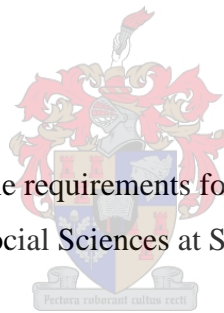


# **FARMING IN THE LANGKLOOF: COPING WITH AND ADAPTING TO ENVIRONMENTAL SHOCK AND SOCIAL STRESS**

by

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Thesis presented in fulfilment of the requirements for the degree of Master of Arts in the  
Faculty of Arts and Social Sciences at Stellenbosch University.



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## **DECLARATION**

By submitting this thesis electronically, I declare that the entirety of the work contained therein is my own, original work, that I am the owner of the copyright thereof (unless to the extent explicitly otherwise stated) and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

Date: 25 February 2015

## **ABSTRACT**

During the period 2006-2012, the Langkloof area, situated in the Eden District Municipality, suffered severely from environmental shocks and social stress including drought, flooding, hail, wildfire, heatwaves and reduced labour demand. These events negatively impacted many farmers and their livelihoods. In response to these external shocks and stressors, large-, medium- and small-scale farmers adopted numerous coping and adaptive strategies.

This study performed a comprehensive livelihoods analysis of large-, medium- and small-scale farmers in the Langkloof area, using the widely recognized sustainable livelihoods framework developed by the United Kingdom's Department for International Development, with a particular focus on coping and adaptive strategies against severe environmental shock and social stress. Variables used in the analysis were the vulnerability context in which farmers pursue a livelihood; livelihood assets (social, human, financial, natural and physical); the policies, institutions and processes in the external environment that influence the degree of ownership and access to assets; livelihood strategies pursued; and the various livelihood outcomes ultimately produced. The analysis of coping and adaptive strategies employed by farmers during these periods formed an integral part of this study.

Sixteen livelihood asset indicators were identified to determine the total assets (human, social, physical, financial and natural) of the farmers. After scaling the indicators, a Principal Component Analysis (PCA) was used to assign weights to each indicator and to subsequently calculate the total assets of each household. Regarding the coping and adaptive strategies employed by farmers against environmental shock and social stress, the average number of strategies was calculated for each household. Spearman's rank correlations were calculated for total assets achieved (capacity) and the number of strategies employed against environmental shock and social stress.

## **KEYWORDS**

Adaptive strategies, disaster, disaster risk, coping strategies, environmental shock, hazards, large-, medium and small-scale farmers, livelihoods, social stress, sustainable livelihoods, vulnerability

## OPSOMMING

Die Langkloofgedied, geleë in die Eden Distriksmunisipaliteit, is gedurende die tydperk 2006-2012 geweldig geteister deur omgewings- en sosiale gebeure, wat droogte, vloed, hael, veldbrande, hittegolwe en 'n gevolglike verlaagde arbeidsaanvraag sluit. Hierdie rampe het verreikende nadelige gevolge op boere se lewensbestaan gehad. Terwyl hulle lewensbestaan tot die uiterste uitgedaag is, is verskeie hanterings- en aanpassingstrategieë teen omgewingskok en sosiale stres geïmplementeer.

Met die gebruik van die Verenigde Koninkryk se Departement van Internasionale Ontwikkeling se volhoubare lewensbestaansraamwerk is 'n gedetailleerde en alomvattende analise van groot, medium- en kleinskaalboere in die Langkloof se lewensbestaan gedoen, met 'n sterk skem op hul hanterings- en aanpassingstrategieë teen omgewingskok en sosiale stress. Die analise veranderlikes het die kwesbaarheidskonteks waarin boere hul lewensbestaan aanpak; hul verskeie bates (menslik, sosiaal, finansiële, fisies en natuurlik); die beleide, instansies en prosesse in die eksterne omgewing wat toegang tot en eienaarskap van bates reguleer; hul lewensbestaanstrategieë; en die lewensbestaansuitkomst wat bereik word, behels. Die analise van die boere se hanterings- en aanpassingstrategieë geïmplementeer teen omgewingskok en sosiale stres gedurende hierdie tydperk was 'n integrale rol van hierdie studie.

Sestien aanwysers is geïdentifiseer om die totale lewensbestaansbates (menslik, sosiaal, fisies, finansiële en natuurlik) van die boere te bepaal. Nadat die aanwysers geskaal is, is 'n Hoofkomponentanalise (PCA) uitgevoer om gewigte aan elke aanwyser toe te ken vir die berekening van totale bates van huishoudings. Die hanterings- en aanpassingstrategieë ingestel deur boere teen omgewingskok en sosiale stres, is die gemiddelde aantal strategieë per huishouding. Spearman se rangorde korrelasies is bereken vir die totale bates (kapasiteit) en die getal strategieë geïmplementeer teen omgewingskok en sosiale stres.

## SLEUTELWOORDE

Aanpassingstrategieë, gevare, groot-, medium- en kleinskaalboere, hanteringstrategieë, kwesbaarheid, lewensbestaan, omgewingskok, ramp, ramprisiko, sosiale stres, volhoubare lewensbestaan

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## CONTENTS

<b>DECLARATION.....</b>	<b>i</b>
<b>ABSTRACT.....</b>	<b>ii</b>
<b>OPSOMMING.....</b>	<b>iii</b>
<b>ACKNOWLEDGEMENTS .....</b>	<b>iv</b>
<b>CONTENTS.....</b>	<b>v</b>
<b>TABLES.....</b>	<b>x</b>
<b>FIGURES.....</b>	<b>xi</b>
<b>ACRONYMS AND ABBREVIATIONS.....</b>	<b>xiii</b>
<b>CHAPTER 1 INTRODUCTION.....</b>	<b>1</b>
<b>1.1 BACKGROUND: OVERVIEW OF ENVIRONMENTAL SHOCK AND             SOCIAL STRESS IN THE LANGKLOOF, 2006-2012.....</b>	<b>2</b>
<b>1.2 CONCEPTUAL FRAMEWORK.....</b>	<b>8</b>
<b>1.3 RESEARCH PROBLEM.....</b>	<b>8</b>
<b>1.4 STUDY AREA .....</b>	<b>9</b>
<b>1.5 AIM AND OBJECTIVES .....</b>	<b>12</b>
<b>1.6 OVERVIEW OF METHODS.....</b>	<b>12</b>
<b>CHAPTER 2 LITERATURE REVIEW.....</b>	<b>14</b>
<b>2.1 FARMING IN SOUTH AFRICA.....</b>	<b>14</b>
<b>2.2 DISASTER RISK THEORY .....</b>	<b>18</b>
<b>2.2.1 Understanding vulnerability .....</b>	<b>19</b>
<b>2.2.2 Understanding hazards .....</b>	<b>24</b>
2.2.2.1 Drought .....	24
2.2.2.2 Meteorological drought.....	25
2.2.2.3 Agricultural drought .....	26
2.2.2.4 Hydrological drought.....	26
2.2.2.5 Socio-economic drought .....	27
2.2.2.6 Floods.....	28
2.2.2.7 Hail.....	29
2.2.2.8 Wildfires .....	29
2.2.2.9 Heatwaves .....	30

<b>2.3</b>	<b>SUSTAINABLE LIVELIHOODS THEORY .....</b>	<b>31</b>
2.3.1	Historical background .....	31
2.3.2	Livelihoods in a south african context .....	32
2.3.3	Value of a suitable sustainable livelihoods framework .....	33
2.3.4	Review of sustainable livelihood frameworks .....	34
2.3.5	The United Kindom's department for international development (DFID) sustainable livelihood framework (SLF) .....	38
2.3.5.1	Livelihood assets.....	41
2.3.5.2	Vulnerability context .....	42
2.3.5.3	Policies, institutions and processes (PIPs) .....	42
2.3.5.4	Household livelihood strategies .....	43
2.3.5.5	Livelihood outcomes.....	43
2.3.6	Sustainable livelihood frameworks compared and critiqued .....	44
<b>2.4</b>	<b>ADAPTIVE AND COPING STRATEGIES AGAINST SHOCK AND STRESS ..</b>	<b>46</b>
2.4.1	Savings and asset management.....	50
2.4.2	Diversification .....	51
<b>CHAPTER 3</b>	<b>METHODS.....</b>	<b>52</b>
3.1	LITERATURE REVIEW .....	53
3.2	KEY INFORMANT INTERVIEWS.....	53
3.3	QUESTIONNAIRE SURVEY .....	53
3.4	SAMPLING FRAMEWORK.....	55
3.5	DATA CONSOLIDATION.....	56
3.6	DATA ANALYSIS.....	56
3.6.1	Scaling of indicator values.....	56
3.6.2	Objective weighting of indicators using principal component analysis .....	57
3.6.3	Spearman's rank correlation .....	58
3.6.4	Spearman's rank significance graph and critical values for correlation coefficients .....	59
<b>CHAPTER 4</b>	<b>SOCIODEMOGRAPHIC/ECONOMIC PROFILE OF SAMPLED HOUSEHOLDS .....</b>	<b>61</b>
4.1	SOCIODEMOGRAPHIC/ GEOGRAPHIC PROFILE OF SAMPLED HOUSEHOLDS .....	61
4.1.1	Household size and household heads .....	61

4.1.2	Language of households, race and marital status .....	61
4.1.3	Highest education level of households .....	62
4.1.4	Settlement history and nearest town .....	62
4.2	<b>SOCIOECONOMIC PROFILING OF HOUSEHOLDS USING PRINCIPAL COMPONENTS ANALYSIS .....</b>	<b>63</b>
4.2.1	Ownership and access to human assets.....	65
4.2.2	Ownership and access to social assets .....	66
4.2.3	Ownership and access to physical assets.....	67
4.2.4	Ownership and access to financial assets.....	68
4.2.5	Ownership and access to natural assets .....	70
4.3	<b>LIVELIHOOD STRATEGIES EMPLOYED .....</b>	<b>74</b>
4.3.1	Agriculture as primary source of income .....	74
4.3.2	Crop cultivation versus livestock farming.....	75
<b>CHAPTER 5 VULNERABILITY CONTEXT AND THE STATE OF INSTITUTIONAL SUPPORT .....</b>		<b>78</b>
5.1	<b>THE VULNERABILITY CONTEXT OF FARMERS IN THE LANGKLOOF ...</b>	<b>78</b>
5.1.1	At the mercy of nature.....	78
5.1.2	Vegetation and debris in rivers.....	78
5.1.3	Location of farm dams and water supply to Haarlem.....	79
4.3.4	Settlement in flood plains .....	79
4.3.5	Seasonal crop cultivation.....	81
5.2	<b>THE STATE OF INSTITUTIONAL SUPPORT .....</b>	<b>82</b>
5.2.1	Agricultural service delivery by state institutions .....	82
5.2.2	The provision of essential health and education institutions .....	85
5.2.3	Access to credit sources .....	85
5.2.4	Accessibility of the local farmers' cooperative.....	85
5.2.5	Access to insurance.....	86
5.2.6	Authority of the local municipality .....	86
5.2.7	Disaster risk governance .....	87
<b>CHAPTER 6 COPING AND ADAPTIVE STRATEGIES EMPLOYED AGAINST ENVIRONMENTAL SHOCK AND SOCIAL STRESS .....</b>		<b>90</b>
6.1	<b>INDIVIDUAL STRATEGIES EMPLOYED .....</b>	<b>90</b>



6.1.1	Hail .....	90
6.1.2	Drought .....	91
6.1.3	Floods .....	92
6.1.4	Wildfires .....	93
6.1.5	Heatwaves .....	94
6.2	COLLECTIVE STRATEGIES EMPLOYED .....	97
6.1.1	General.....	97
6.1.2	Wildfires .....	98
6.1.3	Floods .....	99
6.3	CORRELATION OF FARMERS' TOTAL ASSETS AND STRATEGIES AGAINST HAZARDS.....	99
<b>CHAPTER 7 DISCUSSION.....</b>		<b>104</b>
7.1	KEY FACTORS INCREASING FARMERS' VULNERABILITY .....	106
7.2	LIVELIHOOD ASSETS .....	107
7.3	KEY POLICIES, INSTITUTIONS AND PROCESS CHALLENGES.....	109
7.4	AGRICULTURE AS PRIMARY LIVELIHOOD STRATEGY.....	111
7.5	INDIVIDUAL COPING AND ADAPTIVE STRATEGIES ADOPTED .....	111
7.6	CORRELATIONS BETWEEN TOTAL ASSETS AND COPING AND ADAPTIVE STRATEGIES EMPLOYED .....	113
7.7	LIVELIHOOD OUTCOMES.....	114
<b>CHAPTER 8 CONCLUDING REMARKS AND RECOMMENDATIONS .....</b>		<b>116</b>
8.1	RECOMMENDATIONS .....	118
<b>REFERENCES.....</b>		<b>120</b>
<b>PERSONAL COMMUNICATIONS.....</b>		<b>128</b>
<b>APPENDICES .....</b>		<b>129</b>
<b>APPENDIX A: KEY INFORMANT QUESTIONS .....</b>		<b>130</b>
<b>APPENDIX B: QUESTIONNAIRE SURVEY .....</b>		<b>131</b>
<b>APPENDIX C: SCALING OF SUBINDICATORS AND RATIONALE FOR SELECTION .....</b>		<b>144</b>
<b>APPENDIX D: EIGEN VALUES AND PERCENTAGE OF VARIANCE OF EACH INDICATOR.....</b>		<b>152</b>

<b>APPENDIX E: WEIGHTS OF VARIABLES IN PRINCIPAL COMPONENT ANALYSIS .....</b>	<b>153</b>
<b>APPENDIX F: CALCULATION OF INDICES.....</b>	<b>154</b>
<b>APPENDIX G: COMPONENT COEFFICIENTS OF THE SIXTEEN INDICATORS SELECTED .....</b>	<b>155</b>
<b>APPENDIX H: WEIGHTED HOUSEHOLD SCORES FOR EACH INDICATOR.....</b>	<b>156</b>

## TABLES

Table 2.1 Partial typology of the agricultural sector in South Africa .....	16
Table 2.1 Large scale farm units in South Africa .....	16
Table 2.3 Key demographics and socio-economic features of George Municipality, 2001 and 2011..	17
Table 2.4 Deciduous fruit tree planting in the Langkloof for 2012 .....	18
Table 2.5 Strengths and weaknesses of the DFID sustainable livelihoods framework.....	44
Table 2.6 Comparison between DFID, CARE and UNDP sustainable livelihoods frameworks.....	45
Table 2.7 Examples of shock, stressors with suggested coping and adaptive strategies .....	47
Table 2.8 Adaptive and coping strategies .....	48
Table 2.9 Impacts of climate, vulnerability and adaptive capacity in Africa.....	49
Table 3.1 Research questions for the study.....	54
Table 3.2 Critical values of Spearman's rank correlation coefficient.....	60
Table 4.1 Sociodemographic/geographic profiles of each farming scale .....	63
Table 4.2 Indicators and corresponding questions in questionnaire .....	64
Table 4.3 Household human assets by farming scale .....	65
Table 4.4 household social assets by farming scale .....	67
Table 4.5 Household physical assets by farming scale .....	68
Table 4.6 Household financial assets by farming scale .....	70
Table 4.7 Household natural assets by farming scale .....	71
Table 4.8 Household total assets by farming scale .....	73
Table 6.1 Correlation between total assets and the strategies employed by large-scale farmers.....	100
Table 6.2 Correlation between total assets and the strategies employed by medium-scale farmers...	101
Table 6.3 Correlation between total assets and the strategies employed by small-scale farmers .....	102
Table 6.4 Critical values of Spearman's rank correlation coefficient.....	103

## FIGURES

Figure 1.1 Staging of events and associated hydrological, agricultural and socio-economic effects .....	7
Figure 1.2 The study area, Langkloof .....	11
Figure 2.1 Pelling's model of vulnerability .....	21
Figure 2.2 Pressure and release model.....	23
Figure 2.3 Interconnectedness of social hazards, natural hazards and the built environment .....	24
Figure 2.4 Relationships between four different types of drought.....	27
Figure 2.5 The United Kingdom's Department for International Development's sustainable livelihoods framework .....	40
Figure 3.1 Graph for Spearman's rank correlation coefficient .....	59
Figure 4.1 Score obtained by each farming scales.....	72
Figure 4.2 Total livelihood asset scores .....	73
Figure 4.3 Sources of income for large-scale farmers .....	74
Figure 4.4 Sources of income for medium-scale farmers .....	75
Figure 4.5 Sources of income for small-scale farmers.....	75
Figure 4.6 Sources of agricultural income for large-scale farmers .....	76
Figure 4.7 Sources of agricultural income for medium-scale farmers.....	77
Figure 4.8 Sources of agricultural income for small-scale farmers .....	77
Figure 5.1 Dominant shocks and stresses in the Langkloof.....	80
Figure 5.2 Trends in the Langkloof .....	81
Figure 5.3 Seasonality in the Langkloof .....	82
Figure 5.4 Technical agricultural support by state institutions for disaster relief.....	84
Figure 5.5 Farmers' desire of prominence of state departments to increase.....	84
Figure 5.6 Farmers' view of the local cooperative's prices for agricultural requirements .....	86
Figure 5.7 The process chain for allocating disaster funds.....	87
Figure 5.8 Overall scores for policies, institutions and processes .....	89
Figure 6.1 Strategies to mitigate hail damages .....	91
Figure 6.2 Strategies to mitigate drought effects .....	92
Figure 6.3 Strategies to mitigate flooding.....	93
Figure 6.4 Strategies to mitigate wildfire threats.....	94
Figure 6.5 Strategies to mitigate heatwaves effects.....	95
Figure 6.6 Average number of household strategies used against all hazards .....	96
Figure 6.7 Use of coping strategies as apposed to adaptive strategies according to farming scale .....	97
Figure 6.8 Significance of correlation for large-scale farmers .....	100
Figure 6.9 Significance of correlation for medium-scale farmers .....	101

Figure 6.10 Significance of correlation for small-scale farmers.....	102
Figure 7.1 Synopsis of results of an application of the Department for International Development's sustainable livelihoods framework.....	105

## ACRONYMS AND ABBREVIATIONS

DiMP	Disaster Mitigation for Sustainable Livelihoods Programme
DFID	Department for International Development
ED	enabling development
EDM	Eden District Municipality
FAO	Food and Agricultural Programme of the United Nations
FPA	fire protection association
GDP	gross domestic product
GLM	George Local Municipality
ha	hectare
HEA	household economy approach
IHM	intra household model
IFAD	International Fund for Agricultural Development
IPCC	Intergovernmental Panel on Climate Change
LAL	learning about livelihoods
NGO	non-governmental organization
PAR	pressure and release model
PCA	principal components analysis
PIPs	policies, institutions and processes
SC	Save the Children
SID	Society for International Development
SKCMP	Sequoia and Kings Canyon National Parks
SLA	sustainable livelihoods approach
SMS	short message service

SLF	sustainable livelihoods framework
SPEI	standard precipitation evapotranspiration index
SPI	standard precipitation index
SPSS	Statistical Package for Social Sciences
UNDP	United Nations Development Programme
UNIEP	Uniondale Integrated Empowerment Projects
UNISDR	United Nations International Strategy for Disaster Reduction Secretariat
UK	United Kingdom
LSF	large-scale farmers
MSF	medium-scale farmers
SSF	small-scale farmers
LMSF	large-, medium and small-scale farmers
WFP	United Nations World Food Programme

## CHAPTER 1 INTRODUCTION

The Langkloof area, situated in the Eden District Municipality (EDM), is one of the most productive areas for deciduous fruit cultivation in South Africa (Hortgro 2013). The deciduous fruit farming industry which includes apples, pears, table grapes, peaches, plums, prunes, apricots and nectarine cultivation, is the largest agricultural export industry in South Africa and also the largest employer in the Western Cape (Hurndall 2005). Apart from the many opportunities the industry provides, farmers in the Langkloof area have recently been exposed to many environmental shocks (short term) including drought, floods, hail, wildfires and heatwaves, as well as social stress (long term) in the form of declining wage labour.

