DISSERTATION TOPIC: The role of traditional land management systems on household food security in Dora.

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DATE: JUNE 2018
DEDICATION

To my wife Angeline, my sons Emmanuel Desmond, Benjamin Raymond, and Jonathan Delvine.
ABSTRACT

The study sought to investigate the role of traditional land management systems on household food security in Dora community. The objectives were to identify the main traditional land management practices, determine the relationships between traditional land management systems and food security, assess people’s perceptions of the role of traditional land management systems in ensuring food security and to recommend options for integrating sustainable traditional land management systems into modern strategies for enhancing food security. This was done in order to suggest effective and sustainable traditional land management systems which could be used to improve food security and uplift their livelihood.

A sample of 196 households was selected from a target population of 1 397 households in twenty three villages of the ward. The researcher used both positivist and interpretivist paradigm in this research, had to use both descriptive research design whereby a case study was applied and experimental design whereby hypotheses were formulated before the study begins also. Nine villages were surveyed, both qualitative and quantitative data was collected using questionnaires, interviews, group discussions and field observations as the primary data collection tools, historically records, reports and books for secondary data collection.

The research findings showed that some farmers generally perceive modern, externally introduced systems of land management to be superior to their indigenous, locally developed management systems. In this regard, few farmers still fully appreciate the importance of traditional approaches to land management. The results confirmed that, although elderly people of the community still appreciate the importance of traditional systems of land management, there is an evident knowledge gap in the community, characterised by poor transfer of indigenous knowledge from elderly to the young people. This scenario shows the community faces a risk of loss of valuable indigenous knowledge. It was discovered that the majority of households in Dora community that still practice traditional systems of land management are low income or resource poor household groups. Farmers still practicing traditional systems of land management grow crops mainly for subsistence as opposed to commercial purposes. The study results revealed that there is a positive relationship between traditional systems of land management and agro biodiversity. In this case, households that practice more of these traditional systems generally grow more crops, this gives an indication of nutrition security and agro biodiversity. Research findings confirmed that indigenous knowledge decreases as education level increases, but increases with age. Furthermore, stakeholder partnerships are generally weak in Dora. This implies efforts to promote food security are not effectively coordinated.

In summary, the investigations revealed that traditional systems of land management are still playing a vital role in agro biodiversity conservation, nutritional and food security. Equally important for food security besides traditional systems, however, are other factors such as technical support, soil suitability, rainfall and seed security.

It was recommended that there is need to build measures on local innovations such as soil and water conservation and fertility management. Given the semi arid nature of Dora and poor soils, the community needs technical support. There is need to strengthen traditional institutions that regulate the management of vegetation and establishment of settlements. There is need to seriously consider the reintroduction of traditional crops and indigenous seeds, such as millet, rapoko and sorghum, most of which are drought resistant. There is also need to strengthen the roles and capacities of NGOs with food security concerns. It is also recommended that there is need to incorporate beehive in the forestry and wildlife parks as a traditional land management on vegetation, especially elephants from destroying trees and wiping out crops in their quest for food. Further research be undertaken in other factors that improve food security, these include seed security, appropriate traditional and modern food storage techniques, food processing, and marketing and forestry management. Indigenous knowledge would form an important focal basis for such research.

Conclusion, comparative analysis of the results that were obtained and other researches referred to in Chapter 2 shows that traditional systems of land management still play a vital role in food security. Both scenarios also showed that traditional approaches still require the greater attention of policy makers, and if adequately recognised and reinforced, form an important basis for the current community development approaches.
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My dissertation supervisor Doctor P.P. Bongo, who tirelessly guided me in conducting and compiling the entire dissertation. Special mention would go to him, he tirelessly developed me into a Masters’ degree student, who would be in future able to research on a topic, develop an argument and defend it, identify knowledge gaps and able to research on the gaps. I would also want to acknowledge my Pro-vice Chancellor – Bindura University of Science Education - C.A.T. Katsvanga, for all the encouragement in making me enrol for this Masters programme, you were so wonderful, Doctor.

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CHAPTER 1

INTRODUCTION

1.0 Introduction
This chapter introduces the background of the research area of traditional land management and food security, the research problem, justification, the focus and objectives of the study. It thus provides the tone, rationale and scope of the study.

1.1 Background to the study
The 1992 Rio Earth Summit, United Nations Conference on Environment and Development has widely been considered a major global turning point in many environmental circles. This has been demonstrated by the production of one of the most important, internationally recognized blueprint documents on the environmental calendar, the Agenda 21. Addressing environmental problems however, still remains a great challenge, particularly in developing countries such as Zimbabwe, chief among them food insecurity (SARDC 2002). Food security has raised a lot of concern the world over, given that more than 850 million people are food insecure globally (FAO 1997). This is considered as one of the indicators in the sustainability of human managed systems (Miller 2000).
According to Siem (2002), Africa is one of the most vulnerable regions to food insecurity, in which the absolute numbers of people with inadequate access to food doubled from 103 million to 215 million between 1969 and 1992. On the same note, production per-capita fell by 20% between 1964 and 1992 (Pretty 1995; FAO 1997). The Sub-Saharan region has further been seriously affected by four serious droughts that hit the greater part of the continent in the last two decades (1983, 1987, 1992 and 2002) (Bayer 2000). The effects, especially in the smallholder farming sector, have been devastating both to nature and in magnitude. Southern Africa, which was particularly affected by the severe 2002 - 2003 drought, is not an exception (Siem 2002).

Responses by many governments to most of these disasters in this case have been of a short-term nature (Bayer 2000). The imposition of a range of externally developed land management policies by most colonial governments in Africa has led to the disruption and rejection of many indigenous systems of land management, some of which had been tried and tested for centuries (SARDC 2002). This has undermined local initiatives and innovations (SARDC 2002).

In Zimbabwe, of importance is that apart of Principle 22 of the Agenda 21 (1992), the Zimbabwe Environmental Action Plan (ZEAP) and District Environmental Action Plans (DEAPs) fully recognize that modern and scientific methods of land management need to complement indigenous approaches rather than replace them completely (Chenje et al 1998). However, although some traditional systems of land management are now recognized in some quarters, their role in food security is yet to be fully evaluated in many Zimbabwean communities.

Addressing food insecurity in Zimbabwe is still one of the major challenges facing the country (SARDC 2002). The situation is evident in many rural communities such as Dora Communal Lands, Mutare Rural District, although a wide array of land management strategies have been adopted, in which food security is key. Given Zimbabwe’s current economic climate, the increasingly unpredictable climatic conditions and inappropriate
tillage practices that have characterized many rural environments, food insecurity is closely linked to poverty and environmental degradation (Bayer 2000).

It is against this background that the research sought to investigate the role of traditional land management systems in food security. In this case, the sustainability and adaptability of land management is critical in ensuring food security. Food insecurity due to unsustainable land management systems has triggered this study.

1.2 Statement of the problem
Dora is one of the rural communities beset by food insecurity challenges. This is partly attributed to difficulties in developing appropriate risk management strategies in response to periodic droughts, environmental degradation, declining soil productivity and poverty. The 2002 - 2003 farming season further worsened the effects of drought (UNEP 2011). More so, land management systems that are adapted to the local environment and constraints are poorly developed, making it difficult to manage food security related risks (FAO 2005). Such a scenario is undermining the natural resource base, on which long term, sustainable food security strategies are based.

Attempts to promote food security have been made before, and more importantly after independence, mostly through government departments such as the Agricultural Research and Extension Services (AGRITEX). Of particular concern is the little regard that externally imposed, modern land management systems give to traditional approaches with regards to food security, which is partly a legacy of colonial land policies (Bayer 2000). Such a development has led to the disruption of, and gradual disregard for many indigenous systems of land management (SARDC 2002).

In Dora, resultantly, this has undermined local initiatives and innovations thereby encouraging loss of indigenous knowledge. Such a situation is obtaining against the background of a community most of whose households are beset by poverty, a scenario that has seen many households seriously exposed to food insecurity. The adoption of modern land management systems at the expense of the locally developed approaches has
undermined resource poor farmers’ capacity to cope and adapt to the changes. Effectively this has undermined food security. In view of the strategies however, the questions remain. Is the community food secure? Do the current land management approaches recognize traditional systems? To what extent have modern management strategies promoted food security and are traditional approaches well adapted to the local environmental conditions? All these questions triggered this study.

It is against this statement problem that this research has been undertaken to identify traditional approaches to land management that are still relevant to the present conditions. This helps in determining how they can be integrated in the modern approaches, in order to provide options for measures required to improve and promote food security in Dora community.

1.3 Research Aim
The research sought to assess, investigate and determine the role and impact of traditional land management systems on household food security. This was done in order to suggest effective land management strategies which Dora Community could use to improve food security and uplift their livelihood. Attempts to promote to improve high land productivity have been made before, and more importantly after independence, mostly through government ministries and departments.

In view of these strategies however, the questions remain whether people’s food security guaranteed or secured, do the current land management approaches recognize or promote room for sustainable land utilization and continuity through high productivity and good ecosystem services, and to what extent has land management strategies promoted food security and are land management approaches well adapted to the local community environmental conditions.
1.4 Objectives of the study

i. To identify the main traditional land management practices in Dora

ii. To determine the relationships between traditional land management systems and food security.

iii. To assess people’s perceptions of the role of traditional land management system in ensuring food security.

iv. To recommend options for integrating sustainable traditional land management systems into modern strategies for enhancing food security.

1.5 Hypotheses objectives

a. To test whether traditional approaches to land management promote household food security or not.

b. To test the relationship between the number of traditional land management systems that households apply and the number of crops grown.

1.6 Research questions

The research questions for the study were:

i. What are the land management approaches, traditional and modern systems that are currently being applied to farming in Dora community against the current economic hardships and environmental challenges, given the prevailing climatic changes?

ii. What is the relationships between traditional land management systems and food security at Dora community and does it promote food security?

iii. What are the people’s perceptions on the role of traditional land management system in ensuring food security?

vi. What are the effective options of traditional land management systems that can be integrating into modern strategies for sustainable farming and enhancing food security?

1.7 Hypotheses
**H1** Traditional approaches to land management promote household food security.

**H0** Traditional land management systems do not promote household food security.

**H1** There is a positive relationship between the number of traditional land management systems that households apply and the number of crops grown.

**H0** There is no relationship between the number of traditional land management systems that households apply and the number of crops grown.

### 1.8 Justification of the study

The justification for undertaking this study was to promote sustainable development in Dora Community through that the community is food secured. Whilst the argument that some traditional approaches such as shifting cultivation can present a potential for land degradation (Borlaug 1997, quoted in Pretty 1995) cannot be dismissed due primarily to population growth, it is critical and equally important to assess the role of sustainable traditional systems in food security. This is not only an important component in the overall rural survival and food security strategies, but an important basis on which modern approaches should be built. In this regard, such opportunities have not been adequately explored in Dora. Furthermore, whilst some modern land management systems such as the soil and water conservation works introduced during the colonial era are documented (Rukuni and Eicher 1994), the importance of traditional systems in food security at communal level ought to be fully evaluated.

It is against this background that the research seeks to investigate how traditional systems of land management can be integrated in local level planning and rural community development. On this basis, findings would provide the platform for involving the local community in decision-making, thus empowering them in the process of incorporating traditional systems in the modern land management strategies. In this case, the recognition of local innovations in land management creates a platform for promoting sustainable, environmentally friendly, cheap and well adapted land management options for ensuring food security. Besides, this will help local farmers appreciate the importance of traditional food security coping strategies in view of unreliable climatic conditions and
the low to average rainfall patterns that characterize Dora. Recognizing relevant
traditional systems of land management would also provide a platform for motivating the
community residents to take the future in their own hands by utilizing local knowledge
and resources. Indigenous knowledge remains one of the most important assets that
resource poor communities can make utility of and, thus, over which they have total
control (World Bank 2000). This will foster collective action through a participatory,
farmer friendly grassroots approach.

The research would influence policy makers to adopt policies and guidelines that would
enable the local people to explore and use local resources for sustainable food production
and security. Such recognition helps them make informed decisions when working with
the community. On this note, given food insecurity is one of the challenges besetting
Dora community, there is evidence that some of the modern strategies are not fully
addressing food security. This implies some traditional systems such as the traditional pit
system and soil fertility management practices need to be evaluated, although they are not
fully and widely recognized (SARDC 2002).

Many modern researchers have concentrated more on the perceptions and views of
“experts”. Such include Borlaug (1994), as quoted in Pretty (1995) and Zwahlen (2000),
who consider modern approaches on future food security efforts as the only viable option
to enhance food security. They thus view traditional systems as obstacles to food security
and unsustainable, hence do not acknowledge the role of traditional practices. It is
however undeniable that some traditional systems play an important role in ensuring food
security, such as soil and water conservation in Chivi (Murwira 1996) and terracing in
parts of Chimanimani (SARDC 2002). Such are examples that have been overlooked and
hence need to be seriously evaluated, reinforced and considered.

1.9 Assumptions of the study
It was assumed that the views of the sampled farmers and key informant in the study
area, who were involved in this research would represent a true picture of the role and
impact of traditional land management systems on household food security. It was also
assumed that structured interview guides and questionnaires employed were well constructed to elicit information sought. The study assumed that answers from participants were voluntarily given and they were genuine answers. It was assumed that farmers are in pleasant farming for household consumption and able to dispose surplus food for the uplifting of livelihood.

1.10 Definition of terms

Environmental resource management is the management of the interaction and impact of human societies on the environment. Environmental resources management aims to ensure that ecosystem services are protected and maintained for future human generations, and also maintain ecosystem integrity through considering ethical, economic, and scientific ecological variables. It is thus linked to environmental protection, sustainability and integrated landscape management.

Land management – a system of utilizing a parcel of land for production and maintenance, primarily to meet human needs.

Sustainable land management – a system which maintains an acceptable level of productivity that satisfies prevailing needs for maintaining the carrying capacity of the land resource base, with minimum damage to the environment and danger to human life.

Traditional knowledge – a body of knowledge and beliefs built locally by a group of people, transferred through oral tradition, about the relationship between living things and their environment. It includes a system of organization, a set of empirical observations about the local environment and a system of self management that governs resource use.

Indigenous knowledge - is the local knowledge that is unique to a culture or society. This knowledge is passed from generation to generation, usually by word of mouth and cultural rituals, and has been the basis for agriculture, food preparation, health care, education, conservation and the wide range of other activities that sustain societies in many parts of the world.

Traditional land management – a system of utilizing land, built on local knowledge and beliefs that are transferred through oral tradition. It includes a set of empirical
observations about land as a resource, a system of organization and self management that governs the land resource use.

**Food security** - access by all people at all times to the food needed for a healthy life.

**Household food security** – access to foods that are adequate in terms of quantity, nutritional quality, safety and cultural acceptability to meet each person’s needs at all times, even when the household is faced with situations of unpredictable stress, shocks or crises.

**Sustainable development** is balancing the fulfillment of human needs with the protection of the natural environment so that these needs can be met not only in the present, but in the indefinite future. Includes development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

**Agriculture or farming** is the cultivation and breeding of animals, plants and fungi for food, fiber, biofuel, medicinal plants and other products used to sustain and enhance human life.

1.11 Limitation of the study

Land management is just a component of the food security equation. In this case, the forms of traditional land management only constitute one of the food security dimensions, which may not necessarily be a true reflection of the food security situation in the area of study. Furthermore, indigenous knowledge of land management depends mostly on memory of respondents. There is no systematic documentation of events, which may result in memory lapse. On the same note, the study area was too large to be covered within a limited time period. Literacy levels are also low in the area. The study was carried out when the political climate was relatively tense, although permission was sought from local leaders. There were indications that suspicion was not completely eliminated in some respondents. Misconceptions in some respondents during data collection were thus felt.

Besides, the survey was carried out partly from a background where the study area was affected by heavy rains that affected the country in 2016/2017 farming season. Hence
there was heavy land degradation as there was huge soil erosion and siltation in dams and river lines. This affected their expected harvesting and livestock as crops and grass were swept. The possibility of unreliable answers by some respondents can therefore not be discounted totally given a sizeable number of them were apparently anticipating food aid. Besides, given the study was academic, some respondents indicated that it had no direct benefits to their livelihood and hence perceived it with a negative attitude.

