

# CHAPTER ONE

## INTRODUCTION

### 1.1. Background to the study

The environmental problems which the world is experiencing today are over population, diminishing energy resources, desertification, pollution, loss of natural resources such as soil, water, plants and animals. Inadequate environmental planning and conservation of the man-made environment are evidence of man's indiscreet management of his own affairs and of the planet earth. (Chacko 1990:59). This gives an indication of the general ignorance about the environment and man's impact on it. Environmental education is essential to eventually ensure an environmentally literate population who would be able to solve these problems. Limpopo State of the Environment Report (SOER) clearly illustrates that most serious problems our society faces today is the ongoing conflict between economic activity and the biological environment on which all human activity ultimately depends. This report calls for the participation of all stakeholders (schools, churches and the community) in the Province (Limpopo States of the Environment 2003:2).

Janse (2002:332) has argued that environmental illiteracy is the main culprit in environmental problems. Gabreab and Bak (2000:9 ) have also emphasized that educating learners and raising their awareness about the environment is one way of tackling environmental problems. Therefore, environmental education in schools is vital as a means of producing environmentally literate learners who will possess the necessary knowledge and understanding of their environment.

Environmental literacy can be acquired through formal and informal education. Informal environmental education can be acquired through activities such as participating in outdoor education, undertaking educational tours, visiting museums, nature reserves and national parks, participating in environmental competitions, local conservation, and beautification of school premises . National Arbor Day (2<sup>nd</sup> Friday in August), Environment Week (1<sup>st</sup> week June) and World Environment Day (5<sup>th</sup> June), Heritage Day (8 September), consulting local libraries reading on environmental matters and implementing environmentally orientated subject instruction (Chacko 1998:57). Learning may also take place when applying conservation principles in everyday life such as preventing littering, water wastage, excessive electricity consumption, scraping the land, and burning fossils. This study concentrates on formal education, which is expected to provide the necessary knowledge and understanding of environmental issues and concepts through school subjects such as Geography, Biology, Science and Agricultural Science. It also assumes that it is through such formal environmental education in schools that environmentally literate learners can be produced. Those environmentally literate learners will therefore be expected to play a significant role in solving environmental problems.

According to Clayton (1991:2) geography learners are expected to know and understand many of the environmental concepts because Geography is a study of the distribution and relationships of phenomena on earth. The environmental context can be considered in localized learning programme development. A wide range of environmental education processes can be developed within and across all eight learning areas (Lotz 1994:44 ). Ballantyne et al (1999:90) stressed that if Geography teachers are unable to successfully deal with the challenges of introducing environmental issues into their discipline, then it is probably less likely that teachers trained in other fields of study will be able to do so.

Hughes-Evans (1977; 7) stated that Agricultural Science is a way of life. It acknowledges dependency on nature, which it tries to use, and also conserve for future generations. Therefore, it is expected that Agricultural Science pupils should have an understanding of the various environmental systems on earth.

Physical Science studies the measurable attributes of things. Blum (1996:38), in Hughes-Evans (1977:14) stated that the basic concepts of Physics are defined in terms of measurements, and the purpose of physical theories is to correlate the results of measurements. Therefore Physical Science learners are also expected to know about various environmental systems and their interrelation.

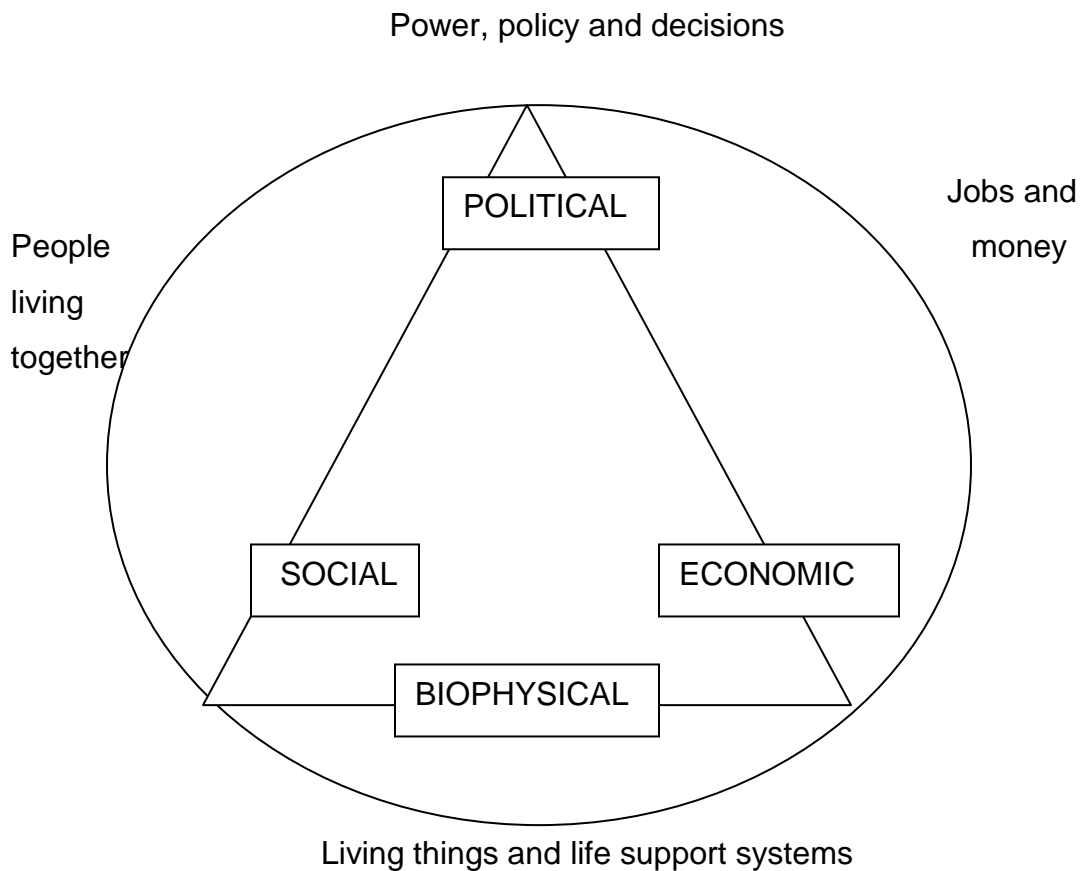
Hughes –Evans (1977:2) stated that Biology studies the features and processes that unify the remarkable diversity of living organisms. Biology learners as well are expected to know the effects of environmental systems on the living organisms and the effects of the living organisms on the environment. Hughes-Evans (1977:14) cautions that even though many of the environmental issues are covered in the science syllabus, which does not mean that other subjects do not have the potential to sensitise learners to environmental issues.

The Department of Environmental Affairs and Tourism, Pretoria (2000) also identifies environmental issues as integral to all learning areas (Gregory 2002:1). The Department therefore believes in bringing together learners in all learning areas into environmental projects. Being environmentally literate means that one has acquired some knowledge, understanding, skills and the ability to actively participate in environmental issues (Chadwick 2000 :14 ). This study makes the assumption that the ability to solve environmental problems requires a well informed and environmentally literate society. Chacko (1998:57) has argued that by producing environmentally literate citizens, environmental problems could be solved because such citizens are able to make wiser decisions about the effects of human activities on their environment. An environmentally literate population is better able to work actively to solve existing environmental degradation

problems and to manage and use their natural resources more wisely (Gregory 2002:1)

Environmental education is one of the ways in which we can respond to the environmental crises that exists both in South Africa and globally. The objectives of environmental education are: knowledge, awareness, attitude, skills, evaluation abilities and participation. (Gabreab and Bak 2000:8) Knowledge helps learners to acquire the basic understanding of the biosphere, ecosystem and how it functions, how people and the environment interact and how environmental issues arise. Such knowledge leads to awareness and to the total environment and its issues. Attitude helps learners to acquire social values, strong feelings of concern for the environment and the motivation for active participation in its protection and improvement resulting in a society complying with environmental law.

The understanding of Environmental Education gradually changed, and it grew to include a more holistic understanding of environmental education and how to educate for environmental education (Fien, 1993:12). This new understanding of environmental education had a bearing on curriculum development in the formal education sector. The holistic view of the environment was a foreign concept to most educationists, and the old debate of how environmental education should be included in the school curriculum continued. Most environmental educators now accept the holistic view of the environment, as depicted in the diagram below.



A MODEL OF A MORE HOLISTIC AND INTERGRATED LEARNING  
ENVIRONMENT

Source: O'Donoghue & Janse van Rensburg (1995:8)

In view of the increasingly serious global problems resulting from human activities, it is therefore important for learners to understand environmental issues (Chacko 1998:8). Consequently, this study investigates the level of environmental literacy among Grade 12 Geography learners in schools at Ga-Molepo. Learners' knowledge and understanding is tested on selected environmental issues such as soil erosion, acid rain and global warming.

## **1.2 Statement of the problem**

For environmental literacy and knowledge on environmental issues, such as: soil erosion, acid rain and global warming in Ga-Molepo schools to be effective, it should be an integrative process whereby all school stakeholders such as parents, educators, learners and School Governing Body (SGB) work together by encouraging one another to take care of the environment in order to sustain it for the future generations. There is a general concern about the increasing deterioration and exploitation of the natural environment (Chacko 1998:54). Most of the environmental degradation that continues to occur is the result of the failure of the society and of the education system to provide citizens with basic environmental knowledge and skills. Human welfare is in many ways dependent on environmental quality as much as environmental quality that is affected by human activity. Damage to the environment can have serious implications if not irreversible damage to the planet. There are many human factors, which contribute a lot towards environmental issues, namely: soil erosion, acid rain and global warming. Farmers do not know the correct methods of ploughing. They do not know how to control their livestock and apply correct grazing methods. People remove natural vegetation (deforestation) which ultimately result in soil erosion. They also burn coal, they cut wood and cause veld fires, and acidic gases contaminate the atmosphere and cause acid rain. Burning of fossil fuels, volcanic activities, industrial and agricultural activities release methane, nitrous oxide and chlorofluorocarbons (CFCs), which cause global warming (Loubser 2005:9-11)

An environmental education and awareness strategy should aim to inform the public about the fundamental human rights enshrined in the Constitution of the Republic of South Africa, 1996 as far as the environment is concerned. The Bill of Rights applies to all law, and binds the legislature, the executive, the judiciary and all organs of state (South Africa, 1996). For a person to understand his/her rights regarding the environment, at least a basic knowledge regarding

environmental matters is critical. An environmental education and awareness (EE&A) strategy in schools should therefore follow the following approaches: Informing and educating about general environmental matters as well as fundamental rights to a safe and healthy environment (Tshwane EE & A strategy April 2005:7-8).