The Langkloof area was significantly affected by the above external shocks and stressors over the period 2006 to 2012 with detrimental consequences for many farmers' livelihoods and posing serious challenges to their coping and adaptive strategies. Hazards affect farmers differentially according to their exposure, resistance and resilience (Pelling 2003). Many small scale farmers (SSF) in the Langkloof do not have the same access to asset resources and reserves that large-scale farmers (LSF) nor medium-scale farmers (MSF) have. Even though farmers are affected equally during periods of severe environmental shocks and social stress, SSF cannot adapt and cope in the same manner as the latter two farming scales because of farmers' limited resources (Holloway et al. 2012).

According to many development agencies and non-governmental organisations (NGOs) (such as the Department for International Development (DFID), the United Nations Development Programme (UNDP), Oxfam, CARE and others), a livelihood comprises capabilities, assets and activities required to secure a livelihood, and it is sustainable when it has the ability to avoid or more usually to be resilient and recover from stressors and shocks. Sustainability serves to maintain and enhance households' capabilities and assets both now and for future generations, while not undermining the natural resource base (DFID 1999). This definition of livelihood is widely used and it lies at the core of livelihoods analysis. The sustainable livelihood framework (SLF) developed by the DFID and adapted from an early formulation by Chambers & Conway (1991) is supported by significant evidence to be the most suitable tool for this study envisaged. Consequently this framework was used to assess the various livelihood components of farmers in the Langkloof.

To provide an adequate understanding of the relationships between vulnerability and hazards causing disasters, the pressure and release (PAR) model (Wisner et al. 2004) was used to inform the livelihoods framework. In the next chapter a literature review is followed by detailed descriptions of the methods used to assess the livelihoods of large-, medium and small-scale farmers (LMSF), with a focus on adaptive and coping strategies during periods of severe environmental shocks and social stress. Analysis of livelihood assets is paramount to livelihood inquiry, therefore an accurate method



was necessary to calculate farmers' assets. Consequently, principal component analysis (PCA) was applied to assign appropriate weights to 16 asset indicators. After calculation of total weighted assets, a Spearman's rank correlation analysis was performed to determine the relationship between total assets accumulated and the strategies farmers employed to mitigate the effects of environmental shocks and social stress. The risk profile of the study area is described below. The understanding of the spatial and temporal distribution of environmental shocks and stresses, certain vulnerability aspects and the state of institutional support provides a necessary background to the study.

## **1.1 BACKGROUND: OVERVIEW OF ENVIRONMENTAL SHOCK AND SOCIAL STRESS IN THE LANGKLOOF, 2006 TO 2012**

A combination of environmental shocks and social stressors spanning the period 2006 to 2012 severely affected LMSF in the Langkloof region, to the degree that only in 2011 was there 'recovery' in the form of a normal harvest reported after the sequence of devastating events (Holloway et al. 2012).

According to a key informant the period 2006 to 2012 began with an intense and destructive hailstorm in November 2006 causing estimated direct damage of R32 million. Other key informants indicate that this incident marks the first time in South African history that a hailstorm was declared a disaster at any governmental level. Disasters in a South African context are defined by the South African Disaster Management Act (2002: 6) where a disaster means a "progressive or sudden, widespread or localised, natural or human-caused occurrence which causes:

- death, injury or disease;
- damage to property, infrastructure or the environment;
- disruption of the life of a community; and

is of a magnitude that exceeds the ability of those affected by the disaster to cope with its effects using their own resources."

Key informants reported extensively to the provincial minister of agriculture about the knock-on effects resulting from the hailstorm, namely, among others, retrenched workers leading to unemployment, poverty, crime and ultimately malnutrition in local communities. Buying power was also reduced causing farm shop incomes to decline. The Department of Home Affairs was affected due to increasing numbers of workers becoming eligible for all pay, which is a social welfare grant. Key informants also indicated that alcohol abuse increased, leading to domestic problems and ultimately increasing crime rates. The hail disaster had the most significant impact of all the

environmental events in the Langkloof because it occurred ahead of the festive season and therefore affected almost everyone's financial well-being.

Seven farms were severely affected by the hailstorm with a substantial number of trees being destroyed and deemed uninsurable by insurance criteria. An estimated 369 000 fruit trees including apple, pear, nectarine, plums, apricot and peach trees were severely affected with some 7 000 trees being damaged beyond repair. During an interview a key informant indicated that the estimated cost of replacing these trees was R44 million. Such an intervention would, however, have resulted in no harvest for three to four years. Additionally, large amounts of potential harvest were lost in the process but fortunately these were insured losses.

Interviews with two key informants revealed that the hailstorm was followed by a flood. Regional damages were estimated at R112 million in the EDM after rainfall of 300 mm within 36 hours. Direct damage in the Uniondale area was estimated at R18 million. Due to strict criteria, only communal dams (dams used for more than one owner) qualified for state assistance. Assistance of only R3 million was allocated to the Langkloof fruit farmers to repair dams.

Subsequently, a cut-off low in November (2007) was responsible for substantial and destructive rainfall. A cut-off low is a midlatitude cyclone that literally becomes cut-off from the main westerly atmospheric circulation (Holloway et al. 2012). Tyson & Preston-Whyte (2000) defines a cut-off low as a mid-latitude cyclone that becomes separated from the main low pressure system and moves off independently. Its independence causes it to lose momentum and become stagnant for a number of days or to move very slowly before disintegrating. In the process very strong atmospheric instability and powerful convection occurs resulting in severe weather such as heavy rain, snow in mountainous areas and damaging winds (Holloway et al. 2012). Cut-off lows are among the main drivers responsible for damaging floods in South Africa (Holloway et al. 2012).

According to a Langkloof farmer, 560mm of rainfall was recorded in a period of 18 hours on his farm, while a total of 1 000 mm rain was recorded from 20-27 November (Holloway et al. 2012). Rainfalls of this magnitude impacted farms in many ways, including:

- Fruit trees stood in water for days, so damaging their root stocks;
- Access to orchards for various tasks, such as protective spraying, was impossible;
- 36 000 fruit trees drowned or smothered by silt;
- More than 100 stock units destroyed;
- $\pm 100$  km of fencing destroyed;
- Many kilometres of pipeline, water furrows or channels destroyed;
- $\pm 200$  km of farm roads seriously affected;

- $\pm 55$  km farm bridges or river crossings destroyed;
- $\pm 25$  pumps damaged;
- Many farm workers' houses damaged;
- Many buildings damaged;
- Erosion-preventing infrastructure such as contours and gabions seriously damaged;
- Many kilometres of river banks seriously eroded, stream beds and riverbanks grossly extended;
- Many rivers silted and river courses changed; and
- More than 100 dams were destroyed or damaged (Holloway et al. 2012).

Regionally, more than R1.2 billion in damages was reported, of which the agricultural sector in the region suffered an estimated R185 million (Holloway et al. 2012). The original flood damage estimate for the Western Langkloof was R46.1 million but later adjusted to R17.5 million due to most farmers repairing damage to orchards, fences, buildings, access roads, fences and irrigation systems with their own funds or by borrowing from commercial banks at high interest rates which put substantial stress on farmers in 2008 (Holloway et al. 2012).

Regarding state assistance, the region was declared as a regional disaster area. Many state departments, including the South African National Roads Agency Limited (SANRAL), provided much assistance to the affected area. The agricultural sector, however, received little assistance. As a result many dams damaged by the intense flooding are still to be repaired. The disaster caused unemployment to increase substantially.

No fatalities were reported during the 2007 flood. However, the Poort, a critical 25-kilometre thoroughfare connecting Uniondale and Avontuur was washed away so causing extensive logistical problems for many groups, including farmers, emergency personnel and the police. The road was closed for about a year and took two years to be completely rebuilt. A 25 km detour was the only access route to Avontuur from Uniondale and this had significantly affected the Fire Department, Emergency Services, South African Police Service and farmers who had to transport their workers. One serious impact was increased response time to fire hazards for the Fire Department that has to respond within seven minutes of receiving notice of a house fire. If their response time is too long, the municipality can be held liable for losses.

In addition to flood damages, a devastating fire swept through parts of the Langkloof in 2007 and affected sixteen farms where an estimated R10 million in damages were reported. Unfortunately, damage sustained due to fire is largely uninsurable and, in this case, the state didn't provide any form of relief for these affected parties. The only option one had was to instigate legal proceedings against the alleged source of the fire, a process which can take up to six years for the courts to reach a verdict.

Due to farmers' high-risk status after flood damages, loans from commercial banks with interest rates as high as prime plus 8% to 9% were signed (Holloway et al. 2012). Delays in repairs to critical infrastructure and farm dams meant that surface water storage capacity was compromised for 2008. This increased farmers' vulnerability to the onset of a meteorological drought. The 2008 rainfall was lower than usual in the Langkloof at 83% of the annual average (Holloway et al. 2012). Insufficient surface-water storage replenishment resulted in reduced capacity to irrigate orchards, particularly during critical times of the growing cycle which vary according type of crop. It was reported that this water shortage became the worst drought in 134 years and would extend from 2008 to 2011. Moreover, in addition to the start of the devastating drought, a fire swept through southern Haarlem in 2008 damaging eight farms and affecting orchards, pipelines, fences and pine plantations. One farmer declared bankruptcy causing the loss of seven permanent jobs and leaving 35 people destitute. Affected farmers once again didn't receive assistance in any form after this event. In 2009 a reduced harvest and poor fruit quality resulted from the compromised irrigation in 2008. The low levels of carry-over water storage from 2008 were aggravated by a second year of below-average rainfall of (416 mm or 76% of the long-term mean) (Holloway et al. 2012).

A meteorological drought characterized by a precipitation deficiency regressed to an agricultural drought where a soil-water deficiency and plant-water stress became apparent. The agricultural drought regressed further to a hydrological drought where reduced stream flow appeared. A socio-economic drought was the ultimate effect, where humans were directly impacted. Little work was available on farms which substantially affected household livelihoods of seasonal workers and the rural poor, mainly in the form of cutbacks, largely due to reduced production. Wider implications for peoples' livelihoods included migration to other farming areas in search of seasonal work.

Another hailstorm was reported in April 2009 which, together with the December 2008 storm, reduced turnover by an estimated 20% for the 2009 harvest season (Holloway et al. 2012). Additional shocks included above-average temperatures during 2009 which resulted in the premature flowering of fruit trees leading to a further reduction in the 2010 harvest. Moreover, additional damages estimated at R7 million were sustained due to veld fires.

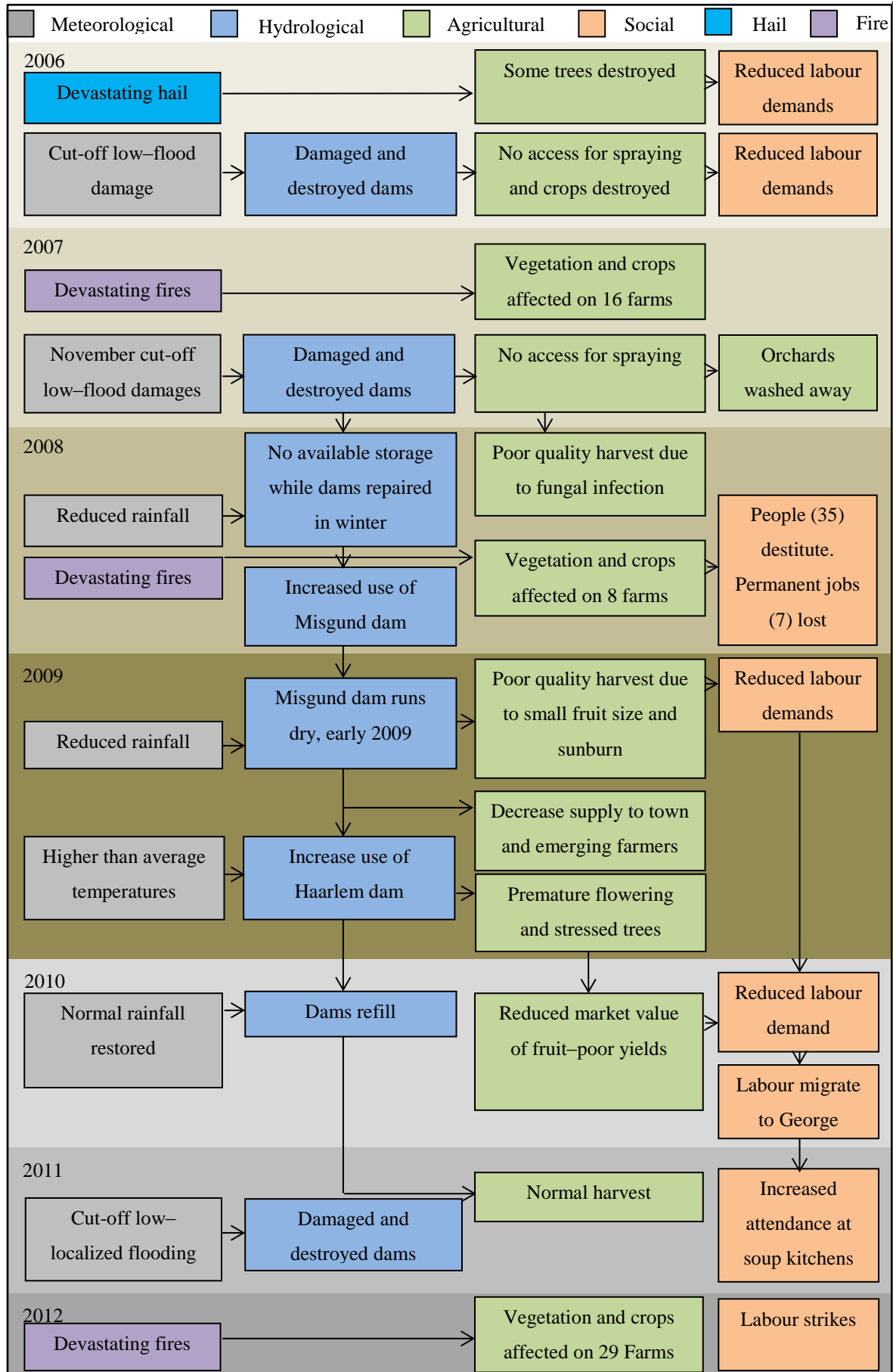
The premature flowering of fruit trees during 2009 caused a reduction in certain apple cultivar production during 2009 and 2010. At the end of the 2010 the provincial government declared the area a drought disaster area. Affected cultivars included Golden Delicious, Granny Smith, Top Red/Starking and Cripp's Red/Sundowner in 2009, decreasing to 55%, 80%, 33% and 20% respectively of the 2008 harvest (Hortgro 2013). During this drought the Haarlem dam that supplies water to over 800 ha of orchards and 40 SSF as well as the community of Haarlem and Uniondale was depleted to such an extent that water had to be rationed. Many dams that were damaged during the 2007 flood were bone dry during this drought. Unfortunately, the area's main employers, i.e. the fruit,

vegetable and seed farmers did not qualify for state assistance due to certain criteria. SSF who mainly rely on vegetables for their income were also disqualified. According to a key informant and Chair of the Small-scale Farmers' Association only livestock farmers, whose employment needs are much smaller than those of the vegetable farmers, were assisted. The only assistance allocated to fruit, vegetable and seed farmers was in the form of discounts on water licenses, although this was pointless as there was no water available. Support was given in the form of mulch to reduce water lost by evaporation and a portion of the labour bill was subsidized to prevent retrenchments.

Although flooding occurred again in June 2011, it was not as severe as the 2007 flood damages but the damages sustained were exacerbated by substandard, temporary repairs to previously damaged infrastructure. A number of key informants reported that due to the lack of governmental response following the previous floods, farmers were very sceptical about even reporting damages. On 29 June 2011 another disaster struck the Langkloof, this time in the form of a devastating which fire burnt for six days and nights and was ultimately responsible for R5.5 million in damages spread across twenty-two farms. Seven other farms still have to complete their damage surveys. Again, according to a key informant no state assistance was received by affected farmers.

Farmers in the Langkloof sustained losses estimated at R600 million during the period 2006 to 2012, but the government only provided about R12 million in relief. This above discussion illustrates the hazard profile of the Langkloof area and articulates the high recurrence interval of environmental shocks and social stress events. This recurrence interval results in cumulative impacts and very little recovery time, ultimately severely impacting peoples' livelihoods. It also illustrates the challenges faced when dealing with fast-paced and destructive threats occurring at multiple scales and often being mutually reinforcing. The exposure to hazards in the Langkloof area was exceptionally high during the study period 2006-2012 and susceptibility to negative outcomes was exacerbated by compromised resistance and resilience as well as shortcomings in transforming structures and processes (outlined in DFID's SLF). The adaptive and coping strategies of farmers were, therefore, severely challenged. Many SSF in Haarlem, but also a number of large- and medium- scale farmers, did not survive the cumulative adverse events. Therefore, many SSF in Haarlem had to seek alternative work on neighbouring farms to offset the cumulative realised damages and their unfortunate implications. A key informant stated that many prosperous and 'cash farmers' did not 'survive' the cumulative detrimental effects and were consequently forced to sell their land and seek employment elsewhere.

Figure 1.1 is a schematic illustration of the range of events and their cumulative effects that struck the Langkloof between 2006 and 2012, following the hailstorm in 2006. Cumulative vulnerability had its origin in meteorological drought which led to hydrological drought and eventually caused knock-on effects in the form agricultural and socio-economic stress.



Source: Adapted from Holloway et al. (2012)

Figure 1.1 Staging of events and associated hydrological, agricultural and socio-economic effects

This accumulation of stressors and shocks affected the livelihoods of farmers in the Langkloof to a great extent. This is evident in the high cost of damages and the resulting migration of labour to nearby George and other urban areas due to a decrease in job opportunities in the Langkloof (Holloway et al. 2012). This internal migration represents an unseen but significant transfer of risk into the urban centres in the region. The conceptual framework used in the assessment and analysis of livelihoods over this time period is discussed in Chapter 1.2 below.

