SMALL-SCALE FARMERS' PERCEPTIONS ON THE CAUSES OF LAND DEGRADATION IN THE LUVUVHU CATCHMENT, LIMPOPO PROVINCE, SOUTH AFRICA

by

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I declare that this dissertation/thesis is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

N. Nthungeni May 2020

SIGNATURE DATE

DEDICATION

I dedicate this project to God Almighty my creator, my strong pillar, my source of inspiration, wisdom, knowledge and understanding. He has been the source of my strength throughout this program and on His wings only have I soared. I also dedicate this work to my wife (Mabogo Takalani) who, despite all the challenges, kept encouraging me and inspired me to be committed to this project, which helped me to reach my goal. To my beloved daughter Mpho who has been affected in every way possible by this quest to study and contribute to growing knowledge. My love for you both can never be quantified. To my late father MP Nthungeni, I miss you so dearly, and Mama Neluvhada Mukondeleli, I love you, God bless you.

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ABSTRACT

Land degradation is currently a major concern in South Africa. However, awareness of the problem and attitude towards it has changed little over the past century. Soil erosion leading to land degradation is continually being depicted as an acute problem leading to soil fertility loss, lowering agricultural output and land degradation. Overpopulation, climate change, overstocking and poor agricultural practices are viewed as the major causal factors. The basic tenets of this are the changing perceptions among small-scale farmers in the Luvuvhu catchment regarding land degradation. Therefore, understanding farmers' perceptions of land degradation in the Luvuvhu catchment and its causes are important when carrying out mitigation measures in order to promote soil and water conservation practices.

This study adopted a quantitative research design method. In order to achieve the objectives of this research, questionnaires and observation were used as instruments for data collection. The data was collected using a self-administered questionnaire to the farmers in the study area. A total of 101 respondents were purposively selected and interviewed by following the snowball sampling technique. Data used in the questionnaires consists of variables such as demographic and socio-economic characteristics of farming, with perceptions of the causes of land degradation and measures used to address problems identified by respondents. Data generated from the semi-structured questionnaires were analysed quantitatively using SPSS (Statistical Package for the Social Sciences) version 22.1 to generate descriptive statistics such as frequency, percentage distribution, and mean.

The findings of the study show that farmers' perceptions vary significantly in terms of their socio-economic determinants such as gender, age, literacy, employment status, agricultural extension and governments support schemes. The result of the analysis revealed that 61% of the respondents perceived rill erosion on their farms as the prevailing form of land degradation. Most of the sampled respondents also believed that the general topography of the area (99%), high rainfall intensities (89%), over-grazing (71%), continuous tilling of the soil (63.3%), and among others were the main causes of land degradation.

Observations revealed that farmers of the study area had varied but generally clear perceptions of the causes of land degradation and the conservation measures used to address soil loss and land degradation through traditional. However, a significant proportion of the farmers received interventions in the form of incentives from the local authority aimed at addressing the challenges of soil loss and decreases in soil fertility due to soil erosion, primarily

in the form of rills. Against the backdrop of the perceived negative impact of land degradation in the Luvuvhu catchment, farmers and support authorities are encouraged to improve soil conservation measures through institutional programs and projects from the local governments support agencies.

Keywords: Socio-economic determinants, land degradation, farmers' perceptions, Luvuvhu catchment, Limpopo Province, South Africa.

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APAP:	Agriculture Policy Action Plan
CA:	Conservative Agriculture
DAFF:	Department of Agriculture, Forestry and Fisheries
DWA:	Department of Water Affairs
DWAF:	Department of Water Affairs and Forestry
FAO:	Food and Agricultural Organization
GDP:	Gross Domestic Product
GHG:	Green House Gases
IAASTD:	International Assessment of Agricultural Science, Technology and Development.
IPCC:	Intergovernmental Panel on Climate Change
MDGs:	Millennium Development Goals
NDP:	National Development Plan
NGOs:	Non-Governmental Organizations
OECD:	Organisation for Economic Co-operation and Development
RSA:	Republic of South Africa
StatsSA:	Statistics South Africa
SPDAFF:	Strategic Plan for the Department of Agriculture, Forestry and Fisheries
WWF:	World Wildlife Fund

CHAPTER ONE: INTRODUCTION AND PROBLEM STATEMENT

1.1 Introduction

Over recent decades, there has been an increasing awareness of the potential effect of land degradation on small and large-scale farming. The main argument put forward by Mango et al. (2017) is that the degradation of land, water and soil resources undesirably have economic and emotional impacts on the farmers by reducing land and soil productivity, consequently endangering the sustainability of agriculture production. It equally has a negative effect on the environment whereby their stability and quality decline, which has an adverse impact on economic and social development. Moges et al. (2017) highlight soil as one of the fundamental natural resources that support life on earth. As a core component of this land-supporting resource, soil is highly vulnerable to various forms of depletion and degradation such as soil erosion and fertility decline. Studies have demonstrated that soil erosion is one of the most widespread forms of land degradation that continues to plague agricultural practices in many sub-Saharan countries (Gelagay & Minale, 2016; Moges et al., 2017). For instance, human-induced activities have shown to be one of the greatest contributors to soil erosion, often leading to severe land degradation, thereby hindering sustainable agriculture (Zegeye et al., 2010). Reports by FAO (2014) and ITPS (2015) suggests that human pressure on soil resources have reached critical limits and has given rise to different types of depletion such as fertility decline and changes in the physical and chemical soil properties (Moges et al., 2017). Variations in temperature, precipitation and evapotranspiration caused by climate change have had adverse effects on the environment, causing changes in land cover, vegetation and hydrological regimes and making soil susceptible to erosion processes (Hofierka, 2008).

Acknowledgement of the significant role of soil as a natural resource that supports life on earth is key. It plays pivotal roles in global climate processes by regulating carbon dioxide (CO_2), nitrous oxides (N_2O) and methane (CH_4) emissions, which is paramount in achieving sustainable farming. Although considerable efforts over the past decades in most sub-Sahara countries has been directed towards soil and water conservation practices (including the construction of box and contour ridges, rainwater harvesting etc.), it has however fallen short in addressing these problems over the long term (Felix et al., 2015). These problems are particularly severe in rural cultivated areas as they are prone to different forms of land degradation. As part of developmental policy to promote small-scale farming in a bid to reduce rural poverty, these measures suggest that the greatest potential for increasing agricultural

produce is most likely to come from improved land management practices and through an efficient application of improved agricultural practices (Assefa, 2009).

Furthermore, Felix et al. (2015) assert that technological and institutional innovations have failed to solve the problems of land degradation in many sub-Saharan countries due to improper application and inadequate resources of the stakeholders. Despite the tremendous effort by national governments and other Non-Governmental Organisations (NGO's) to curb the problem of land degradation and to improve food security at a household level (Tibesigwa & Visser, 2015), small-scale farming is often associated with 'backwardness,' highlighted by non-productive, non-commercial subsistence agriculture. These are mostly found in the former homeland areas and associated with black African farmers (Kirsten & Van Zyl, 1998). However, in order to meet the growing population demands both in rural and semi-rural areas, small-scale farming has witnessed an intensification of agricultural activities leading to land degradation over time. Small-scale farming continues to face multiple challenges ranging from socio-economic to climatic variability, which hinders its agricultural development (Mpandeli & Maponya, 2014). Nevertheless, small-scale farming in sub-Saharan Africa is fundamental to the economy and it plays a vital role by increasing food security.

In South Africa, small-scale farmers in the communal areas have limited access to resources, including capital, credit, information, experience and markets (Ortmann et al., 2006). Additionally, such small-scale farmers are also affected by insufficient property rights and huge transaction costs (Lyne, 1996), yet some are able to successfully produce food for own consumption and for local markets. For example, Matungul et al. (2001) demonstrates the typical household features of small-scale farmers in two rural areas of the KwaZulu-Natal midlands. These two communal areas of the province (Impendle and Swayimana) are able to sell their products through informal channels such as neighbours, local shops and monthly pension markets. The major concern here is that degradation of land across South Africa adversely affects small-scale farming, which leads to a reduction in productivity and impact on economic and social development. This may stem from the farmer's lack of information about adequate measures to combat land degradation, the lack of policy and regulations applied to stakeholders from relevant government departments and farmers' perceptions regarding the causes of land degradation.

The Limpopo province is severely impacted by land degradation in this context. Although the Limpopo provincial Department of Agriculture and Rural Development has made

tremendous efforts in promoting farm-level sustainable agricultural practices in rural areas, research on the significance that farmers ascribe to these practices and the perceptions of small-scale farmers regarding land degradation is still lacking (Mukwevho & Anim, 2014). If small-scale farming is to be considered as the backbone of rural development and poverty alleviation, then farmers need to first understand the importance of this sector for job creation, a stable source of income and maintaining livelihoods (Chikazunga & Paradza, 2013). Therefore, understanding farmers' socio-economic characteristics and perceptions of land degradation is considered a preliminary step in developing an extension programme to promote sustainable farming among the rural population. It is however worth stating that some of the limitations and problems facing small-scale farmers in South Africa has been aggravated by the increased presence of agro-processing business and supermarkets challenging the small-scale farming business operations (Aliber et al., 2009). These businesses prefer to source their goods from large scale farmers who can meet their procurement against local farmers due to limited farming knowhow, output and the stringent demand on food safety and quality set by supermarkets and agro-processors (Vermeulen et al., 2008).

Through analysis of agrarian history in South Africa, one finds evidence that outline how different policies and actions by the government has impacted on the reduction of small-scale farming in South Africa. This has come to a point where its contribution to the economy as a whole and also to the livelihood and welfare of people in rural areas is minimal (Kirsten & Van Zyl, 1998). Furthermore, various factors such as coercive policies, rent-seeking by large-scale farm lobbies, population pressure and climate change has to a greater extent led to the decline of agricultural sector, which was once dynamic, market-responsive and competitive (Kirsten & Van Zyl, 1998). Moreover, the above authors further opine that the most challenging socio-economic problems faced by black people in rural areas is how and/or where to get assistance in order to start a viable rural livelihood. Globally, research has shown that small-scale agriculture has the opportunity to create jobs and generate incomes in rural areas (White, 2012; Patel et al., 2015). Thus, small-scale farming is viewed as potentially competitive activity that, if supported by policy, can unlock opportunities that can lead to the development of smallholder sectors (Kirsten & Van Zyl, 1998).

A host of factors influence farmers' perceptions to land degradation, which is broadly categorised under personal, socio-economic, institutional and physical parameters and perspectives. Many of these factors stem from the physical and social geographic influences of

the area within which a small-scale farmer is located. Assefa et al. (2016) reveal that farmers' awareness and adoption of soil and water conservation measures is highly influenced by their ability to be aware of the problem. In addition, Karltun et al. (2013) highlight that the slash and burn method of farming has been widely used as a preferred farming method in India for decades despite its detrimental effect to the soil. Hence, a farmers' perception (and all the various factors that influences it) in farming as a whole play a vital role in decision making processes and understanding. Farmers' perceptions govern the state of acceptance and execution of suitable land management practice. However, if farmers cannot discern the effects of land degradation as a result of unsustainable small-scale farming practices and the possible negative outcomes associated with the problem, they cannot implement land use management to mitigate it. Also, perceptions of other traditional based farming methods need to be taken into consideration (Goswani et al., 2012). Such perceptions are key as it relates to people's choice of recommendations to address problems and these are varied based on the local perceptions, family traditions, prior education and the prevailing environmental conditions which might bring about different problem formulation and solutions (Karltun et al., 2013). This study, therefore, seeks to assess farmers' perceptions of land degradation in the Luvuvhu catchment, Limpopo Province, South Africa.

In order to realise growth in small-scale agriculture, farmers should have access to support services. Internationally, evidence shows that an adequate access to support services by small-scale farmers can significantly increase production and productivity in agriculture sector. Pederson (2003) indicates that despite a decline in the contribution of agriculture sector to the economic development, the sector is still dominant in most less developed and developing countries. The sector is a source of exports and also a major employer of poor people and women in rural areas. Thus, in order to stimulate agricultural productivity, financial markets should improve. Moreover, credit extension and provision of training is critical in increasing the efficiency of resource-poor farmers (Mushunje & Belete, 2001).

In South Africa, a limited number of case studies have indicated that small-scale farmers are available, and their activities are viable, profitable and efficient to the local and global economy, as compared to their large-scale counterparts (Baloyi, 2011; Maoba, 2016). The neutrality of the policy framework in agricultural sectors have an impact on the efficiency of small-scale farmers through external economy of scale (Johnson & Ruttan, 1994). De Janvry et al. (1987) suggest that external economies of scale occur when there is an increase in size of

the farm, which enables the farmer to gain advantage with regard to access to inputs, credit, services, storage facilities, marketing and distribution opportunities. Furthermore, large farms have real advantages as compared to small-scale farmers resulting from pecuniary economies and policy distortions. Similarly, diseconomies of scale may occur due to absence/failure of labour markets, high transaction costs, and poor management (De Janvry et al., 1987). However, Fields (2011) emphasises the usefulness of small-scale farming in less developed and developing countries where labour force cannot be fully absorbed in formal labour markets. This is more prevalent in South Africa than in the rest of the continent.

Vink & Kirsten (2003) highlight that South Africa's agricultural sector is mainly dualistic in nature: economies of scale historically manifested due to a division between the commercial, large-scale farming sector and the low productive, struggling small-scale sector. According to Neves et al. (2009), this occurs because of historical patterns of dispossession and impoverishment, which had eroded historically successful land-based production systems and livelihood in South Africa. Therefore, majority of people in small-scale farming today are black, who are landless, poor and run small-scale farms on a communal land. They are mostly subsistence farmers who depend on social grants payments from government's social protection programmes (Fenyes & Meyer, 2003; Groenewald & Nieuwouldt, 2003; Lahi & Cousins, 2005). Palmer & Sender (2006) also indicated that instead of the sector being enabled by social programmes, it is non-buoyant and characterised by higher levels of dependency. The critics of this argue that policies should not take this form of livelihood as a poverty reduction tool. Oettle et al. (1998) suggest that agriculture is characterised by inequality with regard to the following: distribution of economic assets, support services, market access, infrastructure and income.

The agriculture sector is still the most important livelihood activity among the rural population in South Africa, where the majority of households are involved in farming, directly or indirectly. According to Statistics South Africa's (2013) General Housing Survey outline that 51% of all households in former homelands are involved in direct farming activities. It is believed that there is a substantial increase in the number of farming households in former homelands. The number rose from 2.28 million in 2007 to 2.68 million in 2013. There is a strong correlation between this increase and the increase in social grants over the same period. This begs the question whether grants have enabled subsistence activity or whether increasingly impoverished small-scale farmers are forced to rely on transfer income. Therefore, many households use small-scale farming to improve their livelihoods and to supplement food within

their localities that are characterised by high unemployment levels (Machethe, 2004; Pauw, 2007).

1.2 Geographic perspectives of small-scale farmers

Geographically, South Africa is a semi-arid country. This led to the production of a various range of agricultural products. Furthermore, South Africa has a diversity of geomorphological settings resulting in a great variety of soil and climate conditions. Climatic regions in South Africa encompass Mediterranean, subtropical and semi-desert. Bassoon (2015) indicates the diversity in biomes that results from the physical landscape and differences in the distribution of rain fall across South Africa. This leads to a very diverse agriculture sector, with clear regional distribution commodities. As Blignaut et al. (2014) assert, nearly 70% of cereals in South Africa and 90% of commercially grown maize is mainly rain-fed on the Highveld region. Moreover, WWF (2010) indicates that livestock is the largest agricultural sector in South Africa since the land surface suitable for grazing is approximately 69%. The eastern areas of the country practise mostly cattle farming because of higher rain fall in the regions. The province Limpopo lies in the summer rainfall region, and this makes its agriculture sector to be distinctive in South Africa. The province has a well-developed infrastructure which support the production stability.

Wallace (2015) indicates that the diversity of agro-climatic zones in the province allows for range of agricultural products. FOA (2014) argue that environmental degradation and conventional farming techniques are not suitable as they have negative impact on natural resources and the environment at large. Furthermore, FOA (2014) indicate that pesticides have chemicals that reduce biodiversity above and below the ground, resulting in loss of approximately 75% of crop genetic diversity. In the same vein, Bolan et al. (2014) corroborate that heavy reliance on chemicals in conventional farming leads to water pollution which have negative effects on natural resources and can be harmful to human health. Thus, increase exposure to synthetic pesticides leads to an increase in trace elements in vegetables. WWF (2010) indicates that tillage, one of the conventional farming techniques, is a leader in causing degradation of soil. United Nation's Food and Agriculture Organisation (2014) indicates that, one third of global farmland is degraded while fossil fuel burning, as in coal-fired electricity generation and diesel, emits carbon dioxide that contributes to climate change and pollutes the air.

Additionally, South Africa is experiencing a shortage of arable land. The country has only 69% of arable land suitable for grazing, and approximately 12% suitable for rain-fed agriculture (Goldblatty, 2010). These constraints are easily understandable when comparing South Africa with other countries in terms of arable surface area (see Table 1.1).

Table 0.1: Comparison of South Africa with other countries in terms of arable land

Country	**Arable surface area (hectare per person)**
South Africa	0.25
Russia	0.85
Argentina	0.95
Australia	2

Source: World Bank (2013).

Therefore, this gives those countries a competitive advantage over South Africa's agriculture products where there is an overlap, like livestock, wheat and maize production. In order to achieve sustainability in agriculture, the needs of present and future generation have to be addressed and also taking into consideration conservation of resources and profitability. Thus, the need to double food production by 2050 places pressure on the agriculture sector (UN, 2009). In light of the above, farmers in South Africa have limited choices and revert to innovative and sustainable farming practices in order to enhance their national and international competitiveness, conserving the environment and contributing to food security.

1.3 Problem statement

Agriculture plays a critical role in the economy, but there have been issues raised about the capacity of the agricultural sector to reduce poverty in rural areas and improve food security as well as to provide a stable source of income to small-scale farmers and rural population (Ngcoya et al., 2017). Although one of the major structural constraints facing small-scale farming in South Africa is the historical and political complexity of the land ownership marked by different forms of tenure systems and ownership (Mpandeli & Maponya, 2014). Loss of productive land due to unsustainable farming in rural communities is a major problem in the Limpopo province of South Africa. According to McCusker (2004), the then Department of Land Affairs promoted intensive agricultural production as the focus of rural transformation. This has had a negative effect on the environment whereby land is degraded by excessive use of fertilizers and tillage, thereby exposing the soil to erosion. This situation is worsened by the unsustainable use of land such as the conversion of cultivable land to pasture, removal of

indigenous trees, repeated use of artificial fertilizers and poor irrigation practices. As a result, the soil degrades thereby making small-scale farming problematic in most rural areas. However, Nieuwoudt (1990) also suggested that small-scale farmers may use land much more intensively than large-scale farmers, thereby contributing to existing environmental problems.

Small-scale farming may contribute to food security (Diao et al., 2007), job creation and poverty alleviation in rural areas (Rural Development Framework, 1997). Sikhweni & Hassan (2013) suggests that lack of access to land, water, and market are some of the challenges faced by small-scale farmers in the rural area that constrain them from generating income. Similarly, Mukwevho & Anim (2014) state that a major reason for farmers who are able to yield excess yet are trapped in poverty cycle is lack of access to profitable markets. If farming processes are well controlled, they can assist in preservation and restoration of important habitats, protect watersheds and improve soil health and water quality (Turpie et al., 2008). When farming is not conducted well, it creates a huge danger to species and ecosystems as well as productivity with soil and land degradation. Due to lack of knowledge in agriculture, inadequate farm management experience, poverty and absence of business management capabilities, small-scale farming may contribute to environmental problems. To this end, farmers' practices and perceptions of environmental problems associated with small-scale farming is critical to develop a sustainable solution to rural agriculture. This study, therefore, seeks to address the problem of land degradation in the Luvuvhu catchment in the Limpopo province of South Africa by exploring and understanding farmers' perceptions of land degradation.

1.4 Significance of the study

While agriculture has been stressed as significant for economic growth and poverty alleviation, many small-scale farmers have not recognised the need to align their agricultural operations with the concept of sustainability, particularly in terms of land preservation and soil health. The study seeks to construct recommendations that can be used by the provincial Department of Agriculture and Rural Development to better manage small-scale farming and prevent further land degradation. It is hoped that this study will promote empowerment of small-scale farmers into sustainable and competitive commercial farmers that can contribute to job opportunities, food security and reduction of poverty in rural areas without harming the environment.

1.5 Aim and objectives

The aim of this research is to explore the perceptions of small-scale farmers on the causes of land degradation in the Luvuvhu catchment, Limpopo province, South Africa. In line with the above-mentioned aims, the following specific objectives are put forward:

- To identify the perceived challenges faced by small-scale farmers in the catchment;
- To explore how socio-economic determinants, influence small-scale farmers perceptions in the catchment;
- To explore farmers' perceptions on the causes of land degradation in the catchment;
- To identify and assess traditional and modern adaptations and mitigation measures used by small-scale farmers to curb the problems of soil erosion leading to soil fertility loss;
- To recommend possible strategies that will assist small-scale farmers in their efforts to solve the problem of land degradations.