In South Africa probably the worst air pollution problems are due to energy generation (through the burning of fossil fuels) coupled with the meteorology of the Eastern Transvaal Highveld (Mpumalanga) which gives rise to serious pollution problems in that area. Sometimes underestimated but also a problem is the practice of domestic coal burning. The people around Ga-Molepo area in Limpopo Province experience it as they cannot afford electricity. These two problems present an interesting and challenging situation for South African policy-makers.

Environmental literacy must be emphasised in South African schools to prevent environmental issues that are degrading the environment. Several studies on specific aspects of the environmental knowledge (pollution, water, acid rain, ozone layer, energy) indicate that learners have low levels of environmental knowledge (Blum et al 1987: 58). Experiences from Rwenjuna et al (1994: 62) have shown that involving the affected communities to effectively participate in environmental programmes is considered essential. Therefore this study was undertaken to determine the views of the learners as to whether they consider minimising environmental issues of value to their environment, and whether and how they would participate in making it a success. In view of the above it is assumed that environmental education which includes environmental law will lead to a better understanding of rights and responsibility for the environment.

### **1.3 Aims of the study**

The aims of the study are to determine the level of environmental literacy among Grade 12 Geography learners, based on selected issues namely, acid rain, soil

erosion and global warming, and to encourage active participation in resolving environmental issues in the High Schools of Ga-Molepo in the Limpopo Province. These aims are often taken together and not dealt with individually.

#### **1.4 Objectives of the study.**

- An objective of the study is to: Assess the understanding of learners in selected schools on the environmental issues including environmental law.
- Evaluate the adequacy of the learning materials used in schools.
- Investigate challenges and solutions to environmental problems.
- Investigate the community involvement and awareness with regard to environmental issues.

These aims are often taken together and not dealt with individually.

#### Environmental background issues

As part of the background sketched in this chapter, it is necessary to give a brief overview of the general environmental issues and challenges that that face rural communities such as the people at Ga-Molepo. It is also against this backdrop that the questionnaire was developed and used for some aspects of this research paper. The following issues will be touched on briefly:

- ◆ Acid rain,
- ◆ Human factors, cultivation methods and soil erosion,
- ◆ Global warming and the greenhouse effect of global warming.

These environmental issues are not the only environmental matters of concern, there are the water scarcity issues, littering and related matters that are of a serious concern but not discussed here. The matter of concern discussed in what follows are examples to indicate that the community may suffer from acid rain, loss of topsoil, incorrect grazing cultivation methods and that they are seriously affected by global warming without knowing what they did wrong or what global warming is. The poor are typically the once to suffer because of ignorance (lack of knowledge and resulting compliance with those laws and have to stake in contribution to global warming in any substantial way).



This is therefore part of the “bigger picture” of what has to be included in the conclusion that, based on the information gathered from the community environmental indicating that current education efforts are insufficient to bring about change of behaviour, understanding and environmental compliance behaviour.

### 1.5 Acid Rain

Acid rain can be defined as simply as rain which is acidic (Beets et al 2006: 319). It is a popular term referring to the deposition of wet (rain, snow, fog and cloud water, dew) and dry (acidifying particles and gases) acidic components. A more accurate term is “acid deposition”. Distilled water, which contains no carbon dioxide, has a neutral pH of 7. Liquids with a pH less than 7 are acidic and those with a pH greater than 7 are bases. “Clean or unpolluted rain has a slightly acidic pH of about 5.2, because carbon dioxide and water in the air react together to form carbonic acid. A weak acid (pH 5.6 in distilled water) but unpolluted rain also contains other chemicals (Likens et al 1987:299-314). The pH scale measures acidity and alkalinity. It runs from 1 (very acidic) to 14 (very alkaline) and 7 is neutral. The scale is logarithmic, so, for example, rain with a pH of 4 is ten times as acid as rain with a pH of 5 (Enviro facts 6:1999). It has harmful effects on plants, aquatic animals, and infrastructure. Acid rain is mostly caused by human emissions of sulfur and nitrogen compounds which react in the atmosphere to produce acids. Likens et al (1984:12-18) states that the problem of acid rain not only has increased with population and industrial growth, but has become more widespread. The use of tall smokestacks to reduce local pollution has contributed to the spread of acid rain by releasing gases into regional atmospheric circulation.

The most important gas, which leads to acidification is sulfur dioxide. Emissions of nitrogen oxides, which are oxidised to form nitric acid, are of increasing importance due to stricter controls on emissions of sulfur containing compounds. 70 Tg (S) per year in the form of SO<sub>2</sub> comes from fossil fuel combustion and industry, 2.8 Tg (S) from wildfires and 7-8 Tg (S) per year from volcanoes

(Berresheim 1995:15). The principal natural phenomena that contribute acid-producing gases to the atmosphere are emissions from volcanoes and those from biological processes that occur on the land, in wetlands, and in the oceans. The major biological source of sulfur containing compounds is dimethyl sulfide. Acidic deposits have been detected in glacial ice thousands of years old in remote parts of the globe (Likens 1979 Amer 241 (4): 43-51). It is caused by the burning of coal by industries, tyres by people who toyi toyi, oil in industries, wood at home for fire and veld fires contaminate the atmosphere and lots of carbon dioxide gases are formed in the air. It is formed when water vapour in the atmosphere reacts with pollutants produced through fossil fuels and power plants. This combustion process emits poisonous gases, which serve as the forming factors of acid during precipitation (Beets et al 2006:319-320).

Acid rain results from the rusting of iron material and plants due to poisoning of the soil or ground. Contaminated water due to environmental waste results in acid killing aquatic plants and animals. The pH level of the soil is negatively affected to be either too acidic if not alkaline. The poisoning of the soil resulting in eutrophication, which is the process whereby soil becomes poisoned by environmental wastes (Beets et al 2006: 74-99).

Combustion of fuels creates sulfur dioxide and nitric oxides. They are converted into sulfuric acid and nitric acid. When it rains, acidic rain through an infiltration process damages the soil. This acid rain dissolves certain minerals in the soil and harms the soil worms and insects that decompose organic matter. In addition, the acid produced from carbon monoxide reduces the oxygen level in the blood and affects the vision and threatens respiratory problems on humans. Contaminated soil is easily erodible. Therefore, environmental education in this regard will help Grade 12 Geography learners to realise the factors that harm our environment by avoiding unnecessary air pollution, which contribute to a lot of acid rain that damages our soil (Beets et al 2000:319).

There is a need to use energy more efficiently at home, in vehicles and in industries. There is also a need to think about alternative energy sources such as nuclear power, hydroelectric power, solar power and wind power because they don't produce any smoke. It is possible to remove acidic emissions from coal burning, but this is very expensive. It may be possible to breed crops and trees that resist pollution, but this would only be a partial solution. In everyday life there is probably a need of a combination of all these ideas and innovations (Beets et al 2000:319).

### 1.6 Soil erosion

Soil erosion is the removal of topsoil by natural causes and is induced by human activities (Beets 2006:320). Soil erosion is the removal of solids (sediment, soil, rock and other particles) in the natural environment. It usually occurs due to transport by wind, water, or ice, by down-slope creep of soil and other material under the force of gravity, or by living organisms, such as burrowing animals in the case of bioerosion. Erosion is distinguished from weathering, which is the process of chemical or physical breakdown of the minerals in the rocks, although the two processes may occur concurrently. Erosion is a noticeable intrinsic natural process but in many places (Hodgkinson 2005:113).

Human factors cause soil erosion through earthworks and grading of roads where the top layer of the soil is removed. Overgrazing whereby too many animals are left to graze in one area for a long time also causes soil erosion. Deforestation, which refers to the chopping of trees and forests until the vegetation cover is removed thus exposing topsoil, also causes soil erosion as well as unmanaged construction activity and road building.

Incorrect ploughing methods such as ploughing up and down hill slopes increases run-off and soil erosion. Burning of the veld reduces soil cover and plant vigour. Burning also destroys organic materials that would have increased the humus in the soil. Overpopulation, which leads to urbanization, by removing vegetation when building houses and constructing roads, leaving excavations

open without rehabilitating. This process results in soil loss due to the disruption of the ecosystem such as agriculture-farmers ploughing and harvesting and leaving the soil exposed where it is easily removed.

Hodgkinson (2005:115) has indicated that land that is used for the production of agricultural crops generally experiences a significant greater rate of erosion than that of land under natural vegetation. This is particularly true if tillage is used, which reduces vegetation cover on the surface of the soil and disturbs both soil structure and plant roots that would otherwise hold the soil in place. However, improved land use practices can limit erosion, using techniques such as terrace building, conservation tillage practices and tree planting. A certain amount of erosion is natural and, in fact, healthy for the ecosystem. For example, gravels continuously move downstream in watercourses. Excessive erosion, however, does cause problems such as receiving water sedimentation ecosystem damage and outright loss of soil.

The result of the disruption of the ecosystem is due to loss of soil. The vegetation will be sparsely distributed due to the removal of topsoil resulting in low crop yield. Soil erosion removes the fertile soil that ends up in dams as silt. Therefore the dams have less storage capacity (Hodgkinson 2005:115).

Environmental awareness in Ga Molepo area might help to focus on solutions to soil erosion. An investigative approach is needed which includes:

- Enhancing people's ability to manage, and take into account ecological, social and economic factors.
- Improving people's ability to make decisions about the use of communal resources.
- Improving the ability of rural institutions that govern land use to do so productively.
- Reducing poverty, and the dependence of rural people on scarce resources (Hodgkinson 2005:117).

These actions taken together may result in people being able to take practical action in their own farming systems. They will probably have to manage the numbers and movement of animals on grazing lands so that they do not overgraze or over-rest the veld. This might mean reducing or increasing, the number of animals and giving attention to the length of time that they graze in an area. Consideration should also be given to the time allowed for plants to recover between grazing periods (Beets 2006:114).

Cultivating the land in ways that improve its ability to hold water and to support plant life, e.g. minimal till planting and mulching (placing a layer of straw, leaves or sawdust to cover the soil). Mulching reduces evaporation, suppresses weed growth, enriches soil as the plant material rots and prevents run-off and hence erosion.

The most important step in the struggle against soil erosion was the enactment of the *Soil Conservation Act 76 of 1969*. It was designed to remedy the shortcomings of the Act and to provide comprehensive control action aimed at combating soil erosion. Conservation of Agricultural Resource Act 43 of 1983 provides for control over the utilization of the natural agricultural resources of the Republic of South Africa in order to promote the conservation of the soil, the water sources and the vegetation and the combating of weeds and invader plants ( Fuggle and Rabie 2009).