## **1.2 CONCEPTUAL FRAMEWORK**

Pelling (2003) sheds light on the components of vulnerability, namely exposure, resistance and resilience. His model of vulnerability is, however static and does not account for changes to the components over time (de Waal 2012). The PAR model, on the other hand assesses changing or progressive vulnerability (Wisner et al. 2004). The PAR model assesses the vulnerability of a system or people in a holistic manner, where vulnerability occurs progressively stemming from root causes and leading to dynamic pressures, unsafe conditions and when exposed to a hazard there the potential arises for a disastrous event to occur (Wisner et al. 2004). To assess changing vulnerability conditions over time, a conceptual framework that assesses the change in exposure to various shocks, including hail, flood, drought, wildfires and heatwaves, but also stressors including declining wage labour over time, was required.

After a comprehensive investigation of livelihoods frameworks, the SLF developed by the United Kingdom (UK) DFID was found to be the most applicable in the proposed study because it includes certain necessary elements for the analysis of livelihoods, such as adaptive and coping strategies pursued against stress and shocks. The DFID's SLF is also preferable to other frameworks by virtue of the mainstreaming of its fundamental principles and holistic approach to initiating support activities in collaboration with issues of direct relevance to improving people's livelihoods and hence poverty reduction (Ashley & Carney 1999; DFID 1999; Krantz 2001). That is, a broader and systematic approach is taken which considers all functioning components of the framework as equally important in establishing a sustainable livelihood. In effect, this framework includes all elements for a comprehensive livelihoods analysis, except for a relationship between vulnerability and hazards. Consequently, the PAR model was used to overcome this shortcoming.

## **1.3 RESEARCH PROBLEM**

The Langkloof is one of the most prosperous deciduous fruit farming areas in South Africa. Unfortunately, the area suffers from continuous environmental shocks and social stress in conjunction with an apparent lack of state support. These circumstances have had significant impacts on many farmers' livelihoods, regardless of hazards differentially affecting farmers' livelihoods. Farmers in the



Langkloof do not all have the same access to asset resources and reserves, therefore affecting their capacities to cope and adapt to adverse conditions. Even though farmers in the region are, on average, exposed equally to hazards, SSF cannot adapt and cope in the same manner as MSF or LSF due to the former's limited resources. This differential ability to cope with and bounce back from disaster events represents a significant developmental concern in the area.

## 1.4 STUDY AREA

A key informant noted that the Langkloof region, known as the 'Valley of a Thousand Vistas', is a 169-km long valley situated in the EDM, southern Cape, that this area is a paradise for nature lovers and ecotourist and also part of Route 62 (R62), the world's longest wine route. The area covers approximately 7 000 ha, across the Eastern Cape and Western Cape provinces of South Africa. The area is situated between the Kammanassie and Kouga mountains to the north and Langkloof, Tsitsikamma and Kareedouw mountains to the south, where the long valley is formed between Herold north of George and Humansdorp in the south. The Langkloof is bordered by a range of hills running parallel to it. The kloof is thus divided into northern and southern sections, the latter being known as the Klein Langkloof which is the main apple-growing area.

In reference to the area's high agricultural productivity, partly due to the average annual rainfall of about 710 mm (Köppen & Geiger 2011), the Langkloof is also known as the "Big Apple of South Africa's agricultural industry." Uniondale's climate, which is indicative of the Langkloof, is classified as warm and temperate. According to Köppen and Geiger (2011), with an average temperature of 15.4°C, this climate is classified as Cfb which means a marine- mild winter climate with evenly distributed precipitation throughout the year. In these climates the average temperature of every month of the year is less than 22°C, at least four months have an average temperature greater than 10°C and the average temperature for the coldest month lies between 18°C and -3°C (Köppen & Geiger 2011).

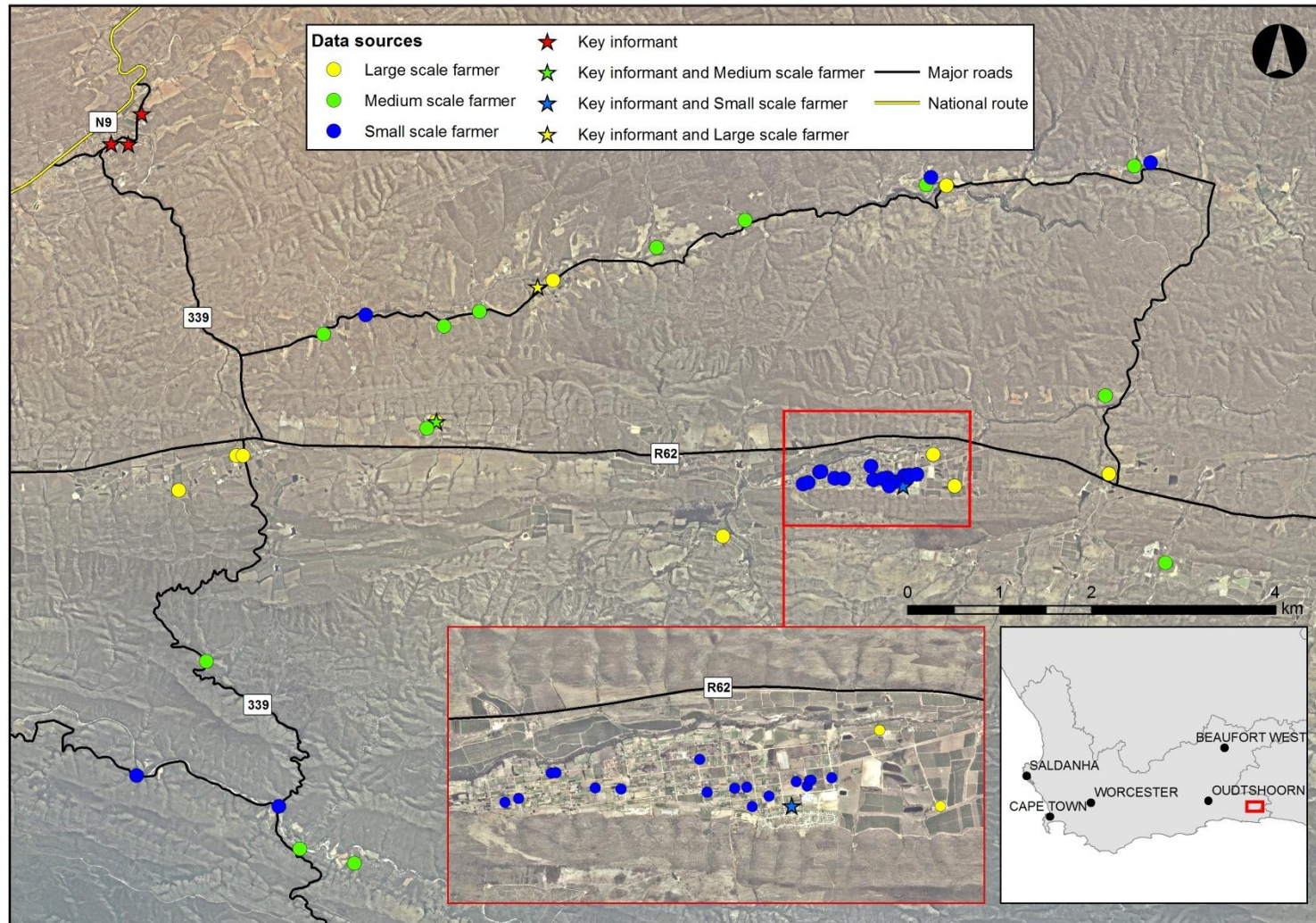
Regarding the demographics of the George Local Municipality (GLM), within which the Langkloof is situated, the population growth of 29.6% from 2001 to 2011 is similar to that of the Western Cape's (28.7%) (Statistics South Africa 2011). For the same period the unemployment rate for the GLM has dropped by 7.1% whereas that of the Western Cape has only dropped by 4.8%. Even though any decrease in the unemployment rate is positive, the rate thereof in GLM is amongst the highest in the Western Cape. This substantial drop may indicate concerted efforts towards increasing employment opportunities in the GLM. In 2011 the average household size for the GLM and the Western Cape was 3.4 people. The number of households in the GLM with no access to piped water and no refuse removal is amongst the highest of all the municipalities in the Western Cape. The GLM's dependency ratio of a 48.6 people per 100 people for 2011 is marginally higher than that of the Western Cape



(45.0). Regarding school attendance (aged 5-24) the GLM's percentage increase from 2001 to 2011 has been 13.2% whereas that of the Western Cape has been 9.4%. In 2011 the average household incomes for GLM (R114 483) is lower with that of the Western Cape (R143 461), which may put increased stress on a household especially seeing that both the GLM and the Western Cape have the same average household size (3.4) and the GLM has a higher dependency ratio than the Western Cape which affects the distribution of those dependants in the household. The same can be said of refuse removal and access to piped water. Though average household size for the GLM and the Western Cape is the same and population growth rates are also similar, the former has amongst the lowest levels of refuse removal and access to piped water. This shortcoming of service delivery may increase the stress placed on a household.

The deciduous fruit industry in this region is dependent on the capacity of on-farm storage dams to collect enough water during the rainy season for irrigation of orchards during the dry season. Production of deciduous fruit for the export market is the region's primary economic activity, with secondary industries and businesses linked either directly or indirectly to fresh fruit production (Hortgro 2013). The Langkloof is currently responsible for the second largest volume of deciduous fruit production in South Africa (Hortgro 2013). Furthermore, up to 45% of Haarlem's residents are dependent on employment on surrounding farms (Holloway et al. 2012). But the area is significantly hazard prone as is patently evidenced by the several hazards that afflicted the valley over the study period with detrimental consequences for many farmers' livelihoods and consequently their coping and adaptive strategies to counter these threats.

Figure 1.2 displays the location of Uniondale (through which the N9 road runs and where three key informant interviews were conducted, indicated with red stars. Haarlem is blocked in red and enlarged to show the location of a number of SSF and one key informant who also is a SSF. The R339 leads from Uniondale to Avontuur and joins the R62 which is known as the Langkloof road. The R62 runs east ward to Haarlem and ultimately to the Eastern Cape. The R339 continues from Avontuur southbound to Knysna and cuts through the area known as De Vlugt. The discussion on the study area is concluded by Figure 1.2 which is followed by the aim and objectives set for this study.



Source: Centre for Geographic Analysis (2014)

Figure 1.2 The study area, Langkloof

## 1.5 AIM AND OBJECTIVES

The aim of the study was to assess the livelihoods of LMSF in the Langkloof area with emphasis on the adaptive and coping strategies applied during periods of severe environmental shocks and social stresses. The purpose was to do a comprehensive livelihoods analysis using the SLF developed by the DFID (1999), followed by a comparison of LMSF regarding the various components of the framework as well as a correlation analysis of the farmers' adaptive and coping strategies adopted during periods of environmental shocks and social stress. To reach the aim the following objectives were pursued:

- Identify each environmental and social hazard in the Langkloof and assess magnitude of each hazard.
- Determine the livelihood components of farmers according to the DFID SLF.
  - Compare LMSF regarding their livelihood characteristics.
  - Draw conclusions from the comparisons made of the livelihood characteristics of LMSF.
- Identify and distinguish the adaptive and coping strategies of LMSF during times of environmental shocks and social stresses.
  - Compare LMSF regarding their in terms of adaptive and coping strategies during times of environmental shocks and social stresses.
  - Draw conclusions from the comparisons from of the LMSF regarding their adaptive and coping strategies.
- Calculate the correlations between total weighted assets accumulated by each household and the coping and adaptive strategies employed against environmental shocks and social stresses.
  - Weight the assets of each household using PCA.
    - Scale each indicator.
  - Determine the average number of household coping and strategies employed against severe environmental shocks and social stresses.
  - Establish the significance of Spearman's rank correlation coefficients by using the Spearman rank correlation graph and critical correlation values.

An overview of the methods employed in this study to reach the above objectives and aim is mentioned below.

## 1.6 OVERVIEW OF METHODS

The multicausal nature of livelihood stresses and shocks presented the challenge of gathering information to reveal the farmers' livelihood characteristics, the hazards faced and the processes in the

external environment affecting livelihoods. Consequently a rural livelihoods assessment methodology was followed consisting of qualitative and quantitative data-collection techniques. The research comprised three stages. First, a literature review provided a background to the study and informed the hazard and socio-economic profiles of the Langkloof. Second, in-depth interviews were conducted with key stakeholders. The third phase involved a quantitative and qualitative questionnaire survey of local farmers. The purpose of the qualitative study was to gain insights into the nuances of the community and the general livelihoods of farmers in the Langkloof. The quantitative study aimed to assess the livelihood capitals and characteristics as well as the adaptive and coping strategies of farmers during periods of environmental shocks and social stresses. A mixed-method design was employed to aid synthesis. The qualitative and quantitative data collection was conducted in accordance with the specifications of the DFID SLF. A comprehensive understanding of the relationships between hazards and vulnerability was gained by applying the PAR model developed by Wisner et al. (2004). PCA was conducted to investigate the farmers' asset resources.

The first chapter provided a background to the study, a conceptual framework, the research problem at hand, the extent of the study area, the aim of the study along with its objectives and finally an overview of methods employed to reach the objectives of the study and ultimately the aim. The following chapter represents a review of the literature that provides a background to the study and also an understanding of the necessary concepts. Clusters of literature discussed include farming in South Africa, disaster risk theories, sustainable livelihoods theories and coping and adaptive strategies against environmental shock and social stress.



## CHAPTER 2 LITERATURE REVIEW

A literature review was conducted to provide a background to the study, inform the study and illustrate the relevance and importance of the research in the field of disaster risk studies. The relevant clusters of literature were identified, among others, as:

- Farming in South Africa
- Disaster risk theories
- Sustainable livelihoods theories
- Adaptive and coping strategies against environmental shock and social stress

### 2.1 FARMING IN SOUTH AFRICA

Since the dawn of democracy in 1994, the South African agriculture industry has been characterized by profound economic and political changes with strong connections with its past, which is rooted in slavery, apartheid and authoritarianism (Hall et al. 2013; Schweitzer 2008). In this light, black farm workers whose labour was responsible for the construction of the foundations of a prosperous agricultural industry, still belong among the most marginalised groups in post-apartheid society. A number of state and non-state role players presently however are attempting to improve the economic and social positions of farm workers in South Africa (Schweitzer 2008).

In support of B-BBEE (broad-based black economic empowerment) (previously known as black economic empowerment (BEE)) the South African land reform policy is a redistributive pillar. The third leg of land reform is land tenure reform, which aims to increase the land rights of farm workers, labour tenants and residents in ‘communal areas’ under ‘traditional’ systems (Claassens & Cousins 2008). B-BBEE projects “are based on partnerships between white farmers, farm worker communities and complex networks of participants, ranging from state agencies to non-governmental organisations, international organisations, businesses and private individuals” (Schweitzer 2008: 31). The mobilization of these participants and their resources empower farm workers to become land and business owners, where other economic, educational and symbolic benefits are received. While these projects demonstrate how marginalized black farm workers become active farmers, they also show a series of shortcomings of which the foremost is that the ‘new black farmers’ do not obtain real autonomy (Schweitzer 2008).

According to Herskovitz (2011) land reform is currently widely acknowledged as being on a ‘road to nowhere’. Claassens & Cousins (2008) further state that the new legislation and policies of land reform have generally failed to achieve the aim of land tenure reform which involved the land rights of farmer workers, labour tenants and residents in ‘communal areas’ under ‘traditional’ systems. Apart from the failures in legislation and its implementation, Sachs et al. (2004) state that

sustainability and productivity regarding irrigation practices are lacking in southern Africa which is currently compromising the improvement of livelihoods of smallholder farmers. Nonetheless, progress to date with B-BBEE in the Langkloof involves:

- 22 B-BBEE projects
  - About 134 farm workers constitute the Misgund East Farm Workers Trust where they own a 35% share (R28 million) of the Koukamma pack-house.
  - The Haarlem Bakery
  - Langkloof Bricks
- 1 538 Beneficiaries (12.2%)
- 5 389 ha have been transferred
- 820 ha of orchards have been transferred (11.7%)

In general, black farm workers in South Africa are one of the most marginalised social groups in post-apartheid society, which is evident in their income levels being the lowest in the formal economy (Ewert & Hamman 1999). Those who are permanently employed or whose relatives are permanently employed usually stay on the farm in housing provided by the farmer. The quality of housing largely depends on the attitude of the farmer and ranges from “decent to scarcely fit for human habitation” (Ewert & Hamman 1999: 217). The low education levels of contemporary farm workers, rooted in Apartheid policies further indicate their marginal position in society (Silolo & Oladele 2012).

According to Hoffmann (2013) South Africa is largely self-sufficient regarding food production, although approximately 14 million people are vulnerable to food shortage primarily due to poverty and a lack of infrastructure. Less than 12% of land in South Africa is arable, with continuous threatening environmental hazards including hail, floods, drought and climate change as well as social hazards including HIV/AIDS (Hoffmann 2013). Vink & Van Rooyen (2009) provide a typology of the agricultural sector in South Africa (Table 2.1). It is indicated that farming scale is defined by turnover, ownership and management, and therefore size of land holding is not considered. For purposes of this study, only the three relevant (large commercial on private land, medium commercial on private land and small commercial on private land) categorisations were included. Other categories include commercial in communal areas, ‘emerging’ commercial in communal areas and subsistence farmers in communal areas. As the last mentioned are not relevant to the farming types in the Langkloof, neither inclusion in the table nor explanation is necessary.

Table 2.1 Partial typology of the agricultural sector in South Africa

<b>Production unit</b>	<b>Turnover</b>	<b>Ownership and management</b>	<b>Number</b>	<b>Binding constraints</b>	<b>Support required</b>
Large commercial on private property	>R2 million/annum	Family owned but incorporated multiple farms. Rent in land-professional management	±5 400	Market size. Equity capital	Export market access. Financial market innovation
Medium commercial on private property	R300 000-R2 million	Family owned, could be incorporated. Some renting in of land-family management	17 000	Land capital management	Mortgage capital for land access. Management training
Small commercial on private property	<R300 000	Family owned, generally part time. Some lifestyle farming (game ranches, weekend farms)	24 000	Management time	

Source: Adapted from Vink &amp; Van Rooyen (2009)

According to Bernstein (2010) and DAFF (2013) post-apartheid agricultural policies reinforce the deregulation thrust of the 1980s, because dramatic restructuring in the form of consolidation is being produced in which the number of large farms has already declined by a third from about 60,000 in 1996 to just under 40,000 by 2007 as indicated by Table 2.2. By 2005, the agricultural workforce was estimated at about 628,000, down nearly a third from 921,000 in 1994 (Department of Agriculture 2008).