1.5.1 Research questions

- What are the perceived causes of land degradation in the Luvuvhu catchment?
- What are the perceived challenges faced by the small-scale farmers in the Luvuvhu catchment?
- How do the backgrounds, education levels and other demographics affect farmers' perceptions of land degradation?
- What are the various strategies used by farmers to address the problem of soil erosion and land degradation in the Luvuvhu catchment?
- What are the various traditional and modern adaptation as well as mitigation measures used by small-scale farmers to curb the effects of soil erosion, soil fertility loss and land degradation in the Luvuvhu catchment?
- What are the strategies that policy makers can use to assist small-scale farmers in their efforts to address land degradation in the Luvuvhu catchment?

1.6 Definition of key concepts

According to Kelly (2009), it is necessary to define key concepts. Terms used in this study are hereby defined:

- **Small-scale farming**: a non-commercial agricultural production solely used for household income. These types of operations are mostly found in the rural areas (Kirsten & Van Zyl, 1998).
- A **small-scale farmer** is one whose scale of operation is too small to attract the provision of the services he/she needs to be able to significantly increase his/her productivity. He/she produces food for home consumption and sells surplus produce to the market. This category of farmers is intermediate between subsistence and commercial (Kirsten & Van Zyl, 1998).
- **Land use** is defined as the sequence of operations carried out with the purpose to obtain goods and services from the land, can be characterized by the actual goods and services obtained as well as by the particular management interventions undertaken by the land users.

1.7 Outline and structure of the research

Chapter One provides an overall introduction, states the research problem, outlines the aim and objectives of the study, the significance of the study and definition of key terms. Chapter Two reviews literature related to the topic. Chapter Three gives a detailed description of the study area, sampling techniques used and statistical analysis. Chapter Four presents and discusses the research results. Chapter Five outlines the research conclusions and recommendations.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

The purpose of this chapter is to review the current literature on small-scale farming. It provides an insight into small-scale farming in South Africa and highlights the challenges faced by small-scale farming and the environment. Equally, the review provides some insight regarding farmer's perceptions of land degradation.

The role that agriculture plays in the economy of less developed nations cannot be overemphasized. In South Africa, small-scale agriculture is similar to that of other nations in Africa and particularly to sub-Sahara Africa when attempting to discuss small-scale farming and soil conservation measures (Andersson & D'Souza, 2014). However, South Africa's recent historical background introduced by the apartheid regime, prior to the introduction of democracy has impacted the country's agricultural systems. From the time of the inception of a new democratic era in South Africa, there has been a series of changes in the agricultural sector in terms of policy, practices and regulations to address the dual nature of agricultural systems with a well-developed, large-scale commercial farming and small-scale subsistence farming (Aliber & Hart, 2009; Baiphethi & Jacobs, 2009; Gbetibouo et al., 2010). The socio-political atmosphere during the apartheid regime manifested in previous agricultural policies persistently marginalised small-scale farmers by limiting their access to farm resources such as land, credit facilitation systems, water and technical support (Coetzee & Van Zyl, 1992; Kirsten & Van Zyl, 1998).

The post-apartheid period saw the emergence of small-scale farmers coupled with land reform policies instituted to contribute to rural development (Cousins, 2013). Taking into consideration the National Development Plan (NDP) and the need to address the Millennium Development Goals (MDGs), democratic South Africa's programmes and interventions promote agriculture, and particularly, small-scale farming (RSA, 2014). For instance, it is estimated that 20.7% of the households in the country are involved in agriculture, and of these households, 65% use agriculture purely as a subsistence strategy to meet household food demands (RSA, 2014). According to Zithutha (2010), small-scale farming is practised in mostly rural areas, with the primary aim of meeting the dietary needs of the family members and selling the surplus. Since its primary objective is for subsistence, cash crops (i.e., vegetables and fruit) are the main forms of produce. Even though this sector contributes to food security in many developing countries, the importance of the agricultural sector, especially in rural communities,

is limited due to low performance and its inability to sustain a livelihood over time (Mango et al., 2017). If care is not taken, the declining productivity will have a negative impact on livelihoods and food security of the rural population (Lemenih et al., 2008). Thus, small-scale farming needs to be promoted and practised in a sustainable manner.

Agriculture is critical due to its impact on increasing the well-being of the people and contribution to national economic growth and development. Agriculture plays multiple roles in the economy as it serves as a source of income and employment to the rural communities. The IAASTD report notes that "agriculture's contribution to rural communities' cohesion, through the maintenance of ecosystem services (e.g., water supply and purification, pollination, pest and disease regulation) and transformation of local economies" (IAASTD, 2009: 495). This highlights the significance of agricultural issues. Within agriculture, small-scale farmers are critically important to agricultural development through the use of indigenous knowledge and also their role in encouraging an ecologically balanced and socially just food system in less developed and developing countries (Altieri, 2004).

It is not easy to classify smallholders and family farmers in terms of common typology of attributes or components (Nagayets, 2005). Although its primary objective is to contribute to food security for poor households both in rural areas and urban areas (Baiphetti & Jacobs, 2009), and as such their productive and social structures often do not follow inflexible patterns. Furthermore, Baiphetti & Jacobs (2009) opine that smallholders and family farms differ according to the undertakings they engage in, the financial assets and resources available to them (such as land area and quality), water resources, animal stocks, infrastructure and machinery. They also differ according to land tenure, the type of contractual arrangements that can include among others (Baiphetti & Jacobs, 2009);

- Renting or share-cropping;
- The control of natural resources used;
- The scale of production;
- The share of family labour utilized (who in the family manages what and how);
- The extent and nature of wage labour employed;
- The degree of market integration;
- The distances of holdings from the family residence.

2.2 Farming in South Africa

When describing the farming sector in South Africa, it is worth stating that in the past, agriculture in South Africa was self-sufficient in the production of food (Baiphethi & Jacobs, 2009). The historical development of the agro-food system in South Africa arises from its distinctive historic past which saw the emergence of two distinct types of farming systems, namely, small-scale farming practiced in the former homelands (especially in Eastern Cape and KwaZula-Natal) and large-scale commercial farming which is dominated by white farmers (Okunlola et al., 2016). Large-scale commercial agriculture continues to dominate the sector and large-scale commercial sector produces about 95% of the agricultural output that occupies 87% of the total agricultural land as compared to small-scale farming (Alibert & Hart, 2009).

The democratic transition in 1994 was envisioned to amend the large inequalities in South Africa since as much as 84% of the land was at one time under the control of the white minority which instituted only 14% of the total population (McCuskey, 2004). This was accomplished by blurring the lines between commercial land and communal lands in the country. Small-scale farming was established in rural areas with a view of increasing and spreading household income where unemployment and poverty levels are high (Chamberlain et al., 2005). Because of the high unemployment rate in the rural population of the former homelands and a high poverty rate relative to the rest of the country (Vink & D`Haese, 2003), the emergence of small-scale farming became the best means of livelihood and food security. In an attempt to eradicate rural poverty effectively, there has been the establishment of programmes such as Comprehensive Agricultural Support Programme, the Pro-Land Acquisition Strategy and the Comprehensive Rural Development Programme by the Department of Rural Development. The introduction of Land Reforms as well and other initiatives such as Zero Hunger and Rural Mechanization Programme by the government is also aimed at stimulating large-scale food production in rural areas (Okunlola et al., 2016).

The World Bank (2008) indicates that small-scale farming is a major force for poverty reduction. This sector consists of two main sub-sectors, that is: smallholders consisting of self-employed farmers producing staple mainly for subsistence or semi-subsistence (that is selling the surplus to provide basic needs) and small-scale commercial farmers producing mainly for commercial purposes. Its importance in poverty alleviation in rural areas cannot be

overemphasized. As outlined by Machethe (2004), agriculture contributes to the reduction of poverty in rural areas, urban and national levels in four ways:

1. Reducing food prices;
2. Employment creation;
3. Increasing real wages;
4. Improving farm income.

Small-scale agriculture offers a livelihood foundation to the rural economy. According to Baiphethi & Jacobs (2009), small-scale farming has the potential to increase food security for poor households, both in rural and urban areas through increasing food provision. Lipton et al. (1996) found that small-scale farming has assisted in creating job opportunities and generate income in many less developed and developing nations.

The role of agriculture to improve food security is, in the simplest terms, multidimensional and multifaceted intertwined by the cultural, political, social and physical characteristic of the landscape. It continues to play a key role in providing formal employment and on-farm employment in rural areas. Particularly, gender practice in agriculture shows that female-headed households, especially in rural area, tend to contribute to food security as compared to male-headed households (Tibesigwa & Visser, 2015). Most often, rural subsistence agriculture has only portrayed a small segment of women involved in rural agriculture as most literature ignores the majority of women farmers in male-headed households (van Eerdewijk & Danielson, 2015). Although studies have demonstrated that the tenure system has tended to discriminate against women in land distribution and agricultural practices, nevertheless, gender bias in agriculture is more pronounced by the adoption of agriculture technology, use of heavy ploughing equipment, which continues to be widely debated (van Eerdewijk & Danielsen, 2015).

The agriculture sector in South Africa contributes meaningfully to the economy - nearly R58.2 billion or 2% to Gross Domestic Product (GDP) in 2012. The sector contributed approximately 7% to formal employment in 2013 thereby partially fulfilling its role of job creation. The jobs are mainly for unskilled labour (Department of Agriculture, Forestry and Fisheries, 2013). According to StatsSA (2007), in RSA, elementary workers make up 77% of the agricultural workforce, 22% of which are considered unskilled. Consequently, the sector has to ensure that there is food security for the country. Besides commercial-scale farming,

small holders and subsistence farmers contribute further to the economy (StatsSA, 2007). This is further discussed below.

2.3 Small-scale farming in South Africa

The concept of small-scale farming is sometimes used interchangeably with smallholders depending on the stakeholders (Nagayets, 2005). Baiphethi & Jacobs (2009), estimate that four million people are engaged in small-scale farming. Around 70% of the farming population in rural areas in Eastern Cape, Kwazulu-Natal, Mpumalanga and North West are comprised of small-scale farmers (Gbetibouo et al., 2010).

When trying to deliberate on the commercial viability of small-scale farmers, it is not clear on who to focus on. These farmers can be classified into the following groups: emergent farmers, subsistence farmers in the homelands, black farmers, small-scale white farmers, previously disadvantaged farmers, farmers on small pieces of land or farmers with a small turnover (Coetzee, 1998). This impasse shows the problem linked with the term "small-scale" farmer. Coetzee (1998) refers to this challenge when indicating that “small farmers” can be defined according to agricultural activity in whatever form they engage in. For this project, “small-scale farmers” refer to subsistence black farmers in Limpopo that rely on small-scale farming for their livelihoods.

Two surveys conducted in the Northern Province and KwaZulu-Natal support the point (Baydas & Graham, 1996; Outtara & Graham, 1996). The surveys were subdivided into two categories, namely small business and small farmer surveys. The findings of the surveys show that small-scale farming have little role to play in terms of income, although a major proportion of small farming, households (and small business households) cultivate the land and produce crops. Thus, very small proportions are sold, and the majority of the households are deficit producers (Van Zyl & Coetzee, 1990). Households which are regarded as small-scale farmers play diverse roles in various parts of the world. In the early stages of development in a country, small-scale farmers are drivers of the economy, as they create employment opportunities, contribute to food security and poverty reduction (Chikazunga & Paradza, 2013).

Besides land distribution and land inequality, there are multiple factors that influence the extent to which small holders in the economy (Deininger & Squire, 1998). The degree to which small-scale farmers provide a decent livelihood differs considerably and depends on land quality, water access, availability of public goods and closeness to markets and infrastructure

(such as roads). Furthermore, it is important to note that there are three marketing destinations for smallholder's farmers. These are the fresh produce market, informal market and the supermarket (Baiphethi & Jacobs, 2009). According to Anriquez & Bonomi (2007), the kind and importance of crop (or livestock) is also a factor; for example, a farmer producing high-value horticulture cannot accurately be compared with a farmer with the same size farm producing a staple crop largely or exclusively for home consumption.

Empirical evidence shows that small-scale farmers in less developed and developing countries are less efficient in terms of their production factors, access to credit, information and availability of market. This trend has also been observed in Asia, Latin America, and Africa (Ortmann & King, 2007). International experiences indicate that if given appropriate support, smallholder farmers have the potential to increase productivity and output. Rukuni & Eicher (1994) indicate that in Zimbabwe, small-scale farmers had doubled maize and cotton production in the 1980s when finance, extension and marketing services were provided. In support of this, training provision and availability of financial services through credit has the potential to increase the efficiency of resource-poor farmers (Mushunje & Belete, 2010).

Various studies corroborate the existence of an inverse relationship between farm size and efficiency in the use of resources, which reveals that an increase in farm size leads to a decrease in the efficiency of resources (Binswanger et al., 1993). "This relationship is basically due to higher efficiency of family labour as compared to hired labour, in combination with commonly observed imperfections in credit and land-rental markets" (Binswanger et al., 1993:337). Berry & Cline (1979) found that the value added per unit of invested capital for the second smallest farm size group (10 to 50 ha) exceeded that of the largest farm size groups (200 to 500 ha) in Brazil. At micro-level, evidence is available, but only with regard to physical yields, which is an imperfect indicator of efficiency (Prosterman & Riedinger, 1987).

Holloway et al. (2000) indicate that important roles of producer cooperatives (involving mutual assistance in working towards a common goal) are overcoming access barriers to assets, information, services and markets for high-value products. Their study investigated milk marketing of small-scale farmers in the East-African highlands and discovered that that cooperative selling institutions are potential catalysts for reducing transaction costs, stimulating entry into the market and promoting growth in rural communities. The increasing importance and changing nature of food grades and standards is a reason for the rise of cooperatives and contract farming in developing countries, particularly for perishables such as horticultural,

meat, dairy and fish products (Reardon & Barrett, 2000). In order to apply the grades and standards, investments in training, equipment, infrastructure and monitoring systems required and are afforded by big organizations. However, Cook (1995) also indicated that conventional cooperatives often do not invest in long-term assets (improvements) or in intangible assets (such as training and research).

Agricultural cooperatives operating in rural areas in South Africa have been unsuccessful in promoting development and economic welfare of members. Van der Walt (2005) carried out a study on cooperative failures in Limpopo Province. The findings of the study were poor management, lack of training, conflict among members, and lack of funds as reasons for poor success. These results were corroborated by Machete (2005) when researching on the causes of poor performance or failures of cooperatives. Qualitative study was undertaken where six cooperative members were interviewed. The following were identified as the major causes:

- The members' lack of identity with their cooperatives,
- Lack of understanding of their cooperatives' role
- Failure of cooperatives to involve members in policy decision-making,
- Failure of cooperatives to compete with other businesses,
- Inability of members to dismiss inefficient management,
- Failure of cooperatives to provide transport for delivery of members' purchases,
- Inability of cooperatives to keep adequate stocks of farming inputs, inability of cooperatives to provide sufficient credit and subsistence nature of agriculture.

Regardless of a decrease in contribution of agriculture sector in the economic development, the sector is still dominant in less developed and developing countries (Pederson, 2003). This comes from the importance of the sector in terms of its contribution to exports and employment opportunities for the poor rural communities, especially women. Improvements in the financial markets can be a key stimulus for accelerating agricultural productivity.

2.4 Challenges facing small-scale farming

From a global perspective, Africa is recently experiencing strong competition for fertile land especially in rural areas (where small hold farmers are mostly found), due to rapid increase in population (Jayne et al., 2014). In Africa, agriculture is mostly labour intensive as farmers rarely use advanced technology in farming; rather they use inadequate technology, such as hoes

and cutlasses (Aina, 2007). Farmers typically do not have adequate financing and are unable to invest in modern technology and farming machinery (Aina, 2007). Mapandeli & Maponya (2014) outline some of the challenges faced by rural farmers among others which include inadequate access to productive resources, the price of inputs such as herbicides and fertilizers, market access and cost of transport. This challenge tends to hinder rural farmer's agricultural development not only in the Limpopo province but also in other provinces in the country (Mpandeli, 2006).

In areas where there is poor vegetation and less resilient soils, soil erosion is still the core problem hindering agricultural productivity (Powlson et al., 2011). Soil erosion in Ethiopia, for example, has contributed to the existing problem of food insecurity has become a real threat to the sustainability of the country's predominantly small-scale and subsistence agricultural system (Bewket, 2011). Hence, the major causes of soil erosion are water and wind resulting from inappropriate tillage (Powlson et al., 2011). Often, the major cause of soil erosion is the cultivation of steep land because steep slopes are hard to cultivate (Bakker et al., 2004). The degree of soil erosion is aggravated by the clearing of permanent vegetation for repetitive farming of cropland or reduced by the re-establishment of natural vegetation and the land becomes covered by plant biomass. Pimentel (2006:119) notes "excessive irrigation increases soil salinity and washes pollutants and sediments into rivers, causing damage to freshwater ecosystems and species" (see also Zheng, 2006). This also affects those systems further downstream, including natural systems such as coral reefs and coastal fish breeding grounds (Pimentel, 2006; Zheng, 2006).

The introduction of conservative agriculture (CA) practices aims to improve agricultural output alongside preserving the environment. Conservative agriculture consists of a set of technologies which, when collectively used, are able to limit or revert many of the causes of unsustainable agricultural practices, such as soil erosion, soil organic matter decline, soil physical degradation and excessive pesticide and fuel use (Wall, 2007). However, this measure has fallen short in achieving its goal most probably because of ignorance and ineffective government support agencies or the extent of adoption of these technologies by farmers despite the technical performance of these CA practices (Felix et al., 2015). This explain why in South Africa, agricultural extension service is one of the main instruments used by Provincial Department of Agriculture to achieve its agricultural developmental goals through. This goal includes among other the provision of appropriate agricultural information and knowledge to enable and capacitate land users and farmers towards improved, sustainable and economic

development though agriculture extension officers. However, farmers are often blamed for poor adoption of extension services and success or failure is based on the level of adoption without considering the effectiveness of extension delivery mechanisms by the extension officers (Maoba, 2016)

This study, therefore, seeks to undertsand farmers perception to land depradation and how changes in land use pattern affect small-scale farming, by bringing on board stakeholders (including Non-Governmental Organizations promoting small-scale farming, communal heads and small-scale farmers) to gain an insight into current farming practices. A pre-recognition of farmer's knowledge was necessary to understand their perceptions to land degradations because of unsustainable practices.

2.5 Land degradation: A South Africa perspective

Land degradation is not a new concept in South Africa. Issues relating to land degradation can be traced back to early European settlers in the 18th century (Boardman et al., 2015). This came through the introduction of agriculture, specifically cattle rearing. This was later accentuated by the apartheid regime with two distinct land ownership that is: white-owned commercially farmed land and African-occupied farmed under a communal land tenure system (Meadows & Hoffman, 2002; 2003). It is worth stating that many rural communities (due to socio-political policy at the time) had to settle in areas of higher slopes and rainfall thereby accelerating the rate of erosion (Le Roux, 2011). Similarly, land degradation was further amplified by biophysical, climatic and land-use factors, and the associated interactions between them (Van der Merwe et al., 2000).

In South Africa, large areas are characterised by soil parent materials and geology that yield soils which are essentially exposed to different forms of land degradation such as crusting, compaction, and water and wind erosion. After erosion, the soils have very low resilience. This is aggravated by intermittent erosive rainfall (Meadows & Hoffman, 2003). Biggs et al. (2004) indicate that demographic and economic factors related to land policies and inappropriate use of land are major drivers of land degradation in South Africa, particularly in the former homelands. Biggs et al. (2004) further note that high unemployment, number of dependants per household, rural population and area of human settlements are the most socio-economic factors influencing land degradation in former homelands. Hoffman & Todd (2000) are of the view that land degradation in rural areas relate to overstocking in communal areas, while Boardman

et al. (2003) and Laker (2003) establish related challenges to commercial grazing systems in the Central Karoo to land degradation in the study area.

Its effect has attracted much attention from NGOs, researchers and government departments in the country. Critchley & Netshikovhela (1998) note that agricultural practices by the settled communities were frequently environmentally exploitative. Concern about soil depletion, shifting cultivation, overstocking and deforestation gave rise to awareness of different types of land degradation.

Although it is widely accepted that the different agents of physical processes lead to land degradation, it has been taking place very slowly in most natural environments, geological time and its accumulative impact on soil quality over time is very significant. Le Roux (2011) provides a comprehensive report of the severely affected provinces in South Africa putting the Eastern Cape as the most severely affected province to land degradation followed by Northern Cape, Limpopo, Mpumalanga, KwaZulu Natal, Western Cape, North West and Gauteng. It is evident from this that land degradation is a serious problem in the study area, considering its ranks as the third most severely degradable province. The Eastern Cape, KwaZulu-Natal and Limpopo have the highest level of soil and veld degradation, predominantly in former homeland areas (Boardman et al., 2012; 2016). However, perusal of literature suggests that there have not been such studies in understanding farmers' perceptions of land degradation in the province and to unravel the causes of land degradation which this study aims to better explore and understand.