Environmental awareness can help people to take part in the activities of conservation groups such as conservancies and land care and to bring overgrazing and land management to the attention of the Directorate of Resource Conservation. Therefore the teaching and learning of environmental awareness is a challenge on the Grade 12 Geography learners to be applied in their real life context.

## 1.7 Global Warming

Beets et al (2006:120) describes global warming as the gradual increase of air temperature in the earth's lower atmosphere. It is the increase in the average temperature of the earth's near surface air and oceans since the mid- 20<sup>th</sup> century and its projected continuation. It is the after effect of greenhouse gases. The greenhouse effect refers to the natural warming effect that certain gases have on the temperature of the earth's atmosphere under normal conditions. Gases in the upper atmosphere, particularly carbon dioxide (CO<sub>2</sub>) form a protective "blanket" that traps the outgoing long- wave radiation in order to keep the earth warm enough to sustain life. This is called the greenhouse effect because it has some similarities to the way in which the glass of a greenhouse keeps the air inside warmer than outside (Loubser 2005:8). An increase in global temperature will cause sea levels to rise and will change the amount and pattern of precipitation, probably including expansion of subtropical desert (Lu Jian 2007:34).

Edward et al (2003:616) states that gases such as carbon dioxide, nitrous oxide, methane, Chlorofluorocarbons (CFC), chlorine based compounds causes the heating of the atmosphere and water vapour, which is the main greenhouse gas. CFC's were discovered in 1928, they appeared to be perfect industrial chemicals odourless, non- toxic, non-flammable and chemically inert. These chemicals are particularly useful as it means that CFC's do not react chemically with other materials, such as the working parts of refrigerators, the contents of aerosols or plastics. However when CFC's are released into the atmosphere, they slowly drift up to the ozone-rich stratosphere where they breakdown and release atoms of chlorine. Each chlorine atom may react repeatedly to destroy many ozone molecules.

Greenhouse effect refers to the natural warming effect that certain gases have on the temperature of the earth's atmosphere under normal conditions. Sunlight passes through the earth's atmosphere and reaches the ground. Once it strikes and warms the earth's surface, long-wave radiation is given off and reflected

back into the atmosphere. Gases in the upper atmosphere, particularly carbon dioxide (CO<sub>2</sub>), form a protective “blanket” that traps the outgoing long-wave radiation in order to keep the earth warm enough to sustain life. This is called the “greenhouse effect”, because it has some similarities to the way in which the glass of a greenhouse keeps the air inside warmer than outside without the greenhouse effect, the earth would be frozen, lifeless planet with an average temperature of 16<sup>0</sup>c (Trefil & Hazen (2000), Loubser (2005:9).

Global warming threatens climatic change in terms of how heat energy escapes from the planet earth (Hodgkinson 2005:77). The term greenhouse effect is used to describe the warming effect that certain gases have on the temperature of the earth’s atmosphere under normal conditions. A greenhouse is made entirely of glass (Hodgkinson 2005:79). When sunlight strikes the glass, most of it passes through and warms up the off heat, but these heat waves have a much longer wave length than the incoming rays from the sun. This long wave radiation cannot easily pass through glass, and thus causes everything in the greenhouse to warm up. If current pollution trends continue, some scientists estimate that the earth could probably be about 1<sup>0</sup>C warmer by 2025 and 3<sup>0</sup>C warmer by the year 2100. This temperature rise could have several effects (Loubser 2005:8).

Rising sea levels-water expands as it warms and glacier melts, adding water to the oceans, thus we can expect widespread flooding of coastal areas as sea levels rise and another possibility is that climate change would reduce water supply in some regions. This will result in the disturbance of the ecosystem. This disturbance will in turn result in an increased evaporation due to warmer climate. However, if this warming brings greater precipitation, agriculture may be helped rather than harmed. This warming could lengthen the growing season in higher latitude areas (Edward et al 2003:91).

Global warming might increase floods. This means that more heat in the atmosphere can mean more humidity, which is an energy source of hurricanes

and storms. Consequently the impact of carbon dioxide concentration in the atmosphere is difficult to reduce because we depend of fossils fuels as our source of energy.

Burning of coal produces poisonous gases where carbon dioxide will be produced enormously (Hodgkinson 2005:79). It might be a challenge to get solutions on how to reduce carbon dioxide in the atmosphere, as this is part of the greenhouse gases, which forms a blanket that traps heat energy from the earth's surface. This cloud has an impact on soil erosion and the gases in the atmosphere contribute to acid rain. Therefore, the environmental awareness literacy has a great challenge towards food production as against the impact on climate change and global environmental patterns.

The environmental patterns might be negative through drought and desertification and land degradation. Hodgkinson (2005:79). This reduces the soil fertility and impacts negatively on food production due to high temperatures. Therefore the Grade 12 Geography learners are challenged to know and understand the impact of environmental awareness and literacy in their real life situation. Environmental awareness might help them to empower their immediate communities on reduction of pollutants responsible for global warming. Industrialists and governments have a key role to play in this regard. As individuals, one can reduce electricity consumption, use lift clubs, public transport, bicycles or our feet for transport, recycle and save energy. The manufacture of all products requires energy.

Individuals can also help reduce global warming by reducing smoke formation, reusing, recycling – by doing this, the energy required to manufacture new things is saved (Hodgkinson 2005:79). Using cars that are more fuel-efficient. Making use of public transport to reduce the number of cars on the road. Reducing the amount of electricity used per day. Going solar – installing solar power to run our homes. Planting trees to absorb CO<sub>2</sub> – Educating the public by informing friends and family about what they have learned on global warming.



From the above discussion of acid rain, soil conservation and global warming are the consequences of economic development approaches, policies and laws of the past. People must learn to observe the environment and to ask questions about why things are in the state they are and how did we get to this state of degrading the environment. Questions can only be asked if there is an awareness and basic understanding that only comes with formative learning, especially at school level. Compliance will follow once the answers to questions asked begin to make sense and there is an appreciation for the desperateness of the current situation.

### **1.5 Location of study**

This study is conducted in five secondary schools located in the Lebopo Circuit. Lebopo Circuit is situated at Ga-Molepo in the Mankweng cluster, Capricorn District of the Limpopo Province of South Africa. There are four circuits in Mankweng cluster they are Lebopo, Mankweng, Kgakotlou and Dimamo. The five schools which the research was conducted from are Tshebela with 98 grade 12 learners, Mamokgari with 52 grade 12 learners, Mmapadi with 64 grade 12 learners, Mokwatedi with 58 grade 12 learners and Momodikeleng with 77 grade 12 learners. The schools are all secondary schools and all in the rural area. Ga-Molepo is situated about 55km South East of Polokwane in the Limpopo Province.

## **CHAPTER TWO**

### **AN OVERVIEW OF ENVIRONMENTAL EDUCATION**

#### **2.1 Origin of environmental education.**

The modern concept of environmental education originated in the 19<sup>th</sup> Century in Europe in reaction to the negative environmental impacts caused by the industrial revolution (Hughes 1998:14). Moreover according to Schreuder et al. (1992:127) the development of environmental education is closely linked with the increasing awareness of global socio- ecological crises since the 1960s (Le Roux 2000:51) states that environmental education has been addressed at various international conferences, the most important being the 1972 United Nations Conference on the Human Environment at Stockholm in Sweden. On this occasion a decision was taken to promote environmental awareness among the world population. A recommendation that UNESCO and UNEP establish an international programme in EE interdisciplinary and encompassing all levels of education. This (the IEEP) was launched by UNESCO and UNEP in 1975 (Le Roux 2000:186). Amongst some of the recommendations, education was cited as a major spacing tool of addressing the environmental problems.

Environmental Education is a process or approach, which develops correct attitudes, values, behaviour and skills that will enable people to live in harmony with the natural resources (water, air, soil, animals), maintain good quality of life considering that there are still generations to come. This approach enables the exploration of environmental issues through educational experiences and reflection in the environment, knowledge about the environment and appropriate commitment and action for the environment (Integration of EE in outcomes based education 1998:11). Landmark Events in the Environmental Movement 1972- UN Conference on the Human Environment Stockholm Sweden recommended that UNESCO and UNED establish an international programme in EE interdisciplinary and encompassing all levels of education. In 1977 Tbilisi IEEP Conference-

Tbilisi Russia by UNESCO and UNEP brought together delegates from 66 UN, member states and 20 international NGO's. The Conference, like its predecessor in Belgrade, developed and endorsed the concept of 'education for the environment' 1991 Caring for the Earth. Gland Switzerland by IUCN, UNEP and WWE – broadened the concept of conservation as described by its predecessor (World Conservation Strategy) by acknowledging the role of economics, culture and tradition in practices affecting ecology. In 1992 the Earth Summit United Nations Conference on Environment and Development (UNCED) Rio de Janeiro Brazil- Five major documents were produced namely: a biodiversity treaty, convention on climate change, Rio Declaration, Statement of Forest Principles and Agenda 21. Most important contributions to EE were to introduce the idea of Environment and Development Education (EDE) or Education for Sustainable living. In 1997 the UNEP Report Nairobi Kenya by UNEP dealt with population growth, soil erosion, overfishing in oceans, species loss and pollution. In 1997 the Earth Summit plus with Commission on Sustainable Development- created to monitor implementation of Earth Summit agreements (Le Roux 2000:186-187).

Hughes (1988:14) has observed that the response by countries of the world and environmental crises has been a call for effective environmental education as a key means to address environmental problems. Loughland et al (2003:3) have asserted that education in schools is an important strategy in achieving environmental protection and improvements. Environmental education is a learning process that increase people's knowledge and awareness about the environment and associated challenges, develops the necessary skills and expertise to address the challenges and fosters attitudes, motivation and commitments to make informed decisions and take responsible actions. (UNESCO, Tbilisi Declaration, 1978). Environmental Education enhances critical thinking, problem solving, and effective decision making skills, and teaches individuals to weigh various sides of an environmental issue to make informed and responsible decisions (Le Roux 2000:186).

The Belgrade Charter of 1975 and Tbilisi Principles of 1977 have had a lasting impact on the field and more recently environmental education initiatives have been shaped by Agenda 21 and the principle developed for the NGO (Non-Governmental Organisation) forum at UNCED. Both Agenda 21 and the NGO forum principles merged environmental and development concerns (Enabling EE Guidelines SADC 1993:3). The environmental education community in South Africa has worked very hard to influence policy and curriculum in the NQF to include environmental education across the curriculum rather than as a special subject on its own. Hughes (1988: 14) has also observed that people often trust the potential that education holds for bringing about change.