Notwithstanding these limitations, however, in order to achieve representative results, out of 23 villages, the study was restricted to nine villages. This made it possible to collect data that were more detailed from a smaller area. To reduce misconceptions by respondents, questionnaires were distributed by hand in order to make necessary clarifications where necessary regarding the purpose of the study. Questionnaires were translated to local language to reduce illiteracy problems. Permission was also sought from village heads and the headman in order to reduce suspicion on political grounds. Data on modern land management systems were also gathered in order to draw a comparison with traditional land management systems as well as other factors influencing food security in the area. This provided a more holistic and balanced perspective of the food security situation in the area. The number of elderly respondents interviewed was also purposively increased, on the assumption that they possess greater indigenous knowledge than other age groups.

1.12 Delimitation/ Scope of the study
The research used the concept of holistic management in agriculture and the study focused on investigating the roles of traditional land management systems on household food security. The study scope was limited to the land management approaches, traditional and modern systems that are currently being applied to farming in Dora community against the current economic hardships and environmental challenges, given the prevailing climatic changes. It also looked at the people’s perceptions on the role of traditional land management system in ensuring food security. It concluded by giving recommendation on ways that can be applied to integrate traditional land management systems into modern land management strategies for sustainable farming and enhancing
food security. The study timeframe was limited to information of 50 years ago to 2017/2018 farming season since traditional land management systems very old versus current modern or green revolution in farming.

1.13 Chapter summary
The research seeks to investigate how traditional systems of land management can be integrated in local level planning and rural community development. On this basis, findings would provide the platform for involving the local community in decision-making, thus empowering them in the process of incorporating traditional systems in the modern land management strategies. The chapter focused on introducing the subject, the research problem, justification, the focus and objectives of the study. It thus provided the tone for the study, the rationale and scope of the research investigations. This sets precedence for the following chapters.

CHAPTER II

REVIEW OF LITERATURE

2.0 Introduction
This chapter focuses on a detailed review of related literature. It takes into account the different schools of thought, views and opinions on the subject relating current and traditional land management to food security.

2.1 Sustainable development and traditional land management
According to Brundtland Report of 1987, sustainable development has been defined as balancing the fulfillment of human needs with the protection of the natural environment so that these needs can be met not only in the present, but in the indefinite future. The term was used by the Brundtland Commission which coined what has become the most often-quoted definition of sustainable development as development that meets the needs
of the present without compromising the ability of future generations to meet their own need

2.2 Agro-biodiversity and the role of traditional land management on food security

Much of the world’s crop diversity is attributed to farmers’ experiences, who follow old farming and land management systems that provide local benefits at minimum environmental costs. Such benefits include the promotion of diet diversity, income generation and maximization of returns under low technological levels. This is evidenced by a study carried out by SARDC (2000) in Barotse, Zambia. Pretty (1995) shares a similar view in that individual farmer evidence shows that even with the substitution of modern knowledge and skills, farmers can cut inputs while they remain economically viable. In Southern Districts of Malawi, traditional indigenous knowledge is sustaining people through their comprehensive knowledge of soil management and cropping practices (SARDC 2002). Most farmers have extensive knowledge in using the tree species, Msangu (*Faidherbia albida*) to improve and maintain soil fertility.

Where such ecological traditional systems are well pronounced, the micro-ecosystems are highly diverse and complex, involving simultaneous growing of as many as twelve crops on the same field, as mixed cropping is the general rule (Pretty 1995). This presents an important indicator of agro-biodiversity. Reij (1996) considers traditional systems as one of the most instrumental systems in satisfying nutritional requirements of any household.

For instance, the pitting technique developed by the Matengo communities to control soil erosion and improve soil fertility embraces such a system and is still used today. It therefore serves as a good example of successful indigenous technologies for controlling soil erosion on steep slopes and ensuring food security (Reij, et. al. 1996). Habitat conservation is important in maintaining biodiversity, an essential part of global food security. There is evidence to support a trend of accelerating erosion of the genetic resources of agricultural plants and animals (FAO 2013).
An increase in genetic similarity of agricultural plants and animals means an increased risk of food loss from major epidemics. Wild species of agricultural plants have been found to be more resistant to disease, for example the wild corn species (UNEP 2011). Teosinte is resistant to 4 corn disease that affect human grown crops. A combination of seed banking and habitat conservation has been proposed to maintain plant diversity for food security purposes (FAO 2013).

According to Daniel (2016), the World Bank, a leading producer of environmental knowledge, continues to advocate the win-win prospects for economic growth and ecological stability even as its economists express their doubts. This point then makes the researcher developed interest in studying the role of traditional land management in enhancing food security basing on this feeling by the World Bank in 2011, so as to build more information on environmental management. In effect, it has been argued that the Industrial Revolution as a whole is unsustainable (Duncan 2015). One critic has argued that the Brundtland Commission promoted nothing but a business as usual strategy for world development, with the ambiguous and insubstantial concept of 'sustainable development' attached as a public relations slogan (Perez-Carmona, Alexander 2013)

2.3 General global overview on role of traditional land management on food security
The September 2000 Millennium Development Goals 1 and 7 stress the need to eradicate extreme poverty and hunger, and ensure environmental sustainability. This is in view of the current land management systems, which have resulted in the loss of 2 billion hectares of crop land, pastures and forests worldwide in the last fifty years (World Bank, 2000). The alarming levels of 5 – 10 million hectares of land being lost annually to severe degradation, have posed a serious threat to food production and rural livelihoods (FAO 2003). In this context, the sustainable management of land resources will help achieve Goals 1 and 7.

2.3.1 The Agenda 21 acknowledges the role of traditional land management
One of the most widely recognized international blueprint documents, the Agenda 21 (1992) acknowledges the importance of indigenous traditional knowledge and practices
in the management of natural resources. The following provisions of the Agenda 21 make reference to traditional land management systems;

Principle 22,

“Indigenous people and their communities and other local communities have a vital role in environmental management and development because of their knowledge and traditional practices. States should recognize and duly support their, culture and interests and enable their effective participation in the achievement of sustainable development”.

Chapter 10,

“Integrated approach to the planning and management of land resources, supports traditional patterns of sustainable land management”

Chapter 14,

Promotes “sustainable agriculture and rural development”

Chapter 15,

Conservation of biological diversity. Section 15.5 specifies the adoption of measures to encourage the promotion of “sustainable production systems, such as traditional methods of agriculture,,,,,,,,, which use, maintain or increase biodiversity”

Considering the above, Agenda 21 promotes support for traditional patterns of sustainable land management through the formulation and implementation of integrated agricultural projects that include other natural resource activities such as management of rangelands, wetlands, forests and wildlife.

2.4 Overview on traditional land management - Zimbabwe and Southern African

2.4.1 Historical perspective on the role of traditional land management systems

Moyo, et, al. (1991) allude to the fact that in Zimbabwe, most traditional methods of resource utilization were well adapted to conservation even before the colonial period. In this context, the scale of land management for food production imposed little stress on the environment, except on the fertile but steep slopes of the Eastern Highlands, where the Shona people initiated terracing as a soil conservation measure. In other parts of the country, modes of the land resource utilization enabled the continuous recovery of, and dependence on the land resource base (Chenje, et, al. 1998).
Indigenous traditions of resource management were, however, overwhelmed by the consequences of the land apportionment and application of restrictive measures. The Land Apportionment Act (1930) and the Land Tenure Act (1965) resulted in the discriminatory demarcation of land. In light of these developments in the local political and social structures, colonization process generally resulted in most Zimbabweans being deprived of most of their land (Mushunje 2003). Such changes saw most traditional systems of land management generally ridiculed and downplayed in favour of modern, often imposed land management practices (SARDC 2002), a scenario that applied throughout the Southern African Region. Indeed, colonial prohibitions were particularly severe on agricultural practices such as the use of wetlands for cultivation and grazing (SARDC 2002). In Malawi, Zambia and Zimbabwe for instance, the colonial governments in the 1950s created soil conservation measures which were particularly more appropriate to commercial, large scale and smallholder farms, but not readily appropriate for African traditional land management systems.

One other striking example was evidenced in Lesotho’s Mobu Valley, where complex, sustainable land management systems existed before the colonial government imposed external systems. In this case, traditional systems that had supported the local communities for centuries were disregarded in favour of misleading, largely untested and little understood land management measures (Kate, et, al. 1992, cited in SARDC 2002)). Resultantly the community largely suffered from food insecurity and huge soil losses.

There were instances, however, when colonial governments recommended management practices which Africans themselves preferred (SARDC 2002). Such include terracing in parts of Chimanimani and mount cultivation in Chisumbanje. These systems have survived even under the pressure of colonialism in the SADC region.

### 2.4.2 The current setting on the role of traditional land management in Zimbabwe

The Zimbabwe National Environmental Policy (2003) Second Draft’s broad objective is to avoid irreversible environmental damage and to sustain the long term ability of natural
resources to meet the basic needs of people, enhance food security and reduce poverty. Sustainable systems of land management (land being one of the key natural resources), are underscored as one of the environmental policy goals. This recognizes traditional systems of land management and in this regard, the Government of Zimbabwe is mandated to develop and implement adequate measures to ensure the protection of traditional knowledge that promotes the sustainable management of natural resources and ensure food security. In context of land management, the new Environmental Management Act (2003, Cap 20:27) emphasizes the need to encourage the protection and recognition of traditional and indigenous knowledge in the management of natural resources.

According to Chenje, et al. (1998) the Zimbabwe Conservation Strategy, Environmental Action Plan (ZEAP) and the District Environmental Action Plan (DEAP) frameworks assert that modern scientific technological innovations and initiatives should not seek to replace but complement and build on the existing community indigenous systems in the management of land. The planning process thus needs to evolve through community participation.

However, despite all the above strategies and Acts, there is knowledge gap on the implementation of these strategies, policies, and Acts and evaluate the role of traditional land management system on household food security.

2.5 Potential of traditional land management for contributing to productivity
The potential of traditional land management for contributing to productivity and food security is supported by Pretty (1995), who noted that it is now not uncommon to find two or three fold increases in agricultural yields following community wide adoption of resource conserving technologies and practices which incorporate traditional land use management systems. Increased yields from 500 – 800 kg/ha to 1000 – 2500 kg /ha and sometimes higher have been achieved……. in programmes focusing on soil and water conservation, land rehabilitation, nutrient conservation, green manuring and integrated pest management. According to Syers and Rimmer (1994), land management and quality
of the land resource need, therefore, to be evaluated not only in terms of productivity, but also in terms of sustainability.

Table 2.1 below shows comparative results of the “Zai” system – Yatenga Province, Burkina Faso

<table>
<thead>
<tr>
<th>Season</th>
<th>Crop</th>
<th>Yield –zai (kg/ha)</th>
<th>Yield - Ploughing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992 – 93</td>
<td>Sorghum</td>
<td>1494,4</td>
<td>397,2</td>
</tr>
<tr>
<td>1993 – 94</td>
<td>Sorghum</td>
<td>620 –1288</td>
<td>280 – 320</td>
</tr>
</tbody>
</table>

Source: Ouedraogo and Kabore (1996), Burkina Faso

Table 2.2 below shows a comparative impact of three traditional soil and water conservation techniques on millet yields in 1993- 1994 season, Tahoua Village Illel District, Niger.

Table 2.2 Impact of three traditional soil and water conservation techniques on millet

<table>
<thead>
<tr>
<th></th>
<th>Half moons</th>
<th>Tassa (kg/ha)</th>
<th>Contour stone bunds</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993 (1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T 0</td>
<td>144</td>
<td>77</td>
<td>156</td>
</tr>
<tr>
<td>T 1</td>
<td>393</td>
<td>416</td>
<td>292</td>
</tr>
<tr>
<td>T 2</td>
<td>659</td>
<td>641</td>
<td>448</td>
</tr>
<tr>
<td>1994 (2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T 0</td>
<td>296</td>
<td>206</td>
<td>390</td>
</tr>
<tr>
<td>T 1</td>
<td>969</td>
<td>912</td>
<td>671</td>
</tr>
<tr>
<td>T 2</td>
<td>1486</td>
<td>1531</td>
<td>900</td>
</tr>
</tbody>
</table>

(1)- Low and irregular rainfall, (2) – Good rainfall
T 0 -The situation without conservation, T 1 - Soil and water conservation technique and manure, T 2 - Soil and water conservation technique and manure and fertilizer. (Source: A. Hassan, 1992)
According to Pretty (1995), the PATECORE (Project d’Amenagement de Terroin et Conservation de resource), a land management project initiated in 1988 in Bam and Passore Provinces of Burkina Faso, was particularly premised on innovations based on local knowledge. Indigenous knowledge adopted included stone bunds, permeable dams, tree planting, contour ploughing, and use of organic manure and establishment of protected zones for regeneration. One of the most important impacts of the project was an increase in sorghum yields from 870 kg/ha to 1650 – 2000 kg/ha between 1988 and 1993 (Savenije and Huijsman 1991).

2.6 Traditional land management, local participation and indigenous knowledge
Local participation, according to Savenije and Huijsman (1991), an internal initiative in community development should build on local innovations and needs. This fosters a participatory approach through local participation and involvement. This approach has formed the basis for the “Ngatili”, an indigenous natural resource management system readopted by Hashi in the 1970s through the Shinyanga Soil Conservation Programme in Shinyanga Region, south west of Tanzania (Barrow and Ekaran, 2002). The major advantage of this traditionally premised initiative was that it was adapted to the local environmental and climatic constraints. Such a project followed the widespread failure of externally imposed policies such as the 1975 Villagization Act. With the Ngatili traditional land management system, more than 250 000 ha of land have been rehabilitated in the region. This was as well particularly instrumental in improving food security. Such is classic case where traditional resource management systems were revived to meet contemporary livelihood needs, chief among them food security, under hostile climatic conditions.

The environmental ethical systems established by indigenous communities in various regions around the world are critically important because they are built on specific experiences by a given group of people (SARDC 2002). In this case, traditional knowledge can be an entry point in a community in promoting strategies for local sustainability.
Pretty (1995) asserts that community participation and incorporation of traditional knowledge are critical in land management oriented development. SARDC (2002) supports this view in that the recognition and use of indigenous knowledge systems encourages local participation and a bottom-up approach to development.

In Zimbabwe’s Chivi District, farmers have demonstrated a good command of locally evolved pitting systems, contour bunds and ridges (Hagman and Murwira 1996). Resultantly, the communities have adapted the fanya juu system introduced by extension agents. This followed the realization that external initiatives should build on local innovations, and this provides local resources over which locals have control. Such a case has not only helped rehabilitate previously barren land, but improved food security as well. This observation is further evidenced by the Chivi Food Security Project, initiated by ITDG, which has demonstrated the importance of working with local institutions already existing to identify and develop technological options by building on their traditional knowledge (Siyamachira, 2000).

Indigenous knowledge, describing the wisdom of indigenous people, the former Director General of UNESCO, Frederico Mayor, in Nakashima, Prott and Bridge (2000) once said that the indigenous people of the world possess an immense knowledge of their environments, based on centuries of living close to nature. The Director went on to say living in and from the richness and variety of complex ecosystems, they have an understanding of the properties of plants and animals, the functioning of ecosystems and the techniques for using and managing them that is particular and often detailed. In rural communities in developing countries, locally occurring species are relied on for foods, medicines, fuel, building materials and other products. Equally, people’s knowledge and perceptions of the environment, and their relationships with it, are often important elements of cultural identity (Nakashima, Prott and Bridge 2000).

With the introduction of modern land management systems, there indigenous knowledge has been eroded, it is against this background that this research would want to investigate the indigenous knowledge levels through assessing people’s perceptions on the role of traditional land management systems in ensuring food security.
2.7 Current land management policy versus traditional land management systems

Pretty (1995) alludes to the fact that one of the biggest threats to traditional land management systems is lack of supportive policies as noted,

Most policy frameworks still actively encourage farming that is dependent on external inputs and technologies….In the process of agricultural modernization, external institutions have tended to ignore and so suffocate local knowledge and initiatives.

On the same premises, Scooners and Thompson (1994), cited in Rimmer and Syers (1994) have noted that the problem with agricultural science is that it has poorly understood the nature of indigenous and rural people’s knowledge.