Table 2.2 Large scale farm units in South Africa

	<b>W-Cape</b>	<b>N-Cape</b>	<b>Free State</b>	<b>E-Cape</b>	<b>KZN</b>	<b>Mpu.</b>	<b>Lim.</b>	<b>Gaut.</b>	<b>North West</b>	<b>Total</b>
<b>2007</b>	6653	5128	7473	4006	3574	3523	2934	1773	4902	39 966
<b>2002</b>	7185	6114	8531	4376	4038	5104	2915	2206	5349	45 818
<b>1996</b>	9759	6730	11272	6338	5037	4675	7273	2342	7512	60 938

Source: Hoffman (2013)

Focussing on the study area Table 2.3 displays the demographic and socio-economic information of the George Local Municipality area. Notably, there has been an improvement in all indicators over time except for the number of female headed households which increased by 2.1%, and housing owned/paying off which decreased by 1.9% from 2001 to 2011.

Table 2.3 Key demographic and socio-economic features of George Local Municipality, 2001 and 2011

Key Indicator	2001	2011	% change
Total population	149 436	193 672	30.0
Young (0-14)	28.9%	26.3%	2.6
Working age (15-64)	67.3%	67.3%	
Elderly (65+)	5.3%	6.4%	1.1
Dependency ratio	51.9%	48.6%	3.3
Sex ratio	95.9%	96.9%	1.0
Population	4.4%	2.6%	1.8
Population density	no data	37 persons/km <sup>2</sup>	
Unemployment rate	27.8%	20.7%	7.1
Youth unemployment rate	34.5%	27.6%	6.9
No schooling aged 20+	8.4%	3.9%	4.5
Higher education aged 20+	9.7%	11.6%	1.9
Matric aged 20+	23.9%	29.1%	5.2
Number of households	38 867	53 551	37.8
Average household size	3.7	3.4	8.1
Female headed households	31.1%	33.2%	2.1
Formal dwellings	80.9%	83.9%	3.0
Housing owned/paying off	50.9%	49%	1.9
Flush toilet connected to sewerage	75.9%	82%	6.1
Weekly refuse removal	82.2%	88.1%	5.9
Piped water inside dwelling	58.5%	70.3%	11.8
Electricity for lighting	86.7%	91%	4.3
Negative % change from 2001 to 2011			
Positive % change from 2001 to 2011			

Source: Adapted from Statistics South Africa (2011)

Regarding fruit cultivation in the Langkloof the two dominant deciduous fruit types cultivated are apples and pears (Figure 2.4). Together the two contributed 30% to the total number of fruit trees in the country in 2012. Measured by area (ha) under cultivation, apples and pears in Langkloof were responsible for almost 35.5% of the country's total in 2012. These figures confirm the important role of the Langkloof in the country's deciduous fruit industry. The Langkloof currently produces the second largest deciduous fruit crop in the country (Hortgro 2013). Table 2.4 also reveals the variety of deciduous fruit types cultivated in the Langkloof although their shares in the country's plantings are not substantial.



Table 2.4 Deciduous fruit tree plantings in the Langkloof for 2012

<b>Deciduous fruit type</b>								
<b>Number of trees</b>	<b>Apples</b>	<b>Pears</b>	<b>Apricots</b>	<b>Dessert peaches</b>	<b>Cling Peaches</b>	<b>Nectarines</b>	<b>Plums</b>	<b>Prunes</b>
Langkloof East	3 916 962	1 802 898	98 004	27 830	111 056	78 463	281 259	500
Langkloof West	576 511	123 010	33 202	4 250	15 410	23 787	64 327	
Total	4 493 473	1 925 908	131 206	32 080	126 466	102 250	345 586	500
Total of country	26 300 833	14 540 890	2 194 385	1 627 433	4 876 964	2 785 308	8 318 590	222 254
% of country	17.1	13.2	6.0	2.0	2.6	3.7	4.2	0.2
<b>Area (ha)</b>								
Langkloof East	4 060	1 602	148	28	114	64	218	1
Langkloof West	524	122	55	4	17	11	41	
Total	4 584	1 724	203	32.6	131.1	75	259	1
Total of country	22 166	11 700	3 230	1 692	5 884	2 140	4 814	307
% of country	20.7	14.7	6.3	1.9	2.2	3.5	5.4	0.3

Source: Adapted from Hortgro (2013)

In terms of the period 2006-2012 in the Langkloof, SSF were unfortunately particularly badly affected, mainly due to the lack of asset resources, especially financial assets and reserves to cope with external stressors and shocks. Many large and MSF who have the capital means are able to resort to micro irrigation which require a huge initial capital investment but prove an effective longer-term option (Holloway et al. 2012).

According to a number of local SSF, orchards perished during the drought while crops died due to the heat and animals were lost due to the farmers' inability to provide fodder. Although the state provided fodder relief, all farmers were required to pay 10% of that cost themselves to qualify, of which many were unable to do so.

## 2.2 DISASTER RISK THEORY

Two of the most widely recognized frameworks for understanding the interaction between vulnerability and hazards in the disaster risk field are the pressure and release (PAR) model developed and discussed by Wisner et al. (2004) and Pelling's (2003) vulnerability framework based on Chambers & Conway's (1991) views on vulnerability. Risk is defined by the United Nations International Strategy for Disaster Reduction Secretariat (UNISDR) (2009a: 12) as "the combination

of the probability of an event and its negative consequences” while Wisner et al (2004) explains that disaster risk is a combination of a natural hazard and people living with varying vulnerability to a specific hazard. Therefore risk is present where people are temporary and spatially exposed to a hazard.

Importantly, hazards can increase disaster risk, but they do not ‘cause’ disasters. A complex relationship hence exists between hazards and vulnerability and risk is a product thereof (Wisner et al. 2004). One can only be vulnerable if one is threatened by a hazard and one can only be threatened if one is exposed and vulnerable, therefore neither hazards nor vulnerability can exist independently (Cardona 2004). Disasters occur when “a significant number of people experience a hazard or suffer severe damage and/or disruption of their livelihood systems in such a way that recovery is unlikely without external aid” (Wisner et al. 2004: 50). In South African an event is declared a disaster once the severity and impacts exceed the ability of the local municipality to respond, hence requiring higher levels of government to assist.

The premise of the PAR framework is that a disaster is the result of two opposing forces, those that generate vulnerability and those that generate the hazard event (Wisner et al. 2004). The main feature of the PAR model is the progression in vulnerability, as illustrated in Figure 2.2. The intersection of vulnerability and hazard causes a disaster. Figure 2.2 also shows a progression of vulnerability from root causes to dynamic pressures and further to fragile livelihoods and unsafe conditions which together progressively increase vulnerability. The PAR model focuses on macro-scale vulnerability factors, whereas Pelling’s (2003) concentrates on local, micro-scale problems. The following subsections will further discuss the abovementioned concepts regarding disaster risk theory namely vulnerability, hazards and then all the identified hazards in the Langkloof.

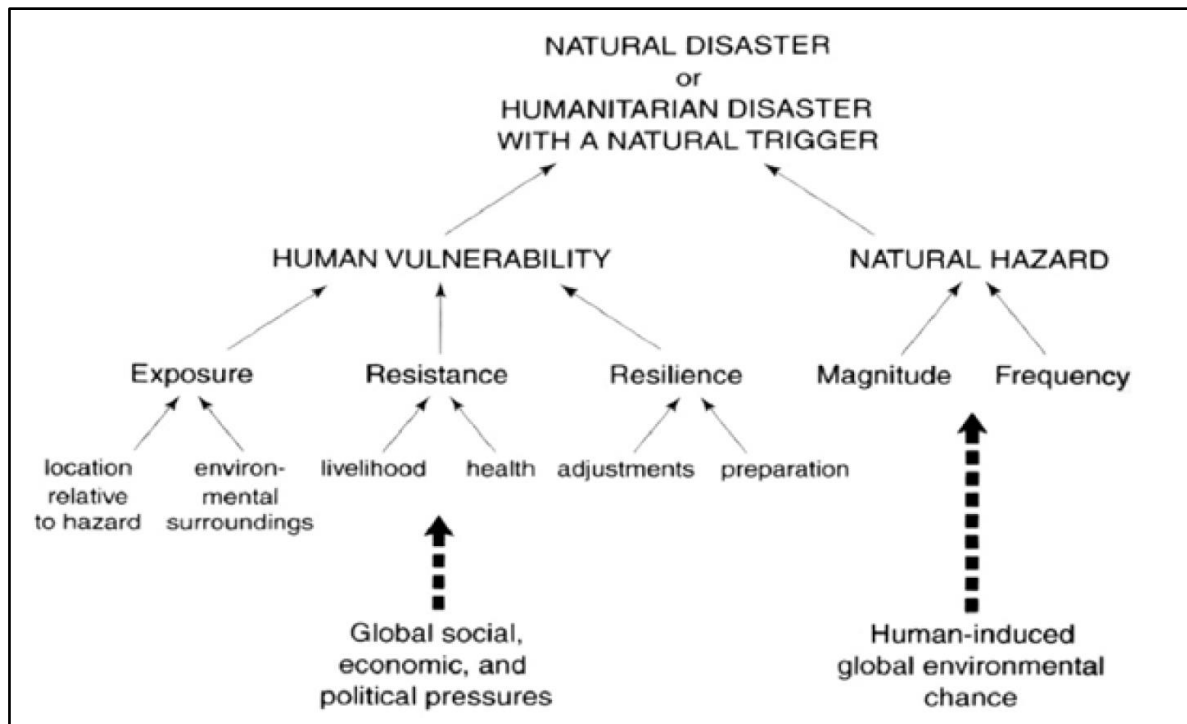
### **2.2.1 Understanding vulnerability**

According to Santha & Sreedharan (2010: 368) the definition presented by UNISDR is one of the most commonly accepted definitions of vulnerability which reads “the conditions determined by physical, social, economic, and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards.” Wisner et al. (2004: 11) interpret vulnerability as “the characteristics of an individual, a population or an organization and their situation that influences their capacity to anticipate, cope with, resist and recovery from the impacts of hazards.” Cannon, Twigg & Rowell (2003:5) defines vulnerability by a set of “characteristics of a person’s: initial wellbeing (nutritional status, physical and mental health), livelihood and resilience (assets and capital, income, and qualifications), self-protection (capability and willingness to build a safe home, use a safe site), social protection (preparedness and mitigation measures) and social and political networks and institutions such as social capital and other features in the institutional environment.”

Pelling (2003) on the other hand differentiates vulnerability into three contributing factors namely exposure, resistance and resilience. Earlier, Chambers & Conway (1991) had already introduced the first and last three components which they dubbed the twin attributes of vulnerability. Chambers & Conway (1991) further viewed vulnerability as having two features (external and internal), the former constituting stressors and shocks to which individuals and communities are subjected. This type of vulnerability can be reduced through public action such as flood prevention, disaster preparedness, prevention against diseases and off-season public works to provide employment (Chambers & Conway 1991). Internal vulnerability is the capacity to cope, 'defencelessness' or the lack of the means to cope without incurring damaging loss. Internal vulnerability is the agency level where households' adaptive and coping strategies can prove extremely valuable in decreasing the negative impacts of hazards. Internal vulnerability can be minimized only through private action in which a household adds to its portfolio of assets and repertoire of responses so that it can respond more effectively and with less loss. Rising vulnerability therefore encompasses both growth of external threats and diminishing capacity to deal with adverse events, reflecting compromising adaptive and coping strategies (Chambers & Conway 1991).

Pelling's (2003) formulations on human vulnerability are graphically illustrated in Figure 2.1. Pelling (2003: 48) characterized exposure as "the product of physical location to a certain hazard and the impact of the surrounding man-made and natural environments which can be reduced through individual or single household intervention or collectively through public-private initiatives such as social investment policy schemes." In light of Chambers and Conway's (2001) views, exposure can be regarded as an external factor which impacts on vulnerability. Resistance reflects the "capacity of an individual or group to withstand or adapt to the impacts of a hazard with an economic, psychological physical origin" (Pelling 2003: 48). The asset potentials of individuals or households are strong determinants of resistance. So, resistance can be regarded as an internal factor which influences vulnerability (Chambers & Conway 1991). Pelling (2003: 48) defines resilience as "the ability to cope with, adapt to or avoid hazards which is a product of the degree of preparation undertaken in light of a potential hazard, but also the short-term coping strategies implemented in response to a hazard." According to Chambers & Conway (1991) resilience is also an internal factor which influences vulnerability. Alexander (2013) on the other hand states that some perceive resilience as "new wine in old bottles" and addition of a new term to the discourse will not improve one's ability approach and solve complex problems associated with poverty, vulnerability, marginalisation and risk. It is further argued that one's resilience may be another's vulnerability.

Pelling (2003) concludes that all the components of vulnerability are shaped by access to rights, resources and assets. Assets which affect coping ability tend to be less common when vulnerability is already high, resulting in the ratchet effects of vulnerability.



Source: Pelling (2003: 48)

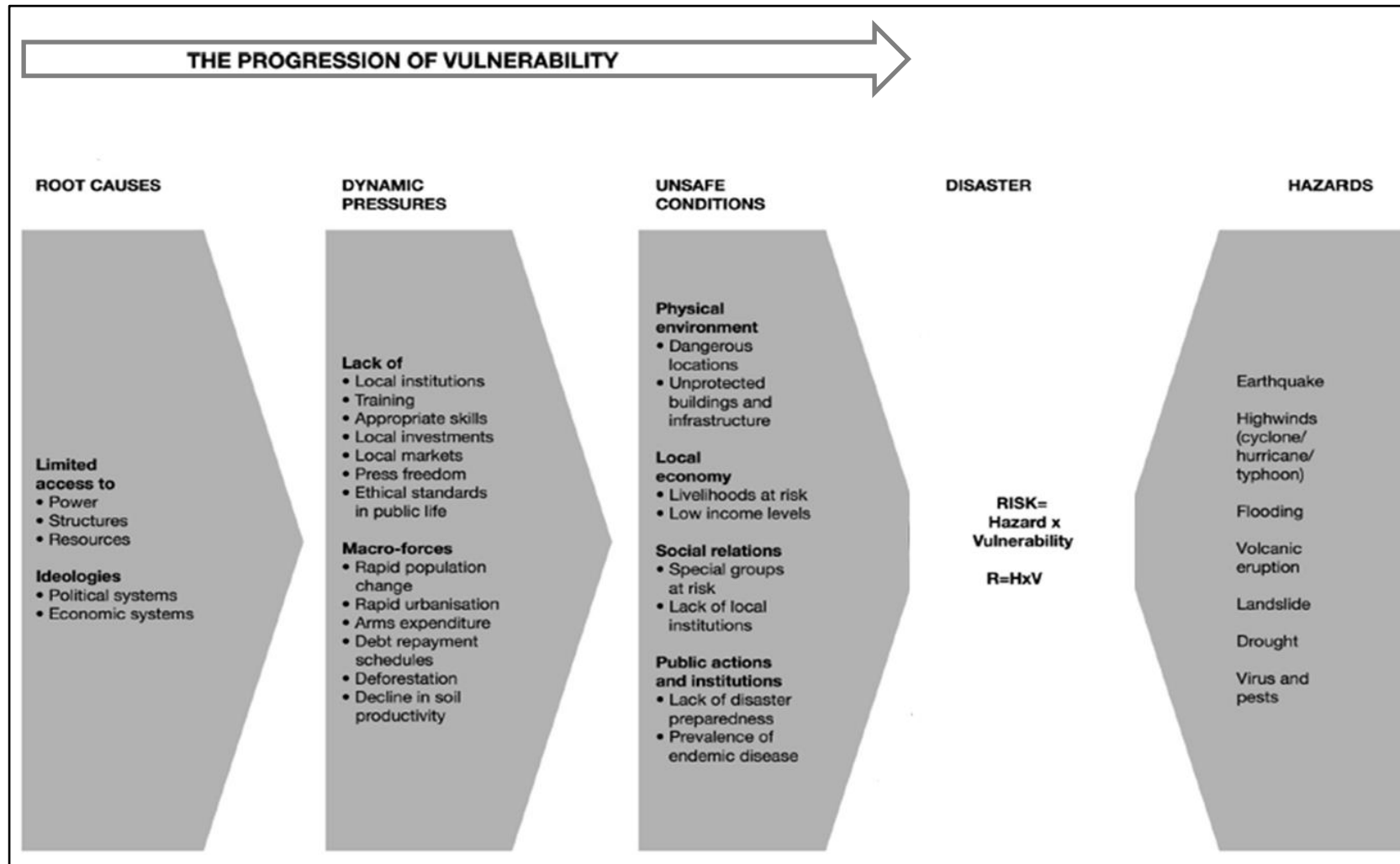
Figure 2.1 Pelling's model of vulnerability

The similarities between Chambers & Conway (1991) and Pelling's (2003) views on vulnerability are striking, the latter no doubt built on the work of the former. Pelling's model is, however, static and does not take into account changes to these factors over time (de Waal 2012). On the opposite side of the two above models hazards are found which together with vulnerability cause the possibility of disasters.

The IPCC (2014: 1048) provides another definition where vulnerability is "the propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt." It also states that a number of factors including wealth, social status, and gender determine vulnerability and exposure to climate-related hazards. One should notice that the IPCC makes a disconnect between vulnerability and exposure which is contradictory to other authors like Wisner et al (2004) and Pelling (2003) who consider exposure a function of vulnerability. Santha & Sreedharan (2010) state that there is a paradox because no precise and universal definition of vulnerability exists and the term is used differently, however Wisner et al (2004) were instrumental in the analysis of population vulnerability and therefore their PAR model had become prominent.

Vulnerability is an outcome of root causes- economic, demographic, environmental and political processes that affect the use and distribution of power in society. For example: power, structures and resources which may ultimately be quite remote from the disaster event may be responsible for

dynamic pressures such as rapid urbanization, population change and rural/urban migration. Unsafe conditions are the ways in which the vulnerability of an individual or group of people is realized in time and space, in combination with a hazard. An example is living in dangerous locations with low income levels while engaging in dangerous livelihood strategies experiencing poor health and lacking disaster preparedness (Wisner et al. 2004).

