images in Post-conflict Situation", UNDP, (200), *World Development Report, 2003;* World Bank, Washington, D.C. *Habitat Debate*, Vol. 6 No 2, pp16-17.

Mitchel, B. (1993), *Geography and Resource Analysis*, Longman; New York, 2nd Edition.

Morenikeji, O. O., Sanusi, Y. A. and Jinadu, A. M. (2000), The Role of Private Voluntary Associations In Community and Settlement Development. Sponsored by Centre for Research and Documentation, Kano in Collaboration with Ford Foundation.

Morgan, B.W. (1996), 'Poverty, vulnerability and rural development', in Uitoo, J.I. and Morgan, W.B. (Eds) *Sustaining the future: Economic and environmental change* Morgan, W.B. (Eds) *Sustaining the future: Economic and environmental change in Sub-Sahara Africa.*. United Nations University. New York.*

Moser, C; Gatehouse, M. and Garcia, H. (1996), *Urban poverty Research Sourcebook; Module 1: Sub-City Household Survey;* Urban Management Programme. Washington, D. C.

Mougeot, L.J.A. 'Urban food self-reliance: significance and prospects' in *International Development Research Council (IDRC) monthly.*

Muffart, I. (1996), *Sustainable Development: Principles, Analysis and Policies.* The Parthenson Publishing Group. London.

Naseem, S. M. (1977), 'Rural Poverty and Landlessness in Pakistan' in ILO Report on Poverty and Landlessness in Asia; ILO, Geneva.*

Narayan, D. I. et al (2000), Voices of the Poor: Can Anyone Hear Us? Oxford University Press, Oxford.

Nationa Board for Community Banks (NBCB) (1991), Community Banks: Operational Guidelines, NBCB, Lagos.

NEST (1991) *Nigeria's Endangered Species.* NEST. Ibadan.

Nkom, S. A.(2000), 'Culture, Empowerment and Local Government with Reference to North-Western Nigeria' in Adedeji, A. and Ayo B. (eds.) *People-Centred Democracy: The Search for Alternative Systems of Governance at the Grassroots.* Heinemann Educational Books and African Centre for Development and Strategic Studies.pp73-85.

Numan, F. and Satterthwaite, D. (1999), *Urban Governance, Partnership and Poverty; The Urban Environment*, Theme Paper 6- Working Paper 6, IDD, University of Birmingham and IIED, London.

Nwosu, H.N. (1977), Political authority and the Nigerian Civil service. Fourth dimension Publishers. Enugu.

Obateru, R. I. (1978), *Controlling Residential Densities*; Book Representation and Publishing Cō Ltd; Ibadan.

Obateru, R. I. (1986), *Land Subdivision Guide*; Evans Brothers (Nig. Publishers) Ltd, Ibadan.

Odemerho, F. O. (1988), 'Benin City: A Case Study of Urban Flood' in Sada, P. O. and Odemerho, F. O. (eds.) *Environmental Issues and Management in Nigeria.* Evan Brothers (Nigeria Publishers) Ltd. Ibadan. Pp 97-107.

Ogunpola, A. and Oladeji, O. (1976), 'Housing as an Indicator of Urban Poverty; The Case of Metropolitan Lagos; in Nigerian Economic Society (NES) *Poverty in Nigeria* , Proceedings of the 1975 Conference of NES, pp 111-123.

Okhimamhe, A. A. (2000), 'satellite Rainfall Estimates for Alleviating the Problems of Climate Change in Agricultural Applications', Paper Presented at the First National Training Workshop on *Climate Change and National* Disasters in Nigeria, 2-15th April.

Okeke, D. C. (2000), 'Urban Land Use Planning and Informal Sector Syndrome: A case Study of Enugu. *Journal of the Nigerian Institute of Town Planners.* Pp 56-65.

Okigbo, B.N. (1996), 'Towards sustainable environmental and resource management futures in Sub-Saharan Africa' in Uitto, J.I. and Morgan, W.B. (Eds.) *Sustaining the future: Economic and environmental change in Sub-Sahara Africa.*. United Nations University. New York.*

Okoye, T. O. (1979), Urban Planning in Nigeria and the Problem of Slums' *Third world Planning Review*, vol. 1 No 1.

Okpala, D. C. I. (1986), Institutional Problems in the Management of Nigerian Urban Environment. NSER. Ibadan.

Oladosu, S. a. (1973), 'Administrative Aspect of urbanization' in Adedeji, A and Rowland, L (eds.) *Management Problems of Rapid urbanization in Nigeria.* University of Ife Press. Ife. Pp .

Oloyede, P. A. (1998) 'Terrain Analysis: A Acase Study of kajuru Area' in Oloyede, P. (ed.) *Man, environment and technology.* CES, Kaduna polytechnic. Kaduna. Pp 91-96.

Olukoshi, A. O. (1993), 'Structural Adjustment and Nigerian Industry', in Olukoshi, A. O (ed.) The Politics of Structural Adjustment in Nigeria. Pp 54-73.

Onimode, B. (1976), 'The Dialectics of Exploitation: Poverty and Power in Nigeria' in Nigerian Economic Society (NES) *Poverty in Nigeria* , Proceedings of the 1975 Conference of NES, pp 335-348.

Onokerhoraye, A. and Omuta, G. E. D. (1984), *Urban System in Nigeria*, Geography and Planning Department, University of Benin, Benin City.

Onyebueke, V. U (2000) 'Incidence of Informal Sector Enterprises in the Urban residential Zone: Analysis of the Pattern and Determinants in Enugu'. *Journal of the Nigerian Institute of town Planners*. Pp12-25.

Oriade, L. A. (1995), How Governance can Affect Urban Environmental Quality: the Case of Festac' Nigeria' in Onibokun, A.G. and Faniran, A. (eds.) *Governance and Urban Poverty in Anglophone West Africa*, CASSAD, Monograph Series 4; pp 167-172.

Osberg, L and Sharpe, A. (2003), Human Well Being and Economic Well Being: What value are Implicit in the Current Indices; Centre for Living Standards, Ontario.

Oyeshola, D.O.P. (1998), *Politics of International Environmental Regulations*. Daily Graphics Publications. Ibadan.

Ozo, A. O. (1987), 'Housing Conditions of the Urban Poor in benin City, Nigeria', in Makinwa, P. K. and Ozo, A. O. (eds), The Urban Poor in Nigeria; Evans Brothers (Nig. Publishers) Ltd, Ibadan

Pearce, D. et al (1990), *Sustainable Development; Economics and Environment in the Third World.* Earthscan. London.

Pinheiro, P. S. (1993), 'Reflections on Urban Violence', *Urban Age*, vol. 1 p3.

Pryjomko, R. and Rabley, P (1998), "Mapping the future" *Urban Age*; Autumn, pp18-19.

Pugh, C. (1995), 'The Role of the World Bank in Housing' in Aldrich B. and Sandhu, R. (Eds.) *Housing the Poor: Policy and Practice in Developing Countries*. Zed, London.

Pulkol, D. 'Forward' in Hambly, H and Angura, T. O. (eds) *Grassroots Indicators for Desertification*. IDRC. Canada.*

Punch Newspapers, June 26, 2003, p23.

