NORTH-WEST UNIVERSITY
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT
MAFIKENG CAMPUS

FACULTY OF EDUCATION
SCHOOL OF POSTGRADUATE STUDIES

Tel: +27 18 3892500/2441
Fax: +27 18 3892038
E-mail: remofilwe.lekgoane@nwu.ac.za/walter.lumadi@nwu.ac.za
Internet: http://www.nwu.ac.za/

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TITLE OF THESIS

The Environmental Effects of Population Growth: A Case Study of the Rustenburg Core Area (Bojanala Region) in North West Province (South Africa)

SUBMITTED BY

Kedibone Jennifer Mokgoetsi

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Has been edited for language and other technical details by

Prof. SA Awudetsey

Prof. SA Awudetsey
School of Postgraduate Studies
NWU

DECLARATION

I, Kedibone Jennifer Mokgoetsi, declare that this dissertation for the degree of Master of Education at North-West university hereby submitted, has not previously been submitted by me for a degree at this or any other university, that this is my own work in design and execution, and that all sources used have been duly acknowledged.

Kedibone Jennifer Mokgoetsi

Signature

02/2008

Date

CERTIFICATE OF ACCEPTANCE FOR EXAMINATION

This dissertation entitled, "The Environmental Effects of Population Growth: A Case Study of the Rustenburg Core Area (Bojanala Region) in the North West Province (South Africa)", written by Kedibone Jennifer Mokgoetsi, is hereby recommended for acceptance for examination.

Supervisors: Dr. E.M. Mwenesongole : _____

Mr. S.K. Modisane : _____

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DEDICATION

With greatest admiration and love for my children: Thusano, Regomoditswe and Karabo.

ABSTRACT

This dissertation is entitled, "The Environmental Effects of Population Growth: A Case Study of the Rustenburg Core Area". One of the major influences on the balance between humans and the environment is the number of people living in a specific area. The earth has limited resources and cannot support an unlimited number of people. The more people there are in an area, the more the pressure they put on the earth's resources. The movement of people to urban areas, coupled with the natural increases in the urban population, has resulted in an over burdening of the already inadequate urban facilities available, causing overpopulation, in turn leading to crime, pollution and resulting in health problems.

The study sought to answer the following research questions:

- How fast is the human population increasing in the Rustenburg Core Area?
- What are the perceptions of people in the Rustenburg Core Area about the land?
- How do the people's actions pose a threat to the environment in the Rustenburg Core Area?
- What actions are necessary for conservation and preservation of resources in the Rustenburg Core area?

The study drew its population and sample from the Boitekong, Tlhabane (Yizo Yizo section), Paardekraal and Kanana areas of the Rustenburg Core Area. The data collected through interviews and questionnaires were subjected to both quantitative and qualitative analysis.

At post-test, findings with regard to the research aims were evident. The literature search revealed that, the main troubling effects of population growth result from human activity, primarily through resource exploitation. Findings on the views of people were also noted. People are not happy about the way their surroundings look. Many people live in shanty houses without basic amenities.

Concerning the remedies for solving the problems caused by population growth, it was suggested that every individual must accept some responsibility and realize that everything they do can affect the environment.

Finally, to ensure success in trying to deal with the problems caused by population growth in urban areas, the study expressed the need for further research to be conducted on the abandonment of more difficult environments and the concentration of population in economic core regions, notably urban centres with special population and environment problems, particularly for the urban poor.

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LIST OF ACRONYMS

- AIDS – Acquired Immunity Deficiency Syndrome
- FAO – Food and Agriculture Organisation
- G8 – Group of eight
- GJMC – Greater Johannesburg Metropolitan Council
- HIV – Human Immuno-Deficiency Virus
- IDP – Integrated Development Plan
- IMF – International Monetary Fund
- IPCC – Intergovernmental panel on climate change.
- IPPF – International planned parenthood federation
- IUCN – International Union for the conservation of nature
- NEPAD – New programme for African development
- NGO – Non-government organization
- PEC – Primary environment care
- PHC – Primary health care
- PRB – Population reference bureau
- RDP – Reconstruction and Development programme
- SADC – South African Development Community
- SDU – Self Defence Unit
- TB – Tuberculosis
- UNDP – United Nations Development Programme
- UNEP – United Nations Environment Programme
- US – United States
- WSSD – World Summit for Sustainable Development
- WWF – World wide fund for nations
- WRI – World Resource Institute

CHAPTER 1

ORIENTATION

1.1 INTRODUCTION

Every second, on average, five children are born somewhere on the earth. In that same second, two other people die. This difference between births and deaths means a net gain of three more humans per second in the world populations. If you multiply this out, you will find people are growing at a rate of about 11,000 per hour, 265,000 per day or almost 100 million more people per year. By 1995, the world population had reached about 5, 7 billion, currently making people the most numerous vertebrate species on the planet. For the families to whom these children are born, this may well be a joyous and long-waited event. But the continuing increase in humans is not good for the planet in the long run (Cunningham and Saigo, 1997).

As the world population continues to grow fast, great pressure is being placed on arable land, water, energy, and biological resources to provide an adequate supply of food while maintaining the integrity of the ecosystem. According to the World Bank (1993) and the United Nations (1995), from 1 to 2 billion humans are now malnourished. This indicates a combination of insufficient food, low incomes and inadequate distribution of food. This is the largest number of hungry humans ever recorded in history. In China, about 80 million people are now malnourished and hungry. Based on current rates of increase, the world population is projected to double from roughly 6 billion to more than 12 billion in 26 years (Population Reference Bureau, 2006:5). As the world population expands, the food problem will become increasingly severe, conceivably with the number of malnourished reaching 3 billion.

In support of the above, Loubser, Schulze, Lebeloane, Hugo, van Staden, and Ferreira, (2003) postulate that, population growth all over the world is one of the greatest threats to humans survival, since too many people will exhaust the earth's resources and the earth

will no longer provide for the people's basic needs. Overpopulation is associated with too little space, lack of essentials, violence, unemployment, illiteracy, poverty and diseases.

From this perspective, according to the researcher, large populations often lead to serious degradation of renewable resources as the poor struggle to stay alive. So, although per capita use of resources is normally quite modest, the disproportionally large populations tend to cause a huge environmental impact. It becomes clear that humans are at the root of all the environmental problems. Environmental problems arise from human minds what humans know about, how they think of and act towards their environments. Crises can be related to human mind-sets, value systems and attitudes. Environmental problems are in essence, problems in the relationship between people and between people and their environments.

This study is undertaken to analyse the environmental effects of population growth. This introductory chapter presents the statement of the problem, problem questions, research aims and definition of key concepts used in the study.

1.2 BACKGROUND OF THE STUDY

The environmental implications of population increase in the Southern African region could be far –reaching. Populations create environmental stress; each person needs water, food, clothing, shelter and energy, which influences ecosystems directly or indirectly (WRI/UNEP/UNDP and World Bank, 2000). Already countries all over the world are experiencing large-scale destruction of the natural environment, while poverty and famine abound in developing countries.

According to Yeld (1997), a rapidly increasing population is not compatible with a national goal of sustainable living. More people consume more resources and cause more pollution. If the old social, economic and political patterns are simply allowed to continue, the rapidly increasing South African population will cause accelerating soil erosion and veld deterioration, higher air, land and water pollution levels, a further

deterioration in health, particularly of women and children, and a lowering of education standards, with the attendant reduction in job prospects and a lessening in the likelihood of achieving an economically secure and healthy society.

Blake, Mokotong, Liebenberg, and Sarakinsky, (2000) point out that, since informal settlements tend to have limited, if any, facilities for water supply and sewage disposal, they have high risk incidences of diseases such as typhoid, diarrhoea and dysentery which take an enormous toll on human health. The crowded urban environment that the people must endure provides no protection from the pollution caused by their own city's waste. The poor die young in cities of the developing world. Diseases and injuries related to environmental conditions underlie millions of preventable deaths each year in many squatter settlements with infant mortality rates 40-50 times higher than those in Europe or America (Blake et al, 2000).

Loubser, De Beer, Dreyer, Hattingh, Irwin, Le Grange, Le Roux, Lotz-Sisitka and Schulze (2005) argue that the biggest challenge therefore is eradicating poverty which of course, is more easily said than done. At the World Summit for Sustainable Development (WSSD) held in 2002 in Johannesburg, richer countries committed themselves, for instance, to halve the number of people without clean drinking water or sanitation by 2015 in an effort to eradicate poverty. African leaders themselves are hoping to improve the lives of millions of African people through the New Programme for African Development (Nepad) and the establishment of the African Union.

Population in Sustainable Development (2002) further argues that the South African Minister of Finance, Trevor Manuel, in his address at the World Summit for Sustainable Development (WSSD), indicated that the opening of markets and the creation of sustainable jobs are priorities for ensuring a better quality life for all. Early in 2003, Thabo Mbeki, President of South Africa, declared that the government would be embarking on an all-out campaign to involve the private sector in job creation (Population in Sustainable Development, 2002). Even though some experts are confident

that population growth will eventually stabilize or may even decrease, population will remain a problem mainly because of unequal distribution of people.

Miller (1995) studied the population growth rate of different countries and uncovered the following;

- In 1993 the population of Mexico City was 16.2 million, the world's fourth most populous city. Everyday, an additional 1,000 poverty-stricken rural peasants pour into the city, hoping to find better life. The city suffers from severe air pollution, high unemployment, congestion and soaring crime rate. One third of the city's people live in crowded slums or squatter settlements without running water or electricity. And at least 8 million people have no sewer facilities, which mean that huge amounts of human waste are left in gutters and vacant lots everyday. About half of the city's garbage is left in the open to rot, attracting armies of rats and swarms of flies. People living in the slums have to buy their water by the buckets from vendors. Many of those who have access to city water won't drink it, complaining that it is yellow and full of worms (Miller, 1995:189).

An article from Wikipedia, (undated document), states that the population's annual growth rate has been reduced from 3.5. Percent peak, in 1965 to 0.99 percent in 2005. While Mexico is now transitioning to the 3rd phase demographic transition, close to 50 percent of the population in 2005 was 25 and younger. Fertility rates have also decreased from 5.7 children per women in 1976 to 2.2. in 2006. Since the 1980s Mexico's population has slowly decentralized, and from 2000 -2005 the average annual population growth rate of the capital, the Federal District, was second lowest in the country at a mere 0.2 percent.

- In 1952, India was adding 5 million people to its population each year. In 1993, it added 49,300 more mouths to feed each day. India's population in 2006 was 1.1 billion and is projected to reach 1.4 billion by 2050. India's people are among the poorest in the world. Nearly half of India's labour force is unemployed or can find only occasional work. Almost one-third of the present population goes hungry. Some analysts fear that India's already serious hunger and malnutrition problems will increase as its population continues to grow rapidly. Without its long standing family planning programme, Indian's numbers would be growing even faster. However, the

> results of the programme have been disappointing. Factors contributing to this failure have been poor planning, the low status of women, extreme poverty and a lack of administrative and financial support. Indian women still have an average of 3.9 children because most couples believe that they need many children as a source of cheap labour and old – age survival insurance (Population Reference Bureau, 2006 & Miller, 2005:191).

Population growth is one of the major pressing environmental issues both globally and in South Africa. A report drawn up at the International Conference of Population and Development in Cairo in 1994 claimed that South Africa's population will increase by at least 30 million in less than 30 years. It is predicted that population in the Southern African region, which was 136 million in 1996, is currently growing at 3 percent per year and will double by 2018. Over 40 percent of the population is under 14 years old, and this places a large burden on economies as does an ageing population that is also expanding. The most effective method of reducing the population growth rate, and hence reducing pressures on South Africa's natural environment, is eliminating poverty and achieving social upliftment. This is where efforts must be concentrated with population growth being tackled as a developmental issue rather than as a demographic problem, within an overall perspective of the need to curb significantly the country's population increase (Yeld, 1997).

Diepe (1996) asserts that environmental problems, which are often referred to as the "environmental crisis", vary widely in nature, magnitude and complexity: hunger and malnutrition, considerable disparities between human population the world over in respect of their quality of life, the degradation of natural ecosystems and landscapes, desertification, the depletion and wastage of resources, the many different forms of pollution or disturbances, and the deterioration of the living environment have become cause for great concern.

Schreuder, Reddy, and Le Grange, (1998) state that, in many areas of South Africa, poverty and affluence (richness) are often found in the same communities. This often leads to social conflict and crime. In the economic dimension, there is a crisis of development. In developed countries, higher economic growth has led to increased

consumption (fuel, raw materials for industry), which makes great demand on the natural resources.

Myers (1994) challenged the above statement. He argued that if a solution to the planet's environmental crisis is to be found before it is too late, the answer will involve putting people first and poor people first of all. They are in the front line of planet management. While the poor are denied the means and rights to a sustainable livelihood, the planet's future is bleak indeed.

Van Aardt (1994: 23-24) postulates that the widespread poverty in South Africa, the absence of electrification, the inadequate provision of health care and quality schooling in the rural areas will for many years to come, have negative effect on the population development in South Africa. It is very difficult to imagine how a new government will be able to master sufficient resources (money, human resources and infrastructure) to affect a significant decline in the population growth rate in the near future. The size of the population may even grow in the short term as a result of improved health-care services being provided on a broad base, thus lowering the mortality rate. An influx of people from neighboring states will also contribute to the already growing population.

From the researcher's point of view, the improvement of living conditions in the squatter settlements or shanty towns is one of the most complex and pressing challenges facing developing countries today. It is not just the rapid societal change that is of concern to many. People are also principally concerned about violence, higher levels of crime, a struggling economy and high levels of unemployment. Some people even wonder whether there really is any future left for them and their children in South Africa. Within this rapid societal change and the consequential fears, the researcher, endeavours to supply through this study, some clarity concerning the issues, options and prospects as they pertain to the future South Africa.

1.3 PROBLEM STATEMENT

The problem under study is to examine the environmental effects of population growth in the Rustenburg Core Area.

1.4 RESEARCH QUESTIONS

Against this background, the following questions came to the fore:

- How fast is the human population increasing in the Rustenburg Core Area?
- What are the perceptions of people in the Rustenburg Core Area about land?
- How do the people's actions pose a threat to the environment in the Rustenburg Core Area?
- What actions are necessary for conservation and preservation of resources in the Rustenburg Core Area?

1.5 AIMS OF THE STUDY

In order to research the above problem, the following aims were formulated:

Aim 1: To determine the environmental effects of population growth in the Rustenburg Core Area.
Aim 2: To find out the views of people about the environmental effects of population growth in the Rustenburg Core Area.
Aim 3: To provide recommendations on how to solve the problems caused by population growth after data has been analysed and interpreted.

1.6 SIGNIFICANCE OF THE STUDY

It is evident from the problem identification that the world is in urgent need for guidelines that can assist in the management of environmental resources. The significance of the study is to contribute to the focus area by attempting to empower

people to take more responsibility for managing their actions. The results obtained from this study will, hopefully, contribute to the process of setting guidelines in order to create a healthy equilibrium with regard to population growth and environmental resources.

1.7 DELIMITATION OF THE STUDY

The study has been conducted in the Boitekong, Tlhabane (Yizo Yizo Section), Paardekraal and Kanana Areas of the Rustenburg Core Area (Bojanala Region-North West). The research investigates the environmental effects of population growth only in the identified area. The findings of this research will not be generalized to the country as a whole. Nevertheless, the findings have been based on the environmental effects of population growth in the Rustenburg Core Area

1.8. DEFINITION OF KEY CONCEPTS

1.8.1. Population growth rate

Tarr (2000) defines population growth rate as the rate (represented as a percentage of the total population) at which a population grows each year. A population growth rate of more than 3 percent is extremely high, while one of less than 1 percent is extremely low. Cunningham and Saigo (1997) state that crude death rate, subtracted from crude birth rate gives the natural increase of a population. Natural increase should be distinguished from the total growth, which includes immigration and emigration, as well as births and deaths. Both of these growth rates are usually expressed as a percent (number per 100 people) rather than per thousands.