Furthermore, according to Spendjian (1991), cited in Rimmer and Syers (1994), the current economic thinking is now characterized by an emphasis on the short term issues, and puts individual profits before a significant gain or the maintenance of the natural resource base.

Lema (1996) notes that the “vinyungu” traditional cultivation system in Njombe District (Tanzania) suffers from lack of extension support as the district extension staff and the higher policy makers generally view the system as a ‘sideline, an informal land use which cannot easily be integrated into their initiatives’. This perception prevents them from according “vinyungu” cultivation the attention it deserves (Lema 1996).

Indigenous people are strikingly diverse in their culture, religion, and social and economic organization. Yet today, as in the past, they are prey to stereotyping by the outside world. By some they are idealised as the embodiment of spiritual values; by others they are denigrated as an obstacle to economic progress. However, they are neither: they are people who cherish their own distinct cultures, are the victims of past and present-day colonialism, and are determined to survive (Burger 1990).

Table 2.3 below shows the characteristics of externally and locally derived soil and water conservation techniques.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>External</th>
<th>Local</th>
</tr>
</thead>
<tbody>
<tr>
<td>Designed by</td>
<td>Engineers and development planners</td>
<td>Local farmers</td>
</tr>
<tr>
<td>Designed for</td>
<td>Soil conservation</td>
<td>Multiple, depending on setting (including soil / water harvesting, conservation, disposal)</td>
</tr>
<tr>
<td>-------------</td>
<td>------------------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Design features</td>
<td>Standardised in relation to slope features</td>
<td>Flexible, adapted to local variations</td>
</tr>
<tr>
<td>Construction</td>
<td>One time</td>
<td>Incrementally (fitting) with household labour supply</td>
</tr>
<tr>
<td>Labour demands</td>
<td>High</td>
<td>Variable, generally low</td>
</tr>
<tr>
<td>Returns</td>
<td>Long term environmental investment</td>
<td>Immediate returns</td>
</tr>
<tr>
<td>Project setting</td>
<td>Large scale, campaign approach, food-for work / cash-for-work employment based safety net programmes, etc</td>
<td>Longer term support to indigenous innovations, participatory research and farmer to farmer sharing</td>
</tr>
</tbody>
</table>

(Source: Reij, et, al. 1996)

### 2.8 Limitations of traditional land management systems in food security

At the other end of the spectrum are opponents of the traditional approaches of land management. Such include Dobbs et al (1991, cited in Pretty 1995), Borlaugh (1992), and Crosson and Ostrum (1998), cited in FAO (2003) whose studies suggest that traditional land management approaches are less profitable than modern approaches. Added to these are Hanson, et, al. (1990) and Reganold et, al. (1990), cited in Pretty (1995), who believe that the option of cutting costs (as in traditional approaches) can as well substantially cut net returns. Leibhardt, et, al. (1993), cited in Pretty (1995), however, dismiss this argument in that traditional systems are not profitable just for a short transitory period.

Of particular interest is Borlaugh’s view (1992) that modern land management systems and technologies are the only viable option to address food insecurity. This argument shares the same view with Osborne (1995), cited in Zwahlen (2000), who concur that some traditional land management systems can present obstacles to resource conservation. Such researchers provide examples of studies carried out by Bourlisre (1965), cited in Zwahlen (2000) in the Mesopotamian Region (Iraq) whose traditional
irrigation and land management systems have rendered the soils unsuitable for agriculture even today. Delvin (1999), cited in Zwahlen (2000) has it that the major criticism of traditional land management systems in food security is that they are labour intensive and less productive than systems which involve heavy fertilizer application and other modern innovations. For instance, maize crop yields may rarely reach two tones per hectare using traditional methods, compared to seven to eight tones per hectare under South Zambian conditions in a normal year.

A further critical criticism of the traditional land management systems is that, unfortunately, most indigenous farmers are unable to conduct soil sampling, surveys and land evaluation so as to match cropping activities with soil capability, thereby increasing the potential for land degradation. Such an observation is evidenced by the widely criticized practice (under present conditions) of shifting cultivation. (Borlaugh 1992, cited in Pretty 1995; Zwahlen 2000). This view has however, been strongly challenged by Delvin and Zettel (1999) who argues that the specificity of indigenous traditional systems to climate and ecological zones suggests that many indigenous communities recognize the soils and land units that are suitable for specific crops and land management practices. This therefore minimizes external requirements. Such an observation has been proven in Southern SriLanka’s traditional paddy oriented land management (Vaheesan 2002, cited in Siem 2002), the land use management studies carried out in Northern Africa by Batanouny (1999), such as the “hema” and the “karm” (soil and water conservation) systems.

In countries such as Zimbabwe, traditional land management systems are no longer considered relevant in some areas in face of growing populations (Moyo, et, al. 1991; Rukuni and Eicher 1994). In most of these situations, modern systems have gradually replaced the former.

2.9 Theoretical Framework
The theoretical framework of this study was holistic management in agriculture, as the researcher sought to assess, investigate and determine the role of traditional land
management systems on household food security. According to Coughlin (2013) holistic management is from a Greek words meaning all, whole, entire, total and in agriculture is a systems thinking approach to managing all resources. While originally developed as a tool for range land use (Weber and Gokhale 2011) and restoring desertified land (Clatworthy 1984) the holistic management system can be applied to other areas with multiple complex socioeconomic and environmental factors.

The above mentioned theoretical framework of this study was based on sustainable agricultural systems to try and enhance food security in Dora community. Although developing a widely accepted vision is outside the scope of this study, the researcher identified four generally goals that help define sustainable agriculture:

- **Satisfy human food, feed, and fiber needs, and contribute to biofuel needs.**
- **Enhance environmental quality and the resource base.**
- **Sustain the economic viability of agriculture.**
- **Enhance the quality of life for farmers, farm workers, and society as a whole.**
According to Coughlin (2013), one limitation of any land management system is that economically and politically powerful users can easily quantify and argue their needs. It is harder to define the economic value of ecosystem services and, therefore, the ecosystems and people most dependent on them for their subsistence become voiceless and often neglected users (Coughlin 2013). In theory Holistic Management framework addresses this issue, but it is not always seen in the field (Nilsson, Renofalt, and Malm 2008). Traditional land management systems are not exceptional, they are affected by social, economic, political and environmental factors as the communal people would want to utilize them in enhancing food security. This is the knowledge gap that the researcher sought to investigate. It is against this framework that the research sought to investigate the role of traditional land management systems in food security as the subject for the study.

2.10 Chapter Summary
This chapter examined the different schools of thought, views and opinions of previous researchers on the subject of research. The issues that emerge from this literature review were that, despite all global and regional strategies, policies and Acts which are to try and curb unsustainably environmental challenges that are introduced by poor land management systems, there is knowledge gap on the implementation of these strategies, policies, and Acts and evaluate the role of traditional land management system on household food security. A global overview of the area of land management, traditional land management, and the available pieces of legislations and policies were discussed. An attempt to draw a comparison between traditional and modern (which include arguments for and against) approaches to land management as they relate to food security was made. This sets the platform for the next chapter, the methodology.
CHAPTER III

RESEARCH METHODOLOGY

3.0 Introduction
This chapter examines the research methodology of the study. It presents the research paradigm, design, sample, data collection methods as well as a description of the data analysis and presentation procedures that were used.

3.1 Location of the study area
Dora Communal Area is a peri-urban, rural community situated 20 kilometres South-West of Mutare urban centre, in Mutare Rural District, East of Zimbabwe. Its Latitude is -19.0833°, Longitude is 32.5333°. Grid reference: 500873. Figure 3.1 and 3.2 below are showing location of Dora Community on Zimbabwe maps.

Figure 3.1 Location of Mutare District and Dora Communal in Zimbabwe
3.2 The research paradigm

The researcher used both positivist and interpretivist paradigm in this research. In order to understand any phenomenon well, one needs to study it holistically and in depth. There is no single route or a particular method to knowledge. Several routes are possible just as there are different ways of eating and different ways of worshipping. There are varied and multiple realities since different people in different circumstances or contexts would understand the same phenomenon differently. Also anything not understood in more than one way is not understood at all. Against this background, the researcher opted to use both positivist and interpretivist paradigm in this research. This then means again both quantitative and qualitative data was used in the research. On positivist paradigm, reality was given from the community and was measurable (quantifiable) using instruments that were independent of the researcher. Observations and reasons were the best means to understand human behavior in the study area. On interpretivist paradigm, reality was perceived by people in the study area, each of whom views it through the lens of his/her prior experience and knowledge. The community farmers tried to make sense of the...
world they live in through interactions with other people and the material world they find around them using their own specific social, political, cultural and historical contexts. This means that reality or knowledge was socially constructed. Knowledge in this research study was shared meaning. The researcher gathered deep information and perceptions through qualitative methods such as interviews and observations and representing this information and these perceptions from the perspective of the research participants.

3.3 The research design
Due to the fact that the two paradigm which are both positivist and interpretivist were used in the research, automatically, the researcher had to use both descriptive research design whereby a case study was applied and experimental design whereby hypotheses were formulated before the study begins. The experimental design was done and viewed as a design that could examine whether traditional approaches to land management promote household food security or not and to examine the relationship between the number of traditional land management systems that households apply and the number of crops that they grow.

The study involved three main outputs; review of literature, detailed field investigations and data analysis. Nine villages of Dora were surveyed through the descriptive field survey method. The investigations targeted households. A detailed review of literature was done before field investigations to identify aspects relevant to area of study. Field surveys were carried out between July 2017 and April 2018 through questionnaires, field observations, interviews and focus group discussions. In addition, secondary data was extracted from census and PRA reports. Quantitative data such as income and food production levels was collected primarily from questionnaire survey, whereas qualitative data such as causes of food insecurity and perceptions of respondents were obtained mainly from interviews and group discussions. Shortcomings were inaccuracy, short memory due to long period information needed. However, these shortcomings were mitigated by the use of secondary data collection. As addition secondary data was
extracted from the organization and government reports to improve on accuracy, and short memory. The procedures used were meant to monitor and control variables, as well as to enhance the validity of study.

3.4 The population and sample
A sample of 196 households was selected from a target population of 1,397 households in twenty three villages of the ward. This represents 14% of the target population, which was envisaged to be sufficiently large to yield fairly accurate representation, statistically reliable and generalizable results. The sample was segregated to manage limitations as noted in chapter 1.

Table 3.1 Sample composition

<table>
<thead>
<tr>
<th>Method</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Questionnaire</td>
<td>56</td>
<td>60</td>
<td>116</td>
</tr>
<tr>
<td>Interview</td>
<td>25</td>
<td>27</td>
<td>52</td>
</tr>
<tr>
<td>Focus Group Discussions</td>
<td>14</td>
<td>14</td>
<td>28</td>
</tr>
<tr>
<td>Total</td>
<td>94</td>
<td>102</td>
<td>196</td>
</tr>
</tbody>
</table>

(Source: Questionnaires and field data)

3.5 Sampling methods and techniques
A simple random sampling method was used to select households for questionnaires. This was done in order to minimize bias and hence afford every household an equal probability of being selected. Household names were obtained from the respective village heads. Thereafter a Stratified Random Sampling was used as the farmers grouped into male and female and a proportional figure of 48% to 52% was used in the subgroups and then taking a simple random sample in each subgroup. Male and female names were gathered separately before name tags were assigned to each of them. The tags were thoroughly mixed in two separate boxes and randomly picked until the required numbers were reached. The method was used separately for each village, and the size for each village was proportional to its household population. This method was, however, time consuming.
Purposive, stratified and then simple random sampling methods were used to select household members for interviews and group discussions. These techniques were applied looking at expertise needed and stratified according to sex group then randomly selected from the groups. Forty one of the key informants interviewed (at least 20.9 % of the total sample population) comprised older members of the community. These were chosen purposively on the assumption that they generally possess greater indigenous knowledge. Names of the members of the community known to be above 60 years of age were obtained from the nine village heads. Key informant interviews were done with each of the nine village heads, the headman of the area and the Councillors. AGRITEX Officer and one EMA officer were also interviewed. Additionally, 28 key informants were selected for focus group discussions. These comprised of 7 men, 9 women as well as male and female youths of six members from each group. In this case, names of the male and female members were selected purposively with the assistance of village heads. The selection was based on sex considering that men and women often have varying perceptions of indigenous knowledge and food security.

3.6 Data collection methods and instruments
The key primary data collection methods used were questionnaire, interviews, focus group discussions, and field visits and observations. The main primary data collection instruments were questionnaire guidelines for individual farmers, focus group discussion questionnaire guidelines for groups, interview checklist for key informants and camera for photo taking during field visit and observations. Books, Articles, Maps, Annual reports from individual farmers, government departments, NGOs, were used to gather secondary and historical data.

3.6.1 Questionnaire and questionnaire guideline
The questionnaire involved three procedures i.e. questionnaire design, distribution and collection. The method and instrument was considered necessary as it made it possible to administered data from a relatively large number of respondents and over a fairly large geographical area. Aspects of the study gathered include demographic, socio-economic, production characteristics, land and fertility management practices (see Appendix I). This
made it possible to statistically analyse large volumes of data involving traditional land management systems. This implies it made it possible to easily generate quantifiable data. Since the survey hinged more the memory of respondents, it also offered them sufficient time to produce answers before they were collected. The questionnaire comprised 28 open ended and 24 closed ended questions.

The research exercise involved the design and distribution of 116 questionnaires. All these questionnaires were returned, which translates to a response rate of 100%. In this case, 59.1% of the total targeted sampled participants received the questionnaires. The simple random method was used to select sample. The random approach was chosen to afford each household an equal probability of being selected, and given that the pattern of houses in the area does not follow a regular order.

A pre-test exercise was run in order to test the relevance and appeal of the questionnaire. This helped clarify some aspects where necessary, and was achieved with the councilors of the area and a few members of the community. The questionnaires were distributed by hand to appraise the respondents on the purpose of the study, and to make necessary clarifications where necessary. The problems encountered with this method, however, involved the administration of the questionnaire, which required a lot of time and proved costly in designing, distributing, collecting and transforming the data for analysis. The questionnaire approach posed problems with some illiterate respondents, although it had been translated to the local language, particularly given that educational levels are generally low in the community. More to this is that it did not allow the researcher the flexibility and room to probe on issues of interest and relevance to the study.

In this study, questionnaires had also other advantages over some other types of surveys in that they were cheap to use and easy to analyse data, quick in gathering large amounts data and could be collected in a short period of time. Questionnaires did not require as much effort from the questioner as verbal or telephone surveys. They had standardized answers that make it simple to compile data. However, there were disadvantages associated to the use of questionnaires to this research. Standardized answers frustrated the user. Questionnaires were also sharply limited by the fact that respondents were
supposed to be able to read the questions and respond to them. Thus, for some demographic groups conducting a survey by questionnaire may not be practical. However, the researcher mitigated by reading and interpreting the questionnaires to the respondents, the researcher also translated to both languages Shona and English. The other disadvantage was that the questions were so specific to what the researcher was asking, as a result information gained could be minimal. Questionnaires may follow the same system as interviews as they will be using structured questions to collect information from respondents. The inclusion of this method helped to gather and compare information through the use of interviews and to analyse the validity of data collected during random sampling. For this research, questionnaires helped to reduce bias as information were presented and viewed differently.

3.6.2 Interviews and interview checklist
Interviews were used to complement the questionnaire method, thus cross-checking the validity of the latter (see Appendix II). Fifty two respondents were interviewed from the nine selected villages. The purposive and stratified-random methods were used in selecting respondents. The interview method was chosen because it made it possible to collect vital information from illiterate respondents, particularly the older folk, who were of particular interest. Some of the unique aspects that arose in the process of interviewing respondents were also captured. Resultantly it was possible to determine the role of indigenous trees in food security and the cultural value of trees and wetlands. Interviews also allowed flexibility in terms of identifying when the respondent was having difficulties in understanding a question and therefore such questions could be rephrased. The problem identified, however, was that the method relied mainly on the memory of respondents when such responses were required. Besides, unfortunately, the method was based mainly on what respondents said, rendering the responses qualitative.