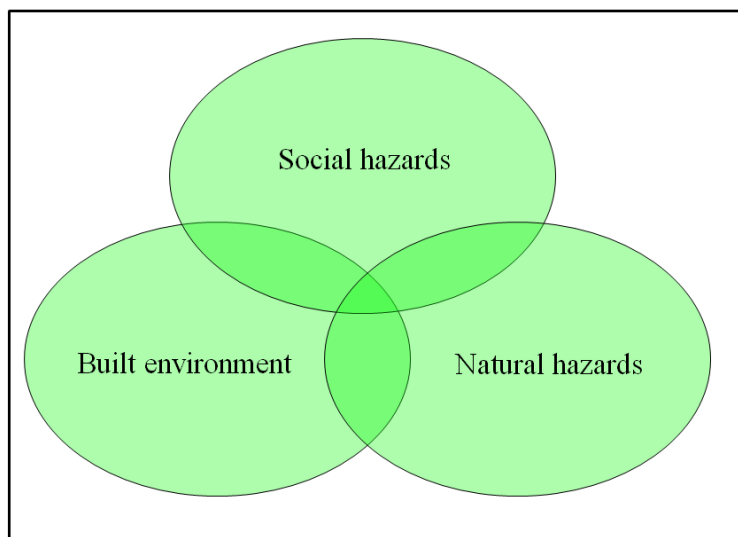


Source: Wisner et al. (2004: 51)

Figure 2.2 The pressure and release model

## 2.2.2 Understanding hazards

A hazard is a “potentially damaging physical or social event or action that may harm people, property, infrastructure or the environment” (UNISDR 2009b: 17). Hazards can have a slow onset such as a drought or a sudden onset such as a cut-off low. Hazards can be natural such as a cut-off low or human-induced (social) such as labour strikes in the agricultural industry (see Figure 2.3). According to Wisner et al. (2004) hazards can be present singularly (only social such as xenophobia) or in combination with each other (natural, social and the built environment such as rising sea levels where the natural environment threatens the built environment where urban spaces are located and therefore can also disrupt the social functionality of that settlement). Hazards can have affect at different times (season of the year, time of day, over return periods of different duration) while also to varying degrees of intensity and severity (Wisner et al. 2004).



Source: Adapted from Pharoah (2013)

Figure 2.3 Interconnectedness of social hazards, natural hazards and the built environment

In the following subsections the nine types of hazard that were experienced in the Langkloof during 2006 to 2012 are considered in turn. The subsections that follow will discuss the hazards relevant to the Langkloof namely drought (meteorological, agricultural, hydrological and socio-economic), flooding, hail, wildfires and heatwaves.

### 2.2.2.1 Drought

According to UNISDR (2009a: viii) drought is a “deficiency of precipitation over an extended period of time, usually a season or more, which results in a water shortage for some activity, group, or environmental sectors.” The agricultural sector is normally affected first but eventually many sectors of society are influenced. In southern and eastern Africa drought, which is a ‘creeping emergency’

rather than a sudden-onset event, is considered the most significant natural threat (Sakulski 2002). South Africa is a water-scarce country with an economy that relies heavily on the agricultural sector, therefore magnifying the country's vulnerability to the drought hazard, especially in vital deciduous fruit-producing areas such as the Langkloof. The below-average and late rain received in the 2003/2004 season resulted in critically low levels of water availability in eight provinces. According to the Department of Agriculture (2008) estimates, this drought resulted in a 4.4% decrease in gross farm income for the deciduous and viticulture industries. That decrease represents a 2.9% drop in the gross regional product for the Western Cape Province. The Department of Agriculture (2008) further indicated that the 67% loss in the horticultural sector was experienced by the deciduous fruit industry with the Deciduous Fruit Producers' Trust also suffering estimated losses in excess of R1 billion. These figures highlight the severe impacts drought is capable of causing.

Persistent drought conditions normally lead to focused attention on food security, specifically in developing countries and in agricultural-driven economies such as the Western Cape (Department of Agriculture 2008). Not only does the reduction in food production affect a community regarding its workforce and immediate dependants (those farming commercially and people living off the land) but also the markets they supply. Production of fruit for own consumption or export may drop dramatically, so posing a threat to the livelihoods of farmers. The drought hazard can be sub-divided into four categories, namely meteorological, agricultural, hydrological and socio-economic drought.

#### 2.2.2.2 Meteorological drought

A region-specific expression of a precipitation's deficit from the normal (over a period of time) is the first indicator of drought (Holloway et al. 2012; Jordaan 2012; UNISDR 2009a; Wilhite 2005). Muller et al. (2009) explain that a meteorological drought is a period ranging from a few months to several years or even decades of low rainfall compared with annual averages. Although no universal definition exists, this type of drought is defined by a "precipitation deficiency threshold over a certain time period" (UNISDR 2009a: 8). The reduction in rainfall is therefore compared to the specific average of an area over a specific period of time (UNISDR 2009a). This calculation is usually done using the standard precipitation index (SPI) or the standard precipitation evapotranspiration index (SPEI). In South Africa, the South African Weather Service (SAWS 2003) defines a severe meteorological drought as "less than 75% of normal rainfall", whereas 80% below average rainfall will significantly affect crops and cause water shortages which will have social and economic consequences (socio-economic drought). According to the UNISDR (2011: 56) a meteorological drought is a "climatic phenomenon rather than a hazard per se, but it is often confused with other climate conditions to which it is related, such as aridity." Meteorological drought only becomes hazardous when translated to agricultural or hydrological drought conditions, which depends on other factors, not just a lack of rainfall.



#### 2.2.2.3 Agricultural drought

An agricultural drought occurs after a meteorological drought but before hydrological drought conditions. This is a situation when “the amount of water in the soil no longer meets the needs of a particular crop, pastures and rangeland species” (UNISDR 2011: 57). That is, below average precipitation (75% below average) leads to an imbalance in the moisture content of the soil during growing season and therefore involves more than just a deficit in rainfall (SAWS 2003). An agricultural drought occurs when crop production and the ecology of agriculture are affected, usually as a result of poor management of water supply and poorly planned agricultural programmes concerning soil conditions and erosion so causing a shortfall in water available to crops and livestock, water-holding capacity and degree of evapotranspiration (Jordaan 2012; UNISDR 2009a; Wilhite 2005). Evapotranspiration is the combined loss of water to the atmosphere through evaporation and transpiration. Transpiration is the loss of water through the leaves of plants and evaporation is the loss of water from open waterbodies and the soil. The consequences of an agricultural drought include compromised natural and cultivated fields, fodder production and water supplies specific to a certain area, to the extent where the natural agricultural resources and livestock production are significantly affected with expectations of mortalities if livestock is not reduced and survival rations not supplied (UNISDR 2009b).

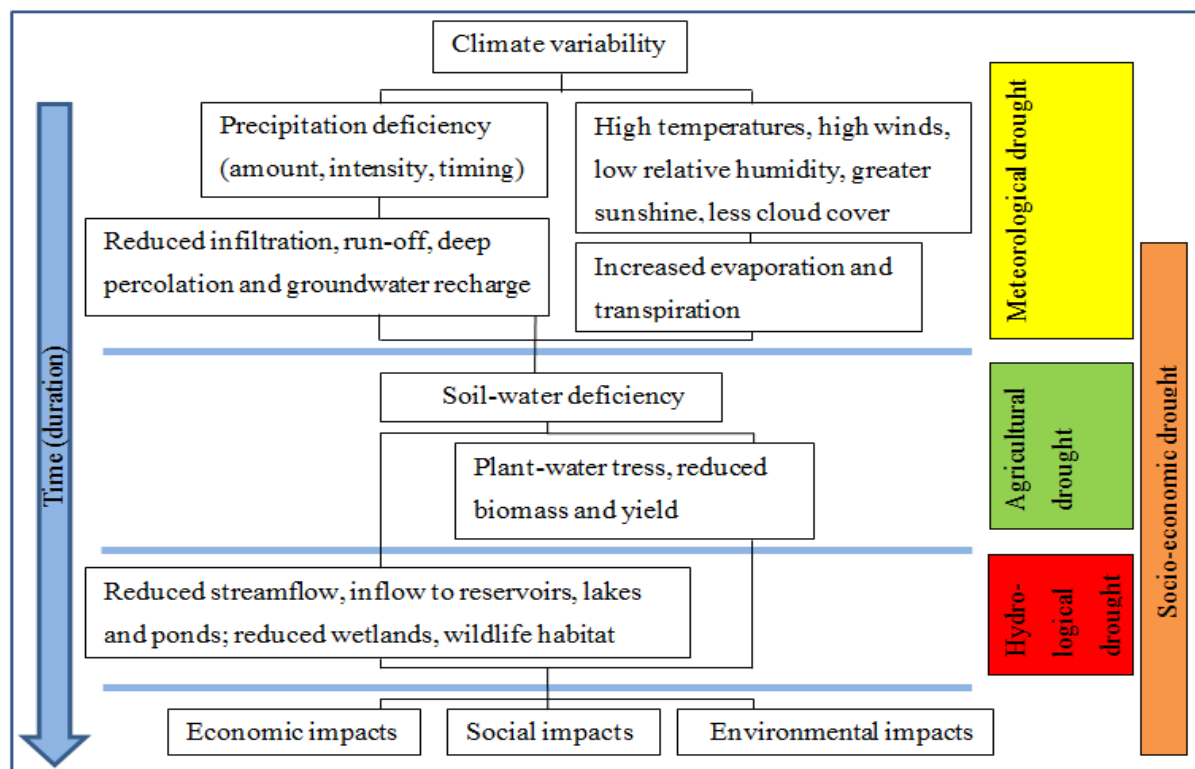
#### 2.2.2.4 Hydrological drought

Hydrological drought “occurs when below-average water levels in lakes, reservoirs, rivers, streams and groundwater adversely affect non-agricultural activities, such as tourism, recreation, urban water consumption, energy production and ecosystem preservation” (UNISDR 2011: 57). When reduced rainfall continues over an extended period, a decline (below average) of surface water (lakes, reservoirs, rivers, streams and groundwater) and subsurface water will be detected (UNISDR 2009a). Although all droughts originate with a deficiency of precipitation, a hydrological drought is concerned with the hydrological cycle, usually without a meteorological drought and an agricultural drought. This is because the precipitation deficiency initially takes a while (up to two months) to show in the hydrological components such as soil moisture, streamflow and groundwater (UNISDR 2009a). Apart from the obvious agricultural impacts, non-agricultural “activities such as tourism, recreation, urban water consumption, energy production and ecosystem conservation” are also affected and, in turn, affect the availability of surface water (UNISDR 2011: 57). Overconsumption or waste of water is consequently an unfortunate inevitability for the above non-agricultural activities.

### 2.2.2.5 Socio-economic drought

Socio-economic drought, also known as a famine drought, deals with certain conditions regarding the supply and demand of goods and services (Department of Agriculture 2008). When the demand for economic goods exceeds supply as a result of a weather-related shortfall in water supply, socio-economic drought conditions are experienced as a combination of economic, social and environmental impacts. Water shortages and consequent shortfalls, and agricultural production shortages start to directly impact on the activities of people, such as the delivery of urban water rather than just water availability. Ripple effects on economic systems become evident (UNISDR 2009a).

A drought framework was developed by the National Drought Mitigation Centre at the University of Nebraska, Lincoln which was adopted by the UNISDR for universal application (UNISDR 2009a). This framework, illustrated in Figure 2.4, explains the consequences of reduced rainfall (meteorological drought), reflecting agricultural effects in the form of soil-water deficiency, plant water shock, and reduced biomass and yield. The diagram illustrates how these effects lead to hydrological impacts including reduced streamflow, inflow to reservoirs, lakes, ponds as well as reduced wetlands and wildlife habitat. Socio-economic drought clearly results from meteorological, agricultural and hydrological droughts where humans experience economic, social and environmental effects due to an initial weather-related shortfall in water supply.



Source: UNISDR (2009a and adapted from Holloway et al. 2012)

Figure 2.4 Relationships between four different types of drought

According to Sivakumar et al. (2010) the progression of the drought process usually begins with a meteorological drought due to reduced rainfall. Due to increasing human influences, the drought typology changes, first generating agricultural, followed by hydrological drought effects. Socio-economic drought conditions eventually become apparent in the form of direct and indirect impacts on humans which are reflected in sectors relating to health and food security. Although meteorological drought is increasingly well characterized, the measurement of agricultural and hydrological drought remains a challenge with scientists acknowledging that drought assessment cannot be done by analysing precipitation, evaporation and transpiration alone (Gbetibouo & Ringler 2009; Wilhelmi & Wilhite 2002; Wisner et al. 2004). Furthermore, Chambers & Conway (1991) and Holloway et al. (2012) point out that insufficient attention has been given to identifying, let alone addressing the underlying risk drivers in drought, namely decreasing rainfall, climate variability and climate change; poverty and rural vulnerability; increasing water demand (urbanisation); inappropriate soil and water management; and weak/ineffective risk governance.

#### 2.2.2.6 Floods

According to Changnon (2005: 70) a society's vulnerability to flood damage is a "function of land use and value, human occupancy and demographics, and other commercial activities." The condition of a flood exists when the discharge of a river cannot be accommodated within the margins of its normal channel, so that the water breaks the riverbanks and spreads over the adjoining ground, known as the flood plain upon which crops of vegetation are able to flourish (Lutgens & Tarbuck 2010). Cut-off lows are among the main causes of damaging floods in South Africa (Holloway et al. 2012). Often settlements rely on rivers overflowing their banks to provide the necessary water supplies for flood plains where people cultivate their various crops.

The flood hazard in the Western Cape is quite severe. Between 2003 and 2008, six intense cut-off low systems in the area were responsible for heavy rainfalls in the Eden, West Coast, Cape Windlands and Central Karoo municipalities with flood losses estimated at approximately R221.6m and agricultural losses exceeding R103m as a result of two of these cut-off lows three weeks apart in August 2006 (Holloway et al. 2010). Capacity to withstand future exposures in the agricultural sector was consequently compromised and an intense cut-off low in November 2007 resulted in agricultural losses of R111.6m. This system further compromised on-farm water storage due to broken farm dams and severely increased farmers' cumulative vulnerability to the onset of a meteorological drought (2008-2009) followed by a hydrological drought (2009-2010) (Holloway et al. 2010).

In the Langkloof, rainfall induced flooding meant that fruit trees stood in water for days, so damaging their roots. The flooding also prevented access to orchards so that essential agricultural practices such as protective spraying were impossible. Dams were destroyed or damaged by the cut-off low-

triggered flooding which compromised available storage capacity for 2008 and, in effect, increased drought vulnerability.

#### 2.2.2.7 Hail

Hail consists of rounded lumps of ice which have an internal structure of concentric circles, “similar to an onion” (Lutgens & Tarbuck 2010: 146). These stones can range in diameter from a fraction of an inch up to four or five inches making them extremely dangerous to crops. This type of precipitation occurs only from cumulonimbus clouds, inside of which strong updrafts of air carry raindrops to high altitudes where they freeze into ice pellets which fall, rise again and grow repeatedly until they fall to the ground as hail (Lutgens & Tarbuck 2010). In 2006, 2008 and 2009 intense and extremely destructive hailstorms hit the Langkloof, damaging fruit trees and causing substantial financial losses.

#### 2.2.2.8 Wildfires

According to Underwood & Held (2011) wildfire refers to an unplanned fire in wilderness vegetation or bush, including grass fires, forest fires and scrub fires. The three primary classes of wildfires are “surface, crown and ground, which are determined by the types of fuels involved and the intensity of the fire” (Underwood & Held 2011: 281). “Surface fires typically burn rapidly at a low intensity therefore presenting little danger to mature trees and root systems. They burn the dead on live organic matter at or near the surface of trees with flames lengths usually below one meter (Paysen et al. 2000 & SKCMP). Crown fires generally result from ground fires and occur in the upper sections of trees (forest canopy), which can cause embers and branches to fall and spread the fire” (Underwood & Held 2011: 281 & SKCMP 2013). Ground fires are the most infrequent, which contain intense blazes, burn in the organic matter below, can destroy all organic matter in their path and therefore also devastating to agricultural land and livestock (Underwood & Held 2011 & Paysen et al. 2000).

There are three essential components of a wildfire: heat, oxygen and fuel (Underwood & Held 2011). For fires to ignite or continue to burn, all three elements must be present. Fuel is the only component that can be controlled by landowners or disaster managers. The reduction of fuel levels (prescribed burning) is indeed a common agricultural practice to reduce fire intensity, to ensure that fires spread less rapidly and consequently ensure less damage. According to a key informant, controlled fires are difficult to execute, due to ever-present fresh oxygen which cannot be controlled. Furthermore, heat cannot be effectively reduced in a wildfire even by dousing from helicopter watertankers and other belly-lifter, water-carrying aircraft, however rain helps. Firefighters in urban areas usually put out fires in structures with water that is readily accessible and available from fire hydrants and water mains, whereas for bushfires the large quantities of water needed to extinguish them are seldom available.

#### 2.2.2.9 Heatwaves

Temperature has a direct effect on all forms of life on earth and it affects a wide range of processes and activities from human comfort and consequent energy supply in the form of demand for heating and cooling, to crop and domestic animal responses, the incidence of pests and diseases as well as rates of evaporation (Whiting, Roll & Vickerman 2004). Temperature parameters such as daily and seasonal means, maxima and minima, optimal and daily ranges of temperature are vital controls by which nature limits, for example, the distribution of crops (Whiting, Roll & Vickerman 2004). The rate of respiration (the processes by which ‘food’ is used by a plant) increases with temperature. As maximum temperatures reach the upper limits for a given crop, the rate of respiration may exceed that of photosynthesis. Each crop therefore has an optimal growth range, for example apples have a maximum rate of photosynthesis at 20-30° C in most temperate zones and as high as 35° C in some tropical zones (Marais 2005; Whiting, Roll & Vickerman 2004).

The term ‘heatwave’ is used relative to the usual temperature conditions of an area, therefore many authors have restricted their interpretations to the general definition of a heatwave, that is a prolonged period of excessive heat where temperatures are well above normal, often combined with excessive humidity (Schulze & Maharaj 2006). Schulze & Maharaj (2006) have formulated three situations that are applicable to a South African context:

- Heatwaves are occurrences with maximum daytime temperature ( $T_{mxd} \geq 30^{\circ} \text{C}$ ) on three or more consecutive days; and
- Extreme heatwaves are either:
  - occurrences with  $T_{mxd} \geq 35^{\circ} \text{C}$  on three or more consecutive days, therefore a higher temperature threshold; or
  - occurrences with  $T_{mxd} \geq 30^{\circ} \text{C}$  on five or more consecutive days, therefore a longer duration threshold.

Heatwaves are usually associated with synoptic-scale anticyclonic (high pressure), circulation systems covering thousands of hectares in size and lasting for several days to weeks. Within such high pressure systems vertical air motion is generally downwards, resulting in adiabatic warming. Heatwaves are often linked with drought occurrence and in many cases the two phenomena are inseparably linked (Whiting, Roll & Vickerman 2004).

Another term, ‘heat shock’, is an increase in temperature exceeding a certain threshold over a period long enough to cause irreversible damage to plant growth and development (Makaredza 2011; Racskó 2010; Wahid et al. 2007). The duration of a heatwave is just as important as the exceeding of certain temperatures. Daily maximum temperatures and their duration will determine the occurrence of

heatwaves which effectively lead to heat shock and ultimately damaging sunburn, which has a fruit-type and cultivar-dependent threshold.