The researcher defines population growth rate as the rate at which members of the population increase in size. This is equal to births + immigration and deaths + emigration,

1.8.2 Core area

According to Demographia (undated document: 2), the core area or central city is the municipality in an urban area or metropolitan area that emerged historically as the most prominent in the urban area. Almost without exception, the name of the core area is also shared with the urban area and the metropolitan area. A core municipality usually includes the historical core. However, through annexation and consolidation, a central city can absorb areas that are suburban in character. In this study, the Rustenburg Core Area comprises the following places: Rustenburg, Boitekong, Tlhabane, Paardekraal and Kanana.

1.8.3 Environment

Educators such as Fien (1993:12) define the word 'environment' as a social construct referring to the interactions between social and bio-physical systems, while Di Chiro (1987:27) explains further that environment should be understood as the conceptual interactions between physical surroundings and the social, political and economic forces that organize people in the context of these surroundings. It is in this sense that the concept 'environment' is understood to be socially constructed. The Concise Oxford Dictionary of current English (1995:323, s.v. 'environment') defines the concept 'environment' as the totality of the physical conditions on the earth or part of it as affected by human activity.

In this research, the term 'environment' is used as the physical surroundings, conditions and circumstances in which a person lives, or the external conditions affecting plant and animal life.

1.8.4 Environmental depletion

According to Blake et al (2000), environmental depletion means that a natural resource (such as water or coal) found in the natural environment is used until it either runs out or

is damaged to the extent that it can no longer be used. Depletion affects resources such as water, land, minerals, wood and the extinction of some plant and animal species. Alternatively environmental depletion means that humans are altering the environment in such a way that the delicate balance of various ecosystems, indeed of the global ecosystems, is being destroyed (Markham, 1988:8). Examples of environmental depletion are;

- The destruction of the rainforests by companies cutting down the trees to make timber or paper out of wood and
- The hunting of some species of wildlife, like the white rhino, until there are very few, or maybe none left because they have died out (i.e. until it is nearly extinct or actually extinct).

In this study, the researcher uses environmental depletion as the reduction in numbers or quantities of the natural resources.

1.8.5 Environmental pollution

Environmental pollution refers to the presence of 'strange' (often unnatural and/or poisonous) substances in the air, water, food or soil. Whatever humans do will cause some changes in the environment. Animals, people, cars and factories all produce waste. This is not a problem if the amount of waste is small and can break down to become harmless part of the soil, sea or air. But when there is too much waste, or when the waste contains poisons, it pollutes the environment (Bellamy, 1991:7). Pollution is usually the result of human action, often in an attempt to improve or develop the world. The irony is that the results of these actions will, in the long term, have negative effects on the human race (Maris, 1988:535)

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The World Book Encyclopedia (1994) regards environmental pollution as all the ways by which people pollute their surroundings. People pollute the air with gases and smoke, poison the water with chemicals and other substances, and damage the soil with too many fertilizers and pesticides. People also pollute their surroundings in various other ways.

For example they ruin the natural beauty by scattering rubbish and litter on the land and in the water. According to Share-Net (1999), some authorities state that pollution is an unwelcome concentration of substances that are beyond the environment's capacity to handle, but the International Union for the Conservation of Nature (1991:227) takes a much stronger view on pollution, stating that "pollution is the poisoning of the environment with anything that reduces its ability to support life". These substances are detrimental to people and other living things.

In this document, the researcher defines environmental pollution as any addition to air, water, soil or food that threatens the health, survival capability, or activities of humans or other living organisms. The extent of environmental pollution illustrates the effect people have on the environment and the way they are in turn affected by their environment.

1.8.6 Sustainable development

Sustainable development is the management and conservation of the natural resource base and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generation. Such sustainable development conserves land, water, plant and animal genetic resources. It is environmentally non-degrading, technically appropriate, economically viable and socially acceptable (FAO, 1995).

Blake et al (2000) define sustainable development as the development that not only generates the economic growth, but distributes its benefits equitably. It is development that generates the environment rather than destroying it, that empowers people rather than marginalizing them. It gives priority to the poor, enlarging their choice and opportunities and providing for participation in decisions affecting them. It is a development that is pro-poor, pro-nature, pro-jobs and pro-women. In summary, sustainable development stresses growth, but growth with employment, environment, empowerment and equity. According to Yeld (1997), sustainable development means improving the quality of human life while living within the carrying capacity of supporting ecosystems.

The researcher defines sustainable development as the wise use of natural resources over generations, rather than only for the good of single lifetimes. In practical terms, it means reducing unnecessary and wasteful consumption patterns, eliminating human poverty and managing natural resources wisely.

1.8.7 Carrying capacity

Weeks (1999:9) refers to carrying capacity as the number of people that can be supported in an area, given the available physical resources and the way people use those resources, while Beazley (1993: 10 & 35) defines it as the number of individuals that can survive in a given area without severely damaging the ecosystem, limited by the amount of food, water, other resources and ultimately space that area can provide. The maximum use of resources that the planet of a particular region can sustain also defines it as carrying capacity.

The World Book Dictionary (1992:310, sub verbo 'carrying capacity') defines the concept 'carrying capacity' as the largest number of population of species the environment can support. Carrying capacity also refers to the size of a population that can live indefinitely in an environment without doing that environment any harm. This applies to plants, animals and people. If the carrying capacity of the environment is exceeded, organisms die and the environment may be permanently destroyed.

According to the researcher, carrying capacity refers to the number of people an area can support, given its resource base and the way those resources are used without permanently damaging the ecosystem upon which they depend.

1.9 ORGANISATION OF THE STUDY

The following programme of activities indicates how the research has been carried out:

- **Chapter 1: Orientation**

  This section presents the background information of the research report, the statement of the problem (which contains a clear delineation of the problem at hand) and the aims of the study (which outline what the study intends to do or to achieve).

- **Chapter 2: Review of the literature**

  This section presents what is known about the problem from various books/theoretical discussions. It provides the reader with background information and the need for the study. Literature review gives discussions of knowledge to date on the problem.

- **Chapter 3: Research design and methodology**

  Here, the researcher decides how he/she will set about obtaining the necessary information from practice. Research design and methodology outline a complete description of methods and procedures followed in gathering or collecting information.

- **Chapter 4: Analysis and interpretation of data**

  This is the phase of the research where the processed data is arranged and structured. The guidelines for this structuring and presentation of the processed data should be found in the research design phase. The structuring of the results is presented in such a way that the aims of the investigation are fulfilled.

- **Chapter 5: Summary, findings, recommendations and conclusions**

  This phase serves as a standard to assess the success of the research. In the presentation of this section, the emphasis is placed in particular on the following:

- A brief summary of the entire project.
- The findings in the analysis and interpretation of data phase are directly related to the initial problem statement and the aims of the study.
- Guideline statements for further research are also formulated.

1.10 SUMMARY

This study is set to analyse the environmental effects of population growth. The study is divided into five chapters, each pertaining to specific aspects crucial to the research of the identified area. This chapter outlined the background of the study, the statement of the problem and the aims of the study. The purpose of this chapter is to investigate the environmental effects of population growth. For the purpose of this study, the following terms were defined: population growth rate, core area, environmental depletion, environmental pollution, sustainable development and carrying capacity.

CHAPTER 2

REVIEW OF THE LITERATURE

2.1 INTRODUCTION

Along with the social injustices of the past, the high population growth as one of the major obstacles toward nation building in a new South Africa, cannot be overlooked. Unfortunately, population growth had been a highly politicized issue in the past. However, the time has come for all the leaders of our country – in the church, the business sphere, education, politics, and the community - to express themselves openly on the democratic realities of South Africa, so that meaningful debate on what needs to be done about the present rate of population growth can start. This is an urgent matter that can no longer be delayed. The devastating consequences in terms of increasing poverty, unemployment and crime, and the shortage in housing, schools and medical facilities, not to mention the growing squatter communities around our cities, are there for all to see (Jordaan, Tshabalala, and Mfono, 1991).

Even if we do accept that the equalization of opportunities in the future and a measure of redistribution of wealth will improve the quality of life among the poorer section of our community, it will not completely address the problem of poverty. We have to curb our population growth at the same time. Jordaan et al (1991) stated that children of smaller families would have a greater chance in future to be better raised, better educated and therefore have better job opportunities. South Africa's population is growing fast. The South African population grew from 40.5 million people in 1996 to 44.8 million people in 2001. This puts a great deal of strain on available resources (Population Reference Bureau, 2006).

Some authors have concluded that population growth is an essential and even dominant factor of the environmental deterioration (Lead, 2002; Kiesker, Thackrah, and Rosenberg, 2001; Laker, 2000 and Hoffman, Todds, Ntshona, and Turner, 1999). According to these

authors, population pressures constitute a determining factor on the environment among many others. The three factors - population, consumption and technology, interact in a multiplicative fashion on the environment together with other factors such as socio-economic inequities, cultural constraints, government policies and the international political order. Each of the three factors reinforces the other's impacts, but the role of the population is bound to be significant, even when population growth is relatively restricted.

According to the Integrated Development Plan (IDP) (2006/2007) of the Rustenburg Local Municipality, Rustenburg has shown a significant population increase in the past number of years. The growth rate of the town over the past 15 years has fluctuated between 0.8% and 5.0% at all times higher than the national growth rate. This growth rate cannot be attributed to natural growth only, but is largely the result of an influx of people into the municipal area, due to the numerous employment opportunities created by mines in recent years. Three possible population growth scenarios have been considered for the Rustenburg Municipal Area of which the 'high and varied' scenario was selected as the most plausible based on historic trends, current governmental policies, urban realities and the proliferation of life-threatening diseases such as Aids.

The resulting overall population growth estimate for the entire Rustenburg Municipal Area is set out in Table 1 below. According to these estimates, the municipal population will grow by roughly 160000 people between the years 2004 and 2015 to a total population of approximately 580000 people. This translates into an average growth rate of approximately 3.7% per annum.

Table 1: Estimated population growth of Rustenburg (2001-2015)

Area	Census 2001	SDF Population Estimate 2004	SDF Population	SDF Population Growth Estimate 2004-2015
Rustenburg Municipal Area	395761	422471	580181	157710

Source: Integrated Development Plan (2006/2007:34)

Ehrlich (cited in Jordaan et al, 1991) postulate that it is clearer that rapid population growth is a time bomb with a fuse that is fast burning out, not only in the rest of the world, but also in South Africa. The results of the time bomb are already evident in the rapidly increasing unemployment, poverty, crime, shortages of medical services and rocketing costs and the squatter camps that are mushrooming around cities.

The rest of the literature review is carried out under three main headings, namely:

- Demographic aspects of population growth,
- The environmental effects of population growth, and
- What can be done?

2.2 DEMOGRAPHIC ASPECTS OF POPULATION GROWTH

2.2.1 The world population increase and the situation in South Africa

The population of South Africa is the total number of people who live in this country. In South Africa the population is growing faster than the rate of growth of the world population. South Africa's population is increasing at the rate of about 2.38% every year. In 1951, there were about 15 million people in South Africa. The population of South Africa grows every year as a result of a natural increase in the number of babies born

informal settlements are frequently in water catchments areas (Percival and Homer-Dixon, 1995).

2.2.2. Birth and death rates

The birth rate of a country is calculated as the average number of births for every 1000 people in that country. The birth rate in a country can depend on the number of young people in the total population. In countries with high birth rate there are usually more young people in the total population of the country than there are old people. According to the South African Institute for Race Relations (1996), the youthfulness of the South African population is cause for concern. About 44 percent of the population is younger than 20 years, so, unless the fertility rate falls considerably, the population will grow for many years. In South Africa the birth rate at present is estimated at 23 babies per 1000 people. The death rate of a population is the number of deaths per 1000 people in the population. The normal death rate in a country is affected by life threatening diseases such as HIV/AIDS, and natural disasters (Cunningham and Saigo, 1997)

The Development Bank of South Africa presents two possible scenarios for the projections of infant mortality rate (UNEP/GRID-Arendal, 2005). The first predicts a rapid decrease in infant mortality rates with the provision that quality of life would improve. The second scenario is based on the assumption that living conditions would not improve, and projects a drop of 24 percent in the infant mortality rate for the next 30 years. A drop in the infant mortality may be accompanied by a drop in fertility rates, as the perception that more children are surviving can result in larger gaps between children, and a reduction in the total number of children per woman. This will then be attributed to a decline in the population growth rate (UNEP/GRID-Arendal, 2005).

2.2.3 Growth rate between 1996 and 2001

The growth rate of the population is the difference between the birth rate and the death rate. About 15 million South Africans are younger than 15 years old. Everyone will need

all the things that we need now: clean air, water, food, homes, electricity, and employment. Who will provide these resources for our rapidly increasing population? Can we provide these resources for so many people quickly enough to fulfill their needs? We urgently need to plan how to manage our resources so that there will be enough for all of us in the future (Cunningham and Saigo, 1997)

The main causes in the twentieth century, of the massive population growth in the world's towns, particularly in the Third World, are the migration of people from rural areas and the high birth rate among the already established population. Thus in Africa, in 1950, only thirty-two million people (that is 14%) were living in urban centres, and only one city, Cairo, had a population of over 1 million. By 1980 the number of people living in urban centres increased to 133 million (24%) and it was estimated that it will be 346 million (42%) by the year 2010 (Singer, 1997:117 – 118).

According to the Population Reference Bureau (2006), as a continent, Africa has the fastest growing population in the world with the current total population figure of 924 million. It has been estimated that by the year 2025, this could have increased to a staggering 1,335 million. Although South Africa is one of the slower growing (in terms of population) countries in Africa, its growth is still well above that found in many countries outside Africa.

The following facts and figures help to illustrate the magnitude of the problem South Africa and its neighbours could be facing if significant action is not taken soon:

- Every 26 seconds, a baby is born in South Africa. At this rate, the areas will double its present population every thirty-two years.
- The United Publication, "World Population Prospect 1988," predicts that Southern Africa could be one of the 23 most densely populated areas in the world by the year 2025 if the present population growth rate continues.
- Experts have calculated that South Africa can, in terms of its natural resources and socio-economic capabilities, only accommodate a population of approximately 80 million people. With the present growth rate, the area will

already reach this figure during the life span of the present generation (Council for Population Development, 1991).

In 1996 and 2001, South Africans were counted as citizens of a democratic country. Table 2. presents the results of the count.

Table 2: ***Population by province for the census year 1996 and 2001***

Province	**1996**	**2001**	**Growth rate**
Eastern Cape	6 302 525	6 436 763	0,42
Free State	2 633 504	2 706 775	0,55
Gauteng	7 348 423	8 837 178	3,67
KwaZulu-Natal	8 417 021	9 426 017	2,26
Limpopo	4 929 368	5 273 642	1,35
Mpumalanga	2 800 711	3 122 990	2,17
Northern Cape	840 321	822 727	0,42
North West	3 354 825	3 669 349	1,79
Western Cape	3 956 875	4 524 335	2,67
South Africa	40 583 573	44 819 778	1,98

Source: Statistics South Africa (2001)

The South African population grew from 40.6 million people in October 1996 to 44.8 million people in October 2001, the census 2001 results show. Statistics South Africa (2001) reported that the 10% population growth, an annual growth of 2%, had a 17% under counter after a post enumeration survey was done to check the level of error on the census results. Commenting the 2001 census figures, Ros Hirschowitz, the general director of quality and methodology at stats SA said there was a 95% confidence that the proportional number of between 44.27,683 and 45,211,872 was accurate with a 0.9% margin of error. According to the report, Gauteng had the largest population growth with 20%, followed by the Western Cape with 14%. The Eastern Cape and Free State each had growth of less than 3%, while the Northern Cape experienced a 21% drop in population.

In terms of population numbers in provinces, Kwazulu Natal has the largest population of 9.4 million, followed by Gauteng with 8.8 million, while the province with the smallest population was Northern Cape with 0.8 million people. The Eastern Cape has the population of 6.4 million, Limpopo 5.3 million, the Western Cape 4.5 million, North West 3.7 million, Mpumalanga 3.5 million and the Free States 2.7 million. Africans constituted more than three quarters of the total South African population with 79% (35.4 million), whereas whites constituted 9.6% (4.3 million), coloured 8.9 %(4.0 million) and Indians/Asians constituted 2.5% (1.1 million) (Statistics South Africa, 2001).