2.6 The negative environmental impacts of small-scale farming

Although the benefit of small-scale farming is potentially immense, it will, however be misleading not to mention some setbacks associated with small-scale farming. Agriculture affects ecosystems through the provision of important habitats for many wild plant and animal species. This is particularly the situation for traditional farming areas that cultivate various species. Small-scale farming may influence biodiversity loss and habitats of various species (Shahid & Mohammad, 2013). The agricultural sector, globally, consumes about 70% of the planet's accessible freshwater (Clay, 2004). Unsustainable water use harms the environment by changing the water table and/or depleting groundwater supplies. Small-scale farming can have an impact on potential source of water supply (El-Swaify & Hurni, 1996). A study conducted

in Ethiopia revealed that the downslope users experience low water supply as a result of small-scale farming (Mekuria et al., 2009).

Topsoil is usually washed away by rain or blown away by wind as a result of clearing natural vegetation and also ploughing farmland (Tilman et al., 2002). This results in loss of soil fertility and increased degraded land. Soil washed away by rain or irrigation water can result in sedimentation of rivers, lakes and coastal areas. The problem is aggravated if there is no riparian vegetation remaining along the banks of rivers and other watercourses to hold the soil. The growing population, together with the rising demand for food and resources lead to gradual depletion of soil nutrients leading to soil erosion and reduces soil fertility. Consistent clearing and ploughing of exhausted existing soil will ultimately became infertile (Amisah et al., 2009).

Although fertilizers used in farming techniques are not directly toxic, however, their presence in freshwater and marine areas alters the various nutrient systems, and as a consequence, specific ecosystems species composition changes (Tilman et al., 2002). Their most dramatic outcome is eutrophication, causing an exponential growth of algae due to an overabundance of nutrients. This depletes the water of much needed dissolved oxygen, which in turn, devastates fish numbers and other aquatic life (Clay, 2004). The 2007 IPCC report indicates that agricultural actions are accountable for approximately 14% of global greenhouse gas emissions. Forests, a primary terrestrial sink of carbon, are cleared by small-scale farmers, contributing to climate change by the removal of these carbon sinks for cattle farming and agriculture. Thus, small-scale farming may disrupt the global carbon cycle and increase the concentration of atmospheric carbon dioxide (Houghton, 2005).

Agricultural crops have lost around 75% of their genetic diversity in the past century due to the extensive use of genetically uniform modern crops. The loss of genetic diversity reduces the potential for modern crops to adapt to or be bred for changing conditions and so directly threatens long-term food security; according to Shahid & Mohammad (2013). Although agriculture remains the backbone of most economies globally, there has however been concern about the ability of the sector to alleviate rural poverty and to provide food security as well as stable incomes to rural people and farmers in developed countries. These concerns have been raised because of farmers' perceptions in terms of farming and land degradation to bring about sustainable agriculture (Shahid & Mohammad, 2013).

2.7 Farmers' perception and causes of land degradation

Soil is one of the important natural resources that supports life on earth and plays an important role in humans and the environment. However, one cannot over-emphasise the pressures humans continue to exert on soil resources. Gelagay & Minale (2016) assert that soil erosion by water is the most widespread and occupies more than 56 % of land surface. Similarly, Moges & Taye (2017) point out that soil erosion is a result of overgrazing, continuous cultivation, deforestation and removal of crop and residue from field highly undermines the role of agriculture to alluvial poverty and food insecurity.

Although natural processes contribute to land degradation, it will be misleading not to state that human activities are the leading cause of land degradation over the last few decades. Human-induced activities such as fast population growth, insufficient attention to natural resources, over ploughing to maximize output and deforestation have triggered land degradation (Zegeye et al., 2010; Lanckriet et al., 2015). Felix et al. (2015) reveals that farmers perceive slope of the land, deforestation, improper farming practices, high intensities of rainfall and the absence of appropriate soil conservation measures as the main causes of soil erosion. Therefore, it becomes imperative to understand farmers' perceptions of land degradation if sustainable farming has to succeed, especially in rural areas. Farmers' perceptions of soil erosion will ultimately influence decision making processes which in turn will affect land management practices.

Farmers' knowledge should therefore be taken into consideration when implementing conservation measures, policy and recommendations in improving farming. Moges & Taye (2017) recently reveal that farmers were ignorant in decision making during selection, planning and implementation processes of soil and water conservation measures in Ethiopia (Tatlidil & Tatlidil, 2009; Zegeye et al., 2010). Consequently, any attempt to curb soil erosion were without success. This situation is exacerbated by the implementation of modern technologies in farming practices. It remains a challenge in Sub-Sahara Africa where farmers are not well adapted to meet up with recent developments but prefer rudimentary practices. For instance, Tatlidil & Tatlidil (2009) suggest land degradation is principally caused by improper use of farm machinery, fertilizers, pesticides and irrigation in addition to the lack of modern farmers' perceptions of the importance of sustainable agriculture. In addition, farmers' perception of soil erosion prevention by using local methods such constructing stone terraces and, where the stone

is not available, creating grass strips, were more effective in reducing soil loss and fertility in some parts of Venda, South Africa (Critchley & Netshikovhela, 1998).

Assefa & Rudolf (2014) assert that although farmers in Ethiopia were mindful of the problem of land degradation but did not bother to implement soil and water conservation measures because of technical problems. Apart from physicochemical characteristics of land degradation, socio-economic and political determinants such as land tenure and land reforms, education, and land managers' perspectives must reflect all aspects of land degradation process operating at varying different spatial and temporal scales (Reed et al., 2011; Lanckriet et al., 2014). Although land degradation occurs in three distinct states (chemical degradation, physical degradation and erosion) at a local level, it is related to past and present human activities such as land management, local capacity, demographics and biophysical activities such as rainfall, topography and biota and other geographical aspects (Orchard et al., 2017). Depending on the stakeholder involved (such as government, NGO's, land users, scientists) and the angle to which it is being perceived, land degradation should be judged independently of its spatial, economic, environment culture context and legal context.

1.8 Land degradation perceptions: international context and case studies

Farmers' perception of land degradation refers to the "perception to relationship and processes of soil erosion and fertility of the soil" (Belay, 2014: 224). Soil fertility depletion is mainly caused by continuous cropping, soil type and bushfires. Findings of Adégbidi et al. (1999) in the north of Benin indicate that the main causes of the decline in soil fertility are deforestation, over-exploitation, continuous cropping, bushfires, improper farming practice, high intensity rainfall and absence of appropriate soil conservation practices. If farmers identify land degradation as a challenge, the chances that they invest in soil management practices will be improved.

Adimassu et al. (2013) showed that Ethiopian farmers perceived water erosion and soil fertility depletion as the major drivers of land degradation. Farmers have their own perceptions in evaluating the problem, causes and consequence of land degradation soil erosion and soil fertility decline (Kassa et al., 2013). Farmers in Sidama area, southern Ethiopia can recognize soil erosion and fertility loss indicators. They have a broad knowledge of land degradation and its causes. They recognize land degradation through observing reduced yields, soil changing in appearance and becoming stony or coarse. According to Kassa et al. (2013), soil erosion

indicators include: soil becoming stony and coarse, rill formation, dissection of fields and gullies and topsoil removal. Furthermore, Kassa et al. (2013) identify the following indicators of soil fertility loss: reduced crop yield, poor crop performance and yellowing of the crop. Although farmers have knowledge of the perceived solutions, their participation in soil conservation activities is so little due to threat of food insecurity.

In order to address land degradation, any programme to be designed should consider farmers' understanding and knowledge of land degradation and should include training that gives guidelines on how to deal with it. While in Mozambique, the use and availability of tractor and machine power is minimal, so soil disturbance has been promoted largely through the use of manual "man-power," that is the hand hoes for digging basins and hand-drawn implements for ripping or direct planting. Alongside minimum and zero-tillage, conservation agriculture promotes mulching, mainly with crop residues and other sources of biomass, crop mixing, crop rotation, herbicide and inorganic fertilisers. Of late, efforts to promote more accessible practices such as integrated pest and weed management and organic fertilizers have also recently been developed (World Agroforestry Centre, 2013).

In the developing countries like Nigeria, where a large proportion of human population depends almost entirely on land resources for their sustenance, there is increasing competing demand for land utilization such as grazing, fish pond construction, quarrying, and crop farming amongst others. Local people can be major assets in reversing the trend towards land degradation (Eni et al., 2010). Other studies (Bewket & Sterk, 2002; Bekele & Drake, 2003; Gebremedhin & Swinton, 2003) have also revealed that farmers perceive land degradation through soil erosion and soil fertility depletion. Nederlof & Dangbegnon (2007) note that farmers' perceptions of land degradation vary from place to place and from household to household due to variations in socio-cultural, economic and biophysical conditions. In Osun-State, Nigeria, 69% of the farmers experienced a low level of crop and loss to land degradation due to erosion (Awoyinka et al., 2005). Agriculture in Benin is oriented more towards the satisfaction of market needs rather than long term sustainable farming. Particularly in southern Benin, population pressure has led to the reduction or elimination of natural shrubby fallow and development of marginal lands.

A study in South-Benin region to assess land degradation showed negative effect on land surface (Van der Pool et al., 1993 cited in Adegbola & Arouna, 2004). Soil depletion is also the most important issue for both farmers, researchers and extension services.

Nevertheless, seemingly, the nature and extent of land degradation are not easily understood. Various technological and institutional innovations that can address the challenge of land degradation have been developed, but they seem not generally successful as some farmers find them difficult to fully understand and implement (Wennink et al., 2000; Douthwaite et al., 2002). However, the farmers of the Sudanian zone of Benin perceive soil erosion through deforestation, slope, runoff, wildfire, animal trampling, gaps in land cover and inadequate land use practices for agriculture (Avakoudjo et al., 2011). But in southern Ethiopia (Moges & Holden, 2007), the most important perceived indicator of soil fertility loss is reduced crop yield, followed by poor crop performance and yellowing of the crop (plant colour).

Okoba & De Graaff (2005) pointed out for farmers in Kenya that soil erosion is due to major factors such as high rainfall, steep slopes, agricultural settlement, deforestation and run-off. Worldwide, the causes and factors suggested here were hitherto described in other areas. In Upper East Region of Ghana, the understanding of farmers on the causes of erosion were:

- high intensity of rainfall,
- inadequate vegetative cover,
- deforestation and
- lack of proper conservation methods (Fariya & Farida, 2015).

But, contrary to these results, Kenyan farmers did not perceive soil erosion as poor soil cover (de-vegetation) and tillage. Their level of education and membership of organization raise awareness of the farmers to land degradation problems (Awoyinka et al., 2005). In the Samanalawewa watershed (Sri Lanka), socioeconomic determinants of preventing soil erosion are, amongst others, education, membership of farmer's organization, agricultural extension training, household size, land tenure, farm labour and income (Udayakumara et al., 2010). Findings of Denboba (2005) showed that household head education, literacy and extension services determine significantly the farmers' perception on soil fertility decline.

In the context of high urbanization and lack of farming systems intensification, agricultural growth model on which the countries of Africa sub-Saharan are based, in more than a generation, is not sustainable over time. It led to a collapse of the soil productivity and accelerated degradation of natural resources (Blein et al., 2008; Simard-Rousseau, 2012). Donors, researchers and policy-makers in Southeast Asia in the past two decades were attracted to the issue of land degradation. Deforestation and soil erosion were recognized as the key

issues, which need to be solved and officially vindicated the development of new national policies and research programmes. The methods to solve deforestation soil erosion are the same in various countries. Policies were developed to eradicate of the shifting cultivation practices and the development of fixed cultivation, on uplands allocation, and on the implementation of ambitious reforestation programs nationwide. Considerable public efforts and funding for instance China has allotted US$1.7 billion (R30.6 billion) in subsidies for fast-growing plantations to be distributed by 2015.

2.9 Legal framework which governs land use in South Africa

In the framework of this project, this section highlights the legalities of land use in RSA. The Constitution of the Republic of South Africa (Section 24) states "that everyone has the right (a) to an environment that is not harmful to their health or well-being, and (b) to have the environment protected, for the benefit of present and future generations through reasonable legislative and other measures that (i) prevent pollution and ecological degradation (ii) promote conservation and (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development" (RSA, 1996).

The National Environmental Management Act (107 of 1998) is grounded on the principle that "everyone has the right to an environment that is not harmful to his/her health or wellbeing", an enabling environment that is free from the destruction and enforcement of other environmental management laws. The Environmental Code constitutes an 'umbrella' for the Planning and Building Act as well as other special laws that have an impact on the physical environment. The aim of the Environmental Code is to encourage sustainable development. It is to be applied so that:

- Human health and the environment are protected,
- Valuable natural and cultural environments are protected and managed,
- Biodiversity is preserved,
- Land, water and the physical environment are used so that a long-term good management is ensured from an ecological, social, cultural and social cost-benefit point of view; re-use and recycling are promoted so that a natural cycle is achieved.

The Mountain Catchment Areas Act (63 of 1970) provides for "conservation, use, management and control of land situated in mountain catchment areas and to provide for matters

incidental thereto." Land reform policies and legislation remain at a central point to this study when engaging with small-scale farmers in understanding land distribution and usage. Understanding these pieces of legislation will help provide a contextual background when dealing with the small-scale farmers. According to Greyling et al. (2015), agriculture and land reforms policies in South Africa post-Apartheid democracy remain at the center point in current debate for land redistribution and reforms but unfortunately, the state remains perplexed as inequality is still present within the South African agriculture sector.

1.10 The context of law

The Department of Agriculture Forestry and Fisheries (DAFF) is mainly accountable for legislation associated to the Agricultural sector. A number of acts and policy documents speak to the conservation of agricultural resources while promoting economic and social development (Department of Agriculture Forestry and Fisheries, 2014). Below are the legislations and their objectives.

Table 0.1: Legislations and their descriptions.

Legislation	Description
1. The Conservation of Agricultural Resources Act 43 of 1983	The main objectives of this act are to regulate the use of natural agricultural resources, conservation of soil, conservation of water sources and combating weeds and invader plants.
2. The National Development Plan 2030 (NDP, 2012)	The purpose of this act is to "eliminate poverty, reduce inequality and highlighting the importance of initiatives that link agriculture to the green economy".
3. The Agriculture Integrated Growth and Development Plan (IGDP, 2012)	The purpose of the IGDP is to ensure "equitable, productive, competitive, profitable and sustainable agriculture, forestry and fisheries sectors and to emphasise the sector's needs to benefit all South Africans".
4. The Agriculture Policy Action Plan (APAP, 2014)	The aim of the APAP is to ensure a programmatic response to key policy documents including the National Development Plan (NDP) and the New Growth Path (NGP).

5. Strategic Plan for the Department of Agriculture, Forestry and Fisheries (SPDAFF, 2013)	The SPDAFF aims to provide an operative framework to solve different problems confronting the sectors and developing targets for the departmental programmes from 2012 to 2017 and "building a leading, dynamic, united, prosperous and people-centred sector" (Department of Agriculture Forestry and Fisheries 2013). If this guideline is fully implemented such laws will have a spill over effect leading to an improved agricultural sector, even as those left behind in hinterlands practising agriculture will benefit, while new measurement tools allow agricultural researchers to target their work all the more precisely

These Acts, policies and plans showed major steps in improving and regulating the agricultural sector, as it became the platforms from which agricultural policies were adopted and were designated to promote small-scale farming which could have a greater impact on their operation. However, it is evident that these policies and plans do not have a major impact on small-scale farmers as they are treated under the commercial farmers' benefits.

2.11 Conclusion

This chapter has reviewed the current literature on small-scale farming. Different concepts related to small-scale farming in relation to land degradation were discussed by reviewing current trends at both local and international levels. Various challenges faced by small-scale farmers were discussed, and the probable negative effect of small-scale farming on the environment. However, this research also reviewed farmers' perceptions of small-scale farming and the legal framework that governs land in South Africa. The next chapter presents the research methodologies used in conducting this study.

CHAPTER THREE: RESEARCH METHODOLOGY AND STUDY AREA

3.1 Introduction

This chapter presents the research design and the approaches used. The data sources and the research design are described followed by the methods of investigation. The first section describes the study context in which the project was undertaken, and explains the research techniques used in this study, which include a questionnaire survey and field observations.

3.2 The study area

The study was conducted in Luvuvhu catchment area located in the Limpopo province of South Africa (Figure 3.1). The Luvuvhu River flows for about 200 km and its basin covers an area of 4,826 km^2. The river is located in the Limpopo province in the North-eastern part of South Africa and flows through a diverse range of landscape before it joins the Limpopo River near Pafuri in the Kruger National Park. The source of the Luvuvhu River is the Soutpansberg Mountains. It is located in the region 22º25’35” S, 31º18’25” E.

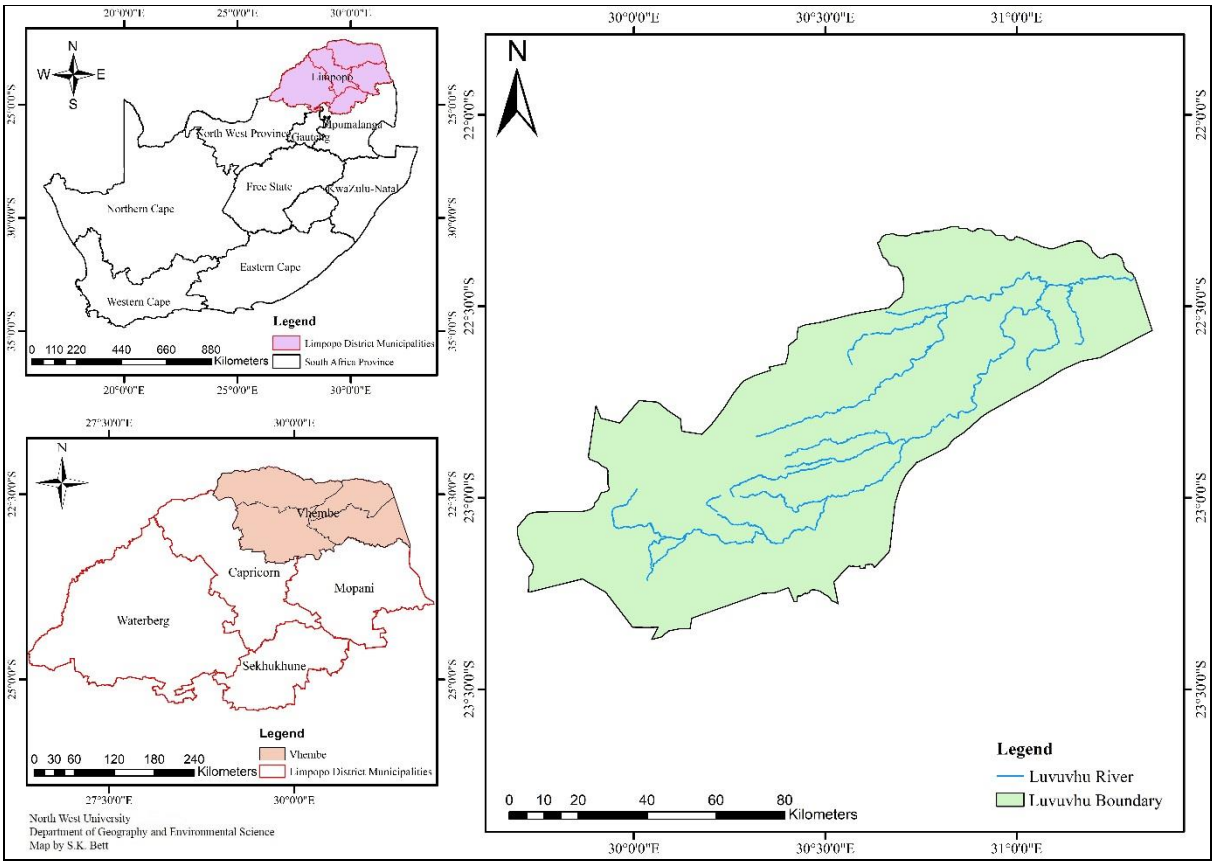

Figure 3.0:1: Study area, showing the Luvuvhu catchment.

The identify study area of the catchment lies on the eastern part that comprises of the rural communities of the area. The area is inhabited by the several communities, namely Mhinga, Shikundu, Makuneke, Dovheni, Gajanani and Lambani who practice small-scale farming. They typically plant maize in summer and other crops in winter. The study catchment is divided into three transects according to the land use types (cattle rearing, crops farming and abandoned land). Questionnaires were administered to small-scale farmers to understand their perception on the causes related to the problem of land degradation, the impacts it has on the affected farmers and the strategies employed to solve the problem. The following sections briefly describe the physical characteristics of the Luvuvhu River catchment as it plays a key role on the physical environment bringing about land degradation experience in the study area: the topography, climate, the geology, the vegetation, wildlife and ecology of the catchment basin.

3.2.1 Topography

The topography of the studied area varies from around 350 m to 1500 m above sea level (m.a.s.l) which impacts on rainfall and run-off distribution in the catchment. The greater depth of rainfall happens in the upper reaches where the Soutpansberg Mountains are situated, with less rainfall depths in the lower reaches around the Kruger National Park. The most important features of the basin are the Soutpansberg Mountains and the Luvuvhu River Gorge. The Luvuvhu River splits the basin into two and according to a report described by the DWAF (2003), the 56 km long Luvuvhu Gorge cuts through the sandstones of the eastern tip of the Soutpansberg. The topography varies from Soutpansberg Mountains in the northwest to the flat low-lying flood plains of the Limpopo River in the northeast. Elevations range from 1587 m.a.s.l. in the Soutpansberg Mountains in the northwest to 232 m.a.s.l at the Limpopo River confluence in the east. The marked change in topography gives rise to varied climatic conditions.