Punch Newspapers, September 13, 2004, p19.

Rakodi, C, Gatabaki-Kamau, R. and Devas N. (2000), 'Poverty and Political Conflict in Mombasa', *Environment and Urbanization*, vol. 11 No 2, pp 153-170.

Ramalho-Filho, A.; Oliveira, R.P. and Pereira, L.C. (1997), 'Use of GIS in (planning) Sustainable Land Management in Brazil : Potentials and User Needs', *ITC Journal*, Vol 3 No 4, pp295-301.

Rao, B. B. (1979), *Housing and Habitat in Developing Countries*; Newman Group of Publishers, New Delhi.

Ravallion, M. (1992), Poverty comparisons: A living standards measurement study. Working paper No 88, World Bank, Washington, D.C.

Reader, S. (1995) 'The present state of Geographical Information System and the Future trends' in Savigny, D. and Wijeyaratne (Eds) *Geographical Information System for Health and the Environment*. IDRC. Canada.

Reissman, L. (1964), *The Urban Process, Cities in Industrial Societies,* Glencoe, Illinois.

Rogers, D. and Randolph, S.E. (1991), 'Mortality rates and population density of tsetse flies correlated with satellite image', *Nature*, No 351 pp 739-741.

Sada, P. O. (1973), 'Urbanization Trends and Problems of Urban Administration in Nigeria' in Adedeji, A and Rowland, L (eds.) *Management Problems of Rapid urbanization in Nigeria*. University of Ife Press. Ife. Pp 139-163.

Sada, P. O. (1976), Urban Poverty, The case of Lagos' in Nigerian Economic Society (NES) *Poverty in Nigeria* , Proceedings of the 1975 Conference of NES, pp 93-110.

Sada, P.O. (1987), 'Urban Households, Employment and Poverty in Nigerian Cities' in Makinwa, P.K. and Ozo, O.A. (eds.) *The Urban Poor in Nigeria.* Evans Brothers (Nigeria Publishers), Ibadan;pp14-41.

Sahlins, M. (1972), *Stone Age Economics.**

Sanusi, Y. A. (2001),'Partnership in the Management of Urban Environment: A Case Study of Solid Waste in Nigeria'; A Paper Presented at the National Conference of the School of Environmental College, Federal Polytechnic, and Nassarawa; 18th-19th July, 2001.

Sattethwaite, D. (1997), Urban Poverty, Reconsidering Its Scale and Nature; *IDS Bulletin*, vol. 28 No 2. Pp 9-22.

Selbourne, D. (1977), *An Eye to India.* Penguin Books, Harmondsworth, Middlesex.

Sen, A. (1985), *Commodities and Capabilities*; Amsterdam, North-Holland.

Shefer, D. (1981), 'Causes and Consequences of Neighbourhood Deterioration', in IFS, *Traffic, Transportation and Urban Planning*, vol. 1. George Godwin. New York.

Silitshana, R.M.K. (1996), 'Urban environmental management and issues in Africa south of the Sahara' in Uitoo, J.I. and Morgan, W.B. (Eds) *Sustaining the future: Economic and environmental change in Sub-Sahara Africa.*. United Nations

Skidmore, A.; Bijker, W; Schmidt, K and Kumar, L (1997), Use of Remote Sensing and GIS for Sustainable Land management", ITC Journal, Vol. 3 No 4, pp295-301.

Soussan, J. G. (1992), 'Urban Development' in Mannion, A. M. and Rolly, S. R. (eds.) *Environmental Issues in the 1990s.* John Wiley and Sons. New York. Pp 26-36.

South, C. (1995), Information and the city: Circa 2025" in *Urban Age*, February, p 12.

Soyombo, O. (1987), Some Issues in the Conceptualization of Poverty and Theory of Urban Poverty in Nigeria' in Makinwa, P.K. and Ozo, O.A. (eds.) *The Urban Poor in Nigeria.* Evans Brothers (Nigeria Publishers), Ibadan; pp 1-13.

Soyombo, O. (1995), 'The Nature and Structure of Urban Economy and Implications for Urban Poverty in Nigeria' in Onibokun, A.G. and Faniran, A. (eds.) *Governance and Urban Poverty in Anglophone West Africa*, CASSAD, Monograph Series 4; pp 116-126.

SPORE (1986) Bulletin of CTA, NO 3.

Stewart, F. (1974), 'Technology and Employment in Developing Countries' in Edward, D. (ed.), *Employment in Developing Nations: Reports on a Ford Foundation Study*, Cambridge University Press. New York, pp 83-132.

Stewart, F. (1986), 'Basic Needs Achievements in Sub-Sahara in Africa: A Macro-Approach. in JASPA, *The Challenge of Employment and Basic Needs in Africa.* Oxford University Press. Nairobi Pp 39-59.

Stohr, W. B. (1981), Development from Below: The Bottom-Up and Periphery-Inward Development Paradigm' in Stohr, W. B. and Taylor, d. R. F. (Eds.) *Development from Above or Below? The Dialectics of Regional Planning in Developing Countries* John Willey and Sons. New York. Pp 39-72.

Streeten, P. (1986), 'Basic Needs: Some Unsettled Questions' in JASPA, *The Challenge of Employment and Basic Needs in Africa.* Oxford University Press. Nairobi. Pp 20-27.