2.2.4 Human migration rates

Humans are highly mobile, so emigration and immigration play a larger role in human population dynamics than they do in those of many species. Currently, about 800,000 people immigrate legally to the United States each year, but many more enter illegally. In 1995, at least 33 million people left their countries for political or economic reasons, while another 27 million fled their homes but remained internal refugees in their own countries. Immigration is a controversial issue in most wealthy countries. "Guest workers" often perform heavy, dangerous, or disagreeable work that citizens are unwilling to do. Many migrants and alien workers are of a different racial or ethnic background than the majority in their new home. They generally are paid low wages and given sub-standard housing, poor working conditions, and few rights. Local residents often complain that immigrants take away their jobs, overload social services, and ignore established rules of behaviour or social values (Cunningham ad Siago, 1997).

People migrate (move) from one place to another because of various 'push' and 'pull' factors. Push factors encourages people to move away from an area while pull factors attract people to places (see Table 3 below).

Table 3: Push and Pull factors

Some 'push' factors	Some 'pull' factors
• High populations in rural areas. Not enough land for each child to inherit. • Reduced soil fertility, land degradation, famine. • Lack of jobs, insufficient housing, high rents, high taxes • War, civil unrest, crime • Religious or racial persecution	• Suitable climatic conditions, fertile soils, scenic beauty • Jobs, good medical and educational facilities, high standard of living. • More reliable sources of food • Shops and entertainment • Social security and low crime rate

Source (Tarr, 2000)

The significance of migration for the environment is in the changes brought about in the spatial distribution of people. Urban migration may help reduce pressure on the rural environment although it brings a new set of pressures on the urban environment associated with the demand for land and services. It has been found, for instance, that urbanization and particularly unplanned informal settlement negatively impacts runoff from storm water, concentrating flows and causing land degradation and erosion. Assessing the impact of urbanization on the environment is complicated, because the "ecological footprints" of urban areas may cross even international boundaries (UNEP/GRID-Arendal, 2005).

International migrants make up about 3 percent of the world's population. Economic conditions, social and political tensions, and historical traditions can influence a nation's level of migration. Net migration rates can mask offsetting trends (such as immigration of unskilled workers along with emigration of more educated residents). Migration trends

vary over time. For example, the Netherlands recently experienced a net outflow of people for the first time since the early 1980s (Population Reference Bureau, 2006).

Figures are not exact, but it has been said that there are between 2 million and 8 million illegal immigrants within South Africa's boarders, although the most recent census indicates that this figure is considerably lower than many originally thought (Jenkins, 2005). Many of these immigrants come from war-torn African countries north of South Africa's boarders. It is estimated that illegal immigration into South Africa has increased by 317 % since 1998. Conservative estimates indicate that each illegal immigrant cost the South African tax payer R400 per year. One must take into consideration the fact that the migration of the Indo-European tribes into what is referred to today as Western Europe, played a major role in destabilizing the Roman Empire, ultimately leading to its downfall and drastically changing the face of Europe (Jenkins, 2005).

2.2.5 African attitudes and values towards the family and rapid population growth

The traditional African family is not nuclear, but is rather the extended family type consisting of a man, his wife and children, plus cousins, brothers, sisters and all related by blood or marriage. An individual in an extended family has close bonds of reciprocity with others in the system. The emphasis is therefore not on the virtues of being an individual but in being one of a group of family members. The camaraderie of belonging to such a family group has been very helpful in the South African situation, where certain public policies are deliberately directed at dislocating family life. The question of numbers in a given family reflects the more respect and honour that particular family will command in the community (Jordaan et al, 1991: 80).

In a traditional setting, a child is regarded as God's blessing, a source of pride. A child is a must for every family. For an average man, the ability to have children is a test of manhood. In Zulu custom, for example, a man without children is considered a 'nobody'. Indeed, a man without children would be treated as inferior in matters affecting civil life. In traditional society, a child is viewed as someone to continue the family name,

especially in the case of the boy. Newly weds are encouraged to have children for the family name to be maintained. There are abundant folklore stories and customary practices to substantiate this. For example, among the Zulu speaking people, the custom of 'ukungena' is still being practised to ensure that child bearing is a normal and strongly encouraged practice in African society. Ukungena is a traditional Zulu custom where upon the death of a married man, his family identifies one of his unmarried brothers to marry by customary rites and settle with the widowed wife. The idea, among others, is to continue the dead man's mission to create a family, in this regard, to make children and support the family (Jordaan et al, 1991:80 –81).

These values and attitudes were reflected in the following statements made by rural black men with regard to fertility (Jordaan et al, 1991:25).

- "I would feel less fulfilled if I had less children.
- "Having less children means I am not a real man."
- "If I had less children than my five, it would mean that I am beaten by other men as far as increasing my family name".
- "Four sons will help me to do my carpentry business."
- "I would get more lobola if I had more girls".
- "Women are not women if they don't bear children".

Typical statements made by rural black women are:

- "I would feel bad if I had less children because men like productive women".
- "A big family of six or more children makes the home feel warm".
- "I like to have more children so they can look after me when I am old or disabled".
- "Children are a gift from God- I will have as many as God gives me".
- "Ancestors and God abandon you if you use contraceptives".
- "Contraceptives cause people to bleed a lot and suffer from cancer".

Jordaan et al (1991:86) agree that population growth is not an issue when family planning measures are used. Whatever their position in society, the family involved are normally concerned with their own interest and not necessarily global and environmental issues of population growth and the economic development of the state. This way of thinking will need to be inculcated into recipients of the service, namely, that their planning to reduce family size helps to reduce numbers in the wider population.

A distinction should be made at the outset, between perceptions regarding family planning measures already in practice and perceptions regarding the government's population development programme. The level of sophistication of the average woman as a result of modernization and other factors, has made South African women aware of contraceptives and consequently of family planning. The level of education and class position in society determine which method of contraception is used by a particular woman. The higher her level of education and the greater her economic means, the more knowledgeable she will be and the wider her range of choices (Jordaan et al, 1991:84-85).

African women with a higher income appear to act in the same way as the other women in the same economic bracket anywhere in the world. They seem to have a high degree of awareness of the value of family planning. And the recent pattern, especially in urban areas, of small families with three to four children, is becoming the norm. A yearning for better life conditions, better education for their children and economic considerations, dictate that these people keep the size of their families to an affordable level (Jordaan et al, 1991:85).

There is a problem, however, when such families only have daughters. African tradition prescribes that there should be a boy to maintain the family name, or as the Zulu expression states, "unkwandisa inzalo." This belief results in more children being conceived until a boy is born, which increases the number of children to a level which was not planned. This is a common phenomenon in family situations where this problem arises. African women with a lower level of education and low income have limited choices in matters of contraceptives use and family planning. These women tell

numerous stories about their experiences in the use of these contraceptives. Naturally these stories, rumours and perceptions have negative results in that most African women become afraid to use these contraceptives and refuse to use them (Jordaan et al, 1991:85).

Some women expressed the belief that "the injection" is a sterilization method used by the government to reduce African population numbers. The side effects of this injection are reported to vary from one woman to another. Some develop a rash and or pimples all over the bodies or faces. Some, and these appear to be in the majority, develop serious complications with their menstrual periods. These beliefs are shared by certain political, educational and health leaders in the African community. Unfortunately, South Africa's political life and the experiences of African people in this regard, have helped fuel these perceptions (Jordaan et al, 1991:86).

2.3 THE ENVIRONMENTAL EFFECTS OF POPULATION GROWTH

2.3.1 The earth's carrying capacity

In the real world, there are limits to growth. When a population exceeds the carrying capacity of its environment or some other limiting factor comes into effect, death rates begin to surpass birth rates. The growth curve becomes negative rather than positive, and the population decreases as fast, or faster, than it grew. This is called the population crash or dieback. The extent to which a population exceeds the carrying capacity of its environment is called overshoot, and the severity of the dieback is generally related to the extent of the overshoot. This pattern of population explosion is called 'irruptive or Malthusian growth'. It is named after the eighteenth-century economist Thomas Malthus, who concluded that human populations tend to grow until they exhaust their resources and become subjects to famine, disease or war (Cunningham and Saigo, 1997).

According to Beazley (1999: 10) the lives of all of us are intimately tied to the resources of the earth such as air, water, soil, minerals, plants and animals. The extent of human impact on the earth depends on the number of people there are and how much of these

resources each person uses. The maximum use of resources that the planet or a particular region can sustain defines its carrying capacity. Carrying capacity must be interpreted as the maximum rate of resource consumption and waste discharge that can be sustained indefinitely without progressively impairing the functional integrity and productivity of relevant ecosystems wherever the latter may be.

Weeks (1999:457) states that, the carrying capacity will vary according to which level of living you might choose for the world's population. The lower that level the greater the number of people that can be indefinitely sustained. On the other hand, if the desired level of living is too high, you may well exceed the caring capacity and start draining resources at the rate that will lead to their exhaustion.

To stay within the earth's carrying capacity and clear of its limits for real improvement in human quality of life, it is essential to keep population growth and resource consumption in check. The action needed will vary greatly from nation to nation and among communities within nations because they vary in population size, population growth rates, religious beliefs, human needs, resource consumption patterns and resource availability. By and large, however the most important tasks are for lower income countries to reduce birth rates and for higher income countries to rein in consumption (Beazley, 1999:36).

More than 99 percent of the world's food supply comes from the land, while less than 1 percent is from the oceans and other aquatic habitats (Pimentel, Harman, Pacenza, Percarsky, and Pimentel, 1994). The continued production of an adequate food supply is directly dependent on ample fertile land, fresh water, energy, plus the maintenance of biodiversity. As the human population grows, the requirements for these resources also grow. Even if these resources are never depleted, on a per capita basis they will decline significantly because they must be divided among more people.

At present, fertile cropland is being lost at an alarming rate. For instance, nearly one-third of the world's cropland (1.5 billion hectares) has been abandoned during the past 40

years because erosion has made it unproductive (Pimentel et al, 1995). Solving erosion losses is a long-term problem: it takes 500 years to form 25mm of soil under agricultural conditions. The replacement of eroded agricultural land is now coming from marginal and forestland. The pressure for agricultural land accounts for 60 to 80percent of the world's deforestation. Despite such land replacement strategies, world cropland per capita has been declining and is now only 0.27 ha per capita; in China only 0.08 ha now is available. This is only 15 percent of the 0.5 ha per capita considered minimal for a diverse diet similar to that of U.S. and Europe. The shortage of productive cropland combined with decreasing land productivity is, in part, the cause of current food shortages and associated human malnutrition. Other factors such as political unrest, economic insecurity and unequal food distribution patterns also contribute to food shortages.

Water is critical for all crops which require and transpire massive amounts of water during the growing season. For example, a hectare of corn transpires more than 5 million liters of water during one growing season. This means that more than 8 million liters of water per hectare must reach the crop. In total, agricultural production consumes more fresh water than any other human activity. Specifically, about 87 percent of the world's fresh water is consumed or used up by agriculture and thus is not recoverable (Pimentel et al, 1996).

Competition for water resources among individuals, regions, and associated human activities is already occurring with the current world population. About 40 percent of the world's people live in regions that directly compete for shared water resources. In China where more than 300 cities already are short of water, these shortages are intensifying. Worldwide, water shortages are reflected in the per capita decline in irrigation, used for food production in all regions of the world during the past twenty years. Water resources, critical for irrigation, and water are under great stress as populous cities, states, and countries require and withdraw more water from rivers, lakes, and aquifers every year. A major threat to maintaining future water supplies is the continuing over-draft of surface and ground water resources (Kendall and Pimentel, 1993).

Economic analyses often overlook the biological constraints that exist in all food production systems. The assumption is that market mechanisms and international trade are effective insurances against future food shortages. A rich economy is expected to guarantee a food supply adequate to meet a country's demand despite existing local ecological constraints. In fact, the contrary is true. When global biological and physical limits to domestic food production are reached, food importation will no longer be a viable option for any country. At that point, food importation for the rich can only be sustained by starvation of the powerless poor (Pimentel et al, 1994).

These concerns about the future are supported by two observations. First, most of the 193 nations of the world are now, to some extent, dependent on food imports. Most of these imports are cereal surpluses produced only in those countries that have relatively low population densities and practice intensive agriculture. For instance, the United States, Canada, Australia, Oceania, and Argentina provide 81 percent of the net cereal exports on the world market. If, as projected, the U.S. population doubles in the next 60 years (Pimentel et al, 1994), then its cereal and other food resources would have to be used domestically to feed 520 million hungry Americans. Then the U.S. would cease to be a food exporting country.

In the future, when exporting nations keep their surpluses at home, Egypt, Jordan, and countless other countries in Africa and Asia will be without the food imports that now help them survive. China, which now imports many tons of food, illustrates this problem. As the Worldwatch Institute has pointed out, if China's population increases by 500 million and their soil erosion continues unabated, it will need to import 200-400 million tons of food each by 2050 (Brown, 1995). But by then, sufficient food imports probably will not be available on the international market.

Fossil energy is one of the prime resources used for food production. Nearly 80 percent of the world's fossil energy used each year is used by the developed countries, and part of it is expended in producing high animal protein diets. The intensive farming technologies

of developed countries use massive amounts of fossil energy for fertilizers, pesticides, irrigation, and for machine as a substitute for human labour. In developing countries, fossil energy has been used primarily for fertilizers and irrigation to help maintain yields rather than to reduce human labour inputs (Giampietro and Pimentel, 1993).

Because fossil energy is a finite resource, its depletion accelerates as population needs for food and services escalate. The U.S. is already importing more than 50 per cent of its oil, and projections from the U.S. Department of Energy indicate that the country will exhaust all of its oil reserves within the next 15 to 20 years (Pimentel et al, 1994). Oil imports will then have to increase, worsening the U.S. trade imbalance. As supplies of fossil energy dwindle, the cost of fuel increases everywhere. The impact of this is already a serious problem for developing countries where the high price of imported fossil fuel makes it difficult, if not impossible for poor farmers to power irrigation and provide for their other agriculture needs. Worldwide, per capita supplies of fossil energy show a significant decline (Pimentel et al, 1994).

In general, developing countries have been relying heavily on fossil energy, especially for fertilizers and irrigation to augment their food supply. The current decline in per capita use of fossil energy, caused by the gradual decline in oil supplies and their relatively high prices, is generating direct competition between developed and developing countries for fossil energy resources.

Strategies for the future must be based first and foremost on the conservation and careful management of land, water, energy, and biological resources needed for food production. Our stewardship of world resources must change and the basic needs of people must be balanced with those resources that sustain human life. The conservation of these resources will require coordinated efforts and incentives from individuals and countries. Once these finite resources are exhausted they cannot be replaced by human technology. Rather, more efficient and environmentally sound agricultural technologies must be developed and put into practice to support the continued productivity of agriculture (Kendall and Pimentel, 1993).

Yet none of these measures will be sufficient to ensure adequate food supplies for future generations unless the growth in the human population is simultaneously curtailed. Several studies have confirmed that to maintain a relatively high standard of living, the optimum population should be less than 200 million for the U.S. and less than 2 billion for the world (Pimentel et al, 1994). This assumes that from now until an optimum population is achieved, strategies for the conservation of land, water, energy, and biological resources are successfully implemented and a sound, productive environment is protected.

According to the researcher, the existing inequities of supply, and the geographic mismatch between people and resources are seriously exacerbated by current population growth rates. It is fairly recently that man has become generally aware that his habitat is a relatively limited asset. Population growth and human activities such as urbanization and resource exploitation have profound effect on all aspects of the environment. However, no one knows how many people the earth can support. Many scientists think that people cannot keep up with the population explosion. No one can predict when there will be too many people on the earth to share the clean water, clean air and the food that can be grown.

2.3.2 Population growth and environmental depletion

The major cause of the continued deterioration of the global environment is the unsustainable pattern of consumption of production. Excessive demands and unsustainable lifestyles among the more effluent segments of humanity place immense stress on the environment. The poorer segments, meanwhile, are unable to meet food, health care, shelter and educational needs. This pattern, which aggravates poverty in the world, is a matter of grave concern (Agenda 21, 1998).

Although Southern Africa is an energy exporter, 75 per cent of its own population is still bio-fuel (wood and charcoal) users, with countries such as Tanzania, Mozambique,

Zimbabwe, Zambia and Malawi topping the list. The mining of minerals in Southern Africa has also impacted on the environment and has seldom been undertaken in a sustainable and environmentally friendly way. In Lesotho, there is much evidence of land degradation because of soil erosion since the restoration of mines is not regulated. In many other countries such regulations exist but are not enforced. The result is river siltation, pollution of water (including ground water) and land degradation, while abandoned mines also represent safety hazards (Loubser et al., 2005).