3.2.2 Climate

Luvuvhu River basin climatic conditions are influenced by the kind of topography in the region. The rainfall patterns range from low-rainfall, warmer regions in the north-eastern low veld of about 400 mm/a to high rainfall humid regions in the mountainous northwest with rainfall of about 1800 mm/a. The Luvuvhu catchment area experiences a mean annual

precipitation of around 608 mm with total evaporation ranging to 1678 mm and the natural mean annual runoff is estimated to be 250×10^6 m^3 (Jewitt & Garratt, 2004). The rainfall distribution throughout the year is highly seasonal in nature. The area usually receives its rainfall mostly in summer, with peak rainfall occurring in the December to February period. The lower rainfall regions in the catchment normally experience more variability as compared to higher rainfall areas.

There is an increase in temperature as one moves from the mountains in the west to the plains in the east of the basin. At Makhado, the normal summer everyday temperature is roughly 21°C. The usual winter daily temperature is approximately 15°C. In the central basin (Luvuvhu and Gouldville) the temperatures are roughly 2°C higher and in the lower basin (Punda Maria) temperatures are also approximately 4°C higher (Jewitt & Garrat, 2004).

3.2.3 Geology

The geology of the Luvuvhu River Basin covers the regional physical geology and geological structure, engineering geology, seismicity, the minerals and mines within the basin and mineral claims and leases. The physical geology comprises three main groups of rock, namely, the Basement Rocks, the Soutpansberg Group and the Karoo Sequence (DWA, 2012). Furthermore, the DWA (2012) indicates that these groups are further sub-divided into a number of sub-formations. The basement rocks are mainly granitoid gneisses and underlie most of the upper 80 km length of the basin. They form the lowveld area to the south of the Soutpansberg. The Luvuvhu River cuts through the mountainous area of the Soutpansberg Group of rocks between 80 km and 135 km downstream of its source. The rocks consist of interlayered conglomerates, sandstones, quartzites, shales and basalt. The Karoo Sequence comprising sandstone, shale, grit, conglomerate and basalt underlies the last 35 km of the river basin. Seismicity does not appear to be a problem in the basin, but individual verification would be necessary as part of the detail design of dams. Some of the minerals that occur in the basin include coal, copper, cobalt, corundum, phosphate and vermiculite. The geological features of the minerals around the basin are significant as they have given rise to diverse economic activity associated with mining. (DWA, 2012).

3.2.4 Vegetation, wildlife and ecology

The most common veld types are Mopane Forest, Dry Ironwood Forest, Tree Arid Sweetveld and Savannah (with bushveld dominating) but is rapidly undergoing changes to to

encroached anthropoenci activities (Griscom, 2010). The veld around the basin is in an excellent condition and there are slight signs of erosion. The ecology of the Luvuvhu River Basin is measured in terms of the Upper Basin, the Central Basin, the Lower Basin and the Luvuvhu River. Moreover, the Upper Basin is developed to a large extent by the influence of afforestation and crop irrigation. The dynamic forces of the ecosystem have been significantly changed from the natural state. The Central Basin is the one which is most likely to be affected by dramatic ecological change. The Lower Basin is a wilderness area of great ecological diversity. This diversity is in part responsible for the ecological stability of the area under the variable conditions of rainfall, as described by DWA (2012). Jewitt & Garratt (2004) asserts that the Luvuvhu River is changing, from being a perennial to a more static one, wherein the yearly systems and components are fading. The overall development is the movement towards anoxic conditions and nutrients are not moved downstream. Large wild animals are almost exclusively confined to within the Kruger National Park boundary and surrounding private game parks.

3.2.5 Land use

Five major land use types can be identified in the Luvuvhu catchment. Commercial forestry estates occupy 4% of the area, subsistence agriculture and grazing occupy 50% of the area, cultivated lands (including irrigated occupy 13% of the area, protected game reserve area occupies 30% and urban area is made up of 3% of the total land use in the catchment (Jewitt & Garratt, 2004). Land cover in the southern highlands of the Luvuvhu catchment is dominated by exotic tree plantations of pines and eucalyptus. According to a report by the DWAF (2002), ground water in the catchment is extensively over exploited due to irrigation schemes particularly around Albasini dam and Thohoyandou. This is linked to human population growth likely contribute to observed reductions in winter base flows and increased events of dry rivers within the Kruger National Park. Forestry happens in the high rainfall mountainous areas, while intensive tropical fruit and vegetable farming is performed where rainfall is good, and irrigation can support agricultural watering (Jewitt et al., 2004). These changes in upstream land uses and resulting alterations in the movement of water through vegetation impacts on the downstream flow of water.

The basin's main agriculture consists of dry land, irrigation and livestock farming. There is also a limited amount of game farming that takes place within the area. A rich diversity of agricultural output is found resulting from the existence of a wide range of climatic conditions.

In the upper reaches of the river are farm dams which are used for irrigation purposes. The central basin has primarily subsistence farming on dry land. Run-off storage, river and borehole irrigation is also widely practised. There exist a number of well-established irrigation schemes due to movement of water through the landscape. In the upper south-western portion of the basin, the crops produced are primarily subtropical fruit (such as bananas, mangoes, litchis, pawpaw, and various nuts; Hope et al., 2004). The area has variety of livestock, which includes cattle, sheep and goats. Animal husbandry ranges from the traditional pastoral type to stud farming. Forestry in the basin covers 14600 hectares, which does influence the catchment hydrology (Hope et al., 2004).

3.3 Methodology

3.3.1 Population and sampling

This section provides comprehensive details of the research methodology used for this study. The population of this study comprised all the small-scale farmers that were of interest to the research and to which the researcher intended to generate results from the study (Andrew et al., 2011). The inclusion criteria for the study population was based on small-scale farmers while the exclusion criteria were the commercial farmers. Diggines & Wild (2013) note that population is the entire set of relevant units of analysis from which a research information is needed for analysis. Hennink et al. (2011) remarks that the unit of analysis for a study should focus on participants who have particular knowledge and experience as they can better contribute to a greater understanding of the phenomenon being studied. Hence, the study comprises of small-scale farmers and agricultural extension officers.

3.3.1.1 Pre-visit survey

A pre-visit was arranged with the tribal authorities in the study area following the procedure of Mpandeli & Maponya (2014). The objective of the pre-visit survey was to meet with the various traditional leaders such as headman, chiefs and civil organisation in the area. The aim was to establish the purpose of the survey and the content of the intended research was to present the researcher to the traditional leaders and to look for consent to conduct research work with them and lastly, to meet with the agricultural officials responsible for the area alongside the communities.

3.3.2 Sampling

Maree (2010) defines sampling as a process used in choosing a portion of the population for the study. Similarly, Daniel (2012) describes sampling as the procedure for drawing units of analysis or participants from a population for inclusion in a study. This study adopted non-probability sampling which allows judgments either purposefully and or intentionally (Bickman & Rog, 2008). The sampling strategy targeted only farmers practising small-scale farming using a purposive sampling technique. During the pre-visit survey, it was observed that there were approximately 1000 small-scale farmers practising farming in the catchment. The researcher, therefore, adopted a nonprobabilistic sample in order to acquire the richest potential source of information to answer the research questions.

The researcher selected only those farmers who practised small-scale farming using households represented by their heads. After the researcher had identified the population of interest for the study, at this scale (with the objective to sample all the small-scale farmers) the researcher then opted to use a snow-ball sampling technique. According to Cohen & Arieli (2011), snowball sampling is used commonly to locate, access and involves people from a specific population where one subject gives the researcher information on the other subject who in turn provides information on the third and the process continues until the targeted population of interest is attained. Therefore, applying this technique, 101 small-scale farmers were identified to constitute the sampling size, representing around 10% of the population in question.

3.4 Data collection instruments

3.4.1 Questionnaires

Questionnaires were the instrument used for data collection in this study. The questionnaires were self-administered to farmers currently practicing small-scale farming. As De Vos et al. (2002) maintain that, the basic objective of a questionnaire is to obtain facts and opinion about the phenomenon from the people who are well informed on the subject matter. Semi-structured questionnaires were self-administered to farmers to gauge their understanding of environmental degradation due to small-scale farming. In line with Marshall & Rossman (2006), when using a questionnaire, the researcher relies on the honesty and accuracy of the participant's response. Data used in the questionnaires consisted of variables such as demographic and socio-economical characteristics of farming, perceptions of land degradation

and their causes (see appendix 1 for the questionnaires used for this study). The response rate was 100% since all the 101 questionnaires were returned.

3.4.1.1 Reasons for questionnaire to be used in this study

The study deemed it necessary to use questionnaires as one the instruments for data collection alongside a survey (field visit) based on the following reasons (Maree & Pieterson, 2006):

- It is easy and quick to answer by respondents
- Answers are easy to code using SPSS (Statistical Package for the Social Sciences) and analyse
- It makes it easier to compare answers from the respondents to the same questions asked
- It has a rapid turnover rate and respondents are likely to answer sensitive questions
- Questionnaire is relatively cheap and easy to administer

However, the researcher had to deal with some challenges while administering the questionnaires since some respondents had no knowledge on how to answer the questions with some clerical mistakes or marking of wrong answers. This necessitated the researcher to make follow-ups and guide the respondents on how to answer the questionnaires correctly.

3.4.2 Field observations

Field visits in the study area provided a chance to the observed and appraised farming-related challenges associated with land degradation leading to biodiversity loss, and loss of arable land due to intensive farming. It also provided the researcher an opportunity to comprehend in situ the harshness of the phenomenon met by farmers and to suggest approaches to be implemented in order to resolve the challenge. During the field visit, prepared checklist was used to guide the research (see appendix 3) and where possible, additional information elicited from the respondents through oral testimony was recorded in a notepad.

3.5 Data analysis

Data generated from the semi-structured questionnaires was analysed quantitatively using SPSS version 22.1 to generate descriptive statistics. Tables and graphs were compiled to illustrate the distribution of the data using MS Excel and Word 2013. Two-way frequency tables were computed for the biographical and socio-economical status of respondents (Section A of

the questionnaires). The second section deals with farmers perceptions of land degradation. The aim was to understand the level of farmers' perceptions and their determinants in order to make possible recommendations specifically address the study aim and objectives. The researcher also ensured that data collected could be extrapolated to the whole population or to draw conclusions about the entire population, thus, inferential statistics was used for this purpose (Maree & Pietersen, 2007).

3.6 Reliability and validity

Reliability and validity are essential components when doing quantitative research. It is therefore important for the researchers to maintain a respectable level of reliability and validity of the measuring instrument (Coe et al., 2017). According to Khalid et al. (2012), reliability and validity examine the fitness of measure of a research instrument. Survey instruments were checked for its reliability and validity by carrying out a pilot study first. However, if an instrument is unreliable, it is also invalid because accurate findings cannot be obtained from inconsistent data (Coe et al., 2017). Reliability is also considered as the degree to which the measuring instruments are free from random error and therefore give consistent results by indicating internal consistency of the measurement (Khalid et al., 2012). Siniscalco & Auriat (2005) promote that measuring instruments are said to be reliable if different researchers can test them at different times and obtain consistent or similar results if administered to another similar population. For the purpose of the present study, the researcher adapted the questionnaire to ensure that the validity could be justified.

In order to remove any ambiguity, biasness and make the instrument reliable, a pilot study was conducted on 24 respondents practising small-scale farming. These respondents however, did not participate in the main study and did not form part of the study sample.

Validity refers to the certainty that it tells about the subject or phenomenon being studied (Saunders et al., 2009). De Vos et al. (2008) argue that within the definition of validity, two aspects need to be addressed: that the instrument actually measures the concept in question and that the concept is measured accurately. The questionnaire aimed to elicit perceptions and attitudes, and it was underpinned by theoretical expectations, but it is acknowledged that certain questions are scenario-based and measure a personal perception based on that specific scenario. The validity of the measuring instrument for this study was enhanced through the inputs of the

officials from the Departments of Agriculture who were involved as well as those of the research promoters who examined each item of the questionnaires.

Reliability can be seriously imperilled by poorly worded and imprecise questions. However, as explained by Salkind (2014), the researcher also increased the reliability of the questionnaire by applying the following:

- Selecting a larger sample of the population to make the sample more representative and reliable.
- Eliminating items that are unclear and ambiguous because participants may respond to them differently at different times.
- Respondents were given enough time limit to avoid guessing or quitting (Coe et al., 2017).
- Standardising the conditions under which the test was being taken and moderate the degree of difficulty of the test to reflect the accurate picture of what was being investigated.

However, a high level of reliability is important but does not guarantee that the resulting scores have some reasonable level of validity (Coe et al., 2017).

3.7 Ethical aspects of the research

This study was cleared by the University of South Africa Ethical Committee for the fulfillment of the requirements for the degree. It was important for this project to ensure that all those who took part in responding to the questionnaires were fully clear on the ethical issues. In this regard, the researcher formally obtained ethical clearance for this research project from Unisa (Reference number: 2017/CAES/050 - see appendix 3), and a written permission from the Department of Agriculture and Rural Development (refer Appendix 4). The researcher did not to engage in dishonest behaviour when conducting research such as making respondents uncomfortable, coercing respondents to take part in the research or exposing respondents to harm either psychologically or physically by observing all ethical issues in conducting this study and complying with ethical demands (Coleman & Briggs, 2002; Leedy & Ormrod, 2010; Struwig & Stead, 2010). The researcher further ensured that the participants knew about the aim of the research. Anonymity was fully respected, and respondents did not have to give their

names. Informed consent was equally ensured by allowing the respondents to withdraw at any time from the research.

3.8 Conclusion

The chapter presented the empirical aspects of the study by describing the research design and instrument used in collecting data as well as how the data were analysed. Ethical aspects of the study were covered, and the next chapter presents the findings from the questionnaire, and observation.

CHAPTER FOUR: RESULTS AND OBSERVATIONS

4.1 Introduction

This chapter presents the results of the investigation on the perceptions of small-scale farmers to land degradation. The results are presented in the form of tables reflecting the frequencies and percentages of responses reflected in the questionnaire in order to contextualize the research findings of the questionnaire. For the sake of summary and ease of comparison of data, the item numbers in the tables correspond to the item numbers as assigned in the questionnaire (See appendix A). Section A presents the demographic characteristics of respondents. Section B focuses on socio-economical determinants of the respondents and Section C explores the perceived challenges faced by the small-scale farmers in the catchment. Section D explores the perceived causes of land degradation in the catchment and Section E deals with measures of how to solve the problem of land degradation. An interpretation of data is given, however, the discussion does not follow each question item in the table but rather, a summarised version of highlights of the table. The detailed discussion on these results will be presented in the chapter that follows.

4.2 Section A: Demographic characteristics of respondents

This section presents the results about the demographic characteristics of respondents in the study. The demographic data was necessary to explore gender composition, marital status and age groups of the respondents. Explaining each of these attributes is crucial in understanding on-going adaptation to changes in the natural environments and management decisions being influenced by gender, age and household members. A better understanding of how they perceive what causes land degradation in the area, and how these perceptions are being reinforced through both ages and gender are important in promoting successful agricultural sector.

4.2.1 Gender

It was important to understand the gender composition of the sampled population as shown in Figure 4.1. The results indicate that males dominate slightly in small-scale farming representing 52% of the respondents as compared to female respondents representing 48%. This indicates a slight difference in terms of gender distribution, revealing that there is some gender equality between male and female in small-scale farmers in the catchment.

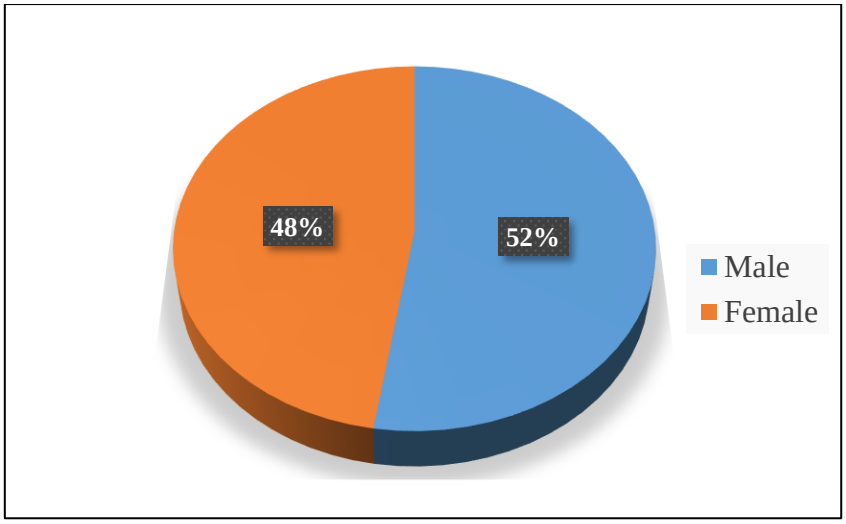

Figure 0:1: Gender of the respondents

Figure 4.2 below depicts the marital status of the respondents. This information enabled the researcher to ascertain the family structure in terms of small-scale farming. This was important in two ways; firstly, in understanding the role that families play in agriculture, whether the farming was purely for subsistence, and whether they sell surplus to buy necessities. Marital status may also influence decision-making processes in the household. Results indicate that 88 respondents indicated that they were married while only 13 respondents were single.

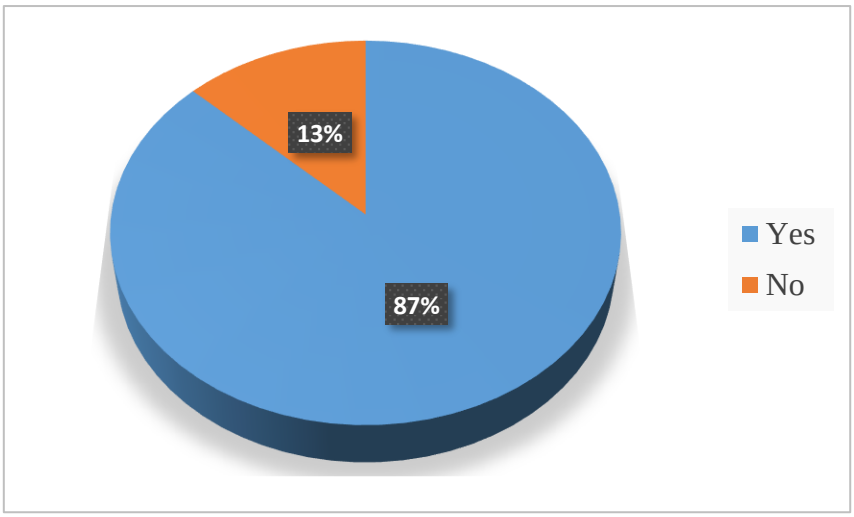

Figure 0:2: Marital status of respondents

4.2.2 Age

Figure 4.3 below reveals the different age groups of the respondents as it will help understand the studied population structure and composition. With reference to age groups, the largest group of the respondents ranges from 51-60 years, with a percentage of 50.5% followed

by those above 60 years old having a percentage of 29.7% and those between 31-40 years (1%) and 20-30 years (4%) represent a lesser percentage respectively. Meanwhile, those from 41-50 years represent 14.8%. This, therefore, signifies that the youthful (active population) population who are supposed to be the driving force to the economy are less engaged in farming activities as compared to the old adult (that is those 50 and above) years. This might be highly influenced by the rural-urban exodus of youth searching for 'greener pastures' in the big cities which is evidence of high rural poverty. Projections suggest that 75% of those residing in the rural areas consume less than one dollar a day (Mendola, 2006) thus, explaining the case of the study area. Notwithstanding, the higher percentage between 51-60 years and those above 60 years could equally signify that these populations consider farming as a source of employment and subsistence after retirement. However, the lesser engagement of the youthful population in agriculture could also be because these youths aspire for white-collar jobs rather than engaging in farming as a source of employment.