The problem of general mistrust was encountered with some respondents. The use of interviews in this type of research had also some advantages as it would motivate respondents to view the problem in their own words and ideas were recorded. The advantages for use of interview for this research were to motivate the respondents. More
took the questions seriously and could create new experience about the problem, hence leading to a break through towards the problem. Most farmers would rather talk than write to express their views. It was also flexible. It allows greater flexibility in wording, sequence and direction. The interviewer was able to clarify or paraphrase questions if the respondent becomes confused about the topic. It was easier to explore highly complex or abstract topics. It allows the monitoring or evaluation of inter-personal skills, non-verbal, paralinguistic behaviour and emotional tone of a person about the topic. It also gives or helps to show behaviour under stress and internal consistency of the respondent's answers. However, there were also some disadvantages noted when the interviews were used, the interviewer had to simultaneously listen, process of verbal and non-verbal information and this was a tiresome job to handle. Guide direction and taking notes could have caused the interviewer not to remember other clues hence misrepresenting the facts. It required more time to cover all the needed respondents hence increasing costs to conduct them. Data or information would remain between the interviewer and the respondent hence little information would be known and this could create bias or distort the research objectives. The researcher mitigated the disadvantages by paying for the time spent with the respondents, also prepared food for the respondents. Group discussions were also conducted to make sure information is known by everyone.

3.6.3 Focus group discussions and guidelines
Focus group discussions were also conducted with both male and female members of the community. Four focus group discussions were conducted separately with men, women, male and female youths. Youths were also targeted in this case (besides men and women) in order to find out whether traditional knowledge is being passed on to younger generations. This tool was vital in checking on the validity and reliability of the data collected through interviews and questionnaires. Some of the aspects gathered through this tool include historical trends, people’s perceptions of the role of traditional land management systems in food security and their recommendations. Factors contributing to food insecurity, and those considered important for a successful land management system were also gathered. The traditional systems still considered relevant to the current conditions were thus identified.
The flexible and participatory nature of group discussions addressed limitations associated with mistrust on one on one interviews. Through this approach, more insights were generated through greater interactions among informants. The tool proved important in that it gave the community groups an opportunity to create and analyse their local knowledge. This was important in making a comparative analysis of locals’ perceptions of seasonal, historical trends and livelihood systems. The informants were thus encouraged to explore their own versions of their environment as opposed to versions directed by the researcher. One of the major problems encountered however, was that some group members tended to dominate discussions such that it was felt other members did not have sufficient opportunity to express their views.

The researcher used a form of qualitative research in which a group of farmers were asked about their perceptions, opinions, beliefs, and attitudes towards traditional land management systems in improving sustainable food security. A group discussion could have too many opinions. This was good and proper because the researcher could get a lot of ideas about the people behaviour towards the problem that was being investigated. On the other hand however, it could derail all the perceptions about the problem being investigated by the researcher hence causing him or her to lose focus of his or her goals. There were also more advantages of using group discussion to the research study. There was face-to-face involvement of a qualified moderator who ensured that the conversation was always on track and encourages participants’ engagement without one individual dominating the meeting.

They had opportunity and ability of group participants to interact with each other. Participants were stimulated to discuss, the group dynamics generated new thinking about the topic and that resulted in a much more in-depth discussion. The researcher was capability to utilise non-verbal behaviour as a research input. The expression, attitude of individual, the intensity of the conversation could be perceived by the researcher, and was used to modify the decisions and also counted in the research result. However, there were also some disadvantages of using group discussions, some groups tend to become
influenced by one or two dominant participants in the session, hence making the output very biased. The researcher played an essential role of moderation and in handling the situation. Group discussions could not be expected to be projectable in the same way as quantitative study findings can be. In focus groups farmers were collected in a meeting room thus they might behave differently from how they behave when they are not watched and could have affected the quality of research results.

3.6.4 Field observations
Field observations, were used to further check on traditional systems still practiced. Observing what actually happens on the ground and how this actually happens helped in drawing a comparison with the data collected through interviews and questionnaire methods. This included the traditional systems on the ground, soil fertility management practices and soil types. Photos were taken in order to provide a record of the traditional management systems that are currently being practiced. One of the main problems was, however, that of time limitations for collecting adequate data about particular land management practices, patterns, cultural aspects and events.

3.6.5 Secondary and historical data collection
This form of data collection involved obtaining data relevant to the study area from secondary sources. References were done on several books, articles, journals, reports from several writers and individuals including the reports from participating farmers as the researcher collected secondary and historical data. This was done through reading and citing and acknowledging relevant literature. Such included an administration map of Dora communal area, which also helped identify village administrative boundaries, the lowest administrative unit in this case, as well as relating natural resource and environmental characteristics to human activities and interactions. Other sources of secondary data were census data defining the household and village populations and gender characteristics from CSO, 2002 preliminary results and existing (PRA and AGRITEX) reports.
3.7 Data presentation and analysis
Tabular format and graphical data presentation methods were used as the basis for interpretation and analysis of results. Some of the main data presentation tools used include frequencies, bar chart and histograms. This made it possible to calculate averages and percentages by converting frequencies into percentages. These were also instrumental in revealing trends, patterns and distribution regarding traditional systems of land management. Besides, these tools provided the basis for analysis. Both descriptive and some inferential statistical techniques involving the manipulation of nominal and ordinal data were employed in the analysis of the results. These helped in providing for relationships and comparisons between variables and distribution. Trend analysis, scoring and ranking were used to establish trends and patterns, as well as causes and effects of variables. Spearman’s rank correlation coefficient, t-test and Pearson’s Product Moment Correlation Coefficient were employed to assess degree of association between forms of traditional land management and food production patterns. Variables used were production levels, incomes, age, area in hectares, number of crops grown, number of traditional management systems, number of meals per day, level of education and Indigenous knowledge.

3.8 Chapter Summary
The researcher used both positivist and interpretivist paradigm, had to use both descriptive research design also, whereby a case study was applied and experimental design whereby hypotheses were formulated before the study begins. The experimental design was done and viewed as a design that could examine whether traditional approaches to land management promote household food security or not and to examine the relationship between the number of traditional land management systems that households apply and the number of crops that they grow. This was done in order to understand any phenomenon well. The sample size of 196 participants that were targeted by the research instruments. It also highlighted data collection procedures, analysis and the presentation of the findings. The researcher highlighted the advantages and disadvantages of the noted and used data collection methods. This sets the platform for the next chapter 4.
Summary and flow of data collection methodology and data analysis

### Primary Data Sources
- Population: 1397
- Sample: 196

### Quantitative and qualitative survey
- Interviews to community, key informants and stakeholders
- Field visits, observations and photo documentation

### Secondary Data Sources
- Documented Data – books, articles, reports and historical records

### Variables
- Income, age, levels of education and IK, production levels, number of TLMS, number of crops,
- TLMSs, MLMS, Fertility management systems
- Historical trends, perceptions of the people
- TLMS, trends, linkages, perceptions, Sustainability productivity

### Data Analysis to answer the aim of the research, (4) research objectives, (4) research questions and the (2) hypothesis objectives
- Scoring and ranking Comparisons, Trend Analysis

### The role of traditional land management systems on household food security
1. Land management systems, 2. Relationship of traditional land management and food security, 3. People’s perception, and 4. Options for integrating sustainable traditional land management systems into modern strategies for enhancing food security.

### POSSIBLE OUTCOMES
- Effective Systems - sustainable land management and food security
- Ineffective Systems - land degradation and food insecure

### Recommendations
- Improvements and Recommendations

Figure 3.3: Data collection methodology and analysis (Source: Own)
CHAPTER IV

DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.0 Introduction
This chapter presents and analyses the key findings of the study. In presenting the results an attempt to provide the linkages between traditional systems of land management and food security is made. In this context, some data analysis procedures are taken into account.

4.1 Historical background and characteristics of respondents
It was very important for the researcher to understand the background and characteristics of the respondents in terms of historical, demographic and social-economic aspects as this was going to help in assessing the people’s perceptions on the role of traditional land management systems on household food security.

4.1.1 Historical characteristics of respondents
Of all the households surveyed, 70% reported to have settled in 1964, 11% between 1980 and 1985, and 19% settled after 1985. The survey revealed that approximately 90% of respondents settled on virgin land, whilst 10% settled on previously cleared land. This shows the majority of the respondents command a greater understanding of the characteristics of the area. Table 4.1 below shows percentage changes in household farm sizes for the households surveyed, for the period 1966 – 2016, due to population growth.

Table 4.1: Percentage changes of household farm sizes for the period 1966 to 2016

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 2 ha</td>
<td>3%</td>
<td>2%</td>
<td>15%</td>
<td>34%</td>
<td>52%</td>
</tr>
<tr>
<td>3 - 5 ha</td>
<td>7%</td>
<td>8%</td>
<td>27%</td>
<td>51%</td>
<td>39%</td>
</tr>
<tr>
<td>6 - 10 ha</td>
<td>32%</td>
<td>40%</td>
<td>26%</td>
<td>10%</td>
<td>7%</td>
</tr>
<tr>
<td>10 + ha</td>
<td>58%</td>
<td>50%</td>
<td>32%</td>
<td>5%</td>
<td>2%</td>
</tr>
</tbody>
</table>

(Source: Field data)
4.1.2 Demographic characteristics

4.1.2.1 Sex characteristics

Out of 196 of all participants involved in the survey, male respondents comprised 48% and females 52%. This scenario shows a higher proportion of female farmers engaged in agriculture, as compared to male farmers. For all the nine villages surveyed, the average household size was 5.

4.1.2.2 Age characteristics

Table 4.2 Age characteristics of respondents by percentage.

<table>
<thead>
<tr>
<th>Age group</th>
<th>Number respondents</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>&lt;30</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>31 – 40</td>
<td>22</td>
<td>23</td>
</tr>
<tr>
<td>41 – 50</td>
<td>24</td>
<td>25</td>
</tr>
<tr>
<td>51 – 60</td>
<td>22</td>
<td>23</td>
</tr>
<tr>
<td>61+</td>
<td>18</td>
<td>19</td>
</tr>
<tr>
<td>Total</td>
<td>94</td>
<td>102</td>
</tr>
</tbody>
</table>

(Source: Field data)

Respondents within the age group 41– 50 years constituted the highest percentage ie 25%, 49 out of 196, whereas the lowest age group (below 30 years) constitutes the lowest proportion (10%), 20 out of 196.

4.1.3 Socio-economic aspects

4.1.3.1 Education characteristics of respondents

In general, the community has a low level of education. The small proportion of people with secondary and tertiary education reflects the fact that most of the people with secondary or higher education migrate to urban areas in search of employment. Within the sample showing no education acquired at all, the majority (75%) were female. This shows a gender imbalance in favour of male access to education and resources, which as well confirms the fact that the majority of women engage in subsistence agriculture.
Table 4.3: Education characteristics and Indigenous Knowledge level of land management of respondents by percentage

<table>
<thead>
<tr>
<th>Education level</th>
<th>Number</th>
<th>Percentage (%)</th>
<th>LKS in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>94</td>
<td>48</td>
<td>80</td>
</tr>
<tr>
<td>Primary</td>
<td>66</td>
<td>34</td>
<td>70</td>
</tr>
<tr>
<td>Secondary</td>
<td>23</td>
<td>12</td>
<td>35</td>
</tr>
<tr>
<td>Tertiary – Diploma</td>
<td>11</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td>Tertiary – University</td>
<td>2</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>196</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

(Source: Field questionnaires)

On relationship on education characteristics and percentage of Indigenous Knowledge level of land management, the table above shows a close linkage between IK levels of land management and educational levels of respondents. Respondents that reported to have attained no education and primary education generally possess higher IK, compared to those that have attained secondary education. IK level progressively decreases among those in the secondary and tertiary categories. This suggests that modern knowledge tends to replace IK as people acquire more education, hence a probable disregard for IK as modern knowledge increases.

4.1.3.2 Income characteristics

Table below shows household sources of income by percentage, it was revealed that majority of the people’s source of income was selling of agricultural products. This was then concluded that the majority rely of land cultivation. It was then noted that the land management systems issues need to be addressed to avoid land degradation as this is the major factor of production for agriculture products to be produced.
Table 4.4 Household sources of income for Dora by percentage

<table>
<thead>
<tr>
<th>Source of income</th>
<th>Number of households</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selling agriculture produce</td>
<td>106</td>
<td>54</td>
</tr>
<tr>
<td>Income generating projects</td>
<td>15</td>
<td>8</td>
</tr>
<tr>
<td>Employment – formal</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>Employment – informal</td>
<td>43</td>
<td>22</td>
</tr>
<tr>
<td>Others e.g. panning</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>196</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

(Source: Field questionnaires)

4.1.3.3 Household income characteristics

Table 4.5: Income characteristics per month and Indigenous Knowledge System (LKS) levels of land management of respondents

<table>
<thead>
<tr>
<th>Source of income</th>
<th>Number</th>
<th>Percentage (%)</th>
<th>LKS in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; USD 100.00</td>
<td>49</td>
<td>25</td>
<td>90</td>
</tr>
<tr>
<td>USD 101.00 - 500.00</td>
<td>78</td>
<td>40</td>
<td>70</td>
</tr>
<tr>
<td>USD 501.00 - 999.00</td>
<td>39</td>
<td>20</td>
<td>60</td>
</tr>
<tr>
<td>USD 1000.00 - 1499.00</td>
<td>16</td>
<td>8</td>
<td>40</td>
</tr>
<tr>
<td>USD 1500 +</td>
<td>14</td>
<td>7</td>
<td>40</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>196</strong></td>
<td><strong>100</strong></td>
<td></td>
</tr>
</tbody>
</table>

(Source: Field questionnaires)

The table above shows that the majority of the households fall within the USD100.00 to USD500.00 income category per month. The proportion however, progressively decreases as the income categories increase, in which case the households in the USD1500.00 or more category constitute the lowest percentage. This shows the majority of the households have very low-income levels per month. Table above also shows linkages between income characteristics and IK levels of land management for the nine villages surveyed. It shows that households with higher incomes have low IK levels of land management, whereas more of low-income households possess greater IK levels.
This implies that higher income households have a propensity to disregard IK as they tend to depend more on modern systems of land management, whilst low-income households depend more on locally available resources, which are easily afforded. This possibly suggests that most of the older members of the community have lower education levels. The observations above, however, show that these older age groups possess higher IK of land management.

### 4.1.3.4 Age characteristics and Indigenous Knowledge levels of respondents

Table below shows age characteristics and level of indigenous knowledge (IK) of land management

Table 4.6 Age characteristics and IK levels

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>LK level</th>
<th>Age group</th>
<th>Score (%)</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very low</td>
<td>0 – 20</td>
<td>&lt; 30</td>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td>Low</td>
<td>21- 40</td>
<td>31 - 40</td>
<td>31</td>
<td>4</td>
</tr>
<tr>
<td>Average</td>
<td>41- 60</td>
<td>41 - 50</td>
<td>54</td>
<td>3</td>
</tr>
<tr>
<td>High</td>
<td>61- 80</td>
<td>51 - 60</td>
<td>66</td>
<td>2</td>
</tr>
<tr>
<td>Very high</td>
<td>81- 100</td>
<td>61 +</td>
<td>85</td>
<td>1</td>
</tr>
</tbody>
</table>

(Source: Group discussion data)

The table above shows the linkages between age characteristics and levels of IK in land management for respondents. It shows a close relationship between age of respondents and the level of indigenous knowledge (IK) of land management. The level of IK was based on scores relating to knowledge of traditional land management systems that are practiced, those that have been abandoned and explanations for their abandonment, perceptions, number of traditional crops grown, justification for this, as well as indigenous trees known and managed. The figure above shows that older members of the community possess greater IK than lower age groups (there is a progressive increase in the level of IK with age). This gives an indication of a knowledge gap between age groups and hence a gradual loss of IK in land management.
It also reflects a very interesting relationships between age, formal education and IKS levels. The relationships in the table above show that IK levels progressively increase with age, thus older sections of Dora community possess greater indigenous knowledge than lower age groups. This suggests the community is gradually undergoing loss of indigenous knowledge as evidenced by the knowledge gap shown above. In contrast, however, formal education levels decrease with age, suggesting that lower age groups have acquired greater modern knowledge through formal education, compared to older members of the society. This scenario explains why lower age groups possess less indigenous knowledge, and this suggests this form of knowledge is gradually being disregarded in favour of formal education or modern knowledge.