Environmentally sustainable development is challenged by population growth and migration and consumption patterns. The pressures created by the dynamics of South Africa's population exacerbate and mutually reinforce the effects of poverty and environmental change. Natural resources are depleted by population pressure and the need for residential land and services. Problems also include overgrazing, depletion of woodlands, deterioration of irrigation systems and overfishing (UNEP/GRID-Arendal, 2005).

The most serious environmental consequence of population growth is an accelerating deterioration and loss of the resources essential for agriculture. The problems include soil erosion, loss of nutrients, compaction of soil, increased salination of both irrigated lands and water used for irrigation, loss of agricultural land to urban development, crop damage due to increased air and water pollution, extinction of local and wild crop strains needed by plant breeders for improving cultivated varieties, and more frequent and more severe regional water shortages, especially where energy and industrial developments compete for water supplies, or where deforestation is severe and the soil can no longer absorb, store and regulate the discharge of water (Viljoen, 1996:3)

In addition, overgrazing and destructive cropping practices and the use of woody plants for fuel are causes of desertification, which is currently claiming about 6 million hectares per annum. The United Nations has classified about 2 billion hectares (2.5 times the area now classified as desert) to be at the risk of desertification (Viljoen, 1996:3)

According to Jordaan et al (1991:22), the population explosion is destroying the environment. Soil erosion washes approximately 400 million tons of South Africa's fertile topsoil into the sea every year. About 12 millions tons of wood are burnt annually in our relatively poor rural areas. This destroys vegetation, which exposes the soil and leads to further erosion. To produce more food and provide more housing for the increasing numbers of people, increasingly large areas will have to be deforested and converted into farms and residential areas. The gradual deterioration of the Dukuduku forest in Natal is only one glaring example of the effect of population pressure on the environment (Jordaan et al, 1991).

In the more developed urban areas, coal fires in some black residential areas have produced some of the highest levels of pollution in the world. Coal-fired electric power stations release sulphur dioxide into the air, and this causes acid rain. This in turn threatens life in rivers and dams and causes diseases in plants and trees (Jordaan et al, 1991:23).

Jordaan et al (1991:23) further illustrate that in the beautiful False Bay near Cape Town, signs warn bathers about sewage. If the number of people in the Cape Peninsula doubles during the next decade, False Bay, Hout Bay and other recreation resorts may be awash in sewage and industrial waste. In Natal, the Duzi River canoe marathon may have to be cancelled because the river is so badly polluted by sewage from squatter camps.

Mwandemele and Mshigeni (1998) asset that marine resources are mainly endangered through over-exploitation, but pollution is also contributing to their demise. Some Southern African economies, such as those of Mozambique and Namibia, depend heavily on marine resources. Annual exports of prawns from Mozambique generate about US $ 50 million, while Namibia exports fish from products worth US $ 300 million per year. Many coasty towns and cities have been dumping their waste water in the sea for years. Rivers are adding to this because the water they carry to the sea is also heavily polluted. More localized in nature, but more disastrous, is the oil pollution that takes place when ships become stranded on the treacherous South African coast. In June 2000 the

'Treasure' sank near Robin Island and started leaking the 1300 tons of oil on board into the sea. About 12 000 penguins had to be caught, cleaned, fed and released to avert a major disaster. Countless other marine species died as a result of the spillage (Mwandemele and Mshigeni, 1998).

The very fabric of mother earth is being threatened by the 'green house effect'. This is caused by the huge amounts of fossil fuel (coal and oil) burned to provide heating, food preparation, and transport. The carbon dioxide released into the atmosphere when these fuels are burned is gradually warming up the atmosphere. The warming of the earth's atmosphere over the next 20 years could cause ice to melt at the poles, which would raise the sea level and flood harbour cities and low-lying areas throughout the world (Jordaan et al, 1991:23)

Hare (1991:8) states that more people also means that more food needs to be produced. In finding land for the cultivation of more crops, wild habitats are replaced by human-made environments. At present, nearly all the land available on earth which can easily be cultivated is already in use as agricultural land. Much of the farmland currently under cultivation is being damaged as farmers try to squeeze more crops out of the soil. This means that the soil may not be fertile in the future, creating the need for new farmland. This is likely to put increasing pressure on the world's remaining wilderness. Many other type of developments also demand land. Roads, industries, mine and dams all need land, and their construction often means the disappearance of some habitats and the disruption of others.

2.3.3 Population growth and resource usage

Rapid population growth is very often viewed to be the most important threat to the environment as more people mean an intensification of the demands made on the finite resources of the earth. However, it is not just the numbers of people, but their consumption patterns that have an impact on the environment. It has been argued that a baby born in a developed country will use up to 30 times more resources and produce 30

times more waste during its lifetime than a baby in a developing country. In South Africa, with its wide gap between rich and poor, extremes of consumption patterns exist which impact on the environment (UNEP/GRID-Arendal, 2005).

According to Agenda 21 (1998), the world's growing population and production, combined with unsustainable consumption patterns are increasingly putting severe stress on the life supporting capacity of the planet, and has affected the use of land, water, air energy and other essential resources. Population concerns should be part of national strategies, and countries should establish population goals and programmes. Increasing human demand for land and its natural resources is creating competition and conflicts. These conflicts must be resolved and effective and efficient ways must be found to use land and its natural resources. Forests worldwide are threatened by uncontrolled degradation and conversion to other uses because of increasing human pressure.

Poor households are depended on burning fuel for energy. This has implications for their health and has an impact on the natural environment. Even in urban Gauteng, electrified households make extensive use of coal for cooking and heating. Wood and paraffin are commonly used in rural areas. About 3 million rural households use fuel wood as a primary source of energy, consuming an estimated 7.2 million cubic meters of fuel wood per year. In addition, many urban house holds are also depended on fuel wood. Only an estimated 6 million tons of wood fuel from natural wood lands in communal areas is available annually, in addition to another 4.2 million tons of residues from commercial forestry. It is therefore likely that current biomass extraction rates for energy provision are not sustainable (UNEP/GRID-Arendal, 2005).

Certainly, improved technology will assist in more effective management and use of resources, but it cannot produce an unlimited flow of those vital natural resources that are the raw materials for sustained agricultural production. For instance, fertilizers enhance the fertility of eroded soils, but humans cannot make topsoil. Per capita fish catch has not increased even though the size and speed of fishing vessels has improved. On the contrary, per capita fish production is lower than ever before because greater efficiency

led to over fishing. In regions like Eastern Canada, over fishing has been so severe that cod fishermen have no fish to catch, and the economy of that region has been devastated. All of the world's fishing grounds are facing over fishing problems (Pimentel et al, 1996).

Fresh water supply is needed not only for agricultural but also for industrial and public use. Water withdrawn from the Colorado River in several states for irrigation and other purposes results in the river being nearly dry by the time it reaches the Sea of Cortes, Mexico. No available technologies can double the flow of the Colorado River, although effective water conservation would be a help. Similarly, the shrinking ground water resources stored in vast aquifers cannot be refilled by human technology. Rainfall is the only supplier (Giampietro and Pimentel, 1993).

Human water use has been increasing about twice as fast as population growth the past century. World-wide, humans withdraw about 10 percent of the total annual runoff and about 25 percent of the stable runoff. The remaining three quarters of the stable supply is generally either uneconomical to tap, or there are ecological constraints on its use. Consumption and degradation together, account for about half the water withdrawn in most industrial societies. The other half of the water we withdraw would still be valuable for further uses if we could protect it from contamination and make it available to potential consumers. We have always treated water available to potential consumers. We have always treated water as if there is an inexhaustible supply (Cunningham and Siago, 1997).

An article by Percival and Homer-Dixon (2005) points out that urban centres throughout much of Africa's densely populated regions are in danger of collapsing under the weight of resource scarcity. Most experts agree that the scarcity of water will play a major role in the proliferation of conflicts in the near future. According to the United Nations figures, 600 million people are officially homeless or living under life-threatening urban conditions, more than a billion lack sanitation and a further 250 million have no easy access to water. The overwhelming speed at which the world is urbanizing, leaves little

time to adapt. Extreme water shortages face developing cities in the next fifteen years. More than a billion people cannot get clean drinking water, while the drinking of dirty water is the cause of up to eighty percent of diseases in the developing world. In Khartoum, the average person spends two-thirds of his/her monthly income on the acquisition of drinking water, largely as a result of leaking water pipes and continued population growth. It is believed that South Africa too, will face extreme water restrictions for similar reasons within the next ten to fifteen years. Water supplies for future development could dry up within the next 30 years if timely precautions are not taken.

Although an estimated 4.3 million households still do not have water services, the increase in demand for domestic and industrial water provision over the last four decades has been four times greater than that of the agricultural sector, which is currently still the largest consumer of water. The demand for domestic water is projected to increase from 11 per cent of the total in 1996, to 23 per cent of the total by the year 2030, an increase of more than 200 per cent. Current projections estimate that serious shortfalls in water provision will occur within the next 10–20 years ((UNEP/GRID-Arendal, 2005).

Contamination (poisoning) of our water supplies is a major problem. Rivers, lakes, and the sea are becoming more and more polluted. Industrial chemicals are often piped directly into the water. This is in spite of the strict laws in most industrialized countries governing the release of liquid waste. Harmful substances build up in the water and this has harmful effects on creatures living in the water. Recent research has, for instance, shown a rise in cancer and other diseases in the sea fish because of the increasing chemical pollution (Markham, 1998:33-35).

Increasing urbanization and industrialization will present increased pollution by industrial and human waste. Such pollution will naturally also have an effect on highly sensitive estuarine and even coastal ecosystem. This in turn could have adverse effect on commercially important fisheries. Sixty to eighty percent of commercial marine fishing

species are estuaries, salt marshes, and mangrove swamps as habitats at some point of their life cycle (Viljoen, 1996:3-4)

It is believed that one third of all deaths in the world are caused by water-borne diseases caused by water pollution. There are many causes of water pollution including:

- Poisoning from agricultural products such as insecticides, pesticides and weed killers.
- Industrial waste that is pumped into the rivers or leaks into the water table.
- Domestic human litter.
- Human and animal waste which is piped into rivers or the sea or through leakages from sewage plants (Moldan, 1992:50).

Arms (1994:166) also states that the main killers among infectious diseases are connected to water. In diseases such as cholera, hepatitis and trachoma, the pathogens are transmitted in polluted water. These diseases can be prevented only by clean water supplies. Secondary hosts that need water to breed spread diseases such as Malaria, Schistosomiasis and sleeping sickness. The spread of irrigation ditches and dams has increased the incidence of these diseases.

Dalal – Clayton (1997:46) states that many people – again, usually the poor – frequently draw water (for drinking and washing, and for supplies to garden and livestock) from sources which are contaminated with poisons after passing through industrial areas, mines and agricultural estates. About seven million of these people live in South Africa. Many people have to walk long distances every day to fetch water from rivers and dams. It is often girls who have the job of fetching water for the family, which means that they cannot go to school.

From the researcher's point of view, the earth is finite. Its ability to absorb wastes and destructive effluent is finite. Its ability to provide food and energy is finite. Its ability to provide for growing numbers of people is finite. And people are fast approaching many of the earth's limits. Current economic practices which damage the environment in both

developed and developing nations cannot be continued without the risk that vital global systems will be damaged beyond repair. Pressures resulting from unrestrained population growth put demands on the natural world that can overwhelm any efforts to achieve a sustainable future.

2.3.4 Population growth and environmental pollution

For many people, the way to dispose of waste is to simply drop it at some place. Open, unregulated dumps are still the predominated method of waste disposal in most developing countries. The giant Third World megacities have enormous garbage problems. Mexico City, the largest city in the world since 1993, generates some 10,000 tons of trash each day. Until recently, most of this torrent of waste was left in giant piles, exposed to the wind and rain, as well as rats, flies, and other vermin. Most developed countries forbid open dumping, at least in metropolitan areas, but illegal dumping is till a problem. The problem of illegal dumping is likely to become worse as acceptable sites of waste disposal become scarcer and costs for legal dumping escalate (Cunningham and Saigo, 1997).

Loubser et al(2003) point out that technological development has generated tremendous amounts of solid waste, including disposable nappies, razor blades, pens, tyres, batteries, cans, bottles, bags, paper, plastic ware and rotten food. Every year, the average First World household throws out the following:

- about one ton of waste
- two trees worth of paper
- 90 cool drink cans
- 100 food cans
- more than 100 bottles and glass containers
- 45kg plastic.

The extent of environmental pollution illustrates the effect people have on the environment, and the way people are affected in turn by the environment. Industries often

create a great deal of pollution by pumping smoke into the air, or by pouring chemical waste into the rivers or sea. One of the results of pollution is that, in some parts of the world, the people living there are struggling to obtain enough food, fuel or clean water in order to survive (Markham, 1998:8).

According to Blake et al (2000:36) there are two ways in which people usually get rid of waste, by dumping it on dumps (also known as land fills) or by burning it. The amount of plastics and other synthetic (human-made) products produced these days has caused a new problem because these products do not disintegrate but remain in their original state, even if they are buried. If plastics are burned, they cause air pollution because of the chemicals out of which they are made. There are many examples of waste products that do not decompose and that, therefore, cause pollution, for example, aluminum cold drinks and beer cans. Natural waste products that do disintegrate or decompose are not so bad, because often they will be absorbed into the soil and can act as natural fertilizers.

An increasing amount of hazardous waste is affecting human health and the environment, but many countries do not have the expertise to manage the problem. Governments often lack information about how much and what types of pollution are released, and what risk they pose to people and the environment. All national environmental protection plans should include targets for hazardous waste reduction (Agenda 21, 1998).

A study by the Department of the Environment on the waste problem in South Africa showed that more than half of the 542 waste disposal sites examined were found to be contaminated (it is estimated that South Africa has at least 1600 of these sites). Of the 460 million tons of waste created in South Africa every year, two million tons are toxic (poisonous). In general, the investigation found among the public, business sectors and government, a lack of awareness about the dangers of uncontrolled waste. Many dumping sites were poorly planned and managed and few industries had a proper waste management plan (Earth year, Edition 3, 1992:58-59).

According to the researcher, one of the major pressures in modern society is the generation of waste and its disposal. Waste generators consist of municipalities, informal settlements, industries, hospitals and mines. Rapidly growing quantities of garbage and sewage from cities pose threats to human health and the environment. The best way to cope with waste problems is through waste prevention approach, focused on changes in lifestyles and in production and consumption patterns. National plans are needed to minimize the creation of waste, and to ensure that waste is re-used, recycled and safely collected and treated.

2.3.5 Population dynamics and global climate change

The dramatic increase in human population since 1950 has been paralleled by two other significant trends: the rapid rise of both atmospheric carbon dioxide levels and average global temperatures. While the relationships among these rising trends are complex, the underlying facts are simple. As the population has increased from 2.5 billion in 1950 to 6.2 billion in 2002, people have progressively consumed greater amounts of fossil fuel and engaged in more activities, such as deforestation and the production of certain chemicals, all of which produce carbon dioxide and other greenhouse gases.

There is broad agreement in the international scientific community that these greenhouse gases have increased the temperature of the earth and will continue to do so at an accelerating rate in the coming decades if current trends persist. In 2001, the Intergovernmental Panel on Climate Change (IPCC), an international UN-sponsored panel on several thousand scientists, concluded that "most of the warming over the past 50 years is likely to have been due to the increase in greenhouse gas concentration" (Intergovernmental Panel on Climate Change, 2001). The 1990s were the warmest decade in the 20^{th} century, and 1998 and 2001 were the hottest years ever recorded.

The IPCC scientists now estimate that if emission trends continue, CO_2 levels will double by the middle of this century from their pre-industrial levels, and the global mean surface temperature will rise from 1.4 to 5.8 degrees Celsius (2.5 to 10.4 degrees Fahrenheit)

between 1990 and 2100 (Intergovernmental Panel on Climate Change, 2001). Due to the persistence of greenhouse gases in the atmosphere, warming will continue for at least several decades after greenhouse gas concentration reaches a peak.