Stewart, F. (1974), 'Technology and Employment in Developing Countries' in Edward, E. (Eds), *Employment in Developing Nations: Reports on a Ford Foundation Study*, Cambridge University Press. New York, pp 83 - 132.
Subramanian, D. K. and Ramachadra, T. V. Detecting Water Pollution Through Fish Assessment *
Sule, R.A.O. (1981) 'Implementing Urban Land Use Plans in Nigeria: The Place of Zoning Instrument' in Ugbozurike, U. M. (ed.) *Land Use and Conservation in Nigeria*. University of Nigeria Press. Nsukka. Pp 74-80.
Sule, R. A. O. (1986), 'Unauthorized Housing Conversions and Structural Modifications in Nigerian Cities: The Paralysis of master Plans' in Adeniyi, E. O. and Bello-Imam, I. B. (eds.) *Development and the Environment*. NISER. Ibadan. Pp 319-334.
Sunday Tribune, September 2, 2001.
Tauer, W. and Numborg, G. (1992), Runoff Irrigation in the Sahel in SPORE , *Bulletin of the CTA* NO 45, June.*
Tevoedjire, A. (1978), Poverty, Wealth and Mankind.*
Todaro, M. P. (1977), *Economic Development in the Third World*; Longman; London and New York.
UNCHS (1994), *Population, Urbanization and Quality of Life*, UNCHS. Nairobi..
UNCHS (1996) *An Urbanizing World: Global Report on Human Settlements*. Oxford University Press. Oxford.
UNCHS (2001), *The Global Campaign for Good Urban Governance*. UNCHS, Nairobi.
UNDP (1997), *Nigerian Human Development Index Report*. UNDP, Lagos.
UNDP, (2000), *World Development Report, 2000;* World bank, Washington, D.C.
UNDP, (2003), *World Development Report, 2003;* World bank, Washington, D.C.
UNICEF (1990), *First Call for Children-World Declaration and Plan of Action*
Vandemoortele, J. (2003), *Are We Really Reducing Global Poverty?* UNDP; New York.
Vibulsresth, S. (1986), Remote Sensing Activities in Thailand in *Remote Sensing Yearbook*. Taylor and Francis. London. Pp 127-138. vol. 28 No 4, pp 4-14.
Weeks, J. (1993), 'A Critics View: Credit Where Discredit is Due', *CERES*, NO 143, Sept-Oct.
White, L.-P. (1977), *Aerial Photography and Remote Sensing*. Clarendon Press. Oxford.
Whittaker, R. H. (1990), *Communities and Ecosystems*; Macmillan; New York.
Willis, K. G. (1980), *The Economics of Town and Country Planning*. Grenada. London.
Wirth, L. (1938), *Urbanism as a Way of Life*, Chicago School, Chicago.
Wood, B.L., et al (1991), Estimating High Mosquito-Producing Rice Fields Using Spectral and Spatial Data. *International Journal of Remote Sensing*, vol. 13 No 15 pp 13-28
World Bank (1990), *World Economic Review* (1990): Poverty. oxford University Press. Oxford.
World Bank (1992), *Development and the Environment*. Oxford University press. New York.
World Bank (1993), World population data sheet 1993. World Bank. Washington, D.C.
World Bank (1995), *Jobs, Poverty and Working in South Asia- Regional Perspectives on World Development Report*. World Bank. Washington, D. C.
Yankson, P.W.K. (1995), Urban Governance and Urban Poverty I Ghana' Nigeria' in Onibokun, A.G. and Faniran, A. (eds.) *Governance and Urban Poverty in Anglophone West Africa*, CASSAD, Monograph Series 4; pp 43-70.

NOTE: * CD-BASED LIBRARY SOURCE (HUMANITY DEVELOPMENT LIBRARY) WHICH PAGES AND OR PUBLISHERS CANNOT BE IDENTIFIED.

APPENDIX 1: VARIABLES OF HUMAN DEVELOPMENT INDEX

	Mean monthly income	Mean annual income	Literacy level	Av. Yr in Schl
Angwa Daji	27481	329772	82	6.8
Barkin Saleh	20286	243432	97	11.4
Bosso Estate	37717	452600	97	16.7
Bosso Town	45621	547448	96	17.5
Chanchaga	33871	406449	97	12.9
Dutse Kura Gwari	51440	617280	80	13.5
Dutse Kura Hausa	46186	554229	93	13.7
Fadipe	42667	512000	100	14.7
F-Layout	81833	981996	100	14.9
Abbatoir/Tayi Village	47030	564360	100	17.3
GRA	51583	619000	100	16.2
Jikpan-Hayan Gwari	22043	264522	100	12.4
Kwangila (Minna Central)	20240	242880	97	16
Kpakungu/Soje	18800	225600	97	14.2
Lamiwa A	29261	351129	97	12
Maitunbi	29376	352512	91	11
Makera (Railway Quarters)	46971	563657	93	5
Nasarawa	34429	413143	100	13.8
Sabo Gari	28364	340364	100	10.5
Sango	17905	214857	94	11.5
Sauka Kahuta	13056	156667	100	8.4
Tundu Fulani	27847	334162	94	13.7
Tundu Wada North	23953	287436	93	14
Tundu Wada South	81040	972480	93	7.9
Tunga low cost	56720	680640	100	17.8

Source: Author's Field Survey, 2004

APPENDIX 1B: CALCULATING THE HDI BY NEIGBOURHOODS

	NEIGHBOURHOOD	I Years spent in schools	II Literacy level	III (I + II)	IV III/2 HDI LITERACY	V Income HDI	VI (IV +V0	VII VI/2 OVERALL HDI
	Angwan Daji	0.264	0.82	1.084	0.542	0.065	0.607	0.304
	Barkin Saleh	0.473	0.97	1.443	0.722	0.047	0.769	0.385
	Bosso Estate	0.714	0.97	1.684	0.827	0.09	0.917	0.459
	Bosso Town	0.75	0.96	1.71	0.855	0.109	0.964	0.482
	Chanchaga	0.541	0.97	1.511	0.756	0.08	0.836	0.418
	Dutse Kura Gwari	0.568	0.8	1.368	0.684	0.123	0.807	0.404
	Dutse Kura Hausa	0.577	0.93	1.507	0.754	0.11	0.864	0.432
	Fadipe	0.622	1	1.622	0.811	0.102	0.913	0.457
	F-Layout	0.632	1	1.632	0.816	0.198	1.014	0.507
	Tayi Village	0.741	1	1.741	0.871	0.113	0.984	0.492
	GRA	0.691	1	1.691	0.846	0.124	0.97	0.485
	Jikpan-Hayan Gwari	0.518	1	1.518	0.759	0.051	0.81	0.405
	Minna Central	0.682	0.97	1.652	0.826	0.047	0.873	0.437
	Kpakungu	0.6	0.97	1.57	0.785	0.044	0.829	0.415
5	Limawa A	0.5	0.97	1.47	0.735	0.069	0.804	0.402
6	Maitumbi	0.455	0.91	1.365	0.683	0.069	0.752	0.376
7	Makera	0.182	0.93	1.112	0.556	0.112	0.668	0.344
8	Nasarawa	0.582	1	1.582	0.791	0.082	0.873	0.437
9	Sabo Gari	0.432	1	1.432	0.716	0.067	0.783	0.392
0	Sango	0.477	0.94	1.417	0.709	0.041	0.75	0.375
1	Sauka Kahuta	0.336	1	1.336	0.668	0.029	0.697	0.349
22	Tudun Fulani	0.577	0.94	1.517	0.759	0.066	0.825	0.413
23	Tudun Wada North	0.591	0.93	1.521	0.761	0.056	0.817	0.409
24	Tudun Wada South	0.405	0.93	1.335	0.668	0.196	0.864	0.432
25	Tunga Low Cost	0.764	1	1.764	0.882	0.136	1.018	0.509

Source: Derived from Appendix 1

APPENDIX 2:

PROPORTION OF URBAN HOUSEHOLDS WITH BASIC HOUSING FACILITIES

	T	WC	BRM	KT	TW	ATW	NSF	E
Angwa Daji	100	65	74	89	40	100	25	100
Barkin Saleh	100	17	100	93	3	100	24	100
Bosso Estate	100	100	100	100	93	100	100	100
Bosso Town	100	64	100	89	52	100	33	100
Chanchaga	98	47	74	95	68	95	37	93
Dutse Kura Gwari	100	56	100	82	12	100	16	88
Dutse Kura Hausa	100	44	100	100	13	96	8	100
Fadipe	100	67	100	93	13	33	63	67
F-Layout	100	100	100	100	73	100	83	100
tayi Village	100	90	92	96	48	100	50	100
GRA	100	100	100	100	97	100	100	100
Jikpan-Hayan Gwari	100	65	98	98	6	50	0	100
Minna Central	100	44	100	81	43	83	17	91
Kpakungu/Soje	100	51	100	76	0	100	0	100
Lamiwa A	100	34	100	100	25	100	14	100
Maitunbi	100	66	91	85	41	59	3	95
Makera	100	80	100	100	94	100	54	100
Nasarawa	100	64	100	100	50	93	15	100
Sabo Gari	95	45	96	89	41	90	27	100
Sango	100	28	100	100	20	100	0	92
Sauka Kahuta	100	28	100	86	30	72	0	100
Tundu Fulani	94	64	100	78	12	100	22	100
Tundu Wada North	100	81	100	96	53	100	41	100
Tundu Wada South	100	73	100	100	73	100	77	100
Tunga low cost	100	100	100	100	100	100	100	100