4.2 Land management systems – Objective (i)
Farmers reported the following fertility management practices; composting, animal manure, spreading mount soil, zero tillage, fallowing, leaving out particular indigenous trees in fields, crop rotation and intercropping, and liquid fertilizers/manure. One modern fertility management practice identified is the use of inorganic fertilisers.

4.2.1 Traditional systems of land management
From the findings below, fallowing, zero tillage, pitting system, contour ridges at short intervals, terracing and wetland cultivation are still being practiced by a relatively few farmers. The investigations revealed the following circumstances as contributing to their decreasing popularity among farmer households, population growth, decline in space for cultivation, labour intensive, externally introduced approach involving the use of straight crop lines to facilitate use of machinery and increasingly greater attention given to AGRITEX officers, whose modern land management approaches are perceived to be superior by some farmers to indigenous approaches to land management as the major reasons.
### Table 4.7: Traditional land management systems in Dora

<table>
<thead>
<tr>
<th>Practice / System</th>
<th>% of respondents that consider practice traditional</th>
<th>% of farmers that practice the system</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Intercropping</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>2 Crop rotation</td>
<td>100</td>
<td>96</td>
</tr>
<tr>
<td>3 Pitting system</td>
<td>90</td>
<td>9</td>
</tr>
<tr>
<td>4 Contour ridges at short intervals</td>
<td>92</td>
<td>80</td>
</tr>
<tr>
<td>5 Zero tillage</td>
<td>100</td>
<td>14</td>
</tr>
<tr>
<td>6 Traditional wetland cultivation</td>
<td>100</td>
<td>21</td>
</tr>
<tr>
<td>7 Hillside cultivation with terracing</td>
<td>100</td>
<td>26</td>
</tr>
<tr>
<td>8 Mount cultivation</td>
<td>100</td>
<td>60</td>
</tr>
<tr>
<td>9 Strip cropping</td>
<td>95</td>
<td>34</td>
</tr>
<tr>
<td>10 Contour ridges at long intervals</td>
<td>15</td>
<td>100</td>
</tr>
<tr>
<td>11 Traditional agro-forestry</td>
<td>100</td>
<td>59</td>
</tr>
<tr>
<td>12 Composting and manuring</td>
<td>95</td>
<td>91</td>
</tr>
<tr>
<td>13 Terracing</td>
<td>100</td>
<td>8</td>
</tr>
<tr>
<td>14 Fallowing</td>
<td>100</td>
<td>11</td>
</tr>
</tbody>
</table>

(Source: Field data)

### Table 4.8: Reasons for the abandonment of some traditional land management systems

<table>
<thead>
<tr>
<th>System</th>
<th>Reasons for decline in use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fallowing</td>
<td>Population growth, decline in space for cultivation</td>
</tr>
<tr>
<td>Zero tillage</td>
<td>Labour intensive</td>
</tr>
<tr>
<td>Pitting system</td>
<td>Long been adopted by a few farmers</td>
</tr>
<tr>
<td>Terracing</td>
<td>N/A</td>
</tr>
</tbody>
</table>
| Intercropping                | Externally introduced approach involving the use of straight crop lines to facilitate use of machinery  
|                               | Tendency to grow more cash crops than before                                               |
| Traditional agro-forestry    | Need for fuel energy, continuous ploughing                                                  |
| Traditional wetland          | Wetland decline and condition deterioration                                                 |
| cultivation                  |                                                                                             |

(Source: Field group discussions)
4.2.2 Modern land management systems and external interventions

Ninety seven per cent of the households surveyed acknowledged the influence of external interventions and impacts on household food security. Some of the modern land management systems adopted by some farmers include:

- Afforestation (of mostly and potentially) degraded areas. Whilst 98% of respondents indicated that these initiatives tend to favour mostly exotic trees, 82% acknowledged the dangers posed by eucalyptus gum trees. These include a decline in the amount of river and wetland water as they require more water.
- Use of machinery. This has necessitated the clearance of indigenous trees (some of which are vital in field agro biodiversity). These technologies include tractors, ox-drawn plough, straight crop lines and single or two crops to allow for easy operation of cultivators and continuous cultivation.

Sixty four per cent of the respondents indicated that some of these modern systems had undermined food security, as richer households can mostly afford them. Thirty one per cent reported these modern systems had improved food security, whilst 5% felt they have had no impact on food security.

4.2.3 Traditional soil classification system

The tables below show, traditional soil classification system and indigenous tree management by the indigenous people of Dora Community. The community use this to identify use of the land, preference of farming system and the land management systems that will be applied at the site. Ninety per cent of informants interviewed demonstrated a great command of indigenous knowledge with regards to the importance of indigenous trees in food security. The investigations showed that trees left on farmlands provide vital leaf litter, fruits and shade for both people and crops (an observation confirmed in the field was that the crops under some tree cover were suffering less from moisture stress than those in the surrounding zones).
### Table 4.9: Traditional soil classification system

<table>
<thead>
<tr>
<th>Soil type (indigenous name)</th>
<th>Crop suitability</th>
<th>Properties</th>
<th>Preference by farmers</th>
</tr>
</thead>
</table>
| **Jecha (sandy)**           | - Not very suitable for maize production  
- Suitable for groundnuts, rapoko, sorghum | - Poor water holding capacity  
- Requires average rainfall  
- Prone to erosion  
- Poor nutrient retention capacity | - Not preferred |
| **Dema**                    | - Very suitable for maize and groundnuts | - Good water holding capacity  
- That with high clay content requires more rainfall  
- High water retention capacity | - Preferred |
| **Jihwo**                   | - Very suitable for maize, ground & round nut, and rapoko production | - Good water holding capacity, but poor drainage  
- Requires more rainfall  
- High nutrient retention capacity | - Preferred |
| **Dongo jena**              | - Poor for maize & groundnut production  
- Fairly good for round nuts | - Difficult under low or high moisture conditions  
- Poor water holding capacity. | - Not preferred |
| **Tsanza**                  | - Suitable for groundnuts, less suitable for maize, rapoko | - Poor water holding capacity  
- Requires high rainfall | - Not preferred |
| **Churu**                   | - Suitable for round nuts and rapoko and maize (under high rainfall) | - High water holding and nutrient retention capacity but poor drainage | - Preferred |

(Source: Field data)
### 4.2.4 Indigenous tree management

Table 4.10: Tree species commonly left out in fields and their purposes

<table>
<thead>
<tr>
<th>Tree species</th>
<th>Purposes</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Msasa</em> <em>(Brachystegia speciformis)</em></td>
<td>- Erosion prevention and control, high quality leaf litter, shade, firewood</td>
</tr>
<tr>
<td>Mupfura <em>(Sclerocarya caffra)</em></td>
<td>- Fruit, leaf litter, erosion prevention, firewood, shade</td>
</tr>
<tr>
<td>Mutohwe <em>(Azanza garkeana)</em></td>
<td>- Erosion prevention, fruits and shade</td>
</tr>
<tr>
<td><em>Muhacha</em> <em>(parinari capensis)</em></td>
<td>- Edible fruits, erosion prevention, shade, leaf litter</td>
</tr>
<tr>
<td>Mutamba <em>(strychnos coccutoides)</em></td>
<td>- Edible fruits, erosion prevention</td>
</tr>
<tr>
<td><em>Mupfuti</em> <em>(Brachystegia boehmii)</em></td>
<td>- Leaf litter, erosion prevention and control, shade</td>
</tr>
<tr>
<td><em>Mususu</em> <em>(Terminalia sericea)</em></td>
<td>- Leaf litter, erosion prevention</td>
</tr>
<tr>
<td><em>Mutondo</em> <em>(Julbernardia globiflora)</em></td>
<td>- Leaf litter, erosion prevention and control, fruits, shade</td>
</tr>
<tr>
<td>Mukamba</td>
<td>- Cultural, shade, erosion prevention</td>
</tr>
</tbody>
</table>

* Provides high quality litter (Source: Field data)

One major traditional land management noted and highlighted by the elderly people was that hanging beehives containing African honeybees can help to keep animals, especially elephants from destroying trees and wiping out crops in their quest for food.

### 4.3 Food security characteristics and traditional management systems- Objective (ii)

Farmers highlighted the following factors as the root causes of food insecurity in Dora; unreliable climate, poor soil conditions, dependence on a single crop, continuous ploughing, decline in availability of organic matter and poverty. Below is a linkage diagram, based on scoring and ranking, of the main causes of food insecurity in Dora.
Figure 4.1: Main causes of food insecurity in Dora (Source: Field group discussions and interviews)

Below is a linkage diagram, based on scoring and ranking, showing factors considered most important for a sustainable land management system in food security for a typical resource poor farmer.

Figure 4.2: Factors considered important for a sustainable food security system. (Source: Field group discussions and interviews)
4.4 Production patterns and characteristics (TLMS vs MLMS)

Table 4.11 below shows maize crop production trends for five selected farmers practicing traditional land management systems and five selected farmers practicing modern land management systems (within the USD100.00 – USD499.00 income category). A comparative assessment of the production trends between the two forms of land management above shows that traditional systems of land management produce less per hectare, but more adaptable to environmental constraints and consistent over a long time period.

Table 4.11: Maize crop production trends for ten selected farmers practicing traditional land management (TLMS) and modern land management (MLMS) systems

<table>
<thead>
<tr>
<th>Farmers practicing - TLMS</th>
<th>Maize average production trends - number of bags per hectare (1966 - 2016)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>22</td>
</tr>
<tr>
<td>3</td>
<td>16</td>
</tr>
<tr>
<td>4</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>16</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Farmers practicing - MLMS</th>
<th>Maize average production trends - number of bags per hectare (1966 - 2016)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>30</td>
</tr>
<tr>
<td>5</td>
<td>25</td>
</tr>
</tbody>
</table>

(Source: Field data)
In contrast, modern systems generally produce more per hectare but less consistent and adaptable to environmental constraints and circumstances. 2016 farming season had a growth in yields as compared to 2006 due to adequate rainfall received, however, the field crops, homes, livestock and other household property were reported to have been affected by floods, observed was huge land degradation in the study area due to erosion.

The survey investigations indicated that a household comprising 6 members consumes an average of 20 kilograms of maize per week to sustain 2 meals per day. This translates to a consumption rate of 80 kilograms per month or 19 fifty kg bags per annum. On this note, in a normal year running, 70% of the surveyed households are capable of producing sufficient food for family consumption through to the next season. Twenty per cent of them produce food sufficient to last for 9 months, 6% for up to 6 months and 4% less than 6 months.

Below is table 4.12 showing that Sixty three per cent of the respondents indicated preference for organic matter as a soil fertility management strategy, whereas 37% indicated preference for inorganic fertilisers. And table 4.13 showing scores and ranks of the food security situation over a period of 50 years, based on the observations of respondents.

Table 4.12: Farmers’ preferences of two forms of fertilisers by percentage.

<table>
<thead>
<tr>
<th>Form of fertilizer</th>
<th>Percentage %</th>
<th>Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organic manure</td>
<td>63</td>
<td>-Cheap</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-A locally designed fertility management mechanism</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Offers greater longer term benefits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Greatly improves soil quality and properties</td>
</tr>
<tr>
<td>Inorganic</td>
<td>37</td>
<td>-Offers immediate benefits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Ensures higher productivity</td>
</tr>
</tbody>
</table>

(Source: Field data)
Table 4.13: Food security situation, based on scoring and ranking by respondents, over a fifty-year period.

<table>
<thead>
<tr>
<th>Year</th>
<th>Percentage score</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1966</td>
<td>100</td>
<td>1</td>
</tr>
<tr>
<td>1980</td>
<td>90</td>
<td>2</td>
</tr>
<tr>
<td>1990</td>
<td>70</td>
<td>3</td>
</tr>
<tr>
<td>1995</td>
<td>65</td>
<td>4</td>
</tr>
<tr>
<td>2000</td>
<td>45</td>
<td>5</td>
</tr>
<tr>
<td>2006</td>
<td>40</td>
<td>6</td>
</tr>
<tr>
<td>2010</td>
<td>30</td>
<td>7</td>
</tr>
<tr>
<td>2016</td>
<td>20</td>
<td>8</td>
</tr>
</tbody>
</table>

(Source: Field data)

The table shows the food security situation was highly sustainable and successful in 1966, whereas it became progressively unfavourable with time. Ninety percent of the respondents attributed this trend to a decline in soil fertility, unreliable climate and heavy reliance on external inputs, whereas 10% attributed this to poverty and lack of adequate inputs. Table below shows the linkages between number of traditional land management practiced and number of crops grown per village.

Table 4.14: Linkages between traditional land management systems and number of crops grown per village.

<table>
<thead>
<tr>
<th>Village</th>
<th>Number of TLMS</th>
<th>Number of crops identified</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Chisamba</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>2 Mambondiani</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>3 Kuhudzai</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>4 Nyangani</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>5 Munyanduki</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>6 Gutukunhuwa</td>
<td>9</td>
<td>11</td>
</tr>
<tr>
<td>7 Matika</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>8 Nyadongo</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>9 Magodhlo</td>
<td>13</td>
<td>12</td>
</tr>
</tbody>
</table>

(Source: Field data)
The table above shows that Magodhlo Village has the highest number of traditional land management systems (TLMS) and number of crops grown. A comparison with Chisamba and other villages shows a close linkage between the number of TLMS and number of crops. In this regard, TLMS are increasing with agro-biodiversity, an indicator of nutrition and food security. This could suggest that more households in Magodhlo are more food secure, as they depend on more crops, compared to other villages.

Table 4.15: Changes in major selected crops in Dora for the period 1966 – 2018 (as a measure of agro-biodiversity change)

<table>
<thead>
<tr>
<th>Crops</th>
<th>Change in number of farmers per crop</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Year of 1966</td>
</tr>
<tr>
<td>Maize</td>
<td>130</td>
</tr>
<tr>
<td>Rapoko</td>
<td>125</td>
</tr>
<tr>
<td>Groundnuts</td>
<td>118</td>
</tr>
<tr>
<td>Roundnuts</td>
<td>115</td>
</tr>
<tr>
<td>Sorghum</td>
<td>131</td>
</tr>
<tr>
<td>Finger millet</td>
<td>112</td>
</tr>
<tr>
<td>Beans</td>
<td>80</td>
</tr>
<tr>
<td>Rice</td>
<td>68</td>
</tr>
<tr>
<td>Pumpkins</td>
<td>142</td>
</tr>
<tr>
<td>Paprika</td>
<td>3</td>
</tr>
<tr>
<td>Sunflower</td>
<td>57</td>
</tr>
</tbody>
</table>

(Source: Field data)

The trends in Table 4.15 above show significant changes in the number of households growing various crops between 1966 and 2018. In this case, the number of households that grew rapoko, round nuts, finger millet, rice, sorghum and beans had fallen significantly by 2018 whilst it had increased for maize, ground nuts, pumpkins, paprika and sunflower by 2018. This suggests a decrease in agro biodiversity during this period.
and increased interest in cash crops by farmers with time. Thus, the gradual decrease in the application of TLMS can be linked to loss of agro biodiversity in the community.

Table 4.16 below shows linkages between number of traditional land management systems, number of crops grown and the average time period sustained by selected individual farmers’ harvests per year. (Monthly income category: less than USD499.00)

Table 4.16: Linkages between traditional systems and food security

<table>
<thead>
<tr>
<th>Farmer</th>
<th>No. of TLMS</th>
<th>No. of crops</th>
<th>Average time period sustained / year (months)</th>
<th>No. of meals / day</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
<td>12</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
<td>11</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>10</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>10</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>7</td>
<td>9</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>9</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>6</td>
<td>10</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>6</td>
<td>6</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>5</td>
<td>7</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>72</strong></td>
<td><strong>91</strong></td>
<td><strong>97</strong></td>
<td><strong>24</strong></td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>7</strong></td>
<td><strong>9</strong></td>
<td><strong>10</strong></td>
<td><strong>2</strong></td>
</tr>
</tbody>
</table>

(Source: Field data)

The table above shows a close relationship between the number of TLMS, number of crops grown by selected farmers and the average time period sustained by selected individual farmers’ harvests per year. In this case, households that practice a greater number of TLMS grow more crops than those that practice less and thus, the former are generally food secure over a longer period of time than others. Given such a situation (without external assistance), TLMS can be considered a reliable as a food security tool.
as they contribute significantly to food security of households. This is particularly evident in the resource poor farmer community of Dora.