Because of the predicted serious impacts of global warming, these findings illuminate the critical link between population and climate change. The size of the human population and its activities in the 21st century will be a major factor driving the extent of warming. Likewise, the impact of warming on humanity will be greatly affected by population size. Greater human numbers may reduce the options for mitigating or adapting to sea level rise, changes in precipitation patterns and other by-products of warning.

2.3.5.1 The effects of population growth on climatic change

A rise in income and standard of living of the poor may lead to increased pressure on the environment in other ways and it may lead to increased demand for consumer goods. The production of consumer goods not only utilizes material directly or indirectly taken from the environment, but the production process itself generates waste and pollutants. Certain consumer goods, such as motor cars and electrical appliances, utilize energy sources that contribute to green house gases. Illustrative of this point is the increase in the number of motor cars on South African roads. More cars on the roads mean an increase in fuel emissions into the atmosphere (UNEP/GRID-Arendal, 2005).

Beyond the parallel rising global trends of population and greenhouse gas emissions, the situation is somewhat more complicated. On a per capita basis, global carbon dioxide emissions from the combustion of fossil fuels rose from 0.3 metric tons (mt) per person in 1900 to 1.1mt in 1970 and have remained relatively flat since then (Carbon Dioxide Information Analysis Center, 2002). On a global scale, the substantial increases in total emissions over the last three decades correlate closely with population growth (Meyerson, 2002 & Meyerson, 1998).

Global per capita emission figures, however, obscure huge disparities in per capita emissions by country. The average person in the United States contributed 5.4 tons of CO_2 to the atmosphere in 1998, five times as much as the average Mexican, and 19 times as much as the average Indian (Carbon Dioxide Information Analysis Center, 2002). In 1995, the 25 percent of the world's population living in countries with the highest per capita emissions contributed 63 percent of the world's fossil-fuel CO2 emissions. The low emitters – the 20 percent of world population at the opposite end of the spectrum – contributed just two percent of global fossil fuel CO2 (Engelman, 1998).

This effect is particularly relevant because of recent trends in per capita emissions. For the developed countries as a whole, per capita emissions have been relatively flat since 1970, fluctuating between 3 and 3.5mt per person. Developing country emissions are far lower on a per capita basis, but the gap is narrowing, in both per capita and absolute terms. In 1950, the developing country per capita average emission was only 0.1mt, but it rose to 0.58mt by 1998 (Carbon Dioxide Information Analysis Center, 2002 & Meyerson, 2002). The aggregate emissions of the developing countries are also increasing rapidly and are expected to surpass those of the developed countries within the first few decades of the next century, as a result of both rising population and per capita emissions in the developing world.

Population is not specifically referenced in the Kyoto Protocol, but it is a factor that will play a major role both in terms of compliance with the Protocol and with respect to future climate policy negotiations. The Protocol is based on national caps that will not be adjusted for increases or decreases in population due to either fertility or migration. Thus, for example, while the United States' population is projected to rise by 24% from 1990-2010, and Italy's population is projected to decline by 1%, both countries must make approximately the same level of emissions reduction (Meyerson, 2002). Since population increases result in more houses, cars, and therefore, emissions, countries with rising populations are at a comparative disadvantage under the national cap formula used in Kyoto (Meyerson, 1997).

Whether or not the Kyoto Protocol is ratified, it is evident that a future global climate change agreement will need to incorporate the concepts of population growth and decline, international migration, and changing relative level of per capita emissions (Meyerson, 1998). While developed countries have had the dominant source of greenhouse gas emissions in the past, developing country emissions will be the major factor in the twenty-first century, and a future treaty will need to respond to this coming demographic reality.

2.4 WHAT CAN BE DONE?

From the analysis done so far, looking at many environmental problems may lead one to think that there are so many problems, and that they are so great that nothing can be done about them. Actually, there is a lot that people can do to save, protect and improve their environment. The government and leaders at all levels of society, as well as every private citizen, will have to make some contributions towards solving the problem of overpopulation in South Africa.

2.4.1 Strategies for managing population growth

Many developed countries have demonstrated that a reduction in the fertility rate occurs naturally when access to family planning and the social status of women are improved. The reasons for this are as follows:

- When women have access to good health services and methods of birth control, they are more likely to have fewer children.
- Well-educated women that are given equal employment opportunities get married later and generally choose to have smaller families. A definite trend has emerged from countries all over the world which shows that the more schooling a woman has, the fewer children she chooses to bear. The amount of education that men receive appears to have very little effect on population growth (Tarr, 2000).

2.4.2 Strategies for overcoming world inequalities

2.4.2.1 Improving trade conditions

It has proved extremely difficult to decrease the North-South trade gap. Efforts to do so include:

- Increasing trade between developing nations.
- Forming regional trade group like SADC (The Southern African Development Community) which eliminates trade barriers between member states.
- Improving opportunities for manufacturing in developing countries.
- Encouraging developed countries to reduce tariffs (import taxes) on raw materials from poorer countries through trade agreements (Tarr, 2000).

2.4.2.2 Improving aid conditions

Aid involves the giving of resources (money, food, technology, goods or skilled people) by one country or organization to another. Although the main aim of giving aid is to help developing countries improve their standard of living and quality of life, this does not always occur. For example:

- Aid in the form of money, food or clothing, supplied to a country that is suffering from famine, drought or other natural disaster, is sometimes used by corrupt officials before it reaches the people who are in real need.
- In order to try and reduce the effects of poverty, governments may subsidize livestock, crops and water. These measures encourage the overexploitation of the natural resources and indiscriminate agricultural practices which contribute to land degradation and the perpetuation of poverty.

To be beneficial, aid should encourage developing countries to become self-sufficient and independent. Ideally this is achieved by helping to improve standards of

education and health, developing skills and small scale sustainable industries and growing food crops for local consumption (Tarr, 2000).

2.4.3 Sustainable development

A healthy environment depends on many factors. When one facet of the environment is changed negatively, other parts are affected too. For instance, if people cut down too many trees, then the climate is affected and will have less water. Sustainable development is a way of interacting with the environment taking into account the way different species depend on one another. In other words, it is a way of working with nature, rather than against it. It takes into account the fact that the survival of the future generations must be safeguarded and the environment must be protected and improved rather than destroyed (Blake et al, 2000).

Sustainability does not require that nature be left untouched. It does require however, that each generation recognize its obligation for stewardship for the earth's natural resources and ecosystems on behalf of future generations. The transformed society must use the earth's resources in a way that will assure sustainable benefits for our children. In practical terms, this means reducing unnecessary and wasteful consumption patterns, eliminating human poverty and managing ecosystems and natural resources wisely (Claxton, 1995:10).

2.4.4 The role of women in helping to develop an ethic of sustainability

There can be little doubt that the varying roles of women in populations around the world have led to considerable contrasts in their use and control of resources and in their contribution to environmental management. Despite their greater vulnerability to pollutants of air, food and water, especially in child-bearing and child-rearing, women have often been ignored in development and environment policies. Furthermore, despite their numerous agricultural activities, they have little access to land ownership, credit facilities and modern technologies. Obviously, women should be involved in decision-

making about environmental issues, and research should be directed to showing how women's roles can be ameliorated with environmental benefits, instead of them working harder in response to environmental degradation. Just as women are vital in primary health care, so are they in primary environmental care. Indeed, primary health care and primary environmental care are linked, particularly through child health and the need for greater education of women, which has such important effects upon both fertility and child mortality (United Nations, 1992).

Research conducted by Cambridge economist, Partha Dasgupta, shows that women who lack paid employment have less decision-making authority in their families. Weak authority, combined with the usefulness of children for labour in subsistence conditions (for collecting fuel wood and water and for herding animals) leads to high fertility rates. In South African rural areas, black women's responsibilities are largely unpaid, and high fertility rates are to be expected. High infant and child mortality rates also raise a fertility rates, as families have no guarantee that their children will survive to adolescence (Percival and Homer-Dixon, 2005).

For too long, the role that women can play in helping to develop an ethic of sustainability has not been recognized. Women are the main role models for the next generation and have the potential to significantly affect its value and behaviour. However, the positive influence which women can exert on the development of the family and the nation, depends largely upon the level of education they receive. It is vital, therefore, that women the world over, but particularly in developing countries, receive levels of education that will raise their status and empower them to have greater control over their lives and that of their families. Improved education, along with access to such things as health services will enable women to make their own informed decisions upon matters affecting their own lives. In terms of developing a sustainable society, this could mean, for example making informed decisions about family size and the consequences that their action may have on their environment (Claxton, 1996:23).

This empowerment is especially important in developing countries, particularly in rural areas where it is the women who are interacting with their environment on daily basis, for example, in having to provide energy for cooking and heating, having to deal with clean water and dealing with waste. Too often their important role is not considered but in order for sustainable development to become a reality, it must be recognized and acted upon (Claxton, 1996:23).

In South Africa, the status of black women in the marriage relationship, especially with regard to decisions about childbearing and family size, is strongly influenced by the lobola custom. Traditionally the passing of the lobola to the bride's family gives the man the right to decide about his wife's fertility and the number of children she should have. The culture of black women has so far not taken kindly to the concept of the smaller family. Many black women have also still to be convinced of the advantages of having a smaller family. They will have to realize that, in the end, big families inevitably result in a much lower standard of living (Jordaan et al, 1991:91).

According to this researcher, women have considerable knowledge and experience in managing and conserving natural resources. However, the role of women in achieving sustainable development has been limited by such barriers as discrimination and lack of access to schooling, land and equal employment.

2.4.5 The role of the community

Internationally, the concept of people working together as communities and with such organizations and authorities that are available to ensure results, has been adopted by many groups involved in helping to develop sustainability. For example, the IUCN's Traditional Ecological Knowledge Working Group has assigned itself the role of promoting 'the use of traditional ecological knowledge and resource management practices in rural communities as an effective basis for modern and sustainable resource management systems and for natural resource conservation' (IUCN, UNEP, WWF, 1991).

In order for the community to decide upon action plan for its environment, all citizens must have the right to participate in decisions that will affect them. Communities should the empowered to identify the problems they see as most important and by discussion and negotiation, decide upon priorities and appropriate actions to be taken. IUCN's report (Yeld, 1997) states that, community participation helps ensure that decisions are sound and all parties will support them. Where environmental actions are initiated by outside organizations, companies or authorities, it is no longer acceptable to simply tell the involved communities what to do as the past has shown this approach to be unsuccessful, often creating worse problems in the process. Rather the community must be involved in all decisions affecting their environment and so their own lives.

The IUCN suggests the following ideas for facilitating such community participations. Conducting consultations where people are:

- Working with traditional leaders and the full range of community groups and organizations.
- Ensuring that the scope of consultation is appropriate to the decision being made.
- Limiting the number of management and consultative bodies to which communities have to relate.
- Giving communities and other interested parties adequate, readily intelligible information and enough time to consider it, contribute to proposals themselves and respond to invitations to consult.
- Ensuring that consultations are in a culturally acceptable form. If indigenous consultation mechanisms exist, they should be used.
- Ensuring that the timing of consultation is right. Consultation must not take place so early that no useful information is available, or so late that all people can do is react or object to detailed proposals (IUCN, 1991).

The role of communities in determining the environmental future of the earth must never be underestimated. From the researcher's point of view, over many generations, indigenous people have evolved a holistic, traditional scientific knowledge of their land, natural resources and the environment. Their ability to practice sustainable development

on their lands has been limited by economic, social and historical factors. People should actively participate in shaping national law policies on the management of resources or other development processes that affect them.

2.4.6 Changing attitudes and practices

Changing people's individual attitudes to the environment and their ability to act upon these attitudes is probably the key to developing an international ethic of sustainability. But it also poses the biggest problem to be overcome for several reasons: many people in the world simply do not have sufficient knowledge to understand what is happening to the earth in environmental terms, let alone thinking about how they may help towards rectifying it, or, at the very least, preventing it from becoming any worse (Claxton, 1996:14).

A number of people who do understand environmental problems and what might be done about them fail to act on this knowledge because 'environmentally friendly' actions do not blend easily with their way of living. For example, it is more convenient for them to travel in their own cars than to use public transport or to arrange 'lift club' where a group of people working in the same area and at the same times travel together. These two alternatives are obviously more 'environmentally friendly' as they save precious fuel resources and add less to atmosphere pollution. Changing the attitudes of these types of people is extremely difficult as they pay lip service to environmental reforms but would rather put individual luxuries before environmental necessities (Claxton, 1996:14).

Miller (1995:178) also points out that buying environmentally friendly or green products and boycotting harmful or wasteful products are ways to reduce our environmental impacts and stimulate companies to make less harmful products. And if populations and per capita consumption continue rising, the environmental benefits of such consumption will eventually be overwhelmed. As Mahatma Gandi reminds us, "when we take more than we need, we are simply taking from each other, borrowing from the future, or destroying the environment and other species".

For a long time, since man's detrimental impact on the environment has first been realized, many of the messages coming across to the public was of environmental doom and gloom. This overriding air of pessimism, while causing many people to act, also caused a great many people to ask whether individual behaviour could actually make a difference on a wider scale, so why bother to change the way in which you live?
Fortunately, the general trend now is to balance reports on environmental problems with possible solutions and air of optimum that something positive can be done but this requires application on the part of the individual (Claxton, 1996:14).

The future of our planet depends on the interaction between humans and the environment and that relationship depends, not only on politicians, but also on ordinary people. Every person can make a difference in some small way. The real solution though, rests not so much with technology as with people. All of us can do one simple thing to help the environment (Mosley and Weber, 1993:41).

2.4.7 Family planning as a human right

The problem in South African society is that, together with the rapid population growth, there are also increasing numbers of unplanned births. Moreover, because of the risks associated with abortion-which is mostly performed illegally, only a small percentage of women with unplanned pregnancies will opt for abortion. This means that, despite the population problem, South African women are forced to have large numbers of unplanned and unwanted children. This goes quite a long way towards explaining the child neglect and abandonment that is taking place at an increasing rate (Jordaan et al, 1991:96).

The International Planned Parenthood Federation (IPPF) regards family planning as a women's right, one that directly affects her ability to exercise her other rights. This is a very persuasive argument when one considers that the teenager who becomes pregnant at 15 years of age is forced by circumstances to relinquish her right to education, the

acquisition of skills and ultimately to meaningful economic and social participation. This process is known as the feminization of poverty, and the description of women in this situation as "poor, powerless, and pregnant" is particularly apt (Jordaan et al, 1991:97).

In their book, 'Population growth-our time bomb', Jordaan et al (1991:97) state that young people must be taught that family planning is a basic human right. Such education should be based on an awareness of the demographic realities of the country. Information with regard to the use of contraceptives and the realities of sexually transmitted diseases such as AIDS, should probably also be included in this instruction. The idea of family planning as a human right has a better chance of acceptance among young people, who are more receptive to new ideas and change. Young people should be the most important target group because:

- They constitute the largest part of the population, since more than 50 percent of the South African population is younger than 20 years of age;
- Most young people have their reproductive lives ahead of them;
- Their fertility behaviour will determine whether or not the country is able to solve its population problem;
- They have more to gain from such rights because they have not yet lost anything; and
- They are faced with a disintegration of the traditional approaches to sex education and are looking for something to replace them.

One very useful indicator of women's ability to limit their number of children-and of the prospect for future fertility decline-is their desire to cease child bearing. In Vietnam,92% of women who had two living children said that they did not wish to have any more children. In Nigeria, by contrast, that figure was only 4% (Population Reference Bureau, 2006).

To summarize, according to the researcher, there are indications that South African women, like women in many other countries of the world, want control over their

reproductive lives, and they surely deserve this right. This should be encouraged through making family planning education part of their formal as well as their informal education, and actually popularizing the idea that they have a right to use whatever family planning methods they choose. Women should have the assurance from the early planning methods they choose. Women should have the assurance from an early age that preventing pregnancy is their right. There should be no misgivings or doubt in this regard. Young people must be persuaded that the traditional insistence on having lots of children to help care for the family, is pointless now that circumstances have changed. Today, it is, in fact, self-destructive, since a family that is too large lowers the standard of living of each of its members.