DEFINITION

T= % of households with toliet

WC= % of households who have water closet toilet

BRM= % of households with bathroom

KT= % of households with kitchen

TW= 5 of households with tap water within the housing units

ATW= general access to tap water by households

NSF= % of households who share no facility

E= % of households with electricity

APPENDIX 3: INDICES OF HOUSING SPACE AMONG THE NEIGHBOURHOODS

	Sitting room	Open space	Spillover pop	Not slpn in SR	Cross ventilatn	Occup ratio
Angwa Daji	100	100	31	54	70	2.9
Barkin Saleh	83	93	26	64	71	2.7
Bosso Estate	100	97	41	55	100	3.4
Bosso Town	100	93	4	30	100	2.1
Chanchaga	91	0	0	59	74	1.7
Dutse Kura Gwari	72	88	24	100	88	2.6
Dutse Kura Hausa	83	94	9	66	89	2.2
Fadipe	91	63	0	35	87	1.8
F-Layout	100	100	0	73	100	1.8
Abbatoir/Tayi Village	94	44	7	90	90	2.1
GRA	100	84	10	97	100	2.2
Jikpan-Hayan Gwari	100	94	0	59	75	2
Kwangila (Minna Central)	91	68	23	63	83	2.5
Kpakungu/Soje	65	28	.	12	.	.
Lamiwa A	55	21	45	2	71	2.5
Maitunbi	87	74	33	42	84	3
Makera (Railway Quarters)	96	100	27	64	81	2.8
Nasarawa	93	93	0	54	59	1.36
Sabo Gari	82	56	31	49	94	2.5
Sango	82	72	33	56	84	3
Sauka Kahuta	86	100	41	84	93	3.9
Tundu Fulani	20	14	23	39	27	2.6
Tundu Wada North	97	86	8	63	69	2.2
Tundu Wada South	97	80	23	57	93	2.6
Tunga low cost	84	100	21	24	100	2.5

	% Sharing	% Removed fundation	% Hanging	% Houses without fund.	% Accesible bldn	% Untarred & ruged rd	% Bldn >25yrs old	% Mud	% Unplastered mud bldn	% Cracked wall	% Collapsing wall	% collapsed wall	% rusty roof	% roofilfting
Angwa Daji	100	0	0	0	30	40	0	11	0	9	0	0	0	0
Barkin Saleh	20	40	17	0	83	67	0	57	20	10	20	27	33	47
Bosso Estate	0	0	0	0	0	0	0	0	0	3	0	0	0	0
Bosso Town	32	6	27	13	16	48	40	53	10	41	9	3	16	3
Chanchaga	5	0	0	0	0	10	20	3	0	12	3	0	46	6
Dutse Kura Gwari	36	30	6	16	50	0	72	38	30	22	30	0	52	50
Dutse Kura Hausa	16	0	0	0	0	26	6	6	0	27	5	0	44	0
Fadipe	73	0	14	0	0	100	0	0	0	30	0	0	17	23
F-Layout	0	0	0	0	0	0	37	7	0	33	0	0	37	0
Abbatoir/Tayi Village	8	0	0	0	24	24	0	28	20	8	0	0	30	2
GRA	0	0	0	0	0	0	2	0	0	0	0	0	0	0
Jikpan-Hayan Gwari	34	6	4	10	52	70	10	48	22	46	8	2	46	0
Kwangila (Minna Central)	31	0	13	0	13	56	57	42	16	34	13	2	64	7
Kpakungu/Soje	18	21	16	0	60	69	5	40	25	24	17	19	37	24
Lamiwa A	49	0	14	0	20	14	74	100	40	37	34	0	53	18
Maitunbi	9	2	0	8	11	65	5	19	9	39	8	0	79	1
Makera (Railway Quarters)	34	0	0	0	32	100	0	0	0	74	0	0	100	0
Nasarawa	23	0	0	7	0	13	58	32	0	41	0	0	47	0
Sabo Gari	39	0	14	56	11	47	42	18	0	57	11	0	62	10
Sango	30	0	0	4	54	58	46	48	22	64	8	0	54	12
Sauka Kahuta	20	30	14	0	72	42	0	66	38	32	24	16	34	36
Tundu Fulani	0	14	30	52	12	38	9	24	0	36	0	0	38	24
Tundu Wada North	27	12	22	27	0	13	45	53	4	37	0	2	33	0
Tundu Wada South	27	0	0	4	0	32	8	0	0	33	0	0	13	18
Tunga low cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	% Rounded part roofs	% Bldn without windw	% cracked windw	% twisted windw	% removed windw	% Mat doors	% cracked doors	% collapsing doors	% collapsed doors	% Houses without drains	% Houses with blocked drain	% H2O Drain to sorrounding	% H2O Drain to drains	% H2O to drian & surrounding	% Houses with visible sewage	Pollution	Flooding	Erosion	Pollution &Erosion	Pollution & Flooding	Erosion & Flooding	Foul odour	None	% Bldn with some envt.l prob
Angwa Daji	0	0	0	0	0	0	0	0	0	58	15	0	79	7	55	0	0	40	0	0	0	0	60	40
Barkin Saleh	0	10	40	27	10	0	17	56	20	100	NA	63	37	0	73	0	67	27	0	0	0	0	0	100
Bosso Estate	3	0	0	0	0	0	0	3	0	3	0	0	0	0	0	0	0	10	0	0	0	0	90	10
Bosso Town	12	9	25	8	21	16	23	2	1	65	55	67	5	1	42	7	40	6	14	0	31	0	0	100
Chanchaga	0	0	5	3	0	0	12	2	0	37	27	23	62	0	15	2	12	27	42	4	2	0	11	89
Dutse Kura Gwari	6	0	0	52	0	0	30	28	0	0	NA	40	50	0	48	0	28	64	8	0	0	0	0	100
Dutse Kura Hausa	0	0	0	3	0	0	3	0	0	37	40	29	39	0	47	23	16	0	0	0	0	0	61	39
Fadipe	0	40	3	7	0	3	93	7	0	100	NA	40	30	0	13	0	0	60	30	0	7	0	3	97
F-Layout	0	0	20	3	0	0	10	0	0	3	14	0	3	0	3	0	0	0	0	0	0	0	0	0
Abbatoir/Tayi Village	0	0	2	6	0	0	8	0	0	84	100	78	0	0	52	0	0	28	68	0	0	0	4	96
GRA	0	0	0	0	0	0	0	0	0	23	0	0	40	0	0	0	0	0	0	0	0	0	0	0
Jikpan-Hayan Gwari	2	0	20	16	4	0	24	6	0	76	67	54	20	0	6	12	12	18	28	2	6	22	0	100
Kwangila (Minna Central)	0	0	14	17	2	0	21	3	2	61	67	52	36	0	25	2	0	1	31	11	1	0	44	56
Kpakungu/Soje	0	6	24	18	6	0	13	31	12	100	NA	55	33	0	56	2	30	39	19	3	0	0	0	99
Lamiwa A	0	-14	3	18	0	0	9	8	0	40	0	60	14	0	63	49	0	17	8	0	0	0	26	74
Maitunbi	0	1	2	4	0	0	5	0	0	95	0	41	6	0	32	5	3	13	64	3	5	7	0	100
Makera (Railway Quarters)	0	0	0	0	0	0	6	0	0	87	60	57	38	0	26	0	0	32	68	0	0	0	0	100
Nasarawa	0	0	12	16	0	0	0	0	0	21	27	24	33	0	16	32	0	20	20	15	0	0	13	87
Sabo Gari	0	0	25	11	2	0	24	7	0	51	58	53	38	0	75	12	0	18	70	0	0	0	10	90
Sango	4	0	0	24	0	4	28	0	0	60	4	68	32	0	12	0	0	12	88	0	0	0	0	100
Sauka Kahuta	0	6	26	34	6	0	22	38	18	34	46	58	40	0	0	0	58	30	4	8	0	0	0	100
Tundu Fulani	12	0	0	0	12	0	12	0	0	100	NA	100	0	0	12	36	0	12	38	14	0	0	0	100
Tundu Wada North	12	3	17	10	18	5	29	1	0	48	0	50	30	5	21	4	16	21	30	0	29	0	0	100
Tundu Wada South	3	7	0	0	0	0	0	0	0	34	44	36	22	0	13	0	0	0	48	0	0	0	0	48
Tunga low cost	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	100	0	0	0	0	0	100