4.5 Hypotheses testing – Hypotheses in 1.7 and Also covering objective (ii)

The researcher had to test whether traditional approaches to land management promote household food security or not. It was also necessary to test the relationship between the number of traditional land management systems that households apply and the number of crops grown.

The variable used were number of traditional land management systems against period over the households are food secured, and number of traditional land management systems against number of crops grown, and number of traditional land management systems against income levels.

The tests were used to determine the relationship between number of TLMS and the period over which the households are food secure (in months), without external assistance. used to assess the relationship between the number of traditional land management systems and number of crops grown and to assess the relationship between traditional land management systems and income levels generated by the farmers.

1. \( H_1 \) Traditional approaches to land management promote household food security.

\( H_0 \) Traditional land management systems do not promote household food security.

Spearmen’s Rank Correlation Coefficient (see Appendix IV) method was used to determine the relationship between number of TLMS and the period over which the households are food secure (in months), without external assistance. In this case, farmers were randomly selected.
Table 4.17: Traditional land management systems and food security

<table>
<thead>
<tr>
<th>Farmer</th>
<th>No. of TLMS (x)</th>
<th>Period Months (y)</th>
<th>Rank (x)</th>
<th>Rank (y)</th>
<th>Diff. between ranks (x-y)</th>
<th>Squared differences (d²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>4</td>
<td>10</td>
<td>10</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>6</td>
<td>9</td>
<td>8</td>
<td>+1</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>5</td>
<td>8</td>
<td>9</td>
<td>-1</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>9</td>
<td>7</td>
<td>5</td>
<td>+2</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>7</td>
<td>8</td>
<td>6</td>
<td>6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>8</td>
<td>7</td>
<td>5</td>
<td>7</td>
<td>-2</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>10</td>
<td>11</td>
<td>4</td>
<td>2.5</td>
<td>+1.5</td>
<td>2.25</td>
</tr>
<tr>
<td>8</td>
<td>11</td>
<td>10</td>
<td>2.5</td>
<td>4</td>
<td>-1.5</td>
<td>2.25</td>
</tr>
<tr>
<td>9</td>
<td>11</td>
<td>12</td>
<td>2.5</td>
<td>1</td>
<td>+1.5</td>
<td>2.25</td>
</tr>
<tr>
<td>10</td>
<td>12</td>
<td>11</td>
<td>1</td>
<td>2.5</td>
<td>-1.5</td>
<td>2.25</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Σd² = 19</td>
</tr>
</tbody>
</table>

\[
P = 1 - \frac{6\sum d^2}{n(n^2-1)}
\]

\[
P = 1 - \frac{19}{10(10^2-1)}
\]

\[
P = 1 - \frac{114}{990}
\]

\[
P = 0.88
\]

It can therefore, be concluded that a positive relationship between number of traditional systems and period without assistance, based on the assessment of the average time period that a year’s produce can sustain a family in months, without external assistance. The conclusion that can be drawn is thus, farmers that practice more traditional systems of land management are more food secure than others in the same income category. The alternative hypothesis that traditional approaches to land management promote food security is thus accepted.
2. The T-test method to determine whether results of the relationship between number of traditional land management systems and food security are due to chance (determined from Spearman’s rank correlation Coefficient value) (see Appendix V).

Determining the t-value (t-test)

\[ T = P \sqrt{\frac{n-2}{1-P^2}} \]

\[ T = 0.88 \sqrt{\frac{10-2}{1-0.88^2}} = 0.88 \sqrt{\frac{8}{1-0.7744}} = 0.88 \sqrt{\frac{8}{0.2255}} = 0.88 \sqrt{35.4767184} = 5.241485546 \]

In this case, the T-value of 5.241 is greater than the critical value of t (2.306) (at the 95% rejection level chosen). The researcher rejected the null hypothesis \((H_0)\) as the calculated t-value is greater that the critical (table) value and therefore accepted the alternative hypothesis \((H_1)\).

It can therefore, be concluded that there is a significant relationship between the number of traditional land management systems and food security. Thus, in this case, the results could not have occurred by chance.

3. \(H_1\) There is a positive relationship between the number of traditional land management systems that households apply and the number of crops that they grow

\(H_0\) There is no relationship between the number of traditional land management systems that households apply and the number of crops that they grow

Pearson’s Product Moment Correlation Coefficient (see Appendix VI) was used to assess the relationship between the number of traditional land management systems and number of crops grown
Table 4.18: Relationship between traditional land management systems and number of crops

<table>
<thead>
<tr>
<th>Village</th>
<th>No. of TLMS (x)</th>
<th>No. of crops (y)</th>
<th>TLMS (x²)</th>
<th>No. of crops (y²)</th>
<th>(x y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chisamba</td>
<td>6</td>
<td>7</td>
<td>36</td>
<td>49</td>
<td>42</td>
</tr>
<tr>
<td>Mambondiani</td>
<td>7</td>
<td>8</td>
<td>49</td>
<td>64</td>
<td>56</td>
</tr>
<tr>
<td>Kuhudzai</td>
<td>7</td>
<td>9</td>
<td>49</td>
<td>81</td>
<td>63</td>
</tr>
<tr>
<td>Nyangani</td>
<td>8</td>
<td>8</td>
<td>64</td>
<td>64</td>
<td>64</td>
</tr>
<tr>
<td>Munyanduki</td>
<td>8</td>
<td>10</td>
<td>64</td>
<td>100</td>
<td>80</td>
</tr>
<tr>
<td>Gutukunhuwa</td>
<td>9</td>
<td>11</td>
<td>81</td>
<td>121</td>
<td>99</td>
</tr>
<tr>
<td>Matika</td>
<td>10</td>
<td>9</td>
<td>100</td>
<td>81</td>
<td>90</td>
</tr>
<tr>
<td>Nyadongo</td>
<td>11</td>
<td>13</td>
<td>121</td>
<td>169</td>
<td>143</td>
</tr>
<tr>
<td>Magodhlo</td>
<td>12</td>
<td>12</td>
<td>144</td>
<td>144</td>
<td>144</td>
</tr>
<tr>
<td>Sum of (Σ)</td>
<td>78</td>
<td>87</td>
<td>708</td>
<td>873</td>
<td>781</td>
</tr>
</tbody>
</table>

Calculations

\[
R = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt[n]{n(\sum x^2) - (\sum x)^2} \cdot n(\sum y^2) - (\sum y)^2}}
\]

\[
R = \frac{(9 \times 781) - (78 \times 87)}{\sqrt{(9 \times 708) - (78^2) \cdot (9 \times 873) - (87^2)}}
\]

\[
R = \frac{7029 - 6786}{\sqrt{6372 - 6084 \cdot 7857 - 7569}}
\]

\[
R = 243 / \sqrt{288 \times 288}
\]

\[
R = 243 / \sqrt{82944}
\]

\[
R = 243 / 288
\]

\[
R = 0.84375
\]

In this case, the R-value of +0.8 means a strong perfect positive correlation coefficient. It can therefore, be concluded that there is a strong perfect positive correlation coefficient relationship between the number of traditional land management systems and number of crops. We can thus conclude that there is a high correlation between the number of traditional systems and number of crops grown by individual farmers. As a measure of nutrition, farmers that practice more traditional systems of land management grow more crops than other farmers.
4. An assessment of the relationship between traditional land management systems and income levels using Spearman’s Rank Correlation Coefficient.

Table 4.19: Traditional Land Management System (TLMS) and income levels

<table>
<thead>
<tr>
<th>Farmer</th>
<th>No. of TLMS (x)</th>
<th>Income (Yearly) (y)</th>
<th>Rank (x)</th>
<th>Rank (y)</th>
<th>Differences between ranks</th>
<th>Squared difference (d²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>14,000</td>
<td>9.5</td>
<td>2</td>
<td>+7.5</td>
<td>56.25</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>10,000</td>
<td>8</td>
<td>3</td>
<td>+5</td>
<td>25</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>15,000</td>
<td>9.5</td>
<td>1</td>
<td>+8.5</td>
<td>72.25</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>9,000</td>
<td>7</td>
<td>4</td>
<td>+3</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>7,000</td>
<td>5</td>
<td>6</td>
<td>-1</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td>7,500</td>
<td>6</td>
<td>5</td>
<td>+1</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>5,000</td>
<td>4</td>
<td>7</td>
<td>-3</td>
<td>9</td>
</tr>
<tr>
<td>8</td>
<td>10</td>
<td>3,000</td>
<td>3</td>
<td>9</td>
<td>-6</td>
<td>36</td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>4,000</td>
<td>2</td>
<td>8</td>
<td>-6</td>
<td>36</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>2,000</td>
<td>1</td>
<td>10</td>
<td>-9</td>
<td>81</td>
</tr>
</tbody>
</table>

\[ P = 1 - 6 \sum d^2 / n (n^2 - 1) \]

\[ P = 1 - 6 \times 326.5 / 10 (10^2 - 1) \]

\[ P = 1 - 1959 / 990 \]

\[ P = 1 - 1.978787879 \]

\[ P = -0.978787879 \]

In this case, the P-value of -0.9788 means a strong perfect negative correlation coefficient. It can therefore concluded that there is a negative relationship between the number of traditional land management systems and income, in which an increase in the number of TLMS is associated with a decrease in income.

This implies farmers that practice traditional systems of land management do not necessarily earn correspondingly high income. Such an observation shows most farmers that still practice traditional systems are poor and produce mainly for subsistence instead of commercial purposes.
4.6 Community perceptions of traditional land management systems - Objective (iii)

Scoring and ranking of farmers’ opinions on traditional land management systems by importance. Table 4.20: Farmers’ opinions on importance of traditional land management systems

<table>
<thead>
<tr>
<th>Traditional land management system</th>
<th>Score</th>
<th>Rank</th>
<th>Reasons / Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Composting &amp; manuring</td>
<td>15</td>
<td>1</td>
<td>-Increases fertility, improves soil condition, yields, cheap, sustainable</td>
</tr>
<tr>
<td>Intercropping</td>
<td>14</td>
<td>2</td>
<td>-Ensures agro biodiversity, conserves soil and water, food security, nutrition, spreads risks, saves space</td>
</tr>
<tr>
<td>Traditional agro forestry</td>
<td>14</td>
<td>2</td>
<td>-Promotes agro biodiversity, spreads risks, soil and water conservation, nutrition, wild fruits</td>
</tr>
<tr>
<td>Hillside cultivation with terracing</td>
<td>12</td>
<td>4</td>
<td>-Substantially supplements yields, soil and water conservation, reduces reliance on ox-drawn power</td>
</tr>
<tr>
<td>Ridging at close intervals</td>
<td>10</td>
<td>5</td>
<td>-Soil and water conservation, increases yields, reduces risks</td>
</tr>
<tr>
<td>Crop rotation</td>
<td>10</td>
<td>5</td>
<td>-Improves soil condition, fertility and nutrition</td>
</tr>
<tr>
<td>Terracing</td>
<td>9</td>
<td>7</td>
<td>-Soil and water conservation, reduces risks</td>
</tr>
<tr>
<td>Mount cultivation</td>
<td>9</td>
<td>7</td>
<td>-Improves soil condition, fertility and yields</td>
</tr>
<tr>
<td>Contour ridges at long intervals</td>
<td>8</td>
<td>9</td>
<td>-Soil and water conservation</td>
</tr>
<tr>
<td>Zero tillage</td>
<td>8</td>
<td>9</td>
<td>-Conserves soil and water, increases fertility, reduces reliance on ox-drawn plough, cheap, practiced mostly by the poor</td>
</tr>
<tr>
<td>*Losing popularity because of shortage of labour</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pitting system</td>
<td>8</td>
<td>9</td>
<td>-Soil and water conservation, increases yields, cheap</td>
</tr>
<tr>
<td>Fallowing</td>
<td>3</td>
<td>12</td>
<td>-Improves soil condition</td>
</tr>
<tr>
<td>*No longer popular because of population pressure</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Source: Field interviews & Focus Group Discussions)

Community perceptions of the impacts of traditional and modern land management systems on productivity and environmental sustainability revealed the following. Respondents that perceive the impacts of traditional land management systems on productivity as positive constitute the highest percentage (64%), whereas 12% view them as very positive, 16 % as negative and 8% very negative. A high proportion (50%) view MLMS as positive, whereas 10% perceive them as very positive, 26 % as negative and 14% as very negative. On environmental sustainability, the majority (50%) perceive the traditional systems as very positive, 30% as positive, 14% negative and 6% as very negative. Respondents that perceive the impacts of MLMS on environmental sustainability as negative constitute 50%, whilst 24 % perceive them as having a positive impact, 16 % as very negative and 10% very positive.
4.6.1 Benefits of traditional land management systems (based on respondent perceptions and field observations).

- Traditional systems are adapted to local environmental and social complexities, constraints and conditions. Most of these are risk management strategies.
- Encourage self-reliance and are cheap to implement as they rely less on external inputs, but more on local resources.
- They are sustainable as they are based more on tried and tested innovations and technologies. They do not seek to dominate natural resources.
- Ensure long-term maintenance of soil fertility.
- Resource conserving techniques, systems and practices are realised.
- Most are simple techniques, which are easily be mastered by most farmers.

4.6.2 Problems of traditional land management systems identified

- Labour intensive.
- More appropriate in lowly populated areas. They thus require careful management, planning and institutional support given the increasing population.
- They generally offer limited productivity per hectare and heavily rely on high doses of organic material.
- Traditional systems such as hillside cultivation are area specific and hence cannot be replicated everywhere.
- Problems of lack of systematic and consistent records have made it difficult to maintain the IKS base. As a result the community is gradually undergoing erosion of this valuable wealth of knowledge.
- Some of the locals themselves (especially lower age groups), perceive modern, externally introduced approaches to land management as superior to, and therefore tend to replace their own traditional systems.
4.6.3 Traditional institutions focused on land management – covering objective (iii)
The traditional institutions, land management and perceptions were identified in Dora;

(i) Management of wetlands.
These were identified mostly in Nyangani and Magodhlo villages. The investigations revealed important traditional wetland management systems exist. Traditional leaders have the responsibility to regulate their management. Approaches identified include the preservation of water loving plants, traditional cultivation techniques and prohibition from cultivating sensitive sections of the wetlands.

In this case, given the regulations are properly followed, wetlands have supported more than 18% of the households for more than 40 years, particularly during the dry seasons. Two farmers in Nyangani and Magodhlo practising traditional wetland management techniques in 2005, planting wheat, rice and maize, the crop production from the wetland declined, especial wheat, followed by rice then maize.

Reasons for the decline of wetlands from data gathered through interviews and group discussions were:
- Population growth.
- Breakdown of traditional institutions that regulate wetland management.
- Rainfall decline.
- Conventional farming systems undermining sustainable utilisation of wetlands.

(ii) Conservation and preservation of indigenous forests
Although traditional institutions still exist, they are being they have significantly been weakened by WADCO and VIDCOs. The disregard has led to an increase in the rate of deforestation and soil erosion in Chisamba, Mambondiani, Kuhudzai and Gutukunhuwa, whilst there is still evidence of indigenous forest conservation through traditional institutions in Magodhlo, Nyangani and Nyadongo.
(iii) Protection of mountainous zones
This is meant to protect micro catchments and areas of cultural importance. New settlers have, however, begun to clear and illegally cultivate some of the environmentally sensitive zones, despite the existence of traditional institutions. This has seen the clearance of some indigenous virgin forests, cultivation of zones around river sources and establishment of illegal settlements. These activities have undermined traditional soil and water conservation systems. Eighty four per cent of the respondents indicated that they felt these developments are undermining water supply and food security.

4.7 Options to integrate traditional land management systems into modern strategies to enhancing food security - Objective (iv)

The research revealed that there are high possible options that can be applied in Dora community for integrating sustainable traditional land management systems into modern strategies so that the community would be able to enhance food security in the area. The key to community success is sustainability. Indigenous people today should use the resources available without depleting them. They should use their intimate knowledge of plants, soils, animals, climate, and seasons, not to exploit nature but to co-exist alongside it. This involves careful management, control of population, the use of small quantities but a wide diversity of plants and animals, small surpluses, and minimum wastage. Plants provide food, medicines, pesticides, poisons, building materials, animals provide meat, clothes, string, implements and or oil.