## **2.2 What is environmental education?**

Wals et al (1990:3) defined environmental education as the process that empowers learners and educators to participate more fully in the planning, implementation and evaluation of educational activities aimed at resolving environmental issues that learners have identified. Janse van Rensburg and Taylor (1993:6) defined environmental education as a planned process, which empowers participants to explore the environment, to investigate recognised concerns and to take action to make the world a better place for all living things. On the other hand, Gabreab and Bak (2002:8) have defined environmental education as a process by which individuals gain awareness of their environment and acquire knowledge, skills, values, experiences and also the determination, which will enable them to act individually and collectively to solve present and future environmental problems.

Environmental education is a process which many people use to identify environmental problems and to take action to solve them. Environmental education in South Africa offers more sustainable living patterns and a better quality of life (Jacana Education 1998:6). Environmental Education in school action projects shows that the school can encourage learners to research and think about local environmental issues, it also shows that it can involve different

school learning areas and it also encourages community participation and partnerships between schools, local authorities and community-local organisations. Environmental Education is about people working together to make their community a better place; many skills are needed to solve different environmental issues. Learning life-skills like financial management and democratic processes is as important as learning about natural environment or starting project like gardening. EE can support community development and income generating activities i.e. action projects where community members take care of vegetable gardens they plant and sell vegetables (Jacana Education 1992:12).

Wals and Stapp (1989: 238) defines environmental education as the process that enables learners and educators to participate more fully in the planning, implementation and evaluation of educational activities aimed at resolving an environmental issue that the learners have identified (Le Roux 2000:252). The aim of environmental education therefore is to communicate knowledge and at the same time gradually change an individual attitude from self – orientated exploitation of the environment to a “caring and sharing” attitude (Hughes-Evans 1977:1). There are three approaches to environmental education through the environment and education for the environment: Education about the environment is the most common form of environmental education (Robottom, 1989). Its objectives emphasise knowledge about natural systems and processes and the ecological, economic and political factors that influence decisions about how people use the environment.

Knowledge of the interactions between natural systems and soil systems is considered an essential requirement for resolving local, national and global environmental issues for managing the environment responsibly. However the integration of natural and social systems is often neglected in programmes about the environment. Robottom and Huckle (1993:97) argue that there has been a marked tendency for science and geography, the two secondary school subjects were traditionally associated with teaching about the environment, to focus on

ecological concepts and technical solutions to environmental problems at the expense of their human cause and of the changes in social systems necessary for solving them.

Le Roux (2000:284) indicated that education through the environment uses learners' experiences in the environment as a medium of education. The aims of this learner – centered approach to environmental education are to add reality, relevance and practical experience to learning, and to provide learners with an appreciation of the environment through direct contact with it. Such experiences may also develop skills for data gathering, skills such as observation, sketching, photography and using scientific instruments as well as social skills such as cooperation and group responsibility. Education through the environment may also foster environmental concern if learners become captivated by the importance and fragility of ecosystems and the beauty of landscapes, or immersed in the values and conflict over an environmental issue (Robottom et al 1983: 74).

Education for the environment has an overt agenda of values and social change. It aims to engage learners in the exploration and resolution of environmental issues in order to foster the values of the new Environmental Paradigm and to promote lifestyles that are compatible with the sustainable and equitable use of resources. In so doing, it builds on education about and through the environment to help develop an informed concern for the environment, sensitive environmental ethic and the skills for participating in environmental protection and improvement. Thus, education for the environment is a counter hegemonic' process: it is a challenge to the way that uncritical educational practices accept and reproduce the Dominant Social Paradigm as it is taken for granted and as a natural way of interpreting people – environmental relationships (Maher 1986:37).

The goal of environmental education therefore, is to create environmentally literate citizens (Hughes 1988:4). Environmental literacy can be acquired through

formal and informal education. Informal education can be gained by participating in environmental activities such as celebrating environmental days like arbor day where the learners in the Ga Molepo area will learn how to plant trees in order to prevent soil erosion. Formal environment education can be acquired through school subjects. Chadwick (2000:16) has identified environmental literacy as a learning process that increases learners' knowledge and awareness about the environment and associated challenges.

Chacko (1998:57-58) believes that formal environmental education in schools is vital as a means of producing environmentally literate learners. He also argues that today's world needs people who are environmentally aware, and can act reasonably towards the environment. Jansen (2002:332) came up with a view that environmental illiteracy is the main culprit in environmental problems. Consequently, Gabreab and Bak (2002:9) have emphasized that educating people and raising their awareness about the environment is one way of tackling environmental problems. According to Loughland et al (2003:1), environmental education in schools is an important strategy in achieving environmental protection and improvements. Through the knowledge that learners from Ga – Molepo schools learned, the people around the area will learn how to protect their environment and will know what to do when they face environmental problems.

Russo (2001:34) agrees that schools are information centers for pupils. Therefore schools have the responsibility to help equip learners with knowledge and commitments to take meaningful decisions and actions to address the challenges of the environment. Chacko (1998:59) maintains that the important function of a school is to provide learners with various kinds of knowledge that would enable them to function as responsible members of the societies in which they live. They will encourage all people in their area to love their environment, as they will be practicing what they acquired from school. Chadwick's (1998:58) observation is that environmental issues on the planet earth are caused by well – educated people. According to Roth in Chacko (1998:54) most environmental

issues are the result of a failure of the society and its educational system to provide citizens with the basic understanding and knowledge needed to make informed choices about interactions and interrelationships in the environment.

The components of Environmental Education are:

- Awareness and sensitivity to the environment and environmental challenges.
- Knowledge and understanding of the environment and environmental challenges.
- Attitudes of concern for the environment and motivation to improve or maintain environmental quality.
- Participation in activities that lead to the resolution of environmental challenges. (UNESCO, 1978).

Hughes – Evans (1977:2) stated that environmental awareness and responsibility are key factors that should be taught in schools. Personal lifestyles and behavior that are in harmony with the environment can be developed through education and teaching (Gabreab and Bak 200:9). Some of the learners will link informal and formal education and apply it practically in their areas. Therefore environmental education will play a role of arousing learners' interest in and caring for their environment.

Although the above authors did not specifically refer to environmental legal education, or teaching learners about environmental law. It can be expected that education aimed at improving decision making, caring for the environment, becoming more responsible and changing behaviour will include dealing with the policies and the laws of a country, region or area.

### **2.3 Environmental education in South Africa**

In 1982, environmental education was addressed in South Africa for the first time at high level during the international Conference of Environmental Education at Treverton College, Mooi River. One of the most important results of this was the



formation of the Environmental Education Association of South Africa (EEASA) in September 1982. The main aim was to promote environmental education in all South African schools and to make all learners environmentally aware. This association provides an important forum for educationists and environmentalists to liaise, exchange ideas and disseminate information. South Africa is in every respect a part of the international environmental issues and should therefore take part in the environmental education process. The Department of Environmental Affairs is, according to its directive, aiming to promote the optimal utilisation of the environment and also be involved in the environmental education. Chacko (1998:57) has stated that South Africa's environmental policy document emphasises the importance of environmental education.

Environmental Education and Empowerment's goal is to promote the environmental education and empowerment of South Africa's people. It also aims to increase their awareness of, and concern for, environmental issues, and to assist them to develop knowledge, skills and values, and commitment that are needed to achieve sustainable development (White Paper on Environmental Management Policy in SA 1999:63). It supports objectives of education and training to integrate environmental education in all learning programmes accredited under National Qualifications Framework (NQF) in formal education, to enhance environmental literacy by using all forms of media.

- It ensures that environmental education programmes and projects foster a clear understanding of the inter-relationship between economic, social, cultural, environmental and political issues in local, national and global spheres.

The environmental education community in South Africa has worked very hard to influence policy and curriculum in the National Qualification Framework (NQF) to include environmental education across the curriculum rather than as a special subject on its own. This means that all educators in all learning areas can draw on 'environment' (both local environment and broader environmental issues) as a basis for their teaching. The Department of Environmental Affairs and Tourism of

South Africa also, recognises environmental awareness and responsibility as critical for building a brighter future (Gregory 2002:1). In 1999 the Department of Education of South Africa realised the need to integrate environmental education into formal education and was based on the following principles:

Principles of Environmental Education for Equitable and Sustainable Societies:

- Education is the right of all; we are all learners and educators.
- Environmental Education, whether formal, non formal or informal should be grounded in critical and innovative thinking in any place or time promoting the transformation and construction of society.
- Environmental Education is both individual and collective.
- Environmental Education must involve holistic approach and thus an interdisciplinary focus in the relation between human beings, nature and the universe (NGO Earth Summit 1992)

Ballantyne et al (1999:86) conducted a study on Geography teachers' perceptions of teaching environmental education in South African schools. The study was useful because Geography is one of the main subjects that teaches about various environmental issues and concepts. In the study respondents indicated that they are committed to promoting responsible environmental behaviour, knowledge and attitude. Schweppenhouser (1977:86) has observed that the biggest challenge of implementing environmental education in schools is the shortage of trained and committed teachers. Hughes (1988:15) also observed that the challenge of environmental education in South Africa is to realise the potential that learners have to participate effectively in the search for sustainable living patterns.

The White paper on Education and Training (1995) advocated that: Environmental education involving an interdisciplinary, integrated and active approach to learning, must be a vital element of all levels and programmes of the education and training system, in order to create environmentally literate and

active citizens and ensure that all South Africans, present and future enjoy a decent life through the sustainable use of resources. Environmental awareness among Grade 12 learners in Ga-Molepo will make it easier for them to take good care of their environment and sustain it for future generations. The Eco- school Programme is a programme, which is about improving environmental management and learning in schools. This means that the teachers, learners, community members and organisations get together and undertake projects to improve some aspects of environmental management at schools. Eco- schools operate in over 40 countries worldwide. It is an International programme of the foundation from Environmental Society of South Africa (WESSA) in partnership with World Wide Fund for Nature of South Africa (WWF-SA), with support from Nampark (Mkandawire 2006:3).

Loubser (2005:127-128) states that the understanding of environmental education gradually changed, and it grew to include a more holistic understanding of the environmental education and how to educate for environmental education (Fien 1993:12). The holistic view of the environment was a foreign concept to most educationists, and the old debate of how environmental education should be included in the school curriculum continued. Despite the efforts to include environmental education in formal education there is still no clarity on how environmental education “should” be implemented in the formal education system. Those advocating critical curriculum theorising have heavily criticised uncritical curriculum theories and practices (Schreuder 1995:21).

According to Le Roux (2000:175) educators must be able to demonstrate an understanding of various educational perspectives and how these have influenced trends in environmental education. Chacko (1998:54) states that better-informed educators can contribute to effective environmental education in schools. To produce better-informed educators, their training should be directed to arousing their commitments and interest in environmental matters. Shoring (2002:26) has stated that educators should consistently promote the development of a positive attitude to the environment amongst the learners.