APPENDIX 5: BUILDING CONDITIONS

	A	GR	IW	IR	IWD	ID	IF	IFD
ngwa Daji	100	87	91	100	100	100	100	100
arkin Saleh	17	33	20	20	23	7	20	23
osso Estate	100	100	97	97	100	97	93	100
osso Town	94	51	41	69	46	74	37	35
hanchaga	100	90	86	47	89	83	81	92
utse Kura Gwari	50	24	48	42	48	42	42	28
utse Kura Hausa	100	74	67	56	97	97	77	84
adipe	100	0	70	60	90	70	43	13
Layout	100	100	67	63	77	90	100	100
batoir/Tayi Village	76	56	92	68	92	92	100	92
RA	100	100	100	100	100	100	100	100
pan-Hayan Gwari	52	16	44	42	60	70	54	52
nna Central	87	44	51	18	59	64	39	49
akungu/Soje	40	30	38	39	51	44	40	44
amiwa A	80	86	27	29	79	83	60	57
aitunbi	89	38	53	20	94	95	62	88
akera	68	0	26	0	100	94	23	66
asarawa	100	87	55	49	68	93	43	72
abo Gari	89	54	32	28	62	69	32	47
ango	46	42	28	30	76	72	28	70
auka Kahuta	28	58	28	30	34	22	30	36
undu Fulani	88	62	64	38	88	88	24	48
undu Wada North	100	87	61	55	55	70	42	39
undu Wada South	100	68	67	66	100	100	83	73
unga low cost	100	100	100	100	100	100	100	100

EFINITION

= % of buildings with access roads
GR= % of buildings facing good roads
V= % of buildings with intact walls
R= % of buildings with intact roofs
VD=% of buildings with intact windows
D= % of buildings with intact doors
=% of buildings with intact floors
FD= % of buildings with intact foundation

APPENDIX 6: PROPORTION OF STREETS EXPERIENCING QUANTITATIVE INDICATORS OF ENVIRONMENTAL DETERIORATION BY NEIGHBOURHOODS

	NEIGHBOURHOOD	Proportion of Streets per indicator									
		UVP	RDAS	FA	ES	MWH	GOH	URD	SOS	DL	DR
1	Angwan Daji	58	77	0	0	0	0	15	77	77	85
2	Barkin Saleh	19	100	100	100	100	100	100	72	24	91
3	Bosso Estate	26	0	19	27	50	16	61	0	8	96
4	Bosso Town	44	77	35	44	23	23	79	87	60	91
5	Chanchaga	92	100	92	92	92	50	100	75	67	100
6	Dutse Kura Gwari	83	58	25	25	25	33	42	91	75	70
7	Dutse Kura Hausa	80	80	10	60	10	0	70	10	100	100
8	Fadipe	100	38	50	50	13	25	38	13	12	66
9	F-Layout	83	100	67	0	100	0	100	0	17	100
10	Abbatoir/Tayi Village	50	83	33	83	0	33	83	33	50	63
11	GRA	88	94	13	13	25	0	63	0	0	100
12	Jikpan-Hayan Gwari	86	100	43	43	43	27	100	82	71	80
13	Kwangila	33	54	43	51	44	37	42	68	48	80
14	Kpakungu / Sodje	67	43	43	59	26	64	69	64	48	95
15	Limawa A	10	10	0	0	0	0	15	90	55	70
16	Maitunbi	53	53	50	57	50	54	61	71	69	89
17	Makera	50	64	14	79	7	7	43	7	21	57
18	Nasarawa	0	24	12	18	6	6	0	0	23	29
19	Sabo Gari	26	9	26	91	83	13	44	4	43	83
20	Sango	73	93	41	78	67	22	93	85	74	96
21	Sauka Kahuta	100	70	80	80	40	60	80	40	60	90
22	Tudun Fulani	36	36	46	100	27	0	91	100	45	91
23	Tudun Wada North	52	88	76	72	12	24	100	82	66	84
24	Tudun Wada South	61	85	92	77	100	40	92	100	85	70
25	Tunga Low Cost	29	21	14	21	9	18	27	39	32	95

DEFINITION:

UVP= unkept vacant plots
RDAS= refuse dumps along the streets
FA= floodable areas.
ES= erosion spots.
GMWH= grinding machine within houses
GMOH= grinding machines outside the houses.
URD= unkept refuse dumps
SOS= sewage on the streets.
DL= domestic liquid on the streets.
DR= degraded roads.