Examples of practices suggested to improve environmental performance of conventional agriculture were: crop rotation, cover crops reduced-tillage and no-till practices, integrated pest management (IPM), precision farming practices and diversification of farm enterprises, The research, through focus group discussion, also highlighted essential ecological based farming systems that can as well be integrated into modern farming strategies to enhance food security, these were organic farming systems and biodynamic farming systems. It was also very clear and concluded that no simple typology or set of categories can capture the complexity of the farming practices and systems used on diverse Dora communal land. This then led to suggestions from the focus group
discussion and support from key informant interview that mixed farming was very important and need to be integrated in the farming strategies to enhance food security. The example noted during the study were, conservation agriculture, reduced- or low-input farming, mixed crop-livestock farming, and integrated farming system whereby production systems combine methods of conventional and organic production systems in an attempt to balance environmental quality and economic profit.

The focus group discussion revealed that traditional land management can be understood as an ecosystem approach to agriculture. It also mentioned that the farming practices that can cause long-term damage to soil include excessive tilling of the soil, leading to erosion and irrigation without adequate drainage, leading to salinization.

Improvements in water well drilling technology and submersible pumps, combined with the development of drip irrigation and low-pressure pivots, have made it possible to regularly achieve high crop yields in areas where reliance on rainfall alone had previously made successful agriculture unpredictable. However, this progress has come at a price. In many areas, such as the Chisamba, Matika, and Nyangani villages, the water is being used faster than it can be replenished. It also suggested that several steps must be taken to develop drought-resistant farming systems even in normal years with average rainfall. These measures include both policy and management actions:

- improving water conservation and storage measures,
- providing incentives for selection of drought-tolerant crop species,
- using reduced-volume irrigation systems,
- managing crops to reduce water loss, and
- not planting crops at all.

Today there is a growing recognition of the value of indigenous knowledge for sustainable development. In order to curb the challenges brought about by formal environmental education whereby traditional environmental education was eroded as highlighted in the literature review chapter 2. The researcher concluded that it would,
therefore, be wise to sustain indigenous knowledge in traditional communities and integrate it into the school curriculum where culturally and educationally appropriate.

From group discussion, farmer interviews, interaction with key informants in the study area and field observations, the researcher identified five ways indigenous knowledge that could help enhance the curriculum and could be options for integrating sustainable traditional land management systems into modern strategies for enhancing food security, and these include:

i. **Learning attitudes and values for a sustainable future**

ii. **Learning through**

iii. **Learning across generations**

iv. **Starting locally: From the ‘known’ to the ‘unknown’**

v. **Learning outside the classroom**

This ready-made knowledge system could easily be used in education if appropriate measures are taken to tap the indigenous knowledge, which remains in the memory of local elderly people. Students can learn much from fieldwork in the local area. This calls for some prior knowledge and understanding. For instance, to be able to understand the relationship between indigenous people, soils and plants, students need to identify the plants and soil types in the local area. One way to get a preliminary knowledge of plants and soil types in the local environment is to consult indigenous people and invite them to teach your students in the field. Indigenous people may also be willing to show students collections of artifacts and certain ceremonies and explain their significance and, where appropriate, share with them particular sites of special significance.

Such a relationship between young and older generations could help to mitigate the generation gap and help develop intergenerational harmony. Indigenous people, for the first time perhaps, would also get an opportunity to participate in curriculum development. The integration of indigenous knowledge into school curriculum would thus enable schools to act as agencies for transferring the culture of the society from one generation to the next. Such a relationship between young and older generations could
help to mitigate the generation gap and help develop intergenerational harmony. Indigenous people, for the first time perhaps, would also get an opportunity to participate in curriculum development. The integration of indigenous knowledge into school curriculum would thus enable schools to act as agencies for transferring the culture of the society from one generation to the next.

4.8 Chapter Summary

The investigations revealed that traditional systems of land management are still playing a vital role in agro biodiversity conservation, nutritional and food security. Equally important for food security besides traditional systems, however, are other factors such as technical support, soil suitability, rainfall and seed security.

The roles of traditional land management systems noted in this study were that farmers would have enough food, based on the assessment of the average time period that a year’s produce can sustain a family in months, without external assistance. Other roles noted were that traditional land management systems would satisfy households with human food, feed, and fiber needs, and contribute to biofuel needs. It would also enhance environmental quality and the resource base. It sustains the economic viability of agriculture, and enhances the quality of life for farmers, farm workers, and society as a whole.

A positive correlation was identified between the number of land management systems and food security, as well as number of crops (which represents agro biodiversity and nutrition security). There is however a negative relationship between traditional land management systems and income levels. Poor households therefore mostly practice traditional systems. These findings confirm cases, views and findings reviewed in Chapter 2 regarding the heavy dependence of traditional systems of land management on local resources. The results also show a close linkage with the views of most previous researchers that were explored in Chapter 2, in that traditional land management systems play a significant role in food security. It was however, confirmed that most traditional systems are not closely associated with high income.
CHAPTER V

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction
In this chapter the summary and conclusions based on the main findings of the study are drawn. Recommendations in the area of traditional land management and food security are also made in the final section of the chapter.

5.1 Summary
Dora Community is situated 20 km south west of Mutare urban centre. Food insecurity is one of the major challenges facing the rural community. This was attributed mainly to unreliable rainfall patterns and loss of soil fertility. Loss of indigenous knowledge was also negatively affecting the food security situation. The research aim, the study sought to assess, investigate and determine the role of traditional land management systems on household food security. This was done in order to suggest effective land management strategies which Dora Community could use to improve food security and uplift their livelihood. Attempts to promote to improve high land productivity have been made before, and more importantly after independence, mostly through government ministries and departments.

In view of these strategies however, the questions remain whether people’s food security guaranteed or secured, do the current land management approaches recognize or promote room for sustainable land utilization and continuity through high productivity and good ecosystem services, and to what extent has land management strategies promoted food security and are land management approaches well adapted to the local community environmental conditions. The objectives of the study were to identify the main traditional land management practices in Dora, determine the relationships between traditional land management systems and food security, assess people’s perceptions of the role of traditional land management system in ensuring food security and to recommend options for integrating sustainable traditional land management systems into
modern strategies for enhancing food security. A sample of 196 households was selected from a target population of 1,397 households in twenty-three villages of the Dora area. Two paradigm were used in the research, hence, the researcher had to use both descriptive research design whereby a case study was applied and experimental design whereby hypotheses were formulated before the study begins. Nine villages were surveyed, both qualitative and quantitative data was collected using questionnaires, interviews, group discussions and field observations as the primary data collection tools, historically records, reports and books for secondary data collection.

Chapter 4 answered all the objectives, research questions and the hypotheses of the study. Sections 4.2 answered objective and question (i) on identification of land management systems in Dora. Sections 4.3, 4.4 and 4.5 answered objective and question (ii) on relationships between traditional land management systems and food security at Dora community and whether it does promote food security. Sections 4.6 answered objective and question (iii) on the people’s perceptions on the role of traditional land management system in ensuring food security. Section 4.7 answered objective and question (iv) on options for integrating sustainable traditional land management systems into modern strategies for enhancing food security. Hypotheses in section 1.7, on relationships between traditional land management systems and food security and whether traditional land management does promote food security were tested and answered in section 4.5.

5.2 Results
The investigations revealed that traditional systems of land management are still playing a vital role in agro biodiversity conservation, nutritional and food security. Equally important for food security besides traditional systems, however, are other factors such as technical support, soil suitability, and rainfall and seed security. The research findings showed that some farmers generally perceive modern, externally introduced systems of land management to be superior to their indigenous, locally developed management systems. In this regard, few farmers still fully appreciate the importance of traditional approaches to land management. The results confirmed that, although elderly people of the community still appreciate the importance of traditional systems of land management,
there is an evident knowledge gap in the community, characterized by poor transfer of indigenous knowledge from elderly to the young people. This scenario shows the community faces a risk of loss of valuable indigenous knowledge.

In Dora, unfavourable rainfall patterns and declining soil fertility are the most important factors undermining food security. The community’s food security situation is further being negatively affected by agro biodiversity loss since the 1960s as exemplified by the absence of some of the traditional crops that include millet and sorghum. There is evidence that traditionally, these crops were highly regarded. Loss of indigenous knowledge in Dora, if not reversed and contained, will make it impossible to document and make utility of it, and to influence policy makers to seriously consider this vital tool in planning processes. It was discovered that the majority of households in Dora community that still practice traditional systems of land management are low income or resource poor household groups.

On this note, economically richer farmers have benefited more from the introduction of modern land management systems. This is because they have the sufficient financial resources to sustain these systems. Farmers still practicing traditional systems of land management grow crops mainly for subsistence as opposed to commercial purposes. The study results revealed that there is a positive relationship between traditional systems of land management and agro biodiversity. In this case, households that practice more of these traditional systems generally grow more crops, this gives an indication of nutrition security and agro biodiversity. It has been noted that systems such as agroforestry and manuring have recently started to be introduced as externally driven, but the local community has a wealth of indigenous knowledge on them.

These techniques were developed locally well before they were introduced from outside. Research findings confirmed that indigenous knowledge decreases as education level increases, but increases with age. Furthermore, stakeholder partnerships are generally weak in Dora. This implies efforts to promote food security are not effectively coordinated.
5.3 Conclusions
The roles of traditional land management systems noted in this study were that farmers would have enough food, based on the assessment of the average time period that a year’s produce can sustain a family in months, without external assistance. Other roles noted were that traditional land management systems would satisfy households with human food, feed, and fiber needs, and contribute to biofuel needs. It would also enhance environmental quality and the resource base. It sustains the economic viability of agriculture, and enhances the quality of life for farmers, farm workers, and society as a whole.

A comparative analysis of the results that were obtained and other researches referred to in Chapter 2 shows that traditional systems of land management still play a vital role in food security. Both scenarios also showed that traditional approaches still require the greater attention of policy makers, and if adequately recognised and reinforced, form an important basis for the current community development approaches. However, as realised in the review of literature, other factors such as population growth, loss of soil fertility and labour requirements need to be evaluated against the applicability of traditional land management systems under present conditions.

5.4 Recommendations
- Food security strategies in Dora should create conditions for sustainable development, based more on locally available resources, skills and knowledge. The policy makers and local people should build measures on local innovations such as soil and water conservation and fertility management.

- Given the semi arid nature of Dora and poor soils, the community needs technical support from government departments, i.e. AGRITEX, Department of Natural Resources, and Non Governmental Organizations that include Community In Need Africa and Plan to implement agroforestry projects at community and household levels. This helps revitalise and reinforce the traditional forms of agroforestry already existing.
• For effective food security strategies to work, there is need to strengthen traditional institutions that regulate the management of vegetation and establishment of settlements. This comes in realisation that people are settling illegally in environmentally sensitive areas such as wetlands, river sources and hillsides. Local traditional leaders to implement this recommendadition.

• Traditional leaders should be empowered by the government to spearhead afforestation programmes that particularly target indigenous trees for soil and water conservation, and increase leaf litter generation.

• Government to intensify farmer training and education. One system worth considering is permaculture. This concept makes the best use of local resources, where farmers try to copy nature through an ecologically sound farming system that is also economically viable and socially acceptable to ensure long term food security benefits.

• Government to introduce low cost, small-scale irrigation projects such as drip irrigation and community boreholes need to be seriously considered, taking into account the water shortages affecting the community. This can however, be achieved with support from NGOs and relevant government departments such as AGRITEX.

• Local farmers and the government to seriously consider the reintroduction of traditional crops and indigenous seeds, such as millet, rapoko and sorghum, most of which are drought resistant. This would increase biodiversity and improve food and nutrition security.

• To improve food security in Dora, it is essential to encourage the formation of local farmer groups. This involves fostering coordinated action through linkages
between farmers. Some farmers still possess a wealth of indigenous knowledge, whereas some are more knowledgeable about modern scientific farming systems. Combining such innovations through collective action at local level is thus ideal. Local institutions that are critical in this case include community organizations, conservation sub committees and farmer research groups. This would promote a farmer-to-farmer extension approach that encourages the development of local farmer networks and linkages for exchanging and sharing information.

- It is critical to increase and encourage wider support for the use of participatory methods in agricultural projects and natural resource conservation. Appropriate incentives to encourage researchers, extensionists and planners to institutionalise this is vital. This promotes the integration and participation of poorer sections of the community, allowing their skills and knowledge to influence resource management and conservation priorities. This approach requires a facilitative role and technical backing from relevant government departments and NGOs.

- To improve the food security situation, there is also need to strengthen the roles and capacities of NGOs with food security concerns. These include Community In Need Africa, Plan and DOMCCP. Thus, strategies such as multiplicative (involving networking and training) and the intermediary approach (involving provision of technical and financial assistance for the community) can be adopted.

- To ensure long term food security benefits that support traditional systems of land management, it is critically important to foster a multi-disciplinary and integrated approach. Considering the fact that stakeholder partnerships and linkages are generally weak in the area, programmes and efforts to address food insecurity are not effectively coordinated. An integrated approach would thus be critical to coordinate efforts of government departments (EMA, Forestry Commission, DDF, AGRITEX, Mutare Rural District Council and Ministry of Health) and NGOs that include Community In Need Africa, Plan, DOMCCP and ICHOP, as well as the community. The integrated efforts should include agroforestry,
permaculture, research, training, farmer-to-farmer extension and natural resource conservation. All these should, however, build on local skills, knowledge and innovations, taking into account the prevailing environmental conditions.

- There is need to develop mechanisms for increasing productivity for long term benefits and generation of organic material. This includes converting crop residues into compost material, and generation of green manure.
- It is also recommended that, the government through agency incorporate beehive in the forestry and wildlife parks as a traditional land management on vegetation, especially elephants from destroying trees and wiping out crops in their quest for food.
- Finally it is recommended that further research be undertaken in other factors that improve food security. These include seed security, appropriate traditional and modern food storage techniques, food processing, and marketing and forestry management. These would provide economic and environmental benefits of natural resources conservation in agriculture and would provide a platform for working closely with the farmers in Dora. Indigenous knowledge would form an important focal basis for such research.
LIST OF REFERENCES


Siem, B. J. (2002). Traditional Environmental Management (UNEP).


Image: CIA World Factbook map for Zimbabwe and Google Earth – (09/11/2017)

APPENDIX 1

Questionnaire guideline to the community farmers

Village……………………………………..