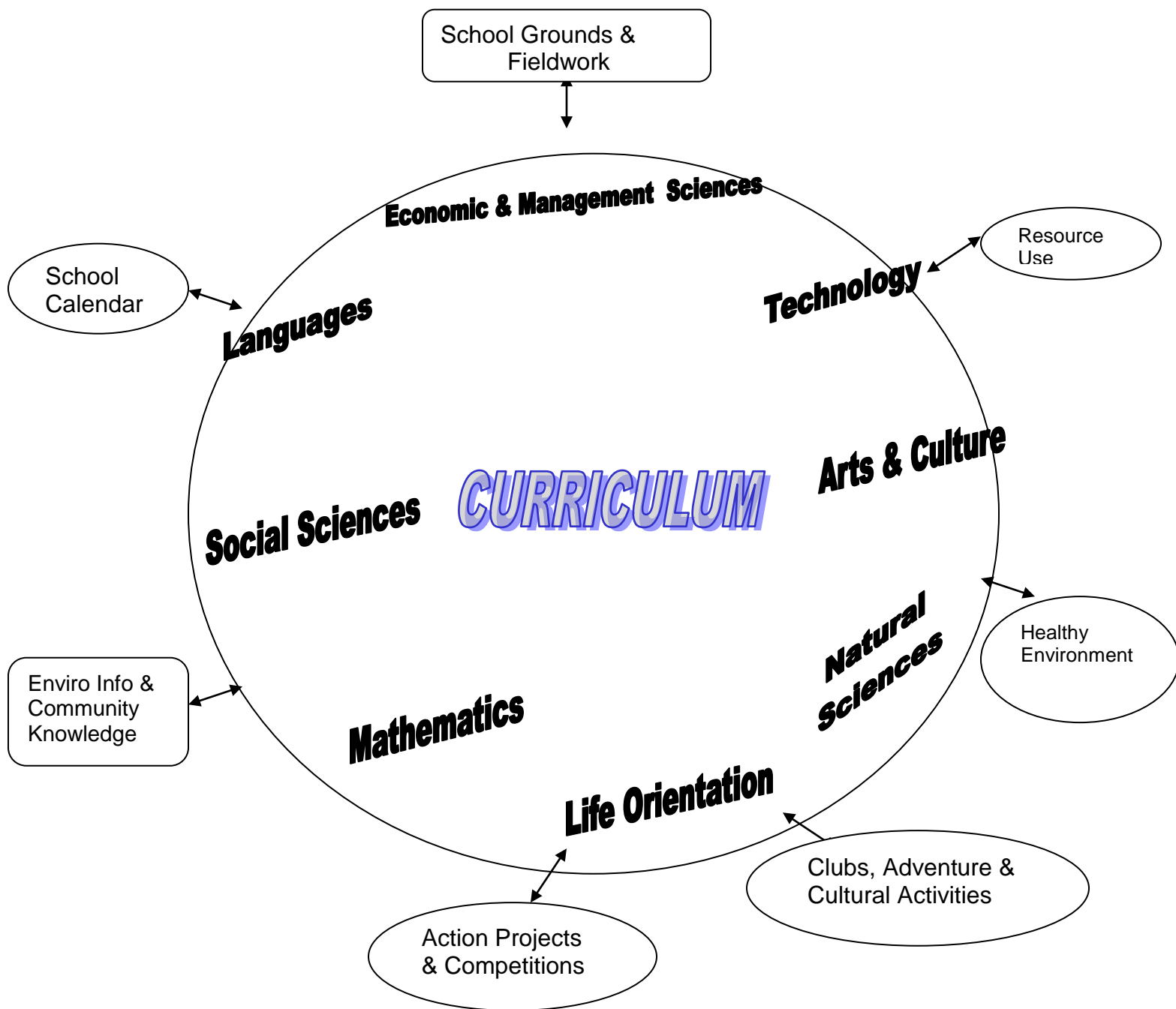
Hughes-Evans (1977:2) has stated that environmental awareness and responsibility are key factors that should be taught in schools. Environmental education should empower all people and promote opportunities for grassroots democratic change and participation. With the change to an African National Congress (ANC) government in 1994, numerous policy and legislative changes were made. The role and status of environment in the national education curriculum were also newly defined. The South African Curriculum 2005 environment was introduced as a “phase organiser” which enabled an environmental focus across learning areas in the new outcomes-based curriculum framework. Research in the Learning for Sustainability Project (a South African project supporting teachers to integrate environmental concerns into the curriculum) Lotz-Sisitka & Raven (2001) indicated that the design of cross curricula activities did not necessarily support deepening of knowledge or process skills in specific learning areas. The Review Committee on curriculum 2005:200 recognised the importance of the environment in the curriculum and recommended that EE should receive “special attention” in the revised curriculum (Lotz-Sisitka & Raven 2001).

#### **2.4 Categories of environmental education.**

Formal: This is definitely by activities that involve structured (through questionable) programmes that seeks to provide support to the education department with regard to outcomes based education School curriculum. This is done through the establishment of support for that is composed of teachers, learners, and department of education officials, environmental officers and in certain areas, community members and non-governmental organisations.

Informal: This is facilitated through coordination or formulation of eco-clubs in schools, community environmental groups and various awareness campaigns and competitions. Mkhandawire (2006:7) Integration of Curriculum 2005 and Environmental Education

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As was mentioned in relation to the first part of this chapter when discussing environmental education internationally, there is no reason why in South Africa, with its formidable array of environmental law and environmental policy, laws and regulations should not form a major component of the environmental learning curriculum. If people do not know about laws, and they do not understand their purpose, they will not help to implement them and will not easily comply with such instruments of environmental management.

## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

#### **3.1 Introduction**

The research design is discussed first then followed by a discussion of the methods of data collection, analyses and presentation.

#### **3.2 Research design**

Qualitative research aims at understanding social life and the meaning that people attach it to everyday life (Schulze 2003:62). Qualitative research requires data that is richly descriptive of people and places. The sampling frame comprises thirteen high schools found in the five different sections of the settlement of Ga-Molepo in Lebopo Circuit. (Table 3.2.1). These Lebopo schools are selected for this study because the researcher is an educator at Ga-Molepo in Lebopo circuit. Therefore it was very convenient to liaise with school principals about the collection of data in their schools.

Table 3.2.1.Sampling Frame.

The sampling frame is constituted by all the high schools in the different sections of Lebopo Circuit.

<b>Sections of Ga-Molepo</b>	<b>Schools</b>
North	St Bedes Mmapadi
East	Maisha Mokwatedi Manoshi
Central	Tshebela Tsela Chueu Phunyako
South	Mamokgari Ngwanaseala Setlakalane
West	Magaedisha Mamodikeleng

### **Sampling Method**

The researcher used purposive sampling methods. Schulze (2003:62) states that the researcher carefully handpicks the participants who would be best able to give him or her information about the phenomenon, which is being investigated. A purposive sampling method was used to ensure that all sections are represented in the sample (Schulze 2003:15). A balloting method was used to randomly select one school from each of the five sections. Sections grouped the names of schools and were all written on pieces of papers, which were folded. The folded pieces of papers were put in a bin and mixed. It was decided that for schools in each section, the first school to be drawn forms part of the sample. In this way Mmapadi was selected from North, Mokwatedi from East, Tshebela from Central, Mamokgari from South and Mamodikeleng from West. This gave a total sample of five schools from five sections of Ga-Molepo.

From each of the schools, the 50% sample of Grade 12 Geography learners was used for schools with high numbers of Geography learners and 100% was used



for schools with small numbers of Geography learners. Tshebela with 51 Geography learners 50% being 26, Mamokgari with 40 Geography learners 50% being 20 and Mamodikeleng with 46 geography learners 50% being 23 learners. Schools with small numbers are Mokwatedi with 22 Geography learners and all learners wrote as their 100% is equal to 50% of the above schools and Mmapadi with 25 Geography learners; 22 wrote and 3 were absent. All learners form part of the sample as their 100% is equal to 50% of the other schools.

Table3.2.2 – Sample of schools

Section of Ga-Molepo	Sample of Schools	Grade 12 Geography learners	Sample of Learners
North	Mmapadi	25	22
East	Mokwatedi	22	22
Central	Tshebela	51	26
South	Mamokgari	40	20
West	Mamodikeleng	46	23

### 3.3 Methods of data collection.

Data for the study was collected through a self-administered questionnaire. The questionnaire was administered from the 23<sup>rd</sup> to the 27<sup>th</sup> of July 2007.

#### 3.3.1 The questionnaire

The questionnaire for the five Ga-Molepo schools was meant to collect information about the level of understanding of the environmental issues such as acid rain, soil erosion and global warming by learners at schools. The above-mentioned environmental issues were selected because it is indicated in the curriculum that they are expected to have been taught to Grade 12 Geography learners.

The questionnaire consisted of 4 Questions. Questions 1 to 3 were open ended; (questions). Schulze (2003:42) states that they give the respondent the opportunity to write any answer in the open space. They intended to give the learners the opportunity to show their understanding and awareness of the environment. Question 4 consisted of ten multiple-choice questions. Each question had one correct answer and two distracters. The fourth distracter was “I don’t know” response. It was expected that the “I don’t know” response would reduce guesswork associated with multiple-choice questions so that the respondents will give honest answers.

Lastly, there were questions where learners were requested to give their opinions on environmental laws in order to test their level of knowledge and understanding of environmental laws. Opinions were not allocated marks.

### **3.4 Methods of data analysis and presentation**

#### **3.4.1 Data analysis and presentation**

The means, standard deviations and the coefficient of variations were calculated for the scores of each of the five schools (Hammond et al 2002:67).

#### **3.4.2 Conclusion**

Policy should not define or prescribe new methodologies and approaches that environmental education will employ, but it may be helpful to refer to the wealth of experience that has been gained through methodologies and approaches, which have been tried out. Methodologies and approaches should be learner-centered and participatory in nature (Loughland et al 2003:3). A wide range of methodologies should be explored and serve the following purposes that is – to motivate the learner, introduce the learner to hands on experience, build self respect and trust, and develop the love of the environment amongst learners.

## CHAPTER FOUR

### ENVIRONMENTAL LEGISLATION AND EDUCATION IN SA.

There are presently two important pieces of legislation in operation namely; *Conservation of Agricultural Resource Act 43 of 1993* and *National Environmental Management Act (NEMA) 107 of 1998* in South Africa. It is clear that NEMA in respect of the national environmental management principles in the words of Glazewski has sent a strong indication to the courts that unrestrained polluting activities will no longer be tolerated. These principles provide a clear signal that the legal convictions of the community have evolved to become less tolerant of unmitigated pollution generating activities.

