A LIVESTOCK PRODUCTION SYSTEMS STUDY AMONGST RESOURCE-POOR LIVESTOCK OWNERS IN THE VHEMBE DISTRICT OF LIMPOPO PROVINCE

By

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PREFACE

Livestock farming practices amongst smallholder black farmers are invariably described and characterised to make various conclusions and predictions. A desire emerged in me to conduct a study and to learn and develop an understanding about livestock production systems with the intention of formulating intervention initiatives.

The first encounter with farmers of the study area was not easy, it was during the time when government withdrew from assisting stock farmers with dip chemicals and encouraging them to form dip-tank committees and buy dip with their own money. As a Government official I had to make a contribution in explaining the reasons behind the decision. Being their neighbour, being in a similar situation and also keeping a few heads of cattle myself, helped them to notice that they are not alone. There were however hard liners whom I managed to convince that, when the study commenced, they assisted with the logistics of access to the study area. Other arrangements were facilitated by the officials of the Department of Agriculture, traditional leaders and community based organisations who gave permission for the study to be conducted.

Another problem was the difficulty of studying whilst simultaneously being an employee and manning various responsibilities. There were times when I felt that the pressure was unbearable and had to cope with the stress associated with work and study fatigue.

This thesis is about the study conducted amongst smallholder livestock owners. Livestock farming systems amongst resource-poor farmers is more complex than we imagine. I have been confused and embarrassed at my limited understanding. Now I am proud of the times when I wrestled with the difficulties to gather knowledge. By having the humility to admit that I have little knowledge and being confused, I was spurred on even if it was like groping in the darkness.

NTHAKHENI N.D.

DECLARATION

I declare that this thesis hereby submitted for the degree of Doctor of Philosophy at the University of the Free State, is my own independent work, and has not been submitted for the purposes to any other university. I hereby forfeit any copyright of this thesis to the University of the Free State.

Ek verklaar dart die proefskrif wat hierby vir die graad Doktorandus van Filosofie aan die Universiteit van die Vrystaat deur my ingedien word, selfstadige werk en nie voorheen deur my vir ‘n ander universiteit ingedien is nie. Ek doen voorts afstand van die outeurreg van die proefskrif ten gunste van die Universiteit van die Vrystaat.

…… ……

Nkhangweni David Nthakheni Date

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- Edwin Mushadu, an Agricultural Officer, for facilitating the PRA on constraints, coping mechanisms, preferred traits and selection traits by livestock owners.

- The livestock farmers of the study area who cooperated and willingly gave information required, even informally.
- My family for their understanding, support and sacrifices they made.

DEDICATION

This work is a tribute to those who directly or indirectly contributed towards the successful completion of this study, but it is mainly dedicated to my mother Vho-Elelwani for having brought me up the way she did under difficult conditions bordering abject poverty. My family (wife, Thivhudziswi Johanna, sons Vuwani, Vhugala, Mukhathutshelwa, Zwivhuya and daughter Ipfi) who understood that some of their privileges were denied them because of this study. I hope this work will be a source of inspiration and challenge to our children.

ABBREVIATIONS

AAAP	Asian-Australasian Association of Animal Production
ACB	Agricultural Credit Board
ACS	Agricultural Credit Scheme
AERC	African Economic Research Council
AIDS	Acquired Immune Deficiency Syndrome
AFSRE	Association for Farming Systems Research-Extension
AnGR	Animal Genetic Resources
ATNESA	Animal Traction Network for Eastern and Southern Africa
ARC	Agricultural Research Council
ASAP	Australian Society of Animal Production
BASED	Broadening Access to Service and Extension Delivery
CASP	Comprehensive Agricultural Support Programme
CPA	Common Property Association
DBSA	Development Bank of Southern Africa
DFID	Department of International Development
ESCOM	Electricity Supply Commission
FAO	Food and Agricultural Organisation of the United Nations
FMD	Foot and Mouth Disease
FSH	Follicle Stimulating Hormones
FSR	Farming Systems Research
FSA	Farming Systems Approach
FSR&E	Framing Systems Research and Extension
GSSA	Grassland Society of Southern Africa
GTZ	Gesellschaft fur Technische Zussammenarbeit
HSRC	Human Sciences Research Council
IFPRI	International Food Policy Research Institute
HIV	Human immunodeficiency virus
ICRA	International Centre for development oriented Research in Agriculture
IIED	International Institute for Economic Development

ILCA	International Livestock Centre for Africa
ILRI	International Livestock Research Institute
INRA	Institut National de la Recherche Agronomica
IPILRA	Interim Protection of Informal Land Rights Act
IDT	Independent Development Trust
ISCW	Institute for Soil, Climate and Water
LEISA	Low External Input and Sustainable Agriculture
LRAD	Land Redistribution for Agricultural Development
LSU	Large Stock Unit
LH	Luteinising Hormone
MAP	Mean Annual Precipitation
MAFISA	Micro Agricultural Finance Scheme of South Africa
NCD	New Castle Disease
NRF	National Research Foundation
NGO	Non-Governmental Organisation
NRI	Natural Resources Institute
ODI	Overseas Development Institute
PEA	Participatory Extension Approach
PIDA	Participatory and Integrated Development Approach
PLAAS	Programme for Land and Agrarian Studies
PRA	Participatory Rural Appraisal
SADC	Southern Africa Development Community
SARPN	South African Regional Poverty Network
SAS	Statistical Analysis System
SASAS	South African Society of Animal Science
SDG	Short Duration Grazing
SLAG	Settlement Land Acquisition Grant
SPSS	Statistical Package for Social Science
UNICEF	United Nations Childrens Fund
WHO	World Health Organisation

GLOSSARY

Braai An outdoor roasting of meat over an open fire.

Smallholder livestock owners Communal farmers who keep their animals communally and share resources like grazing, water and land for farming purpose.

Communal ownership system A system of land ownership in which specific plots of land are assigned temporarily or permanently to members for family cultivation, while other areas are held in common for grazing, forestry and game. Individual plots may not be inherited or traded in internal rental or sales markets, but sales to non-members are always forbidden or subject to community approval.

"Work party"(Davha) Voluntary unpaid labour provided by members of a community to a fellow member by assisting with ploughing, planting, weed control, harvesting, thatch grass cutting etc. In return the member assisted offers food (chicken, pigs or goats are slaughtered) and brewed beer. (Draught animal are sometimes also used in case of ploughing and planting).

Hamlet A sub-village situated within the same village.

Patch Grazing A type of grazing system in communal areas where animals graze in uncultivated patches of land while guarded by herdsman preventing them from damaging or invading the planted crops.

Stokvel An informal savings association in which members regularly contribute a fixed amount and receive payouts in rotation or share the savings at the end of the year.

Z goods Basic commodities from livestock that are not marketed but are consumed by the household for subsistence stock by smallholder farmers.

TABLE OF CONTENTS **PAGE NUMBER**

CHAPTER 3

REVIEW OF LITERATURE

CHAPTER 4

CHARACTERISTICS OF LOW-INPUT LIVESTOCK PRODUCTION SYSTEMS IN RESOURCE-LIMITED AREAS OF LIMPOPO PROVINCE IN SOUTH AFRICA

CHAPTER 5

THE RELATIONSHIP BETWEEN BENEFITS OBTAINED FROM LIVESTOCK AND DESIRED SELECTION TRAITS BY SMALLHOLDER RESOURCE-POOR FARMERS IN THE LIMPOPO PROVINCE OF SOUTH AFRICA.

CHAPTER 6

EFFECTS OF CLIMATIC AND NON-CLIMATIC FACTORS ON LIVESTOCK PRODUCTION SYSTEM IN THE LIMPOPO PROVINCE OF SOUTH AFRICA

CHAPTER 7

AN OVERVIEW OF POLICIES AND PROGRAMMES THAT ENABLE LIVESTOCK PRODUCTION AND DEVELOPMENT IN THE LIMPOPO PROVINCE.

ANNEXURE

LIST OF TABLES

CHAPTER 2

CHAPTER 3

CHAPTER 4

CHAPTER 5

CHAPTER 6

CHAPTER 7

LIST OF FIGURES

CHAPTER 1

GENERAL INTRODUCTION

This chapter discusses the background, purpose of the study and outline of the thesis.

1.1 Background and Justification

South Africa's climate is ideally suited for livestock farming, and it is the most important agricultural activity contributing 40% of the total value of agricultural output in a large part of the country. Almost 80% of the 122.3 million hectares of land surface of South Africa are suitable for raising livestock, particularly cattle, sheep, goats and equines (Department of Agriculture, 2004). On the primary production level the South African red meat industry has a strong dualistic character, which stems from the existence of homeland states of the pre-1994 political dispensation. There exist a large-scale commercial production sector and a smallholder communal livestock production sector.

Over 70% of agricultural land in Limpopo province is suited for grazing. Livestock production contributes 51% of the province's gross income from agricultural products (Nesamvuni *et al*., 2003). Livestock numbers (cattle and goats) in communal areas are more than livestock numbers in the commercial sector. There are currently (2004) about 1.18million cattle (458 435 commercial and 723 832 communal); 204 439 sheep (140 257 commercial and 64 182 communal); 544 503 goats (51 904 commercial and 492 599 communal) (Limpopo Department of Agriculture, 2004).

A review of livestock production practiced by smallholder livestock owners in the communal land use systems of Limpopo province suggests that there is a scope for improvement, however, this view may be deceptive because the parameters used in assessing productivity and performance of their livestock are those used to assess commercial livestock production practices **(**Nthakheni, 1993; Swanepoel *et al.,* 2004).

This argument is supported by Lahiff (1997) who argues that livestock, particularly cattle kept in communal areas, are under-utilised as an economic resource and tend to be based either on conventional measures of herd productivity (for example, off-take for sale or slaughter, calving rate, herd mortality) herd management practices, (for example, disease control and selective breeding) or herd structure (proportion of productive to non-productive animals). Livestock has multiple uses and benefits that they confer to smallholder livestock owners and are realised independent of market mechanisms (Swanepoel *et al.,* 2000).

In the commercial sector, the production parameters are clearly defined, but in the smallholder livestock sector, the production parameters are not clear because the objectives of keeping livestock are not necessarily for commercial purpose and faces constraints in terms of limited resources. The measurement of productivity and performance of these animals is difficult because there is no record keeping or handling facilities which ensure regular direct observation. According to De Lange (1991), these smallholder livestock owners cannot be regarded as farmers because they are a diverse mixture of people.

Understanding livestock production systems and the constraints that go along with how the smallholder livestock owners survive, is of paramount importance. In agricultural farming systems, study is considered as an appropriate vehicle for better understanding of livestock production systems (Waters-Bayer & Bayer, 1994).

Beranger & Vissac (1993) argue that farmers' local knowledge base combined with the synthesis of scientific knowledge and new techniques are essential. This knowledge base helps in understanding these complex systems in order to develop intervention strategies and practices that may stabilise and sustain livestock production in those areas.

Information gathering on livestock in communal areas and from smallholder livestock owners is always challenging and usually avoided as much as possible. This observation is supported by Oetle *et al*. (1998) who contend that the understanding of the smallholder

reality with its particular complex, diverse risk prone and dynamic nature is typically still poor.

In this study, the view is taken that livestock production systems are not well documented in the Limpopo Province, and even ignored, because of scanty research information and documentation.

Increasing urbanisation has significant impact on livestock production because this leads to a decreased area available for livestock, thus exerting pressure on livestock and smallholder livestock owners to act in a peculiar manner. At the same time increasing ubrbanisation shows that population is growing and resulting in increasing demand for products like meat and milk.

The 'Livestock Revolution' predicts a dramatic increase in demand for meat (87%) and milk (75%) in the developing countries, with envisaged consequent opportunities for black smallholder livestock owners to contribute and grow from subsistence to market-based production (Delgado *et al.,* 1999). The increased demand for meat and milk stated in the Livestock Revolution is driven by population growth, economic growth with accompanying higher incomes and increased consumption and urban migration (Delgado *et al.,* 1999; ILRI, 1999; Stroebel, 2004).

The principles of farming systems research place the farmer or household in the centre of the system (Mintz, 1991). Therefore targets of the livestock production systems analysis are smallholder livestock owners in a particular area. Livestock in this study refers to cattle, goats, pigs and poultry because they are the most abundant in the study area.

1.2 Choice of the area

The villages where the study was conducted represent a typical underdeveloped area with some characteristics of urban development, but still show a typical down to earth lifestyle. The lifestyle displayed by the people in the chosen villages is diverse because they depend

on many livelihoods including livestock keeping. It is hoped that the study may reveal some problems besetting livestock keeping in situations like these.

The study area also appeals to the researcher because during his herd-boy days, he and other herd-boys, during summer, used to cross the river boundaries into those areas to graze their cattle during weekends, because, in those days cattle in the researcher's area used to be grazed through the "patch grazing" method as most of the land was under dry-land summer crops. Accessibility and acceptability and other criteria to conduct the study as advocated by Sprodley (1980) were followed.

1.3 Purpose of the Study

1.3.1 The Primary Objective

The primary objective of this study is to contribute towards a better understanding of the complexities of livestock production practices amongst smallholder livestock owners in the communal areas.

1.3.2 Secondary Objectives

- To describe the characteristics of livestock production systems and of smallholder livestock owners.

- To analyse benefits and functions obtained from livestock and how they link with selection traits.

- To analyse climatic and non-climatic factors which influence productivity of livestock in the study area.

- Contribute to the knowledge and understanding of low-input livestock farming systems.

- To make an overview of policies which enable livestock production, identify policy gaps that hinder support and service provision to smallholder livestock farmers.

- To make a summary and recommendations which may assist in the enhancement of benefits derived from livestock.

1.4 Outline of this Thesis

To describe the livestock farming systems in the resource-poor areas, this thesis consists of chapters written as individual articles.

Chapter one presents the background, justification and objectives of the study as well as the outline of the thesis. The restrictions (constraints) to which the study was subjected to are also highlighted as inhibiting factors in reaching a conclusion that cover the current situation in the smallholder livestock sector.

Chapter two discusses the research design and methodology. The discussion includes orientation and planning of the study; survey instrument and design, sampling and sampling procedure. Data collection and methods used for data collection, such as a structured questionnaire, Participatory Rural Appraisal (PRA) and literature survey were used. The chapter also discusses how the data was analysed using Statistical Analysis System (SAS), Statistical Package for Social Sciences (SPSS), Excel and direct calculations. The time schedule restrictions of the study are also outlined. Finally, this chapter describes the study area.

Chapter three discusses the literature review on different inquiry methods starting from the philosophical inquiries to alternative research methods such as the farming systems approach, PRA, multi-methods, qualitative and quantitative methods. Productivity, functions, ownership, herd size, herd composition, reasons for keeping livestock as well as livestock and land use.

Chapter four introduces the characteristics of livestock production systems in resource-poor areas of the study area. The chapter provides a picture of the dynamics of livestock production in the study area.

Chapter five presents the benefits and functions obtained from livestock that are linked to desired traits used for selection of livestock by smallholder livestock owners in the study area.

Chapter six discusses the analysis of the effects of climatic and non-climatic factors such as year, season and area on productivity of cattle in the study area.

Chapter seven sketches an overview of national and provincial policies that create an enabling environment for livestock production and development in the province. Implications of these policies on livestock production and extension services are also discussed. Issues discussed in chapters four, five and six assist to inform and contextualise policy within the province on smallholder livestock farmers of the same profile as in the study area.

Chapter eight contains the conclusions and recommendations for interventions to improve the situation and conclusions.

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CHAPTER 2

RESEARCH DESIGN AND METHODOLOGY

2.1 Introduction

The research in the field was preceded by a literature survey and secondary data collection. The field study started with a reconnaissance survey of the study area. Primary data collection was done through a questionnaire, direct calculations and PRA tools (direct observation and direct matrix ranking). Secondary data was collected through informal interviews and literature reviews. The primary and secondary data obtained was analysed using SPSS, SAS, direct calculations, direct matrix of farmers' perceptions of constraints and coping mechanisms, and an overview of policies and programmes related to livestock.

2.2 Research Design

The research design was both qualitative and quantitative. Qualitative and quantitative methods are two distinct research methods. Qualitative method is based on contextual or narrative that is either descriptive, or subject to other forms of analysis (observation); and quantitative method is based on numeric information which is usually machine readable and can be analysed by accepted statistical tests and models (testing)as described by Maxwell (1998). A combination of more than one research method or approach is referred to as multi-method. According to Brewer & Hunter (2005) multi-method research entails the application of two or more sources of data collection (structured observation, structured interviews) or research methods to the investigation of a research question. Multi-method research offers an explanation of how a planned research technique namely, fieldwork, surveys, experiments and non-reactive studies, is conducted (Wood *et al.,* 1998; Taylor, 1999; Hudson, 2002). The multi-method helps to address the perceived weakness of single-shot studies by attaching research problems 'with an arsenal of methods' that have non-overlapping weaknesses in addition to their strengths (Brewer & Hunter, 1989). In this study a combination of instruments was used which included

questionnaires, participatory rural appraisal, *ad hoc* conversation, direct observations including participants and non-participant observation and direct measurements. These instruments were used to collect qualitative and quantitative information. These methods were used because they were more convenient and cost effective for the current study. The questionnaire was used to get basic information on the livestock production and smallholder livestock owners. The PRA was used to gather information about the area in a short space of time.

2.3 Orientation and Planning Stage

The orientation and planning of the study commenced in 1999. The objective of the preparation stage was to get a clear idea of the livestock farming systems, noting and gathering information for the planning of the study. There was no available reliable information on the area.

The first step was to obtain information of the six targeted villages and to negotiate permission with local leadership structures to conduct the study.

The negotiations to access the area were done concurrently with sensitising communities about the research to be conducted. Identification of and negotiation with people who assisted the researcher took place simultaneously. Places like dipping tanks, Chiefs and Headmen's kraals, civic organisation meetings, beer drinking spots, agriculture and animal health offices were visited to gunner for support.

The information gathered during the visit to the villages and discussions with the local structures assisted in the development of the type of questions to be designed. Additional research tools were used to supplement the main instruments (questionnaire and PRA) employed to collect data. This included a comprehensive literature review, personal observations, field notes and informal discussions.

In order to facilitate the collection of data, assistance of enumerators was required. These enumerators were selected from the then Free State Technikon (now Central University of Technology). They were trained on how to interview the respondents and to make some observations. The piloting of questionnaires (Annexure C) was done with them as part of training.

2.4 Survey Questionnaire and Design

According to Chambers (1996), the most common method of formal rural research is the questionnaire survey. A questionnaire was designed to collect data. The questionnaire was developed in May 1999 for use in the study area and was piloted for validity. The piloting revealed that the questionnaire was too long because it took more than an hour to complete by inexperienced enumerators. However, the questionnaire was implemented as it was after subjecting the enumerators to further training.

2.5 Sample Frame and Sampling Procedure

2.5.1 The Sample Frame

A list of livestock owners (332) in the study area was compiled from a list of livestock farmers in the Thulamela Municipality and used as the sample frame. The frame was determined from the list of cattle owners through their dipping stock cards from the Department of Agriculture veterinary services offices.

2.5.2 Sampling Procedure

Simple random sampling (the lottery method to pick numbered or unnumbered cards out of a bag or hat) was used. A sample size of not less than 30% was considered big enough to be a representative sample for the survey. The sampled number of farmers was 131and it worked out to 30% of the total sample. The sampling procedure entailed numbering the cards equal to of the number of the identified livestock owners (332) who were present in

the sampling meeting, and the marked cards mixed with an equal number of unmarked cards. The cards were placed in a bag and individuals were called forth to pick up a card by inserting his or her hand in the bag while blind folded. Livestock owners, who picked marked cards, were the targets for interviews. In order to be effective and to make those targeted for interview feel at ease, where applicable and necessary to do so, the interactive research method was used (Bailey, 1987). This method is based on asking leading questions where the smallholder livestock owners are given a chance to confirm. This is important especially when the research is conducted in the area with people characterised by illiteracy, poverty, fear and uncertainty of giving information.

Purposive method of sampling was also used for the selection of farmers to participate in the PRA. Purposive method is a nonprobability sampling, which is characterised by the use of judgement and a deliberate effort to obtain representative samples from a particular group or individual to participate in a research (Kerlinger, 1986). This method involves targeting smallholder livestock owners residing within the six villages of the study area. Five livestock owners were selected per village. Thirty livestock owners participated in the PRA exercise.

2.6 Data Collection

The methods used for data collection included completion of questionnaires, PRA, informal discussions and a literature survey for secondary data. The secondary data included weather, livestock and population census data.

2.6.1 Questionnaire

A questionnaire with open and closed questions was used to survey the identified households in the six villages of the study area.

Interviews started in October 1999 and ended in February 2000. One hundred and thirty one (131) livestock owners were targeted for interviews, but only 128 were interviewed

because two passed away during the survey and one relocated to another area outside the study area.

2.6.2 Participatory Rural Appraisal

According to Chambers (1996) questionnaire surveys and statistical data analysis limit investigation to what can be asked in interviews and can be committed. There are other approaches which challenge the conventional questionnaire survey. One example is the PRA method which is a family of techniques that are cost effective to the researchers. Chambers (1996) further indicates that PRA is participatory, with more ownership and analysis by rural people themselves. A researcher does not dominate and/or lecture; instead, he facilitates, sits down, listens and learns (Chambers, 1993). Thirty smallholder livestock owners were subject to PRA and informal discussions. The thirty member group were representatives of smallholder livestock owners of the six villages. The thirty member group of smallholder livestock farmers gathered at the Tshikonelo Tribal Authority hall during October 2000. The PRA was facilitated by the local Extension Officer.

The researcher was responsible for capturing data, even though he together with the facilitator probed some of the answers that appeared not to be clear. Questions were not fixed or pre-determined. One question could lead to several questions depending on how the answers were presented.

Since the participants were all Venda speaking, the PRA was conducted in Tshivenda language with no need for a translator. The workshop was divided into three sessions. The morning session was devoted to transect walks, and the second session devoted to the identification and prioritisation of desired traits for selection of livestock they keep. The afternoon (third) session was devoted to dealing with constraints and coping mechanisms by smallholder livestock owners.

The PRA workshop took 10 hours (7h00 to 17h00). In order to cover the whole study area on time, vehicles were also used for the transect walk (transect drive).

2.6.3 Literature Survey

A continuous literature survey was done according to guidance given by Mouton (2001) and Blaxter *et al.* (2001). This entailed exploring the work done by international and local researchers on livestock production systems, inquiring systems, research methodologies, livestock production in conditions characterised by low-input agricultural practices, weather, livestock and population census data as well as other relevant literature which are of importance to the study.

Other information on livestock and weather were obtained from the veterinary services of the Limpopo Department of Agriculture, the South African Weather Services and the population data was obtained from Statistics South Africa.

2.7 Data Analysis

Data from the questionnaires was entered into an Excel spreadsheet by the researcher and analysed with Statistical Package for Social Sciences (SPSS) (SPSS, 2000). The above data was analysed and used in chapter four.

Descriptive statistics were used to determine frequencies and simple graphs. Data analysis in chapter four was performed using SPSS. Analysis of data included characteristics of livestock owners, access to land, herd flock size and ownership, herd and flock composition, reproduction, mortalities, milk production, off-take, labour remuneration, extension and animal health services, social activities attached to livestock, average prices charged per livestock type and class, and knowledge of technologies related to livestock. A PRA was used in analysing the constraints and coping mechanisms of livestock owners.

Data analysis in chapter five was performed using PRA, SPSS and direct calculations. Analysis of data included benefits and functions from livestock, as well as desired traits used for selection by smallholder livestock owners. Data analysis in chapter six was performed using SAS (SAS, 2000). Data analysed through SAS included weather and livestock records of 1996 to 2000 obtained from the South African Weather Bureau Services and Northern Province Department of Agriculture (now Limpopo Department of Agriculture), respectively. Discrete weather and livestock records were captured through Excel spreadsheets and then transferred to SAS. The GENMOD Procedure with log link function was used to test the effects of area, year, and the effects of temperature, morning and afternoon humidity and rainfall compounded within season on calves born (CB), calves dead (CD), adults dead (AD), cattle slaughtered by owners (SLO), cattle slaughtered by butcheries (SLB), cumulative number of calves (BLCUM) and balance total number of cattle (BLTOT). Least Square Means and Standard Errors for each variable were computed through the GENMOD Procedure. Results were converted into normal numbers from log. Data analysis in chapter seven was performed using direct calculations of data obtained from the literature survey. Data analysis in chapter seven was performed using direct calculation of land reform data of land suitable for livestock farming; landcare projects related to livestock and household food security related to livestock production.

2.8 Restrictions of the Study

The study is conducted in a communal farming setup where there is no infrastructure for cattle handling, weighing scales and auctioning kraals except the dipping tanks which are generally in a state of disrepair such that cattle handling is difficult.

Implementation of breeding plans and programmes is difficult due to communal grazing with no grazing camps. Breeding and calving is throughout the year. Expansion of human settlements is encroaching into the already overstocked grazing area.

Farmers do not keep records of their livestock such as birth dates, birth weights, weaning weights, financial records, etc.

Marketing is limited to local buyers such as butcheries for retail of meat and members of the communities for functions. This kind of market presents difficulties because recording is not done and information on how many animals sold is sometimes not available.

2.9 Time Schedule

The study was undertaken for a period of five years from 1999 to 2005 with a break period of three years from 2001 to 2002 due to ill health. Much of the work was done during 1999 and 2000. The remaining period was devoted to additional literature survey and writing up the thesis. The research proposal was done and accepted during 1999. The period from May 1999 was devoted to developing the survey instrument. Piloting of the survey instrument was done during July 1999. The household survey was completed from October 1999 to February 2000. PRA was conducted during October 2000. Data entry and analysis took place between July 2000 and November 2003. The write up of the thesis started in May 2005 and the final draft was submitted in November 2006. The rest of the period was spent revising and reanalysing the thesis based on the comments from the study committee.

2.10 The Study Area

This section provides a brief overview of the Limpopo Province followed by discussion of the study area.

Limpopo Province of South Africa is located in the northern most part of the country; it is bordered by Zimbabwe to the north, Mozambique to the east, Botswana to the west and the Provinces of Gauteng, Mpumalanga and North West to the south. It comprises a surface area of 124 000 km^2, is the fifth largest province in South Africa in size, and the fourth largest in terms of population (5.6 million people) (Statistics South Africa, 2001).

The province comprises of six districts, namely: Bohlabela in the east, which includes the whole of the Kruger National Park; Capricorn in the centre; Mopani in the east; Sekhukhune in the south, Waterberg in the west and Vhembe in the north.

The study area consists of six villages namely, Malamangwa, Malavuwe, Mbahe, Nweli, Tshifudi and Tshikonelo in the Thulamela Municipality of the Vhembe District in the north-eastern part of Limpopo Province in South Africa. The study area is located between 22^0 85' latitude and 30^0 71' longitudes (in radius). The study area is situated in the farms Vredenberg 266 MT, Paswane's 257 MT, Sterkstroom 277 MT, Lock 270 MT and Ross 265 MT. In figures 2.1, and 2.2 the location of Limpopo Province in South Africa and the location of the six villages (the study area), respectively, are depicted.

The topography of the study area ranges between 300 and 900 meters above Mean Sea Level (Nesamvuni *et al.*, 2003). The area is predominantly warm to hot (mean minimum temperature is 14.4^0 C, mean maximum temperature is 44.9^0 C) in summer and receives Mean Annual Precipitation (MAP) of 790-1174 mm with mean annual evaporation of between 1750 and 1900 mm (Institute of Soil, Climate and Water, 1999; Nesamvuni *et al.*, 2003). Soil types are mainly red Hutton and Avalon Forms (Loxton, Venn & Associates, 1985).