1.0 DEMOGRAPHIC CHARACTERISTICS

1.1 Sex (tick appropriate) Male □ Female □

1.2 Age (in years) <20 □ 20-30 □ 31-40 □ 41-50 □ > 50 □

1.3.1 Number of household members …………………………………

1.3.2 Head of household Male (adult) □ Female (adult) □ Child □

1.3.3 Number of dependents……………………………………………..

1.4 Education (level) (tick appropriate)

Primary □
Secondary □
Tertiary - diploma □
Tertiary- University □
None □

2.0 SOCIO-ECONOMIC ASPECTS

2.1 Source(s) of income (tick appropriate)

Selling of agricultural products □
Selling of livestock □
Income generating project(s) □
Employment - formal □
Employment - informal □
Others □ (specify)…………………………

2.2 Occupation……………………………………………………………………

2.3 Average household monthly income (USD) (tick appropriate)

Less than 100.00 □
101 – 500.00 □
501.00 – 999.00 □
1,000.00 – 1,499.00 □
More than 1,500.00 □
3.0 HISTORICAL BACKGROUND

3.1 How long have you been staying in this area? (in years)

- Less than 5 yrs
- 5 - 15 yrs
- 16 – 30 yrs
- 31 – 40 yrs
- More than 40 yrs

3.2 Current size of your farm holding (in hectares)

- 0 –3 ha
- 3 –5 ha
- 6 – 10 ha
- 11 – 20 ha
- 21 ha or more

3.3 Size of farm holding (in hectares) (tick appropriate)

- 40 years ago
  - 0 –3 ha
  - 3 –5 ha
  - 5-10 ha
  - 10 – 20ha
  - More than 20 ha
- 30 years ago
  - 0 –3 ha
  - 3 –5 ha
  - 5-10 ha
  - 10 – 20ha
  - More than 20 ha
- 20 years ago
  - 0 –3 ha
  - 3 –5 ha
  - 5-10 ha
  - 10 – 20ha
  - More than 20 ha
- 10 years ago
  - 0 –3 ha
  - 3 –5 ha
  - 5-10 ha
  - 10 – 20ha
  - More than 20 ha

3.4 Have you settled on virgin or cleared land? Virgin [ ] Cleared [ ]

4.0 LAND TENURE

4.1 Type of farm holding

- Large scale commercial [ ]
- Small scale commercial [ ]
- Resettlement [ ]
- Communal [ ]

4.2 How was your land holding acquired?

- Bought [ ]
- Inherited [ ]
- Allocated [ ]
- Rented [ ]
- Other means [ ] (specify)……………………………………..
5.0 FARMING ACTIVITIES AND LAND MANAGEMENT

5.1 What are the main farming activities on the farm?
- Crop production
- Livestock production
- Mixed farming
- Other (specify)

5.2.1 Do you practice any traditional land management systems?  Yes  No

If yes, give details
- Structural (specify)
- Biological (specify)
- Combination (specify)
- Other (specify)

5.2.2 Impacts of the traditional land management practices you have mentioned in 5.2.1 on;
- Agricultural productivity
  - Very positive
  - Positive
  - Negative
  - Very negative
- Environmental sustainability
  - Very positive
  - Positive
  - Negative
  - Very negative

5.3.1 If there are any, specify the benefits of the traditional systems that you have adopted

5.3.2 Have you had any problems with the traditional systems that you have adopted in agriculture and land management?  Yes  No

If yes, specify them

88
5.4.1 Do you practice any modern land management systems? Yes ☐ No ☐
If yes, give details
   Structural (specify)………………………………………………………………………………
   Biological (specify)……………………………………………………………………………
   Combination (specify)………………………………………………………………………
   Other (specify)………………………………………………………………………………..

5.4.2 Impacts of the modern land management practices you have mentioned in 5.4.1 on;
   Agricultural productivity - Very positive ☐
   - Positive ☐
   - Negative ☐
   - Very negative ☐

   Environmental sustainability - Very positive ☐
   - Positive ☐
   - Negative ☐
   - Very negative ☐

5.3.1 If there are any, specify;
   The benefits of the modern land management systems that you have adopted
   ………………………………………………………………………………………………………
   ………………………………………………………………………………………………………
   ………………………………………………………………………………………………………
   ………………………………………………………………………………………………………

   The problems of the modern land management systems that you have adopted
   ………………………………………………………………………………………………………
   ………………………………………………………………………………………………………
   ………………………………………………………………………………………………………
   ………………………………………………………………………………………………………

6.0 TRADITIONAL SOIL FERTILITY MANAGEMENT
6.1 Do you know any traditional ways of classifying soils? Yes ☐ No ☐
If yes, name them and give details in the table below
6.2 What soil types do you consider fertile and why? (fill in the table below)

<table>
<thead>
<tr>
<th>Soil type</th>
<th>Reasons or indications</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6.3 How do you know your soil is no longer fertile or its productivity is declining?

6.3.1 Have you taken any measures to increase soil fertility or improve its productivity?

If yes, specify what measures;

Traditional .................................................................

Modern .................................................................

6.4 Do you practice any traditional soil fertility management techniques?  

Yes ☐  No ☐

If yes, what effects have they had on

Crop productivity .................................................................

Environmental sustainability .................................................................

6.5 Agroforestry

6.5.1 Do you practice any agroforestry techniques?  

Yes ☐  No ☐

If yes, what benefits have you realized?  

........................................................................................................

........................................................................................................
6.5.2 Source of knowledge of the agroforestry practices (tick appropriate)

Traditional [ ]
Extension services [ ]
Training [ ]
Project activities [ ]
Other [ ] (specify) .................................................................

7.0 AGRICULTURAL PRODUCTIVITY

7.1 What criteria do you use to determine household farm production levels? (specify in terms of quantities) ..............................................................

7.2 With reference to 7.1 (above), what were your farm production levels like;

- 30 years ago very low [ ] low [ ] average [ ] high [ ] very high [ ]
- 20 years ago very low [ ] low [ ] average [ ] high [ ] very high [ ]
- 10 years ago very low [ ] low [ ] average [ ] high [ ] very high [ ]
- 5 years ago very low [ ] low [ ] average [ ] high [ ] very high [ ]
- Previous year very low [ ] low [ ] average [ ] high [ ] very high [ ]

What reasons do you think explain this trend?

........................................................................................................
........................................................................................................

7.3 In terms of crop yields per season, how much do you think is sufficient for your household consumption per year (in kgs)? ..................................................

7.4 Crop production

7.4.1 List crops that your family grows

........................................................................................................

7.4.2 Any crops you used to grow in the past that you are no longer growing

........................................................................................................

7.4.3 Which crops do you consider more important than others

Why? .....................................................................................................
7.4.4 (a) Which crops do you normally allocate the largest land area…………………..
Why?……………………………………………………………………………………………………
(b) Which crops do you allocate the smallest land area…………………………….
Why?……………………………………………………………………………………………………

7.5 Specify the farming practices that you have adopted on your farm;
Crop rotation         ☐
Fallowing             ☐
Intercropping         ☐
Monoculture           ☐
Mixed farming         ☐
Other (specify)       ☐

Specify the source of knowledge for each farming practice
Crop rotation; indigenous ☐ extension services ☐ training ☐ projects ☐ other ☐
Fallowing; indigenous  ☐ extension services ☐ training ☐ projects ☐ other ☐
Intercropping; indigenous ☐ extension services ☐ training ☐ projects ☐ other ☐
Monoculture; indigenous ☐ extension services ☐ training ☐ projects ☐ other ☐
Mixed; indigenous ☐ extension services ☐ training ☐ projects ☐ other ☐
Other (specify); indigenous ☐ extension services ☐ training ☐ projects ☐ other ☐

7.6 Have there been any changes with regards to the farming practices you have indicated in 7.5?
Yes   No
Give reasons ……………………………………………………………………………………
If yes, specify what changes …………………………………………………………………

7.7 For how long have you been practicing the techniques you have indicated in 7.5?
30 years ago ☐
20 years ago ☐
10 years ago ☐
5 years ago ☐
8.0 INSTITUTIONS

8.1 What institutions govern the management and utilization of land as a resource in the area? (indicate in table below)

<table>
<thead>
<tr>
<th>Traditional</th>
<th>Modern</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8.2 Role of the institutions in land management and food security (indicate where appropriate)

Traditional
- very positive
- positive
- negative
- very negative

Modern
- very positive
- positive
- negative
- very negative

9.0 OPINIONS

9.1 Traditional land management systems are appropriate in terms of;

Productivity
- Strongly agree
- Agree
- Disagree
- Strongly disagree

Environmental sustainability
- Strongly agree
- Agree
- Disagree
- Strongly disagree

For both cases, give reasons

For both cases, give reasons

For both cases, give reasons

For both cases, give reasons

For both cases, give reasons

For both cases, give reasons

For both cases, give reasons

For both cases, give reasons

For both cases, give reasons

For both cases, give reasons

For both cases, give reasons
9.2 In your opinion, which of the two approaches (traditional and modern) is more appropriate than the other in ensuring food security? .................................................................
Give reasons for your opinion.........................................................................................
........................................................................................................................................

9.3 Do you think the two can be integrated? Yes □ No □
If yes, why do you think traditional land management systems should be integrated into the modern systems? .............................................................
........................................................................................................................................
........................................................................................................................................

9.4 How best do you think they can be integrated to promote and ensure food security?
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................

10.0 Considering the current land management systems and food security situation in your area, what do you think should be done to ensure food security in your family and the local community? ............................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................

THANK YOU FOR YOUR INPUT AND PARTICIPATION
APPENDIX II

Interview checklist to the community

1. a) Why did you choose to live in Dora?
   b) How long have you been staying in this area?
   c) What has happened to the size of your household farm since then?
   d) What is the tenure of your farm holding?

2. a) Who owns natural resources in this area?
   b) Are they any institutions meant to regulate the management of land as a resource?
   c) Which ones are considered traditional?
   d) Who regulates these institutions?
   e) Are they effective? Why?

3. a) What land management practices have you adopted on your farm?
   b) Are they any traditional systems that you practice?
   f) Are they effective compared to modern land management systems?
   g) If yes what benefits have you realized through the traditional approaches?
   h) Are they any traditional land management initiatives that are practiced at community level?
   i) If yes, how is the community encouraged and motivated?
   j) What effects have traditional land management systems had on food security, livelihoods, social life and the environment?
   k) Do you think they can be improved?
   l) How do you think they can be improved?
   m) What is the community able to do collectively?
   n) What individual households can do?

4. (a) Can you comment on your household food production trends you settled in this area?
   (b) What crops do you grow?
   (c) Have there been any changes in the types of crops that you grow?
   (d) What changes and why?
   (e) What effects have these changes had on your household food security situation?
   (f) What cropping practices have you adopted?
(g) Of these, which ones are traditional and which ones are modern?
(h) In your opinion, which cropping practices do you prefer (traditional or modern) and why?

5. What do you think are the root causes of food insecurity in this area?
6. What factors do you consider most important for successful and sustainable food security system at household and community level?

7. (a) How do you traditionally maintain or improve the fertility status of your soil? How did you adopt these measures?
(b) What can you say about the present fertility status of your soil?
   (c) What measures do you think are necessary to increase your food production levels? Do you think they are sustainable?
   (d) What effects have you realised on productivity, soil quality and the environment?

8. (a) What uses do wetlands serve?
   (b) How are they utilised in the area?
   (c) How have they been traditionally managed?
   (d) Which techniques (traditional or modern) do you think are more appropriate in terms of food security and sustainability?
   (e) How best do you think wetlands should be managed?

9. (a) How do you manage your farmland during dry seasons and or drought years?
   (b) How has the land been traditionally managed during drought years?
   (c) In terms of food security, how have you traditionally coped during drought years?
   (d) If yes, are you still practicing these coping strategies?
   (e) What coping strategies do you think are necessary to ensure food security in your household?

10. (a) In terms of environmental sustainability and food security, what is good about traditional land management systems?
    (b) What is bad about traditional land management systems in the area?
    (c) What comparisons can be made with modern approaches?

11. What do you think can be done to improve your food security situation at household level?
APPENDIX III

Interview checklist to key informants and other stakeholders

1. (a) Are there any institutions designed to regulate the management of land?
   (b) At what level are they managed? (c) What exactly are they designed to achieve?
   (d) Which ones are considered traditional and which ones modern? (e) In your opinion, which are more appropriate than the other? Why?

2. (a) How long have you been working with the community? (b) What is your role as an organization / department? (c) What effects have your initiatives had on local initiatives?
   (d) What has been the response of the community? Why do you think this is so?
   (e) Have your initiatives involved local farmers? (f) What effects have they had on farmer participation and food security? (g) What has been the effect of your interventions on food security?

3. Comment on the production and food security trends since you started working with

4. (a) Have you observed any positive aspects in traditional systems of land management? How do you think they can further improved? (b) Have you observed any problems associated with traditional systems of land management? What are they? How do you think they can be addressed?

5. What can you say about the current food security situation in the area? How do you think this can be improved?

6. Are there any opportunities for integrating traditional approaches to land management in the modern initiatives? Can you identify any?

7. What effects do you think this will have on food security and environmental sustainability?
APPENDIX IV

Hypothesis 1

Spearman’s Rank Correlation Coefficient; Determining the relationship between the number of traditional land management systems (TLMS) and the period over which households are food secure (number of months / year) without external assistance. The households fall in the same income category of USD100.00 – 500.00.

Procedure

- Ten households were randomly selected from the sample households.
- Data was tabulated and the two data sets (number of TLMS and the number of months over which the households are secured) were ranked independently, giving the highest value a rank of 1, the lowest value the lowest rank in ascending order.
- The differences between the ranks of each of the paired variables (d) were calculated.
- The differences were squared ($d^2$) and summed ($\sum d^2$).
- The coefficient ($r_s$) was calculated using the formulae $r_s = 1 - \frac{6 \sum d^2}{n^2} - 1$

Where $d =$ difference in rank of values of each matched pair

\[
\begin{align*}
n &= \text{number of pairs} \\
&= 1 - 6 \times \frac{19}{10} (10^2 - 1) \\
&= 1 - 114 / 990 \\
&= +0.88
\end{align*}
\]

(0) no correlation

- In this case, +1.............0....................-1

Perfect (+) correlation        Perfect (-) correlation

There is therefore a strong positive correlation between number of traditional land management systems and the number of months over which the selected households are food secure. Thus, it can be concluded that TLMS influence the food security status of households in Dora.
APPENDIX V

Using the T-test method to determine whether results for the relationship between number of traditional land management systems and food security are due to chance (determined from Spearman’s rank correlation Coefficient value).

Procedure
- Determining the t-value (t-test)
  \[ t = \sqrt{\frac{n-2}{1-p^2}} \]
  Where;
  \[ p = \text{Spearman’s Rank Correlation Coefficient value} \]
  \[ n = \text{number of pairs} \]
  
  \[
  0.88 \sqrt{\frac{10-2}{1-0.88^2}} = 0.88 \sqrt{\frac{8}{1-0.7744}} = 0.88 \sqrt{\frac{8}{0.2255}} = 0.88 \sqrt{35.4767184} = 5.241485546
  \]
- Given \( p = 0.88 \); the regression level chosen was 95%, which is 0.05
- Determine the degrees of freedom (df)
  \[ df = n-2 \text{ i.e. 10-2} \]
  \[ = 8 \]
- Check the critical value in the t-tables using the degrees of freedom and the rejection level. In this case
  \[
  \begin{array}{c}
  \text{Rejection level} = 0.05 \\
  df = 8 \\
  \end{array}
  \]
  Critical value of t is therefore 2.306

If the critical value of t is less than the t-value then the correlation is significant at the level chosen (95%).

In this case, t-value (5.241) is greater than the critical value of t (2.306).
APPENDIX VI

Hypothesis 2

Pearson’s Product Moment Correlation Coefficient; Assessment of the relationship between the number of traditional land management systems and number of crops

Procedure

- Ten households were randomly selected from the sample households.
- Data was tabulated and the two data sets (number of TLMS and number of crops) were used in the assessment of the relationship between the number of traditional land management systems and number of crops.
- Products from the tabulated data was calculated, and sum of the product was used to find R as follows:

\[
R = \frac{n (\sum xy) - (\sum x)(\sum y)}{\sqrt{n(\sum x^2) - (\sum x)^2} \sqrt{n(\sum y^2) - (\sum y)^2}}
\]

\[
R = \frac{9 \times 781 - 78 \times 87}{\sqrt{9 \times 708 - 78^2} \sqrt{9 \times 873 - 87^2}}
\]

\[
R = \frac{7029 - 6786}{\sqrt{6372 - 6084} \sqrt{7857 - 7569}}
\]

\[
R = \frac{243}{\sqrt{288 \times 288}}
\]

\[
R = \frac{243}{288}
\]

\[
R = 0.84375
\]

(0) no correlation

- In this case, +1……………0……………….-1

Perfect (+) correlation Perfect (-) correlation

In this case, the R-value of +0.8 means a strong perfect positive correlation coefficient. It can therefore, be concluded that there is a strong perfect positive correlation coefficient relationship between the number of traditional land management systems and number of crops
APPENDIX VII – PHOTOS ON LAND DEGRADATION, FARMING SYSTEMS AND SUSTAINABLE LAND MANAGEMENT

Shallow wetland, bare soils, overgrazing, deforestation and land degradation as evidence of poor land use in Dora Community
Research process – Conducting focus group discussions on role of traditional land management, field visits and observations by the researcher.
Integrated land management – 2017/2018 farming season land preparation, crops rotated maize and beans in field and livestock feed enhanced food security in Dora communal area
2017/2018 Harvested sorghum, short seasoned maize variety, open pollinated varieties (OPV) maize and groundnuts crops under drying process near the grain silos in Dora communal area