To mention a few of the other relevant legislative measures, Acts such as *National Environmental Management: Air Quality Act 39 of 2004*, the *Dumping at Sea Control Act 73 of 1980*, the *Conservation of Agricultural Resources Act 43 of 1993* the *Water Service Act 73 of 1998*, *National Veld and Forest Fire Act 101 of 1998*, *Constitution of the Republic of South Africa* can be referred to section 152 of the Constitution describes the objectives of local government, which include – ensuring the provision of services to communities in a sustainable manner; promotion of social and economic development; encouragement of communities and community organisations in the matters of local government. *National Environmental Management Act 107 of 1998* and *National Environmental Management Amendment Act 8 of 2004*, Section 24E of the amended act states that every environmental authorization must as a minimum ensure inter alia – adequate provision for ongoing management and monitoring of impacts throughout the lifecycle of an activity.

*The National Environmental Management Protected Areas Act 31, of 2004*, provides for the application of National Environmental Management. *The Protected Areas Act of 2003* with regards to national parts and marine protected

areas as well as provide for matters connected with these, accords minister with the power to declare an area specified in the notice as a national park, part of a national park, or assign a name to a park. *The National Environmental Management Air Quality Act 39 of 2004* gives effect to Section 24 of the Constitution of South Africa and reforms the law regulating air quality in order to protect the environment by providing reasonable measures for the prevention of air pollution, ecological damage and degradation while promoting justifiable economic and social development and conservation. *The National Environmental Management: Biodiversity Act 10 of 2004* provides for legal framework within the context of NEMA for biodiversity conservation and management and facilitates the drawing up of national lists for threatened and protected species as well as the establishment of a National Biodiversity Institute. It also specifies punitive measures for those who contravene the law (City of Tshwane EE and Awareness Strategy 2005).

South Africa has a problem with its environmental legislation (White Paper on Education and Training 1995) which is about ineffective implementation of the legislation. *Section 24 of the Constitution of the Republic of South Africa 1996* states that every South African has a right to an environment that is not harmful to their health or well – being. This must be brought to the attention of learners at Ga – Molepo schools. It is therefore the obligation of formal education to ensure that all learners contribute to the care and wise utilisation of natural resources. Learners must be aware of the environmental legislation and practices even if they are in an informal learning situation (White Paper on Education and Training 1995).

Concern for environmental issues in South Africa was reflected in the Reconstruction and Development Programme (RDP) (ANC 1994) which advocated programmes to rekindle our people's love of the land and to increase environmental awareness among our youth, to coordinate environmental education policy at all levels and to empower communities to act on environmental issues and to promote an environmental ethic.

The White Paper on Education and Training (DOE 1995) states that through environmental education environmentally literate and NEMA which emphasizes that the well being and empowerment of communities should be promoted through environmental education and the raising of environmental awareness (Monograph Cases of Development in EE 2005:2). This concern for the environment and environmental education has been taken further in the context of National Environmental Policy through NEMA and National Qualification Framework Section 2 (NQF). NEMA stresses the importance of environmental education by stating that community well being and empowerment must be promoted through environmental education, the raising of environmental awareness, the sharing of knowledge and experience, and other appropriate means.

Environmental concerns are also reflected in National Educational Policy. Le Roux (2000:44) came up with another view on the poor enforcement of environmental legislation. South Africa has many pieces of legislation, which are contained in many acts of Parliament, ordinances, rules and regulations. Relevant legislation is difficult to access. Resultantly and conflicting measures are inevitable (Barnard 1999:195). According to Barnard (1999:196) it becomes difficult for environmental legislation to be effectively implemented. He continued to argue that this was often caused by the fragmentation of these Acts. "This fragmentation of control detracts from in effective management and lends itself either to conflicting control or to a complete absence thereof" (Barnard 1999:195).

*Air Quality Act 39 of 2004* is concerned about the impact of air pollution in the atmosphere as a contributing factor towards global warming. Geography learners must know the impact of air pollution as they contribute to that effect by causing veld fires. The Nature Conservation and Biodiversity Legislation is also aimed at the conservation of land and its vegetation particularly in the protected areas, such legislation plays an important role in effecting soil conservation in these

areas. The Nature Conservation Legislation is dealing with conservation of the treasure chest of nature, which is the soil among others, is of much importance. From the formal education information, which the learners will have acquired about soil conservation under soil erosion, they will be able to apply it practically.

The Fire Protection Association (FPA) was launched in Thabazimbi (South Africa) to help communities prevent and fight fires, in particular forest and veld fires. Ms Leah Matlala from the Department of Water Affairs and Forestry (DWAF) said during the launch the “The PFA will be tasked with ensuring that contingency plans are in place to fight veld fires and emergency services available to take care of the knock on effects”. *The National Veld and Forest Fire Act 101 of 1998* provides for control management and prevention of mountain, forest and veld fires. It also allows fire control committees to be more effective. It provides for training and support for rural communities in the management of veld fires. The South African government established the working group on fire programmed to manage uncontrolled fires across the country by training a group of people specifically to prevent and fight fires. In November 2006, the government embarked on a massive campaign to highlight dangers of veld fires. The campaign called “Fire Wire” was aimed at reducing the human, economic and environmental damage caused when people start fires, which burn and spread out of control. According to some recent statistics people start more than 90 percent of these fires. Mr. Jimmy Masombuka, spokesperson for the Mpumalanga Tourism and Parks Agency said that people who ignored the warnings could face up to two years imprisonment (The Speaker, June/July 2007:3).

#### **4.1 Punishment of Environmental Crime**

The punishment of environmental crimes should reflect the gravity and extent of the degradation and abuse of the environment. The government will investigate ways of calculating the occurrence of fines and prison sentences that are linked to the cost of living and to the cost of crime to the environment. It will explore the possibility of alternative sanctions like community service, the seizure of the assets that are used to cause environmental harm. Fines based on how much money the individual or community is making from the crime will be determined by the damages occurred (White Paper on Environmental Management by DEAT 1999:8).

#### Liability for environmentally Harmful Action

- To protect and promote the right to a healthy environment, the government must hold those who harm the environment legally liable by means of fines. Compensation claims and restitution and rehabilitation orders. The government will also consider new remedies for people who are suffering from the effects of the present and past environmental damage. (White Paper on Environmental Management Policy by DEAT 1999:8).

The Lead Agent for Environment Management is the department which is able to play an important role to ensure that the national government passes a law outlining its powers. Among these powers must be the power to make all government and private institutions to comply with the national policy on environmental management, environmental legislation and norms and standards. The lead agent will have to ensure that policy, legislation, and norms and standards all focus on current problems and that they provide proactive solutions and coordinated implementation. (White Paper on Environmental Management Policy 1999:8).

The Department of Environmental Affairs and Tourism, Pretoria (2000) will be the custodian of the environment. As such, it will have to:

- Make sure that people's environmental rights are respected and enforced.

- Fulfill its Constitutional, executive and legislative responsibilities by taking the lead in integrating and co coordinating the various environmental authorities.

When government enforces laws and regulations its role will be to:

- Promote, protect and enhance the environment in accordance with the Constitution.
- Protect Common rights and interests.
- Regulate the impact of human activity on the environment in a fair and consistent way.
- Enforce regulations and laws through prosecutions, fines and civil litigation.
- Carry out all our functions in accordance with this national policy on environmental management.

The fragmented environmental legislation poses a challenge to environmental practitioners to establish effective management systems of this collection of legislative measures in the manner that facilitates their accessibility, integration, coordination, application and further development. It is also argued that most legislation focused on the 'old command and control approach (Barnard 1999: 95). The old command control approach' in environmental legislation is said to be not focusing on the prevention of environmental degradation. The legislation that had been identified as practicing the old command – and – control approach is the *Environment Conservation Act 73 of 1989*. The old command – and control approach has been widely criticized in favour of the new environmental protection management approach. The first component of the new environment protection and management strategy is an attempt to create a project that, through good planning and design would be less likely to cause environmental degradation.

It can be deduced from the above that there is a complex set of laws applicable to environmental management and that this need to be implemented within the framework of the *National Environmental Management Act (NEMA)* as well as the relevant policies and policy guidelines. The policies and laws are based on a set of principles aimed at giving effect to universal values, such as those



underlying the Constitution itself. While it will not be possible to teach learners at grade 12 level the details of laws and policies, the main principles, such as those contained in NEMA and *National Water Act* ( NWA ) can be taught by way of integrating these ideas and concepts into learning curricula across the board of the learners at that level. While the bulk of the environmental issues and problems will feature in geography and related subjects. The principles and values must be part of the way learners are taught to think. Changing values and perceptions can only happen through sharing information and learning. If the values that the learners pick up are the same as those underlying law and policy, compliance by the new generation will be no problem.

Soil Erosion – Criminal Sanctions. Fuggle and Rabie states that criminal prosecutions are instituted in the regional courts where it seems that public prosecutions and magistrates are not always aware of the seriousness of soil erosion and its effect on the future of South Africa. Criminal sanction is used as a sanction of last resort, which means that causing soil erosion is not in itself crime, only the failure to obey directive of the executive officer constitutes an offence. Most serious causes of soil erosion come before the courts and therefore more attention should be given to them in order to raise public awareness. *Intergovernmental Relations Framework Act 13 of 2005* must establish intergovernmental committees to work on the prevention of soil erosion ( Fuggle and Rabie 2009: 237). *National Forest Act 84 of 1998* has a principle which states that `forests must be developed and managed so as to conserve natural resources, especially soil and water`.

Acid Rain. Fuggle and Rabie state that International Society became very conscious of the fact that human activities could have an effect by modifying the ozone layer. This could adverse effects on the physical environment including climate change resulting in harmful impacts on human health and the environment. The Vienna Convention for the Protection of the Ozone Layer was adopted in 1985. In November 1979 the first international agreement covering acid rain and snow, the Convention on Long Range Transboundary Air Pollution,

was adopted by the members of the United Nations Economic Commission for Europe. In 1988 a Protocol to the 1979 Convention was concluded concerning the control of emissions of nitrogen oxides or their transboundary flukes. The Protocol implements the Convention and sets standards of emissions which cover both plants and motor vehicles.

Global Warming. The Intergovernmental Panel on Climate Change was created within the framework of World Meteorological Organisation ( WMO ) one of its tasks being to prepare a convention on climate change ( Governing Council Decisions). Fuggle and Rabie (2009:149) states that specific legal measures on harmful products causing ozone layer depletion have already been adopted and such measures are in the process of being formulated for harmful products which induce climate change. The general problem of products harmful to health and the environment has also been the subject of attention by United Nations General Assembly.