2.4.8 Requirements for an effective population control programme

The South African Government's objectives in its population programme are:

- That the quality of life of the population be raised by decreasing fertility and improving levels of literacy and career involvement of women in particular.
- That there should be a primary health programme that would concentrate on bringing about a reduction in the infant mortality rate (Jordaan et al, 1991:102).

At the 1990 Midrand conference, President F.W. de Klerk also stated the following objectives:

- To accord population programmes greater priority,
- To contribute towards the development of a viable population objective.
- To improve the role and status of women at all levels and to ensure that they participate actively in population development activities.
- To ensure that population programmes provide education, advice and services for young people, and to encourage them to take part in such programmes. Obviously, prosperity will bring smaller families, but how will this prosperity be created if there are already too many mouths to feed? Greater prosperity can be achieved only if far fewer people are born in the short term. We therefore have to

find ways of reducing the number of people who will share this prosperity. If we do not, an improvement in per capita living standards will remain just a dream (Jordaan et al, 1991:102-104).

It is clear that South Africa is not in a position to eliminate existing backlog and is in fact rapidly falling further behind, even though the population is not even close to half of the stated objective. It is thus evident that the policy objectives in the population development programme are not realistic. They should be amended urgently.
The following recommendations may be considered:

- The two –child family has to become the norm.
- The highest priority must be accorded to family planning that the state budget is drawn.
- The limitation of population growth must be placed high on the agenda for negotiations (Jordaan et al, 1991:106-107).

2.4.9 Governments and the environment

According to Blake et al (2000:5), local and national governments have a part to play in maintaining a healthy environment. Governments have to create conditions for economic growth with particular focus on poverty alleviation, food security and sustainable agricultural systems. However, Governments do not act in isolation. What happens in one country affects another. A healthy and sound environmental policy is needed for sustainable development to take place in any country. South Africa and most other countries now have laws to control environmental pollution, control discharge of waste, control noise pollution, provide for conservation of natural resources by promoting the sustainable use of natural resources and provide for environmental impact assessment-research into the effects of developmental organizations such as Trees for Africa. Earth Life Africa, Hluvukani Development Agency and other environmental organizations are also using a holistic approach to sustainable development of our natural resources.

It is the government and its citizens that influence policy. Agencies such as the World Bank, the International Monetary Fund (IMF) and other multinational corporations can often dictate the agricultural policies in many developing countries. NGOs play a useful role in lobbying governments and business and reminding us all of the importance of a sustainable environment (Blake et al, 2000: 49)

Implementing new environmental policies usually involves a debate about the relationship between costs and benefits. Although South Africa cannot afford measures which slow down economic growth, it can also not afford the high costs of population growth (Rotating the Cube, 1990:43). A compromise has to be reached which protects the environment but does not involve too much expense for the country's economy. In making decisions, one also has to work out what costs will be if nothing is done about a particular environmental problem.

From the researcher's point of view, NGOs play a vital role in the shaping and implementation of participatory democracy. In addition to their independence, NGOs have diverse and well-established expertise in fields needed to implement environmentally sound and socially responsible sustainable development. Governments should involve NGOs in sustainable development plans, making the best use of their abilities in such areas as education, alleviation of poverty and environmental protection and rehabilitation.

2.5 SUMMARY

Of all the issues the world faces, none is more important than population growth. This review of the literature revealed that the main troubling causes of environmental destruction are the combination of factors that result from human activity, primarily overpopulation and over-exploitation of the natural resources.

No one knows how many people the earth can support. But scientists, economists, and other experts, fear that food production cannot keep pace with the population explosion

for too long. They believe that the world will soon become overpopulated, that is, it will have more people than it can support at an acceptable standard of living.

The literature also indicates that often humans do not seem to understand what carrying capacity means. As human populations climb, there is also the need to think about limits. Population numbers do not constitute the only problem, misuse of the land due to thoughtlessness or greed or poor management practices should also come under scrunity.

The Rustenburg area has shown a significant population increase in the past number of years. This growth rate cannot be attributed to natural growth only, but is largely the result of an influx of people into the area due to the numerous employment opportunities created by mines. As a result of this high growth rate, natural resources are being depleted by population pressure and the need for residential land and services.

From the researcher's point of view, there are many challenges facing the South African government as it reforms itself, seeking to better respond to the needs of all its citizens. These challenges include eradicating poverty, creating job opportunities and the provision of adequate basic services, concentrating much in former 'black townships' and peripheral informal settlements.

When selecting a specific future path for South Africa, the various environmental issues delineated in this study need to be kept in mind to ensure that the chosen future path leads towards the finding and implementation of solutions to such problems. Any future path that does not address these problems is doomed to fail because of the extent of the problems and the large percentage of the population facing such problems on daily basis.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

3.1 INTRODUCTION

The choice of a research design and methods is largely influenced by the desired end product and the best way to investigate the research question. Ideally, all researchers should have the capacity to work within different research traditions, research designs and use a variety of research tools and techniques (Anderson and Arsenault, 1999). In essence, the design and methodology in the research process is the distinctive framework according to which the data pertaining to the research question was collected. The research protocol and data collection procedure for this research are clearly spelt out in the paragraphs that follow.

The main objective of this chapter is to outline the method used to collect valid and reliable information about the variables under investigation. It includes methods in which participants are asked questions. Questions may be structured or unstructured as the situation demands.

The empirical investigation which is designed in the form of questionnaire and interviews, determines the environmental effects of population growth in the Rustenburg Core Area.

3.2 METHOD OF RESEARCH

This is a case study investigating the environmental effects of population growth in the Rustenburg Core Area (Bojanala region) in North West Province (South Africa). The case study enabled the researcher to get a comprehensive understanding of problems in the area under study, that is, the Rustenburg Core Area. The qualitative and quantitative research methods have been applied in this investigation. A combination of these

methods was used to make a detailed examination of the problem under investigation. Quantitative methods are more concerned with maximizing the objectivity and testing the validity of what is being observed, whereas qualitative methods are more concerned with subjectivity and tapping the deeper meaning of human experience.

3.3 STUDY POPULATION AND SAMPLE

The population targeted for this research consists of all the community members of the Rustenburg Core Area (that is 259846 people). The sample size is n=100 members from the area. Random sampling method was applied to select the sample from the population. Because the population of interest is spread over a large area, the researcher subdivided the identified areas into clusters. The sample consisted of people within each of the chosen clusters. In this case the researcher had the advantage of concentrating the case study in a specific section of the greater geographical area at a time and thus saved time.

The study sample comprises the following subjects:

- A random sample of n=80 respondents from the community under study, that is, the Rustenburg Core Area, consisting of male and female adults from twenty years and above.
- Another sample of n=20 key-persons was selected from the population. The key-persons are the district councils in the area under study. They gave information pertaining to the development initiatives from their respective departments and organizations, particularly those that have information pertaining to the environmental effects of population growth in the Rustenburg Core Area.

Table: 4. Sample of respondents

Community members	80
Key persons	20

In the interview, subjects were selected in the same manner as the questionnaire in terms of sampling techniques.

3.4 LITERATURE STUDY

Local as well as international sources were used in order to accumulate as much information as possible concerning the central question of this study. A literature study of both primary and secondary sources was undertaken. The gathered information was measured and evaluated, from which conclusions were drawn. A DIALOG computer search and an internet search was undertaken using the following descriptors: population growth, the effects of population growth; the earth's carrying capacity; demographic aspects of population growth; and population growth and resource usage.

3.5 METHOD OF DATA COLLECTION

A combination of data collection methods was used in this study. Based on the literature study, questionnaires for the randomly selected respondents in the Rustenburg Core Area were used with the view to determine the environmental effects of population growth. The questionnaire is aimed at determining the opinions of people with regard to the conditions of their environment and the degree to which efforts are made to protect it. The questionnaire was administered and analysed by the researcher.

An interview schedule for the key-persons was also used. The focus group comprising six participants was selected from the chosen study sample to pre-test the research instruments. A combination of data collection methods was used to enable the researcher to cross-check the data to ensure its reliability and validity.

3.6 INSTRUMENTATION

The study used the questionnaire and an interview to investigate the problem. Tools employed in the collection of data in surveys are the questionnaires and an individual

interview (Borg and Gall, 1989). The method of data collection is, to some extent, guided by the purpose of the study (Dixon, 1989).

In this study, questionnaires and interviews were used as data collecting tools. This case study required the administration of the questionnaires to the sample of respondents selected from the population in order to obtain the information needed. The aim of the questionnaire was to gather information about the environmental effects of population growth in the Rustenburg Core Area. Respondents themselves completed the self-administered questionnaires. An unstructured interview was also conducted giving the interviewer greater flexibility and freedom. A tape recorder was used to record the responses of the key-persons. The researcher used the respondents' mother tongue to accommodate those who felt uncomfortable with the English language.

3.6.1 Questionnaires

Legotlo (1996) states that, the questionnaire is the measuring instrument used to collect data and it has the greatest influence on the reliability of the data collected. It is important that great care be taken when designing a questionnaire because an improperly laid out questionnaire can lead respondents to miss questions and can also confuse them about the nature of the data desired. A questionnaire is a device which enables subjects (respondents) to answer questions. The major task of a researcher is to design a questionnaire that can help in getting accurate information needed for solving the research problem.

Moate (1996:128) & Guy, (1987:229) also state that, a questionnaire is a data collecting instrument which contains a selected group of questions chosen because of their relevance, thus the questionnaire is carefully worded for clarity. Questions asked should produce the data needed for the study. To gather information, one requires an artistic touch. Creativity also plays a vital role in developing the questionnaire. The measuring instrument has the greatest influence on the reliability of the collected data hence great care should be taken in the construction of the questionnaire. A well designed

questionnaire boosts the reliability and validity of the data to acceptable levels of tolerance (Schnetler, 1998).

A good questionnaire must create a feeling of importance on the part of the respondents, a sense of relevance and that their co-operation is vital. The researcher should avoid emotionally charged words. He/she should allow the respondents to report what is really true for their situation. Some people may distort their responses and feel the need to comply with these types of items (Moate, 1996:129).

A structured questionnaire (likert type) was developed, based on the literature study, and administered to the selected sample in order to obtain the information needed to attain the aims of the study listed in section 1.5.

3.6.1.1 Types of questionnaires

3.6.1.1.1 Mailed questionnaires

This is the type of questionnaire that is commonly used in the collection of data; hence great care should be taken in the construction of the questionnaire and its administration so that more favorable responses could be attained (Dixon, 1989).

This is definitely a non-personal method of gathering data. It is done by mailing the questionnaires and asking the respondents to send them back. The questionnaires may be completed at the respondent's convenience. The respondents may be willing to provide socially understandable answers since there is no interviewer present who can identify them later.

3.6.1.1.2 Self - administered questionnaires

These are types of questionnaires that researchers construct and distribute to the respondents especially those who are widely separated geographically and cannot be easily reached because of the distance.

3.6.1.1.3 Advantages of the questionnaire

The questionnaire is normally employed because of the following advantages:

- Geographical coverage: a large coverage of the population can be reached with little time or costs.
- Anonymity of respondents: respondents are asked to fill in the questionnaires without indicating their names and this also helps them to be honest in their answers.
- A well-designed questionnaire ensures the reliability and validity of the data.
- Questionnaires can allow open-ended questions; therefore, people can be free to respond.
- Some types of questions, which might require reflection or consultation before answering, will be more appropriately dealt with when the respondent has more time for an answer and no waiting interviewer to cause a hasty response.

In this study, the respondents were not asked to indicate their names in order to ensure confidentiality.

3.6.1.1.4 Disadvantages of the questionnaire

Schnetler, (1998) and Kamil, Langer and Shanahan, (1995) share the view that the questionnaire is commonly used as a tool for data collection. However, there are some criticisms against the use of the questionnaire, like:

- Excessive non-response rate: a high non-response rate is quite common.

- Poorly structured items: an improperly laid out questionnaire can lead the respondents to miss questions and can also confuse them about the nature of the desired data.
- Data from the different questions are difficult to synthesize; a questionnaire does not allow the investigator to follow through on misunderstood questions or inadequate answers.
- If the questionnaires are to be administered by the researcher, it might be an expensive exercise, especially when respondents are far apart.
- Negative attitudes to the questionnaire: questionnaires are commonly used today and some respondents could have negative attitudes towards them.

Schnetler (1998) states that the major criticism against the use of questionnaires is the poor design rather than the questionnaire per se. To overcome the difficulty of poorly constructed questionnaires, items should deal with meaningful research problems. Questionnaires are to be structured carefully and administered effectively to qualified respondents (Borg and Gall, 1989).

The study confronted non-cooperative respondents among the sample during the data collection stage in particular. For example, the Director Corporate Support had the tendency to deny the researcher access to written documents relevant to the study. However the researcher managed to get all the potential respondents.

3.6.1.1.5 Objectives in designing questionnaires

According to Wai-Ching Leung (2001), there are two main objectives in designing questionnaires:

- To maximize the proportion of subjects answering questionnaires–that is, the response rate.
- To obtain accurate relevant information for the survey.

To maximize the response rate, people have to consider carefully how they administer the questionnaire, establish rapport, explain the purpose of the survey, and remind those who have not responded. The length of the questionnaire should be appropriate. In order to obtain accurate and relevant information, researchers have to give some thought to what questions they ask, how they ask them, the order they ask them in, and the general layout of the questionnaire.

To obtain relevant information, the researcher thoroughly pilot-tested the questionnaire before using it in the main investigation.

3.6.1.1.6 Format and content of the questionnaire

In this research, the questionnaire was used as the main instrument for data collection. Questionnaires used in this study comprised three sections. The purpose of Section A is to provide the respondents' biographic and demographic data that include age, gender, education profile, settlement and employment. Such information is essential in determining the background of the respondents.

In section B, fourteen items using the four-point likert scale with "strongly agree and strongly disagree" as end points was used to determine the effects of population growth on the environment.

The names of the respondents were not included in the questionnaire to ensure confidentiality.

3.6.2 Interviews

The most obvious difference between an interview and a questionnaire is in the gathering of the data. According to Strauss and Myburgh (1999), an interview provides access to what is inside the person's head, makes it possible to measure the level of what the person knows, what the person likes or dislikes and what the person thinks. In the

interview, the researcher speaks to the person and obtains direct information. Interview is often the primary source of data where the qualitative research approach is used. In this case, the researcher is guided exclusively by the respondent's narration. Usually only one question (or a few as possible questions) is given to the respondent. On the other hand, the quantitative research interview is much more structured and often takes place in terms of a pre-set schedule.

In this study an unstructured interview guide was developed and pre-tested (see Appendix iv). Through the unstructured interviews with open-ended questions, the respondents had the opportunity to elaborate upon their answers. The aim of the interview was to draw information from the key-persons about the development initiative from their respective departments, pertaining to the environmental effects of population growth in their area.

3.6.2.1. The advantages of interviews

- Flexibility: Interviewers can probe for more specific answers and can repeat a question when the response indicates that the respondent misunderstood the question.
- Response rate: The interview has a much better response rate than the questionnaire. People who are unable to read and write can still answer the questions in an interview.
- Question order: The interviewer has control over question order and can ensure that the respondent does not answer the question out of order.
- Spontaneity: Spontaneous answers may be more informative than answers about which the respondent has time to think.
- Respondent alone can answer. The respondent is unable to cheat by receiving prompting answers from others.
- Completeness: The interviewer can make sure that all questions are answered.

3.6.2.2 Disadvantages of interviews

- Cost: Interviews studies can be more costly. Interviews must be paid not only for the hours that they interview, but also for training periods.
- Time: Interviews are often lengthy and may also require the interviewer to travel distances.
- Interview bias: The interviewer may misunderstand the respondent's answer or may understand it but make a clerical error in recording it.
- Less anonymity: The interviewer knows the respondent's name and address and often his/ her telephone number.

Despite unresponsive, non-cooperative respondents including those who were unwilling to be interviewed, they were not obliged or forced to participate in this study. They received a thorough explanation of the objectives of this study and how important and valuable is their participation. This aroused their interests to participate out of free will.

3.7 VALIDITY AND RELIABILITY OF THE MEASURING INSTRUMENT

A test is valid if it measures what it purports to measure (Barth, 1979). Validity is the degree to which a test is capable of achieving certain aims (Borg and Gall, 1989). It is a specific job one wants a test to do, thus a test is valid for a specific purpose.