Vegetation type is mainly sour veld which consists of Lowveld Sour Bushveld, patches of North Eastern Mountain Sourveld in the North and South Eastern Mountain Sourveld in the South as described by Acocks (1975). Figure 2.3 presents the veld types obtained in the study area. The commonly occurring tree species include amongst other *Sclerocarya caffra (Murula), Brachystagia sp, Diospyros mespiliformis, Combretum sp, Ficus sp, and Anona senegalensis*. Common grass species comprise of *Cynodon sp, Penicum sp, Cymbopogon sp, Cetaria sp, Urocloa sp, Hyparrhinia sp*

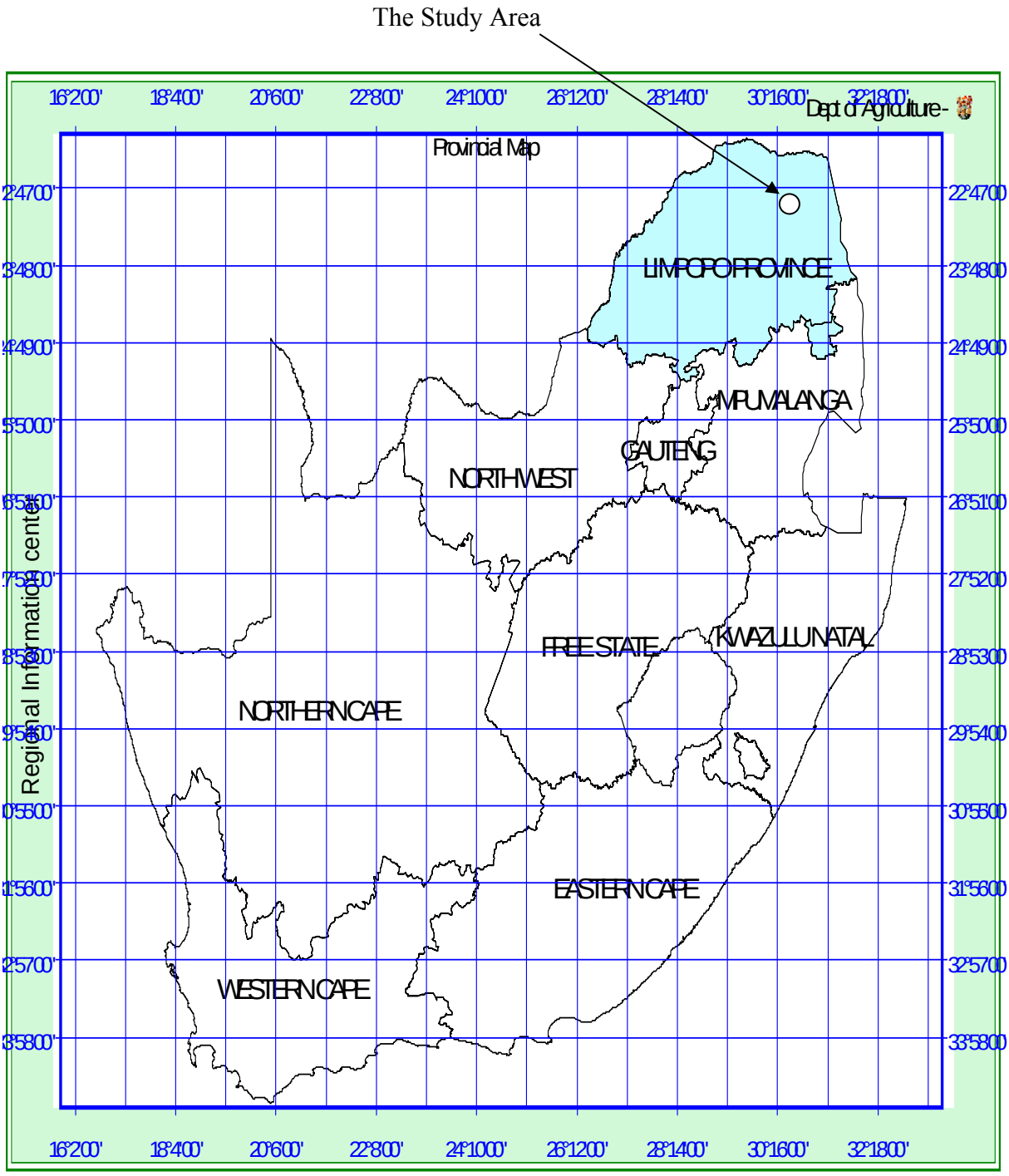

Figure 2.1 Location of the study area within the Limpopo Province

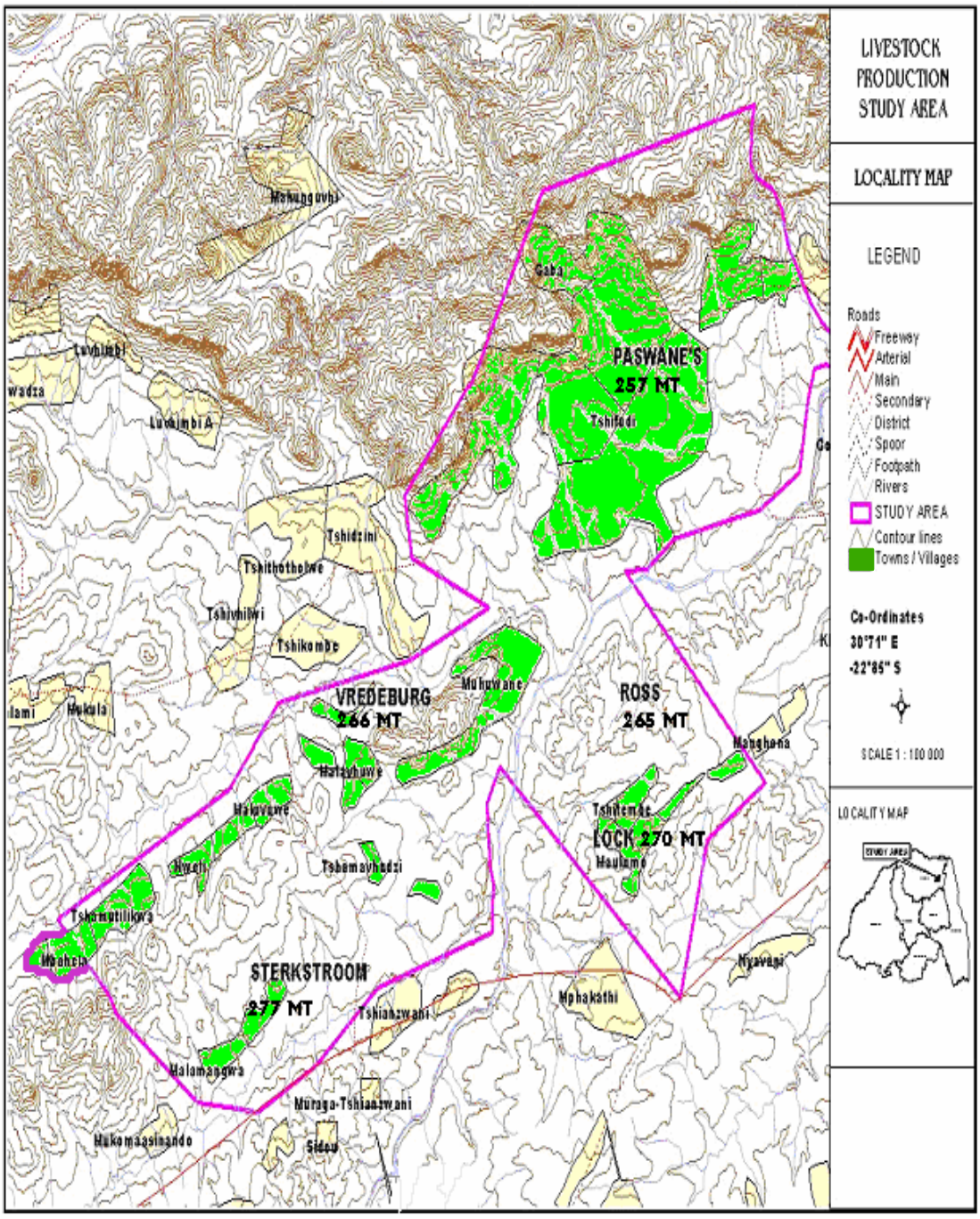

Figure.2.2 Location of the study area depicting villages' location

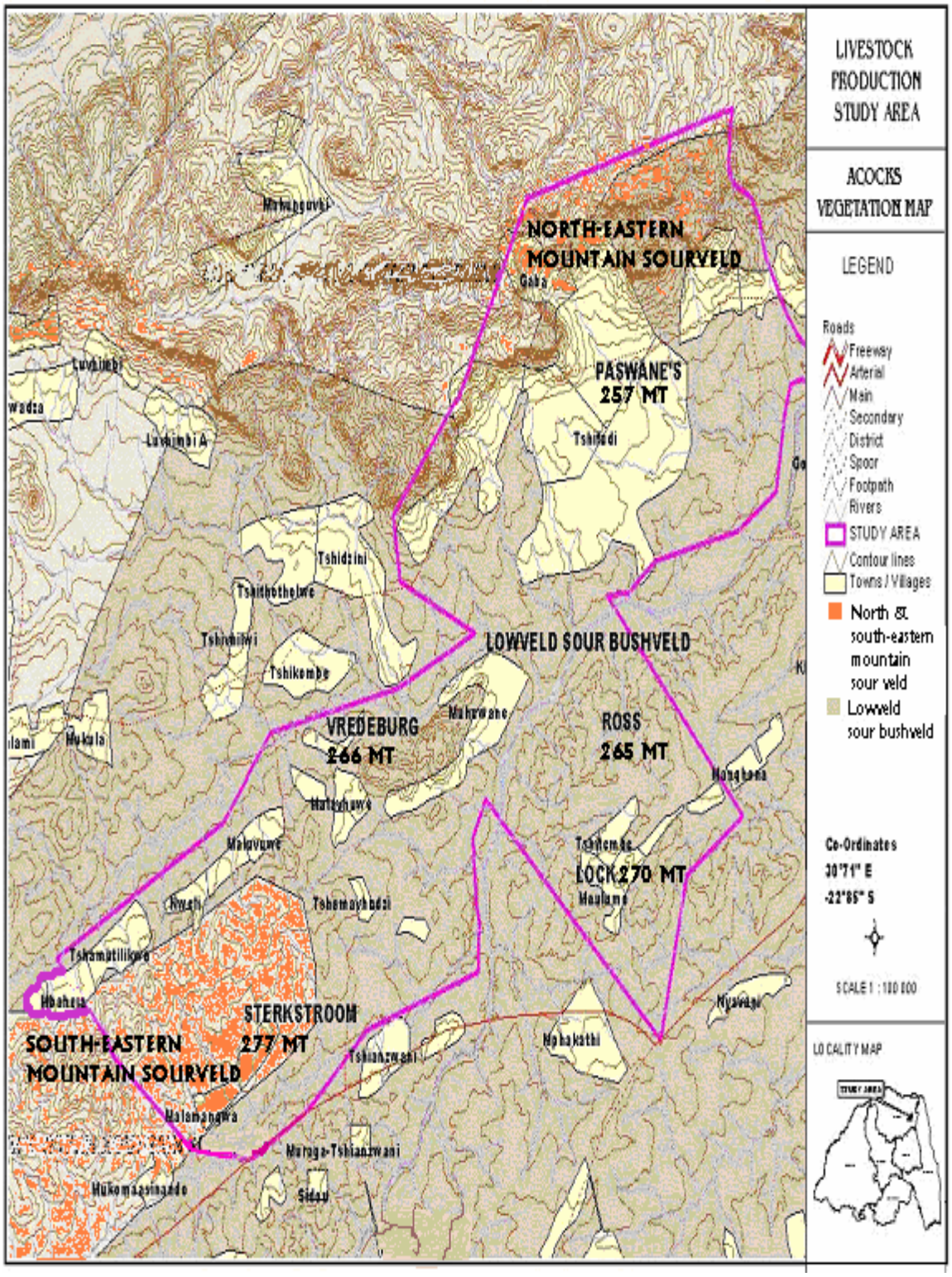

Figure 2.3. Vegetation map of the study area

The total human population is 19 692 from the six villages including their hamlets (Statistics South Africa, 2001). The population distribution as reflected in Table 2.1 shows that Tshikonelo has the highest population, followed by Tshifudi and indications are that it is expanding.

Table 2.1 Population size per village in the study area (Statistics South Africa, 2001)

Village	Population
Malamangwa	1 559
Malavuwe	1 882
Mbahe	1 035
Nweli	959
Tshifudi	6 575
Tshikonelo	8 717
Total	**19 692**

The study area is transversed by two perennial rivers (Luvuvhu and Mutshindudi). Main sources of water are rivers, boreholes and earth dams. The main agricultural activities are livestock farming and rain-fed crop farming although there are other farming activities which involve dryland and irrigated subtropical fruit farming (bananas and mangos). There are also two small irrigation schemes, 20 and 15 hectares in size, at Malavuwe and Tshikonelo, respectively. The type of livestock kept in the study area are cattle (mainly Nguni type), indigenous goats, pigs and chicken, and to a lesser extent, donkeys. The largest area is used for grazing and dryland crop farming.

The area is linked to the major towns (Thohoyandou and Malamulele) by road and the mode of transport is predominantly bus and taxi services. The area is well served by various church denominations of Christian orientation. There are five Senior Secondary schools and eleven Primary Schools. There are three clinics, three Extension Officers and three Animal Health Officers. There is electricity supply from Electricity Supply Commission (ESCOM). Piped water is available from boreholes and dams.

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CHAPTER 3

REVIEW OF LITERATURE

3.1 Introduction

The study is concerned with livestock production systems amongst black smallholder livestock owners in the Limpopo Province. However, it is important to consider livestock production systems in resource-poor areas with particular reference to other world experiences starting with inquiry methods suitable or relevant to such situations. This literature review is by no means exhaustive. The objective is to provide a contextual framework for the study as well as certain norms.

The literature on farming systems in other countries has been written from different substantive frameworks and different scales of observations based on productivity and production. According to Bembridge *et al.* (1992), single village studies are generally anthropological in nature and although they often provide a great deal of detailed information regarding the specific site, they are often not representative of the area. The literature review was done on the different inquiry methods, research methods and instruments used, farming systems, productivity and land uses. The inquiry and research methods were included in the literature review to provide an understanding of the principles behind them and not necessarily to apply them in the study.

3.2 Different Inquiry Systems

According to Van Rooyen (undated) there are two schools of thought about the inquiry into the rural environment:

The first school of thought indicates that there are scientists, administrators and development workers who still hold that science and scientific methods, exemplified by the transfer of "modern technology/ control of nature" will provide the answers to hunger,

poverty and development. Such actors have a primary concern with narrowly defined problem solving activities, biological yield potential, optimization of resource use, commodity approach in which the natural and physical scientists are dominant.

The second school of thought are those who feel that scientific thought is but one component of dynamic social and political life systems in which human values, beliefs and political action (by many actors) all influence how technology evolves. However, it is important to note that all those scientists who are currently working in systems research and development programmes have sympathy with this research paradigm.

Inquiring methods are systems whose actions result in the creation of knowledge (Courtney *et al.,* 1998). Inquiring systems have been developed based on the theory of knowledge of philosophers like Leibniz, Locke, Kant, Hegel and Singer which were recast into models of inquiry also known as Inquiring Systems (Churchman, 1971). Churchman (1971) identified five distinct types of inquiring systems from which most research methods are derived. The five types are briefly described and adapted from Linstone &Turoff (1979); Courtney *et al*. (1998); Courtney *et al.* (2000).

3.2.1 The Liebnizian System

The system is characterised by being closed, deductive (begins with undefined ideas and rules of operation), cognitive (cannot ignore its origin) and logical (the primary source of data is the logical relation between the elements) (Courtney *et al.*, 2000). The Liebnizian system is mainly applicable in operations research methods such as linear programming, objective function alternative maximization and constraints minimization (Van Rooyen, undated). Knowledge is validated through assessing the logical consistency of the process Courtney *et al.,* 1998; Courtney *et al.,* 2000). Good for well defined problem or well-defined parts of unstructured problems.

3.2.2 The Lockean System

The Lockean system is characterized by being an open system, experiential, inductive, consensual, empirical (data oriented), communicative, social and seeks input from the environment (Courtney *et al*., 2000). It uses five senses to observe the environment and it uses technology to store data (Courtney *et al*., 1998). Knowledge is validated by developing a consensus about what has been observed (Courney *et al.,* 2000). Theoretical prediction is made and validated by reference to empirical data, or empirical data is collected, and a theory is built to account for it. The method is applicable to production analysis and regression analysis (Van Rooyen, undated).

3.2.3 The Kantian System (Lockean + Liebnizian)

The Kantian system involves deliberate framing of multiple alternative perspectives on both theories and data (combination of Lockean and Liebnizian systems), it is characterised by being both formal and empirical. (Courtney *et al*., 2000). It provides time, space and a framework to track time and place at which observations were made; it is predominantly rational, consistent with data mining and online analytical processing (Courtney *et al.,* 2000). It is applicable in cost benefit analysis, policy analysis and multi criteria analysis (Van Rooyen, undated).

3.2.4 The Hegelian System

The Hegelian system functions on the premise that greater enlightenment results from the conflict of ideas; it assumes that dialectical confrontation between experts or models results in creative synthesis (Courtney *et al.,* 1998). It comprises of three major players. The first player begins the dialectic with a strong conviction about a fundamental thesis; the second player is an observer of the first subject; the final player is a bigger mind and an opposition to the conflict between the thesis and antithesis (Mitroff & Turoff, 1979). It is applicable to group discussion and structured interviews (Van Rooyen, undated).

3.2.5 The Singerian-Churchmanian System

The Singerian-Churchmanian system represents a holistic orientation toward inquiry in that the psychological, sociological, and ethical components of a research problem are viewed as inseparable from its physical representation or theoretical presuppositions (Courtney *et al.,* 2000). Truth is explicitly goal oriented (Richardson & Courtney, 2004). It seeks solutions that are ethical, sweeps in variables or methods from any discipline if that will shed light on solution, etc. (Courtney *et al.,*1998; Courtney *et al.,*2000; Richardson & Courtney, 2004). Knowledge is validated through social processes applied in large data gathering efforts; the application of a range of analytical methods to discover the best answer; production function analysis, regression analysis and in case studies (Van Rooyen, undated).

In systems inquiry, there is a wide range of approaches, methods and tools that can be used according to the situation, purpose and nature of inquiry and a specific problem to be tackled.

3.3 Alternative Systems of Inquiry (Research Methods)

The research method is a way to carry out an inquiry system into a phenomenon being studied. It uses the approaches used in gathering data and analysis (Pretty, 1994). Some such methods are briefly discussed and they include amongst others, the Delphi method, Multi- methods, Qualitative and quantitative methods, Appreciative inquiry, Farming systems research, Farming systems approach and Participatory rural appraisal. There are others like Participatory research, Participatory action research and On-farm trials, On-station trials that could not be discussed because participatory approach covers principles; others researches discuss are either On-station or On-farm trials. Pretty (1994) named these approaches as “alternative systems of inquiry” and suggested that they provide alternatives to the positivist research paradigm to address sustainability issues. These alternative systems of inquiry also provide a way of researching which combine finding

out about complex and dynamic situations with taking action to improve them (Koelen & Vaandrager, 1994).

3.3.1 The Delphi Method/Technique

Delphi is a procedure for the synthetic solicitation and collation of informed judgments in a particular topic, using a set of carefully designed sequential questionnaires interspersed with summarized information and opinion feedback derived from earlier responses. A refined definition of the Delphi states that "it is a procedure for structuring the communication process of a group, so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem" (Linstone & Turoff, 1979).

The Delphi Technique was originally designed as a procedure to solicit and synthesise the forecast of group experts, and was to be primarily used to obtain accurate estimates of projected dates of future occurrences. It began in the early 1950s and was named Delphi by RAND Corporation (Linstone & Turoff, 1979).

Although the Delphi method is a high powered method and has numerous variances, it can accommodate case studies.

3.3.2. The Multi-method Approach

The multi-method approach is based on a combination of complementary empirical research methods (Wood *et al.,* 1998). They further argue that the multi-method approach potentially provides benefits in terms of more robust conclusions, development and investigation of research hypothesis in an evolutionary manner, and increased understanding of research results. According to Brewer & Hunter (1989), the multi-method approach helps to address the perceived weakness of single-shot studies by attaching research problems "with an arsenal of methods" that have non-overlapping weaknesses in addition to their strengths. The multi-method approach to data gathering is useful as a data collection technique and as an analytical tool (Hudson, 2002). This

approach allows a researcher to view research problems from different methodological view points because most studies, even fairly small and well focused ones, require a considerable amount of information. It also enhances the researcher's ability to more accurately analyse and portray pertinent study findings and the reliability of available information (Taylor, 1999). The multi-method approach provides the opportunity for inductive, theory generating analysis. Qualitative methodology allows human values to be present and explicit in scientific investigations that are usually explored only with quantitative methodology (Taylor, 1999).

3.3.3 Qualitative and Quantitative Methods

Qualitative and quantitative are two distinct research methods based on contextual or narrative that is either descriptive, or subject to other forms of analysis (observation); and numeric information which is usually machine readable and can be analysed by accepted statistical tests and models(testing)(Maxwell, 1998).

According to Denzin *et al.* (1994), qualitative methods in most cases include qualitative interviews, which range from semi-structured questionnaires to open-ended and *ad hoc* conversations; direct observations including participants and non-participant observation; ethnographic dairies and photography and video and case studies, combining different methods to compile a holistic understanding of, for example, markets or institutions. Qualitative information is usually gathered by asking the same set of questions to a specific sample from a reference population, with answers recorded in numeric codes or actual numbers (Maxwell, 1998). Survey methods usually generate quantitative information, although open ended questions with narrative answers can be used on survey questionnaires.

Observational methods can result in either qualitative or quantitative information, depending on the structure of the observational protocol, and on the nature of the selection of the sample (Moris & Copestake, 1993).

Quantitative methods can be used to draw statistical inferences that is, obtaining empirical measurements and drawing empirical conclusions about an entire population based on a sample (Moris & Copestake, 1993). Qualitative methods cannot be used to draw statistical inferences, but can be used to draw logical or analytical inferences (Moris & Copestake, 1993; Maxwell, 1998). According Barrett (2003), qualitative and quantitative methods can be mixed in analysing poverty dynamics. The differences between qualitative and quantitative research are presented in Table 3.1.

Table 3.1 Differences between qualitative and quantitative research (Moris & Copestake, 1993)

Qualitative		**Quantitative**	
Captures reality by	**Main Traits**	**Captures reality by**	**Main Traits**
Extended interviews	Inductive	Physical counts	Deductive
Photographs and maps Imagery Case studies Open questions	Sampling by value of informant/ document	Closed questions	Sampling by pre-determined statistical design
Reported happenings	Observation recorded in representational form (images, narratives, notes)	Reported rates and and frequencies	Observations recorded as categories or numbers, pre-classified
In-place observation	Analysis: free-form to suit investigator isomorphic to content	Employs derived quantities: yields, prices, etc.	Analysis closed- form to meet methodological
Reported meanings major intuitive effort by interpreter	Situationally driven	Major procedural effort by data handling team	Criteria isomorphic to procedurally driven

3.3.4 Appreciative Inquiry

Appreciative Inquiry is a complex philosophy that engages the entire system in an inquiry about what works (Hammond, 1998).

Appreciative inquiry is the method which emanates from the thinking that the researcher should focus his energy on the strengths of the community rather than its problems. It is used to eliminate the negative thinking in communities, for example, that their area is full of problems and needs, most of which require injection of resources from outside, or it is the outsider that has the energy and ability to overcome such problems that disempower and create dependency for life (Cooperrider & Whitney, 1998; Cooperrider *et al.,* 2003).

Appreciative approach involves a collaborative inquiry based on interviews and affirmative questioning to collect and celebrate the good news of a community; it focuses on community achievements rather than its problems and seeks to go beyond participation to foster inspiration at the grass roots level (Hammond, 1998).

3.3.5 Farming Systems Research

According to Mettrick (1993), Farming Systems Research (FSR) is a process aimed at increasing the productivity of farming systems by analysis of the constraints and opportunities of existing farming systems, the implementation of sustainable adaptive research programmes and the subsequent development of appropriate technological inferences can be drawn. Gerhart (1986) contends that FSR recognises the resources and constraints of the farming families and seeks solutions that are relevant, useful, and acceptable to these families. According to Leyland (1991), FSR is primarily a diagnostic tool, providing a better understanding of the strengths and weaknesses of existing production systems. (multi-disciplinary specialists can be farmer-centred, holistic, on-farm, iterative and continuous). However, the argument presented by Schiere (1995) indicates that FSR suffers from a confusing array of definitions, methodologies and objectives.

FSR has four stages that it passes through, namely, a diagnostic survey of existing farming systems to identify constraints and provide characteristics of representative farmers; design of experimental innovations, whether biological or mathematical, to overcome the identified constraints; the testing of innovations on the farmers' fields; and the

introduction of the innovation(s) together with necessary infrastructural support (Norman & Baker, 1986). Schiere (1995) added the fifth stage, namely demonstration and extension.

In FSR research is undertaken by multi-disciplinary teams of scientists that interact continuously with farmers for and with whom research is intended (Moock, 1986). According to Waters-Bayer & Bayer (1994), FSR contributed a great deal to revealing that traditional farming is by no means static. They further add that FSR showed that rural people are capable of adapting their farming systems to changing conditions.

3.3.6 Farming Systems Approach

According to Schiere (1995), the Farming Systems Approach (FSA) refers to the aggregate of variety of interdisciplinary and holistic studies of farming systems. The same author also shows that modern concepts of farming systems research such as surveys, on-farm research and farmer participation are not new as they were part and parcel of project development and systems research long before the formalisation of FSR.

The farming systems approach evolved from FSR and out of a concern that the traditional approach (often referred to as the top-down approach) to agricultural research and development was not having significant impact on the development of small scale agriculture (Matata *et al.,* 1997; Collinson, 2000).

The farming systems approach is a holistic view of the whole farm as a system. It focuses on the relationship between the various components under the control of the farm household and of the interactions of these components with physical, biological and socio-economic factors under the household control, and aims at enhancing the efficiency of systems by focusing agricultural research to generate and test improved technologies (Shaner *et al.,* 1982).

The basic characteristic of the approach is that it focuses on small farmers and is holistic, integrated, location specific and dynamic. In the case of livestock, the results may be applicable across a wider range of situations. Historically, the concept was developed biased to crop farming, and it is only in the last decade that the livestock component has been added (Matata *et al*., 1997).

3.3.7 Participatory Rural Appraisal (PRA)

According to Theis & Grady (1991) and Schubert *et al*. (1994), Participatory Rural Appraisal (PRA) is a systematic but semi-structured way of learning from, and with community members to investigate, analyse and evaluate problems, constraints and opportunities and make informed and timely decisions regarding development projects or activities.

According to Chambers (1997), PRA applications include natural resource management, agriculture, poverty and social programmes.

Conway (1998) accounts that PRA arose in the 1980's out of earlier participatory approaches by combining semi-structured interviews and diagram making. In another article, Conway (2001) shows that PRA enables the people to take the lead, producing their own analysis, developing solutions to problems and putting forward recommendations for change and innovation. PRA evolved to challenge a top down process that has characterized so much development work.

Various methodologies have evolved from the PRA and were designed to suit local needs and innovations (Chambers, 1997). The emphasis of rapidity emerged because survey methods used to collect data took too long to be completed, analysed and disseminated to be useful to make decisions (Theis & Grady, 1991).

3.4. Livestock Production amongst Smallholder Farmers

Livestock husbandry is an essential economic activity in traditional farming systems. Approximately 70% of the ruminant livestock species in Southern Africa is kept under small-holder farming conditions which are characterised by communal use of resources like grazing and water (Nesamvuni *et al.,* 2002).

However, livestock production in general, and amongst smallholders/ communal/ traditional or resource-poor farmers is regarded as complex, dynamic, difficult to study, less understood, receives insufficient attention and hence less favoured by researchers, development officers and government policies (Steyn, 1988; Tapson, 1991; Roeleveld & van den Broek, 1996; De Lange, 2000; Swanepoel *et al*., 2000a). Several studies attribute this state of affairs to the multiplicity of functions related to livestock, combined with the complexity of its management, the social arrangements and resource use. In addition the poor performance of livestock is said to be due to inadequate policies, institutional deficiencies, and resource constraints, but also failure to develop new technologies and institutional mechanisms to facilitate wide application (Roeleveld & van den Broek, 1996).

Roeleveld & van den Broek (1996) further report that, over the past decade, the livestock sector in Africa has performed poorly because the output has grown at a low rate; the per capita consumption has declined; imports of major livestock commodities such as meat and milk have risen and environmental degradation is apparent. Livestock functions are particularly important to smallholder livestock farmers and have the capacity to serve as a buffer against bio-physical (drought) and socio-economical risk (Steyn, 1988; Ndlovu, 1990; Swanepoel *et al,*. 2000a).

The development of technologies for smallholder livestock owners has been constrained by several elements which include failure to understand the circumstances of smallholder farmers, lack of policies and support systems. Given these failures, farming systems research was introduced/ developed to strengthen the organisation of agricultural research

and provide technologies that are more relevant to resource-poor farmers. Farming system research was also introduced to ensure participation of livestock farmers in the development and introduction of technologies (Worman *et al.,* 1991; Reijntjes *et al.,* 1992; Okali *et al.,* 1994).