## **2.3 SUSTAINABLE LIVELIHOODS THEORY**

Livelihood perspectives focus on how people in different places live along with ensuring an understanding of their activities to sustain their well-being in the long term rather than just relying on short-term unsustainable solutions. This theme and its theories are pivotal to this study. This section outlines a broad historical background of livelihood theory and focusses on livelihoods in a South African context followed by a discussion on the value of a suitable SLF. A review of numerous livelihoods frameworks was done in order to determine which framework was the most suitable for the conceptualisation and analysis of this study.

The essence of the sustainable livelihoods approach (SLA) is how peoples' assets (access to, ownership of and use of) in the form of various 'capitals' (social, physical, natural, financial and human) enable them to achieve positive livelihood outcomes, which are the primary determinants of human well-being (De Haan & Zoomers 2005; Reid & Vogel 2006). Carney (1998) and Scoones (2009) suggest that a livelihood approach to be actor-orientated (human-centred) which departs from actual rural realities and focuses on the methods rural people pursue, particularly grassroots initiatives rather than top-down interventions, to ultimately improve their living conditions. In a pursuit of positive livelihood outcomes people change, adapt or combine their livelihood strategies over time as they adapt in response to changes in their surroundings or as part of longer-run systemic restructuring. People often may move to locations they perceive to offer better opportunities for better living standards. Rural areas involve a combination of agricultural and non-agricultural activities (Ellis 2000).

The term 'livelihoods' can be attached to a number of other words to construct different fields of development enquiry and practice (Scoones 2009). These relate to settings (rural or urban livelihoods), occupations (farming, pastoral or fishing livelihoods), social difference (gendered, age-defined livelihoods), directions (livelihood pathways and trajectories) and dynamic patterns (sustainable or resilient livelihoods). After the above background provided the next section discusses the historical background of sustainable livelihoods theory.

### **2.3.1 Historical background**

The connection of the three words 'sustainable', 'rural' and 'livelihoods' as a term suggesting a particular approach was probably first attempted in 1986 in Geneva during a discussion of the Food 2000 report for the Brundtland Commission. Involving MS Swaminathan, Robert Chambers and others, the report laid out a vision for people-orientated development, with a point of departure in the

rural realities of poor people (Swaminathan 1987). This was a strong theme in Chambers' writing and especially in his book *Rural development: Putting the last first* (Chambers 1983). Concurrently, through the initiative of Richard Sandbrook, sustainable livelihoods became a focus for a conference organized by the International Institute for Environment and Development in 1987. Following the strong advocacy for sustainable livelihoods approaches (SLAs) in development the early 1990s, Chambers & Conway (1991) and later Scoones (1998), Ashley & Carney (1999), Carney (2002) and Scoones (2009) and many development agencies started to promote livelihoods approaches as central to their programming and even organizational structures. Its early formulations as for example by Chambers & Conway (1991) emphasized several key aspects to compose a definition subsequently been adapted by Carney (1998) and Scoones (1998) to create the initial sustainable livelihoods framework (SLF) eventually adopted by the DFID, UNDP and other agencies.

A livelihood comprises capabilities, assets and activities required for making a living (DFID 1999; Hussein 2002). These components are captured in many variations of the SLF, including the DFID (discussed in detail later). Any satisfactory definition of livelihood sustainability must include the ability to avoid, or more usually, to withstand and recover from stressors and shocks. A livelihood is hence sustainable when it can cope with and recover from stressors and shocks and in the process maintain and enhance household capabilities and assets both now and in the future, while not undermining the natural resource base (DFID 1999). This definition is widely used and lies at the core of the livelihoods analysis. A more focussed approach is taken in the next section where livelihoods in a South African context are investigated.

### **2.3.2 Livelihoods in a South African context**

According to Leibbrandt et al. (2010) present-day rural livelihoods in South Africa are characterized by racialized and spatial legacies of poverty. Using a poverty line of US \$2/day, over 25 million South Africans were poor in 2000, with more than 95% of these poor being African (Leibbrandt et al. 2010). Poverty rates are lower amongst Coloured and Indian population groups, with Whites constituting one tenth of the population but less than 1% of the poor (Leibbrandt et al. 2010).

Moreover, South Africa's high levels of aggregate income inequality have increased during the postapartheid period, along with income inequality within the four main racial groups (Leibbrandt et al. 2010). Poverty in South Africa is not only widespread and persistent, but it is disproportionately rural with some 70% of the poor living in rural areas (May, Woolard & Clasen 2000). This disproportionality is clearly illustrated by the 2013 Human Development Report released by the UNDP where South Africa's GINI coefficient was at 63.1 for 2013 which is among the highest in the world. An index of 100 represents perfect inequality regarding income distribution or consumption expenditure among individuals or households within an economy (Donnelly 2013).



Impoverished rural livelihoods have always been and remain strongly associated with continuous mobility and migration that have long connected rural households to urban areas where enhanced opportunities and resources are assumed to exist (Neves & Du Toit 2013). Many rural households represent a combination of urban and rural geographical spaces because these households are often characterized by insecure household membership and diversified household income (De Haan & Zoomers 2005). One example is cash remittances from family members in urban areas. Household members living and earning away from their rural home constitute a livelihood source considered by Adams, Cousins & Manona (2000), Cousins (1999) and Shackleton, Shackleton & Cousins (2001) to be the main source of income in many rural areas. These characteristics, limited opportunities for low-skill employment, constrained agricultural livelihood activities and reduced prospects for asset accumulation affect the livelihoods' economic environment, but remain intertwined with social and cultural norms (Neves & Du Toit 2013).

A popular SLF used in a South African context is De Satgé's 'Learning about Livelihoods Framework' (LAL) (De Satgé 2002). In the face of South Africa's post-1994 aim of land reform the 1998 Policy Guidelines for Integrating Environmental Planning into Land Reform (PGIEP) programme were set in place by the Department of Land Affairs along with the Danish funding agency DANCED (De Satgé 2002). The LAL framework was then derived from the PGIEP programme and its principles. It essentially perceives a household to have capabilities and access to different assets to pursue different livelihood activities while this process is affected by various enabling influences and shocks and stresses at various levels (De Satgé 2002). The above sections put sustainable livelihoods theory in a certain context whereas the next section takes a turn and presents the value of a suitable SLF.

### **2.3.3 Value of a suitable sustainable livelihoods framework**

Rural livelihood analysis should be made from a logically tight conceptual perspective. The SLA offers a suitable entry point for such analysis (De Haan & Zoomers 2005; Ellis 2000; Scoones 2009). Literature searches reveal numerous references of livelihoods approaches, perspectives, methods and frameworks (Scoones 2009). According to Kritzing, Barrientos & Rossouw (2002) the SLA provides a significantly applicable analytical starting point for understanding the complexities of risk and vulnerability faced by farm labourers. Krantz (2001) has noted that a suitable SLF is necessary to illustrate the main elements that influence livelihoods as well as the relationships between them. One significant constituent of analyses is the five assets, namely human, social, physical, financial and natural. Economists often use income to measure wealth, whereas Moser & Felton (2007) argue that a total asset analysis may provide a better understanding of long-term livelihood standards than looking at income alone because assets have been accumulated over time and last longer. This approach is eminently applicable because it goes beyond simple income analysis to examine the broader socio-



economic and interdisciplinary nature of poverty, an environment in which people combine different activities to secure positive livelihood outcomes (Scoones 2009).

The SLA has, among other things, synthesized multidimensional perspectives on poverty. According to Scoones (2009) diversity is pivotal which is why livelihoods approaches have challenged fundamentally single-sector approaches to solving complex rural development problems. Livelihoods approaches enable a bridging of divides so allowing scholars to work together, particularly across the natural and social sciences to reach appropriate entry points in support of livelihoods (DFID 1999; Krantz 2001).

The SLA provides an understanding of the effects of poverty and well-being, especially people forced into insecure and fragmented forms of labour which, in turn demand alternative household adaptive and coping strategies. A suitable framework can serve with the dual purpose of planning new development activities and assessing the contribution made by existing activities to livelihood sustainability (Krantz 2001). A framework provides a checklist of important challenges to livelihoods in an area and the various influences and processes (internal and external) involved, but also the way in which they are linked (Jacobs & Makaudze 2012; Krantz 2001; Reid & Vogel 2006). Jacobs & Makaudze (2012) observe that an appropriate SLF is a practical research tool, based on participatory action research which combines easily adaptable methods of information collection to make sense of complex rural realities. It is difficult to observe reality and attempt to understand situations from local perspectives (Scoones 2009). SLFs are not intended to be exact models of reality; rather they provide a tool for analysis and a broad, systematic understanding of the various factors that influence livelihood opportunities. With their accent on understanding complex and local realities, livelihoods approaches are ideal for participatory approaches to development. The application of theoretical frameworks in practice is not simple because of inherited organizational forms, disciplinary biases and funding structures. Therefore a number of SLFs and SLA were assessed for their applicability to the Langkloof situation.

#### **2.3.4 Review of sustainable livelihood frameworks**

Carney (1998) and Scoones (1998) were responsible for the SLA's initial framework formulation which included all the functioning components, including different assets, institutions and organizations as well as livelihood strategies. The interactions of livelihoods components with one another, the influence of institutions and organization, and the role that adaptive and coping strategies play can all be investigated by this framework.

CARE's influential SLF framework was considered. CARE is an international NGO that uses the livelihoods approach as its primary planning framework (De Satgé 2002). CARE uses Chambers &

Conway's (1991) livelihood definition which identifies three fundamental attributes of livelihoods: human capabilities, access to tangible and intangible assets, and the existence and influence of economic activities. CARE's approach is similar to that of the DFID in that it emphasizes the dynamic interrelationships between different aspects of the framework. However, rather than assessing the 'five capitals' approach to assets, it distinguishes between assets, capabilities and activities. This is similar to Chamber & Conway's (1991) approach. The CARE framework does not explicitly identify 'transforming structures and processes' and places less emphasis on macro-micro links within the framework (De Satgé 2002; Krantz 2001). CARE's definition of household livelihood security emphasizes a capacity-building approach to development and relief activities so treating people more as active beings in constructing their own livelihoods than as passive recipients of external help. The framework stresses empowerment (personal and social) as fundamental to its approach (Drinkwater & Rusinow 1999; Krantz 2001).

Another global development network, the United Nations Development Program's (UNDP) SLF has received worldwide recognition. As one of the UNDP's corporate mandates, sustainable livelihoods offer both a conceptual and a programming framework for poverty reduction in a sustainable manner and in the process also strengthen the resilience of coping and adaptive strategies (Krantz 2001). Other key emphases of this approach are that:

- the focus should be on people's strengths, as opposed to needs;
- policy challenges (macro-micro links) and governance issues should be taken into account and addressed through specific actions; and
- sustainability is constantly assessed and supported (Carney et al. 1999).

The UNDP employs an asset-based approach, emphasizing the promotion of people's access to and sustainable use of the assets upon which they rely as central to poverty reduction. Coping and adaptive strategies are understood to be influenced by people's asset status but they also have implications for the composition of the assets which could be depleted or regenerated. Moreover, the UNDP specifically pays attention to the importance of technological improvements as a means to help people rise out of poverty.

Oxfam Great Britain is an independent development and emergency relief organization affiliated with Oxfam International which works in partnership with national and international NGOs to overcome poverty in more than 80 countries (Hussein 2002). Oxfam takes its definition of sustainable livelihoods from Chambers & Conway (1991) which stresses that sustainability needs to be addressed at from several perspectives, including economic, social, institutional and ecological.

Attention was also given to the Food and Agriculture Organization (FAO) of the United Nations which has the mandate "...to raise levels of nutrition and standards of living, to improve agricultural

productivity, and to better the condition of rural populations” (Hussein 2002: 18). Sustainable livelihood principles are visible in one of FAO’s core aims to address sustainable rural livelihoods and more equitable access to resources. The United Nations’ World Food Programme (WFP) is also relevant. The WFP addresses vulnerability and food insecurity in politically stable and unstable environments. Its interest in SLA is rooted in its enabling development (ED) policy directive introduced in 1999. This identified a role for WFP in providing food aid for development as well as in emergencies. The starting point is the recognition that poor, marginalized and starving people are the least able to benefit from mainstream development. The ED policy tries to address this exclusion by using food aid as a temporary measure, enabling the chronically poor to escape the hunger trap, invest in assets and human assets, and take advantage of broader development opportunities, thus generating more sustainable livelihoods. Although ED is not explicitly a SLA, the core principles of the policy and the approach are similar, namely:

- A people-centred approach coupled with the use of participatory approaches for programme design and implementation.
- A focus on enabling the poor to access, preserve and invest in assets, notably physical and human assets.
- The understanding the different dimensions of vulnerability.

The International Fund for Agricultural Development (IFAD) uses a sustainable livelihood approach worthy of consideration. Their mission is to enable the rural poor to overcome their poverty. IFAD believes that this can be achieved only through partnerships with the shared purpose of promoting conditions in which the poor can use their own skills and talents to work their way out of poverty. IFAD’s strategic framework draws on SL principles, including partnership, participation, building on people’s existing skills and livelihood strategies. The framework also emphasizes access to assets and the need to ‘enable enablers’.

In contrast to the above approaches, the World Bank has neither explicitly adopted nor institutionalized a SLA. Its approach to development has, however, been informed, as in the case of many other development agencies, by Chambers’ work on participation and Chambers & Conway’s (1991) work on livelihoods. In the early 1990s the World Bank’s Participation Learning Group highlighted core principles in a participatory survey, *Voices of the Poor*, which are compatible with those of the SLA. These principles include poverty reduction by addressing vulnerability and assets, empowerment and opportunities (Hussein 2002).

Khanya-aicdd, based in Braamfontein, Johannesburg, South Africa was first established in 1998 as Khanya-managing rural change (Khanya-mrc) and dedicated to change management in the rural sector in the Free State province in South Africa. The organization wanted to increase its impact and

therefore had to grow which then led to Khanya becoming the African Institute for Community-Driven Development in February 2006. It currently uses an adapted version of the DFID SLF and emphasizes the importance of linking local realities to central policies and institutions in its development interventions (Hussein 2002). It operates with government, business and civil society to promote sustainable livelihoods for the rural poor. Khanya's activities integrally employ many SL principles, namely its focus on governance issues; its use in structuring development plans, poverty strategies, social management plans; and its use in project design and analysis and development of regional strategies.

The Society for International Development (SID) based in Rome was established in 1957. It is an international NGO with a global network of more than 6 000 individuals and organizations having a common interest in promoting participatory, pluralistic and sustainable development. Its core principles stipulate that local people are the main actors in social transformation; complementary actions are key; and that collective/individual empowerment requires social energy and political space and that micro-macro linkages must be examined. It works at local and international levels with local and international organizations, political leaders and development experts emphasizing the importance of civil society participation in development processes. SID developed a sustainable livelihoods action research programme in 1995 in which a SLA was used to analyse social change. According to Hussein (2002) this programme addressed two key issues namely how to strengthen and multiply grassroots initiatives and local innovations; and identifying institutional changes and policies that could support and strengthen SLA.

Save the Children (SC), based in the United Kingdom sees SLAs as valuable for describing livelihood systems and encouraging 'joined up' analysis of the multidimensional nature and causes of poverty. The household economy approach (HEA) complements the SLA and can be used to operationalize the SLF. HEA, and a more recent (still experimental) extension of HEA, the intra household model (IHM), enable users to quantify and model economic outcomes within the wider SLF. This model also analyses assets, capabilities and opportunities available to the poor (Hussein 2002)

The Learning about Livelihoods (LAL) framework is holistic and strongly people-centred which leads to targeted interventions. De Satgé (2002), the pioneer of this approach, followed Chambers & Conway's (1991) lead that households have capabilities and access to a range of assets which they use to carry out different livelihood activities. The more diversification there is in the livelihood strategies of a household, the more secure it is likely to be. Similar views are also shared on capabilities which are considered the same as 'human assets' in the 'asset pentagon' approach. By treating capabilities as a separate element, the significance of people in a livelihood is emphasized. The other four assets (social, physical, financial and natural) are clustered into two simple categories, namely social

(intangible) and material (tangible) assets as in the approach pioneered by Chambers & Conway (1991).

The different livelihood strategies result in a variety of outcomes which may have a greater or lesser degree of sustainability. The more desirable livelihood outcomes vary from household to household but increased well-being, such as more income, is usually a high priority. When a household is able to achieve a desired livelihood outcome, it impacts positively on its assets and capabilities and vice versa (De Satgé 2002). Local livelihood activities are affected by factors in the external (macro) environment, including the built environment such as buildings and roads; the natural environment such as earth; and the social, political/institutional and economic environments on local, national and international levels (De Satgé 2002). It is possible for a household activity to improve the well-being of the household on an individual level while having a negative impact on the external environment. A household may, for example, cut wood to sell for a cash income in an unsustainable manner which destroys the natural resource base and undermines the livelihoods of many other people. Central to this study is the use of DFID's Sustainable Livelihoods Framework. A description and critique of the framework is outlined below.

### **2.3.5 The United Kingdom's Department for International Development (DFID) sustainable livelihoods framework (SLF)**

Because the UK DFID SLF was applied in this study, it is discussed here in greater detail. The SLA concept and framework adopted by the UK DFID in the late 1990s has been adapted by many organizations to suit a variety of contexts, issues, priorities and applications and it is one of the most widely used frameworks globally (Ashley & Carney 1999; Carney 2002; Carney et al. 1999; De Satgé 2002; Drinkwater & Rusinow 1999; Krantz 2001). The SLA shifts attention from livelihood outputs to a people-orientated method for the exploration of poor people's own priorities. This approach also questions macro-micro links and it demands and facilitates cross-sectoral analysis. The distinctive objective of the DFID's SLF separates it from many other frameworks, namely to increase the agency's effectiveness in poverty reduction. This is accomplished by mainstreaming a set of core principles and a holistic perspective in the programming of support activities to ensure that these correspond to issues or areas of direct relevance for improving poor people's livelihoods (Ashley & Carney 1999; DFID 1999; Krantz 2001). A broader and systematic approach is taken which considers all functioning components of the framework as equally important in the establishment of a sustainable livelihood.