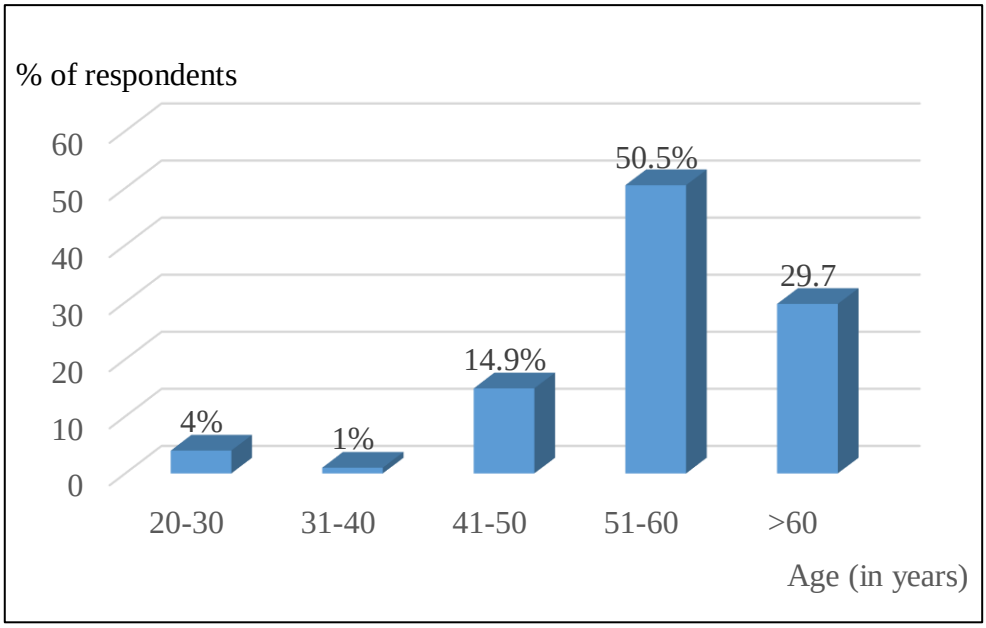

Figure 0:3: Age groups of the respondents

4.3 Section B: Socio-economical determinants of respondents

In order to understand the socio-economical characteristics of the respondents, items on the questionnaires explored whether the respondents were employed and if they consider farming as a source of employment. It has been recognised that agriculture contributes to poverty alleviation at rural employment creation (Machethe, 2004). However, it was important to determine if the respondents were formally employed or not. This was critical to the study to

determine whether farming was carried out on a part-time basis to complement food shortage, as a hobby or as a direct source of living as indicated in Figure 4.4. It is clear from the results that majority of the respondents (92%) were not formally employed, nor employed in any corporate organisation and only 8% of the respondents indicated that they were formally employed.

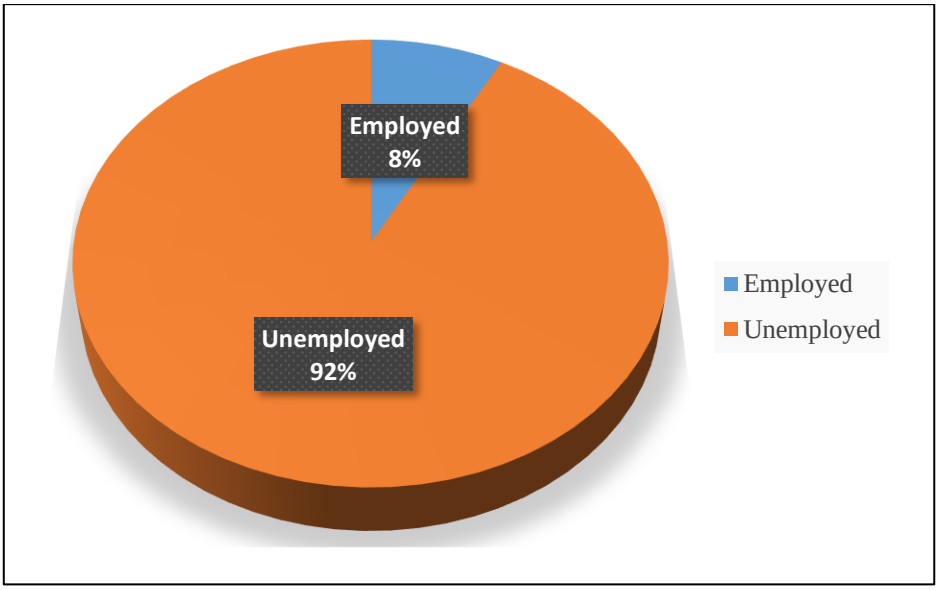

Figure 0:4: Employment status of respondents

High levels of unemployment are significant in relating to the importance of agriculture and its effects on the lives of the population in general. Moreover, after having determined that the majority of the sample population were unemployed, it was important to understand the respondents' perceptions on whether they consider farming as a source of employment to provide the basis for which this activity could improve the sector as shown in Figure 4.5.

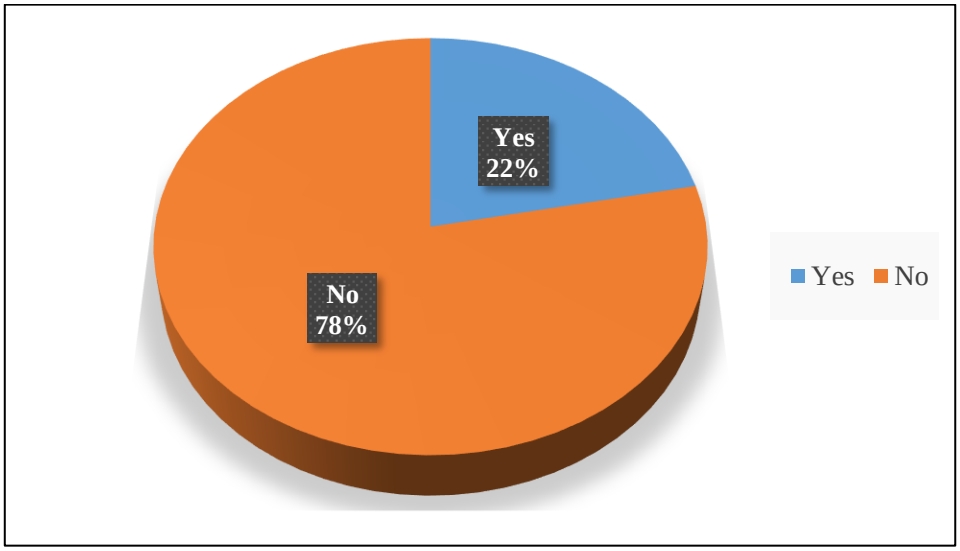

Figure 0:5: Farming as source of employment

The results from the respondents indicate that 78% of the respondents did not consider farming as formal employment as compared to 22% who consider farming as formal employment. Since most of the respondents did not consider farming as a direct source of employment, the researcher therefore sought to find out the respondents' range of income as non-farming source of income as indicated in Table 4.1. The results confirm the state of employment by the farmers.

Table 0.1: Respondents' monthly income range per month

Monthly income	**Percentage (%)**
No stable monthly income	89.1
< R2500	5.9
R5000-7500	3
R7500-10000	1
>R10000	1
Total	100

The findings from Table 4.1 indicate that a greater percentage (89.1%) of the respondent did not have any monthly income as it is linked to unemployment observed on the study area, while only 5.9% of the respondents receive a monthly income of less than R2500 per month. Three respondents indicated that they earn a monthly income ranging between R5000-7500 while only one respondent each indicated that they earn a monthly income ranging between R7500-10000 and more than R10000 respectively. These findings therefore confirm those earlier indicated in Figure 4.4. These findings, however, contradict that of Simbi & Aliber (2000) who found that agriculture plays a major role in providing formal employment. Considering the fact that agriculture is considered as a driver to reduce unemployment in rural areas (Machethe, 2004), it was expected that agriculture-related activities provide most of the employment in the rural area. This also means that small-scale farming does not have any significant positive impact on poverty reduction in the study area. Therefore, this indicates that the respondents perceive employment simply as white-collar jobs and not agriculture.

Having considered this, the next step was to find out if the respondents were full-time farmers or not (indicated in Figure 4.6) as it will provide a clue into their perceived observed problems related to land degradations. This was important in two dimensions: First, as a link to unravel the reasons for the respondents to practise farming, whether for subsistence,

commercial or both subsistence and commercial purposes. Secondly, to provide insight on whether other basic needs could be met by practising farming.

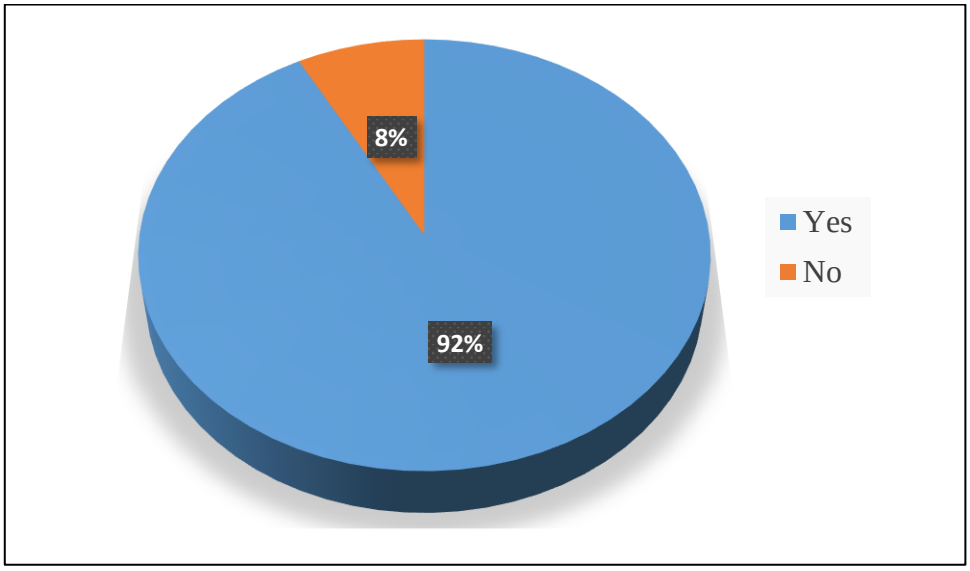

Figure 0:6: Respondents' farming status. Are you a full-time farmer?

The findings indicate that the greater proportion of the respondents (92%) were full-time farmers. This highlights the importance of farming in the Luvuvhu catchment but contradicts the question whether farming was a source of employment or not thus indicating that the farmers' overall perceptions on small-scale farming as employment. However, the researcher wanted to find out if the respondents had another source of income apart from farming as indicated in Figure 4.7. This will indirectly provide a better understanding of farmers' perception to farming as a source of employment and the contradictions thereof.

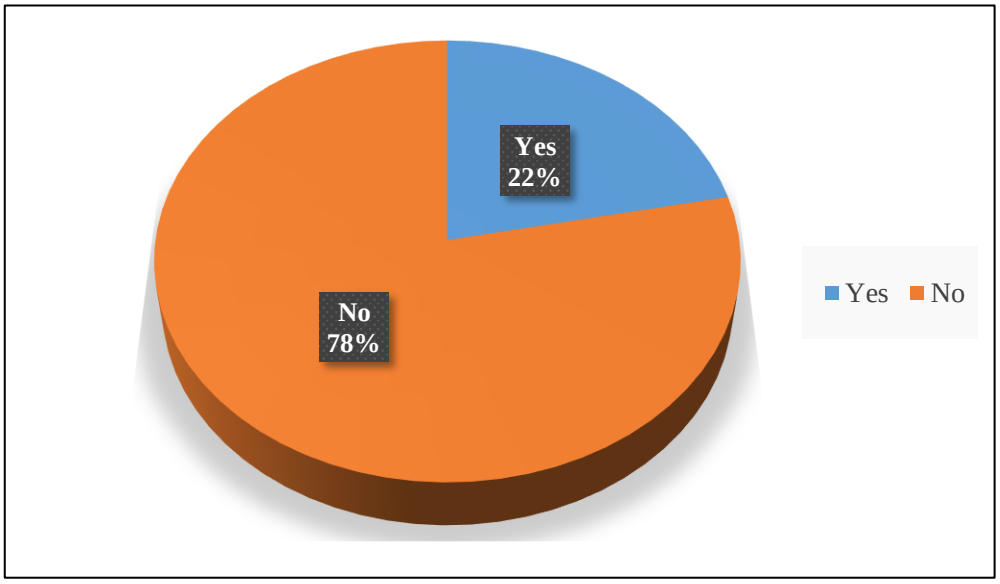

Figure 0:7: Source of income except farming

A total 79 respondents indicated that they do not have any other source of income as compared to the remaining respondents who had another source of income apart from farming. With the majority of the respondents not having any other source of income, it was obvious that their most direct source of income could be farming, thereby confirming that farming can be considered as a source of employment. For instance, the household survey conducted by StatsSA (2000) states that on-farm employment is the most important source of work in rural areas, especially for black Africans and Coloureds. Although most respondents do not consider farming to be a form of employment, it is evident that the majority of the respondents depend solely on farming as their source of income. This then gave the researcher impetus to find out from the respondents the reasons for farming (see Table 4.2 below).

Table 0.2: Respondents' reasons for farming

Reasons for farming	**Percentage (%)**
Subsistence	27
Commercial	1
Both	72
Total	100

According to Table 4.2, 72% indicate that they practise farming for both subsistence and commercial purposes followed by 27% respondents who practise farming only for subsistence and only 1% of the respondent's practice farming only for commercial purpose. These results verify the importance of farming as a source of livelihoods: food security and poverty alleviation in rural areas (Tibesigwa & Visser, 2015). According to RSA (2014), an estimate of 65% of households who engage in agriculture use agriculture mainly for subsistence purpose to meet household food demands. Agriculture in rural areas has the potential to uplift the population income (Machethe, 2004). As such, the respondents were asked who their potential buyers were for commercial purposes. These provide insight into their commercial operation as indicated in Table 4.3.

Table 0.3: Respondents' potential buyers

Potential buyers	**Percentage (%)**
Small-scale retailers	3
Middle-scale retailers	6
Large-scale retailers	2
Local buyers	82
Friends and relatives	5
Others	2
Total	100

The results indicate that a greater majority of the respondents' (82%) potential buyers were local buyers, while a smaller percentage comprised various sized retailers with the remaining 15% comprised of friends, relatives and large-scale retailers. Note that large scale retailers only contribute 2%. To corroborate these findings, the researcher asked the respondents the location of the farms. This was to ascertain if the buyers were indeed locals and to establish the sphere of influence of the market. Results from Table 4.4 show that 87.1% respondents indicated that their farms are located in the villages, followed by 10.9% respondents who indicated that their farms are in semi-rural areas and only two respondents indicated that their farms are located within the township. This, therefore, signifies that there is a ready market for farm produce from local residents from nearby villages where farming takes place as indcated in Table 4.4.

Table 0.4: Location of farms

Situation of Farm	**Percentage**
Township	2
Village	87.1
Semi-rural areas	10.9
Total	**100**

Similarly, Mpandeli & Maponya (2014) note that the majority of farmers in the Tshakhuma area in the Limpopo province sell their produce to the local buyers in the market area including friends and relatives. It was imperative to know how often farmers supply their customers. This would help the researcher to understand seasonal variability in crop production and the income of farmers as illustrated in Table 4.5.

Table 0.5: Buyers' supply schedule

Buyers' supply schedule	**Percentage (%)**
Once a year	74
Twice a year	19
Once in three years	1
None of the above	6
Total	100

Results according to Table 4.5 indicate that most of the respondents (74%) attested that they supply their customers once a year as compared to only 19% who indicated that they supply their customers twice a year. Only one farmer indicated that he supplies his customers once every after three years and six indicated none of the above. This implies that most of the farming activities are yearly-based cash crops and staple crop production. In subsistence farming, surplus produce is usually sold to provide for the basic family needs. This implies that, the farmers annual produce were on a yearly basis and could not have had a greater impact on soil degradation because less continuous ploughing.

Literacy rate plays an important role in the level of the farmers' perceptions in the overall understanding of land degradation. A study by Denboba (2005) highlights that when the head of the household is educated or literate, it significantly influences their perception on soil fertility decline and their ability to determine soil fertility loss from different socio-physical indicators. The respondents were requested to indicate their qualifications and the results are shown in Table 4.6.

Table 0.6: Qualifications of respondents

Qualifications	**Percentage (%)**
Matric	35.6
Diploma	2
BSc (Hons)	1
Master	1
Doctoral	1
Other	59.4
Total	100

The results show that the majority of the respondents have not attained any form of tertiary education. The table above clearly shows that 59.4% of the respondents have certificates that did not fall within the academic line listed above, nor did they provide the equivalent when asked to specify, and only 35.6% asserted that they have matric certificate. Also, two respondents have diplomas; one has a BSc (Hons), one is the holder of a Master's degree and one has a Doctorate degree. Although the majority of the respondents have had some form of basic education, it, however, shows that most of the respondents have not had any tertiary education, which, as a result, might negatively affect their involvement in farming as well as their perceived knowledge on issues relating to land degradation. Similarly, Denboba (2005) asserted that household head education, literacy and extension services determine significantly the farmers' perception of land degradation and their ability rehabilitate land and address the loss of soil fertility. During the discussions with the respondents, a question was asked in order to establish if the farmers had undergone any other form of training in agriculture activities. This was to shed light in terms of modern and traditional soil conservation measures which are adopted to land degradation. Therefore, one of the items on the questionnaire read thus 'Do you have education in agriculture?' The results are indicated in Figure 4.8 below.

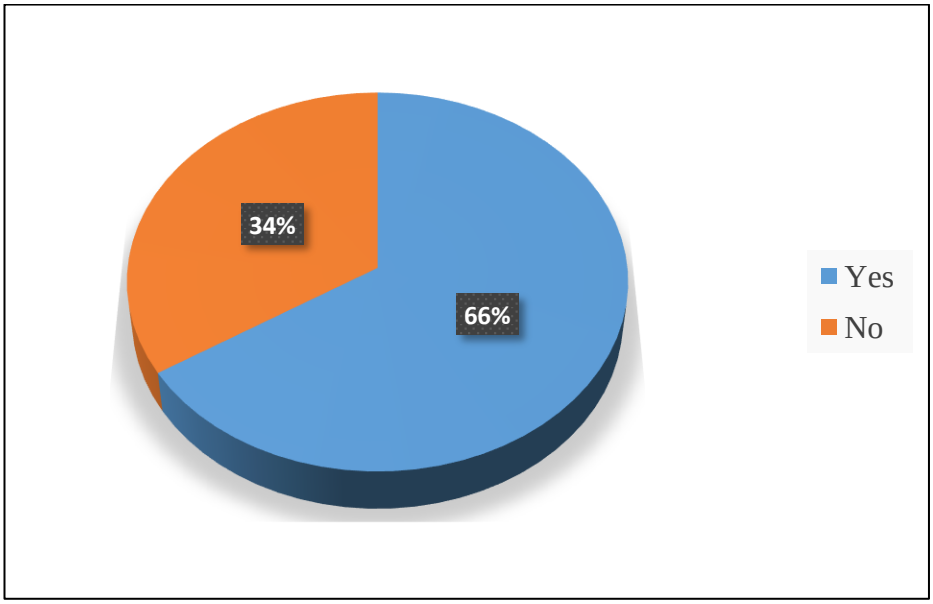

Figure 0:8: Respondents who had education in agriculture

The majority of the farmers (66%) did not have any formal education in agriculture, thereby confirming that most of the respondents were not trained with agricultural education and only 33% had some form of education in agriculture (Figure 4.8). The researcher also noted that those who attested to have some form of education or qualifications obtained them during the workshops conducted by the officials from the agricultural department on farming related

practices where they were issued certificates, which they consider as some form of qualifications. However, it was difficult for the researcher to ascertain the validity of those certificates, hence the researcher had to rely on the honesty of the respondents. However, since only a smaller fraction of the respondents attested to have had education in agriculture and therefore might have influenced the perceived knowledge to the problem related to land degradation. A follow-up question was to ask amongst those who had education in agriculture which was their area of specialty as indicated in Table 4.7.

Table 0.7: Respondents' area of specialty in agricultural education

Area of specialty	**Percentage (%)**
Crop science	43.6
Animal science	2
Agricultural economics	1
Other (not in agriculture)	50.5
None of above	3
Total	100

From the table above, it is seen that 43.6% studied crop science while the majority of the respondents (50.5%) attributed to other while those who studied animal science were two respondents, and one respondent studied agricultural economics. Only three respondents did not identify any of the above-mentioned fields of study. Judging from the responses, this finding still highlights a much greater disparity in terms of literacy rate amongst the respondents and thereby confirms the smaller number who had education in agriculture as indicated in Figure 4.8. The findings show that education in agriculture is not a prerequisite to become a farmer or to engage in any agricultural activity. This therefore implies that farmers' perception to land degradation and soil conservation measure are influenced by their literacy rate, which is pivotal when adopting traditional soil conservation methods against modern soil conservation measures and vice versa.

4.4 Section C: The perceived challenges faced by small-scale farmers in the study area

This section purposed to understand different farmers' perceptions of the spatial aspects of land use and the challenges they faced, which has an important implication for sustainable agriculture as a result of land degradation. Farmers' perception and their ability to perceive land

degradation is a key precondition for their choices to adapt appropriate soil conservation measures and this is imperative for not only the continuous production of farm products but how these perceived challenges might eventually lead to land degradation. This was important as the type of farming operation might determine the nature and extent to which the soil can be degraded as indicated in Table 4.8.

Table 0.8: Types of farming practised by respondents

Types of farming	**Percentage (%)**
Cattle rearing	3
Crop planting	88
Both cattle and crop farming	5
Other	4
Total	100

The results obtained from the analysis as seen above indicate that crop farming was dominated with a total percentage of 88% followed by those who practise both cattle rearing and crop farming with five respondents. Only four respondents mentioned other forms of farming, which was not clear to the researcher as to the type of farming they meant. Three respondents (3%) indicated that they practise cattle rearing.