3.4.1 Livestock Ownership and Numbers

Livestock ownership and production in the rural, communal areas of South Africa is multi-purpose in character, with both cattle and goats serving a far greater diversity of functions than in the typical commercial production system (Shackleton *et al.,* 1999; Swanepoel *et al.,* 2000a). The same authors further argue that this multiple-use system may yield higher economic returns per hectare, when all functions are valued, than is expected given the low rates of off-take and conventional wisdom around livestock production and carrying capacity in the communal areas. Other studies have demonstrated that the values of functions are indeed higher than those for commercial ranches (Barrett, 1992; Scoones, 1992; Hatch, 1996). The argument presented is that the higher values per hectare are not only a result of multiple goods and services from livestock, but also lower input costs under communal systems (Hatch, 1996). It is argued that contribution of livestock to rural households has been underestimated in economic and livelihood security terms for several reasons (Shackleton *et al.,* 1999). These reasons include focus on productivity, limited consideration of non-monetised products of services and neglect of small stock such as goats or poultry.

Livestock owners in communal areas are rational in the ways in which they use and manage their herds (Bembridge, 1987; Bayer, 2000) and social or cultural factors are usually the major drivers of their behaviour (Barrett, 1992; Stroebel, 2004).

The primary objectives of livestock owners are, thus, to attempt to maximise the yield of consumable products for household investment or number of animals for savings, security and emergency cash purposes (Tapson, 1991).

Most researchers found that in pastoral farming in Sub-Saharan Africa ownership of livestock is not uniform and there are households that do not own livestock such as cattle, goats, sheep, pigs and fowls or their combination. In South Africa, several studies conducted show that ownership of livestock varies among different villages; for example, Maswana *et al.* (2002) found that in the Eastern Cape 81.5% households reared fowls 74 % reared cattle, 71.4% reared pigs and 57.1% owned goats. Schuh (1999) reported that 49% and 41% in the Vhembe and Capricorn Districts keep bigger animals. Sixteen percent (16.2%) households in Vhembe and 17.9% in Capricorn keep only chickens. Shackleton *et al.*(1999) in Bohlabela District found that 4.7% households owned only cattle 15% owned only goats 19% owned both and 61.3% did not own either. Swanepoel *et al.* (2000b) at Makuya and Nebo analysed ownership of livestock in the household based on gender and found that ownership of cattle, sheep and goats is four men to one woman but the ratio changes to four women to one man owning chicken in the household. Schuh (1999) investigated how the livestock came into possession of owners and found that 68% purchased while 28.8% inherited.

3.4.2 Herd and Flock Size

Herd size is regarded as one of the major factors which adversely affect productivity of livestock amongst black smallholder livestock owners. The literature studied shows that herd size on average ranges between 1-10 heads of cattle and goats amount to 10 per household. Table 3.2 presents percentage households owning cattle and goat and the herd/flock sizes reported by different authors in various localities in South Africa.

Table 3.2 Percentage households owning livestock and herd/flock sizes by different authors

Author	Locality of the study	% household owning cattle	Ave cattle herd size	% household owning goats	Ave flock size
Bembridge (1987)	Eastern Cape	71.0	6. 9	36.0	25.0
Vink &Kassier (1987)	Limpopo	88.0	10.0	-	-
Beinhart (1992)	Eastern Cape	50.0	10.0	-	-
Schmidt (1992)	North West	53.0	6.0	-	-
Pretorius (1994)	Limpopo	45.0	10.0	-	-
Bembridge (1998)	Limpopo	40.0	8.0	53.0	10.0
Moorosi (1999)	Free State	-	10.8&7.2	-	-
Swanepoel *et al.* (2000a)	Limpopo	52.0	8.0	-	-
Swanepoel *et al. (*2000b)	Limpopo	40.0&70.0	5.0&10.0	-	-
Schwalbach (2001)	North West	-	29.0	-	-
Stroebel (2004)	Limpopo	59.0	10.3	-	-

Bayer *et al*. (2001) reported that smallholder farmers can handle up to a certain number of livestock because the situation forces them to behave in that way.

Past increases in production have come mainly from increasing numbers, placing the natural resources base under strain (Fitzhugh & Vercoe, 1999). They further observed that, as the returns from livestock increases, so also will producers willingness to invest in productivity increasing technology.

3.4.3 Productivity of Livestock amongst Smallholder Livestock Owners

Livestock production in South Africa can be described as dualistic in character, namely a resource-endowed commercial sector and a resource-limited communal sector (Kadzere, 1994). Productivity in livestock is defined as a quantitative measure of the rate and amount of production per unit of land or input (Altieri & Anderson, 1986).

A number of studies with no empirical testing assert that the evaluation of smallholder livestock farming production was done without recognising the fact that some farmers place a higher premium on the reduction of risk than maximising production *per se*. In livestock, productivity is expressed as mass of meat per animal, per unit land, per unit feed

consumed or per capital invested (Tapson, 1991). On the other hand the latter author views productivity being the determinant of maintenance cost of the herd because it is related to cow mass.

Productivity and production performance of livestock in communal grazing land is low by commercial standards (De Brouwer, 2002). The same author further asserts that livestock do not contribute significantly to the well-being of the community and further concedes that livestock in communal areas is unevenly distributed among livestock owners or that access to the communally held resources is skewed.

The reasons advanced for poor performance are amongst others: land use systems that allow overexploitation of rangeland, poor nutrition, animal condition, low reproductive rates, animal health, insufficient water resources, introduction of less suitable breeds, management approach, absentee owners, absence or lack of marketing structures and lack of co-operation. All these reasons are inextricably linked to one another and to the land tenure system (De Brouwer, 2002). Some of these assumptions are right, if production is judged through production parameters used in commercial livestock production. However, if the marketable and non-marketable benefits or functions derived from livestock in the communal sector are taken into account, livestock is gainfully kept (Barrett, 1992; Lahiff, 1997; Ouma *et al.,* 2003).

The objectives of commercial livestock farmers is mainly profit oriented while the objectives of smallholder livestock farmers is multipurpose. Given the limited resources in the smallholder situation and the abundance of natural resources to the commercial farmers, the two cannot be compared on equal footing.

Kadzere (1994) argues that conventional ways of measuring productivity in livestock production enterprises are based on an assumed economic value that is attached to selling the animal and/or its products. Products such as milk, meat, eggs, wool, and hides are easy to quantify. An increase in productivity can come from very direct improvements such as increased weight gain or milk production, or improved feed utilisation by animals as well

as from improved fecundity, increased disease resistance, and particularly, for lower input production systems, increased longevity (Mendelsohn, 1999).

3.4.4 Reasons for Keeping Livestock

Studies across South and southern Africa reveal that the goods and services obtained from livestock are similar throughout, but that the relative importance of these may vary from place to place in response to agro-ecological conditions, markets and income from other sources (Shackleton *et al.,* 1999). Several authors have come to contrasting conclusions as to the role and value of livestock in communal systems and rural livelihoods. Cousins (1996) revealed a number of papers dealing with the importance and economic value of cattle in communal grazing systems in South Africa, whilst Barrett (1992) has dealt with the Zimbabwean situation. Livestock owners on communal land have different goals than commercial producers (Kadzere, 1996). Maswana *et al.* (2002) investigated the livestock farming objectives and observed that own consumption and sales of animals are the main objectives of farming on all classes of livestock indicated in the study conducted in the Eastern Cape. Other reasons why communal farmers keep cattle cannot be ascribed to a single motive but rather to a multitude of reasons, for example, inherited, consumption, savings, status, draught power and income (Tapson, 1991; Ramsay, 1992; Nthakheni, 1993; Duvel, 1998; Nel, 1998; Moorosi, 1999; Bayer, 2000; Bayer *et al.,* 2001; Swanepoel *et al.,* 2002; Stroebel, 2004).

3.4.5 Functions and Benefits from Livestock

A significant volume of literature has been produced on benefits, functions, goods and services, and roles of livestock to the small-holder, communal, resource-poor farmers in southern Africa (Tapson, 1991; Barrett, 1992; Shackleton *et al.,* 1999; De Lange, 2000; Swanepoel *et al.,* 2000a;b) and in other countries (Bosman, 1995; Devendra, 1999; Phillipson, 2000; Slingerland, 2000; Devendra & Chantalakhana, 2002; Blench *et al.,* 2003; Ouma *et al.,* 2003, Stroebel, 2004). Furthermore, Swanepoel *et al.* (2000a) reported that livestock are particularly important to smallholder farmers because they have multiple

functions and jointly produce a range of social, environmental, economical and cultural benefits, goods and services that can contribute directly to food security, rural development and enhanced environmental sustainability. A summary of the benefits, functions, goods and services derived from livestock species is presented in Table 3.3.

Table 3.3 Benefits and functions from livestock (Swanepoel *et al.,* 2000a; Stroebel, 2004)

Function	Products
Food	Milk; meat; eggs; blood; fish; honey; processed products.
Clothes	Wool; hides; skins; leather.
Work	Draught power-cultivation; transport of goods and people; threshing; pumping water.
Monetary	Capital wealth; investment; income from: hiring working animals; sale of products; sale of animals.
Social	Lobolo; ceremonial; companionship; recreational; status.
Manure	Fertilizer; fuel; flooring; plastering.
Other benefits	Feathers; bone meal; soap production

Nesamvuni *et al*. (2002) found that capital/wealth, investment and sale, social/ceremonies and meat are the most important functions; whereas milk, manure, skins and dung were ranked the lowest. Tapson (1991) found that in Kwazulu –Natal milk amongst communal farmers is the most important "Z" goods. Duvel (1998) in his study found that cash and form of employment were major reasons for keeping cattle. These findings confirm that location specific variations do exist and that in order to make proper conclusions, it should be noted based on the knowledge of such variations.

Livestock functions (especially non-marketable) for the smallholder livestock farmer are often difficult to attach a true value (Tapson, 1990), to value (Shackleton *et al.,* 1999) and because of that, the value of these functions is often ignored (Ouma *et al.,* 2003). This may be attributed to the fact that they do not feature in commercial agriculture. The omission of this consideration tends to assume that livestock in the hands of the smallholder farmers is not productive and not gainfully kept. This assumption is disputed by the findings of researchers, for example, in Botswana, De Ridder & Wagenaar (1984) and Abel (1993) found that traditional systems were 95% more productive than ranching in terms of live

weight production equivalent. However, ranches are more productive on a per animal basis, whether assessed in terms of calving rate, mortality, weaning rates or body weights. In Zimbabwe studies by show that the value of communal area cattle production far exceeds (ten times) returns from ranching (Jackson, 1989; Barrett, 1992; Scoones, 1992). In Mozambique, Rocha *et al*. (1991) found that traditional systems have higher overall returns per hectare because of the multiple benefits of draught, transport, manure, milk and meat compared to the single beef output from ranches. In South Africa, it was found that cattle production in Transkei have higher overall returns but lower productivity indicators, compared to ranches in the commercial white sector (Richardson, 1992; Tapson, 1993).

De Ridder & Wagenaar (1984) comparing gross energy and crude protein balances, found that productivity expressed in live weight equivalents per hectare was at least 20% higher in traditional systems than in ranching. However, in the same study it was found that productivity per LSU was 65% higher in ranching than in traditional systems.

Scoones (1992) assessed benefits from livestock (cattle and goats) in different ecological zones using data based on biological productivity parameters, milk production, sales and slaughter, manure production and draft power. The study revealed very high internal rates of return for all livestock categories, and returns per hectare that are considerably higher than conventional beef ranching systems. The high economic value of communal area livestock is derived from the ability to stock at a high level, to make use of a mixture of species for a variety of purposes including meat, milk, draft power and transport.

Shackleton *et al.* (1999) assessed the direct value of goods and services derived from livestock and concluded that the multiple uses of livestock may yield higher economic returns per hectare than is expected, when all functions are valued, given the low rates of off-take and commercial wisdom around livestock production and carrying capacity in communal areas.

Some of the benefits and functions listed above are difficult to value hence they are often ignored by researchers when they develop breeding objectives and determine productivity

of the animals; where emphasis is typically placed on the physical market production (Barrett, 1992; Shackleton *et al., 1*999; Ouma *et al.,* 2003; Kosgey, 2004). The diversity of the benefits outlined by Swanepoel *et al.* (2000b) is erroneously viewed by animal scientists as negative factors in themselves responsible for low livestock productivity in communal systems. However, the multiplicity of purposes of keeping livestock can be viewed more positively because black smallholder farmers make maximum utilisation of these animals. This view point is valid as long as a direct comparison in productivity between black smallholder farmers and commercial enterprise is avoided (Nthakheni, 1993).

Production and income from livestock keeping has been extensively studied, quantified and modelled. However, very little has been done to obtain a conceptually better understanding and more quantitative grasp of the importance of the socio-economic functions, that would explain why livestock keepers are willing to keep low productive animals in the herd as perceived by the researchers and technical staff (Ouma *et al.,* 2003).

The functions and benefits often overlooked and bypassed when determining productivity of livestock are social status, savings, wealth demonstration, draught power, cementing relationships through bride dowry and loaning (Ouma *et al.,* 2003; Kosgey, 2004). According to Mendelsohn (1999), the value of these benefits and functions can be expressed in terms of opportunity costs or contingent valuation method (a survey method primarily used to place monetary values on products and services for which market prices do not exist or do not reflect their social value).

The contingent valuation method is a method for valuing goods that uses survey questions to elicit willingness to pay, or willingness to accept compensation, by developing a hypothetical market in which the respondents are given the opportunity to buy the good(s) in question (Romano, 1999). Contingency valuation is one of the most widely used valuation techniques because of its flexibility and ability to estimate total value, including passive use value (Carson *et al*., 2001). However, despite the acceptability of the method, the weaknesses identified by Romano (1999) are that it can be very costly, and

hypothetical answers can lead to over- or understatement of true values. Shackleton *et al.* (1999) attempted to attach value to goods and services obtained from livestock but stressed that the values attached to the products and functions are not static and will fluctuate from year to year in response to a range of variables at the household.

The various studies cited above suggest that, when all forms of production are taken into consideration, many livestock owners in the resource–limited areas obtain rates of productivity that can be compared with commercial herds (Lahiff, 1997).

3.4.6 Functions of Livestock Related to Breeding Objectives

According to Bayer *et al*. (2001), animals in smallholder farming have more functions than to produce food and raw materials. These functions of animals and the related breeding objectives can change with circumstances. However, other authors are asking questions that need to be pursued if the multi-functionality of animals for black smallholder is widely accepted. These questions include:

- What are the requirements for the organisation of breeding operations and the consequences for breeding objectives?
- How can the multiple functions, benefits and services derived from animal keeping be measured/evaluated/expressed as a productivity index, so that they can be translated into breeding objectives?
- How can policy-makers be influenced to accept subsistence as a valuable aim for animal keeping?

The strategies pursued by black smallholder livestock owners for the management of Animal Genetic Resources (AnGR) distinguished by Bayer *et al.* (2001) include: acquisition of new animal breeds or species, opportunistic extensive breeding of mostly small stock, selective breeding, mostly of large stock, selective breeding of livestock for more commercial purposes.

Animal breeding generally aims to obtain a successive generation of animals that will produce desired products more efficiently under future farm economic and social circumstances than the present generation of animals (Groen, 2000). Definition of the breeding objective is generally regarded as the primary step in the development of a structured breeding programme (Ponzoni, 1986). Breeding objective involves determining the economic values of biological traits that enhance profitability (James, 1986).

Formal breeding objectives for subsistence production systems are scarce in the tropics (Amer *et al*., 1998; Kosgey, 2004). Likely factors contributing to this situation include illiteracy, lack of record keeping, small herd/flock size and the multiple roles animals play in smallholder systems (e.g. as a form of insurance, banking reserve, source of prestige, etc). This has forced animal breeders in the past to define breeding objectives in purely biological terms (Franklin, 1986).

Smallholder farmers, unlike commercial ones, tend to keep animals for family needs, rather than purely as an economic enterprise, and so do not necessarily have the motivation to gain from increased production, especially if increased production also involves increased risks (Amer *et al.,* 1998). In low-input traditional production systems, livestock may provide agricultural inputs, such as manure and render the enterprise more productive and more secure by using residual capacity of production factors with low opportunity costs such as non-arable land, excess labour by converting crops and crop residues into high value animal products and by balancing production and market risks (Jahnke, 1982).

Conventional breeding objective experts acknowledge that developing breeding objectives for smallholder resource poor livestock production systems is not easy due to tangible and intangible functions and benefits which cannot be valued (Amer *et al*., 1998; Ouma *et al*., 2003; Kosgey, 2004).

The functions and the desired traits of animals kept by smallholder farmers with the associated breeding objectives are presented in Table 3.4.

Table 3.4 Functions of livestock related to breeding objectives (Bayer *et al.*, 2001)

Function	Animal species	Desired Characteristics	Breeding Objectives
Production of meat	All species of domestic animals	Growth and reproduction, coping with feed shortages, good disease resistance and good mothering ability.	Growth on available forage, and disease resistance, good fertility, ease of calving/lambing, good mothering ability.
Milk production	Cattle, goats	Milk production from basic ration. Survival on low quality forage.	Optimal milk yield, strongly independent of infrastructure and Input supply, good fertility.
Provision of draught power	Cattle, donkeys	Easy to handle, survive on low quality forage, hardy and disease resistance, strong and docile.	Strong and docile character.
Savings account/ Capital	Cattle, sheep, goats poultry and pigs	Hardy and easy to care for.	Survival under local conditions, disease resistance.
Social value/ prestige	Cattle, in some areas Goats and chicken	Colour	Colour

3.4.7 Livestock and Land Use

Historically in South Africa, access to land was determined by race. Black South Africans were removed by the apartheid government from their lands and resettled in the so-called homelands (Department of Land Affairs, 1997). These areas included some of the poorest and most degraded soils in the country and they became islands of rural poverty (Cousins, 2003; Stroebel, 2004). Resource utilisation in these areas is characterised by communal use where none bears the responsibility of damage caused (Boonzaier *et al*., 1990). Livestock owners have a long tradition of livestock production on natural grazing and communal rangeland areas. Livestock owners are criticised for low productivity, little use of new technologies, and the belief that livestock production is responsible for environmental degradation (Mearns, 1996). This argument supports the assertion by Trollope (1985) that the absence of any significant costs, together with the communal system of land tenure, has resulted in livestock numbers far exceeding the carrying

capacity of the veld. Mearns (1996) further argues against these beliefs and observations by showing that livestock does benefit the environment and the benefits are also shared by multiple users.

Carrying capacity is described as the average number of animals that a particular veld or range or ranch can support over the long term without causing damage (Behnke, 1992). It is a measure of the ability of the veld to produce enough grazing to meet the requirements of grazing animals and it is based on stocking rate. Behnke (1992) asserts that the carrying capacity of rangeland cannot be based solely on botanical consideration but must also take into account the management objectives of rangeland users. The same author further shows that misleading carrying capacity estimates are often based on the confusion between ecological and economic carrying capacity. The economic carrying capacity is defined as a point at which populations cease to grow because limited feed supplies produce death rates equal to birth rates (Behnke, 1992). He concluded that the concept of carrying capacity is not appropriate to the management of grazing systems not at equilibrium.

Stocking rate is the number of animals on a veld during a grazing season, and is usually expressed in animal per unit area. Behnke (1992) demonstrated that determination of the correct stocking rates in a particular area is a process of reconciling multiple-alternatives of production.

More than half of the world's land surface is used for livestock production; however the environmental consequences of livestock production vary widely, depending on the opportunities and constraints afforded by different production systems (Mearns, 1996).

Ehui *et al.* (1998) reported that livestock have been accused of causing degradation of natural resources such as land and forest, as well as pollution and global warming. He further asserted that animal production partly contributes to these problems, but the allegations against livestock are often exaggerated or unfounded. Their study showed that the main forces driving environmental degradation included:

- Increasing human population pressure,
- Micro- and macro-economic policies,
- Cultural values,
- Poverty,
- Communal land tenure,
- Lack of appropriate technology to harmonise production with resource conservation,
- Lack of awareness of the interactions between livestock and environmental and human needs,
- Lack of infrastructure to facilitate marketing, and
- Lack of involvement of the local communities in their own development.

These findings are supported by Fitzhugh & Vercoe (1999) who cautioned that it is worth remembering that animals themselves are neutral in their effect on the environment, what matters is how people manage their livestock and the degree to which government policies and regulations motivate sustainable production. They further argue that, unless effective measures of regulating land ownership and use is put in place, rising livestock numbers in these systems could exacerbate any existing problems of overgrazing, leading to severe erosion.

De Haan (1996) reported that one of the most powerful new insights that have emerged over the past years in Sub-Saharan Africa concerns the notion of opportunistic range management. The new paradigm of range management is based on 'non-equilibrium ecological theory' in range ecology (Niamir-Fuller, 1996). The theory recognizes three main characteristics of arid ecosystem, namely; ecological variability, unpredictability and resilience. The new paradigm postulates that the greater the unpredictability, the more suited it is to being managed communally (Niamir-Fuller, 1996). However, Tapson (1991) argues strongly against these scientific views in that most of the studies were conducted in sites which are not affected, instead benchmarks were used comparing well managed veld

and communally used veld. The resilience of the veld to recover from overgrazing or drought situation has put doubts to some conclusions of other studies (Tapson, 1991).

Resilience of veld refers to the ability of the veld to recover following disturbance driven change (Walker *et al.,* 2002). Communal land use is known to have a contributing share of land degradation (Simpson & Evangelou, 1984; Dyson–Hudson, 1985; Trollope, 1985). Livestock development projects were embarked on as proposed alternatives to traditional livestock keeping which was viewed as unproductive. Projects such Kenya cattle company, Botswana tribal grazing land policy, community land company, grazing schemes in Zimbabwe and livestock production schemes in the former homelands of South Africa were introduced but all failed, because they were implemented based on top-down approaches (Tapson, 1990).

3.4.8 Constraints to Livestock Production

Constraints to increased agricultural productivity may be due to natural, technical and economic factors (Nthakheni, 1993). Natural factors relate weather patterns, for example, drought and rainfall; technical factors relate to management skills, traditional values and attitudes; economic factors relate to markets, finance and infrastructure. There is ample literature that discusses the constraints that affect the productivity and performance of livestock amongst smallholder farmers. The most common primary constraint identified amongst smallholder farmers is the lack of resources such as water and grazing. These resources are unavailable during specific times of the year.

Some constraints are summarised from cited literature (Nthakheni, 1993; Milner-Gulland *et al.*, 1996; Jabber & Ehui, 1998; Swanepoel *et al*., 2000b; De Brouwer, 2002; Stroebel, 2004) and are summarised as follows:

- Inadequate nutrition,
- Scarcity of grazing,
- Diseases,
- Lack of capital to purchase livestock medicines,

- High price of medicines and unavailability,
- Poor management skills,
- Poor genetic materials of animals,
- Internal and external parasites,
- Low adoption of available livestock technologies,
- Poor sheltering against inclement weather,
- Inappropriate use of available livestock technologies,
- Introduction of unadapted breeds to areas characterised by harsh conditions,
- Poor extension service,
- Lack of production and market information,
- Water scarcity and long distance to watering points,
- Poor market information and infrastructure,
- Lack of fencing or grazing camps in communal areas,
- Uncontrolled breeding,
- Poor maintenance of exiting infrastructure by both communities and government support services, and
- Lack of managerial/ entrepreneurial skills by smallholder livestock owners.

Constraints to livestock production in resource-poor areas differ from place to place. The above listed constraints are most common in resource-poor areas.

3.4.9 Policy Constraints

Different policies applied to commercial agriculture and to black smallholder farmers in the former homelands (Stroebel 2004). Current legislation to improve production cannot meet the needs of both the commercial and resource–poor sectors. A holistic Livestock Industry and Implementation Framework were developed to address this anomaly. The strategy emphasises the need to enhance equitable access and participation in the livestock sector, improve global competitiveness and profitability, and ensure sustainable resource management (Department of Agriculture, 2004). The overall goal of the strategy is to

create an enabling environment within an emerging and commercial farming environment in order to address the constraints and challenges identified within the sector.

Some authors have reported that most agricultural policies in African countries, are either unclear, biased (Garba, 2000); inadequate, inappropriate (Roeleveld & Van den Broek, 1996); poor (Ehui, & Pender, 2005) and offer very little support (Mbilinyi & Nyoni, 1997) to livestock research, production and development.

In the South African situation the following are some policy gaps identified (Nesamvuni *et al.,* 2003; Department of Agriculture, 2004; Stroebel, 2004):

- Weak policy and low capacity in the Provincial Department of Agriculture,
- Lack of access to finance and capital,
- The need for a well developed provincial infrastructure platform,
- Skills gaps and deficiencies at local government and provincial level,
- Poor education levels and lack of entrepreneurial experience,
- Sustainable resource management is weak in the resource-poor and communal areas (overstocking, high stocking rates and low effective carrying capacity leading to low reproductive and growth rates as well as low off-take as animals take a long time to be marketable),
- Lack of infrastructure for livestock (fences, sales pans, livestock handling facilities),
- Weak coordination between research and extension, and
- Lack of access to markets by emerging and smallholder livestock farmers.

The South African Government has developed policies and intervention programmes that target the previously disadvantaged farmer in order to reduce the backlog in services and provision of infrastructure. Examples of some interventions are Land reform policy, Comprehensive Agricultural Support (CASP), land reform and food security programmes.

3.5 Conclusion

The literature survey confirms that most of the research methods were derived from the inquiry systems developed by the cited philosophers. There are also different approaches to conduct research. This literature review on systems, methods and approaches gave guidance to the current study as to the choice of research methods. The understanding of a variety of the research methods studied guided the researcher to learn the boundaries of the philosophies, methods and their applicability in the current study.

The literature review revealed more information on the constraints, dynamics, complexities, and the multiplicity of livestock uses in smallholder livestock systems. Therefore conclusions made without considering the local situation may lead to inappropriate outcomes or decisions.

Livestock production amongst smallholder farmers is known to perform poorly in terms of reproductive performance but if all the functions, including non-commercial or non-market benefits, that livestock offer to the smallholders, it can be concluded that they are gainfully kept.

The literature reviewed revealed that polices and strategies that support livestock production are lacking or their implementation to support the smallholder livestock farmers is weak.

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CHAPTER 4

CHARACTERISTICS OF LOW-INPUT LIVESTOCK PRODUCTION SYSTEMS IN RESOURCE-LIMITED AREAS OF THE LIMPOPO PROVINCE OF SOUTH AFRICA

Abstract

A survey was conducted in six villages located between 22º85' latitude and 30º71' longitudes in the Limpopo Province of South Africa. The objective of the study was to develop an understanding of characteristics of livestock production practices of the study area, with a view to contribute to appropriate intervention initiatives. Data collection was by means of structured questionnaires and a Participatory Rural Appraisal exercise. The results show that 62.2% of the respondents are between the ages of 55 years and older. The income of the respondents is from multiple sources and is mainly derived from salaries/wages, pension and sale of livestock. Sale of livestock contributes 22.7% towards school requirements while salaries and pension contribute 44.7% and 38.7%, respectively. A significant majority (59.2%) of the respondents keep up to 10 heads of cattle, 41.6% up to 10 goats and 30.4% keep up to and less than 10 pigs. Cattle constitute 67.3% of the total livestock, followed by goats 18.9% and pigs 13.8%. Ownership is reflected by 41.9% own cattle only, 27.1% own cattle, goats and pigs, 22.5% own only cattle and goats, and 8.5% own cattle and pigs only. Female animals, except pigs, constitute the highest number in the herds/flocks sited (cows 55.0%, and ewes 60.5 %). Birth rates (cattle 35.6%, goats 38.3% and pigs 37.9%) are low. Mortality rates of young and old animals are 15.7% for cattle 16.6% for goats and 6.6% for pigs. Eighty one percent of the respondents have access to land for crops ranging between 0.5 to 15 hectares.

Key words*:* Characteristics, low-input, livestock production system, resource-limited.

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4.1 Introduction

Livestock production amongst resource-poor livestock owners plays a significant role in poverty alleviation and food security. Livestock production in resource-limited areas in South Africa, in many instances, is assessed in terms of conventional production.

The differences in resource endowment like land, capital, quantity and quality of feed and housing are some reasons why there are differences between the two sectors (Rae & Hertel, 2000). Swanepoel *et al*. (2000a) purported that "production" is relative especially when comparing two systems which from the onset have different objectives. The benefits derived from livestock in resource-limited areas are numerous, variable and they sustain smallholder livestock holders in different ways. De Lange (2000) found that domestic uses of livestock (milk, meat, ceremonial, draught, insurance, investment, emergency cash needs) predominate over cash sales amongst smallholder livestock owners. The understanding of low-input livestock systems does not take into account such factors which make it what it is. In this paper, resource limited areas are areas settled with black people in the former homelands of South Africa.