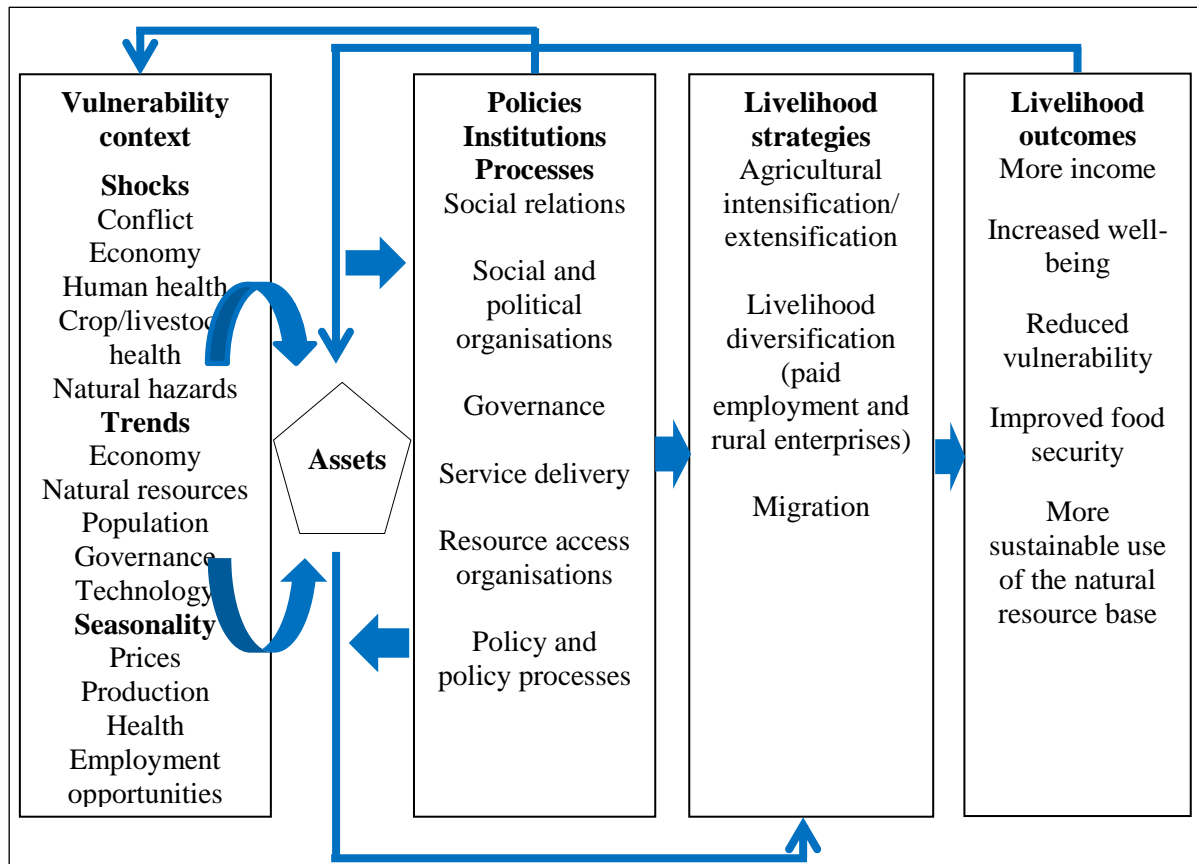
The framework is grounded in core principles which are poverty-focused and people-centred (Ashley & Carney 1999). People-centred principles entail responsiveness and participation from poor people as the key actors in identifying and addressing livelihood priorities (Ashley & Carney 1999).

Furthermore, this approach employs multilevel (micro and macro), sustainable (economical, institutional, social and environmental) activities (Ashley & Carney 1999). Such activities are also conducted in partnership with the public and private sectors (Ashley & Carney 1999). For this approach to be successful one must recognize the dynamic nature of livelihood strategies, be adaptive to peoples' circumstances and attempt to establish longer-term commitments (Ashley & Carney 1999).

The SLF is built on the early formulations of the SLA by Chambers & Conway (1991) which allows (like most other frameworks) for access to and ownership of assets- human, physical, natural, social and financial. Chambers & Conway (1991) singled out human capabilities which the DFID considers as human assets. Additional aspects of the DFID SLF are portrayed in Figure 2.5. These are the way in which people use assets to develop a range of activities, a position adapted by the DFID in the form of livelihood strategies; separating agricultural intensification and extensification; livelihood diversification including both paid employment and rural enterprises; and lastly migration where people might move away to search for better livelihood opportunities, either temporarily or permanently. Apart from the framework's ability to identify assets, capabilities and activities, it also stresses the role of the vulnerability context in which people strive for access to and ownership of assets to secure a positive livelihood, a quality few other framework address. The external environment, including policies, institutions and processes, is also included as a pivotal influence on livelihoods. Outcomes are included as objectives to be achieved to reach a livelihood that is more sustainable livelihood overall.

The form of the framework is not intended to suggest that the starting point for all livelihoods (or livelihood analysis) is the vulnerability context yields livelihood outcomes which through a series of permutations (Haidar 2009). Livelihoods are shaped by a multitude of different forces and factors that are constantly shifting. A people-centred analysis is therefore most likely to begin with simultaneous investigation of peoples' assets, their objectives (the livelihood outcomes they are seeking) and the livelihood strategies which they adopt to achieve these objectives. There are some important likely feedbacks between transforming structures and process and the vulnerability context; livelihood outcomes and livelihood assets and livelihood outcomes and the vulnerability context. An example of the latter is that often if people feel less vulnerable (outcomes), they are more likely to have fewer children which has implications on population trends (vulnerability context) (Ashley & Carney 1999; DFID 1999). The general idea is that if people have better access to assets they will be more able to influence structures and processes so that these become more responsive to their needs (Carney et al. 1999). The DFID therefore considers two important areas to promote effective contributions. The first is direct support to assets (increased access) and the second is support to increase effective

functioning of the structures and processes that influence access to assets and livelihood strategy opportunities.



Source: DFID (1999: 3)

Figure 2.5 The Department for International Development sustainable livelihoods framework

According to Scoones (2009) assets are resources of different types which people use in two ways, namely to own or directly control them (have authority about how they are used) or to have access to resources not owned but they are sources of livelihoods and are affected by historical trends and seasonality. Assets can be significantly affected, positively or negatively, as a result of the trends, shocks and seasonal changes in the vulnerability context. Policies, institutions and processes can have a significant influence on access to assets, such as their creation and the influencing rates of asset accumulation. Scoones (2009) contends that age and gender to a large extent determine how assets are distributed and controlled.

The DFID SLF identifies five types of assets (human, social, physical, financial and natural) whereas Chambers & Conway (1991) initially grouped assets into two groups, namely social and material assets. The five assets are also referred to as the 'capitals pentagon', a term which captured much attention worldwide (Chambers & Conway 1991; De Satge 2002; Jacobs & Makaudze 2012; Scoones 2009; Scoones & Wolmer 2003). This approach is very useful in highlighting trade-offs, for example between economic assets (fodder, credit), natural assets (natural resources) and human assets (skills,



education) in the construction of livelihood strategies (Scoones & Wolmer 2003). According to De Haan & Zoomers (2005) the pentagon displays the relative ordering of assets rather than metric measurements or estimates of their quantities or monetary values. Despite the ranking of assets, scope is allowed to analyse the ways in which assets may complement each other as well as any trade-offs and substitutions that may take place. The following subsections investigate the different elements of the DFID SLF namely livelihood assets, the vulnerability context, policies, institutions and processes (PIPs), livelihood strategies and livelihood outcomes.

#### 2.3.5.1 Livelihood assets

Human capabilities as seen by Chambers & Conway (1991), but referred to the DFID SLF as ‘human assets’, involve the household members’ combined education, knowledge, skills, state of health, the ability to engage in labour or command labour, and the ability to find and use information to cope, adapt, organize and innovate in the face of shocks and stressors. Human assets are used to ultimately enable people to access other types of assets and make the best thereof and to subsequently engage in different livelihood activities (De Satgé 2002). Reid & Vogel (2006) argue that human assets are required to make use of the other four types of assets (social, physical, financial and natural).

De Satgé (2002: 62) defines social assets as “social resources which people draw upon in pursuit of their livelihood objectives which include a variety of sources such as social networks, organisations, the relationships of trust within and between families, within social networks and in communities as well as the support provided by religious, cultural and informal organisations.” Equal human rights, a strong democracy (governance systems) and vibrant local institutions enhance these various social assets. An example is where the rights and duties of people who use common grazing are governed by locally agreed and enforceable norms and rules.

De Satgé (2002) records that natural assets are the land and the natural resource base which may be marine resources, wood, edible plants and fruit, wildlife, soils, grazing and water among others. Unfortunately, in some rural communities certain institutions enforce land rights which govern access to natural resources and hence the amount of natural resources available for the use by households (De Satgé 2002). Physical assets include farm equipment, shelter and infrastructure (De Satgé 2002). Infrastructure includes clinics and schools, roads, dams, water and sanitation services, electricity supply, communication and information sources such as telephones, radio, television and the Internet (De Satgé 2002). Finally, financial assets represent the “entitlements that have a cash value which may include income, remittances from family members working away from home, sources of credit, pensions, savings, livestock, stores of seed, crops and food” (De Satgé 2002: 63). Some economic resources like livestock have many asset values. For example, livestock has important cultural



significance, it can be exchanged or sold for cash, and it provides milk and meat. By-products like manure contribute to agriculture and household cultivation, and it can be used as fuel.

#### 2.3.5.2 Vulnerability context

The vulnerability context creates the external environment in which people pursue their livelihoods. The external environment is largely influenced by trends, shocks and seasonality. The DFID (1999) gives examples of trends, shocks and seasonality. Trends may (or may not) be more non-threatening, though they are more predictable. Trends have a particularly important influence on rates of return (economic or otherwise) to chosen livelihood strategies. DFID (1999) points out that this may include trends with regards concerning economies, resources, population dynamics, government politics and technology. Shocks have the ability to destroy assets directly, floods, storms and conflict being prime examples. Shocks can also force people to apply coping and adaptive strategies such as the abandonment of their homes and the premature disposal of their assets such as land. According to DFID (1999: 3), “examples of shocks may include conflict, economic fluctuations, human health, crop/livestock health and natural shocks.” Seasonal shifts in prices, employment opportunities and food availability are among the most influential and enduring sources of hardship for poor people in developing countries (DFID 1999). Another seasonal shift is production fluctuations.

These factors can directly impact on people’s asset options, access to assets and ultimately the pursuit of beneficial livelihood strategies. Shocks have been known to force people to prematurely sell off livestock to drought. Not all trends are negative or cause increased vulnerability. For example, new technologies, medical advances or positive economic trends may help promote sustainable livelihoods. The vulnerability context is often influenced by external factors beyond direct control. Vulnerability is furthermore often dependent on wider policies, institutions and processes. To enhance resilience to the negative effects of trends, shocks and seasonality, development policymakers and practitioners can support people’s access to assets and ensure that critical policies, institutions and processes are responsive to peoples’ needs. These PIPs are treated next.

#### 2.3.5.3 Policies, Institutions and Processes (PIPs)

An analysis of assets also makes room for giving greater prominence to non-material dimensions of a livelihood (also known as external processes). The PIPs in the external environment cover the complex social, economic and political context in which people pursue their livelihood strategies. PIPs operate on global, national, regional, district and local levels. The key to understanding their impact on local livelihoods is an analysis of the operation, or absence, of links between micro, meso and macro levels (DFID 1999). These include institutions and power relations, considered by many, including Chambers & Conway (1991), to be intangible forces. These forces can, however, have a

lasting tangible effect on the livelihoods people are able to construct for themselves (Scoones & Wolmer 2003). These forces furthermore draw attention to processes and mechanisms that regulate or govern access to and use of assets to secure different livelihood strategies (Scoones & Wolmer 2003). According to Haidar (2009), PIPs involve the interrelated issues of social relations (e.g. gender and ethnicity); social and political organization (e.g. democracy); governance (e.g. structure and power); service delivery (state and private); resource access institutions (social norms); and policy and policy processes. Examples of structures and institutions are international organizations (e.g. World Bank, United Nations and commercial banks); regional political and trade institutions (e.g. the Southern African Development Community); national and provincial structures (e.g. development agencies and NGOs); and local structures such as local municipalities and traditional authorities (Haidar 2009).

Economic processes and globalization at the international level which form part of the external environment to livelihood security, determine the terms of trade between countries and tariff barriers between countries which influence changing market and commodity prices. Ultimately, these influence livelihoods substantially. Most developing countries rely on exporting primary commodities such as minerals and agricultural goods.

#### 2.3.5.4 Household livelihood strategies

Livelihood strategies are the combination of activities (strategies) that people choose to undertake to achieve their livelihood outcomes. According to Bahry (2010) livelihood strategies are generally categorized in three types, namely agricultural intensification/extensification, livelihood diversification (paid employment and rural enterprises) and migration (in search of better livelihood opportunities). De Satgé (2002) argues that this categorization can also be designated as productive activities, reproductive activities and community maintenance activities. The former categorization was applied to this study because it was regarded by the researcher as more applicable to the study area and affected communities.

#### 2.3.5.5 Livelihood outcomes

Livelihood outcomes are the result of the livelihood strategies pursued but they are also influenced by the vulnerability context, PIPs and livelihood asset resources. Livelihoods approaches stress the importance of understanding and supporting poor people's efforts to achieve these goals. According to DFID (1999) examples of more desirable livelihoods outcomes include reduced or increased income, reduced or increased vulnerability, reduced or increased well-being, decreased or improved food security and less or more sustainable use of natural resources. After a look at various SLFs a comparison can be made between the most noteworthy frameworks, along with a critique.

### 2.3.6 SLFs compared and critiqued

Murray (2000) has concisely summarized some of the strengths and weaknesses of the DFID SLF as given in Table 2.5 and a comparison of the three most widely used SLFs (DFID, CARE and UNDP) is set out in Table 2.5.

Table 2.5 Strengths and weaknesses of the DFID SLF

Framework strengths	Framework weaknesses
Pursues an understanding of the ever-changing modes of livelihoods and their combinations in a dynamic and historical context.	Insufficient importance given to vulnerability elements such as rampant inflation, extreme civil conflicts and the knock-on effects of mass unemployment.
Advocates a tension between different levels of analysis.	Assumes the possibility of expansion of the people's 'asset pentagon'.
Acknowledges the need to transcend discrete sectors such as urban and rural, industrial and agricultural, formal and informal.	Insufficient importance accorded to inequalities of power and conflicts of interest.
Requires investigation of the relationships between different activities that constitute household livelihoods, which in turn requires attention to intra-household and extra-household social relations.	'Participation' may disguise the reality that, in one way or another, the improvement of one group's livelihood will undermine that of another. Inadequate definition of livelihood sustainability regarding criteria to assess what period of time.

Source: Adapted from Murray (2000)

Many agencies have only recently started with efforts to implement sustainable livelihoods approaches. Notable common features when comparing the SLFs are the focus on assets and micro-macro links, the common roots in the work of Chambers & Conway (1991) and the emphasis put on flexibility in applications. Krantz (2001) and Carney et al. (1999) have conveniently compared the DFID, CARE and UNDP frameworks. Table 2.6 is an excerpt from their report. In Table 2.6 the column on the left lists the elements the framework possibly complies to and 'x' indicates where that element is addressed by a certain framework.

Table 2.6 Comparison of the DFID, CARE and UNDP sustainable livelihoods frameworks

	<b>DFID</b>	<b>CARE</b>	<b>UNDP</b>
<b>Towards poverty alleviation</b>	x	x	x
<b>Asset-based approach</b>	x	x	x
<b>Considers the impact of overriding policies and economic structures on livelihoods</b>	x Basic framework for analysis to assess and review ongoing projects and programmes	x To facilitate planning of concrete projects and programmes	x To facilitate planning of concrete projects and programmes
<b>Sustainability</b>	Environmental criteria to some extent	Household livelihood security over sustainable livelihoods	Environmental criteria. Technological development. Social and economic investment
<b>Need to understand and facilitate micro-macro links</b>	x	x	x
<b>Functioning level</b>	Community level. Enabling policy environments, macro-economic reforms, and legislation equally important for effective poverty reduction	Community level	Community level. Enabling policy environments, macro-economic reforms, and legislation equally important for effective poverty reduction
<b>Empowerment</b>	Different	Different	Different
<b>Technology</b>	To some extent		x
<b>Identifying specific poor</b>			
<b>Distribution of resources and opportunities</b>	Power relations (gender)	Gender to some extent	Gender to some extent

Sources: Adapted from Carney et al. (1999) and Krantz (2001)

The literature provides substantial critiques of the SLA premise. The basic idea of the SLA is to begin with a broad and open-ended analysis, but this requires a highly flexible planning situation which rarely exists (Krantz 2001). The best hope is to ensure that sector development initiatives already identified and decided on fit people's livelihood strategies and improve them to better respond to the constraints and opportunities affecting the poor.

Also if the SLA is applied consistently it might exceed the practical realities of many local development administrations so remaining an initiative of donors and their consultants. One measure to counteract this would be to ensure that counterpart staff are involved from the beginning when discussing how and if such a strategy should be applied, and to train them to use the approach, and/or start with a simplified version of the approach. The literature provided for a comprehensive

understanding of all the SLFs with a detailed version of the DFID SLF as it is the framework used in this study. The DFID SLF was found to be most applicable in the proposed study because it adds another element to sustainable livelihoods theory namely adaptive and coping strategies. It also takes a broader and systematic approach is taken which considers all functioning components of the framework as equally important in establishing a sustainable livelihood.

As the investigation into the coping and adaptive strategies used by farmers against environmental shock and social stress a background was needed on this subject therefore the next section was included.

## **2.4 ADAPTIVE AND COPING STRATEGIES AGAINST SHOCKS AND STRESSES**

Coping strategies are short-term responses to a specific shock which is sudden, unpredictable, and traumatic such as drought, hail, flood, wildfires and heatwaves. Adaptive strategies entail long-term change in behaviour patterns, usually as a result of stress which is typically continuous, predictable and distressing such as seasonal shortages, rising populations or declining resources. Regularly occurring stressors arise from cycles which are either diurnal (midday and afternoon heat, mosquitoes in the evening and at night, cold and difficulty seeing at night) or seasonal. For the sustainability of livelihoods, seasonal stressors are more significant than diurnal ones. They comprise of physical, biological and socio-economic dimensions (Krantz 2001).


Periods of climate shock, such as prolonged drought periods, usually reveal a host of factors that contribute to heightened vulnerabilities to environmental change such as deteriorating social networks linked to HIV/AIDS, poor access to basic services and resources and a range of wider structural and governance factors (Reid & Vogel 2006). A region's capacity to cope, respond and adapt to climate risk will be determined by its overall vulnerability to climate variability. A number of situations of shocks and stressors are sketched by Chambers & Conway (1991) and United Nations Framework Convention on Climate Change (UNFCCC) (2003) together with proposed adaptive and coping strategies. Table 2.7 presents the former and Table 2.8 the latter.