It became imperative to know if the farming was on a rental land, privately own land or communal land. This was important considering the fact that agricultural land use (land tenure) differs significantly from communal to private ownership. Studies have revealed that land use under communal ownership are potentially high agricultural areas characterised by high level of overgrazing and soil erosion (Huntley et al., 1989; Hoffman & Todd, 2010). The item on the questionnaire was to find out if the land use for cultivation was privately owned or not. This was important, as the area under investigation was predominantly rural settlement and black dominated (Hoffman & Todd, 2010). The results of the study indicate that 96% of the respondents own the agricultural land while 4% indicated they do not own the land as indicated in Figure 4.9. It is however important to state South Africa is among the countries in Africa with extreme land ownership inequality where the majority of farm land (approximately 86%) before 1994 was owned by the minority white population (Byamugisha et al., 2014). In most cases, land is communally owned and passed on from one generation to another as indicated by some of the respondents.

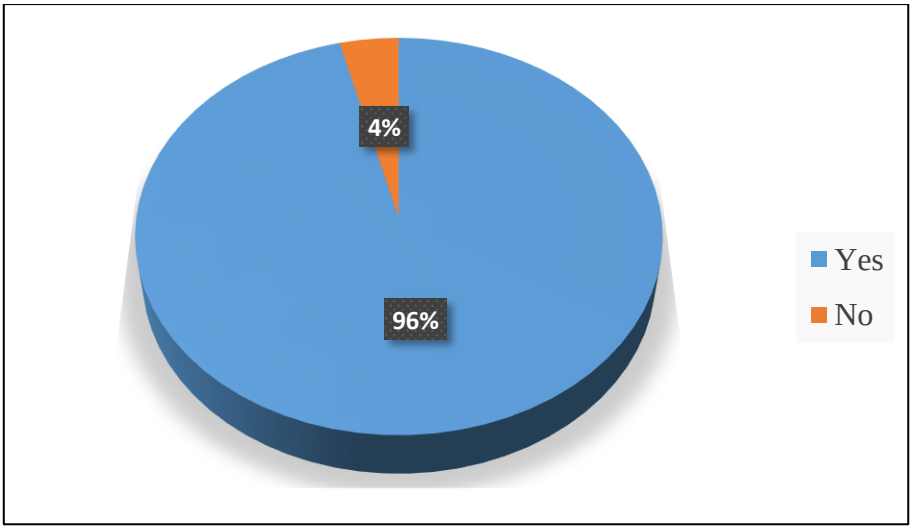

Figure 0:9: Land ownership by the respondents

Although land degradation is profoundly influenced by the type, duration and extent of activity, it has been proven that animal's hooves promote break down of the soil crust, thereby exposing the land to different agent of erosion (Whitmoore, 2000). However, from a geographical perspective, it is obvious that the cause of land degradation due to cattle rearing might not be the immediate cause of land degradation in the area but might have been caused by other factors. This finding, however, contrasts with the findings by Mighall et al. (2012) who asserted that widespread soil erosion in the Karoo, South Africa was as a result of increased livestock farming in the area.

Findings from the field observations indicate visible signs of land degradation in all the farms visited especially in areas where livestock were reared. It was uncertain whether the farmers kept to the prescribed stocking rate. For instance, the carrying capacity of an area is prescribed as 12 ha per Large Stocking Unit (LSU) and 12 ha per Small Stocking Unit (SSU) (Rabumbulu & Badenhorst, 2016). In the case where the stocking rate were respected by the farmer, degradation could be attributed to other factors such as sensitivity of the biome in that area or human impact. However, in areas where the stocking rate where not respected as the case in one of the visited farms, some visible signs of land degradation were observed. This assertion is also revealed by the responses of the farmers on whether their farm is open or enclosed (Table 4.9). Most of the respondents (69) indicated that they had enclosed farms while 31 respondents indicated that they had open farms. Only one of the respondents did not provide a definitive answer.

Table 0.9: Respondents description of farms.

Description of the farm	**Percentage (%)**
Open	30.7
Enclosed	68.3
None of the above	1
Total	100

According to Mekuria (2009), exclosure is a type of land management implemented with the aim of improving environmental conditions of the degraded open land. It involves areas where grazing and other agricultural land use are not allowed. A major feature of this structure is beneficial in the domestication of animals and disease control where animals are kept out of bounds through a continuous monitoring system to the crop and animals. This could as well be seen from a broader perspective by Jayne et al. (2014) who indicate that just 1% of African rural land area contains 21% of its rural population. Consequently, there is a growing demand for land and land related issues continue to be a well-debated issue in a country like South Africa where land distribution and competition for fertile farmland continue to be a battle between the local authority and smallholder farmers.

Still, in line with the perceived challenges faced by farmers, the respondents were asked if they have assistance from the local government and from community councils (Table 4.10). This was to gauge the level at which the department of agriculture (through its local branches) aimed at reducing local food shortages, improve rural agricultural development and assist farmers whose land might have being affected by fertility loss as a result of surface erosion. The farmers were asked if they receive any support from the local governments.

Table 0.10: Respondents' responses to government incentives.

Government subsidies	**Percentage (%)**
Yes	62.4
No	37.6
Total	100

The results indicate that almost two-thirds of the respondents receive government subsidies in some form, usually through workshops arranged by the government. These

workshops afforded an opportunity for farmers to interact with the officials where some of their challenges were reported and addressed. Through these workshops, the subsidies and aid fertilizers, tractors and other support were made available to farmers as indicated in Table 4.11.

Table 0.11: Types of subsidies and aid to farmers.

Types of subsidies and aid	Percentage (%)
Tractors	52.5
Fertilizers	3
Others	44.6
Total	100

From the above table, around half of the respondents (52.5%) received tractors from the local government as subsidies and aid to promote subsistence farming while only 3% of the respondents receive fertilizers and 44.6% respondents indicated other forms of subsidies and aid which might be in the form of financial support, provision of seeds access to credit facilities with zero interest rate. It should, however, be noted that these subsidies and aid were provided based on the need of the farmers. In line with the findings from other researchers (Woldeamlak, 2003; Seid, 2009), understanding and recognition of soil erosion problems on their farm and its cause in the soil is the first step towards searching for and adoption of remediation measures. This, therefore, signifies that the government plays a vital role in promoting subsistence agriculture through subsidized interest rates, tax concessions and price support (Ortmann & King, 2007). Despite this support, the government has equally encouraged cooperatives to help enhance the development of small-scale farming in South Africa, however, this was not the case as all the farmers indicate the absence of cooperative in the area despite it being enacted in the new Cooperative Act (No 14 of 2005) (RSA, 2005).

4.5 Section D: Farmers' perceived causes of land degradation

Taking into consideration farmers understanding of land degradation, this section explores farmers' perception on the causes of land degradation in their respective farming areas. According to Morgan (2005), the notion of farmers damaging land through ignorance is misleading. The author pointed out that both small-scale farmers and large-scale commercial farmer are both experienced and efficient practitioner in land husbandry but the difference stem from their objectives of survival and profit. It will be misleading to conclude that if a farmer destroys land by over-cropping or overgrazing is because there is no alternative employment

from which that farmers can make a living however, it might be due to the interplay between physical and human factors operating within the catchment. Items on the questionnaires varied from physical factors (rainfall intensities, general topography of the area, accelerated surface erosion, semi-aridity of the area, flooding and water logging experience in the terrain) to human factors (continuous tilling using tractors and other heavy equipment's to plough the land, land clearing and burning of vegetation in the catchment, intensive cultivation of throughout the year and unsupervised land tenure poor irrigation systems).

In terms of the prevailing physical condition in the catchment, the result reveals that 99% perceived the general topography of the areas as main cause of land degradation, while 69% of the farmers perceive the semi-aridity of the area to be definitely the cause of land degradation (Table 4.13 on the following page). Moreover, 89% perceived high rainfall intensities in the area as a definite cause of land degradation and 73.2% of the total sampled farmers in the area also perceived the general climate change as the most likely cause of land degradation. In Addition, 65% were of the opinion that flooding, water logging experienced in the studied terrain was a definite cause of land degradation, and 65.4% of the respondents perceived accelerated soil erosion was perceived as the most likely cause of land degradation in the area.

In terms of the perceived human causes of land degradation, which were perceived by the small-scale farmers as causes of land degradation, 70.2% of the respondents perceived land clearing and burning of vegetation in the catchment as a definite cause of land degradation. This was also supported by 83.1% of farmers who perceived that deforestation by farmers was definitely the cause of land degradation. Of the respondents, 71% was of the opinion that over grazing by animals was a definite cause of land degradation. Some 63.3% were of the view that the continuous soil tilling and the use of heavy equipment to plough the land was a definite cause of land degradation. In addition, a greater proportion of the respondents 95% and 82.1% perceived that unsupervised land tenure systems being practice in the area and intensive cultivation throughout the year respectively was definitely the cause of land degradation.

The perceived challenges faced by farmers leading to decline in soils fertility has showed to varied from one country to another as indicated in chapter two, section 2.8. Thus it was important to understand the farmers perception of the impact of soil erosion leading to the loss of soil fertility in the catchment (Table 4.12). Farmers awareness of the conservation

measures depended on their perceptions of the problems and which soil conservation measures were most appropriate in solving the problem.

Table 0.12: Farmers' responses to the causes of land degradation

No	Item	1 Not a cause	2. Not likely a cause	3. Somewhat likely a cause	4 Most likely a cause	5 Definitely a cause
	Questions	%	%	%	%	%
F1	Generational topography and terrain of the farming area	-	-	-	1	99
F2	High rainfall intensity in the study area	-	1	4.9	4.9	89
F3	Failure of farmers to adopt soil conservation measures	2.9	7.9	6.9	12.8	69.3
F4	Continuous soil tilling using tractors and other heavy equipment's to plough the land	3.9	3.8	11.8	16.8	63.3
F5	Lack of community engagement in facilitating conservative farming practices	-	1	2.9	2.9	93
F6	General climate change	-	-	15.8	73.2	10.8
F7	Over-crowded farming areas due to increase population	-	11.8	35.6	49.5	2.9
F8	Flooding and water logging experience in the terrain	1	3.9	11.8	17.8	65.3
F9	Poor use of irrigation systems	5.9	2.9	1.9	6.9	82
F10	Administrative and institutional problems accentuated by the various departments	-	63.3	13.8	5.9	16.8
F11	Over grazing by animals	1.9	4.9	3.9	17.8	71.2
F12	Accelerated surface soil erosion	-	1	19.8	65.3	13.8
F13	Land clearing and burning of vegetation in the catchment	1.9	1.9	9.9	15.8	70.2
F14	Intensive cultivation of throughout the year	1	3.9	6.9	4.9	82.1
F15	Semi-arid landscape	2.9	1	3.9	22.7	69.3
F16	Deforestation caused by farming in the area	-	2.9	2.9	22.7	83.1
F17	The unsupervised land use systems being practiced in the area	1	1.9	1	1	95

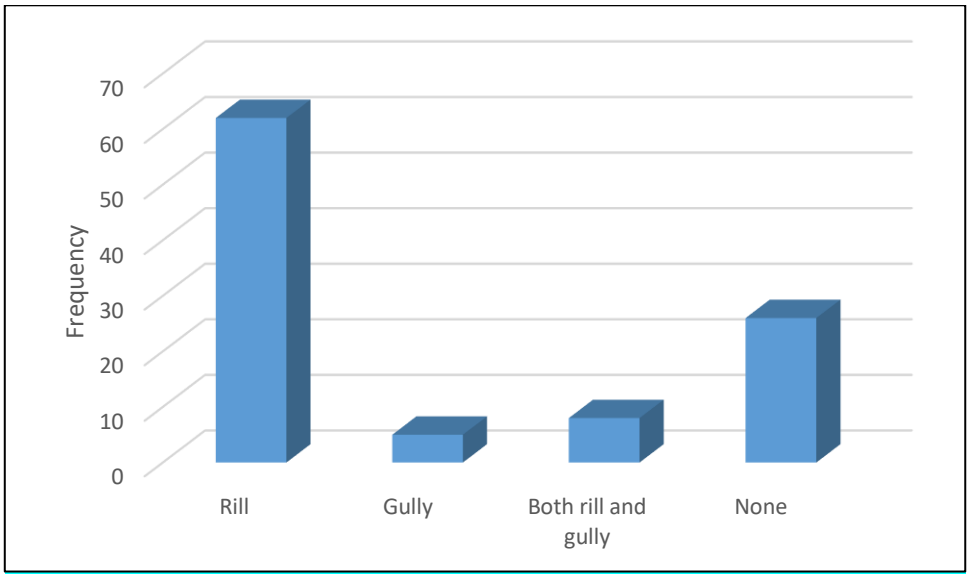

Figure 0:10: Types of erosion identified in respondents farm

The results from the analysis revealed that, rill erosion was perceived to be prevalent as 61.4% respondents identify rill erosion (as described by the researcher) as the prevailing type of soil erosion. This was followed by 25.7% of respondents who indicated not having any form of erosion visible on their farms. Eight of the respondents identified both rill and gully erosion on their farms and five respondents noted gully erosion on their farms. Boardman et al. (2017) have equally acknowledged the devastating effect of soil erosion leading to loss of fertility in Karoo regions of South Africa due to the introduction of sheep farming and unsustainable use of soil for farming.

A similar observation has been reported in Kenya where farmers pointed out that soil erosion is due to major factors such as high rainfall, steep slopes, agricultural settlement, deforestation and run-off (Okoba & De Graaff, 2005). Figure 4.11 indicates visible signs of sheet erosion in one of the observed vegetable farming area where the top 5 cm layer of the soil was slowly washed away in the form on sheet erosion. The devastating effect of soil erosion on agricultural practices cannot be overemphasized. Soil erosion impoverishes the soil and also berries crops in the farming areas. It equally exhausts the soil from important mineral constituents needed for crop survival and deplete chemical bonding and the mineral constituents which as important in soil stability (Morgan, 2005). Seasonal variation in crops planting have equally shown to influence the nature and types of soil erosion on land associated with tillage operations, which alter the bulk density and hydraulic conductivity of the soil. Thus, during the field survey, such phenomenon was observed as washing away of topsoil in legumes cultivated

area as depicted in 4.11. Although these crops were planted on seasonal basis, it however conforms to the finding of Morgan (2005) who stated that erodibility are four times higher in summer which corresponds to the raining reason in South Africa than in winter which corresponds to the dry season.

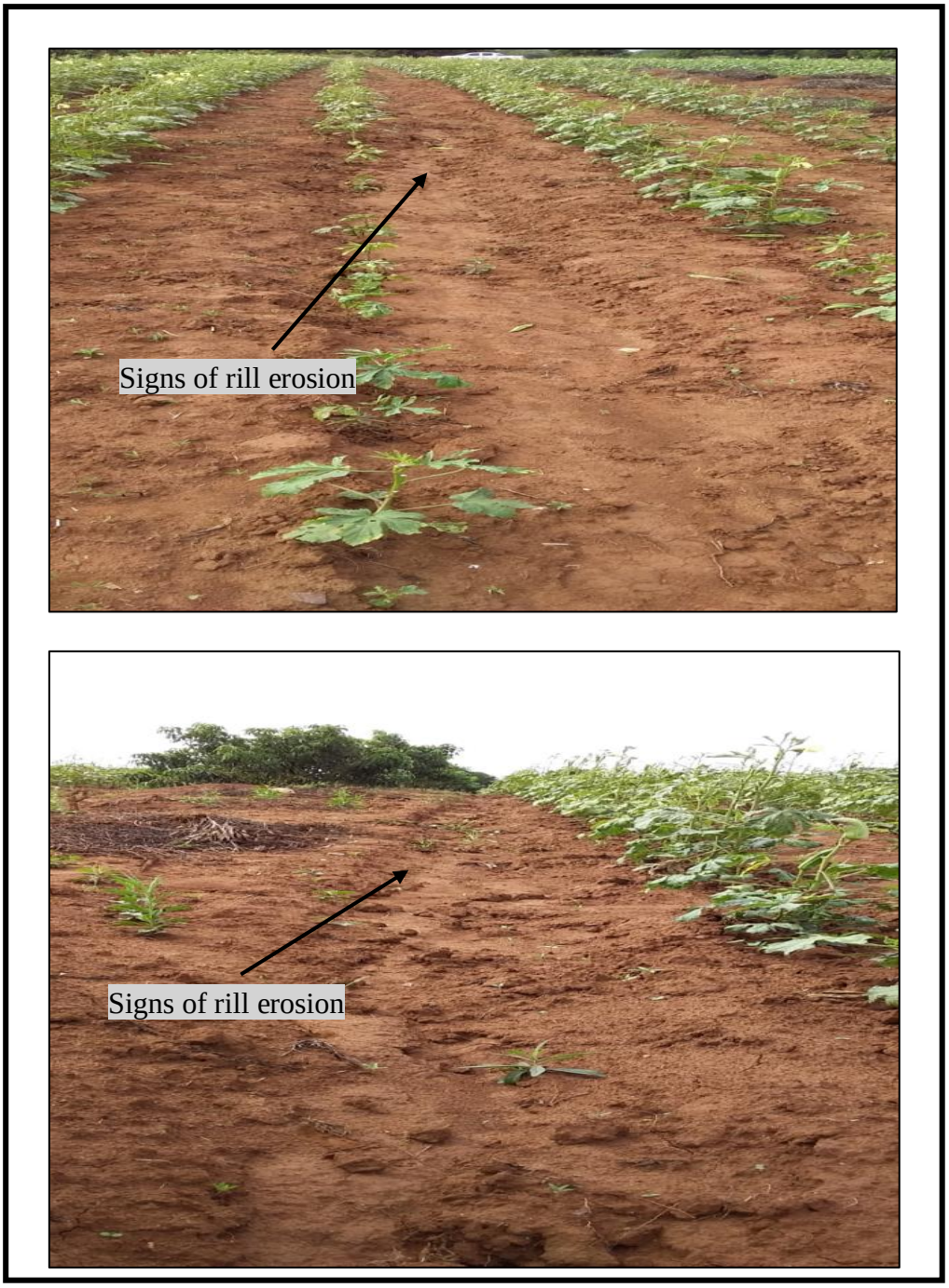

Figure 0:11: A photograph showing of rill/sheet erosion in vegetable farming area. Date of photograph: 17/7/2017. Source: Author.

4.6 Section E: Measures used by farmers to solve the problem of land degradation

The adoption of soil conservation measures varies from one location to another and different types of traditional and modern conservation measures exist within the country (Lalani et al., 2016). These conservatives measure from an agricultural standpoint should form the basis for which soil conservation measures has to be adopted. These attributes of conservation measures are also considered as one of the factors influencing farmers' adoption decision. In view of this, farmers were asked about the major improved conservation strategies of land management practices adopted in their respective farms (see Table 4.13 below). Although modern technologies in farming have gained widespread adoption in recent years, crop rotation can improve soil fertility, and reduce runoff of nutrients and chemicals as well as potential contamination of surface water (Lalani et al., 2016). Crop rotation plays a major role in the production and maintenance of soil and its susceptibility to agents of erosion. Extensive crop rotations are largely perceived as old age farming practices in most traditional African society, however, its benefit as soil conservation measures and disease control cannot be overemphasized. For instance, Tilman et al. (2002) spatially indicates that the continuous production of crops may progressively become susceptible to diseases and pest due to insufficient crop rotation and land degradation.

Table 0.13: The practice of crop rotation

The practice of crop rotation	**Percentage (%)**
Yes	70
No	30
Total	100

According to Table 4.13, 70% respondents agree to the practice of crop rotation while 30% respondents did not practice crop rotation. This result shows that the greater proportion of farmers practice crop rotation, which alongside other crops, improves soil aeration, soil organic matter and nutrients which can improve soil structure and increase soil water-holding capacity. A study by Karltun et al. (2013) indicates a positive benefit of crop rotation of which the farmers in Beseku a village in rural Ethiopia were well informed through indigenous knowledge transferred from one generation to another by planting specific crops such as legumes. Crop

rotation is considered as an integral part of expanding the practice of zero tillage and organic farming (Nel, 2005).

A number of measures were highighted as possible solutions to the problem of soil erosion. These include planting of vegetation and trees, contour farming, creating windbreaks, soil and stones to fill the eroding areas, using man-made structures and using grass and cowdung improving the aggregate stability of the soil and increasing surface roughness to reduce the velocity of runoff. These measures are broadly classified under and agronomic measures, soil management and mechanical methods. Morgan, (2005), identify key areas in which mitigation measures can be effectively applicable such as; soils management and mechanical methods. Soil management involves ways of promoting plant growth and improving its structure so that it can be more resistant to erosion while mechanical method involves installation of terrace or windbreaks to control the flow of water. It should however be noted that, the success or failure of these measures inherently depended of socio-physical factors prevailing in the catchment area. Also, some of the soil conservation conservation measures are traditional practices developed though gradual and handed over though a gradual and dynamic process from one generation to another.