The objective of this chapter is to present the results of a study on the characteristics of livestock production systems (cattle, goats, pigs and chickens) with a view to understand the production practices and environment under which production takes place and to make recommendations for future interventions.

4.2 Material and Methods

Details regarding the study area, sampling procedures, questionnaire design, methods of data collection and data analysis are described in chapter two. For the purpose of this chapter, only a summary is provided.

4.2.1 The Study Area

The study was carried out in the six villages in the Vhembe District of the Limpopo Province in South Africa. The study area is situated between 22^0 85' latitude and 30^0 71' longitudes.

4.2.2 The Sample

Random sampling (lottery method) was applied in the sampling of the respondents for the general survey questionnaire as described in section 2.5.2.

Thirty livestock owners were sampled to participate in the PRA. Purposive Sampling method was used. The PRA approach was used to gather information about constraints and coping mechanisims of the respondents.

4.2.3 Data Collection and Analysis

Structured general survey questionnaires, PRA, secondary data and direct calculations were used for collection of data for the study. The questionnaire was used in order to gather detailed information on smallholder livestock owners and other relevant information, though it was time consuming. The PRA was used for its cost effectiveness and short time to gather information about constraints and solutions to identified constraints.

Of the 131 sampled respondents only 128 were interviewed because two passed away and one relocated to another area. Some information was obtained from secondary sources, for example, veterinary services records.

Data was captured on an Excel spreadsheet and was analysed through SPSS for frequencies (SPSS, 2000) and direct calculations. Information gathered through PRA was tabulated as it came from the respondents.

4.3 Results and Discussion

4.3.1 Profile of Smallholder Livestock Owners

The results show that the majority of the respondents are of the older generation, 62.2% are between the ages of 55 years and older as presented in Tables 4.1.

Table 4.1 Ages of respondents and household heads

Age	No of respondents	Percentage
>65	46	35.9
55-64	35	27.3
45-54	31	24.2
35-44	12	9.4
25-34	1	0.8
15-24	1	0.8
Don't know	2	1.6
Male	115	89.8
Female	13	10.2

The aging respondents profile has an implication in the adoption of modern technologies especially if there is no succession plan to infuse the youth to take over from the old generation. The aging bodies are also challenged to do physical work. The education level of the respondents ranges between those with no formal education (41.2% mostly old age) and the majority (57.8%) of the respondents can read and write as presented in Table 4.2. Higher literacy level (secondary and tertiary) is lower than expected and is also a course for concern for adoption of new technologies.

Table 4.2 Education level of respondents

Level	Number of respondents	Percentage
None (no formal education)	54	41.2
Primary	55	43.0
Secondary	15	11.7
Tertiary	4	3.1
Total	**128**	**100**

The average family size is seven members per household. Bigger families are important in providing labour for farming; however, cost of living and time for schooling are posing a challenge to such families. The income of the respondents is from multiple sources and is mainly derived from salaries/wages and pension, as presented in Table 4.3. Sale of livestock and meat (17.3%) rank higher than sale of crops and is the third largest source of income for the respondents. This shows that sale of livestock and meat has a reasonable contribution to the livelihoods of the smallholder livestock owners in the study area.

Table 4.3 Sources of income

Source	Number of respondents	Percentage
Salary/wages	59	33.2
Pension	46	25.8
Business	5	2.8
Saving clubs	5	2.8
Sale of crops	21	11.8
Sale of livestock	23	12.9
Slaughtered meat	8	4.4
Remittance	4	2.2
Others	7	4.0

A similar trend was noticed on the source of income for payment of school requirements for school children. Sale of livestock only contributes 22.7% towards school requirements while pension and salary/wages contribute 44.7% and, 38.7% respectively. Cash income of the majority (41%) of the respondents' ranges between less than R200.00 to R600.00 per month as presented in table 4.4 and the main sources identified are salaries/wages and pension.

Table 4.4 Income levels of respondents in the study area

Income Range (R)	Number of respondents	Percentage
< 200	9	7.0
201-600	44	34.0
601-1000	21	16.4
1001-1600	23	17.9
1601-2000	14	10.9
>2000	10	7.8
None	7	6.0
Total	**128**	**100**

The cash income level of the majority of the farmers is less than the figures (R1000-R1999) reported by Schwalbach *et al.* (2001) in their study. This differences imply that sources of and level of income will differ form place to place. Schwalbach *et al.* (2001) also found a positive correlation ($r = 0.58$, $p < 0.05$) between level of income from sources other than farming and number of cattle owned. This implies that it is easier for people to invest in agriculture if they have access to non farm income, which enables them to deal with risks inherent in agriculture.

Annual expenditure on the maintenance of livestock is mostly on medicines (61.2%) and dip (16.2%) averaging R360 and R1700, respectively. This expenditure is the result of a government policy change. The government discontinued supplying free dip in 1999. Livestock owners had to purchase dip for themselves. Initially, smallholder livestock owners were reluctant to purchase dip and this resulted in outbreak of tick-borne diseases and wound infestations caused by tick bites. Another factor was that during the year of survey, there was excessive rain which interrupted dipping cycles, such that tick load on animals, and incidence of diseases were abnormally high.

4.3.2 Herd/Flock Size and Ownership

The herd/flock size and ownership are presented in tables 4.5 and 4.6.

Table 4.5 Herd/flock sizes of the respondents in the study area

Range	No of respondents	Cattle %	No of respondents	Goats %	No of respondents	Pigs %
1-10	76	59. 2	53	41. 6	39	30. 4
11-20	43	33. 4	10	7. 6	3	2. 4
21-30	3	2. 6	-	-	1	0. 8
30-40	5	4. 0	-	-	-	-
41-50	-	-	-	-	-	-
>50	1	0. 8	-	-	-	-

A significant majority of the respondents (59.2%) own up to 10 head of cattle. This figure is comparable to the figures of 10.3 and 10.8 head of cattle per household reported by Stroebel (2004) in Venda and Moorosi (1999) in Thaba Nchu, respectively. Lower figures of the mean of eight head of cattle were also reported by Nthakeni (1993) in Venda and a mean herd size of six in the former Transkei reported by Bembridge (1984). In terms of goats, 41.6% own up to ten head of goats. The figure is comparable to the flock size of ten goats reported by Bembridge (1998), the mean flock size of eleven goats reported by Stroebel *et al*.(2005) in Limpopo and less than 25 in the Eastern Cape (Bembridge 1987). Stroebel (2004) found that there was positive correlation between the goat and cattle herd size with family size. He further argues that the increases in cattle and goat herd sizes as farm family size increased reflect the strategy to provide employment for children and older members of extended families. The results of the study also show that 30.4% of the respondents own up to and less than 10 pigs and no comparable study could be traced. The small number is mainly to do with management in feeding and watering as pigs are always confined in sties.

Furthermore, the results in Table 4.6 illustrate that, 41.9% own cattle only and 27.1% own a combination of cattle, goats and pigs. Only 22.5% own a combination of cattle and goats, while only 8.5% keep cattle and pigs. The results also show that the largest livestock type in terms of numbers is cattle.

Table 4.6 Number, livestock types and combination of livestock owned by the respondents in the study area (excluding poultry)

Livestock Type	N	% of total livestock	Combination of livestock	N	% of total owners
Cattle	1563	67.3	Cattle	54	41.9
Goats	440	18.9	Cattle, goats& pigs	35	27.1
Pigs	320	13.8	Cattle & goats	29	22.5
			Cattle & pigs	11	8.5

Given the limited resources like grazing, feed and labour in the study area, it is concluded that herd/flock size of which the majority keep ten and less of each species, is rational. This is supported by Bayer (2000) who argues that risk reduction often includes

maximizing herd/flock size instead of aiming at high production per animal. An increase in herd/flock size has an implication of higher costs in terms of labour, feed, health care and housing. However, 55% of the respondents indicated that if they have extra money they will buy more cattle. Ownership of livestock by smallholder livestock owners is not attached to obligations like debt collaterals and as a result they are not under pressure to maximize production in order to pay debts.

4.3.3 Herd/Flock Composition

The herd/flock composition as presented in Table 4.7 shows that female animals (except with pigs because of multiple births) constitute the highest percentage of the total herd and flock studied (cows 55.0%, does 60.5%). The figure of females (heifers and cows) is higher than the figure of 45.6% of breeding females reported by Stroebel (2004)..

Table 4.7 Herd and flock composition of the respondents in the study area.

Cattle			Goats			Pigs		
Class	**Number**	**%**	**Class**	**Number**	**%**	**Class**	**Number**	**%**
Cow	860	55.0	Doe	266	60.5	Sow	82	25.5
Bull	232	14.5	Buck	69	15.7	Boar	25	7.8
Calf	307	20.0	Kid	102	23.1	Piglet	214	66.7
Ox	164	10.5	Castrate	3	0.7	-	-	-
N	**1563**	**100**	**N**	**440**	**100**	**N**	**320**	**100**

Swanepoel *et al.* (2000b) reported figures of 60% and 30% for Makuya and Nebo areas, respectively The ratio of intact males to females shows that there are more males than necessary (cattle 1:4 goats 1:2, and pigs 1:4). This ratio is in agreement with the ratios of 1.3 bulls to cow and 1.5 of bulls to females reported by Stroebel (2004). In the study area it was observed that these male animals are not uniformly distributed amongst the smallholder livestock owners. Some households do not have male animals. This anomaly is dealt with by loaning the male animal from those that have. The practice is prevalent

amongst pig owners. These animals are used mainly for draught purpose as could be noted from the visible yoke scars on their necks.

4.3.4 Reproduction

The reproductive rate based on the number of young animals born and recorded at dipping tanks just before and during the survey, indicates low productivity (cattle 35.6%; goats 38.3% and pigs 37.9%). The birth rates reported in this study are lower than those reported by Swanepoel e*t al*. (2000b) (50% and 40%) for Makuya and Nebo; Tomo *et al.* (1999) (40 % and 50%) and Stroebel (2004) (49.4%), respectively. The goat kidding rate of 38.3% is much lower than that reported by Mahanjana & Cronje (2000), namely, 64% for older does and 76% for maiden does in the Eastern Cape. The litter size observed ranged from five to 12 piglets per sow. The low reproduction rates are typical of smallholder herds and flocks and this suggest that there is a high percentage of non-productive breeding females in the herds and or high neonatal deaths.

Swanepoel *et al*. (2000a) observed that parturition intervals of two years and longer in cattle are common in communal areas. This finding is supported by the findings of Stroebel (2004) who reported an average calving interval of 24 months in Venda. A case study by Bester *et al*. (2001) revealed that Nguni cows have a breed average inter-calving period of 35.2 and a national average of 35 months, respectively. Stroebel (2004) argues that the long calving intervals could be attributed to the fact that few farmers wean calves and the majority leave the calves with the dams until natural separation occurs. There is no systematic breeding programme and calving seasons are throughout the year. The highest number of births is recorded between October and February months. This trend is attributed to abundance of good grazing from February to May during which mating activities are high.

The average age at first calving reported by Stroebel (2004) is 34.5 months; this is comparable to the figures reported by Bester *et al.* (2001) of 31 months for breed average and 34 months for national average.

4.3.5 Mortality Rates

The mortality rates of the young and old animals in the study area are moderately high (15.7% cattle and 16.6% goats) and low in pigs (6.6%s). A similar figure (15.6%) for herd mortality for cattle was reported by Stroebel (2004).The mortality of young animals as a percentage of the total number dead (young and adults) within species constitutes the highest proportion of the mortality (73.3% calves, 70.5% kids and 90.4% piglets). The high mortality rate in cattle and goats is attributed to tick-borne diseases that were prevalent due to the excessive rainfall that favoured the increase in the tick population and also prevented cattle dipping for more than three months.

New Castle disease and other diseases accounted for 90.5% of mortalities in chickens, while predators accounted for eight percent of the chicken mortalities. Highest mortalities of calves and goat kids are recorded in summer 73.9% and 21.7%, respectively. Pig mortality is low in the study area (6.6%). The cited mortality was attributed to crushing of piglets by the sows, and drowning in the mud due to inappropriately designed pig sties.

4.3.6 Weaning rates

Weaning is not practiced on cattle and goats but to a certain extent by pig owners especially during cropping seasons to relieve the sows from suckling pressure when they become too emaciated. Calves and kids are allowed to run with their mothers until naturally weaned. Judging from the birth rates and the mortalities incurred, the weaning rate is less than the birth rates. Stroebel (2004) reported a weaning rate of 34.2% in his study area.

4.3.7 Milk off-take

Milk production in the study area is low, averaging 5.5 litres per cow. Only 9.3% of the respondents milk their cows, and only one of them sells milk at an average price of one rand per litre. The low milk production may be influenced by that Nguni type cattle do not yield much milk. Stroebel (2004) found that herd size and cattle wealth influence milk off-

take because milking is primarily focused on household food needs. The number of cows in milk is negatively correlated with milk off-take yield.

4.3.8 Herd Off-take

Livestock off-take in the study area is expressed by a number of slaughtered and sold animals (productive off-take) throughout the year. Sales are not formal and not influenced by the market. Livestock records from the Northern Province Department of Agriculture (2000) for the study area show that 28.5% of the cattle were slaughtered by owners, other buyers and butcheries.

Off-take (total sales and slaughter) of cattle based on the figures from the Department of Agriculture is 21.3%. This figure is higher than off-take rates of cattle under communal tenure reported elsewhere, for instance, Tapson (1982) (5.4%); Steyn (1988) (7.5%); (6.01%); Stroebel (2004) (7.8 %).

Most sales of livestock especially cattle, goats and chicken take place during festive seasons such as Easter and Christmas. The price is determined by visual assessment of the size and condition of the animal. Price determination is also informed by prices paid when they purchase breeding stock and slaughter animals during festive seasons from commercial farmers and at auction sales.

In the commercial sector, livestock are mostly sold by weight and smallholder livestock owners cannot afford to buy weighing scales. However, this problem may be solved by applying simple and affordable methods for estimation of live mass through linear body measurements like heart girth and whither height studied and described by Nesamvuni *et al*. (2000). They found that heart girth and wither height are highly correlated to live mass and they observed that it is easy to apply in communal areas. A pocket tape measure or a calibrated stick can be used to measure heart girth and whither height in order to arrive at a correlated live mass, in order to estimate or determine a price. In the study area, selling of cattle is done when a large amount of money is required and goats are sold when a small amount of money is needed.

4.3.9 Livestock Management

Livestock management practices such as supplementary feeding, planned breeding, weaning, culling and disease control are not visibly practiced in the study area. Livestock management follows a typical communal area pattern. The absence of conventional management practices suggests that there is the minimum investment or input for livestock except in extreme cases of disease outbreak and drought problems. Little attention is given to reducing losses and improving productivity of existing practices, through simple improved management, disease control, improved housing and feeding.

4.3.9.1 Cattle

Cattle in the study area are generally herded because there are no camps except at Tshikonelo; patch grazing during cropping seasons is a common practice. After crop harvests cattle are allowed to graze on crop residues. Cattle are kraaled every night throughout the year for fear of theft, road accidents and prevention of crop damage. Average time spent looking after cattle at grazing area is seven hours per day with extremes of 12 hours. Disease and parasite control is minimal.

4.3.9.2 Goats

Goats are kept under a low-input production system. Goats are also herded, but the common and growing herding practice is tethering. Reasons given by the respondents, for tethering are prevention of crop damage (15.3%), lack of herding labour (35.7%) and laziness on the part of children 37.8%. Goat housing in the study area is generally poor, made of low quality building materials and inadequate to protect them from bad weather like excessive rain and cold wind. In some households goats are tethered under the verandas or inside of the huts used as kitchen. Average time spent attending to goats is four hours per day. Although respondents are aware of diseases like heart water, foot-rot and diarrhoea, very little is done to control or treat them. In some cases indigenous medicines are used, but it was not possible to obtain details of names of the plants or herbs used as it is always a closely guarded secret in the community.

4.3.9.3 Pigs

Pig keeping is characterized by minimum input in terms of labour and feed. Pigs are kept in sties during cropping seasons to prevent crop damage. Pigs kept in the area are indigenous. They are fed food remains, wild fruit (figs), weeds, and domestic fruit (paw paws, pumpkins and mangoes) and in some cases, maize bran and beer brew residue depending on availability. During the survey no farmer was found feeding pigs on commercial feeds. Average time spent attending to pigs, especially for feed collection, is one hour. Pigs are normally released from the sties in winter to reduce feeding pressure (47.5%). Other respondents indicated that it is done so that pigs grow well. The release of pigs is done with the full knowledge of measles infection implications (66.4%). Pig sties observed varied from stone-built, pole-built and corrugated iron-built mostly with nothing on top to prevent sun and rain. Most sties are situated near or under trees. Most respondents site heat and mud as the main problems that respectively result in heat stroke on adults and drowning of piglets. Disease control in pigs is non-existent. Except for measles, knowledge of other diseases is scanty amongst pig owners and they consider measles as the main problematic disease in pigs. Seventy-seven percent of the respondents know that measles in humans is acquired by consuming infected meat by measles. Many believe that measles in pigs can be prevented by feeding feed mixed with salt (27.8%); 7.4% believe that it can be prevented by medicine and the majority (51.9%) do not know. These results give a clear indication that the respondents do not know how to prevent measles from infecting pigs.

4.3.9.4 Poultry

The main poultry type in the study area is chickens and ducks. Chickens and ducks are left to scavenge freely. Very little investment is made in terms of time, feed, shelter and management or money. In some cases chicken are fed grain and bran. Poultry sheltering involves sharing the kitchen space with humans, roosting on trees and chicken runs provided. ducks are always left to seek shelter for themselves. Routine feeding and disease control is non-existent, except at Tshikonelo where farmers have undergone training in the Participatory Extension Approach (PEA). Farmers in this village have organized

themselves to buy New Castle disease vaccine to vaccinate their chickens and this effort resulted in the decrease in mortalities and increased number of chicken per household. No mortality of ducks were reported or observed during the survey.

4.3.10 Labour

Labour for attending to livestock is mostly derived from within the household. In some households cattle are herded by hired labour which is either paid in cash or in kind. The average cash payment is R210.00 per month (1999). The implementation of minimum wage as directed by the minimum wage (R650 per months) policy is generally not practiced. If it were practiced it would render most smallholder livestock owners unsustainable. The in-kind payment to a herder is in the form of a heifer per annum or a period agreed upon. The majority (49.2%) of the respondents pay their workers in cash, 14.1% pay in-kind and the rest (36.7%) provide their own labour. Labour time in a household for livestock is divided among other activities which require labour, for example, cropping. The division of labour within a household is more distinct in summer during school vacation. Early morning time is devoted to ploughing and cropping whereas from mid-morning (average 11am) till sunset cattle are attended to. Pigs, chicken and goats are the responsibility of women and children. Cattle and donkeys are mainly the responsibility of boys and the elderly men.

4.3.11 Extension and Animal Health Services

Thirty-three percent of the respondents indicated that they see the animal health officer on a monthly basis, while 23.9% indicated that they see an extension officer once in six months. The best source of advice is obtained from relatives (37.5%), followed by fellow farmers (29.5%), input suppliers (25%) and Government officials (8.3%). It was noted that extension officers tend to shy away from livestock production systems and concentrate on crop production systems. Swanepoel *et al.* (2000a) reported that the traditional bias of agricultural extension towards crop production contributes towards low productivity in smallholder livestock enterprises in Southern Africa. Knowledge of technologies related to

livestock, based on the responses from the respondents seems to be reasonable as illustrated in Table 4.8.

Table 4.8 Knowledge of technologies related to livestock.

Technology	No. of responses	% Knowledgeable	No. of responses	% Not Knowledgeable
Tethering	83	73.5	30	26.5
Breeding	80	73.4	29	26.6
Dehorning	74	64.9	40	35.1
Suppl feeding	78	63.4	45	36.6
Vaccination	53	46.5	61	53.5
Deworming	48	40.7	70	59.3
Castration	23	22.5	79	77.5
Dipping	10	7.9	116	92.1

The respondents are more knowledgeable in technologies such as tethering (73.5%) mostly practiced in goats, breeding (73.4%) mostly in cattle, dehorning (64.9%) and supplementary feeding. The reasons for low adoption of these technologies seem to be low as reflected through high mortalities and low reproductive and production performance of livestock in the area. The respondents (55.3%) indicated that they obtain source of advice on livestock from farmers' days. These findings suggest that extension services are not visible and helpful to livestock owner.

4.3.12 Crop –Livestock Interaction and Grazing Management

Crop-livestock production in the study area is characterised by dryland maize as the grain crop, cowpeas, groundnuts, subtropical fruit trees and livestock keeping consisting of cattle, goats, pigs and poultry. The crop-livestock interaction of the study area is presented in **Figure 4.1**.

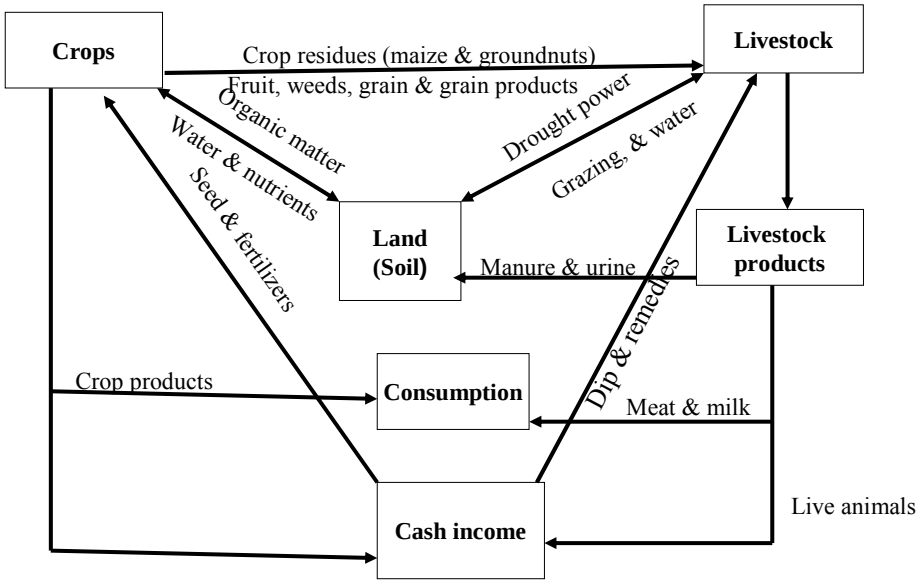

Figure 4.1 Schematic presentation of crop-livestock farming systems of the study area

Crop residue is used for feeding animals after harvesting and livestock manure is used for fertilising crop land. All respondents did not confirm sale of manure. Most respondents (88.2%) have grazing rights of which 60.7% of the 88% were allocated by the traditional leaders. These rights are allocated by virtue of owning cattle or goats (inherited, bought, gift, loaned, etc) and no grazing fee is charged.

The average size of land is 3.2 hectares ranging from 0.5 to 15ha. Table 4.9 presents land size holdings of the respondents.

Table 4.9 Land size holdings per respondent in the study area

Size (ha)	No Farmers	Percentage
None	25	19.5
0.5-2	47	36.7
2.5-4	35	27.3
4.5-6	15	11.7
6.5-8	0	0.0
8.5-10	4	3.2
10.5-12	1	0.8
>12	1	0.8

Note: None refers to those community members who have no land outside their residential sites

Further probing revealed that the grazing referred to is other grazing outside their existing grazing. Grazing resources are free for all and continuously utilised throughout the year. The signs of control on grazing restrictions were noticed in one village (Tshikonelo) where there are local rules which control numbers of cattle and access to grazing resources. New comers to the area are restricted to bringing in not more than 20 head of cattle. Long time dwellers are restricted to keep not more than 100 head of cattle. Forty-eight percent indicated that if they run out of grazing they will buy feed, an experience they learnt from the severe drought spells of 1983/84 and 1993/94. However, 55.9% of the respondents identified annual veld burning as the main cause of veld degradation and not overstocking (most respondents 43.8% and 20.3% of the total respondents indicated that veld fires are caused by jealous and careless people, respectively). Stroebel *et al.*(2005) reported that farm size and grazing land area did not affect ($p<0.05$) the number of cattle or goats kept because cattle and goat herd sizes are more closely correlated with communal grazing area than with farm size.

4.3.13 Constraints on Livestock Production

Smallholder livestock owners are in many ways faced with numerous constraints which result in low productivity of their livestock. The most cited constraints pertain to low quality and quantity of feed resources, shortage of water, drought, poor management, low adoption of technologies, poor marketing and extension services, lack of finance, diseases, external and internal parasites, and many more (Nthakheni, 1993; Jabber & Ehui, 1998;

Swanepoel *et al.,* 2000a;b; De Brouwer, 2002; Stroebel, 2004). Constraints of the study area are lack of grazing, tick borne diseases, high mortalities of the young, lack of stock remedies and vaccines, high cost of herding labour, high cost of dipping chemicals, lack of proper housing, low reproductive rates and high temperature.

It was noted that livestock owners in the study area have innovative ways and means of addressing problems they face.

4.4 Conclusion

Livestock keeping in the study area is characterized by low-input in terms of maintenance input, but is gainfully kept in that the benefits accrued sustain the livestock owners.

Smallholder livestock production systems remain low compared to commercial livestock production systems because of losses incurred due to weak control of parasites and diseases, inadequate feed supply and inappropriate sheltering. Productivity of livestock can improve by reducing losses through the improvement of existing practices. The suggestions made by smallholder livestock owners when dealing with constraints indicate that if extension services are improved through training on PEA, productivity can improve. Improving productivity of livestock in a resource-limited environment requires appropriate technologies, livestock owner's participation, enabling policies and supportive initiatives.

However, there is not much room for increasing the number of livestock in the study area. Smallholder livestock owners will have to adjust their herds/ flocks and management within the constraint of shrinking resources due to other demands for land use from the growing population or will have to improve on stock reduction through aggressive selling of access stock.

The understanding of the characteristics of livestock owners and livestock production systems is important as it creates a knowledge base through which improvements and interventions can be made.

Constraints to productivity include factors related to the environment, poor management, social conditions of the smallholder livestock owners, capacity building and knowledge of livestock owners and inherent adaptability of livestock. The above mentioned constraints are largely responsible for low productivity figures in the study area and productivity figures of livestock.

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CHAPTER 5

THE RELATIONSHIP BETWEEN BENEFITS OBTAINED FROM LIVESTOCK AND DESIRED SELECTION TRAITS BY SMALLHOLDER RESOURCE-POOR FARMERS IN THE LIMPOPO PROVINCE OF SOUTH AFRICA.

Abstract

A study was conducted in six villages located between 22^0 85' latitude and 30^0 71' longitudes in the Limpopo Province of South Africa. The objective of the study was to develop an understanding of functions, benefits and desired traits used for selection of animals by smallholder livestock owners. Data was collected by means of a general survey questionnaire and a participatory rural appraisal (PRA) exercise. The results show that smallholder livestock owners obtain benefits and functions (selling and meat consumption (49.4%); wealth, status and savings (33.1%); socio-cultural activities (11.0%) and draught power (6.5%)) from livestock which they link to desired traits for selection of their animals. The desired traits and their ranking are adaptability (score24), frame size (score24), yearly calving (score22), temperament (score14), traction utility (score12) and colour (score9). There is strong evidence that benefits and functions obtained from livestock are the basis from which decisions are made by smallholder livestock owners to retain or remove an animal from the herd. If selection was to be made based on the selection traits identified, the selection index for smallholder livestock owners should combine the mentioned traits.

Key words: Benefits, desired selection traits, livestock, resource-poor

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5.1 Introduction

Livestock in resource-limited areas are known to play a major role in the home economy of smallholder livestock owners and they are also used for cultural activities and social status of the owners (Ramsay, 1992; Steyn, 1993; Tapson, 1993). Beef cattle in the communal areas of South Africa constitute 40% of the total livestock population, contribute 5% of the total sales and contribute 50% of pre-weaning mortalities of the livestock in the country (Department of Agriculture, 2004).

Despite the low productivity of livestock kept by smallholder livestock owners there are arguments that it is also under exploited and or their value is under estimated. Steglish & Peters (2002) assert that there is a perception that exploitation of indigenous breeds reward very little due to low production output, poor response to management intervention and uncertain genetic potential. The value of indigenous livestock is underestimated when only marketable outputs are considered and the multitude of functions and performance sustainability are left aside (Lahiff, 1997; Mendelsohn, 1999; Ouma *et al.,* 2003).