The 2003 Beijing Declaration of the Second Global Environment Facility Assembly – The Facility is a programme established in 1991 for providing financial resources to achieve global benefits in four areas: biodiversity, climate change, international waters and ozone layer depletion. The Declaration adds two other areas: land degradation and persistent organic pollutants.

Criminal Sanctions. Most legislation provides that failure to comply with its provisions is an offence and prescribes maximum penalties to be imposed upon conviction Environmental Legislation no exception (Michael Kidd 2002). The criminal sanction is `by far the most widely prescribed sanction for contravention of legal and administrative provisions ( Fuggle and Rabie 2009: 243).

Fuggle and Rabie also states that lack of public awareness of threats to the environment and in addition as to what is prohibited, also impairs the efficacy of the criminal law. People who are aware that the conduct is wrong and prohibited by law may well assist officials by bringing offences to their notice

## CHAPTER FIVE

### FIELDWORK RESEARCH FINDINGS

#### 5.1 Introduction

In this Chapter, the mean scores for males and females and for the whole school, and coefficient of variation of the environmental literacy test scores of all the schools are presented and discussed in the tables. The mean scores of the environmental literacy test scores of the schools are compared for significance and the results are discussed. Finally the findings from the results are summarised at the end of this chapter.

Table 5.1. Statistics of Environmental Literacy test scores.

School	n			Mean scores			Scores equal to and above the mean			Scores below the mean			CV		
	Males	Females	All	Males	Females	All	Males	Females	All	Males	Females	All	Males	Female	All
1. Tshebela	9	17	26	21.11	25.24	23.81	44%	47.1%	46%	56%	53%	54%	39%	37%	33%
2. Mamokgari	9	11	20	19.80	16.72	18.10	44%	45%	45%	56%	55%	55%	52%	59%	50%
3. Mamodikeleng	12	11	23	17.08	16.82	16.90	58%	45%	52%	42%	55%	48%	46%	52%	43%
4. Mmapadi	6	16	22	12.83	14.43	14	33.1%	44%	41%	67%	56%	59%	56%	44%	41%
5. Mokwatedi	9	13	22	14.40	13.07	13.60	46%	38%	45%	44%	62%	56%	78%	67%	67%

CV= Coefficient of variation (Hammond 1977:59).

### 5.2.1 Findings and explanations

Table 5.1. Shows that the lowest mean score of 13.6 was obtained by Mokwatedi High School learners. This means that on average the learners of this school had the lowest level of understanding of the environmental issues that were tested. However, the male learners of this school performed better than the female learners in their school at the mean of 14.4. 5 out of 9 males obtained scores that were higher than the mean and 4 males scored below the mean whilst females obtained a mean score of 13.7. 5 out of 13 females obtained scores that were above and equal to the mean and 8 out of 13 were below the mean. The males at Mokwatedi High even performed better than the males at Mmapadi High and the overall mean of 14 of Mmapadi is higher than that of Mokwatedi High. Males at Mmapadi High obtained a mean of 12.8. This is the lowest mean of all the males and females in all the schools. This means that their level of understanding on environmental literacy is extremely low. 10 out of 22 learners of Mokwatedi High obtained scores that were equal to and above the mean whilst 12 learners scored below the mean. (2 to 12 marks out of 40 marks). This means that on average the performance of the school was weak.

The coefficient of variation of the scores of this school is 67%, which is very variable; this indicates that the understanding of the environmental issues that were tested varies very widely among the learners of the school.

The second lowest mean score of 14 which was obtained by Mmapadi High School. 13 out of the 22 learners obtained scores equal to and above the mean and 9 out of 22 learners scored below the mean (5 to 12 marks of 40 marks). Male learners obtained a mean score of 12,83, which is lower than the females in their class at a mean score of 14.43. 2 out of 6 males obtained scores that were equal to and above the mean and 4 out of 6 males obtained scores below the mean. 7 out of 16 females obtained scores equal to and above the mean and 9

out of 16 obtained scores below the mean (5 to 14 marks out of 40 marks). This means that on average, the performance of the school was weak.

The coefficient of variation of the scores of this school, which is 41%, is not very variable. Both males and females level of understanding is low although 3 out of 22 learners proves to have a better understanding than others as they obtained a score of 20 to 24 out of 40 marks.

The highest mean score of 23, 81 were obtained by Tshebela High. This means that on average, the performance of learners from this school was higher than that of learners in all the other schools. This means that the learners of Tshebela High had the highest-level of understanding the environmental issues that were tested. 15 out of 26 learners scored equal to and above the mean. There are five learners who scored between 30 and 38 out of 40 marks, which indicate a clear understanding. 11 learners scored below the mean. The lowest learner scored 8 marks followed by 15 marks out of 40 marks. Even if the learners scored below the mean their performance is still good as five learner scored between 20 and 22 marks, which is above, and half of 40 marks. Female learners obtained a mean score of 25.24, which shows a clear understanding of environmental issues. Females scored above male learners who scored 21.11, which also show a good level of understanding. Males and females at this school performed far better than all the males and females of the other schools.

The coefficient of variation of the scores of this school is 33%. This indicates that the learners understanding of the environmental issues that were tested was not variable. Their level of understanding is the same.

The second highest mean score of 18.1 was obtained by Mamokgari high school. This means that this school had the second best performance. 10 out of 20 learners scored equal to and above the mean and the remaining 10 scored below the mean. Male learners at this school performed better than female learners. Males obtained a mean score of 19.8 and females 16.72. Their level of understanding on environmental issues is better. This means that on average the

learners from this school demonstrated a similar level of understanding of the environmental issues tested. 10 learners who scored above the mean obtained between 19 and 29 marks out of 40 marks which indicates a good understanding of environmental issues. The lowest mean score of 3 marks was obtained which shows a poor level of understanding of 10 learners who scored below the mean obtained between 3 and 18 marks out of 40 this also indicates poor level of understanding.

The coefficient of variation of 50% which is the second highest below that of Mokwatedi High indicates that the level of understanding of the environmental issues that were tested was not variable. Mamodikeleng High obtained the third highest mean score of 16.9. 12 out of 23 learners obtained marks above the mean whilst 11 out of 23 learners obtained marks below the mean. Learners who scored above the mean obtained between 18 and 31 marks, which indicate a better level of understanding of environmental issues. Mamodikeleng males performed better than females as they obtained a mean score of 17.08 whereas females at their school obtained 16.82. 7 males out of 12 scored above the mean, which shows a better understanding. 5 out of 11 female learners obtained marks above the mean and 6 obtained marks below the mean. This indicates that females from this school are weaker than males though 3 females performed well; as two of them obtained 23 marks and one obtained 31 marks.

The coefficient of variation of 43% which is the third highest above that of Tshebela and Mmapadi indicates that the learners understanding of the environmental issues (that were tested) were not variable. Though the level of understanding amongst female learners was variable as their coefficient of variation is 52%. Coefficient of variation for male learners is 46% which indicates that the level of understanding is not very variable.

Tshebela male learners, followed by Tshebela female learners at a mean score of 21.11, obtain the first highest mean score of 25.24. The third mean score of 19.8 is obtained by Mamokgari male learners. The fourth mean score of 17.08 by

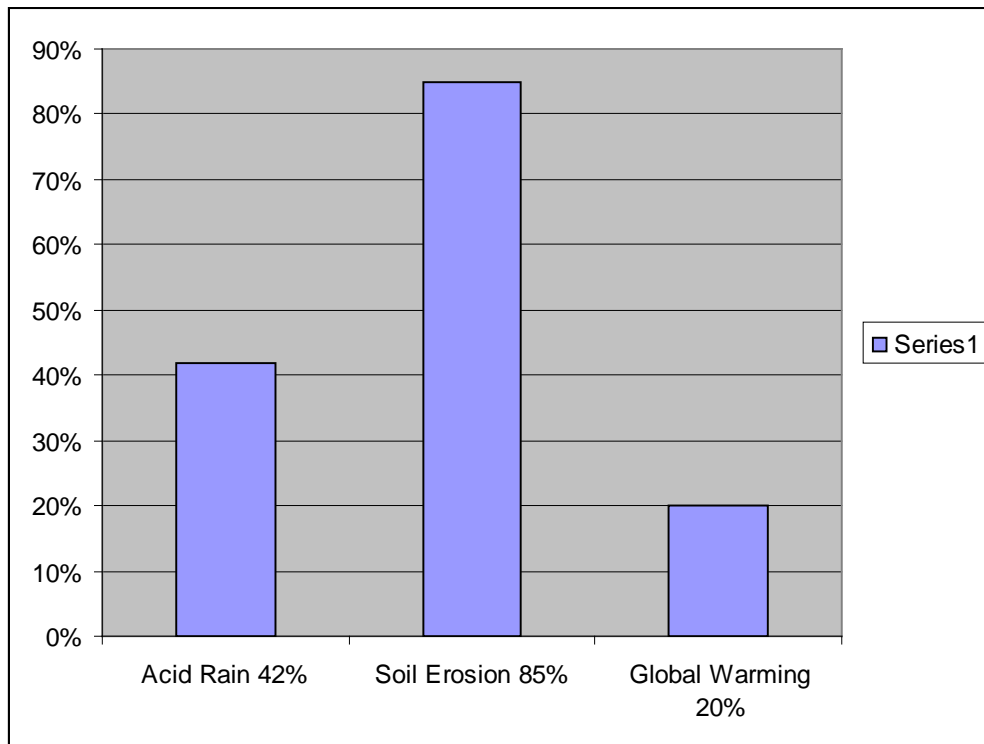
Mamodikeleng male learners. The fifth mean score of 16.82 by Mamodikeleng female learners, which is not far from 16.72, mean score obtained by Mamokgari females taking them to sixth position. Seventh are Mmapadi females at a mean score of 14.43. The eighth is Mokwatedi males with a slight difference as they obtained a mean score of 14.4 and the ninth is Mokwatedi females with a mean score of 13.07 and the tenth and last is 15 Mmapadi males with a mean score of 12.83.

On the mean score of all the schools Tshebela obtained the highest mean score of 23.81 followed by Mamokgari at a mean score of 18.1 and third by Mamodikeleng at a mean score of 16.9. Fourth is Mmapadi at a mean score of 14 and the fifth and last with a mean score of 13.6 is Mokwatedi High School.

### **5.2.2 Testing learner's knowledge**

The following bar graph represents the learner's general performance in percentages based on soil erosion, acid rain and global warming. The numbers of learners in the Ga- Molepo area were 113.