Validity in research is concerned for instance, with the soundness, and the effectiveness of the measuring instrument. These raise questions like: does the measuring instrument measure what the researcher wants to measure; what is it supposed to measure? (Leedy, 1989).

Question items in the questionnaire should, at the end of the day provide the researcher with the empirical information he/she wanted to obtain. The information should be used to test the hypothesis postulated at the beginning of the study.

Reliability is the most basic feature which an instrument or procedure should possess. If an instrument is unreliable, it serves no purpose to consider any of the other features (Strauss and Myburgh, 1999).

3.7.1 Predictive validity

Predictive validity is the extent to which a test can predict the future performance of individuals (Cates, 1985). The degree to which a test can predict the future performance of individuals depends on the degree of relationship between the variables, the test, and the future performance, the higher the relationship the higher the predictive validity of the test.

In this study, a predictive validity was used because the items provided the empirical information that the researcher wanted to obtain. The information provided was necessary to test the hypothesis postulated. The test was relevant as a way of establishing relationships between humans and the environment.

3.8 PILOTING (PRE-TESTING) THE INSTRUMENTS

A pilot study is a small-scale preliminary investigation designed to test for flaws and any problems that need attention before the major study. It offers the researcher the opportunity to pre-test the instrument. The major purpose of a pilot study is to detect the problem before the major study is undertaken (Legotlo, 1996).

The questionnaire and interview questions were pre-tested by using a sample of six members from the community. These sampled respondents were asked to comment on the points that might need to be considered to improve the instrument. The pre-test results were checked and the suggestions made by the respondents were taken into consideration in preparing the final form of the instruments.

3.9 FOLLOW-UPS

Ary et al (1990: 43) say that in order to research the maximum percentage of returns in questionnaires, survey planned follow-ups are essential.

Follow-ups were made telephonically and personal visits were made to some of the respondents.

3.10 DATA ANALYSIS AND PRESENTATION

Data analysis was subjected to both qualitative and quantitative approaches. Qualitative data such as the respondents' views on the development initiatives from their departments was subjected to content analysis.

Quantitative data on the other hand, inclusive of statistics from the respondents, was subjected to descriptive analysis. Therefore, graphs and tables were used to present the quantitative data.

3.11 SUMMARY

This chapter dealt with the research design and methodology. The research design is the identification of a research problem and is concluded by analysis and interpretation of data relating to such a problem. The questionnaires and interviews were used to collect data. The purpose of the current study was to gather information about the environmental effects of population growth in the Rustenburg Core Area and how these problems could be combated.

CHAPTER 4

ANALYSIS AND INTERPRETATION OF DATA

4.1 INTRODUCTION

The data that was collected by means of questionnaires and interviews was analysed and interpreted. Data analysis and interpretation assist readers to understand how the test subjects responded to the questions. The responses of the test subjects were recorded in percentages.

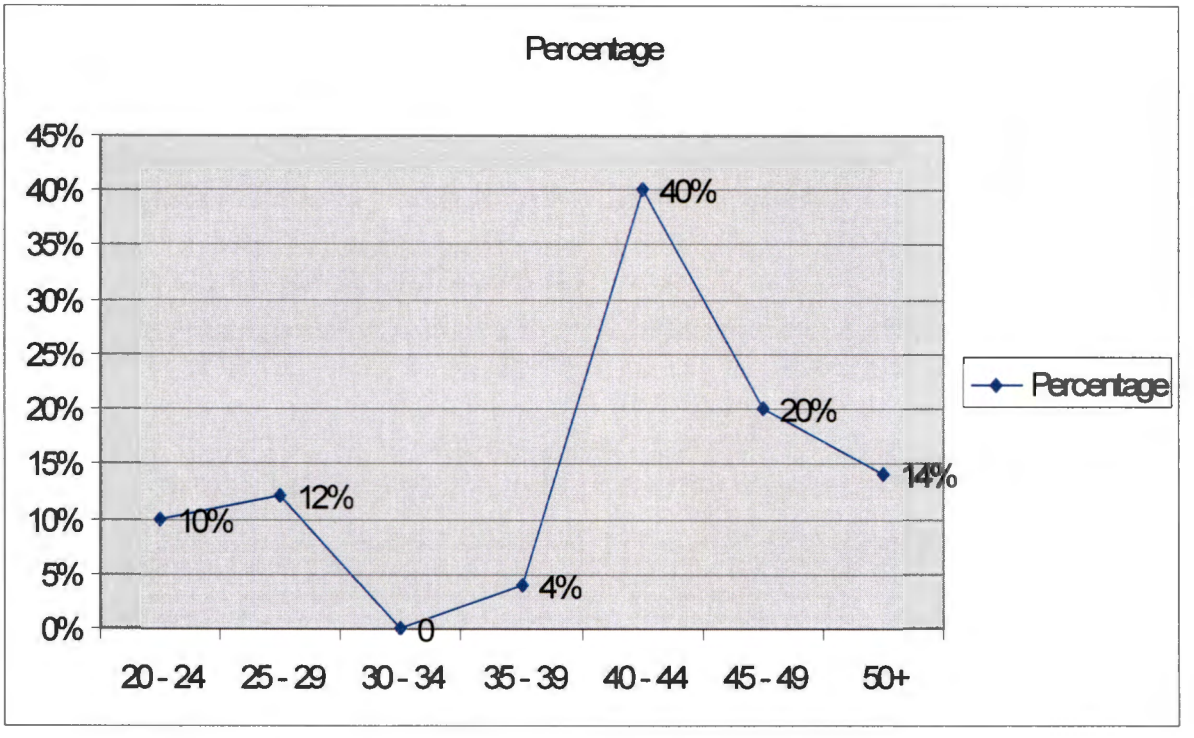
4.2 REVIEW OF THE RESPONDENTS

A total of hundred (n=100) respondents was identified. Out of that total, eighty completed questionnaires, all of which were returned and were usable. Therefore, the statistical analysis of questionnaires was based on 100% responses. Another sample of 20 (n=20) key persons was identified and interviewed. Qualitative analysis of the interviews was also based on a 100% response. The results of some of the more pertinent findings of the sample survey are represented in a set of tables and graphs and discussed below.

4.3 BIOGRAPHIC AND DEMOGRAPHIC DATA OF RESPONDENTS

The biographic and demographic data helped in determining the age, gender, education profile, settlement and employment of the respondents.

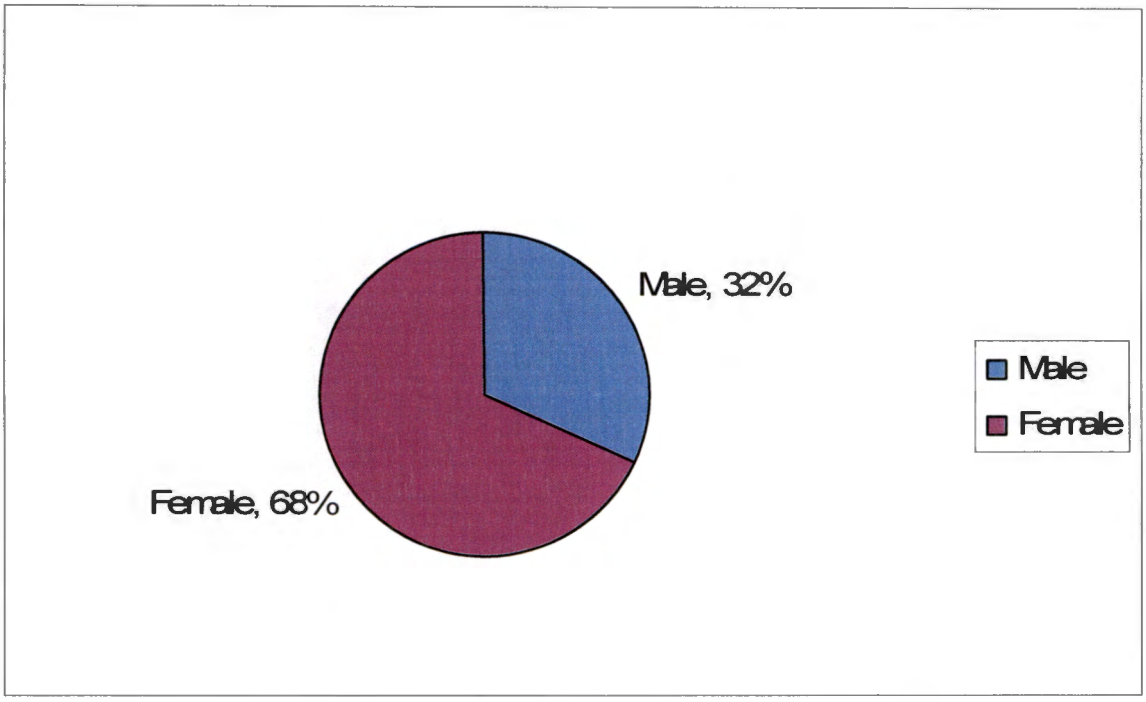
Figure 1: Age differences of respondents in percentages



4.3.1 Responses from the age category

The respondents reported their age by selection of one of the age groups indicated. The study has shown that 8 (10%) respondents, aged between 20 and 24 are still young and therefore, lack information about the impacts of overpopulation. The fact that (76% = 12% + 4% + 40% + 20%) of the respondents are matured enough to motivate the young ones is encouraging in the sense that the young respondents will learn and take advices from their elders. Other respondents (14%) are above 50 years of age

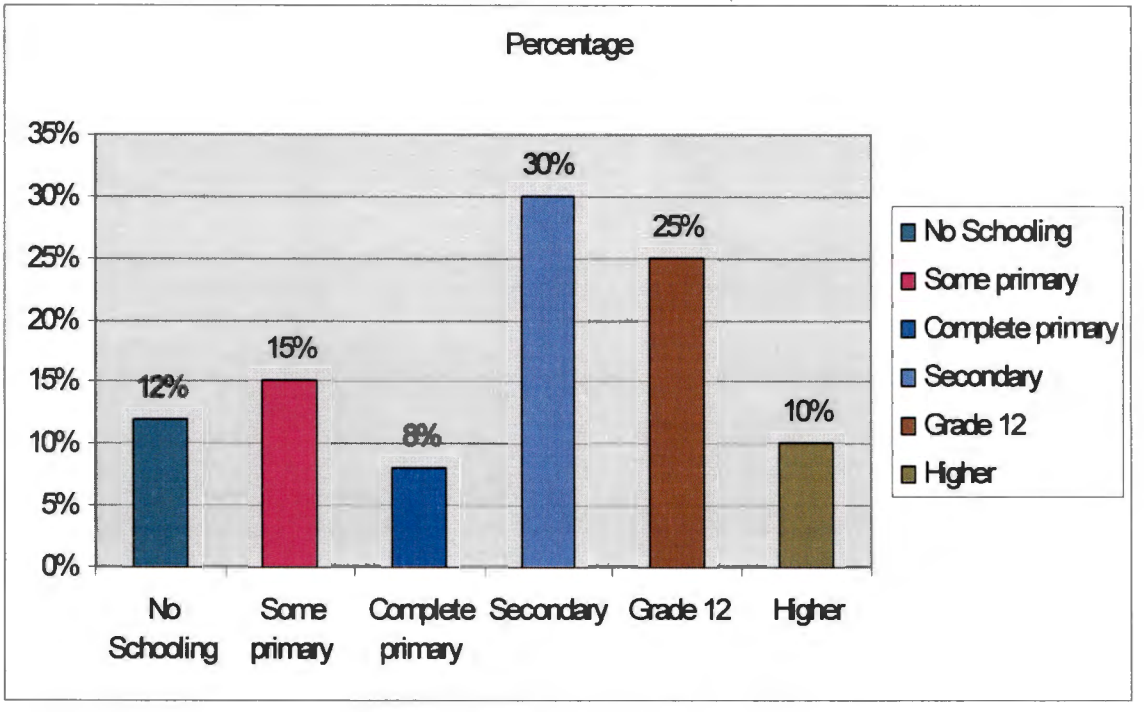
Figure 2: Gender of respondents



4.3.2 Responses from the gender category

Figure 2 reveals that, out of the total respondents, 32% were males and 68% were females.

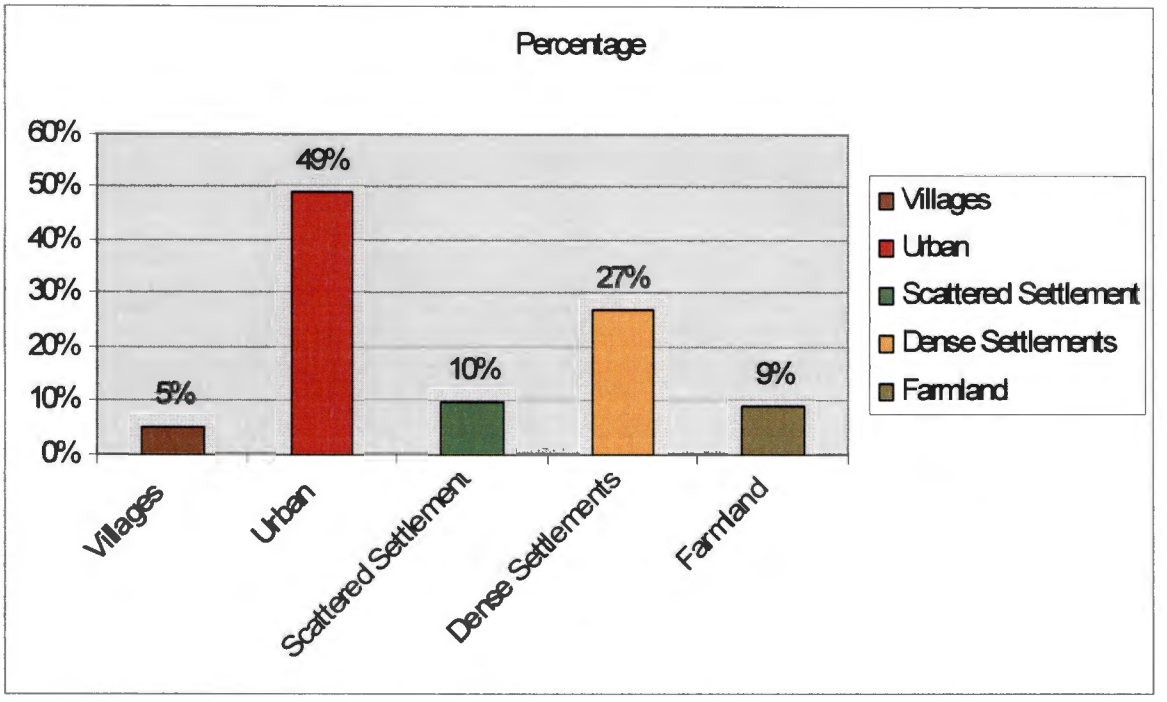
Figure 3: Education profile of respondents



4.3.3 Responses from the education profile category

The information depicted in Figure 3 indicates a significant improvement in the literacy levels of the population of the Rustenburg area. The proportion of the adult population with no schooling is 12% and those who only completed some primary education is 15%. Conversely, the proportion of the adult population who have completed Grade 12 is 25% and those with higher education is 10%. Although these figures indicate a positive trend, the overall skill levels are still very low with 10% of the total adult population with some form of tertiary qualification. This overall low literacy levels in the area will impact on the ability of the economy to maintain high future economic growth rates in the area.