Livestock functions for the smallholder livestock owners are often difficult to attach a true value on (Tapson, 1990); to value (Shackleton *et al.,* 1999) and thus are often ignored (Ouma *et al.,* 2003). The value of livestock is derived from products or activities not sold on the market (Shackleton *et al.,* 1999). Ouma *et al*. (2003) calls these benefits non-market functions. Kosgey (2004) refers to those benefits and functions as intangible benefits. Tapson (1991) refers to them as Z-goods (basic commodities from livestock that are not marketed but are consumed by the household for subsistence by smallholder farmers). Bayer (2000) argues that breeding objectives defined as improving the genetic potential (higher growth rates, higher milk production and more eggs) do not enjoy priority amongst smallholder livestock owners. Bayer *et al.* (2001) attempted to relate different livestock functions to desired selection traits and to breeding objectives in a smallholder livestock farming environment where conventional breeding objectives are difficult to define.

It is believed that smallholder livestock owners in resource-limited areas have traits they prefer through which they select their livestock. This chapter will discuss functions and benefits as well as desired traits for selection of animals to be retained or removed from the herd and appropriate breeding objectives by smallholder livestock owners.

5.2 Material and Methods

Details regarding the study area, sampling procedures, questionnaire design, methods of data collection and data analysis are described in chapter two. In this chapter only a summary is provided.

5.2.1 The Study Area

The study was carried out in the six villages in the Vhembe District of the Limpopo Province in South Africa. The study area is located between 22^0 85' latitude and 30^0 71' longitudes.

5.2.2 The Sample

Purposive sampling was applied in the sampling of the participants for the Participatory Rural Appraisal (PRA). The sampling procedure entailed selection of 30 (five per village) smallholder livestock owners from the six villages. Sampling for the questionnaire survey was done as explained in chapter two, section 2.5.2.

Random sampling (lottery method) was applied in the sampling of the respondents. The frame of the sample is the total number of smallholder livestock owners in the study area (332). The sampling procedure entailed numbering the cards equal to half the total number of livestock owners and mixing the marked cards with the equal number of unmarked cards and placed in a bag for individuals to pick one card. Those that picked the marked cards were the targets for the interviews. One hundred and thirty one (131) smallholder livestock owners were sampled for interviews.

5.2.3 Data Collection and Analysis

General survey questionnaires, PRA, secondary data and direct calculations were used for collection of data for the study. Of the 131 sampled respondents only 128 were interviewed because two passed away and one relocated to another area. Some information was obtained from secondary sources, like veterinary services records.

Data was captured in an Excel spreadsheet and analysed with SPSS (SPSS, 2000) and direct calculations. Information gathered through PRA was tabulated as it came from the respondents.

5.3 Results and Discussion

5.3.1 Benefits and Functions from Livestock

The results of the PRA and questionnaire survey on benefits and functions obtained from livestock are presented in Table 5.1. The PRA results of this study are in agreement with the questionnaire results in terms of the hierarchy of the benefits and functions from livestock.

Table 5.1 Functions and benefits obtained from livestock in the study area

Function/Benefit/Reason	Questionnaire		PRA	
	N	%	N	%
Selling and meat consumption	76	49. 4	27	90.0
Wealth, Status and Savings	51	33. 1	23	76.6
Social functions	17	11. 0	20	70.0
Draught power	10	6. 5	13	43. 3

NB: 1. Number of respondents on general survey questionnaires were 128 and on PRA they were 30.
2. Each respondent answered more than one question under PRA.

5.3.1.1 Selling and Meat Consumption

Selling and meat consumption ranks the highest (49.4% and 90.0%) in both the questionnaire and PRA results as presented in Table 5.1.

Meat and meat products are known to be sources of high quality protein and their consumption can help to alleviate some common nutritional deficiencies (Bender 1992). In addition, animal products are known to provide the best quality protein in the human diet as they are able to provide essential amino acids, such as that human body cannot manufacture (Wilson 2000). According to Bender (1992), animal products supply about 17% of the energy and 32% of the protein eaten by human beings. There is also increasing speculative evidence that high-protein, high-energy diets may have a role in reducing susceptibility to HIV and reducing the impact of AIDS (Stack *et al*., 1996; Beaugerie *et al*., 1998; Kadiyala & Gillespie,2004; Wilson *et al.,* 2005) possibly this speculative suggestion refers to diets rich in animal protein.

Livestock disposal in the study area is mainly based on out of hand transaction and slaughtering for home consumption and sale of meat. Twenty-eight percent of cattle found in the study area were slaughtered during the year 2000 (Northern Province Department of Agriculture, 2000).

Livestock are also kept for socio-cultural purposes. The social and cultural functions of livestock are important in addition to their direct productive value (Amer *et al.,* 1998*)*. Social activities, for example, use of cattle for bride dowry are still prevalent, although this is decreasing and being replaced by the equivalent of money; ancestral worshipping (where a household keeps a mature bull or goat ewe upon which an ancestral spirit is installed by a spirit medium) (Barrett, 1992) and ritual ceremonies, girl and boy initiation ceremonies as reported by Nesamvuni *et al.* (2002) still exist, although they are now being challenged by Christianity, pressure groups on the initiation practices and health regulations. During these ceremonies, livestock especially cattle, chicken, sheep

and goats are slaughtered for the occasion. Table 5.2 presents some socio-cultural activities attached to livestock in the study area.

Table.5.2 Socio-cultural activities attached to livestock keeping

Activity	Cattle		Goats		Pigs		Chicken	
	N	%	N	%	N	%	N	%
Funerals	42	32.8	27	21.0	0	0.0	21	16.2
Savings clubs	5	3.6	4	3.0	0	0.0	13	10.2
Party (*Stockvels*)	24	18.9	14	11.2	4	2.7	17	13.5
Own meat consumption	28	21.9	23	18.4	18	13.8	17	13.3
Bride dowry	1	0.7	17	0.0	0	0.0	0	0.0
Visitors	1	0.7	17	13.2	0	0.0	13	10.0
Rituals	1	0.7	17	13.1	0	0.0	14	11.1
Work party (*davha)*	16	12.7	22	17.5	29	22.8	16	12.2
Initiation	1	0.7	2	1.3	0	0.0	4	3.3
Open meat roasting (*braai*)	9	7.3	2	1.3	62	48.6	13	10.2

Note: 0.0 refers to non-participation in a particular social activity

Cattle feature the highest (32.8%) in funeral activities. Pigs feature the highest (48. 6%) in open meat roasting (*braai*) activities and 22.8% in the work party (*davha*) and own meat consumption (13.3%). Goats also feature prominently in funerals (21%), meat (18.4%), rituals (13.1%) and stockvels activities (11.2%). All the above-mentioned activities are related to slaughtering of livestock and consumption of meat. Chicken contribution feature in all activities except in the payment of bride dowry, but they are slaughtered for the visitors paying the bride dowry.

Desired traits for selection are adaptability (score 24). Animals that survive drought, diseases and parasites, survive on poor quality and quantity of feed; frame size (score 24) animals with bigger body frame size and older animals are preferred to sell or slaughter; fertility (score 22) cows that calve annually are preferred; and temperament (score 14) is used in removing animals with bad disposition, however those that display good mothering ability in defence of their young are kept, docile animals are preferred for ease of handling.

5.3.1.2 Wealth, Savings and Status

Livestock is regarded as a store of wealth, savings and status symbol amongst the black smallholder livestock owners of the study area.

According to FAO (2000) livestock, especially cattle are preferred because they are considered a better and more stable and fast growing form of wealth accumulation. Cattle multiply; cattle have visible products unlike money that remains the same or even shrink in value over time. Cattle perform multiple functions to different people.

Schmidt (1992) defines wealth as the accumulation of assets that confer among other things, security, prestige and status. Status on the other hand is defined as the ranking given to individuals based upon consensus of members of community or society as to what they regard as high or low characteristics (Nesamvuni *et al.*, 2002). The store of wealth is correlated and associated with elevated status (Schmidt, 1992). Bayer (2000) argues that there is a wide belief that African people behave irrationally when investing in large numbers of animals. In doing so, they disregard the fact that livestock is kept to serve multi-purpose functions.

According to Waters-Bayer & Bayer (1994) increasing numbers of livestock to store wealth and to increase savings in order to elevate status, can be regarded as the human needs objective, and is associated with keeping a large number or keeping a mixture of various species. Mtetwa (1978) refer to the practice of keeping for prestige and status and not for production as the "cattle complex". Stroebel (2004) cited capital and wealth as the third most important reason for keeping cattle and concluded that socio-economic status is related to the ownership of cattle in the same area. Bembridge & Burger (1977) inferred that socio-economic status is a useful predictor of successful, progressive cattle farming as important in their analysis. Wealth creation in the study area is linked to increasing the number of livestock. It was noted that in the study area livestock as savings can be converted into cash or food relatively quickly and easily in times of need.

Steinfeld *et al.* (1996) reported that functions such as accumulating of wealth and investment are being replaced by financial institutions. A similar trend is observed in the study area because of maintenance difficulties and the escalating cost of labour, and improved means of transport that makes it easier to access the banks.

Bayer *et al.*(2001) argues that to fulfil the function of savings and wealth creation, it is important that the type of animal does not require much management input or veterinary care and can be kept at low cost.

5.3.1.3 Socio-cultural Functions of Livestock

Some uses of livestock in social activities are discussed in section 5.3.1.1. In addition, these uses of livestock are regarded as a means of creating and maintaining social relationships, through bride dowry payment, as an allotment to children or wives, as traditional form of loan (Katalyi *et al.*, 2005).

Colour is used in designating preferred colour traits and as criteria for making selection decisions to achieve breeding objectives. Colour is categorised as a type trait that an aesthetic nature, where personal preference is important.

Certain colours, especially black, are preferred for bulls and goat ewes which are used for ancestral worshipping. Colour in the study area features most in socio-cultural functions. Socio-cultural functions feature the highest and are accommodated in all the selection traits as presented in Table 5.3. Dun coloured animals are not used for payment of dowry, such animals are avoided.

5.3.1.4 Draught Power

Draught power in the study area is an important function that assists those who own small plots. Average land size in the study area is 3.2 ha per household with the majority

accessing 0.5 hectares and less. The biggest land size allocated to an individual is 15 hectares.

Cattle in the study area are the primary animals used for traction when ploughing, transporting logs for building kraals, manure and harvested crops. According to Wilson *et al.* (2005) draught animals and humans provide an estimated 80% of the power input on farms in developing countries where enterprise size and scale rule out mechanical power.

Desired traits used for selection are adaptability, frame size, temperament and traction utility.

5.3.2 Desired Traits Used for Selection

According to the PRA and facilitated informal discussion exercises, and using a direct matrix ranking as guided by Theis & Grady (1991), adaptability, frame size, annual calving, temperament, traction utility and colour are the most desired traits used for selection in the herds. The matrix further shows traits that rank the most important per benefits as presented in Table 5.3.

Table 5.3 Direct matrix ranking of desired traits for selection by livestock owners (PRA results)

Benefits/ Functions	Desired traits for selection					
	Adaptability	Frame Size	Fertility	Temperament	Colour	Traction Utility
Selling and meat consumption	4	4	4	2	1	1
Wealth, status and savings	4	4	4	2	1	1
Social functions	4	4	4	2	4	4
Draught power	4	4	2	4	1	4
Total Score	**24**	**24**	**22**	**14**	**9**	**12**
RANK	**A**	**A**	**B**	**C**	**E**	**D**

Note: 4= highly desirable; 3= desirable; 2= less desirable; 1= not desirable

5.3.2.1 Adaptability

Adaptability as defined by coping and surviving the prevailing harsh conditions is the most important and desired trait to the smallholder livestock owners and is common to all functions and benefits. Although natural selection played a bigger role in the selection, smallholder livestock owners recognise those animals that are not adaptable and dispose them from the herd. Hetzel & Seifert (1986) define adaptability as 'the fit of an animal to its environment or level of expression of genetic potential for productive purposes'. Adapted animals are expected to have high gene frequencies for both adaptive and productive traits (Hoogenboezem & Swanepoel, 1995).

Livestock in the study area have been subject to natural selection because they are raised in harsh conditions characterised by insufficient and poor quality feeds, high temperatures, internal and external parasites and diseases. De Lange (2000) reported that indigenous breeds subject to natural selection have evolved special mechanisms to cope with food scarcity. The breeds have lower fasting metabolic rates than exotic breeds. Bester *et al*. (2001) reported that Nguni cattle have the ability to maintain their condition in winter. This characteristic is attributed to maintenance of high blood urea when the nitrogen content of the grazing drops. Moyo (1996) found that calves of the exotic breeds like Charolais and Brahman had the lowest survival rates from birth to 18 months compared to indigenous breeds like Tuli, Mashona and Nkone. The findings hold true for the current study because indigenous breeds like the Nguni, as observed during the drought periods, had a higher survival rate than exotic breeds. Scholtz *et al.* (1991) reported that Nguni cattle survival attests to an acquired tolerance to diseases and as one of the most tick resistant of the local breeds. Smallholder livestock owners know animals that tolerate harsh conditions and they also know which animals are fertile. These animals survive and reproduce with limited resources.

Lactational anoestrus is regarded as an adaptive safeguard to protect animals during adverse conditions. When cows lose weight to a level where cyclic activity ceases, they will only start cycling again when body weight is significantly higher than that at which

cycling ceased (Van Zyl *et al., 1993).* The phenomenon (Cole's Phenomenon) is well explained by Beffa (2005) who found that Afrikaner cows stopped cycling after losing 19% of their body weight suggesting inherent endocrine functions thus confirming that Afrikaner cows have the ability to suppress oestrus.

Small size and a relatively low mature body weight in Sanga cattle types, compared to *Bos taurus* and *Bos indicus* cross-bred cattle are regarded as adaptational features in terms of maintenance requirements (Van Zyl *et al.,* 1993). Under extensive conditions, small size is a desirable adaptive attribute, generally associated with early and regular production attributed to inherent fertility of the tropically adapted animals (Swanepoel & Lubout, 1992; Taylor & Swanepoel, 1999).

Kirkpatrick (2004) classified and named some adaptive traits such as disease and parasite resistance, and heat tolerance as convenience traits because they contribute to savings in time, facilities, drugs and labour in beef cattle production enterprise.

Adaptive traits to consider in the study area are survival from insufficient and poor quality feed, and drought tolerance. Van Zyl *et al*. (1993) concluded that susceptibility to the above-mentioned stressors accounts for large differences in growth rate, fertility and mortality between and within breeds.

Prayaga & Henshall (2005) reported heritability estimates for adaptive traits of cross-bred beef cattle tick resistance (measured by tick count) 0.13; parasite resistance (measured by egg count) 0.24; heat tolerance (measured by rectal temperature) 0.12. They further found that genetic correlation between growth traits and heat tolerance were moderately negative implying that as the ability of an animal to handle heat stress increases, growth also increases at genetic level. Correlations among tick resistance, parasite resistance and heat tolerance were moderately positive, suggesting that closely-linked genes affect these adaptive traits. Cost of selection or breeding for adaptive traits is rated medium to high (Van Zyl *et al.,* 1993).

5.3.2.2 Frame Size

Frame size can be used to estimate the weight which young cattle will gain. Frame size is measured by hip height and interpreted into frame scores which are classifications of skeletal size (Dhuyvetter, 1997). Skeletal size indicates mature proportions and subsequently cattle growth patterns (Hammack & Gill, 1997). Cattle with low frame scores are smaller and shorter (Boyles *et al.,* 1992; Torrel *et al*., 1992; Dhuyvetter, 1995; Hammack & Gill, 1997). Mature size is closely related to measures of weight because it follows the lifetime growth curve for weight through maturity (Dolezal, 1999).

Mature size expressed by frame size, condition and utility are price determinants in the study area. The major characteristic of livestock in the study area is small frame size because the predominant cattle breed is Nguni which is relatively small in size compared to other beef cattle types kept in the study area. Scarce feed resources, absent or poor management and constitution and natural selection could be reasons attributed to this characteristic. The decision to sell at older age may be that their livestock reached a size that they can put a higher price on or get more meat from. This behaviour could well have influenced the choice of exotic breeds against indigenous breeds over the years when cross-breeding was used to "upgrade" pure indigenous herds. Mature size and age influence the increase in value of an animal. Table 5.4 presents the average prices that could be charged by the respondents per type and class of livestock. Male and older animals which have bigger frame size fetch higher price than females and younger animals, respectively.

Table 5.4 Average price charged by livestock owners per class and species

Species	Class	No of responses	Average price (1US$=7Rand)
Cattle	Cow	117	1750.00
	Bull	117	1940.00
	Heifer	110	1700.00
	Ox	120	2240.00
Goats	Buck	61	160.00
	Doe	55	155.00
Pigs	Boar	35	170.00
	Gilt	32	80.00
	Sow	28	160.00
Poultry	All sexes	45	25.00- 70.00

Reported heritability estimates of frame size measured by hip height are high (0.50-0.60 (Ritchie & Hawkins 1999; Dhuyvetter, 1995). These heritability estimates imply that significant change through sire selection can be effective because large frame size is associated with greater growth potential and heavier slaughter weights.

Mature size is reported to be positively correlated to early growth weights such as birth weight (r_g =0.64), weaning weight (r_g =0.80), and yearling weight (r_g =0.76) (Bullock *et al*., 1993). They further argue that this is not to say that there exist perfect relationships between these traits.

5.3.2.3 Reproductive performance/ Fertility

Reproductive ability is the primary source of all benefits derived from livestock (Hoogenboezem & Swanepoel, 1995). It is now common knowledge that fertility is greatly affected by differences or changes in the environment especially nutritional environment; hence, Hoogenboezem & Swanepoel (1995) argue that it is important to match the cow genotype to available feed resources. Indigenous cattle breeds, possessing high gene frequencies of adaptation play a particular important role in livestock production systems.

It is widely reported that during extended dry periods, especially during droughts the likelihood of lactating cows dying is higher than for non-lactating cows. Cows which

calve regularly remain in relatively poor condition, and rarely have the opportunity to gain weight during severe droughts; therefore highly fertile cows are "high risk". Non lactating cows function as insurance and therefore enhance economic survival (Hoogenboezem & Swanepoel, 1995). The same authors observed that fertility can be considered as two traits, namely inherent fertility and expressed fertility. Inherent fertility refers to the genetic potential for reproductive performance and is not directly measurable. It is suspected that genes that affect overall physiological and endocrine functions control inherent fertility and account for the generally favourable genetic relationships of measures of early reproductive fitness with growth, milk and overall productivity. Expressed fertility can be measured by age at first puberty, quality and quantity of spermatozoa, conception rate, etc. Expressed fertility is dependent upon the external environment and additional stressors created by an animals' potential for growth, size or milk production.

It is well documented that Sanga cattle breeds, for example Nguni and Afrikaner are genetically well adapted to the environment characterised by being drought prone and have limited quality and quantity of grazing (Tomo *et al*., 2000; Stroebel 2004; Beffa, 2005). Nguni is more fertile than the Afrikaner because of difference in their migratory routes; Nguni has migrated south along the east coast of Africa, with high rainfall and abundant feed supply. The Afrikaner, has migrated south along the dry and arid west coast of the continent, as a result the Afrikaner has developed an inherent protective mechanism whereby reproduction is suppressed when feed supply is limited (Hetzel, 1988; Tomo *et al.,* 1999; Stroebel, 2004; Beffa, 2005). Another difference may be due to the fact that Nguni cattle are smaller in frame size, hence early and regular production (which is ascribed to inherent fertility) as explained by Swanepoel & Lubout (1992) and Taylor & Swanepoel (1999).

Annual calving in the study area is described as calving every year. The results of the PRA show that annual calving is an important and desired functional trait used in the decision to have the animal removed or retained in the herd.

The reproductive performance of cattle in the study area expressed in terms of birth rates is low (35.6%). The main reasons attached to low reproductive rates are amongst others, limited managerial skills and limited feed resources (due to limited area for grazing) which result in lactation anoestrus described by Van Zyl *et al*. (1993) and uninhibited growth.

Heritability estimates for reproductive rates are reportedly low to moderate (0.24-0.44) (Van Zyl *et al.,* 1993). In another study, Rust & Kanfer (1998) also reported low figures (0.27-0.30) for age at first calving of Afrikaner and Drakenberger beef breeds. Heritability estimates for fertility traits are reported to be higher for heifers than in cows (Koots *et al*., 1994; Rust & Groeneveld, 2001). It is also reported that heritability estimates of female reproductive traits are generally low, averaging 0.0-0.44 (Mackinnon *et al.,* 1990; Meyer *et al.,* 1990; Van Zyl *et al*., 1993; Ritchie & Hawkins, 1999) compared to male reproductive (testicular) traits averaging 0.31 to 0.68 (Coulter & Foote, 1979; Davis *et al.*, 1993).

Hoogenboezem & Swanepoel (1995) reported the existence of favourable correlations between scrotal circumferences of bulls and age at first puberty (-0.55), days to calving (0.35); calving rate(0.65) and calving interval (0.66), suggesting that cow fertility can be improved by indirect selection on bull fertility, especially using scrotal circumference as an indicator trait.

5.3.2.4 Temperament and Docility

Temperament is defined as an animal's behavioural response to handling by humans (Burrow, 1997). Boissy *et al.* (1995) defines temperament as the individual basic stance towards environmental change and challenge. Under extensive grazing systems and where animals are used for draught power, temperament is economically important in terms of reducing costs related to handling facilities, drugs and labour (Kirkpatrick, 2004). Cattle with poor temperament have comparatively lower average daily gain in feedlots, low quality meat (tenderness and appearance characterised by dark colour) and low conception

rate where artificial insemination is practiced (Fordyce *et al*., 1988; Burrow, 1997; Kirkpatrick, 2004). This behaviour is characterised by amongst others struggling, blowing, bellowing, aggression, kneeling down, nervous restless, lying down and flight (some as observed in the study area when breaking them for ploughing and treating them for wounds). Burrow & Corbet, 2000) developed an objective measurement (flight time) that is safe, quick and simple to implement on farm to measure temperament. Docility is categorised as a convenience trait because it contributes directly to savings in time, facilities, drugs and labour (Kirkpatrick, 2004). Docile animals are preferred to those with temperament because they are easy to handle.

In the study area temperament is a characteristic that is always selected against especially when dealing with animals for draught purposes and handling when dosing, branding or treating them for wounds. Bullocks with high temperament are castrated in an effort to reduce temperament. If castration does not work, such animals are sold or slaughtered. Animals that display docility in the study area are the most preferred and tend to be overworked. Burrow (1997) conducted a study on measurements of temperament and their relationships with performance traits to beef cattle and found that temperament is affected by age or experience, sex, handling, maternal effects, inheritance and breed.

Van Zyl *et al.* (1993) reported assessed but subjective scores with varying heritability ranging from 0 to 0.67. Objective measures of temperament have been moderately high for speed 0.26–0.54 and flight distance at between 0.32–0.40. Burrow & Corbet (2000) reported moderate heritability estimates of 0.35-0.50 for flight speed. This implies that selection against this trait can result in increased docility. Heritability estimates based on docility of Limousin cattle are 0.22 for docility score and 0.18 for docility criterion (Neindre *et al*., 2000). Other figures for docility scored by crush and field data reported for Australia are 0.30 and 0.41 in the USA. On the other hand Kirkpatrick (2004) reported that heritability estimates for temperament are moderately high and directional change can be made by selection and culling.

Prayaga & Henshall (2005) reported significant negative genetic relationship between heat resistance and temperament, suggesting that cattle with heat resistance have desirable temperament (docile).

5.3.2.5 Traction Utility

Animal power assists in many ways in agriculture for operations such as ploughing, planting and harvesting (Starkey, 1999).

Although draught power ranks the lowest of the benefits and functions from livestock, it is still in use in the study area. Animals that tolerate hard chores due to docility and strength are the most preferred by the owners. In some cases these animals are kept longer than necessary in the herd. Increased use of tractors and other equipment has resulted in the decrease in use of draught animals in the study area.

Breeding objectives are for a strong animal, endurance of hard chores and docile characteristics.

5.4 Conclusion

The results of the study confirm that smallholder livestock owners have functions and benefits from livestock which are linked to selection traits of their desire and these traits are linked to breeding objectives.

A productive animal is one that will give the most offspring that reach maturity (a good bank and enhance the status of the owner), provide traction power and is easy to handle, and also be useful for socio-cultural activities.

There is a need to understand the driving factors of livestock production systems of smallholder livestock and this may assist in defining appropriate breeding objectives. This understanding may assist in defining appropriate breeding objectives for smallholder

livestock farming. It is also acknowledged that this intervention may not be easy as there are numerous challenges which tend to discourage researchers to conduct their research in areas characterised by lack of records, livestock handling facilities and measuring equipment.

When livestock in the communal livestock smallholder area are assessed, prevailing conditions must be taken into account. Conventional measures of performance based on optimal environment should be avoided. This argument should be taken into account when breeding objectives are being considered for the smallholder farming situation.

If selection was to be made based on the selection traits identified (annual calving, adaptability, temperament, colour, docility and traction utility), the selection index for smallholder livestock owners should combine the above mentioned traits.

5.5 References

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CHAPTER 6

EFFECTS OF CLIMATIC AND NON-CLIMATIC FACTORS ON LIVESTOCK PRODUCTION SYSTEM IN THE LIMPOPO PROVINCE OF SOUTH AFRICA

Abstract

A study was conducted at three dipping tanks serving six villages located between 22^0 85' latitude and 30^0 71' longitudes in the Limpopo Province of South Africa. The study attempts to justify the effects of climatic and non-climatic factors (area, year, season as well as the effects of maximum temperature, morning humidity, afternoon humidity and rainfall nested within season). The dependant variables were calves born (CB), calves dead (CD), adult cattle dead (AD), cattle slaughtered by owners (SLO), cattle slaughtered by abattoirs (SLB), balance cumulative number of calves (BLCUM) and balance total number of cattle (BLTOT). Five year historical livestock and weather data were collected from the Limpopo Department of Agriculture and the South African Weather Services, respectively. Data were analyzed using GENMOD Procedure of the Statistical Analysis System package (SAS), assuming a Poisson distribution with log link. The calculated proportions showed evidence of differences in proportions for the effect of area, year and season on the response variables. The results show that area, year, season as well as the effects of maximum temperature, morning humidity, afternoon humidity and rainfall within season had important effect (P<0,01) on the response variables. However, area did not have an important effect (P>0.01) on CD. The effect of temperature within a season did affect BLCUM and BLTOT. The results of this study confirm that, climatic and non-climatic factors have an important influence to the reproductive performance of cattle in the study area. Productivity of livestock can improve by reducing losses through the improvement of existing practices.

Key words: Climatic, non-climatic, livestock production systems.

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6.1 Introduction

Livestock production practice amongst smallholder livestock owners is affected by numerous factors which determine its productive performance. The broad factors can be categorized into technical, physical, natural and human factors (Nthakheni, 1993). The natural factors include amongst others climate, especially rainfall which influence quality and quantity of grazing (Le Houerou *et al*., 1988; O'Connor, 1991; Hatch & Tainton, 1995; 1997; Fynn & O'Connor, 2000). Climate also has an impact on the incidence, seasonal range and geographical distribution of several vectors and vector-borne diseases like tick-borne diseases (Lindgren, 1998). In addition to the above observations, Schwalbach *et al.* (2003) and Swanepoel & Stroebel (1998) reported that environmental conditions (temperature, humidity and type of vegetation) and the abundance of wild life are reservoirs of these parasites and that they create favourable conditions for multiplication and survival of vectors of livestock diseases. De Jager (1996) also reported that total solar radiation, temperature, and rainfall are the most important elements which directly regulate the incidence of diseases and are also an important limitation to livestock production where rainfall is moderate to high due to air humidity and protracted wet seasons.

The study was prompted by high mortalities experienced by livestock owners. It was alleged that ticks and tick borne diseases are causing high mortalities due to excessive and protracted rainfall which led to long and irregular dipping intervals.

The paper aims to determine and justify the effects of climatic and non-climatic factors to explain adult cattle and calf mortalities and their influence on calves born, cattle slaughter by owners and abattoirs, as well as on the cumulative balance of number of calves and cumulative balance of total number of cattle in the study area.

6.2 Material and Methods

6.2.1 The Study Area

The study was carried out in the six villages in the Vhembe District of the Limpopo Province of South Africa. The study area is situated between 22^0 85' latitude and 30^0 71' longitudes.

6.2.2 Management

The dominating breed of cattle is Nguni; other breeds like Brahman, Simmental, crosses, Bonsmara and Afrikaner constitute a small proportion. The estimated cattle population is 3,844 (Northern Province Department of Agriculture, 2000).

Management practices include dipping for tick control. Disease control is practiced to a certain extent and herding is practiced during summer. Diseases like Foot and Mouth disease, Black quarter, Anthrax and Contagious abortion are controlled by the state through vaccination and movement control.

The grazing system is mainly communal and is characterised by patch grazing and the camp system during cropping seasons. During winter, cattle are allowed to roam freely while also feeding on crop residues. No supplementary feeding takes place. Mating is not controlled and occurs throughout the year with the peak calving occurring during summer. Livestock identification through branding and registration of brands is now compulsory by law due to stock theft.