Table 4.2 Bar graph on environmental issues



This indicates that learners generally are aware of causes, effects and combustion of soil erosion more than knowledge and understanding of acid rain and global warming. This is because of the mountainous area that surrounded them. They are exposed to a lot of soil erosion which affects them even in their own home yards, in the vegetable garden in the yards and field gardens.

### 5.3 Observation

The level of learners' knowledge and understanding in terms of environmental literacy is not so good but there are some learners who are environmentally literate. Mostly learners understand soil erosion better than the other two environmental issues being global warming and acid rain. Educators in Ga-Molepo schools must work on creating a relationship between the classroom and outside environment as far as the imparting of knowledge and understanding of environmental literacy is concerned.



## 5.4 Analysis of fieldwork results

The level of literacy in Ga-Molepo schools is generally very low. The learners are not able to interrelate the current situation in schools and the ideal situation around their environment. Therefore there is no balance between the current situation and the ideal situation in terms of knowledge and understanding of environmental issues.

## 5.5 The Ideal situation

It was found that environmental laws are not clear to learners, because when they gave their general opinion at the end of the questionnaire it was clear that they contributed in damaging the environment though unaware that they violated environmental rules. The performance at Mokwatedi High School is very poor followed by Mmapadi and Mamodikeleng being on average and Mamokgari and Tshebela being the highest on their level of environmental education offered.

### 5.5.1 *National Veld and Forest Fire Act 101 of 1998.*

The inputs of learners on this law, indicates that 30% of them are exposed to air pollution on a daily basis in their kitchens. This is so because of the use of firewood, which violates their right to a harm-free environment regarding their health. Forest and veld fires caused by negligently thrown cigarettes and intentional burning of fields by the parent community cause air pollution. In this case 45% of learners indicated that veld fires are done to reduce thick bushes and to allow new grass to grow. In addition to kill endangered species such as snakes and poisonous vegetation to their life stock. From all the schools visited, 5% did not comment on forest and veld fires and 20% was not clear. *National Environmental Management: Air Quality Act 39 of 2004* is concerned about the impact of air pollution in the atmosphere. In this case 80% of learners were unable to show a clear understanding of this Act, hence poor performance based on acid rain and global warming (refer to bar graph 4.2). 20% did not answer.

5.5.2 *Conservation of Agricultural Resources Act 43 of 1983*. 45% of the learner community indicates that the use of firewood depends on chopping of trees, and they feel it is unavoidable. Added to the afore, 30% indicated that the rural community uses indigenous species for herbs. Thus they become scarce. No conservation mechanisms are in place. The researcher therefore realised that this is a violation of the rights to conserve and secure ecological sustainability and development. On the question of how to secure the ecological sustainability and development, 70% of learners indicated that wild animals are killed for food consumption. This shows that there is no control mechanism in place. Ga-Molepo area is turning to be a barred area with shrubs and fewer bushes around its rivulets and mountains. The researcher realised that the veld fires, chopping of trees for new settlements areas and unused agricultural fields resulted in desertification of the area. As such the land is exposed to erosion. (*Soil Conservation Act of 1969*).

## **Conclusion**

In conclusion the whole activity indicates that the learner community of Ga-Molepo area have very little knowledge and understanding of the environmental laws that manage their lifestyle and the environmental paradigm.

## CHAPTER SIX

### Conclusions and Recommendations.

#### 6.1 Conclusion

There is a dire need to maintain the quality of the environment and to produce environmentally literate learners. It was discovered that the level of environmental knowledge and understanding of most learners who participated in this study is low. Male learners at Tshebela performed far better than all the males and females of the other schools, which shows a good level of knowledge and understanding of environmental issues followed by their female learners. Generally the level of understanding at this school is good.

Environmental literacy and knowledge differ when it comes to specific environmental issues. Therefore it is necessary to carry out further research into learners' knowledge and literacy of various environmental issues. This is clearly proved by the score of 85% on soil erosion and 42% of acid rain and 20% of global warming.

Environmental laws need to be integrated into the learners' knowledge as their opinions on environmental laws show it clearly that they do not have knowledge and understanding of environmental legal implications. We can work together towards improving a better environment when we all consider and respect the environmental laws. Being environmentally literate can help us to sustain our environment for future generation.

Environmental Education in Ga-Molepo schools whether formal, non-informal or informal, should be grounded in critical and innovative thinking in any place or time, promoting the transformation and construction of the society. Generally learners in Ga-Molepo area are not environmentally literate because there are many environmental issues, which they are not aware of, and some of the issues

they are conversant with but they do not consider them harmful to their society as they concentrate more on benefiting from natural resources than sustaining them. Such include the following, namely:

- The use of firewood on a daily basis violates the right to a harm-free environment on human health and well being.
- Learners do not have knowledge and understanding of environmental issues in relation to APA.
- No relationship between air pollution and the resultant acid rain and global warming.
- No relationship between chopping trees with creation of soil erosion.

Learners have no knowledge and understanding of the environmental laws. They cause veld fires without any fear of the legal implications. They chop trees and kill animals for their own benefit violating the right to ecological sustainability and development.

- People should know about duties and rights provided for in law.

It has been shown in chapter one that the concern for damage caused by acid rain, soil erosion and global warming are often irreversible and have serious effects even in our life time. As occurrences resulting from the age of industrialisation and a lack of education and understanding, the current generation must live with it. However knowledge of these phenomena and their impact on the human environment and quality of life, needs to be incorporated in the syllabi of at least grade 12 learners, if not through the school going years of the youth.

It was also shown above that environmental education is not something new and is regarded as of great importance internationally and in South Africa. The quantitative research done in respect of the schools involved in this research showed that there is some awareness of environmental issues but that much need to be added to bring levels of knowledge and awareness to the desired levels where people can participate in discussion on global warming and acid rain.

It was also pointed out that South Africa has a high quality value system that underlies a comprehensive and modern environmental management policy and law system, but that these underlying values are not reflected in curricula or the knowledge and attitude of the grade 12 learners who participated in this research.

## **6.2 Recommendations**

Based on the research and research findings recorded in this dissertation it is recommended that:

(1) Schools must have a school environmental policy, which should define how the school intends to promote better environmental learning and management within its precincts (Le Roux 2000:74).

(2) Schools must develop a program of their choice of focus areas and describe what they will do to address each focus area e.g. celebrate environmental days, or participate in environmental projects in the area.

(3) Schools must share the policy widely so that the whole school (including parents and the local community) are aware of the school's plans and can become involved (Carr & Kemmis 1987:20).

(4) In close co-operation with environmental organizations and government departments the school curriculum must be designed to also provide for:

- Educating learners on environmental issues in relation to environmental protection and improvements.
- Alerting learners on environmental problems caused by veld fires, chopping of wood, burning of tyres and wrong ploughing methods which they apply.
- Environmental education must involve a holistic approach and thus an interdisciplinary focus in the relation between human beings, nature and the universe ( Le Roux 2000:76)
- Environmental education should treat critical global issues, their causes and inter-relationship in a systematic approach and within their social and historical contexts. Fundamental issues in relation to development and the

environment such as population, health, peace, human rights, democracy, hunger, degradation of flora and fauna, should be perceived in this manner<sup>138</sup>.

- Environmental education must recover, recognise, respect, reflect and utilize indigenous history and local cultures, as well as promote cultural, linguistic and ecological diversity.
- Constitutional rights, legal obligations and accountability under law as well as the need to comply with law must be part of all environmental education.

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## APPENDIX

### Questionnaire

#### ENVIRONMENTAL LITERACY AMONG GRADE 12 GEOGRAPHY LEARNERS IN SCHOOLS IN GA-MOLEPO

Name of the school: \_\_\_\_\_

Gender: Male/Female \_\_\_\_\_

### Instructions

1. Answer all questions.
2. Please be honest when answering questions
3. Write neatly.

### Question 1

#### ACID RAIN

- |   |      |
|---|------|
| 1.1 What is acid rain?                                  | [2]  |
| 1.2 Explain in two ways on how acid rain is caused.     | [4]  |
| 1.3 Mention any two environmental effects of acid rain. | [4]  |
| Total   | [10] |

### Question 2

#### SOIL EROSION

- |   |      |
|---|------|
| 2.1 What do you understand by soil erosion?                           | [2]  |
| 2.2 Explain how any one human activity can contribute to soil erosion | [2]  |
| 2.3 In which three ways can you combat soil erosion?                  | [6]  |
| Total   | [10] |

### Question 3

#### GLOBAL WARMING

- |   |      |
|---|------|
| What is global warming?   | [2]  |
| Explain two any impacts of global warming in the north and south poles. | [4]  |
| Explain two ways in which global warming can affect climate.            | [4]  |
| Total   | [10] |

## Question 4

### **MULTIPLE CHOICE**

Choose the correct answer form the given alternatives.

4.1 Acid rain is mainly caused by

- A. Dust.
- B. Drought.
- C. Carbon dioxide.
- D. I don't know.

4.2 Acid rain can destroy

- A. Aquatic life only.
- B. Aquatic life and plants only.
- C. Aquatic life, plants and buildings.
- D. I don't know.

4.3 Mpumalanga is a big contributor to South Africa's acid rain problem because:

- A. It is located in the east.
- B. It has a big power station and coal mines.
- C. It is overpopulated.
- D. I don't know.

4.4 There are various causes of acid rain in South Africa, namely:

- A. Pollution from industries.
- B. High use of electricity for manufacturing.
- C. All of the above.
- D. I don't know.

4.5 The following is land management strategy used to control soil erosion.

- A. Air pollution.
- B. Overgrazing.
- C. Crop rotation.
- D. I don't know.



4.6 Soil erosion is caused by one of the following.

- A. Running water.
- B. Tree planting.
- C. Infiltration.
- D. I don't know.

4.7 From the list below which one is not relevant to soil erosion.

- A. Deforestation.
- B. Urbanization.
- C. Pedology.
- D. I don't know.

4.8 People can contribute to global warming by

- A. Burning fossil fuel.
- B. Using electric stoves.
- C. Using solar batteries.
- D. I don't know.

4.9 Global warming is expected to cause

- A. Precipitation.
- B. Overpopulation
- C. Veld fires.
- D. I don't know.

4.10 The following are effects of global warming.

- A. Loss of biodiversity.
- B. Sea level to rise and coastal towns will be submerged under water.
- C. All of the above.
- D. I don't know.

[10]

TOTAL = 40 MARKS.

Give your opinion on the following

1. Why do we have veld fires?
2. Why do we destroy our forests?
3. Comment about Nature Conversation Act.
4. How can the ecological animal species be secured?