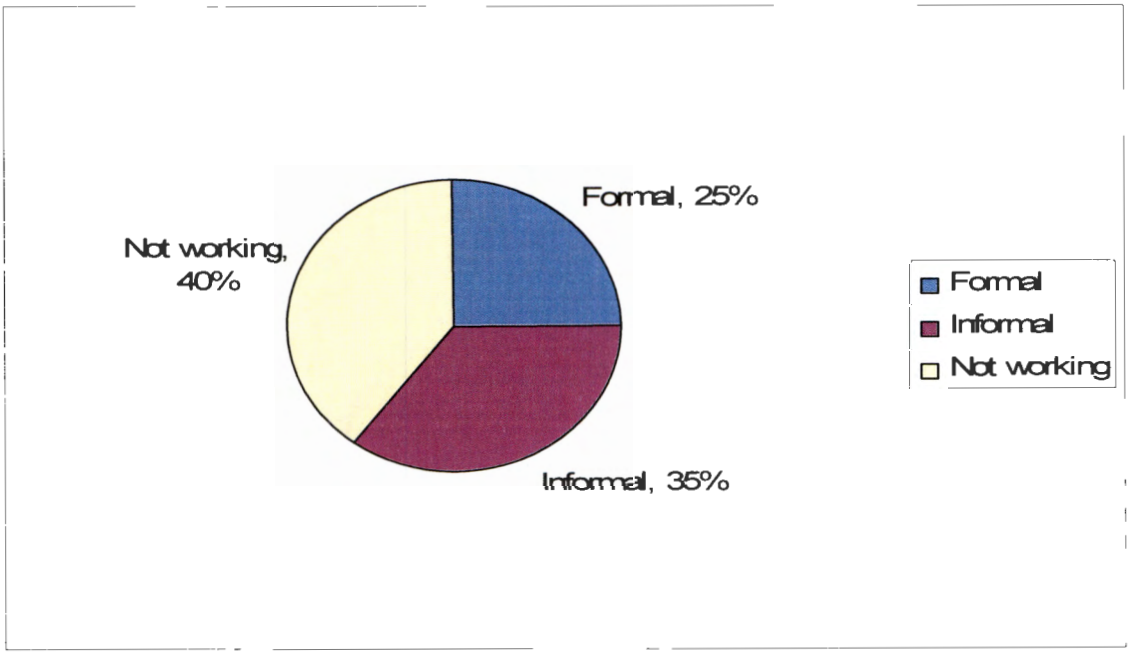
Figure 4: Settlement of respondents



4.3.4 Responses from the settlement category

Figure 4 indicates that, 5% of the people live in villages and on tribal land while 9% live on farms within the area. The fact that a small percentage of the people live in rural areas show that people migrate to townships in search for greener pastures. In total, 86% of the population can be described as urbanized. The platinum mining industry, constituting the primary economic sector and an employment provider in the Rustenburg area, has the greatest impact on the housing sector. Through ownership bonds or subsidies, the mines have a direct impact in approximately 60% of Rustenburg's residential properties. In addition, an influx of mine personnel in recent years has led to an increase in the population growth, which is substantially higher than just that which can be contributed to growth through natural births alone. Population growth, combined with the historic housing shortage, has put pressure on the demand for housing within the Rustenburg area.

Figure 5: Employment of respondents



4.3.5 Responses from the employment category

The information depicted in Figure 5 above indicates that a large percentage of the people in the Rustenburg Core Area are without jobs. The majority of the formal sector employment opportunities are within the mining sector.

4.4 OBSERVATIONS WITH REGARD TO POPULATION GROWTH AND THE ENVIRONMENT

Several facts have been listed and the respondents were to indicate their responses by making a cross on the relevant space. Respondents were given key to use.

Key : 1: SA = Strongly agree

2: A= Agree

3. D=Disagree

4. SD=Strongly disagree

Table 5: The environmental effects of population growth

	SA		A		D		SD	
	F	P	F	P	F	P	F	P
1. Population growth has negative effects on the environment	40	50%	32	40%	3	3.75%	5	6.25%
2. More people consume more resources and cause more pollution	19	23.75%	51	63.75%	3	3.75%	7	8.75%
3.Overcrowded settlements in your area are the biggest threat to the environment	8	10%	24	30%	40	50%	8	10%
4.More than 50 percent of garbage is left uncollected in the streets of your area	48	60%	20	25%	8	10%	4	5%
5.Most of the solid waste is littered and disposed of illegally	24	30%	32	40%	16	20%	8	10%
6.I am happy with the way my surroundings look	10	12.5%	13	16.25%	35	43.75%	22	27.5%
7.People in your area have no problem in terms of water supply	3	3.75%	6	7.5%	52	65%	19	23.75%
8. Unplanned settlements make it difficult to control environmental quality.	17	21.25%	35	43.75%	6	7.5%	22	27.5%
9. Most people in your area live in shacks without basic services	60	75%	18	22.5%	-	-	2	2.5%
10.Population explosion will not end until people decide to have fewer children	48	60%	24	30%	5	6.25%	3	3.75%

11. Only a few of the population in your area have access to adequate sanitation.	56	70%	8	10%	8	10%	8	10%
12. Overcrowding in townships has led to the mushrooming of squatter settlements in most areas.	56	70%	24	30%	-	-	-	-
13. Family planning policy can help in reducing population pressure on the environment	72	90%	8	10%	-	-	-	-
14. Overcrowding in your area is mostly the result of migration and not high birth rates.	32	40%	24	30%	16	20%	8	10%

Responses about population growth and the environment are presented in Table 5 above. What is evident is that a small percentage of the public or private sectors dispose of their own general waste at the landfills, which either implies that the municipality collects most of the general waste in and around the landfill areas. This however could also indicate that the waste that is not collected by the municipality is being dumped somewhere illegally.

It is very clear from the analysis that unplanned or informal settlements pose a threat to the environment. The increasing pressure on natural and human resources is manifesting in acute problems such as the informal settlements, uncoordinated and fragmented housing development and loss of biodiversity. Some informal settlements do not receive services from the local municipality. Observations were that waste is not collected and is either buried or illegally dumped.

4.5 OBSERVATIONS WITH REGARD TO THE INTERVIEW WITH THE KEY PERSONS.

From the interviews, it is clear that, the population growth rate experienced in Rustenburg impacts negatively on the environment. This is evidenced by the finding that out of all the people sampled, 75% point out that they encounter problems in their respective work departments. Many people create a great deal of pollution and use resources unsustainably, which makes it difficult for the district personnel to provide the necessary services, but efforts are being made to improve this system.

It became evident also from the views of the people that illegal immigrants also contribute to the environmental problems encountered in the area. Overcrowding in this area, result more from immigrants than high birth rates. Population growth awareness campaigns should be arranged as this might save the country from the outcomes of overpopulation.

4.6 SUMMARY

The data that was colleted was analysed and interpreted. Findings with regard to the research aims were evident. The literature search revealed that the main troubling effects of population growth result from the relationship between humans and the environment. Graphs and tables were used to analyse data.

CHAPTER 5

SUMMARY, FINDINGS , RECOMMENDATIONS AND CONCLUSION

5.1 INTRODUCTION

This research was about "The environmental effects of population growth: A case study of the Rustenburg Core Area". It was based on the following premises:

- The statement of the problem and the aims of the study,
- Literature review, which revealed that the environmental effects of population growth result from the relationship between humans and the environment,
- An empirical investigation conducted to determine the environmental effects of population growth in the Rustenburg Core Area,
- An analysis of data derived from the empirical investigation conducted, and
- Summary and recommendations.

The findings of this study are based on the following research questions:

- How fast is the human population increasing in the Rustenburg Core Area?
- What are the perceptions of people in the Rustenburg Core Area to the land?
- How do the people's actions pose a threat to the environment in the Rustenburg Core area?
- What actions are necessary for the conservation and preservation of resources in the Rustenburg Core Area?

5.2 SUMMARY OF THE IMPORTANT FINDINGS

At post-test, findings with regard to the research aims were evident. The literature review revealed that, the main troubling effects of population growth result from human activity,

primarily through resource exploitation. Findings on the views of the people were also noted. People are not happy about the way their surroundings look. Most people live in shanty houses without basic services. Concerning the remedies regarding how to solve problems caused by population growth, the view is that every individual must accept some responsibility and realize that everything they do can affect the environment.

5.3 RESEARCH FINDINGS

5.3.1 Findings with regard to research aim 1

In terms of aim one, which is, to gain knowledge about the environmental effects of population growth in the Rustenburg Core Area, the following findings were made:

- The nature and scope of the effects of population growth on the environment is very broad and complex. The literature review revealed that, the main troubling effects of population growth result from human activity, primarily through resource exploitation. As humans are consumers of goods and resources, their consumption patterns can increase or decrease pressure on the environment.
- Among the findings is the revelation that, as populations grow, formerly self-sufficient populations are forced into a downward spiral of poverty and hunger because of increasing demands made on the areas in which they live.

5.3.2 Findings with regard to research aim 2

Concerning aim two, which is, to find out the views of the people towards the environmental effects of population growth in the Rustenburg Core Area, the following findings were made:

- More people consume more resources and cause more pollution.
- Population growth has negative effects on the environment.
- Unplanned settlements make it difficult to control environmental quality.

5.3.3 Findings with regard to research aim 3

Aim three is concerned with recommendations about how to solve the problems caused by population growth after the data has been analyzed and interpreted. The following remedies were recommended:

- Every individual must accept some responsibility for and realize that everything they do, affects the environment in some way.
- People must avoid littering and set examples to others, especially children, by not littering, ask them to pick up their rubbish.
- Family planning: people must visit the local clinic for information on family planning and pass it on to friends and family.

5.4 RECOMMENDATIONS

Recommendation 1

Restraining population growth to match the availability of resources

Motivation

Overcrowding in the Rustenburg Core Area results from immigrants than high birth rates. Because immigrants contribute to the environmental problems in this area, it is essential that rural places be developed so that they meet the needs of people. Population growth awareness campaigns are essential for saving the area from the environmental outcomes of overpopulation.

Recommendation 2

Controlling and reducing pollution

Motivation

People must be aware of the problem of pollution and take steps to prevent it from happening. There must be alternative ways of getting rid of waste products. Recycling is the way of re-using resources, especially those that do not decompose, so that they do not remain as waste that people cannot get rid of. Everyone needs education to be able to set example to others by not littering. Anyone seeing other people littering must be bold enough to ask them to pick up their rubbish. Clean-up campaigns can be organised to pick up litter in public areas and to educate others about the problems of litter. The local government can help by providing more bins or to collect rubbish more often.

Local communities can be advised to start projects such as the creation of a park, a clean-up operation involving litter, or a recycling project. Recycling glass, cans and paper can contribute to caring for our environment. Any community that does not have recycling collection points must be advised to set up some through help provided by an environmental organization.

Recommendation 3

Public awareness and environmental education

Motivation

Public awareness can make a difference in every community. Environmental education can focus on issues such as population growth, population, depletion of resources, conservation of resources and planning the human environment. In the process of education, individual responsibility towards the environment should be stressed. It is not enough to be worried about the environment, people need to be informed, and based on that, to do something.

Recommendations for further research

Here are the recommendations for the future researcher:

- The abandonment of more difficult environments and the concentration of people in economic core regions, notably urban centres, with special population and environment problems, particularly of the urban poor.

Future researcher should go deep in researching about the abandonment of rural areas and the migration of people to urban centres and population problems to reveal more hidden agendas, which the past researcher was unable to unearth.

5.5 CONCLUSION

The causes of environmental destruction are a combination of factors that result from human activity through over exploitation of natural resources. The study indicated that, often humans do not seem to understand about carrying capacity. As human populations increase, there is a need to think about limits. Population numbers is not the only problem, but misuse of land due to thoughtlessness or greed. Poor management practices should also come under scrunity.

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APPENDIX I A

P.O. Box 3194
Rustenburg
0300
24 July 2007

The Director Corporate Support
Rustenburg Local Municipality
Rustenburg
0300

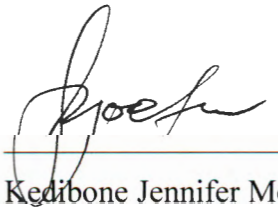
To whom it may concern

PERMISSION TO CONDUCT A RESEARCH IN YOUR AREA

I am a Master of Education student at the North West University (Mafikeng campus). I am conducting a research on "The environmental effects on population growth in the Rustenburg Core Area". I am therefore asking for permission to conduct my research in your community.

Your cooperation in this regard will be highly appreciated because the information provided will enable me to identify factors that are detrimental to the environment. The information will also help to enlighten the community about the environmental problems in their area.

Thank you in advance.



Kedibone Jennifer Mokgoetsi

APPENDIX I B

RUSTENBURG

PLAASLIKE MUNISIPALITEIT

LOCAL MUNICIPALITY

DIREKTORAAT: KORPORATIEWE ONDERSTEUNINGSDIENSTE

Posbus / P O Box 16
0300 RUSTENBURG,
NORTH WEST PROVINCE

DIRECTORATE: CORPORATE SUPPORT SERVICES

Tel: (014) 590 3111
Faks / Fax: (014) 592 0181
E-pos / E-mail: kc15@pixie.co.za

MR K d BEER/jm
REF:

2007 -09- 12

Kedibone Jennifer Mokgoetsi
P O Box 3194
0300 RUSTENBURG

PERMISSION TO CONDUCT A RESEARCH IN OUR AREA

Your letter dated 24 July 2007 has reference.

Your application to conduct a research in this area has been approved.

Your faithfully

ACTING DIRECTOR: CORPORATE SUPPORT

APPENDIX II

P.O. Box 3194
Rustenburg
0300
24 July 2007

The District Council
Rustenburg Local Municipality
Rustenburg
0300

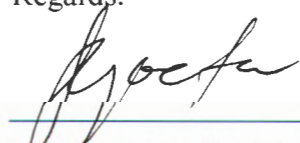
Dear Sir \ Madam

REQUEST FOR CONDUCTING AN INTERVIEW

I, Kedibone Jennifer Mokgoetsi, am a Master of Education student at North West University (Mafikeng campus). I am currently doing a research on "The environmental effects of population in the Rustenburg Core Area". Therefore, I would like to conduct an interview with you.

The interview can be conducted whenever you become available, but preferably before the end of August 2007. The purpose of the interview is to collect data required for one's research studies. Kindly schedule your date of availability and inform me as soon as you possibly can. Your response is highly appreciated.

Regards.



Kedibone Jennifer Mokgoetsi

APPENDIX III

QUESTIONNAIRES TO THE COMMUNITY MEMBERS

This is a research conducted on "The environmental effects of population growth in the Rustenburg Core Area". The purpose of this research is to collect data required for one's research studies. Your cooperation in this regard will be highly appreciated because the information provided will enlighten the community about the environmental problems in their area.

Please respond to the questionnaire as genuinely as you can. Your response will be treated confidentially.

Section A

Biographic and Demographic Data

Please indicate your response by crossing (x) in the appropriate block.

1. **Age of respondents**

20-24	
25-29	
30-34	
35-39	
40-44	
45-49	
50 +	

2. Gender of respondents

Male	
Female	

3. Education Profile of respondents

No schooling	
Some Primary	
Complete Primary	
Secondary	
Grade 12	
Higher	

4. Settlement of respondents

Urban	
Dense settlement	
Villages	
Scattered settlement	
Farmland	

5. Employment of respondents

Formal	
Informal	
Not working	

Section B

You are requested to answer the following on a scale of 1-4. There are no right or wrong answers to represent your opinion.

Keys: 1: SA= Strongly Agree
2: A= Agree
3: D =Disagree
4: SD= Strongly Disagree

The environmental effects of population growth.

	SA	A	D	SD
1. Population growth has negative effects on the environment.				
2. More people consume more resources and cause more pollution.				
3. Overcrowded settlements in your area are the biggest threat to the environment.				
4. More than 50 percent of the garbage is left uncollected in the streets of your location.				
5. Most of the solid waste is littered and disposed of illegally.				
6. I am happy with the way my surroundings look.				
7. People in your area have no problem in terms of water supply.				
8. Unplanned settlements have serious threats to the environment.				
9. Most people in your area live in shanty towns without basic services.				
10. Population explosion will not end until people decide to				

have fewer children.				
11. Only a few of the population in your area have access to adequate sanitation.				
12. Overcrowding in townships has led to the mushrooming of squatter settlements in most areas.				
13. Family planning policy can help in reducing population pressure on the environment.				
14. Overcrowding in your area is mostly the result of migration and not high birth rate.				

THANK YOU FOR YOUR PATIENCE AND CO-OPERATION IN COMPLETING THESE QUESTIONNAIRES IN AN HONEST, GENUINE MANNER.

APPENDIX IV

INTERVIEW WITH THE KEY PERSONS

Population growth has been described as one of the most serious problems in the Rustenburg Core Area.

- Due to the population growth rates experienced in Rustenburg, what are the problems encountered by your department in this regard?
- In your department, what efforts are being made to try and protect the environment and the people from the problems caused by population growth?
- Every year, thousands of immigrants enter this area illegally, what is your department's position on this problem?
- If you were the president of a country whose population is increasing very fast, what would you do?