6.2.3 Data Collection

Data for this study were from five years (1996-2000) discrete cattle records of six villages as well as discrete weather records from adjacent and representative weather stations (Thohoyandou 07668987 & 07236646, Phunda Maria 07680113 & 0768011A8). Data on livestock was collected from the Limpopo Department of Agriculture veterinary offices for the three dipping tanks, namely, Malavuwe, Tshifudi and Tshikonelo which serve the six villages of the study area, Data on weather was collected from the South African Weather Services registered weather stations. Qualitative information was collected through a general survey questionnaire.

6.2.4 Statistical Analysis

The collected data was analysed using SAS (SAS, 2000). The GENMOD Procedure with Poisson distribution and log link function was used to test the effects of area, year and the effect of maximum temperature, morning humidity, afternoon humidity and rainfall within season on

discrete dependent variables of calves born (CB), calves dead (CD), adults dead (AD), cattle slaughtered by owners (SLO), cattle slaughtered by butcheries (SLB), cumulative number of calves (BLCUM and, balance total number of cattle (BLTOT). The total number of animals in each class as well as corresponding proportions was calculated for each dependent variable.

The General Linear Model was constructed as follows:

Model I $Y_{ijklmno} = \mu + A_i + Y_j + S_k + Tmax(S)_{kl} + Hmam(S)_{km} + Hmpm(S)_{kn} + Rainfall(S)_{ko} + E_{ijklmno}$

Where:

$Y_{ijklmno}$	= Dependent variable
μ	= Overall mean
A_i	= Effect of area
Y_j	= Effect of year
S_k	= Effect of season
$Tmax\ (S)_{kl}$	= Effect of maximum temperature within season
$Hmam\ (S)_{km}$	= Effect of morning humidity within season
$Hmpm\ (S)_{kn}$	= Effect of afternoon humidity within season
$Rainfall\ (S)_{ko}$	= Effect of rainfall within season
$E_{ijklmno}$	= Random error term

6.3 Results and Discussion

The total number of animals in each class as well as the corresponding proportions is presented in Tables 6.1**.** The calculated proportions indicate that although the proportions of CB were lower in Area 1 as compared to the other two areas, the proportions of CD was slightly greater in Area 1. The proportions of AD was however greater in Area 2. The proportions of SLO, BLCUM and BLTOT were greater in Area 3 than the other two areas. The differences can be attributed to the effect of area coupled with availability of grazing and management. As expected, the effects will differ from area to area.

Although Season 1(summer) has a greater proportion (34%) of CB, however less calves died during that season as indicated by lower CD (19%). The low calf mortality is expected in the study area because during this season cattle have fresh grazing and the dam have milk for the calves. Season 3 (winter) had a greater proportion of CD, AD, SLO, and SLB. This trend could be

attributed to unavailability of grazing. Smallholder livestock owners in the study area are risk averse when higher variability in weather patterns and fluctuation of feed are experienced; they tend to dispose of their animals through slaughtering and selling to butchery owners. The response variables also showed differences in proportions over the years, with CD highest in 1999, AD highest in 1997, and SLO highest in 1999. The variation of climate and its influence on feed resources are believed to be attributable to the differences experienced.

Table 6.1. Total number of animals in each class (and calculated proportions) for CB, CD, AD, SLO, SLB, BLCUM and BLTOT

Source[#]	CB	CD	AD	SLO	SLB	BLCUM	BLTOT
Area 1	728 (0.23)	224 (0.37)	316 (0.26)	287 (0.22)	329 (0.28)	9817 (0.24)	61224 (0.28)
Area 2	990 (0.33)	185 (0.31)	673 (0.57)	445 (0.35)	466 (0.39)	12467 (0.31)	74478 (0.34)
Area 3	1345 (0.44)	194 (0.32)	201 (0.17)	543 (0.43)	388 (0.33)	18466 (0.45)	82091 (0.38)
Year 1996	805 (0.26)	53 (0.09)	128 (0.10)	180 (0.14)	118 (0.10)	8029 (0.20)	37934 (0.17)
Year 1997	541 (0.18)	139 (0.23)	370 (0.31)	278 (0.22)	257 (0.22)	8546 (0.21)	42389 (0.20)
Year 1998	808 (0.26)	139 (0.23)	234 (0.20)	165 (0.13)	237 (0.20)	8882 (0.22)	45560 (0.21)
Year 1999	456 (0.15)	196 (0.32)	234 (0.20)	358 (0.28)	300 (0.25)	8770 (0.21)	46463 (0.21)
Year 2000	453 (0.15)	76 (0.13)	224 (0.19)	294 (0.23)	271 (0.23)	6523 (0.16)	45447 (0.21)
Season 1	1032 (0.34)	113 (0.19)	249 (0.21)	296 (0.23)	206 (0.17)	10762 (0.26)	55381 (0.25)
Season 2	600 (0.19)	154 (0.25)	294 (0.25)	339 (0.27)	317 (0.27)	10782 (0.27)	53895 (0.25)
Season 3	638 (0.21)	209 (0.35)	395 (0.33)	386 (0.30)	343 (0.29)	9486 (0.23)	53821 (0.25)
Season 4	793 (0.26)	127 (0.21)	252 (0.21)	254 (0.20)	317 (0.27)	9720 (0.24)	54696 (0.25)

[#]CB =Calves born; CD =Calves dead; AD =Adults dead; SLO= Slaughtered by owners; SLB=Slaughtered by butcheries; BLCUM =Balance cumulative Number of calves; BLTOT = Balance total number of cattle
Area 1= Malavuwe; Area 2= Tshifudi; Area 3= Tshikonelo
Season 1 = summer, Season 2= autumn, Season 3= winter, Season 4= spring)

Table 6. 2. Summary of Statistics for CB, CD, AD, SLO, SLB, BLCUM and BLTOT

Source	DF	CB	CD	AD	SLO	SLB	BLCUM	BLTOT
Area	2	178.32***	0.90ns	307.92***	90.79***	22.76***	2535.82***	3121.8***
Year	4	282.95***	45.49***	121.21***	38.52***	38.59***	303.53***	1152.21***
Season	3	46.35***	66.86***	75.1***	44.32***	29.57**	37.67***	29.91***
Tmax (Season)	4	30.88***	37.00**	36, 65***	35.12***	6.41ns	4.35ns	3.49ns
Hmam (Season)	4	136.27***	21.22***	103.02***	62.60***	62.47***	131.54***	13.07*
Hmpm (Season)	4	67.65***	16.93**	19.28***	30.78***	16.84**	0.29***	48.25***
Rainfall (Season)	4	138.73***	17.94**	25.45***	46.78***	31.77***	28.01***	6.81ns

Key: *** = P< 0.0001;** =P<0. 001;* = P< 0.01; Ns = Not significant; DF = Degree of freedom;
Dependent Variable-CB =Calves born; CD =Calves dead; AD =Adults dead; SLO=Slaughtered by owners; SLB= Slaughtered by butcheries; BLCUM=Balance cumulative number of calves and BLTOT = Balance total number of cattle s.

The GENMOD Procedure of SAS was used to assess the effect of area, year and the effect of maximum temperature, morning humidity, afternoon humidity and rainfall within season on discrete dependent variables of calves born (CB), calves dead (CD), adults dead (AD), cattle slaughtered by owners (SLO), cattle slaughtered by butcheries (SLB), cumulative number of calves (BLCUM and, balance total number of cattle (BLTOT). The results are presented in Table 6.2.

The results (Table 6.2) show that area, year, season and the confounding effects of maximum temperature, morning and afternoon humidity and rainfall within season are significant sources of variation on calves born (CB) ($P< 0.0001$). Significant effects of the area, year, and the confounding effects of maximum temperature, morning and afternoon humidity and rainfall within season and on CB are attributed to variation in physical environment characterized by weather patterns, husbandry practices and availability of sufficient and quality of grazing to the animals, particularly the cows. It is widely documented that climatic variation from year to year and season to season have an influence on the grazing which in turn has an influence on the condition and productive and growth performance of animals (O'Connor, 1991; Hatch and Tainton, 1995; 1997; Fynn and O'Connor, 2000). Year to year and season to season climatic conditions vary, hence their effects will differ and the resultant variation on calves born will differ. Grazing in the study area is of poor quality due to overgrazing and inadequate rainfall. One of the major problems presented in **Figure 1** is that lack of grazing contributes (17%). Lack of grazing is indirectly or directly associated and influenced by climatic conditions.

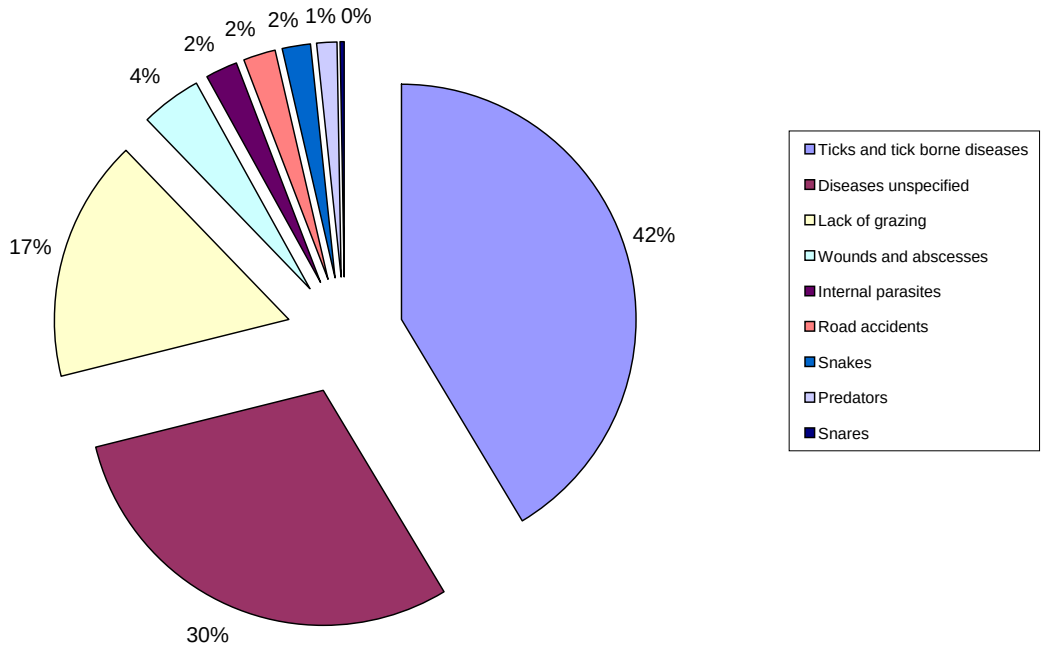

Figure 6.1 Problems and causes of mortalities on cattle in the study area

Animals tend to loose condition during the period of scarcity which is normally winter, spring and early summer; in some instances, when rain starts falling very late in the summer. The study by Spitzer *et al*. (1995) indicates body condition as the most important factor that influences the reproductive performance of beef cows and low body condition scores have been reported to delay onset of oestrus. The level of nutrition is reported to have an influence on postpartum reproductive performance in beef cows (Rasby *et al.,* 1990). It is also reported that rising plane of nutrition during the breeding season is the most important requirement to secure a large calf crop. Good body condition as a result of good nutrition influences follicular growth and ovulation in cows (Perry *et al.,* 2000; Lalman *et al*., 1997) hence the increase in conception and pregnancy rates (Lamb, 1999). Follicular growth and ovulation are influenced by hormones such as FSH, LH and progesterone which are also reported to be influenced by nutrition (Imakwa *et al.,* 1986; Nolan *et al.,* 1988; Bearden and Faquay, 1992; Lamb, 1999). Macgregor & Swanepoel (1992) concluded that inadequate nutrition is the major causes of lowered fertility in beef cows. The same conclusion can be made for the study area which is explained by the low calving rate; however there may be other factors also accountable for this state of affairs.

Year, season and confounding effects of morning and afternoon humidity and rainfall within season were significant sources of variation ($P<0.0001$) on calves dead (CD) and adults dead (AD). However, area did not have significant effect on CD but did have significant effect on adult cattle (AD) ($P<0.01$). The mortalities of calves can again be attributed to the availability of quality and quantity of grazing, which in turn is influenced by seasonal and year changes in climatic conditions. High summer temperatures, humidity and rainfall are confirmed to be correlated with high incidence of mortalities due to ticks and tick-borne diseases as well as other diseases. This confirms the assertions by De Brouwer (1996); Lindgren (1998); Swalbach *et al*., (2003) who individually reported that climate (temperature, humidity, solar radiation and rainfall) has an impact on the incidence, range and geographical distribution of diseases and their vectors amongst which ticks and tick-borne diseases, are some of them. Chan *et al*. (1999) sum it up by indicating that the effects of temperature and other meteorological variables on the physiology of disease vectors (such as ticks) have been known for quite some time.

The responses from the general survey questionnaire of the study show that the major problems faced by cattle owners are the mortalities of calves and adult cattle caused by amongst others ticks and tick-borne diseases (42%) and unspecified diseases (30%) as presented in **Figure 1**. Dreyer *et al.* (1999) also reported a similar concern by farmers (88.5%) in the Free State who indicated that they experienced high tick infestation and tick-related problems in their livestock. Apart from the mortalities caused by tick-borne diseases, ticks also indirectly contribute to mortalities of calves through tick bites on cows which result in udder damage "dead udders" which cannot provide milk for the new born calves. Diseases like heart water, red water (babesiosis) and anaplasmosis are known to be transmitted by ticks to cattle.

Rainfall patterns fluctuate from year to year and season to season; sometimes prolonged seasonal droughts and protracted rainfall are experienced. These fluctuations affect animals, for example, when seasonal drought is experienced grazing gets scarce and animals starve (farmers, in the study area do not supplement their animals); when protracted rainfall is received it interrupts dipping cycles resulting in an increased tick load on animals (animals loose condition, have wound infestation and damaged udders and even die of diseases transmitted by ticks) or opportunistic diseases which take advantage of weakened animals.

It is also reported that productivity of livestock is influenced by the land tenure system (Mahabile *et al.,* 2005). They argue that the influence is attributed to decisions about stocking because stocking rates are expected to increase more on open access communal grazing than on private land. Herd productivity in communal areas as defined by birth rates in the study area is 35.6% (Nthakheni *et al*., 2002)**.** Swanepoel *et al*. (2000) reported 50% and 40% at Makuya and Nebo areas in the same Province, respectively. In the study area mortality is high (15.7%) and off-take is low (21.3%) reported by Nthakheni *et al.* (2002).

Area, year, season and confounding effects of morning and afternoon humidity and rainfall within season were significant sources of variation (P< 0.0001) on SLO and SLB. However, temperature within season did not have significant effect on SLB. The effect of the above-mentioned factors on SLO and SLB may be attributed to climatic factors. The lessons learned by cattle owners during 1982/83 and 1992/92 drought episodes, has taught them to sell when there are signs of drought as well as heeding the early warning calls from Government. Based on the slaughter figures from the Northern Province Department of Agriculture (2000), the productive off-take of the study area is 28.5% and the off-take which includes mortalities is 21.3%. The study of the functions and benefits from livestock revealed that sales and consumption of meat ranked the highest (49.4%), more than wealth, savings and status (33.1%); culture (11.0%) and drought power (6.5%).

Livestock owners in the study area prefer to sell their animals at old age, the reasons given are that older animals are bigger in size and they can charge higher prices. Butchery owners also prefer to buy bigger animals for obvious business reasons. The implication is that older animals are kept longer in the herds for owners to charge higher prices

The BLCUM was significantly affected (P<0.0001) by area, year and confounding effects of morning and afternoon humidity and rainfall within season. The effects are attributed to climatic factors and husbandry practices which vary from year to year and season to season. Grazing, seasonal drought and disease incidence due to climatic variation are factors which influence the cumulated balance total of calves.

Area, year and season are the significant sources of variation on BLTOT of the herd (P<0.0001). Temperature and rainfall within season did not have significant effect on BLTOT. Seasonal

changes in climate from year to year, difference in areas and husbandry practices are attributed to variation in BLTOT.

6.4 Conclusion

The results of this study confirm that, climatic and non-climatic factors have an important influence to the reproductive performance of cattle in the study area. Tick and tick borne diseases, unspecified diseases and lack of grazing were the major factors whose effects varied from area to are, season to season and from year to year.

It is important that when intervention strategies such as parasite control (dipping and dosing), drought and grazing management are developed (with farmers) such factors should be planned for in order to enhance sustainability of livestock production.

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CHAPTER 7

AN OVERVIEW OF POLICIES AND PROGRAMMES THAT ENABLE LIVESTOCK PRODUCTION AND DEVELOPMENT IN THE LIMPOPO PROVINCE

Abstract

Livestock production makes a major contribution to food security and performs a number of social and cultural roles and functions in rural areas. An overview of Government policies and programmes was conducted. The objective of an overview was to identify and assess policies and programmes that create an enabling environment for smallholder livestock farming. The findings show that Government has developed deliberate policies and programmes that create a favourable environment to enable the majority of the black smallholder livestock owners to participate in the main stream of the economy. The intention is also to ensure that the economy grows, poverty is reduced, and employment is created and that there is food security in the country. The policies and programmes identified are related to access to land, access to markets, support services for example, extension and research, and provision of infrastructure. It was observed that omission of support service like extension services impedes implementation of policies. This omission creates problems at implementation level hence the assertions that extension officers are neglecting livestock production.

Key words: Policies, programmes, enable livestock production

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7.1 Introduction

Livestock production has a major contribution to food security and sustainability and performs a number of social, cultural roles and functions in rural areas (Van Rooyen *et al.*, 1997). In South Africa, livestock accounts for more than 40% of the total value of agricultural output and this is because about 80% of agricultural land can only be utilised for animal production (Department of Agriculture, 2004b). In the Limpopo Province, livestock contributes about 51% of the total income accrued from agricultural products when game farming is included (Nesamvuni *et al*., 2003). Livestock production in the Province is still characterized by a dual nature, namely commercial and resource-poor smallholder livestock farming and keeping, respectively.

The commercial sector is dominated by white farmers who were, in the past, empowered by land ownership rights, subsidies on inputs, tax concessions, income transfers, cheap credit and protection through price controls and infrastructure (Kirsten & Van Zyl, 1996; Townsend & MacDonald, 2000).

The laws passed in the previous dispensation marginalized black farmers who ended up struggling to make ends meet in agriculture on mostly marginal and congested land. As a result of the past history, the new South African democratic government is at present undertaking public investment programmes (Ngqangweni & Delgado, 2002) and agricultural policy reforms which are deliberately targeting the previously disadvantaged people (Department of Agriculture, 2004b).

Most policies, especially in African countries, are reported to be either unclear, biased (Garba, 2000), inadequate, inappropriate (Roeleveld & Van den Broek, 1996); poor (Ehui & Pender, 2005) and offer very little support (Mbilinyi & Nyoni, 1997) to livestock research, production and development.

This disparity is also evident by amongst others, inadequate or weak support services like extension and research services biased to crop production (Schiere, 1995; Swanepoel *et al*.,

2000), or lack of infrastructure which tends to discourage investment in livestock (Ngqangweni & Delgado, 2002). Duvel (2003) asserts that programmed extension appears to be confused with the implementation of certain projects and other development activities, which have little to do with it and could be performed by other special technical service division.

Agricultural policies are typically perceived as types of state interventions in the agricultural sector (Nesamvuni *et al*, 2003). Policy is defined as a course of action or inaction chosen by public authorities to address a given problem or interrelated set of problems (Wolf, 2000). Another definition refers to policy as a set of instruments aimed at reaching specified objectives (Mbilinyi & Nyoni, 1997). The instruments can be described as units of actions taken by government to implement policy.

The purpose of this paper is to provide an overview of existing government policies that enable sustainable livestock production and development amongst resource–poor farmers, as well as to identify policy gaps and implications on extension service for technology transfer.

7.2 Material and Methods

The information was gathered through literature reviews of government policies, programmes and related subject matter as well as data of beneficiaries of some programmes. Some results of the general survey questionnaire on "A farming systems study of livestock production amongst smallholder livestock owners" (Appendix C) were also used.

7.3 Findings and Discussion

The findings reveal that there are numerous agricultural policies, programmes, strategies and instruments deliberately developed and modified to normalize the imbalances which

existed in the past dispensation. The overview in this paper will only discuss those that have direct or indirect implications to livestock.

7.3.1 Land Reform Policy

Three initiatives were developed by the new political dispensation to ensure that previously disadvantaged people have access to land. These initiatives are land restitution, land redistribution and land tenure reform.

7.3.1.1 Land Restitution

Land restitution is a process of reinstatement of the land which was dispossessed from individuals or communities through discriminatory laws or forced removals since 1913.

Land restitution has delivered a total of 102 000 hectares of land in the province of which a total of 43 689 hectares of land suitable for livestock production (Limpopo Department of Agriculture, 2004b). Table 7.1 shows land parcels restored to households per district and per municipalities.

Table 7.1 Land Suitable for livestock acquired through land restitution (Limpopo Department of Agriculture, 2004b)

District	Municipality	No of Households	Area size (ha)	Average land size/ Household (ha)	Project
Capricorn	Polokwane	474	3120	6. 6	Reboile
	Molemole	379	3600	9. 5	Makotopong
	Molemole	427	7148	16. 7	Marobala-O-Itsose
	Molemole	574	3580	6. 2	Rita/Bethesda
	Lepelle-Nkumpi	331	5776	17. 5	Bjatladi
Mopani	Greater Letaba	1500	6900	4. 6	Pheeha
Vhembe	Makhado	1030	660	0. 6	Getrusberg
	Makhado	250	719	2. 9	Ximange
	Makhado	200	1489	7. 4	Mavungeni
	Makhado	600	1204	2. 0	Munzhedzi
	Makhado	120	1547	12. 9	Kranskop
	Makhado	600	2612	4. 4	Manavhela
Waterberg	Bela-bela	111	1966	17. 7	Pienaarsrevier
	Modimolle	500	1884	3. 8	Baphalale
	Moogopong	160	1484	9. 3	Rooipan
	Total	**7256**	**43 689**	**8. 1**	

Although land restitution has delivered, it was observed that most of the land is underutilised because of problems with respect to conflicts amongst the beneficiaries, lack of technical skills, lack of finance (operation budget), dilapidated infrastructure, lack of post settlement aftercare support, etc. Planning for post settlement support should have been done concurrently with the process of land acquisition. It also implies that group dynamic exercises were insufficient, inappropriate and did not include post-settlement support.

The main policy gaps identified in this programme are that from the day the National Minister handed over the land to the beneficiaries, there was no post-settlement support; no repair and provision of infrastructure; no repair or provision of farming equipment, and training of restitution beneficiaries on farm management did not take place. The beneficiaries are also scattered throughout the country such that farm production plans are difficult to develop and implement. Some members with signatory powers are working in urban areas and this arrangement delays farming practices.

There is a need for policy intervention to ensure that productive land does not deteriorate and to retain or revitalize its productivity. One of the land use options that could be sustainable is that land can be farmed as a business entity involving strategic partnerships such that beneficiaries share the proceeds of the enterprise. Intensive livestock farming may be an option if there is sufficient water and the necessary infrastructure.

7.3.1.2 Land Redistribution

According to Chamberlain *et al.* (2005), land redistribution refers to the acquisition of land by the state for the purpose of distribution to those who have been previously denied access to land. The land settlement acquisition grant (SLAG) was used as a redistributive sub-programme.

This programme was developed for the previously disadvantaged group of individuals, who were required to contribute R15 000 state social grants to a pool of money that would be used to purchase land through "willing buyer willing seller" on offer (Department of Land Affairs,1997). Beneficiaries had to group themselves to form legal entities such as Communal Property Associations (CPAs) or a Trust and were required to develop business plans for on-farm infrastructure, equipment, production and enhancement of tenure rights. (Department of Land Affairs, 1997).

A total of 63 087 hectares was bought in the Limpopo Province and 39 214 hectares is land suitable for livestock farming (Limpopo Department of Agriculture, 2003a). Table 7.2 presents the number of SLAG projects, sizes of land parcels and the number of beneficiaries.

Table7.2 Land suitable for livestock acquired through SLAG in the province (Limpopo Department of Agriculture, 2003a)

District	Area (ha)	Beneficiaries	Average land Size (ha)/ household
Bohlabela	614	441	1. 4
Capricorn	25 200	2768	9. 1
Mopani	3 058	1234	2. 5
Sekhukhune	967	7494	0. 1
Vhembe	561	120	4. 7
Waterberg	8 814	1206	7. 3
Total	**39 214**	**13 263**	**4.2**

This programme was stopped by Government because it was not achieving the intended objectives. Most of the SLAG projects were fraught with problems from the beneficiaries. Post-settlement support was not available and most beneficiaries were not on the farm.

Policy intervention by Government could be through facilitation of strategic partnerships and equity scheme models recommended by De Lange *et al*. (2004), mentorship by experienced and expert farmers; the promotion of enterprises that could yield better returns to the beneficiaries; and to deregister members of CPAs or Trusts to reduce the number of beneficiaries.

7.3.1.3 Land Tenure Reform

Land tenure reform is intended to provide secure tenure to those living on land owned by others and not in the possession of rights. The majority of people in South Africa live in rural areas under communal arrangements, holding their land under indigenous customary land tenure systems. A tenure system is defined as the legal institutional framework which determines the ways in which property rights (tenure) are defined and enforced (Roth & Haase,1998); or a set of rules and practices that govern the coexistence of a people in the use and control of land resources within their geographical boundary (Adegboye,1996). Land tenure security is the individual's perception of his/her rights to a piece of land on a continuous basis, free from imposition or interference from outside sources, as well as the ability to reap the benefit of labour or capital invested in land either in use or upon alienation (Roth & Haase, 1998).

Land tenure is described as a differential distribution of ownership and user's rights in land and water among persons or groups in society (West, 1986). The description given relates to allocation of land by the leadership within the society, however, the ownership status is not recognised by the financial institution because land under such circumstances cannot be used as security or collateral to borrow money for farming. Tenure reform involves changes in terms and conditions that govern the use of resources.

According to Kepe & Cousins (2002), in South Africa tenure reform has achieved very little to date in terms of providing greater tenure to those living in the former homelands. The Interim Protection of Informal Land Rights Act (IPILRA) to protect the long-term vested interests in land of people with informal tenure rights. In South Africa, there are land rights that exist in practice, but which are not otherwise adequately protected in law. IPLIRA recognises the right to use, occupy and have access to land, such as beneficial occupation, or elements of land ownership in the land (Department of Land Affairs, 1997).

The policy challenges are the provision of infrastructure (fences, dipping tanks and crush pans) and to ensure that there are measures to address degradation of grazing land, for example, conservation works and appropriate rangeland management practices. Farm workers on private farms may have difficulty in acquiring land for livestock, especially grazing, even if IPLIRA has been passed.

7.3.1.4 Land Redistribution for Agricultural Development (LRAD)

LRAD is a sub-programme of the land reform programme which replaced the SLAG programme. LRAD is designed to provide grants to black South Africans to access land specifically for agricultural purposes, or to make better use of land accessed. LRAD encourages participants to design what works best for them. Beneficiaries can access grants from R20 000 up to R100 000 depending on the amount of their own contribution in kind, labour or cash. The minimum contribution from the beneficiary is R5 000. The approval of the grant is based on the viability of the proposed project which takes into account total project costs and projected profitability (Department of Agriculture, 2001).

This programme seems to be successful in that most LRAD beneficiaries are performing very well and are not different from the commercial farmers. However, it was observed that LRAD livestock farmers like in the communal areas are not receiving post-settlement technical support like training and advice. LRAD delivered a total of 51 968 hectares in the Limpopo Province, 48507 hectares is land suitable for livestock production (Limpopo Department of Agriculture, 2004a). Table 7.3 presents parcels of LRAD land suitable for livestock and sources of that land.

Table 7.3 LRAD livestock projects (Limpopo Department of Agriculture, 2004a)

District	Donated land (Ha)	Private land (Ha)	Landbank land (Ha)	State land (Ha)	Total (Ha)
Bohlabela	-	-	-	-	-
Capricorn	3 312	1 441	3 519	2 169	10 441
Mopani	21	543	173	-	737
Sekhukhune	-	-	-	-	-
Vhembe	-	2 766	1 679	3 549	7 993
Waterberg	124	3 017	1 038	25 157	29 337
Total	**3 457**	**7 767**	**6 408**	**30 876**	**48 508**

The policy gaps are identified at the policy implementation level such as lack of post-settlement support services, lack of extension and research, lack of finance for inputs, lack of market information, lack of infrastructure and lack of strong livestock organisations.