The fact that most farmers view soil erosion as a natural occurrence on their land have associated with high rainfall, lack of vegetation, unsupervised tenure systems as noted earlier, showed that they correctly perceived erosion problem on their land. However, its effects were mainly through its effect on yield, sediment accumulation on foot slopes and the formation of gully (Figure 4.12A) but underestimate its seriousness on the long-term effect and did not have any long-term adaptation plan in place. In most cases the farmers were concern with the effect of erosion on productivity and increase cost of buying fertilizers due to loss in soil fertility, buying of seed for replanting of crops destroyed by erosion and maintenance of water storage or irrigation facilities to provide additional water for crop growth. Similar observation has been reported in the Free State province by Rabumbulu and Badenhorst, (2016) as farmers had severe financial constrained to buy extra seed as a result of drought and rainfall variability on their farming operations.

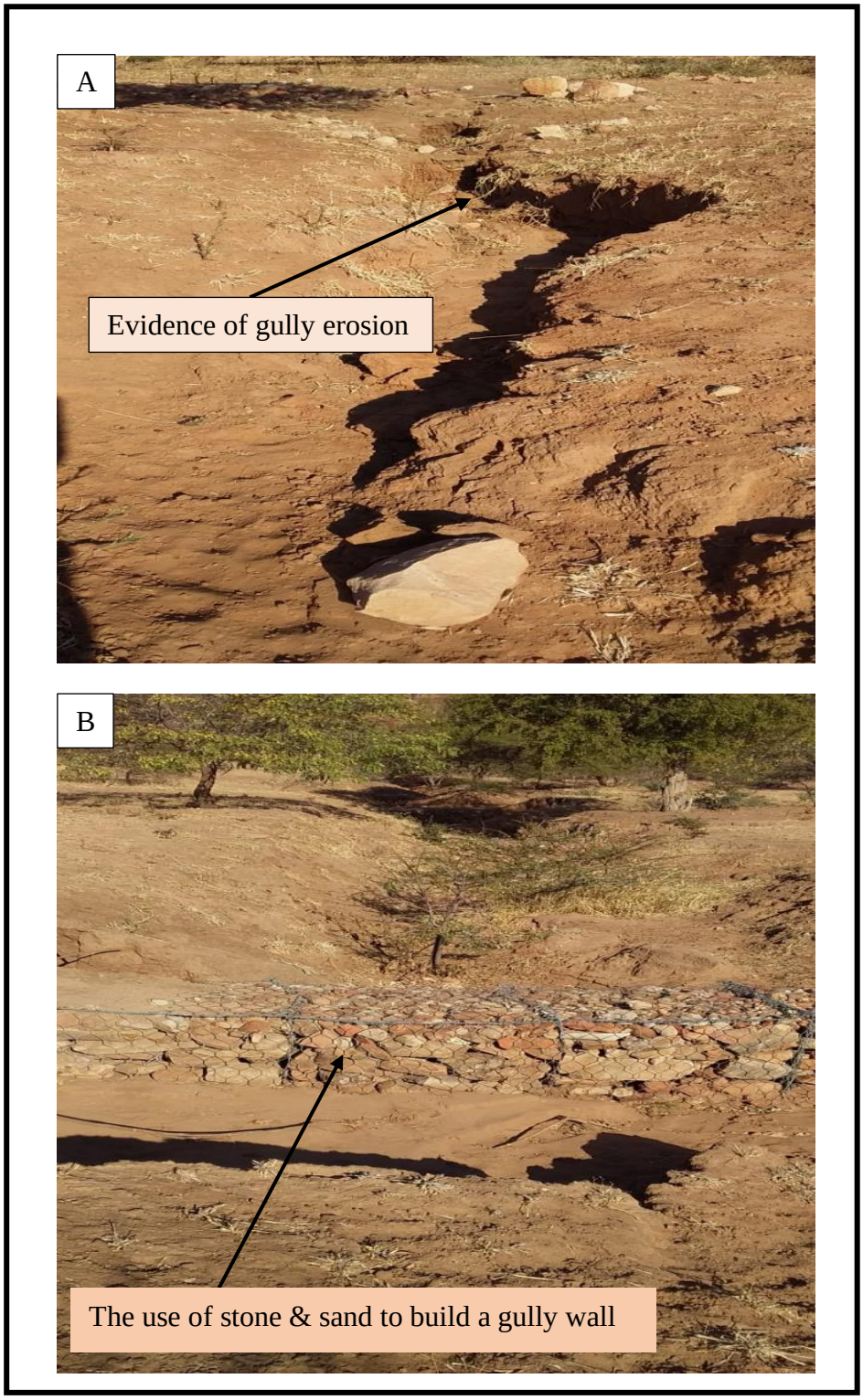

Figure 0:12: A photography of gully erosion and gully wall. Date of photograph: 17/07 2017. Source: Author.

Farmers were asked to identify those measures used to solve the problem. Interestingly, the results obtained show that all the farmers were using contour farming system measure.

Although Ervin & Ervin (1982) stated that the types of physical erosion will determine the type of farming practice being used, perhaps contour farming was the preferred farming practice, but the researcher could not ascertain if it was a strategy being used to solve the problem of soil erosion. However, alongside contour ploughing, the respondents equally identified manmade structures as well as soil and stone, to fill existing gullies and channels to prevent further erosion as indicated in Figure 4.13. A study by Rabumbulu and Badenhorst, (2016), in Free State province in South Africa, reported how farmers were able to rehabilitate some areas of their degraded land for a period of two years by strategically placing dung heaps along contour line the degraded rangeland.

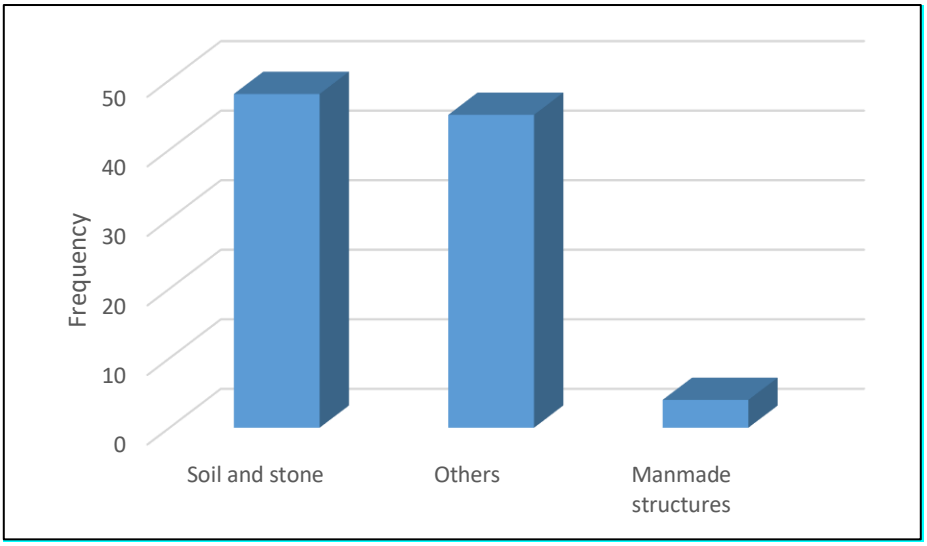

Figure 0:13: Measures used to address soil erosion

Results show that majority of the farmers (48 respondents) also used soil and stones to fill in recently developed gully and form barriers from the washing away of the topsoil during periods of heavy rainfall as a strategy to solve the problem of soil erosion while (45 respondents) used other strategies and only four respondents used man-made structures (Figure 4.13). These measures adopted by farmers to prevent soil erosion which are considered soil conservation measures were some of the strategies used to combat soil erosion in the studied catchment. From the different strategies proposed and the results obtained from the respondents, it would not be an over generalized statement that soil erosion is a major problem confronting farmers. In spite of the phenomenon, there seems to be a voluntary approach as seen from the range of strategies used by farmers. However, it was observed that the quality of the structures used by farmers was relatively ineffective in solving the problem and required to invest on its maintenance. Hence perceiving problems of land degradations does not always guarantee for

the use of improved soil conservation measures as observed in the study area. Rather other factors which might affect their decision such as improving on this traditional method in terms of purpose and material for the purpose of soil trapping should come to play.

4.7 Conclusion

This chapter set out to understand farmers' perceptions of land degradation in the Luvuvhu catchment and factors that influence these perspectives. It was observed that there was less disparity in terms of gender distribution from the sampled population who were engaged in small-scale farming. Majority of the respondents above 65 years old indicated that farming was a source of employment after retirement. In terms of qualification, the findings revealed that most of the respondents did not have any formal training in education which has an indirect effect on farming. Although the majority of the respondents had no formal employment, they, however, did not consider farming as a source of employment. The farmers perceived causes of land degradation ranges from physical to human factors. The most perceived significant physical factors were general topography of the study catchment, high rainfall intensities while the human perceived factors include clearing and burning of vegetation in the study catchment, over grazing and unsupervised tenure systems. The farmer's choice of the adoption of soil conservation measures is assumed to have been affected by the socio-physical and cultural considerations. The following chapters present the discussion of major findings.

CHAPTER FIVE: DISCUSSION

This chapter discusses the results from the questionnaire undertaken to understand farmers' perception of land degradation in the Luvuvhu catchment. This section incorporates findings from the studies and the preliminary literature survey.

5.1 Demographic determinants

The results from the demographic analysis of the small-scale farmers in term of gender showed that males dominate slightly more than the female counterpart in farming. This is particularly important because of the significance of role played by gender in farming as source of poverty alleviation is rural sub-Sahara countries. Contrary to this finding, other studies have shown that women tend to dominate in small-scale as compared to male counterparts (van Eerdewijk & Danielsen, 2015). A report by DOA (2002) suggests that one third of South African households are headed by females These female-headed households are more likely to be more vulnerable to food insecurity than the male dominated household. Similarly, female-headed rural households are among the poorest in the world, in terms of their contribution of food security (Tibesigwa & Visser, 2015). Although a varying degree of women play an important role in the agricultural labour force (as noted by FAO, 2011), which undoubtedly contributes to output is difficult to quantify, nevertheless, the results indicate that male farmers still dominate this sector as compared to female farmers in the study area of this research.

Therefore, this signifies the role of women in small-scale farming, as well as their contribution to alleviating rural unemployment, increasing food security, farming operations, and marketing systems that mediate women's access to resources in general, and agricultural innovations in particular, have often gone unrecognized. It also signifies that women still lack access to and control over a range of resources including land which is crucial for farming, extension service and income in the study area. Gender in agriculture is still, however, a much-debated topic and more particularly in the context of commercial agriculture and food security, and a system of operation which indirectly affects the environment. For instance, women's share in agriculture in Bangladesh now exceeds 50% of the labour force (FOA, 2011). Although van Eerdewijk & Danielsen (2015) highlighted the importance of women in farming operation such as tillage, ploughing and land preparation, it failed to pinpoint their role in environment conservation which might eventually cause land degradation and loss of fertile soil. Ortmann & King (2007), however, focused on the importance of marketing of agricultural products and

other related activities mostly undertaken by female members of the households. The roles that women play in agriculture vary considerably in terms of region and changing in many parts of the world.

In term of age distribution, findings reveal that those engaged in small-scale farming are mostly those in the 60 years and above group who have reached the retirement age. Although most studies focusing on small-scale farming and land degradation have directed their attention towards environmental impact of land degradation, socio-economic challenges faced by small-scale farmers and farmers' perceptions to degradation as indicated in section 2.7, age distribution of farmers has often gone unrecognised in our contemporary time. The findings presented here, however, show a less likely engagement of the youthful population in small-scale farming. Baiphethi & Jacobs (2009) reported a similar trend where only 4.6% of the youthful population were engaged in agriculture production.

The low youthful participation in agricultural activities, therefore, hinders skills development as the youth can play a substantial role in addressing the problem of land degradation within their respective communities. Their participation in rural development provides the basis for which solution to land degradation can be addressed taking into consideration the prevailing climatic conditions of the area. In addition, studies have demonstrated that the use of technology in farming has proven to be environmental sustainable but most of this old age population are not so conversant with this new-farming technology. This hinders the efficiency in crop production (Mendola, 2007; Mariano et al., 2012). Furthermore, in terms of a cost-analysis, having an old age population group in farming will require more money in various training programs such as the use of farming machinery, proper application of synthetic fertilizer in order to meet the demand of the growing population.

It is widely believed that long-standing traditional practices of small-scale farming and the conservations measures is usually passed from one generation to another. The failure of the youthful population in agriculture might have an adverse implication to the future of small-scale farming for the next generation since there would not be many young that will continue to uphold and practice traditional soil conservation measures. This might also have an implication to land distribution plans for the community and the government. Although Mariano et al. (2012) discuss the benefit of applications of modern techniques by small-scale farmers in rural Philippines, the author however, pointed out that farmers were hesitant to adopt these technologies due to budget constraints.

5.2 Socio-economic determinants of the respondents

Agriculture continues to play a major role in providing employment in rural areas, albeit farmers' perception to small-scale farming, as a direct source of employment does not support that of Simbi & Aliber (2000). On-farm employment is the most important source of work in rural areas by creating 29.9% of jobs and employing more than 12% of the non-urban economically active population (Machethe. 2004). Although the rate of farm employment has decreased over the last few decades due to mechanisation, its contribution to unemployment in rural areas cannot be over-emphasised (Machethe, 2004). The findings presented here signify firstly that farmers perceived small-scale farming not as a direct source of employment, but as a means of survival. Agriculture is usually the largest source of livelihood and jobs in most rural areas (Wiggins et al., 2010); however, this was not the case of this research where agriculture was not considered as a source of job creation.

Secondly, government's interventions to develop small-scale farmers, as drivers of rural development, is still very low as most of the consumers are local buyers from the village as indicated in Section 4.3. Baiphethi & Jacobs (2009) affirms that the removal of government support to small-scale farmers witnessed a decrease in farm production, as farmers could no longer afford the necessary inputs. From a geographical perspective, agriculture in South Africa is highly influenced by the previously discussed dual system whereby most emphasis over the past was focused on large scale commercial farming against small-scale farming. Also, land tenure system has equally influenced land use patterns for developments in rural subsistence agriculture whereby small-scales farmers have not been able to economically benefit as large-scale commercial farmers. For instance, a study by Parret (2001) estimated that 82 million hectares of stock and farm land are under private use, whilst only 16 million hectares is under communal land tenure with an estimated 1.3 million hectares under both commercial and subsistence agriculture.

Developing this sector is therefore, of primary importance especially at a time where the Millennium Development Goal of halving poverty and hunger has been directed to where the poor and hungry live. This can be achieved through four ways according to OECD (2006). Firstly, by raising farm incomes and thereby benefiting the many farmers who live in poverty. Secondly, by creating employment on farm, given that agriculture tends to employ more workers per unit of output than other sectors. Thirdly, by stimulating the rural non-farm economy through linkages in both production and consumption and fourthly, by pushing down

the prices of staple food to the benefit of the many poor who are not food buyers in rural areas. However, observations indicate that these measures are very low due to inadequate access to farm input as well as market opportunities. These interventions, if properly implemented, will go a long way to change rural farmers' perceptions and upscale the sector.

5.3 Farmers' perceptions on the causes of degradation and measures used to solve the problem

From a geographical point of view, it is widely believed that sustainable agricultural practices determine the level of food production and largely, the state of the global environment (Tilman et al., 2002). However, this can only be achieved when there is a proper understanding in farming operation and practices. However as noted by Morgan, (2005), most farmers are aware of the problem the effects of land degradation, but the relevance of conservation measures solely depended on the farming systems and how the farmers perceive the problems of land degradation and its consequences. For instance, the decision by a farmer in adoption of conservation measures tend to be compromised between preventing long-term soils degradation by erosion and maximises short-term income through farming operations. The general believe system of a farmer is not unwilling to change their farming practice but will be willing to do so only when benefit derived, and the investment cost are covered as observed in Table 4.13). Where a land user does not perceive such benefits, soil conservation is unlikely to be adopted.

Land degradation, a decline in land quality caused by human activities and some physical factors to some extent, will continue to remain high on the national and international agenda in this presence century. Because productivity decline may be directly and indirectly linked to land degradation through depletion of soil nutrients, soil toxicity, or soil water holding capacity, or indirectly, through infestation of degraded soils by persistent weeds that reduce yields to. In the developing countries like Nigeria for instance, where a large proportion of human population depends almost entirely on land resources for their sustenance, there is increasing competing demand for land utilization such as grazing, fish pond construction, quarrying, crop farming amongst others (Akinnagbe & Umukoro, 2011). This has had an unprecedented rate in accelerating land degradation in various forms if remain uncheck.

It is no doubt that literacy plays a major role in the overall perception in understanding the problems and causes of land degradation and the best suited soil conservation measures to be adopted. A greater proportion of the farmers in the catchment perceived the following as

main causes of land degradation: the general topography of the area, high rainfall intensities, lack of community engagements, poor use of irrigation system and deforestation. It was noted that farmer's individual perceptions to the causes and consequences of land degradation (soil erosion, decline in fertility) and measures used to solve the problem varied greatly. The findings equally revealed a large proportion of farmers who perceived the impact of land degradation and its conservation measures (were using more traditional measures such as sand and stones) might be due to the failure of farmers to use modern soil conservation measures. A study by Rabumbulu and Badenhorst, (2016), demonstrated the use of dung heaps were successful in reducing surface runoff, which increased the moisture content of the soil and how the undigested seeds in the dungs germinated and were fertilized by added nitrogen in the dungs. This therefore implies that the farmers in the study area were aware about soil erosion and its effects and willingly expressed their desire to solve the problem by using traditional methods such as sand and stone, man-made structures, however, these methods were found to be less effective to mitigate the problem. In Ethiopia, Moges et al. (2017) highlight that famers used traditional methods to curb the problem of soil erosion, but the results of such practices yielded lesser results as compare to other convection western methods, a similar experience to the farmers in this current study.

The failure of the farmers to adopt soil conservation measures or proper interventions could be associated with inter-household variations in age and education status. The high unemployment, number of dependants per household, rural population and area of human settlements are the most socio-economic factors influencing land degradation in former homelands. The rapid young population decline in the rural areas engaged in agriculture compels the farmers to constantly adjust and change their agricultural practices to sustain their livelihoods. Consequently, the future of the long standing traditional agricultural practices is slowly fading out in the Luvuvhu catchment. Although the study confirms that animal rearing was not the direct cause of land degradation in the study area, natural influences such as wind, water and cultivation types might equally be contributing factors.

The findings presented here show that majority of farmers did not have any formal education in agricultural practices and have not undergone any form of training in agriculture and soil conservation measures. The results presented in the previous chapter reveal that a two-thirds of the respondents (69.4%) had no formal education with half (50.5%) having had no training in agriculture related studies. Despite low literacy levels, some individuals have post

matric qualifications. This has two implication to the overall operation of farming practice. Firstly, it aids in the understanding of the impact of land degradation and the effect on soil and nutrient loss, in the form of low crop yields which elevate rural food shortages (Kassa et al., 2013). Secondly, understanding farming practices in terms of the application of modern technological based advancements and conservation measures has proven to have a positive impact on farming. For instance, Ortmann & King (2007) affirm that education levels of respondents in the study area are generally low (mean of 5.2 years), and only 36% of all respondents speak English (32.5% speak and write English). This implies that language serves as a barrier for the respondents to market their products outside of their own areas. The emergence of agro-food chain stores such as supermarkets is rapidly transforming rural areas in agro-food business (Louw et al., 2008), having an unprecedented impact to the livelihood of those practicing small-scale farming. The agro-food processing businesses strict policies of procurements of products have on the contrary being the at the forefront in the rise of large-scale commercial farming against the detriment of small-scale farming in South Africa thus explaining the slow growth of small-scale farming despite much effort by the farmers.

Secondly, it involves the degree to which farmers are exposed through curriculum-based teaching and workshops on sustainable farming practices. Graaff et al. (2008) state that the proper adoption of conservative and sustainable farming is the recognition of problem and farmers' perceptions. For instance, if farmers are not aware that high application of fertilizers and pesticides can increase nutrients and toxics in ground water and surface water, thereby incurring health and water purification cost, it will be difficult for those farmers to do so without compromising the environment integrity. Many studies (e.g. Tatlidil et al., 2008; Graaff et al., 2008; Zegeye et al., 2010; Mango et al., 2017; Moges et al., 2017) have been devoted to farmers' perceptions and soil erosion and concluded that farmers' perceptions of land degradation vary considerably from one farmer to another and from one country to another, but the problems faced are largely the same.

Erosion, whether in Ethiopia or Bangladesh, is a similar phenomenon but the approaches based on physical and social characteristics in the environment and communities may differ. For instance, based on the prevailing climatic conditions, the approaches used to address soil erosion might be different. This difference in techniques therefore explains why the most popular strategy used by farmers in the Luvuvhu catchment consists of sand and stones which might have been influenced by the geological formation of the landscape (refer to section

3.2.3). Managing land degradation effectively requires an in-depth understanding of human-environment interactions, as a result, it was not surprising given the different adaptation strategies by the local population to solve land degradation (Reed et al., 2011).