APPENDIX 7: ENVIRONMENTAL DEVELOPMENT INDEX: HOUSING FACILITIES

S/N	Neighbourhood	Toilet	WC users	Brm	Kitchen	Tap within	Access to tap	Shared facilities	electricity	EDI
1	Agwan Daji	1	0.65	0.74	0.89	0.4	1	0.25	1	0.74
2	Barkin Saleh	1	0.17	1	0.93	0.03	1	0.24	1	0.67
3	Bosso Estate	1	1	1	1	0.93	1	1	1	.99
4	Bosso Town	1	0.64	1	0.89	0.52	1	0.33	1	0.80
5	Chanchaga	0.98	0.47	0.74	0.95	0.68	0.95	0.37	0.93	0.76
6	Dutse Kura Gwari	1	0.56	1	0.82	0.12	1	0.16	0.88	0.69
7	Dutse Kura Hausa	1	0.44	1	1	0.13	0.96	0.08	1	0.70
8	Fadipe	1	0.67	1	0.93	0.13	0.33	0.63	0.67	0.67
9	F-Layout	1	1	1	1	0.73	1	0.83	1	0.95
10	Tayi Village	1	0.9	0.92	0.96	0.48	1	0.5	1	0.85
11	GRA	1	1	1	1	0.97	1	1	1	1.0
12	Jikpan-Hayan Gwari	1	0.65	0.98	0.98	0.06	0.5	0	1	0.65
13	Minna Central	1	0.44	1	0.81	0.43	0.83	0.17	0.91	0.70
14	Kpakungu / Sodje	1	0.51	1	0.76	0	1	0	1	0.66
15	Limawa A	1	0.34	1	1	0.25	1	0.14	1	0.72
16	Maitunbi	**1**	**0.66**	**0.91**	0.85	0.41	0.59	0.03	0.95	0.68
17	Makera	1	0.8	1	1	0.94	1	0.54	1	0.91
18	Nasarawa	1	0.64	1	1	0.5	0.93	0.15	1	0.78
19	Sabo Gari	0.95	0.45	0.96	0.89	0.41	0.9	0.27	1	0.73
20	Sango	1	0.28	1	1	0.2	1	0	0.92	0.68
21	Sauka Kahuta	1	0.28	1	0.86	0.3	0.72	0	1	0.65
22	Tudun Fulani	0.94	0.64	1	0.78	0.12	1	0.22	1	0.71
23	Tudun Wada North	1	0.81	1	0.96	0.53	1	0.41	1	0.84
24	Tudun Wada South	1	0.73	1	1	0.73	1	0.77	1	0.90
25	Tunga Low Cost	1	1	1	1	1	1	1	1	1.0

APPENDIX 8: HOUSEHOLD-BASED INDICATORS OF DEPRIVATION;: ENVIRONMENTAL DEVELOPMENT INDEX: HOUSING SPACE

S/N	Neighbourhood	SRM	OS	SOPOP	SRBR	CV	AEDI
1	Agwan Daji	1.00	1.00	0.69	0.54	0.73	0.68
2	Barkin Saleh	0.83	0.93	0.74	0.64	0.71	0.64
3	Bosso Estate	1.00	0.97	0.59	1.00	1.00	0.69
4	Bosso Town	1.00	0.93	0.94	0.30	1.00	0.53
5	Chanchaga	0.91	0.00	0.00	0.59	0.74	0.37
6	Dutse Kura Gwari	0.72	0.88	0.76	1.00	0.88	0.71
7	Dutse Kura Hausa	0.83	0.94	0.91	0.66	0.89	0.71
8	Fadipe	0.91	0.63	0.00	0.35	0.87	0.46
9	F-Layout	1.00	1.00	0.00	0.73	1.00	0.62
10	Tayi Village	0.94	0.44	0.93	0.90	0.90	0.69
11	GRA	1.00	0.84	0.9	0.97	1.00	0.79
12	Jikpan-Hayan Gwari	1.00	0.94	0.00	0.59	0.75	0.55
13	Minna Central	0.91	0.68	0.77	0.63	0.83	0.64
14	Kpakungu	**0.65**	**0.28**	**0.00**	0.12	0.00	0.18
15	Limawa A	0.55	0.21	0.55	0.02	0.71	0.34
16	Maitumbi	0.87	0.74	0.67	0.42	0.84	0.59
17	Makera	0.96	1.00	0.73	0.64	0.81	0.69
18	Nasarawa	0.93	0.93	0.00	0.54	0.59	0.5
19	Sabo Gari	0.82	0.56	0.69	0.49	0.94	0.58
20	Sango	0.82	0.72	0.67	0.56	0.84	0.6
21	Sauka Kahuta	0.86	1.00	0.59	0.84	0.93	0.7
22	Tudun Fulani	0.20	0.14	0.77	0.39	0.27	0.3
23	Tudun Wada North	0.97	0.86	0.92	0.63	0.69	0.68
24	Tudun Wada South	0.97	0.80	0.77	0.57	0.93	0.68
25	Tunga Low Cost	0.84	1.00	0.79	0.24	1.00	0.64

Source: Based on data in Appendix 3.

SRM: Presence of sitting room
OS: Open space within a residential building
SOPOP: Spill-over population
SRBR: Index of not using sitting room as sleeping room
CV: Cross ventilation in rooms
AEDI: Average Environmental Development Index

APPENDIX 9: INDICES OF GENERAL PHYSICAL ENVIRONMENT

	IVP	RDAS	FA	ES	GMIH	GMDH	URD	Sewage on street	Domestic Liter	Degraded road
Angwa Daji	58	77	0	0	0	0	15	77	77	85
Barkin Saleh	19	100	100	100	100	100	100	72	24	91
Bosso Estate	26	0	19	27	50	16	61	0	8	8
Bosso Town	44	77	36	47	23	23	79	87	60	96
Chanchaga	92	100	92	92	92	50	100	75	67	91
Dutse Kura Gwari	83	58	25	25	25	33	42	91	75	100
Dutse Kura Hausa	80	80	10	60	10	0	70	10	100	70
Fadipe	100	38	50	50	13	25	38	13	12	100
F-Layout	83	100	67	0	100	0	100	0	17	66
Abbatoir/Tayi Village	50	83	33	83	0	33	83	33	50	100
GRA	88	94	13	13	25	0	63	0	0	63
Jikpan-Hayan Gwari	86	100	43	43	43	27	100	82	71	100
Kwangila (Minna Central)	33	54	43	51	44	37	42	68	48	80
Kpakungu/Soje	67	43	43	59	26	64	69	64	48	95
Lamiwa A	10	10	0	0	0	0	15	90	55	70
Maitunbi	53	53	50	57	50	54	61	71	67	89
Makera (Railway Quarters)	50	64	14	79	7	7	43	7	21	57
Nasarawa	0	24	12	18	6	6	0	0	23	29
Sabo Gari	26	9	26	91	83	13	44	4	43	83
Sango	73	93	41	78	67	22	93	85	74	96
Sauka Kahuta	100	70	80	80	40	0	80	40	60	90
Tundu Fulani	36	36	46	100	27	0	91	100	45	91
Tundu Wada North	52	88	76	72	12	24	100	82	66	84
Tundu Wada South	61	87	92	77	100	40	92	100	85	70
Tunga low cost	29	21	14	21	9	18	27	39	32	95