7.3.1.5 Farmer Settlement Policy on State Land

Of significance to sustainable agricultural production in the context of land reform is the Farmer Settlement Policy on State Land (1993 revised in 1995). The policy identifies four models for the settlement of farmers on State Land (commercial farmer, traditional communal, cooperative and corporate). The policy states that unplanned informal settlement should not be allowed, and that high potential agricultural land must be reserved for agricultural use (Oetle *et al.,* 1998).

To promote the effective use of the productive land and resource base, the policy lists criteria for farmer selection and argues that a range of agricultural support services should

be provided, including financial, training equipment and management. The directives of this policy resulted in 171 black livestock farmers settled on state land on lease basis in the Limpopo Province. A livestock farmer pays R25.00 per animal per month on private land whereas on state land a farmer pays R6.00 per animal per month (De Lange *et al.*, 2004). Some lessees of state land not encumbered with claims purchased this land through LRAD. This policy is also doing well because livestock farmers settled on this land are as successful as the LRAD settled farmers. However, these farmers are in danger of losing this land due to land restitution claims and land invasion.

The policy gap identified is that government is weak and slow to deal with land invasion. A case in point is invasion of leased properties at the Immerpan and Strydpoort block of state farms where the lessees are sharing their grazing land with invading farmers. Provision of infrastructure in these farms is very slow. Even if the lessee can offer to repair of replace the infrastructure, decisions to grant such requests are slow.

7.3.2 Landcare Programme

Landcare is a community-based and government supported approach to the sustainable management and use of natural agricultural resources.

Government has introduced a Landcare programme in an attempt to empower land users, both private and communal, to rehabilitate and control the use of natural resources. The Landcare programme provides funding for community mobilisation through awareness campaigns, veldcare where grazing is fenced off into camps so that it be used judiciously. Soil care which provides funds for liming of land with low ph, to provide for communities rehabilitate of highly degraded areas, as well as protection of natural water sources (Department of Agriculture, 1999).

Land used by communal livestock owners is characterised by marginal fertility of soils, erratic rainfall, degraded, eroded, overstocked, overgrazed and under pressure for needs of

expanding population. This negative status of communal land is attributed to communal land use (Boonzaier *et al.*, 1990).

There are 23 Landcare funded projects in the province, but only 13 are livestock projects (veldcare), as presented in Table 7.4 (Limpopo Department of Agriculture, 2003b)**.** Veldcare is implemented by way of eradication of invasive and alien plants, infrastructure provision (fences, crush pens, water supply in camps, etc.) and soil conservation in highly eroded communal grazing areas.

Table 7.4 Landcare projects related to livestock production (Limpopo Department of Agriculture, 2003b)

District	Municipality	Location	Name of project	Type of livestock	Size (ha)
Bohlabela	Bushbuckridge	Shere	Hlanganani vafuwi	Cattle	5 175
		Ronalsdsey	Ronalsdsey	Cattle	916
Capricorn	-	-	-	-	-
Mopani	Greater Giyani	Mayepu	Mayepu	Cattle	3 538
		Muyexe	Muyexe	Cattle	2 529
Sekhukhune	Marblehall	Makgatle	Makgatle-diphiri	Cattle	5 143
	Makhuduthamaga	Thabapitsi	Thabapitsi	Cattle	3 478
Vhembe	Thulamela	Matsika	Matsika (Malavuwe)	Cattle	100
Waterberg	Thabazimbi	Dwalboom	Bakgatla	Cattle	1 100
		Eerstegeluk	Eerstegeluk	Cattle	628
		Kromkloof	Kromkloof	Cattle	700
		Platfontein	Lechaba	Cattle	3 003
		Lennis	Lennis	Cattle	1 226
		Vogelpan	Vogelpan	Cattle	1 341
			Total		**23734**

The weakness identified in this policy is at the grassroots level where most beneficiaries lack the understanding of the need to conserve their resources because the benefits are not immediate and appreciable to members of the communities; inability to control and manage the use of funds. This weakness can be addressed by vigorous awareness campaigns and training to ensure that beneficiaries take responsibility of managing their resources.

7.3.3 Water Policy

This policy proposes that the status of South Africa's water resources as "an indivisible national asset" be formalised, thus moving away from the current legal status of private ownership of water resources. Only water required to meet basic human needs and maintain sustainable environmental needs will be regarded as a right (Department of Water Affairs & Forestry, 1997). Riparian and rights to ground water have been abolished. To promote efficient water, charges will be levied on all water consumption, and in situations where there are competing uses, a resource conservation charge will also be levied. While this is an admirable step forward for conservation, the practicality of implementation will be difficult especially in communal areas because in privately owned land water is linked to the title of the land. Until such time, water rights are separated from land titles, access to water by those who are in water scarce areas will still be a problem.

In communal areas water supply is very scarce to the extent that water for primary use and for livestock is difficult to supply. Most of the water sources are boreholes and rivers. These are the areas targeted by government programmes to ensure that water is available. Primary water supply is the responsibility of the Department of Water Affairs and the Municipalities. Water supply for livestock is by the Limpopo Department of Agriculture, boreholes are drilled and water is reticulated into the camps at strategic points. Earth dams are also constructed to store water from the runoff, these earth dams provide water for livestock.

During 2003 and 2004 the Limpopo Department of Agriculture provided stock water in some municipalities that were faced with severe water shortage as illustrated in Table 7.5.

Table 7.5 Stock Water supply efforts between 2003 and 2004 (Limpopo Department of Agriculture, 2004c).

Local Municipality	Site	Drilled	Tested	Dry	Equipped
Aganang	57	50	48	4	25
Blouberg	60	59	59	5	20
Lephalale	34	31	7	4	4
Mogalakwena	57	57	43	5	55
Fetakgomo	8	8	0	0	0
Makhuduthamaga	58	0	0	0	0
Total	**265**	**205**	**157**	**18**	**104**

(Limpopo Department of Agriculture, 2004c). Although this water supply is for livestock, communities are using it for primary needs and this is due to long distance travelled to the water sources provided for domestic use and crowding.

In the communal areas where dipping is compulsory, water supply is sometimes a serious problem to the extent that animals only get counted instead of dipped. The situation compels government to cart water to the dipping tanks through the water tankers.

7.3.4 Access to Markets

Marketing of agricultural products in the past was done through cooperatives that had an important function for the large scale agricultural sector. Infrastructure like processing and grain storage facilities was developed with the assistance of soft loans from the Land Bank (Ministry of Agriculture & Land Affairs, 1998).

Controlled markets were deregulated when the Marketing of Agricultural Products Act (Act 47 of 1996) was passed. All commodity boards ceased to operate, and their assets were transferred to industry Trusts which provided services such as market information, export advice, and product development. Price controls are removed and single channel markets disappeared with the abolition of control boards.

Rural livestock owners do not have ready access to formal markets for a variety of reasons ranging from transport, road infrastructure and lack of knowledge.

Although this policy change created an environment for small scale farmers to access the markets, in this competitive and open economy they are failing to become part of the mainstream agriculture. Those benefiting the most are the crop farmers. Most livestock owners in communal areas are not organised to participate in global markets, and strict disease control measures are also a barrier, especially in FMD endemic areas. Thus, livestock owners will always be at a disadvantage in the market place. They sell small numbers, often have variable animals, sometimes of poor condition; they lack market information and have limited links with buyers in the marketing chain (Hazell, 2005).

According to Nesamvuni *et al*. (2003), overstocking (high stocking rates and low effective carrying capacity) leads to low reproductive rates and growth rates as well as low off-takes; unsatisfactory grazing management; inbreeding in animals and stock theft and losses through snares. They are also open to exploitation by livestock speculators. These constraints can adversely affect smallholder livestock owners as producers of good standing.

The total livestock population (particularly cattle) in the Limpopo Province is 1 372 795.
The Agricultural study conducted by Nesamvuni *et al*. (2003) predicted that the cattle population in the Limpopo will have increased from 1 197 940 in 2003 to 1 216 208 in 2010. The increase in livestock population has an implication of market requirements especially in the communal areas. Market infrastructure and information, registered abattoirs and logistics are always problematic. As presented in Table 7.6, there are red meat and poultry abattoirs of various grades but dominated by low grade abattoirs which slaughter a small number of cattle and chicken.

Table 7.6 Distribution of abattoirs in Limpopo per district (Nesamvuni *et al., 2003)*

District	Poultry	Red meat Registered	Red Meat Unregistered	Total
Bohlabela	1	0	0	1
Capricorn	4	5	0	9
Mopani	2	5	0	7
Sekhukhune	1	0	7	8
Vhembe	2	35	36	73
Waterberg	8	11	7	26
Province	18	56	50	124

This marketing channel does not help the smallholder livestock owners in that most of these abattoirs buy livestock for slaughtering from the commercial farmers or bigger abattoirs. The supply from the smallholder farmers is also not reliable to sustain the operational abattoirs

There are no pig abattoirs, especially in the Vhembe district, within the study area. The income generated from livestock in smallholder agriculture between 2000 and 2002 as shown in Table 7.7, presents income generated (in South African Rand) from livestock. Waterberg district ranks the highest in income generation followed by Mopani and then Vhembe district. The income generation status of the Districts is also proportional to number of livestock.

Table 7.7 Income Generated from livestock in smallholder agriculture (Nesamvuni *et al., (2003)*

Year	Bohlabela	Capricorn	Mopani	Sekhukhune	Vhembe	Waterberg
2000	6 227	6 249	19 609	4 576	10 276	39 258
2001	7 233	8 434	20 527	5 466	13 285	35 977
2002	7 061	7 670	23 585	5 347	16 984	28 757

Note: 1$= R6-00

There is a need for smallholder livestock owners to organise themselves into livestock marketing cooperatives to overcome these challenges of the required infrastructure, have bargaining power and to exploit new opportunities offered by these market changes.

Infrastructure investments by government to communal farmers are important; there is a need for access roads, livestock handling facilities, fixed or portable weighing scales, higher grade livestock abattoirs (poultry, pigs and red meat), transport and storage facilities.

Adherence to the market without paying attention to the constraints small farmers face can lead to these farmers being further marginalised and income disparity being encountered (Hazell, 2005). In the free market economy like in South Africa, it is difficult to intervene on behalf of smallholder livestock farmers.

7.3.5 Access to Finance

Financial support is important for any farming enterprise. Livestock owners are not able to access sufficient finance due to a variety of reasons; the main one being land ownership that usually forms the basis of equity.

Access to finance by smallholders has always been a challenge, even to government. Commercial banks served the needs of the large scale farming communities which have historically been adequately catered for. Oetle *et al.* (1998) argues that access to finance can enable smallholders to meet both long and short term needs for sustainable farming; they also presented a counter argument that in risk prone environments credit can lead smallholders into the failure of their enterprise.

There were numerous subsidies created to serve the large scale commercial sector in the past. The Department of Agriculture has been a principal conduit for these subsidy benefits directed to commercial farmers (Strauss Commission Report, 1996).

The subsidies retained when others were phased out are drought disaster relief, transaction cost subsidies, carryover debt subsidies, debt compromises and farmer protection (Strauss Commission Report, 1996).

The Land bank has reformed itself to position itself to finance blacks who were excluded in the past, but, according to a report on Micro-Finance (HSRC, 2001). The Land Bank has reformed itself in terms of political positioning, but its systems and products, as well as clarity on mandate have not materialised. The Land Bank has 27 branches and 37 satellite offices meant to reach the rural farmers.

The Land Bank introduced new products suitable for small-scale and emerging farmers, namely Step-Up and Bronze. The Step-Up product ranges from R250 to R18 000. The Bronze product is up to a maximum of R50 000 (Land Bank, 1999).

The Agricultural Credit Board (ACB) has been rationalised to make provision for schemes aimed at broadening access to finance (Strauss Commission Report, 1996). This approach did not work and the ACB had to be closed down.

Recently, another scheme initially called the Agricultural Credit Scheme (ACS) was initiated. It was later renamed the Micro Agricultural Finance Scheme of South Africa (MAFISA). It has been developed in order to provide for the financial needs of the smallholders and emerging farmers. MAFISA is established to encourage retail institutions to finance a new segment of small farmers, and to provide for Government to deal indirectly with informal financial intermediaries through the linkage system (Department of Agriculture, 2004c).

In communal areas smallholders cannot use land as collateral because they do not have title on the land. Although IPILRA has been passed it is still to be implemented and it may take a long time. Use of livestock by communal farmers as security seems to be a challenge to the banks and may have to do with traceability in times of debt default. Smallholders came to rely on traditional sources of income such as savings clubs (stockvels) for inputs like medicines and feeds.

Improving small farmers' ability to save and invest requires the development of an entire rural financial infrastructure in which farmers can access a full range of financial services including credit and deposit at competitive interest rates (Oetle *et al*., 1998*)*.

7.3.6 Research and Extension

The Department of Land Affairs is responsible for the delivery of land while the national and provincial departments of agriculture are responsible for the provision of post-settlement and financial assistance. Provincial departments of agriculture are responsible for provision of a range of services like extension and veterinary services (Hall & Lahiff, 2004).

According to Morton & Wilson (2000), the transfer of livestock production techniques to farmers by extension services in many developing countries has been neglected both by policy makers and researchers. Small farmers need improved technologies appropriate to their needs if they are to survive in today's market place. Publicly-funded research and extension still has a crucial role to play in meeting the technology needs of small farmers (Hazell, 2005).

Extension service to livestock holders is known to be weak and extension services are biased towards crop production (Swanepoel *et al.,* 2000). Some of the factors attributed to poor extension services have been identified by Oetle *et al*. (1998) as, extension staff lacking practical farming skills; expertise is extremely limited and inappropriate to the needs of their client; low education levels; and training was based on modernising traditional production practices.

The technology for smallholders is inadequate mainly because research priorities are not informed by the problems on the ground (Roeleveld & van den Broek, 1996). This is compounded by poor technology transfer due to limited access to production assets, poor information transfer and uncoordinated efforts of different institutions.

In the study area, 23.9 % of the respondents indicated that they see an Extension Officer once in six months and 33% see Animal Health Officers on a monthly basis. This situation is not acceptable and needs to be addressed in order that required new and appropriate technologies are developed and transferred to the smallholder livestock farmers.

Agricultural research is designed to serve the needs of commercial large scale farming and private agricultural research is less attracted to the problems of small farmers (Oetle *et al.,* 1998).

To meet these challenges, there is a need for a more client-oriented, problem-solving approach in public agricultural research and extension systems. This approach will often translate into a need for more on-farm research and a more participatory approach in which farmers will have a greater say in selecting research priorities and in evaluating research outputs (Hazell, 2005). Sonaiya (1996) suggests that the better option is technological blending (defined as the integration of newly emerging technologies with traditional modes of production to ensure higher productivity).

In order to address this challenge of delivery of extension services, the Limpopo Department of Agriculture has introduced a Participatory Extension Approach (PEA) where farmers are facilitated to develop, test and evaluate their own technologies (Northern Province Department of Agriculture, 1998). This approach has assisted livestock owners at Tshikonelo and Mbahela to develop technologies pertaining to vaccination and breeding of indigenous chickens. However, research and extension is shy to attend to the needs of livestock farmers in general.

7.3.7 Drought Relief

Small farmers face a range of weather, disease, pest and market related risks that can discourage them from investing in major enterprises and from adopting more profitable technologies in livestock activities.

Most livestock production systems are extensive in the Limpopo Province where rainfall is on average 500mm and seasonal distribution is erratic. Seasonal, annual and prolonged droughts should be recognised in risk management plans for livestock. Government caters for this through drought relief schemes (fodder purchase and fodder transport) and early warning systems. Limpopo Province is drought prone and government ensures that there is a drought disaster plan in place and that farmers should include drought in their plans.

During the 2003/2004 drought a large number of livestock died (30 515 cattle and 2655 small stock valued at R36 618 000 and R531 000, respectively), especially in the Vhembe, Waterberg, Capricorn, Bohlabela and Sekhukhune Districts as illustrated in Table 7.8 (Limpopo Department of Agriculture, 2004d).

Table 7.8 Stock Losses due to drought per district 2003-2004 (Limpopo Department of Agriculture, 2004d)

District	No of large Stock units	Value (Rand)	No of small stock units	Value (Rand)
Bohlabela	2 802	3 362 400	-	-
Capricorn	14 466	17 359 200	1 225	245 000
Mopani	1 920	2 304 000	-	-
Sekhukhune	2 123	2 547 600	-	-
Vhembe	2 689	3 226 800	325	40 000
Waterberg	5 321	6 385 200	1 107	221 400
Total	**30 515**	**36 618 000**	**2 655**	**531 000**

Government spent R25million to purchase and transport 29 118 tons of fodder for the communal and commercial farmers (4756) as presented in Table 7.9 (Limpopo Department of Agriculture, 2004e). Although the number of smallholder farmers is more than that of commercial farmers the expenditure is more on commercial farmers. This is because smallholder farmers do not have adequate funds to purchase fodder. Purchase of fodder was based on the applications submitted by each individual farmer to avoid wastage.

Table 7.9 Drought fodder and concentrates supply scheme in the Limpopo Province (Limpopo Department of Agriculture, 2004e)

Farmer Description	No Assisted	Fodder in tons	Amount spent
Communal farmers	4 252	13 343 (fodder)	R7 000 000
Commercial	504	15 775 (fodder & concentrates)	R17 900 000
Total	**4 756**	**29 118**	**R25 000 000**

Note: Commercial farmers were buying concentrates which were more expensive than the fodder

The policy is deficient in drought management plans, drought strategies and monitoring mechanisms.

7.3.8 Food Security

Food security is defined as 'access to food, adequate in quantity and quality, to fulfil all nutritional requirements for all household members throughout the year' (Jonsson & Toole, 1991). Food security is expressed by availability and access to food (Sonaiya, 1996).

Livestock production amongst smallholder livestock owners plays a significant role towards poverty alleviation and food security. Differences in resource endowment like land, capital, availability of quality and quantity of feed and housing are some of the reasons why there are differences between the resource-poor and resource-endowed farmers (Rae & Hertel, 2000).

Government has introduced food parcels to the poorest of the poor. The Limpopo Department of Agriculture is required to equip these needy recipients of food parcels to produce their own food and to generate income. Families were given 18 egg layers to produce eggs for consumption and to sell the surplus; some families are given dairy cows to supply milk for the family and to sell surplus milk to neighbours; fish fingerlings are supplied to identified families, the fish come with a plastic dam. Table 7.10 presents the effort made by the Limpopo Province to supply layers to the beneficiaries of food parcels.

Table 7.10 Household egg production schemes in Limpopo Province 2004- 2005 (Limpopo Department of Agriculture 2005)

						Training	
District	**Targeted Families**	**Hens**	**Units Supplied**	**Hens**	**Cost (Rand) ($1=R6-00)**	**Workshops**	**No. of farmers**
Sekhukhune	1 778	64 008	637	22 932	1 911 000-00	1	75
Bohlabela	1 778	64 008	637	22 932	1 911 000-00	6	390
Vhembe	1 190	42 840	551	19 836	1 653 000-00	14	826
Mopani	1 107	39 852	519	18 684	1 557 000-00	4	260
Capricorn	927	33 372	497	17 892	1 491 000-00	9	594
Waterberg	655	23 580	463	16 668	1 389 000-00	4	240
Total	**7 435**	**267 660**	**3 304**	**118 944**	**9 912 000-00**	**38**	**2 385**

Extension services guidance is lacking, and beneficiaries tend to do wrong feeding and management which lead to poor production and mortalities.

Broiler projects have also been established for groups of women identified to be in need of start-up finances.

This policy has delivered a lot but it is not free of challenges. Some egg layer beneficiaries cannot keep up with the demands of maintenance of layers, like feed and water supply due to time and ignorance.

Dairy cows beneficiaries are struggling to acquire good quality fodder for the cows because they are situated in dry areas and sometimes far away from the irrigation schemes. The fish beneficiaries have a challenge of refilling/ topping up the aqua dams, especially those that struggle to obtain 25 litres for primary use.

Although beneficiaries are selling surplus products after consuming some, it does not make business sense, because, for example, 18 layers may lay 18x30 = 540 eggs per month and if half of the eggs (270) are consumed, 270 eggs sold at R1-00, R270 is realised. This amount is even less than the pension grants. The impact of these projects still has to be assessed. The inadequate number of layers has now been increased to 36 layers per household.

It is important that Government should consider some irrigation schemes being rehabilitated to produce high quality fodder like lucerne. This fodder will assist households to acquire fodder for their dairy cows. This approach may result in beneficiaries increasing the number of cows, and therefore more milk produced. As far as free range chicken production is concerned, chicken owners need to be mobilised into groups to purchase vaccine for the most important diseases like New Castle Diseases (NCD). In the part of the study area (Tshikonelo) farmers were mobilised to purchase vaccine and taught to vaccinate their chickens. This approach was successful because chicken numbers increased dramatically due to the decline in the NCD mortality. Technology transfer on good chicken husbandry, as well as research on the best methods and feeds suited to free range chickens may enhance production.

7.3.9 Animal Genetic Resources

The purpose of this policy in respect of breeding is primarily to support the industry through steps which encourage investment in improved stock and provide confidence for those engaged in the purchase and sale of breeding stock (Department of Agriculture, 1998).

Bayer, (2000) found that breeding objectives in the sense of improving the genetic potential- higher growth rate, higher milk production and more eggs- do not enjoy priority amongst smallholder farmers.

Past policies of supplying bulls of exotic breeds and indigenous composite breed bulls did not work because communities did not want them. In the former Venda these bulls had to be assembled and sold to the abattoirs. A new bull programme has now been introduced and so far it is working, however the impact still has to be assessed. In the study area it was found that livestock owners have selection traits which they identify with functions, goods and services they derive from their livestock. It is therefore important that research policy should be directed at researching the development of breeding objectives based on the selection traits preferred and benefiting resource poor livestock owners.

The challenges on this policy are that it seem to be applicable to commercial farmers who are in a position to export and import genetic materials for breeding purpose. It is not clear in protecting the smallholder farmers from being exploited of their genetic materials.

7.3.10 Dip Policy and Animal Disease Control

During the new dispensation the Limpopo Department of Agriculture introduced a policy to stop supplying dip chemicals to the communal farmer in the controlled and surveillance areas. The reason was that dipping material was expensive and therefore livestock owners should supply their own dipping chemicals. Livestock owners were encouraged to form dip tank committees that will be responsible for maintenance of kraals and to collect money for buying dipping materials. Committees were established, but did not last long because there was no cooperation amongst members and not everybody participated. The turn up of cattle for inspection decreased drastically. Three episodes of FMD outbreak occurred and Government realised that in order to ensure regular turn up of cattle for inspection, the policy should discontinue and Government will supply dipping chemicals.

Dip chemicals are now supplied by Government in controlled and surveillance areas. The supply of dip was meant to encourage cattle owners to bring their cattle to the dipping tank for inspection. According to Randela (2000) cost benefit analysis revealed that the control of ticks and tick borne diseases by Government is not economically justified. However, he further asserts that, because of the economic nature of the services it provides (public good) the dipping of cattle still deserve Government support.

7.3.11 Comprehensive Agricultural Support Programme (CASP)

The lack of delivery and implementation of a wide range of government measures, regulations and programmes, as well as inefficient support systems- all of which are critical to ensure an enabling environment for agriculture, constitute a major concern and challenge to all state agencies supporting the agricultural sector (Oetle *et al.,* 1998).

The reality is that there already exists a gap between progress that the Department of Land Affairs has made with providing access to land to black people, and the provision of agricultural services to these beneficiaries. The Department of Agriculture introduced a programme called CASP to address the post-settlement support needs of restitution, SLAG and LRAD.

The overall aim of CASP is to provide post settlement support to beneficiaries of the land reform processes such as restitution, land redistribution. CASP focuses on the following generic areas (Department of Agriculture, 2004a):

- Information and knowledge management,
- Training and capacity building,
- Marketing and business development, and
- On and off-farm infrastructure.

7.4 Conclusion

The list of existing policies which support livestock directly is limited, the majority of policies cited are cross-sectoral, and the list is not exhaustive. In the review it became apparent that some policies have since taken a back seat and are overtaken by the newly developed ones. However, all these policies have one thing in common; they are developed to improve the situation of smallholder farmers and aid members of communities to emerge from the effects of the past policies which marginalized them. It would also appear that all these policies were developed with good intention to assist those targeted. However, what seems to be lacking is the will and capacity to implement them. It is only until recently that National and Provincial Departments are spurred to start implementing the directives of the policies through the development of comprehensive programmes or instruments. Land policies are at an advanced stage of implementation but there are problems emerging from the side of those who acquired land in groups. Conflicts amongst members, lack of knowledge of farming, and limited support services, amongst others, are impeding productivity of the land acquired.

The policies developed to assist emerging and subsistence farmers excluded capacitating the extension services but when the policies fail, the blame is levelled on the extension officers. The success of policy implementation therefore also rests with training of extension officers.

Other interventions can be achieved by mobilising community members to tackle the problem they are facing, for example, New Castle disease control.

The most important interventions required from government is the creation of an enabling environment through provision of basic infrastructure such as fencing, water reticulation, livestock marketing facilities, capacity building of both officers and farmers, mobilisation of farmers to jointly tackle their problems, the formation of farmer organisations and the introduction of strategic partners where large scale production is taking place. These required interventions are associated with the policy gaps identified in this study.

Access to support services remains a critical factor constraining the development and growth of smallholder farmers as well as productivity of their livestock.

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CHAPTER 8

GENERAL CONCLUSION AND RECOMMENDATIONS

The literature survey confirms that most of the research methods were derived from the inquiry systems developed by the cited philosophers. There are also different approaches to conduct research. The literature review on systems, methods and approaches provided guidance to the current study in the choice of research methods. The literature review revealed more information on the constraints, dynamics, complexities, and the multiplicity of livestock uses in smallholder livestock systems. Different methods, approaches and systems have been designed to arrive at certain conclusions and interventions. Conclusions made without considering the local situation may lead to inappropriate outcomes or decisions.

The understanding of the characteristics of livestock owners and livestock production systems is important as it creates a knowledge base through which improvements and interventions can be made. The "nothing about farmers without the farmers" principle applies. Constraints to productivity include factors related to the environment, poor management, social conditions of the smallholder livestock owners, capacity building and knowledge of livestock owners and inherent adaptability of livestock. The above mentioned constraints are largely responsible for low productivity figures reported in this study. The constraints identified by the farmers can be eliminated if production technical support, provision of basic infrastructure, development and transfer of appropriate technologies are provided to the smallholder livestock owners.

There is a need to understand the benefits and functions from livestock as assets of smallholder livestock owners, the purposes of investing in livestock and the desired traits that are related to functions and purposes for keeping livestock. Livestock owners in the study area have the knowledge of breeding and they have traits that they use in selecting their animals. Those traits are linked to the benefits and functions obtained from livestock. Most of these benefits and functions cannot be marketed as a result; they are always ignored when the value of livestock traits is assessed for the development of breeding

objectives. Breeding objectives can be developed if requirements for the organisation of breeding operations suitable to this sector are identified. The multi-functionality of livestock keeping should be measured, evaluated and expressed as a productive index so that this can be translated into the breeding objectives. It is also acknowledged that this intervention may not be easy as there are numerous challenges which tend to discourage researchers into conducting their research in such areas characterised by lack of records, absence of livestock handling facilities and measuring equipment. The situation can be improved by means of using portable digital weighing scales, focused mobilisation of farmers and provision of livestock handling facilities. When livestock in the communal areas are assessed, prevailing conditions must be taken into account. Conventional measures of performance based on optimal environment should be avoided because the study area is poorly endowed with resources for livestock production. This argument should be taken into account when breeding objectives are being considered for the smallholder farming situation.

Climatic and non-climatic factors are important to the production and reproductive performance of cattle in the study area. Productivity of cattle in the study area can improve by reducing losses through the improvement of existing husbandry practices. Calving rates can increase if proper selection of good bulls and culling of unproductive cows are applied. Mortality rates in both adults and young animals can be reduced by amongst others, disease and parasite control as well as proper sheltering, especially for the young animals. Fodder banking in times of plenty can also play a major role in assisting with fodder availability during the times of scarcity.

The list of existing policies which support livestock directly is limited, the majority of policies cited are cross-sectoral, and the list is not exhaustive. In the review it became apparent that some policies have since become dormant and overtaken by the newly developed policies. However, all these policies have one thing in common; they are developed to improve the situation of smallholder farmers and aid members of communities to emerge from the effects of the past policies which marginalized them. However, what seems to be lacking is the will and capacity to implement them. It is only

until recently that implementation of these policies has started through the development of comprehensive programmes or instruments. Land policies are at an advanced stage of implementation but there are problems emerging from the side of those who acquired land in groups. Conflicts amongst members and lack of knowledge of farming on a large scale, and limited support services, are impeding productivity of the land acquired. Group dynamics processes were implemented hurriedly and inadequately in order to meet the targets of land delivery to beneficiaries without providing monitoring and evaluation mechanisms. The policies developed to assist emerging and subsistence farmers excluded capacitating of the extension services but when the policies fail, the blame is levelled on the extension officers. The success of policy implementation therefore also rests with training of extension officers.