Government interventions, rural developments projects, community engagement and physio-chemical characteristics of the soil play a vital role to farmers' perceptions. The effects of these interventions to farmers play a vital role to their understanding of farming practice. Although, to a lesser extent, officials from the Department of Agriculture organised workshops to sensitise the local farmers and to educate them, these workshops have fallen short to meet their target and purpose. Moges et al. (2017) reported that farmers in Ethiopia who had contact with extension workers would acquire more information related to the benefit of soil and water conservative measures and technical implementation in farming than those who did not. The contrary was observed in this study as more farmers reported the absence of agriculture extension officers and government intervention schemes to support their activities. Ortmann & King (2007) equally reported on the low participation of agricultural extension officials in KwaZulu-Natal by stating that extension officers only visit respondents (household heads) about once a year. Also, given that South Africa is a semi-arid country with severe water scarcity (Gbetibouo, 2010), it is expected that farmers need to be exposed to these unfamiliar conditions and therefore, specific regional policies and adaptive measures need to take into consideration respondents' educational profile. Of particular interest to this study is a finding of the continuing importance of extension services in generating higher adoption in support services and the growing disinclination by governments to continue funding these services. The absence of support services by the government at various levels (i.e. national, provincial and local) will continue to have far-reaching consequences on the development of small-scale farming and the associated rural food shortages.

It is well known that farmers who frequently participate in training workshops on soil and water conservation measures are more aware of how soil conservation technologies are more beneficial than those who do not participate. Gbetibouo (2010) is of the view that access to extension service are more likely to have knowledge management practices address climate changes and to diversify the portfolios to reduce risk. From the discussion with farmers, it was observed that lack of awareness to improve agricultural practices was common in the area. Similarly, Nagassa et al. (1997) report that farmers who had access to training and participated in workshops, help to improve their perceptions of soil erosion problems and facilitated the use

of soil conservation measures. Although Pender et al. (2004) acknowledge the role of education in agriculture in Uganda; the authors, however, stated that acquiring basic training in agriculture is not a pre-requisite for improved agriculture, but incorporating other socio-physical characteristics of the environment.

Soil erosion is the leading cause of land degradation due to loss of fertile farmland surface (Pimentel & Burgess, 2013). This is seen through a permanent decline in the productive capacity of the land as the surface soil is continuously and gradually being eroded over time. This has an adverse effect on the farmers as farmers have to rely on synthetic fertilizer to enrich the soil. Since rill erosion is the washing away of up to the top 30 cm of the soil surface by water or wind erosion, this will go a long way to have an impact as cropland will become unproductive and consequently, abandoned for those farmers who cannot afford fertilizer. Therefore, to ensure environmental, economic and social sustainability, farmers must learn to come up with different adaptation farm-practices such as the proper use of chemical, irrigation and proper ploughing and animal husbandry systems to cope with contemporary climate change. These include long-term changes in average climatic conditions such as mean temperature, precipitation and changes in the frequency and intensity of extreme climate events such as droughts and heavy rains (Gbetibouo, 2010).

Although there is no clear consensus on the concept of land degradation especially in semi-arid area where a combination of climatic variability and human activity play a big role. Rainfall variability and timing is of importance to small-scale farmers including the timing of the onset of first rains, which affects crop planting regimes, the distribution and periodicity of rain events within the growing season, and the effectiveness of the rains in each precipitation event represent real criteria that impinge the effectiveness and success of farming. The climate data of the Limpopo province analysed by David et al. (2007) show evidence of a growing length to the dry season, resulting in a later start to the wet season which might affect the planting season. This prolong dryness especially in clay soil can easily forms large cracks in the surface soil when dry which might naturally increase the erodibility of the soil and surface runoff in certain areas. Certain areas visited had visible signs of erosion and donga formation and according to Kiage (2013), clay soils have high erodibility because of the ability to seal soil pores.

According to David et al. (2007), droughts have been frequent in the last two decades in the Limpopo province which corroborates the information obtained from the farmers that the

cause of land degradation might be associated with the climatic variability brought about by climate change in the province. Most farmers in the catchment compensate for the low rainfall by using irrigation systems such as borehole. However, this method is associated with constraints as the farmers find it very expensive to and the farmers have less disposable income to buy or installed the equipment's. Also in terms of subsidies and aid, the finding revealed that irrigations systems were not part of the support packages received by the small-scale farmers.

5.4 Research summary

This study investigated that farmers' perception of land degradation undertaken in the Luvuvhu catchment South Africa. This area is known for small-scale farming and most recently, there is an increased occurrence in surface land degradation due to different anthropogenic and physical processes. This study concludes that a combination of natural and anthropogenic factors have played a role in land degradation in the Luvuvhu catchment. These factors in combination with unsustainable farming practice of cattle rearing and crop cultivation in the area could have contributed some form of land degradation. Most farmers in the area perceived drought, rainfall intensities general topography of the area as natural causes of land degradation and do not have any specific modern measures in place to cope with the loss of soil fertility. Many of these farmers used traditional methods to curb the problem of land soil erosion.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

The study was set to explore farmers' perceptions to land degradation in the Luvuvhu catchment. The transition to a democratic state in South Africa lay down framework and policies to encourage the emergence of small-scale farming through the creation of different support agencies. However, the current practice of cattle rearing and soil cultivation practised by the farmers in the area have contributed towards land degradation. The information obtained from the area shows that the process on landscape transformation has been accelerated by unsustainable practice of farming and to rapid urbanization. What is evident in the area is the marked variety in farmers perceptions to land degradation. This chapter presents the conclusion of the study and the recommendations in understanding farmers' perceptions to land degradation.

6.2 Chapters summary

Chapter One presented the introduction to the study, the problem statement, the significance of the study, the aim and objectives of the study as well as the research questions aimed at guiding the researcher and lastly, the definition of key concepts. Chapter Two explored current literature in relation to farming in South Africa by classifying the two broad sectors. It furthers discusses land degradation by looking at the South Africa perspective. This was considered because of the need to understand land degradation within the South African context and the most affected provinces of which Limpopo is third most degraded province in the country. Famers' perceptions of land degradation were explored and discussed in terms of gender and a salient conclusion was drawn based on the interplay between several factors such as rainfall, topography, tillage types and the socio-political determinants. The legal framework that governs land use in South Africa was equally discussed because of its role in understanding land distribution and usage.

Chapter Three presented the empirical aspects of the study. The research design was explained, and the choice of the quantitative approach justified in the chapter. The advantages and disadvantages of a questionnaire as a data collection instrument were explained as well as how the questionnaire was designed and structured. Issues of validity and observation were discussed. The population of the study, how the sample was selected from all those practicing

small-scale farming in the Luvuvhu catchment and a detailed explanation of how the questionnaires were administered and data analysed were explained.

Chapter Four focused on presentation and discussion of the findings of the study. The first section was based on the demographic characteristics of respondents and the results were presented in tables and figures followed by explanations and interpretation of the results. A comparison of data across all stratums of the research population was made. It was revealed that there are some variations associated with causes and management of land degradation.

6.3 Findings summary

6.3.1 Finding from demographic and socio-economic determinants

Rapid population growth and environmental change has equally compelled farmers to adjust and change their farming practices in order to sustain their livelihood. Consequently, the farming system in the Luvuvhu catchment has gradually shifted from long-held traditional methods to a farming system under continuous change in adopting new sustainable farming methods and the use of modern equipment. In terms of gender composition, males dominate in the practices of small-scale farming as compared to females. Although other studies (Kiage, 2013; Farnworth et al., 2016) in sub-Sahara Africa have proven that females are more engaged in small-scale farming than males, it should, however, be contextualised within a regional context taking into consideration the interplay between socio-economic characteristics of the study area. Although the results from this study reveal a very small proportion of young people (1%) are involved in small-scale farming, similar observation have been observed by other researchers internationally. For instance, from evidence gathered from developing countries suggest that urban food production has accelerated the rate of increases in urban populations and consequently changes in their diets leading to a shift in cultivation as a result of demands (Satterthwaite et al., 2010). Evidence from Sub-Sahara countries suggest that an increase in urban population is most likely be attributed to rapid urbanisation bringing about high standard of living and the inability of small-scale farming to generate income and not to supplement for food stuff as the case in the study area (Masters et al., 2013). Furthermore, the unprecedented change in land use systems caused by various factors such as mechanization, use and proper application of synthetic fertilizers, especially in the domain of rural agricultural development, and fallow systems have contributed to a scarcity of farmland.

Moreover, a cross section of the respondents reveals that most are unemployed or retired senior members of the community. The educational status of the respondents revealed that the majority of the respondents have not attained any form of tertiary education and only a smaller percentage had education in agriculture mostly obtained during specialised workshops organised by officials from the Department of Agriculture. Farmers dominated the planting of crop and surplus were sold mostly to local buyers to obtained basic necessities and the dominant type of farming practices was an enclosed farming system. The predominantly old-age population involved in small-scale farming are not so conversant with this new-farming technology which may have resulted in lower productivity from farming in the catchment. The majority of the respondents practicing small-scale farming fall within the third age group age suggestion the small-scale farming was seen as a means of subsistence and as a source of income for basic necessities. Although the majority of the respondents were unemployed, they did not consider farming as a source of formal employment as opposed to widely accepted scholarly research that consideres farming as a direct source of employment despite the fact that they were full-time farmers.

6.3.2 Findings from farmers' perception on the causes of land degradation

Most farmers in the study area perceived land degradation to result from a combination of different forms of physical and environmental factors. Amongst the prevailing physical causes, a greater proportion of the farmers attributed it to high rainfall intensities, general topography of the area, accelerated surface erosion, semi-aridity of the area, flooding and water logging experience in the terrain. In terms of the human factors, a greater proportion of the respondents attributed it to continuous tilling using tractors and other heavy equipment's to plough the land, land clearing and burning of vegetation in the catchment, intensive cultivation of throughout the year and unsupervised land tenure poor irrigation systems. This shows how farmers in the Luvuvhu catchment perceived these problems as causes of land degradation, which is probably an opportunity to promote the best soil conservation measures. From a geographical perspective, the findings also revealed that land degradation in the sampled area was not directly related to cattle rearing but rather to the socio-economic status of the farmers leading to poor farming practices and land management.

6.3.3 Findings from measures used to solve the problem of land degradation

Most of the farmers practice crop rotation and seem to be unaware that it is an effective method of soil conservation and the prevention of fertile land. Although rill erosion was

widespread in the study area and a preferred method used to solve the problem, including using sand and stones. The findings also revealed that government participated actively in providing support to small-scale farmers in the study area. However, the vast majority of farmers in this catchment reported that absent of support agencies and highlight the need for these agencies to be proactive.

Most farmers in the Luvuvhu catchment use alternatives means of maintaining crop production. Crop rotation is practiced by most farmers in the Luvuvhu catchment but, to a certain degree, farmers seem not to be aware of the positive effect as observed during the analysis. It is most likely that the positive effect of crop rotation observed by the farmers in the Luvuvhu catchment can be attributed to a reduced impact of soil fertility. Despite the absence of formal education by most of the farmers in the catchment and the absence of soil conservation training methods is, therefore, the most likely cause of decline in productivity. Farmer's awareness of the problem of land degradation in the area stem from the long history of land use and occupation and the strategies use could be well explaining due to their exposure to information. Because these farmers have been living in the area for decades, and their livelihood centred around farming. This land use experience has indirectly contributed to the farmer's perception to the land degradation and how to combat soil erosion in the area.

However, intervention measures should consider the heterogeneity of the study area and the above factors before implementing or promoting appropriate soil conservation measures. Also, all the support and soil conservation measures and governmental institutional support program and projects aimed at promoting soil conservation measures should have strategies which focus on enhancing the educational status of the households.

6.4 Recommendations

From the above finding, the following recommendations for further studies should be considered.

- Improving education is critical for sustainable practice in agriculture, hence more specialised workshop on land degradation and mitigations measures should be held with the local small-scale farmers in the Luvuvhu catchment.
- Strategies to reduce land degradation and improve agricultural productivity of the Departments of Environmental Affairs and Agriculture should be location-specific and interventions must be tailored based on local circumstances.

- External agencies such as NGOs have a key role to play in the overall education and training, but these agencies should consult local farmers and scientific external communities.
- There should be more innovations techniques introduced by the Department of Agriculture to small-scale farmers stimulated by taking farmers outside their area to witness initiatives and adaption methods elsewhere.
- Perceptions of small-scale farmers on climate and environmental change should be incorporated when developing strategies to address land degradation.
- Holistic rehabilitation schemes, to which considerable resources can be properly channeled, should be developed to improve small-scale farming by reducing the effects of land degradation.
- Short courses for farmers should be developed to provide valuable skills and knowledge with regards to erosion and land management, as well as assisting them in managing their finances and produce.

6.4.1 Recommendations for future studies

- Further research should be directed to quantify the exact extend that geographical factors contribute to land degradation in the area.
- There is need for further investigation on ecological sound conservation measure using selective and high intensity crops cultivation and cattle grazing farming areas in the catchment.

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Appendix 1: Questionnaire schedule for farmers

General instruction

This survey is aimed at assessing the historical land use of small-scale farming in the Luvuvhu catchment, Limpopo Province, South Africa. Participation in this survey is voluntary. Completion of the survey items is expected to take approximately 30 minutes. Your responses will be treated confidentially. To help ensure anonymity, please "DO NOT" write your name on the questionnaire. If you would like a copy of the results or have a question, comment, or complaint, please contact the researcher:

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SECTION A: BIOGRAPHICAL AND DEMOGRAPHIC DATA

Kindly complete the following questions by marking with an X in the box that corresponds with your choice.

A1 Gender

Male	
Female	

A2 Your age in years

< 20	
20-30	
31-40	
41-50	
51-60	
60+	

A3 Your highest qualifications

Matric certificate/grade 12	
Diploma	
Bachelor's degree	
BSc (Hons)	
Master's degree	
Doctoral degree	
Other qualification	

A4 Your Race

Black	
White	
Indian	
Coloured	
Other	

A5 Your language

English	
Afrikaans	
Setswana	
Tsonga	
Zulu	
Sesotho	
Xosa	
Venda	
If other language specify	

A6 Location of your farm

Near Township	
Near Village	
Near Rural Area	
Far from any population centre	
If other specify	

A7 Are you married?

Yes	
No	

SECTION B:

B1 Are you employed?

Yes	
No	

B2 If yes, approximately how much do you earn per month?

R < 2500	
R5 000-R7 500	
R 7 500-R10 000	
R10 000-12 500	
R12 500-R15 000	
> 15000	

B3 If No, do you consider farming as a source of employment?

Yes	
No	

B4 Do you have any other source of income except farming?

Yes	
No	

B5 Do you practise farming?

Yes	
No	

B6 If yes, what type of farming?

Rearing of animals	
Planting of crops	
Other	
If other specify	

B7 For which of the following reasons do you practice farming?

For subsistence	
For commercial	
Both	

B8 If for commercial purpose, who are your buyers?

Small-scale retailers	
Middle man retailers	
Large scale retailers	
Local buyers	
Friends and relatives	
Others	

B9 Do your buyers themselves do the harvesting?

Yes	
No	

B10 How often do you supply your buyers?

Once a year	
Twice a year	
Once every after three years	
If any specify	

SECTION C

Kindly complete the following questions by marking with an X in the box that corresponds with your choice.

C1 Do you own land?

Yes	
No	

C2 If yes, what is the size of your land?

< 1 ha	
1-5 ha	
5-10 ha	
> 10 ha	

C3 Do you have education in agriculture?

Yes	
No	

C4 If yes, what is your area of specialty?

Crop science	
Animal science	
Agricultural economics	
Others	

C5 Are you a full time farmer?

Yes	
No	

C6 Do you have experience in farming?

Yes	
No	

C7 How long have you been farming?

1-3 years	
4-5 years	
6- 10 years	
> 11 years	

SECTION D

D1 Do you own a tractor?

Yes	
No	

D2 If yes do you use tractors to till the soil?

Yes	
No	

D3 Do you practise mix farming in your farm?

Yes	
No	

D4 Do you rotate your crops?

Yes	
No	

D5 If yes, how often do you rotate your crops?

1-2 years	
3- 5 years	
> years	
If any specify	

D6 Do you allow your farm to fallow?

Yes	
No	

D7 If yes, for how long?

After 2 years	
After 4 years	

D8 Is your farming area enclosed or open?

Open	
Enclosed	

D9 Does your farm experience soil erosion?

Yes	
No	

D10 What types of erosion are visible on your farm?

Rill erosion	
Gully erosion	
Both	

D11 What measures have been put in place to curb the problem of erosion?

Planting of tress	
Using soils and stones	
Man-made structure	
Other measure	
If other specify	

Section E

E1 Have you received any assistance from the community head to solve the problem of land degradation as a result of erosion?

Yes	
No	

E2 If 'Yes', what types of assistance?

Financial assistance	
Equipment	
Workshops	
Others	

E3 If 'Others', please specify.

……

……

E4 Do you receive incentives from the government?

Yes	
No	

E5 If ‘Yes’, please specify.

……

……..

E6 Do the government officials organise workshops and or seminars to educate you?

Yes	
No	

E7 If ‘Yes’, please specify.

……

……

E8 What type of ploughing methods do you use?

Contour ploughing	
Bed ploughing	
Tilling	
No tilling	

E9 If ‘Yes’, please specify.

……

……

SECTION F: CAUSES OF LAND DEGRADATION

Which statement is the likely cause of land degradation in your area? Mark with an X the number that represents your opinion on the following scale:

1. Not a likely cause
2. A moderately likely cause
3. A likely cause
4. An extremely likely cause

Item	1 Not likely cause	2. Moderately likely cause	3. Likely cause	4 Most likely cause
F1. Generational topography and terrain of the farming area				
F2. High rainfall intensity in the study area				
F3. Failure of farmers to adopt soil conservation measures				
F4. Continuous soil tilling using tractors and other heavy equipment's to plough the land				
F5. Lack of community engagement in facilitating conservation farming practices				
F6. General climate change				
F7 Over-crowded farming areas due to increase population				
F8. Flooding and water logging experience in the terrain				
F9. Poor use of irrigation systems				
F10. Administrative and institutional problems accentuated by the various departments				
F11. Over grazing by animals				
F12. Accelerated surface soil erosion				
F13. Land clearing and burning of vegetation in the catchment				
F14. Intensive cultivation of throughout the year				
F15. Simi-aridity of the landscape				
F16. Deforestation caused by farming in the area				
F17. The unsupervised land tenure systems being practice in the area				

Appendix 2: Observation Checklist

Observation checklist was guided by the need to understand land degradation due to small-scale farming in the Luvuvhu catchment.

The following were observed during the field:

- What type of farming system is practices by the farmers?
- What is the current state of the farm?
- Are the farms having any visible signs of erosion?
- Have the farms experienced erosion before?
- How do farmers address the problem of erosion?
- What are the types of preventing measures currently used by the farmers?
- Other than erosion, are they any other forms of land degradation in the catchment?

Appendix 3: Ethics Clearance Certificate

UNISA university of south africa

CAES RESEARCH ETHICS REVIEW COMMITTEE

National Health Research Ethics Council Registration no: REC-170616-051

Date: 03/03/2017

Ref #: **2017/CAES/050**
Name of applicant: **Mr N Nthungeni**
Student #: **41838106**

Dear Mr Nthungeni,

Decision: Ethics Approval

Proposal: Assessing historical land use changes associated with small-scale farming in the Luvuvhu catchment, Limpopo Province South Africa

Supervisor: Mr R Anderson

Qualification: Postgraduate degree

Thank you for the application for research ethics clearance by the CAES Research Ethics Review Committee for the above mentioned research. Approval is granted for the project.

Please note that the approval is valid for a one year period only. After one year the researcher is required to submit a progress report, upon which the ethics clearance may be renewed for another year.

Due date for progress report: 31 March 2018

Please note point 4 below for further action.

The application was reviewed in compliance with the Unisa Policy on Research Ethics by the CAES Research Ethics Review Committee on 02 March 2017.

The proposed research may now commence with the proviso that:

1) *The researcher/s will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.*

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Appendix 4: Letter from the Department of Agriculture and Rural Development

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
AGRICULTURE AND RURAL DEVELOPMENT

Ref: 12R

Enquiries: **Dr S B Dikgwatlhe**
0152943229
0723179445

27 March 2017

Mr. N NTHUNGENI (Masters in Geography)
University of South Africa (UNISA)
Department of Geography
South Africa

RE: ASSESSING HISTORICAL LAND USE CHANGES ASSOCIATED WITH SMALL-SCALE FARMING IN THE LUVUVHU CATCHMENT, LIMPOPO PROVINCE.

1. Your letter dated 09/03/2017 of request for permission to do research has reference.

2. Kindly take note that your request to conduct Research in Luvuvhu Catchment in Vhembe District (Limpopo Province) has been recommended and approved. You will be required to present your proposal to the LDARD Departmental Research Forum/Committee as an when required, failure to do so will result in the retraction of the recommendation and the approval thereof. You are kindly required to visit the **Office of the Director, Vhembe district** in conjunction with Local Agricultural Office before you start with the actual work, in order to brief them on the study and your request, this is also important in raising awareness. The Department is prepared to embark on any activity to make this research work possible, which could assist our small-scale farmers in improving their farming systems and production at large and ultimately an improvement of livelihoods of our communities.

3. Kindly take note that you will be expected to hand over a copy of your final report to the Department for record purposes as well as for reporting. You may also be invited to share your findings in the Departmental Research Forum.

4. Hoping that you will find this in order.

Kind regards

27 March 2017