APPENDIX 10: INDICATORS OF DRAINAGE AND SANITATION

SN	NEIGHBOURHOOD	Indicators of sanitation and Drainage				
		D	FD	SNV	WDLW	VEP
1	Angwan Daji	43	85	45	79	60
2	Barkin Saleh	0	0	27	0	0
3	Bosso Estate	97	100	100	100	90
4	Bosso Town	35	45	58	27	0
5	Chanchaga	50	54	85	14	11
6	Dutse Kura Gwari	0	0	52	10	0
7	Dutse Kura Hausa	63	43	53	33	61
8	Fadipe	0	0	87	30	3
9	F-Layout	93	83	97	97	100
10	Tayi Village	16	84	48	22	96
11	GRA	76	92	100	60	100
12	Jikpan-Hayan Gwari	24	33	94	26	100
13	Kwangila	0	11	64	11	56
14	Kpakungu	66	62	44	10	1
15	Limawa A	53	26	37	37	74
16	Maitumbi	5	52	69	53	0
17	Makera	87	13	74	5	0
18	Nasarawa	73	53	79	43	13
19	Sabo Gari	49	21	25	9	10
20	Sango	40	96	88	0	0
21	Sauka Kahuta	66	54	2	74	0
22	Tudun Fulani	38	62	88	0	0
23	Tudun Wada North	55	83	15	79	0
24	Tudun Wada South	63	37	87	37	52
25	Tunga Low Cost	100	94	100	100	0

DEFINITION:

D= % of buildings with drainage in front.

FD: % of available drainage that are free.

SNV: % of buildings with no visible sewage.

WDLW: % of buildings with well disposed sanitation.

VEP: % of buildings surrounded with visible environmental problems.

PPENDIX II: QUESTIONNAIRES

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA.

SCHOOL OF SCIENCE AND SCIENCE EDUCATION

Department of Geography.

QUESTIONNAIRE SURVEY ON:
THE RELATIONSHIP BETWEEN POVERTY AND THE ENVIRONMENT IN MINNA.

This questionnaire is meant to gather information on the living standards of the people of Minna and to establish relationships between existing human living conditions and the quality of the environment. The study is an academic work meant to further the knowledge of people-environment relation. The study is not meant for anything personal against the respondents in particular and the residents of Minna in general. Therefore, we require no name of the respondent. We also promise to keep your responses confidential.

NB: THE QUESTIONAIRE IS TO BE FILLED BY THE HOUSEHOLD HEAD OR HIS/HER DEPENDABLE REPRESENTATIVE

Ward..........Neighbourhood.........Street................House Sample Number......DATE.....

SOCIO-ECONOMIC CHARACTERISTICS

1. Sex.... (1) Male............(2) Female................
2. Age...
3. Marital status (1) Married.........(2) Single...............(3) Divorced..................(4) Separated.........................
4. Household size.....................................
   Children.................................
   Wife(s)..................................
   Dependants.............................
5. Level of education (1) None..........(2) Primary School................(3) Post primary................(4) Tertiary....................(5) Quranic school.........
6. Years spent in school..
7. Migrant status.: (1) Indigene............(2) Migrant..........................
8. Length of stay in Minna...

EMPLOYMENT, INCOME AND EXPENDITURE (as at December, 2002)

9. Primary job: (1) Civil servant (government employee)...........
   (2) Public servant (employee of organized private sector......
   (3) Self-employed (formal; professional...................................
   (4) Self-employed; informal trading...................................
   (5) Self-employed; informal, farming...................................
   (6) Self-employed; informal services.......................................
   (7) Self-employed; informal manufacturing................................

10. Do you have secondary work? (1) Yes................(2) No....................
11. If Yes, name the activity.......................................
12. When did you start work?...................................
13. Indicate current monthly income from

(1) your main job: ₦.................................
(2) your other job(s) ₦ ....
(3) your spouse ₦ ....
(4) Other members of your household
(1) ₦ ....
(2) ₦ ....
(3) ₦ ....

14. Indicate animal kept by you and income therefrom:

Animal	Number	Annual income (₦)
Fowl		
Goat		
Pig		
Cow		
Others		

Indicate the mode of keeping the animals
(1) Free ranging..........(2) Kept in a garden or cage..................reared in farm outside the town.................(4) Others (specify)............

15. Other home-based production activities which do not constitute employment but that also generate income

Activity	Monthly income (₦)

16. Household expenditure:
Indicate how much you spend per month
(1) Total expenditure..................................
(2) Expenditure on food...............................

18. Income generating assets available with you:

S/NO	Asset	Monthly income from asset (₦)
1	House	
2	Market stall	
3	Motorcycle for daily hire	
4	Taxi or other vehicle for daily hire	
5	Wheel barrow for daily hare	
6	Others	

19. Did you experience any increase in income in the last three years?
(1) Yes...........(2)..................

Borrowing

20. Do you borrow to supplement your monthly income?
    (1) Yes......................(2) No......................

    If Yes, how often per year within the last three years
    (1) Once......(2) Twice..........(3) Thrice...........(4) Four times..........
    (5) Five times..............(6) More than five times.

S/No	Source of Borrowing	Amount borrowed per year
1	Relatives and Friends	
2	People's Bank	
3	Nigerian Agricultural and rural development Bank	
4	Community Bank	
5	Commercial Bank	
6	Mortgage bank	
7	Esusu	
8	Others	

HOUSING AND HOUSING CHARACTERISTICS

21. Indicate your housing type
    (1) Room and parlour..........................
    (2) One-bedroom semi-detached flat...........
    (3) Two-bedroom semi-detached flat...........
    (4) Three bedroom semi-detached flat...........
    (5) Four bedroom semi-detached flat...........
    (6) Bungalow................................
    (7) Others..................................
22. Number of habitable rooms............................
23. Do you have a sitting room (1) Yes...........(2) No...............
24. If yes, do you use it as bedroom also (1) Yes...........(2) No...............
25. Size of the dwelling in square metres..........................
26. Ventilation (1) Number of rooms with cross ventilation....(2) Number of rooms with No cross ventilation...........
27. Do you consider your dwelling adequate for your household? (1) Yes...(2) No...
    If No, why cant you change the house?
    (1) No money to get a larger house...........
    (2) I cannot get a larger house................
    (3) I cannot get a larger house close to my place of work

27b. Indicate the rental status of your housing
    (1) Owner-occupied...(2) Rented....(3) Inherited...(4) Government staff housing...(5) Squatting...(5) Others (specify)....

Facilities and Services Within the House:

27. Has the household an open space within the compound for relaxation (1) Yes........(2) No....
28. If yes, indicate size of the open space in square metres................
29. Source of power for lighting
    (1) Electricity (NEPA).... (2) Electricity (generating plant) .....(3) Lantern......
    (4) Candle.........(4) Red oil powered light...............
30. Source of domestic cooking (1) Electricity.....(2) Gas.......(3)Fuel wood...........

(5) Charcoal.... ...(5) Cooking coal...................(6) Others.................

31. Source of water supply
(1) Tap within the dwelling.....(2) Tap outside the dwelling but within the compound.....(3) Public Tap located outside the compound.........(4) Tap from neighbours...... (5) Well water within the compound.........(6) Well water outside the compound.......(7) Tap water purchased from vendours. (8) Combination of two or more of these.

32. Type of toilet facilities (1) Water closet...(2) VIP toilet........(3) Ordinary pit........ (4) Bucket type..........(5) None...........