The most important interventions required from government is the creation of an enabling environment through provision of basic infrastructure such as fencing, water reticulation, livestock marketing facilities, capacity building of both officers and farmers, mobilisation of farmers to jointly tackle their problems, the formation of farmer organisations and the introduction of strategic partners where large scale production is taking place. These required interventions are associated with the policy gaps identified in this study. Access to support services remains a critical factor constraining the development and growth of smallholder farmers. The challenges identified in the policy discussion could be resolved by amongst others, leasing the land for productive purpose to those prepared to do profitable farming, a strategic partnership model overseen by Government, a dedicated mentorship programme by those already in business, and managing the rigidity of the provision of some legal entities like CPA's and Trusts.

Capacity building of farmers and extension officers on livestock husbandry practices (feeding disease and parasite control, breeding and selection), focused marketing of livestock, record keeping, natural resource management and development of breeding programmes the suite the communal smallholder livestock environment. This should strongly link up with provision of basic infrastructure such as crush pans, auction kraals

where feasible, portable weighing scales, mobilisation and group dynamic exercise to make people able to work together, mentorship programmes and strategic partnerships.

ANNEXURE A

Abstract

Understanding livestock production systems and the constraints to survival of smallholder livestock owners is of utmost importance. However information gathering on livestock in communal area is always challenging. The primary purpose of this study is to contribute towards a better understanding of the complexities of livestock production practices amongst smallholder livestock owners in the communal areas.

One hundred and twenty eight smallholder livestock owner in the Vhembe District of the Limpopo Province were surveyed. A significant majority (59.2%) of the respondents keep up to 10 heads of cattle, 41.6% up to 10 goats and 30.4% keep up to and less than 10 pigs. Cattle constitute 67.3% of the total number of livestock, followed by goats 18.9% and pigs 13.8%. Regarding ownership, 41.9% of the farmers own cattle only, 27.1% own cattle, goats and pigs, 22.5% own only cattle and goats, and 8.5% own cattle and pigs only. Female animals, except pigs, constitute the highest number in the herds/flocks sited (cows 55.0%, and ewes 60.5 %). Birth rates (cattle 35.6%, goats 38.3% and pigs 37.9%) are low. Mortality rates are 15.7% for cattle, 16.6% for goats and 6.6% for pigs. The conclusion derived from the results suggests that if the characteristics of the area are known, interventions initiatives are possible.

Smallholder livestock owners obtain benefits from livestock which area related to desired traits for selection. Adaptability, frame size, annual calving, temperament and traction utility are the desired traits for selection. Benefits obtained from livestock are the basis from which breeding objectives are derived by smallholder livestock owners. Livestock kept by smallholder livestock owners is gainfully kept because of multiple uses. If selection was to be made based on the selection traits identified, the selection index for smallholder livestock owners should combine the mentioned traits.

A study on climatic and non-climatic factors was conducted based on historical weather and livestock data of five years. The objective was to justify the claim by the farmers that

rainfall influences ticks and tick borne diseases which are causing mortalities to their livestock. The results of the study confirm that climatic and non-climatic factors have highly significant effects (P<0,0001) on productivity of cattle in the study area. Productivity of livestock in the study area can improve if existing animal husbandry practices can be improved. Fodder banking in times of plenty can also play a major role in assisting with fodder availability during the times of scarcity.

An overview of government policies and programmes in the agricultural sector, pertaining to livestock production, was conducted. The objective of this overview was to identify and assess policies and programmes that create an enabling environment for smallholder livestock farming. The findings show that government has developed deliberate policies and programmes that create a favourable environment to enable the majority of the black smallholder livestock owners to participate in the main stream economy. The intention is also to ensure that the economy grows, poverty is reduced, employment is created and that there is food security in the country. It was observed that omission of support services like extension impedes implementation of policies. The implication is that at implementation level the extension officers are blamed for neglecting livestock production.

It is concluded that the situation in the study area can be improved by amongst others capacity building of farmers and extension officers on livestock husbandry practices (feeding, disease and parasite control, breeding and selection), focused marketing of livestock, record keeping, natural resource management and development of breeding programmes that suite the communal smallholder livestock environment. Provision of basic infrastructure such as crush pens, auction kraals where feasible, portable weighing scales, and mobilisation and group dynamic exercises to enable people to work together, mentorship programmes and strategic partnerships, are important considerations to improve the current plight of smallholder farmers in communal areas.

ANNEXURE B

Abstrak

‘n Begrip van die omstandighede van kleinboerveeproduksiestelsels in kommunale areas is van uiterste belang, maar die verkryging van betroubare data in hierdie navorsingsomgewing is uitdagend. Die primêre doel van die studie is om ’n bydrae te lewer tot ‘n beter begrip van die kompleksiteite van kleinskaalse veeproduksiestelsels in kommunale areas.

Een honderd agt en twintig kleinboer vee eienaars in die Vhembe distrik van die Limpopo provinsie is ondersoek. ’n Groot meerderheid (59.2%) van die deelnemers hou tot 10 beeste, 41.6% tot 10 bokke en 30.4% hou tot 10 en minder varke aan. Beeste maak 67.3% van die totale hoeveelheid kudde uit, gevolg deur bokke (18.9%) en varke (13.8%). In terme van eienaarskap besit 41.9% van boere net beeste, 27.1% besit beeste, bokke en varke, 22.5% besit net beeste en bokke, en 8.5% besit net beeste en varke. Vroulike diere, afgesien van varke, maak die grootste deel van die kuddes uit (koeie 55.0% en ooie 60.5%). Geboortekoerse is laag (beeste 35.6%, bokke 38.3% en varke 37.9%). Sterftesyfers vir beeste is 15.7%, vir bokke 16.6% en vir varke 6.6%. Uit die resultate word afgelei dat as die area se uitdagings geïdentifiseer is, inisiatiewe ter ondersteuning van die uitdagings moontlik is.

Die voordele wat kleinboere uit vee verkry is gekoppel aan eienskappe vir seleksie. Aanpasbaarheid, raamgrootte, gereelde kalwing, temperament en aanwending as trekdiere is die ideale eienskappe vir seleksie. Voordele verkry uit vee is die basis waarop teeldoelwitte van kleinboer veeproduksie gebaseer moet word. As seleksie gebasseer word op identifiseerbare seleksie eienskappe, moet die seleksie indeks vir hierdie vee die verskeie eienskappe kombineer.

’n Studie oor klimaats en nie-klimaats faktore oor vyf jaar gebasseer op weer- en veedata was uitgevoer. Die doel was om die bewering van die boere te regverdig dat reënval bosluise en bosluis oordraagbare siektes beïnvloed wat sterftesyfers by hulle diere

veroorsaak. Die resultate van die studie bevestig dat klimaats en nie-klimaatsfaktore 'n betekenisvolle invloed ($P<0,0001$) op produktiwiteit van beeste in die studie area het. Produktiwiteit van beeste in die studie area kan verbeter as huidige bestuurspraktyke verbeter kan word. Die berging van voer in oorvloedige tye kan help met voertekorte in tye van skaarste.

Regeringsbeleide en programme ten opsigte van landbou en spesifiek veeproduksie, was ondersoek. Die doel van die ondersoek was om beleide en programme te identifiseer wat 'n bydrae tot kleinboer veeproduksie lewer. Die bevindinge wys dat die regering daadwerklike programme en beleide ontwikkel het wat 'n gunstige omgewing skep om die meerderheid swart kleinboere in staat te stel om aan die hoofstroom ekonomie deel te neem. Die doel is ook om te verseker dat die ekonomie groei, armoede verlig word, werksgeleenthede geskep word en om voedselsekuriteit in die land te verseker. Daar is ook gevind dat die uitlating van ondersteuningsdienste soos voorligtingsbeamptes, die implementering van beleide kniehalter. Die implikasie is dat op implementeringsvlak die voorligtingsbeamptes geblameer kan word vir die afskeping van diereproduksie.

Daar is dus bevind dat die situasie in die studiearea verbeter kan word deur onder andere kapasiteit te bou van boere en voorligtingsbeamptes in bestuurspraktyke van vee (voeding, siekte en parasiet beheer, teling en seleksie), gefokusde bemarking van diere, rekordhouding, natuurlike hulpbronbestuur en ontwikkeling van teelprogramme wat die kleinboer veeproduksie omgewing pas. Die verskaffing van basiese infrastruktuur soos drukgange, veilingskrale waar nodig, draagbare skale, asook aspekte van inkoop en oefeninge in groepsdinamika om mense te leer om saam te werk, mentorskap programme en strategiese vennootskappe, belangrike oorwegings is om die huidige behoeftes van die kleinboer in kommunale dele aan te spreek.

ANNEXUXE C

GENERAL SURVEY QUESTIONNAIRE

A farming systems study of livestock production amongst smallholder livestock owners

Date : …….
Enumerator : …….
Name of respondent : ……..

Region : ……
Sub Region : ……
Village : ……..
Dip tank : ……..
Respondent number : …….

The questionnaires relate to the small-scale, resource poor livestock holders. A small scale livestock holder refers to a family or household and individuals that own or keep livestock in the study area. The livestock referred to in this study are cattle, goats, sheep, pigs, donkeys and poultry.

The questionnaire is designed to gather information on personal characteristics, Socio-economic, socio-cultural, other farming systems and land uses and the livestock farming in the study area.

The information is strictly confidential and will be used by the researcher in drawing conclusions which may assist in the design of the intervention programmes improving livestock production practices or assist stock owners to benefit more out of the livestock they keep. The information will also assist to evaluate circumstances and problems relating to livestock production in the study area.

NOTES:

1. If a question is not applicable please indicate with N/A.
2. Specify unit of measurement where applicable.
3. Multiple choice questions should be answered by circling or crossing the answer.

A. PERSONAL CHARACTERISTICS

1. Sex of respondent (Record without asking)

   1. Male
   2. Female

   [1] [2]

2. Sex of household head

   1. Male
   2. Female

   [3] [4]

3. Marital Status of household head

   1. Married
   2. Single
   3. Divorced
   4. Widowed
   5. Separated

   [5] [6] [7]
   [8] [9]

4. If married, how many spouses do you have?

   1. One
   2. Two
   3. More than two
   4. None

   [10] [11]
   [12] [13]

5. Age of the household head, (If unknown, judge by probing asking historical events)

   1. > 65 yrs
   2. 55 – 64
   3. 45 – 54
   4. 35 – 44
   5. 25 – 34
   6. 15 – 24
   7. >14
   8. Don't know

   [14] [15]
   [16] [17]
   [18] [19]
   [20] [21]
   [22] [23]

6. What is the highest education level you have attained?

   1. None
   2. Std1-Std6
   3. Std7-Std10
   4. Diploma
   5. Degree

   [24] [25] [28]
   [26] [27]

7. Ethnic Group

1. Venda
2. Tsonga
3. Sotho
4. Others (Specify)

29 30

31 32

B. HOUSEHOLD CHARACTERISTICS

8. Household Structure

33 34

35 36

37 38

39 40

41 42

43 44

45 46

Household member	Age group	Male	Female
	> 65 yrs		
	55 – 64 yrs		
	22 – 54 yrs		
	19 – 21 yrs		
	15 – 18 yrs		
	7 – 14		
	7 yrs		

9. Child education profile (write number)

47 48

49 50

51 52

53 54

55 56

Age	Male	Female
Attending School		
19 – 21 yrs		
14- 18 yrs		
6 –13 yrs		
<6 yrs		

10. Household members working (Number): …… 57

11. Areas of Work

1. Education
2. Health
3. Correctional Services
4. South African Police Services
5. Civil Services
6. Metropolitan
7. Private
8. Factory
9. Shop
10. Self
11. None

58 59 60

61 62 63

64 65

66 67 68 69

12. Others (Specify)

12. Pension members of the household

1. Father to the household head
2. Mother to the household head
3. Both father and mother to the household head
4. Household head
5. Household head's spouse
6. Both household head & and spouse
7. Sons
8. Daughters

70 71 7 73 74 75 76 77

C. INCOME

13. Source of income

1. Salary/Wages
2. Pension
3. Business
4. Stockvel
5. Sale of crop
6. Sale of livestock
7. Slaughtered meat
8. Remittance
9. Others (specify)

78 79 80 81 82 83 84 85 86

NB: Where more that one sources is identified please indicate the sources.

14. Source of income for maintenance of livestock

1. Salary/Wage
2. Trade
3. Pension
4. Remittance
5. Stockvel
6. Bank saving
7. Sale of livestock
8. Sale of Crop
9. None
10. Others (Specify)

87 88 89 90 91 92 93 94 95 96

15. Source of income for children's education

1. Salary/Wage
2. Pension

97 98 99

3. Remittance
4. Stockvel
5. Bank savings
6. Bursary
7. Sale of livestock
8. Sale of livestock products
9. Sale of crops
10. None
11. Others (specify)

100 101 102
103 104 105
106 107

16. Income per month

1. <R200
2. R201-R600
3. R601-R1000
4. R1001-R1600
5. R1601-R2000
6. >R2000
7. None

108 109 110
111 112 113
114

17. How much money do you generate from the sale of livestock per annum?

1. Chicken R…….
2. Cattle R……..
3. Goats R……..
4. Donkeys R……
5. None

115 116
117 118
119

18. How much money do you generate from the following crops per annum?

1. Maize R……
2. Millet R……
3. Sorghum R……..
4. Groundnuts R……
5. None

120 121
122 123
124

19. Do you sell cow dung from your kraal?

1. Yes
2. No

125 126

20. If yes, how much per what unit? R……./…….

127

21. Do you milk your cows?

1. Yes
2. No

128 129

22. If yes, how much do they produce? …….Litres 130

23. Do you sell the milk?

1. Yes
2. No

131 132

24. If yes, how much per litre? R…… 133

D. EXPENDITURE

25. Expenditure per month

1. R100--R300
2. R301-R600
3. R601-R900
4. R901-R1200
5. R1201-R1500
6. R1501-R1800
7. R1801-R2100
8. R2101-R2400
9. R2401-R2700
10. R2701-R3000
11. >R3000
12. None

134 135 136
137 138 139
140 141 142
143 144 145

26. What do you spend your money on most in your household?

1. Food
2. Clothes
3. School fees
4. Hired labour
5. Maintenance of vehicles
6. None
7. Others (specify)

146 147 148
149 150 151
152

27. On what aspect did you or do you spend most on maintenance of your livestock?

153 154

1. Feeding
2. Medicine
3. Dipping
4. Labour
5. Water supply
6. None

155 156
157 158

28. How much did you spend on the following?

1. Feeds R ……
2. Medicine R ……
3. Dipping R …….
4. Labour R……
5. Water Supply R…….
6. Others

160 161
162 16
164

29. In what form do you pay your workers who look after your livestock?

1. Money (indicate the amount)
2. In kind (specify)

165 166

30. How much do you spend on your source of energy**?**

1. R……
2. None
3. Don't know

167 168
169

31. How many hours of labour per week do you think is required for herding or attending to your livestock?

1. Pigs ……..
2. Chicken ……..
3. Goats ……
4. Cattle ……
5. Donkeys ……..

170 171
172 173
174

E. LIVESTOCK & VELD MANAGEMENT

32. If there is scarcity of water for both humans and livestock who should get the preference?

……
(Please give reasons for your answer) 175

33. If water is scarce and you have crops that need water while on the other hand you have livestock, which one will you try to save?

…… 176
……
State reason…… 177
……

34. Do you have grazing rights?

1. Yes 178
2. No 179

35. Do you have control over grazing in your area? …… 180

36. How did you obtain you grazing rights?

1. Allocated by the chief 181 182
2. Allocated by the Government
3. Bought livestock 183 184
4. Inherited

37. What will you do if there is no more grazing available for your livestock which require grazing?

1. Sell 18 186
2. Buy feed
3. Move them elsewhere 18 188
4. Use crop residues
5. Others (specify) 189

38. Which of the livestock are (in your view) most destructive to the veld?

1. Cattle 190 191
2. Donkeys
3. Goats 192 193
4. Both
5. Don't know 194

(Give reasons why for any of the first four answers)

39. Do you think it is important that grazing should be used judiciously to prevent degradation? …… 195

40. What according to you is the main reason for veld degradation?

1. Annual burning
2. Overgrazing
3. Unplanned camps
4. Not enough rain
5. Too many livestock
6. Too little grazing

196 197 198

199 200 201

41. Do you personally believe that all people residing in the village you stay should have grazing rights?

1. Yes
2. No

202

203

42. Why are most people inclined to set fire on the veld?

1. It is a custom
2. Done to kill ticks
3. Carelessness
4. Jealousy
5. Hunting
6. To get rid of old grass for new grass when rain comes
7. Firewood

204 205 210

206 207

208 209

43. If you are asked to pay for grazing are you prepared to pay?

1. Yes
2. No
3. Don't know

211 212 213

F. DECISION MAKING

44. What source of protein do you eat most in your household**?**

1. Chicken
2. Pork
3. Mutton
4. Beef
5. Milk
6. Eggs
7. Fish
8. Mopani worms
9. Locusts
10. Termites
11. Crickets

214 215 216 217

218 219 220 221

222 223 224 225

226

12. Mushrooms
13. Flying ants

45. According to your preference can you indicate which are on the top of the list?

1,2,3,4,5,6,7,8,9,10,11and 12 | 227 | 228 | 229 | 230 | 231 | 232

46. What are the prices for? :-

| 233 | 234 | 235 | 236 | 237 | 238 |

1 R…….
2 R…….
3 R…….
4 R…….
5 R…….
6 R…….
7 R…….
8 R…….
9 R…….
10 R…….
11 R…….
12 R…..……

239	240
241	242
243	244
245	246
247	248
249	250

47. What do you associate your livestock with?

1. Money
2. Wealth
3. Satisfaction
4. Status
5. None of the above

251	252
253	254
255	

48. If you were to put a price on your livestock, how much will it be for the following?

1. Cow ……..
2. Bull …….

| 256 | 257 |

3. Heifer …….
4. Ox …….
5. Ram ……
6. Ewe ……
7. Boar …….
8. Saw ……..
9. Gilt ……
10. Chicken ……..
11. Duck ……..
12. Donkey ……...

258	259
260	261
262	263
264	265
266	267

49. Why do you keep livestock?

…… 268

50. If you were asked to choose one between livestock and crop farming, which one would you prefer?

269 270

……

51. What are the taboos related to the above mentioned in livestock?

1. ……
2 ……
3 ……
4. ……
5 ……
6 ……
7. ……
8. ……
9. ……
10. …….
11 …….
12 …….

271 272 273 274 275

276 277 278 279 280

281 282

52. What are the ritual uses of the above mentioned livestock?

1 …….
2 …….
3 …….
4 …….
5 …….
6 …….
7 …….
8 …….
9 …….
10 …….
11 …….
12 …….

283 284 285

286 287 288

289 290 291

292 293 294

53. **W**hich social activity do you attach to the following animals?

1. Pig …….
2. Chicken …….
3. Cattle …….
4. Goat …….
5. Donkeys …….

295 296 297

298 299

54. Who decides about husbandry of cattle, goats, pigs?

1. Myself
2. Family
3. Wife
4. Others (specify)

300	301	302	303

55. What would you like to improve concerning your?

1. Cattle …….
2. Goats ……
3. Pigs ……
4. Chicken ……..
5. Nothing

304 305 306 307 308

56. How do you shelter your livestock?

1) Cattle ……
2) Goats ……
3) Pigs ……
4) Poultry ……
5) Donkeys ……

309 310 311 312 313

57. Why do people tether their goats these days instead of leaving them to roam freely or under control?

314 315

……

58. Why do people release their pigs from the sty in winter or after summer crop harvest?

59. Do you know what measles is?

316 317

1. Yes
2. No

60. How is it acquired by human beings?

318

……

61. What do you do to prevent measles?

319

……

62. Do you practice patch grazing? ……

1. Yes
2. No

320 322 321

63. If no, why? ……

64. To save your livestock from starving from hunger during drought, what do you do?

1) Cut tree branches
2) Graze them along the river banks
3) Feed them with fodder
4) Just leave them

323 324 325 326

65. If you had the chance to inherit a good amount of money what would be the first thing you would buy with it?

1. Cattle
2. Land

Vehicle

3. Tractor
4. New house
5. Furniture
6. Nothing

327 328 329 330 331 332 333

66. What are the four major constraints that you that adversely?
Your Cattle?

1) …….
2) …….
3) …….
4) …….

334 335 336 337

67. Your Goats?

1) …….
2) ……..
3) ……..
4) ……..

338 339 340 341

68. Your Pigs:

1) ……
2) ……
3) ……
4) ……

342 343 344 345

69. Poultry:

1) ……
2) ……

346 347

3) ……
4) …… 348 349

70. Do people in your community have the freedom to increase their livestock numbers? (Specifically cattle).

1) Yes 350 352
2) No
3) No opinion 351

71. If yes what are those conditions

……
…… 353

72. Did the community in the area of your residence lose their livestock due to drought?

1) Yes 354
2) No 355

73. How serious was the problem?

1) Very serious 356 357 358
2) Serious
3) Uncertain 359 360
4) Not serious
5) No problem

74. What lessons did you learn? 361

……
……

G. HERD COMPOSITION

75. How many types of livestock do you have?

1) …… 362 363
2) ……
3) …… 364 365
4) ……

76. Of this number mentioned how many are:

1) Oxen? …… 366 367
2) Cows?…… 368 369

3) Bulls?.....
4) Calves?……..
5) Rams ?……..
6) Ewes ?……..
7) Castrates? ……..
8) Kids ? ……..
9) Boars?……
10) Saws ?……
11) Piglets?……...

370 371 372 373 374 375 376

77. Did any of the young animals die at birth this year?

1) Yes
2) No

377 378

78. How many died?

1. Calves ……
2. Kids ……
3. Piglets ……

379 380 381

79. What do you think is the main cause of mortality?

1. Calves …….
2. Kids ……
3. Piglets……..

382 383 384

80. What time of the year does this normally occur?

1) Summer
2) Winter
3) Spring
4) Autumn

385 386 387 388

81. How many of the older animals died this year?

1) Cattle ……..
2) Goats ……..
3) Pigs ……..
4) Donkeys ……...

389 390 391 392

82. What do you think was the main cause of deaths to the older animals?

1. Cattle ……..
2. Goats ……..
3. Pigs …….

393 394 395

83. What do you think was the main cause of deaths to the chickens?

1) Predators
2) Disease
3) Others specify

396 397 398

H. OTHER FARMING ACTIVITIES

84. Do you have land for cropping purposes?

1. Yes
2. No

399
400

85. What is the size of your land?
……..ha

401

86. What is your right to your cropping land**?**

1) Temporary
2) Permanent
3) Leasing
4) Privately owned

402 403
404 405

87. Is the cropping land irrigable?

1. Yes
2. No

406 407

88. If yes what crops do you produce?

1. Fruit
2. Maize
3. Cotton
4. Tobacco
5. Potatoes
6. Sweet potatoes
7. Vegetables

408 409 410 411
412 413 414

89. What type of fencing are you using for the protection of the land crops?

1. None
2. Sisal fence
3. Thorn branches
4. Wire
5. Others (specify)

415 416 419
417 418

90. If your cropping land is dryland (rain-fed), what crop do you produce?

1. Maize
2. Millet
3. Sorghum
4. Groundnuts

420 421 422 423

91. How much money do you generate from the crops you produce? R……

424 425 426 427

92. How much do you charge per bag of the following?

1. Maize R ……
2. Millet R ……...
3. Sorghum R ……

428 429 430

93. How much do you pay for labour in the following for maize production?

1) Land Preparation R …….
2) Planting R ……..
3) Weed control R ……..
4) Harvesting R ……..

431 432 433 434

94. for Millet

1) Land preparation R …… 435 436
2) Planting R ……
3) Weed control R …… 437

95. for Sorghum

1) Land preparation R …….
2) Planting R ……
3) Weed control R ……
4) Harvesting R ……

438 439 440 441

96. for Groundnuts

1. Land preparation R ..……..
2. Planting R …….
3. Weed control R …..……..
4. Harvesting R …….

442 443 444 445

97. How do you divide labour for Livestock caring and cropping?

…… 446

98. What do you regard as the most important?

1) Livestock
2) Crops
3) Both

447	448	449

99. To what extent does crop farming interfere with livestock farming?

1) Very much
2) Not much
3) None

450	451	452

100. If very much, what do you do with each of the following?

1) Chicken
2) Donkeys
3) Cattle
4) Pigs
5) Goats

453	454	455	456	457

101. Who gives you advice on livestock farming?

1) Extension officer
2) Animal health officer
3) University
4) Books
5) Magazine
6) Farmers days

458	459	460
461	462	463

102. Which of the following do you use to till your land?

1) Manual implements e.g. hand hoe
2) Animal drawn implements e.g. ox plough
3) Tractor drawn implements e.g. disc plough
4) Others (specify)

464	465
466	467

103. What are your main constraints with the following (state problems where applicable)?

1) Vegetable
2) Cattle
3) Goats
4) Pigs
5) Chicken
6) Fruit
7) Maize

468	469	470
471	472	473
474	475	476	477

8) Sorghum
9) Millet
10) Groundnuts

104 What are your needs to overcome the problems mentioned above (state the needs)?

1) Vegetable
2) Maize
3) Sorghum
4) Millet
5) Cattle
6) Goats
7) Pigs
8) Chickens
9)

478 479 480 481 482 483 484 485

105. With which farming operations if any, do experience problems with labour?

1) Ploughing
2) Planting
3) Weeding
4) Harvesting
5) Herding Livestock
6) Feeding
7) Gathering feed for livestock

486 487 488 489 490 491 492

I.REASONS FOR KEEPING LIVESTOCK

REASONS	CATTLE	GOATS	PIGS	DONKEYS	POULTRY
Selling	493	506	519	532	545
Meat for own Consumption	494	507	520	533	546
Milk	495	508	521	534	547
Status	596	509	522	535	548
Wealth	497	510	523	536	549
Draught (work)	498	511	524	537	550
Form of saving	499	512	525	538	551
Social Functions	500	513	526	539	552
Selling	501	514	527	540	553
Inherited	502	515	528	541	554
Don't know	503	516	529	542	555
Just for keeping	504	517	530	543	556
Sport	505	518	531	544	557

NB: Mark with cross where applicable
Also ask if the owner eats donkey's meat also ask how it tastes

J. ADVISORY & INNOVATION SYSTEM

106. Do you use one of the following technologies in crop production?

	Technology use	Y/No	Reasons			
				558	559	560
1.	Fertilizer application	---------	----------	561	562	563
2.	Hybrid seeds	---------	----------			
3.	Pesticides	---------	----------	564	565	566
4.	Herbicides	---------	----------			
5.	Drought power	---------	----------	567	568	569
6.	Soil Conservation	---------	----------			
7.	Water harvesting	---------	----------	570	571	

107. Do you use one of the following technologies in livestock production?

Technology	Uses	Reasons			
1) Tethering	Y/N	----------	572	573	574
2) Vaccination	Y/N	----------	575	576	577
3) Deworming	Y/N	----------			
4) Dipping	Y/N	----------	578	579	580
5) Breeding	Y/N	----------	581	582	583
6) Supplementary feeding	Y/N	----------			
7) Castration	Y/N	----------	584	585	586
8) Dehorning	Y/N	----------		587	

108. How often do you see the extension officer?

1) Daily
2) Weekly
3) Fortnightly
4) Monthly
5) Once in six months
6) Don't remember
7) Never

588	589	590
591	592	
593	594	

109. How often do you see animal health officer?

1) Daily
2) Weekly
3) Fortnightly
4) Monthly
5) Once a month
6) Once in six months
7) Don't remember
8) Never

595	596
597	598
599	600
601	602

110 What kind of advice do you need most?

1. In crop …….. 603 604
2. In livestock ……

111. In your experience, who provided the best advice?

1. Input supplier
2. Fellow farmers
3. Relatives
4. NGO
5. Government officials

605 606 609 607 608

112. Do you experience any problem of soil degradation in your field?

1. Yes
2. No

610 611

113. If yes, how does it show?
…… 612

114. Who is responsible for the repair?

1. Government 613
2. People of the village 614
3. Myself 615

115. Do you experience any problem of soil degradation in the grazing lands? 616

116. If yes, how does it show?

1. Yes…….. 617 618
2. No…….

117. Who do you think is responsible to prevent such damage?

1. Myself 619
2. Family member 620
3. Everybody 621
4. Other people 622
5. Nobody 623