33. Location of the toilet (1) Within the dwelling unit... (2) Within the compound...... (3) Outside the compound.....................

34. Do you have bathroom (1) Yes..........(2)No..............

35. Location of bathroom (1) Within the dwelling unit... (2) Within the compound...... (3) Outside the compound.....................

36. Do you have kitchen (1) Yes..........(2)No..............

37. Location of kitchen (1) Within the dwelling unit... (2) Within the compound...... (3) Outside the compound.....................

38. Which of the facilities are shared by more than one household
(1) Water.....(2) Toilet......(3) Kitchen.......(4) Bathroom......(5) all these.......
(6) Water and toilet.......(7) water and kitchen.......(8) water and bathroom......(9) toilet and kitchen.......(10) toilet and bathroom......(11) kitchen and bathroom......(12) water, toilet and kitchen....(13) water, kitchen and bathroom.... (13) toilet, kitchen and bathroom......

39. How will you judge the qualify of your toilet, bathroom and kitchen
(1) Very high quality.....(2) High quality.....(3) Very poor quality.......(4) poor quality....(5) Cannot say................

HOUSEHOLD MOBILITY

(40) Which type of means of mobility do you have? Indicate in the following table:

S/No	Vehicle	Number
1	Car	
2	Motorcycle	
3	Bicycle	
4	None	
5	Others	

Material Possession

S/NO	Material	Number
	Television	
	Video player	
	CD player	

SANITATION

41. Facilities fro waste storage: (1) Bags.... (2) Dust bin.... (3) Buckets...(4) Drum....(5) Others......

42. Waste disposal; (1) Burnt outside...(2) Disposed by self..(3) Private firm disposal...(4) Urban Development Board Disposal....(5) Wheel barrow/cart disposal....

Perceptions of Income and the Environment

43 How satisfied are you with your income
(1) Very satisfied ....(2) Satisfied...(3) Unsatisfied...(4) Very Unsatisfied...(5) Cannot say....

44. How will you grade the environmental quality of your neighbourhood?
(1) Very Good..(2) Good...(3) Poor...(4) Very Poor...(5) Cannot say....

45. If the quality is poor, why do you continue to stay in the environment?
(1) Because it is close to my place of work....(2) Because I live in my personal house...(3) Though I do not own the house I don't pay rent...(4) Because I enjoy the comfort of friends and relations....(5) Because I cannot find alternative accommodation...(6) Because housing rent is relatively cheap here....(7) Cannot say.....

46. Grade yourself according to your income status
(1) Very rich...(2) Rich...(3) Poor...(4) Very Poor...(5) Cannot say...

47. Grade the quality of your housing
(1) Very Good..(2) Good...(3) Poor...(4 Very) Poor...(5) cannot say....

48. Will you associate the quality of the environment with the income status of the people (the residents)? (1) Yes...(2) No....

49. Which of the followings affect your attitude to the environment
(1) Income...(2) Housing rental status......(3) Both income and housing rental status...(4) Others (Specify)....

50. Will an improved income status for you lead to a better attitude to the environment?
(1) Yes...(2) No....

51. For the following environmental problems, weigh them on the scale of 1-5 according to their seriousness to you:

Environmental Problem	Scoring
Indoor pollution Poor sanitation Noise from micro industrial activities Overcrowding arising from high housing density Lack of open space within residential areas Poor access to houses	

Ward................Neighbourhood......................Street................House Sample Number......

ASSESSMENT OF THE PHYSICAL CONDITIONS OF THE HOUSES

1 Accessibility of the house (1) Accessible ...... (2) Not accessible........

2. Condition of access roads (1) Tarred and motorable...(2) Tarred but not motorable....(3) Un-tarred but smooth...(4) Un-tarred and rugged......

3. Age of building........

4. Wall materials (1) Mud plastered.. (2) Mud Un-plastered.. (3) Sand Crete bricks plastered... (4) Sand Crete bricks Un-plastered...(5) Burnt clay bricks... (6) Others.....

5. Condition of wall (1) Intact.. (2) Cracked.....(3) Collapsing.....(4) Collapsed.

6. Roofing Materials: (1) Concrete decking...(2) Corrugated iron sheets...(3) Asbestos/clay roof...(4) Others.....

7. Roof conditions; (1) Intact...(2) Rusty ...(3) Part lifted and flying affixed....(4) Part missing .....

8. Windows Materials: (1) Glass/tainted louvers...(2) Wood...(3) Iron Sheets....(4) Mats.....

9. Window condition: ; (1) Intact...(2) Twisted.....(3) Cracked....(4) Removed........

10. Door Materials: (1) Glass...(2) Wood...(3) Metals...(4) Metals/Glass.....(5) Mats.....(6) Others......

11. Condition of door (1) Intact.. (2) Cracked.....(3) Collapsing.....(4) Collapsed.

12. Drainage in front of house: (1) Open... (2) Covered......(3) Not available......

13. Condition of drainage: (1) Free....(2) Blocked........

14. Liquid sanitation: (1) All waste water drain into soak-away..(2) Some waster drain into the drains....(3) Waste water drain into surrounding land.....

15. Sewage conditions: (1) Sewage is visible from within the house.......(2) Sewage not visible..........

16. Visible environmental, problems; (1) Pollution from macro-manufacturing activities.....(2) Flooding......(3) Erosion......(4) Pollution and Erosion.....(5) Pollution and Flooding.......(6) Erosion and Flooding..............

17. Floor materials: (1) Concrete floor....(2) Mud floor...........(3) Others (specify).............

18. Floor conditions: (1) Intact.. (2) Cracked.....(3) Collapsing.....(4) Collapsed.

19. Foundation: (1) Absent...(2) Mud.....(3) Concrete....

20. Condition of foundation: (1) Intact... (2) Showing but not hanging......(3) Showing and hanging.........(4) Removed.......

NEIGHBOURHOOD ENVIRONMENTAL ASSESSMENT

Ward.................Neighbourhood...................................House Number............

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1. Road: (1) Motorable...(2) Not motorable.....(3) Partially motorable...............
2. road appearance: (1) Pot holed partly......(2) Pot holed greatly...........(3) Not pot holed..............(4) Not tarred........
3. Number of unkempt vacant plots along the street................

SANITATION

4. Refuse on the street: (1) Scattered on the street........(2) Concentrated on the street.....(3) Scattered and concentrated on the street......(4) No refuse on the street.....
5. Refuse dumps along the street (i.e. plots facing the street): Number.........
6. Sewage: (1) Open sewage is observed in most parts of the street....(2) Open swage is observed in some parts of the street.....(3) Open swage is not observed..........
7. Other domestic water: (1) Found in most parts of the street...(2) Found in some parts of the street....(3) Not found on the street............

OTHER ENVIORNMENTAL PROBLEMS:

8. Number of floodable area per street....
9. Number of erosion spots on the street......
10. Grinding machines per street: (1) Within the house....(2) outside the house.........
11. Number of facilities and services per street
    (1) Nursery/ primary schools..........(2) Health centre.....(3) Court.........(4) Hotel/restaurant....(5) market....(6) Others......
12. Number of unkempt refuse dumps along the street...........