Table 2.7 Examples of shocks and stressors with suggested coping and adaptive strategies

Shocks		Stressors	Adaptive and coping strategies
Household and individual level	Community level	Declining labour work available	<b>Stint:</b> Reduce consumption, shift to lower quality food, draw on energy stored in the body. <b>Hoard:</b> Accumulate and store assets. Protect and preserve asset base. <b>Deplete:</b> Draw on household stores food; pledge or sell assets. Diversify food sources and assets. (Langkloof: Honey-bush and fish farming) <b>Claim:</b> Social support, e.g. family members. <b>Move:</b> Disperse family members, livestock, assets, and/or migrate.
Accident	Drought	Declining real wages	
Episodic illness	Storms	Declining yields	
Chronic illness Death of family member or valued animal	Extreme temperatures	Acidity	
Livestock disease	Crop and livestock diseases	Erosion	
Asset loss	Human illness	Declining common property resources	
Crop failure	Conflict (war, persecutions, civil violence)	Declining water tables	
Job loss	Adverse market conditions	Declining rainfall	
	Fires	Population pressures on resources	
	Famines	Ecological change	
	Landslides	Indebtedness	
		Physical disabilities	

Sources: Chambers &amp; Conway (1991); UNFCCC (2003)

Table 2.8 Adaptive and coping strategies



	Single household	Group based	Market based	Publicly provided
Adaptive	Preventative health	Collective action for infrastructure		Good macro-economic policy
	Successful migration	Common property resources		Environmental, health and labour policy
	More secure income sources			
Risk diversification	Crop diversification	Occupational associations	Savings accounts	Agriculture extension
	Income diversification	Savings and credit associations	Micro finance	Liberalization of trade
	Investment in human and physical assets	Investment in social assets		Protection of property rights
	Marriage and extended family			Pension scheme
				Mandated insurances
Coping with shocks	Buffer shocks	Mutual support network	Old-age annuities	Social protection
	Intensify labour inputs		Accident insurance	Social assistance
	Draw on savings		Sale of financial assets	Workforce
	Cut down on consumption		Loans from banks	Subsidies
	Migration to marginal lands			Social funds
		Cash transfers		

Sources: Reid &amp; Vogel (2006); UNFCCC (2003)

The Intergovernmental Panel on Climate Change compiled a valuable compendium of climate shocks and their impacts. These impacts are compared to the adaptive capacity and general adaptive and coping strategies of people in Africa. A number of situations are summarized in Table 2.9.

Table 2.9 Impacts of climate, vulnerability and adaptive capacity in Africa

<b>Likely impacts of climate vulnerability</b>	<b>Vulnerability and adaptive capacity</b>
Increase in drought, floods and other extreme events will add stress to water sources, food security, human health and infrastructure thus, constraining development	Adaptive capacity is low due to low GDP per capita, widespread poverty, inequitable land distribution and low education levels
Changes in rainfall and intensified land use will increase desertification (e.g. southern Africa, western Sahel)	Absence of safety nets, particularly after harvest failures
Sea level rise will affect coastal settlements, flooding, coastal erosion especially along the south-eastern coast of Africa	25% of the population lives within 100km of the coast. Africa's largest cities are along coasts, vulnerable to extreme events, coastal erosion and sea level rise
Major rivers are highly sensitive to climate variations: decreases in surface runoff and water could affect agricultural and hydro-electric power stations thus increasing cross-boundary tensions	Individual coping strategies for desertification are already strained thus leading to further poverty
Increase in extreme events in some places e.g. flooding, rainfall and drought.	Dependence on rain-fed agriculture is very high
	Adaptive capacity will be highest in countries with civil order, political openness and sound economic management

Source: Adapted from IPCC (2007)

A household's portfolio of tangible (stores and resources) and intangible (claims and access) assets can be understood as partly chosen by design to reduce vulnerability and to enable the household to survive stress with minimum risk of threat to the future livelihood (Chambers & Conway 1991). There is also evidence of the stubbornness of the poor in protecting and hanging onto their assets in difficult times (Chambers & Conway 1991). Similarly, the repertoires of activities of household members are often designed to spread risk. Security is a basic dimension of livelihood sustainability. This is why the vulnerability of assets is evident where stores of grain can be stolen, destroyed by floods, fire or pests; where households can be deprived of their resources or their resource rights, where claims may be lost as with death of a relative on whom a claim could have been made (Baez 2006). Even access may disappear, as with government action to withdraw a bus service to the market, or to close of a school or health centre (Baez 2006).

Among many other challenges, individuals in developing countries survive with low incomes in conditions of high levels of uncertainty. Because approximately 70% of the workers in low-income countries are employed in agricultural activities they are relatively more vulnerable to factors beyond their control (e.g. weather, crop prices variation, diseases and pests) (World Bank 2003). Income fluctuations, however, are not expected to alter consumption and well-being if poor households have



the means to protect themselves by saving in 'good' times. The absence of formal means to smooth the consumption of low-income households is a central feature of livelihoods in the developing world. Many of the non-market risk-coping mechanisms available are extremely precarious. The lack of assets, underdeveloped market opportunities for dealing with risk (credit and insurance), the shortage of public transfers during crises, the low levels of education and the limited ability to switch jobs, among others, limit the capacity of poor farmers to reduce the impact of adverse shocks (Baez 2006).

In many cases the consequences of these downturns may be severe enough to remain for a long time so lowering consumption below subsistence levels and affecting nutrition, health, schooling and other human and physical vital assets related to future potential earnings (Baez 2006). A better understanding of how the income of farmers in poor countries changes with unfavourable shocks, formal and informal arrangements available to deal with risk and the effects of income variability on basic dimensions of socio-economic welfare is crucial for the design of development-aimed policies (Baez 2006). Savings and the correct management of assets have proved to be a very successful means of disaster preparedness and also response after such an event.

#### **2.4.1 Savings and asset management**

It is widely held that savings are the optimal response after shock to ensure resilience over time (Baez 2006). Romero & Nagarajan (2011) state that several studies, such as Deaton (1992), Alderman (1996) and Kazianga & Christopher (2006), found that households approach savings as an ex-ante (based on forecasts rather than actual results) coping strategy when income reductions are expected due to shocks. Chandrasekhar, Cynthia & Horacio (2010) furthermore points towards research that shows that savings are just as important in an ex-post role when dealing with shocks.

A benchmark model of savings with perfect markets illustrates that farmers can borrow and lend freely, spending savings when income is less than consumption and building them back up when consumption is less than income. Households mainly have three forms to save: borrowing and lending from formal credits institutions and informal systems, accumulating and de-accumulating assets and storing durable goods (Baez 2006). Unfortunately, certain barriers still prevent optimal savings from happening, among which low income is the main obstacle to saving and accumulating assets. This is often countered by several forms of credit markets by poor households to insulate consumption from income variability. Furthermore, the saving initiatives of poor people are at risks from economic instability, inflation, high labour informality, limited social welfare coverage and poor land designation (Baez 2006).

Generally, poor farming households use their few assets to deal with certain shortcomings, although these portfolio allocations are technically inefficient because positive livelihoods are generally more diversified, also with regards to the five types of assets. Furthermore, other conditions can reduce the

effectiveness of these risk management strategies when villages are credit constrained, particularly when times are unfavourable. When negative income shocks and low levels of assets occur simultaneously or when economic downturns are long enough to exhaust all the accumulated stocks these risk management strategies become less effective (Baez 2006). Another very successful coping or adaptive strategy against disaster events is livelihoods diversification which will be discussed next. The livelihoods activities of farmers in the Langkloof are significantly diversified which is evidenced through the range of livelihood strategies used by farmers.

#### **2.4.2 Diversification**

Livelihood diversification is a commonly implemented coping or adaptive strategy. Diversification embraces a household's attempts to reduce its vulnerability by having more than one livelihood activity. If one activity does not prove to be sufficient, or is compromised, there are other livelihood strategies to serve as a backup (De Satgé 2002). All households have a variety of capabilities and assets which influence their livelihood strategies for survival (De Satgé 2002). Household livelihood security is often influenced by the ability of a household to diversify its livelihood sources by using a wide variety of livelihood strategies so that the household does not depend on a limited number of livelihood sources. The more diverse a household's livelihoods strategies the greater its capability and asset base and hence the more secure it is. But the smaller a household's asset base the more vulnerable it is likely to be. A diverse range of livelihood sources can include a combination of cash remittances from family members who have formal jobs; benefits from a range of informal trading and economic activities; using natural resources and livestock; or turning to pension benefits, insurances payments, burial societies and stokvel (an informal short-term capital savings societies) (De Satgé 2002). The literature review provided a necessary understanding of all the relevant contexts, concepts and theories essential to successfully conduct this study. The following however will discuss all the various methods and tools implemented to perform the study.

## CHAPTER 3 METHODS

Typical rural livelihoods investigations are localized case studies that make extensive use of participatory research techniques to construct household asset profiles and map the social relations that affect ownership and access to resources (Jacobs & Makaudze 2012). This study used an adapted case study methodology consisting of qualitative and quantitative-data collection techniques. The research methods comprised three processes, namely a literature review, in-depth semi-structured interviews with key stakeholders, and a quantitative and qualitative questionnaire survey. The two latter phases are based on the two frameworks of analysis, namely the PAR model and the DFID SLF. The aim of the qualitative study was to collect information to gain insight into and understanding of the Langkloof farmers' general livelihood activities, coping and adaptive strategies against environmental shocks and social stresses and their general challenges regarding the pursuit of a livelihood. The quantitative phase aimed to describe and assess the livelihood characteristics and the adaptive and coping strategies of Langkloof farmers during periods of environmental shocks and social stresses. This mixed-method design was employed to promote generalization, triangulation and the development of research instruments, and to ensure credibility.

The DFID's SLF differs from other frameworks in mainstreaming its core principles and holistic approach toward the programming of support activities relating to issues or areas of direct relevance to improving people's livelihoods, and therefore poverty reduction (Ashley & Carney 1999; DFID 1999; Krantz 2001). A broader and more systematic approach was taken which considered all the functioning components of the framework as equally important in establishing a sustainable livelihood. Concerning the application of the DFID SLF, although the analysis of people's livelihoods usually takes place at a household (or community) level, the aim was not just to identify constraints or opportunities that could be remedied at that level, but to gain an understanding of how policies and other institutional factors impact on people's livelihoods at the local level (Krantz 2001). The DFID SLF also addresses assets, capabilities and activities, but like few others, it also stresses the role of the vulnerability context in which people strive for access to and ownership of assets in search of a more positive livelihood (Krantz 2001). For these reasons, the DFID SLF was the framework for analysis in this study. This chapter describes the various methods employed and the justifications thereof to reach the desired aim and objectives for the study. These methods include a literature review, key informant interviews conducted, a questionnaire survey conducted with the sampled population, the sampling framework, data consolidation and the various tools used for the data analysis.

### **3.1 LITERATURE REVIEW**

The literature review (Chapter 2) covered the material and concepts to provide an understanding of the research problem, including a discussion of the various hazards experienced in the Langkloof and the theoretical frameworks, classifications and models in which to undertake the study. An extensive study of various SLFs was undertaken and, after deliberation, the SLF developed by DFID (1999) as adapted from the earliest formulation by Chambers & Conway (1991) was selected as a suitable framework for a livelihoods analysis of the farmers in the Langkloof. The elements analysed were the vulnerability context; farmers' assets (social, human, financial, natural and physical); the instrumental policies, institutions and processes; the livelihood followed strategies; and the livelihood outcomes. The literature review provided a good understanding of important concepts which enabled the drafting of relevant questions during the key informant interviews, the construction of a questionnaire survey and an understanding of the tools used for the data analysis.

### **3.2 KEY INFORMANT INTERVIEWS**

Six interviews were conducted with key informants prior to and during fieldwork in the Langkloof (Appendix A). This exercise aimed to explore the research questions in more depth and to develop an understanding of the hazard profile of the area, the vulnerability drivers in the Langkloof, the components of the livelihood framework and adaptive and the coping strategies devised to counter environmental shocks and social stresses.

The semi-structured interviews were conducted by telephone and during face-to-face conversations with individuals who agreed to participate. The interviews were voice recorded and transcribed later. Key stakeholders were identified by a key informant who lives in the Langkloof and whose positions are, among others, Chairman of the Uniondale Farmers' Association and Chairman of AfriForum. Other important key role players interviewed were members of the Western Cape Department of Agriculture, municipal officials in the Langkloof region and other members of the farming community. The information gathered during these interviews informed the questionnaire survey conducted with the sampled farmers.

### **3.3 QUESTIONNAIRE SURVEY**

A multipurpose questionnaire survey (Appendix A) was conducted to gain an understanding of livelihood characteristics and adaptive and coping strategies of farmers during periods of environmental shocks and social stresses in the Langkloof area. Each interview lasted 50 to 70 minutes and five to six households were interviewed per day given that farms are close to one another and to place by appointment. The questionnaire design was informed by the informant interviews as

well as the DFID SLF. The interviews served as a tool to pilot the questionnaire and to make necessary adjustments.

Table 3.1 Research questions for the study

Primary questions	Secondary questions	Method	Chapter allocation
What are the hazards in the Langkloof?	What are environmental hazards in the Langkloof?	Literature search Semi-structured interviews Questionnaire survey	Chapters 1,2 and 5
What are the livelihood characteristics of farmers in the Langkloof?	What is the general household information of farmers in the Langkloof?	Literature search Key informant interviews Questionnaire survey	Chapter 2,4 and 5
	What assets have the farmers in the Langkloof accumulated?	Questionnaire survey	Chapter 4
	What policies, institutions and processes (PIPs) impact the range of assets?	Literature search Semi-structured interviews Questionnaire survey	Chapter 4
	What are the farmers' livelihood strategies?	Questionnaire survey	Chapter 4
What are the adaptive and coping strategies of farmers during periods of severe environmental shocks and social stress?	What are the coping and adaptive strategies concerning the 'capitals pentagon'?	Questionnaire survey	Chapter 4
What are the main differences and similarities between LMSF?	What are farmers' livelihood characteristics?	Semi-structured interviews Questionnaire survey	Chapter 4
	What coping and adaptive strategies are followed?		

The questionnaires collected a combination of qualitative and quantitative data. These questionnaires focused on farmers' livelihood characteristics and adaptive and coping strategies during periods of stress and shock. The number of farmers in the study area was confirmed by a key informant at 62 (14 large-, 18 medium- and 30 small-scale) farmers with a confidence level of 95% and a confidence interval at 10, the stratified random sample size needed to make the study scientifically sound was 12 large-, 15 medium- and 23 small-scale farmers. Table 3.1 summarizes the broad categories of

questions investigated during fieldwork. This section dealt with the conduction of the questionnaire survey, the information it was aimed at collecting and the purpose thereof. The next section discusses precisely how the sampling took place in order to make the study scientifically accurate. A sampling framework was necessary to establish the number of farmers to be included in the study.

### **3.4 SAMPLING FRAMEWORK**

The typology of the agricultural sector in South Africa (Table 2.3) was used to select the sampling population. Three statistically representative stratified samples, namely LMSF were selected. Each of these groups are commercial farmers referred to hence as LMSF or farmers. Stratified random sampling was used as defined by Burt & Barber (1996) as a sample obtained by forming classes, or strata, in the population, and then selecting a simple random sample from each. According to Hardon, Hodgkin & Fresle (2004) stratified sampling makes it possible to draw a relatively large sample from a small group in the study population. An adequate sample is attained to enable valid conclusions to be drawn about a relatively small group without having to collect an unnecessarily large (i.e. expensive) sample from other, larger groups.

Because simple random sampling does not ensure that the proportion of some individuals with certain characteristics will be represented, stratified random sampling was used to increase representativeness and to decrease the probable sampling error. The use of unequal sampling fractions made it important to make corrections when generalizing findings to the whole study population. The ultimate function of stratification was to organize the population into homogeneous subsets (with heterogeneity between subsets) and to select the appropriate number of elements of each (Babbie & Mouton 2010). The choice of stratification variables depends on what variables were available, with gender and age often being the most common in livelihoods studies (Babbie & Mouton 2010; Hardon, Hodgkin & Fresle 2004).

The units of analysis in this study were individuals, households and groups constituting LMSF. Expected difficulties did occur with farmers not being willing to reveal information about incomes. Therefore it was not possible to gather this income data to categorize the farmers according to each farming scale. Consequently, using the typology of the agricultural sector in South Africa provided by Vink & Van Rooyen (2009) a key informant, the Head of Coordination and Planning of Avontuur Agriculture Uniondale and Chairman of AfriForum referred to his farmer database and divided the total sampling population into classes (strata), according to annual turnover. Farmers representing each scale (LMSF) were systematically assigned a number and a numbered list was entered into Microsoft Excel where a statistically random representative sample size was computed. This calculation for each group produced a stratified random sampling. Farmer scale was the only distinguishing variable and represented LMSF. Three samples were calculated. When a sampled unit

turned out to be vacant or unwilling to respond, another unit was selected from the remaining farms in the population. After the fieldwork was completed and the data collected it was necessary to format the data to be analysed.

### 3.5 DATA CONSOLIDATION

The information collected from the key informant interviews was summarized in Microsoft Word and subsequently used in the collection of quantitative data by adjusting the questionnaire and survey procedure to obtain more accurate data. Information collected during the interviews was also compared with the qualitative findings of the questionnaire survey to help explain or corroborate the results. Once the data has been prepared and consolidated into the correct format it was ready for analysis, where various tools were used.

### 3.6 DATA ANALYSIS

The qualitative data were analysed using the DFID SLF. Because the relationship between vulnerability and hazards is not included in this above framework, the PAR model was incorporated to facilitate the data analysis. Quantitative data analysis was performed with the PCA function in the Statistical Package for the Social Sciences (SPSS) and Microsoft Excel 2010. The data was visually inspecting and descriptive statistics, namely averages, percentages, tables and frequency distributions were calculated. The data was then analysed to identify relationships between the variables, make comparisons between the farmer groups (LMSF) and reveal trends. Spearman's rank correlation coefficients were calculated. ArcMap was invoked to create a map that plotted the location of the farmers who were interviewed and the key stakeholders who participated. These tools mentioned are further discussed in the following subsections, the first of which is the scaling or standardization of asset indicator values to make these values suitable for the principal components analysis where asset indicators are weighed.

#### 3.6.1 Scaling of indicator values

Because each of the indicators was measured on a different scale, it was necessary to standardize each indicator into comparable units to construct a composite index. Thus the indicators were scaled from 0 to 1. The equation used to scale each of the indicators was adapted from Sharp (2003), namely:

$$\text{Scaled value} = \frac{(X_1 - X_{\min})}{(X_{\max} - X_{\min})} = \frac{(\text{actual value} - \text{minimum value})}{(\text{maximum value} - \text{minimum value})}$$



where  $X_1$  is the actual value of an indicator for a specific household,  $X_{\min}$  is the minimum value of an indicator and  $X_{\max}$  is the maximum value of an indicator. The transformed values were scale free and had a uniform standard deviation.

In cases where an indicator with a high value has a negative influence and a low value positive effect (for example number of implements needed for production purposes), the above formula was inverted to the former:

$$\text{Scaled value} = \frac{(X_{\max} - X_1)}{(X_{\max} - X_{\min})}$$

As Sharp (2003) notes, the maximum and minimum values used in scaling each of the indicators can be the actual data ranges or they can be threshold values chosen according to the context. In this study, where the main purpose was to examine the relative differences in household asset profiles between farming scales and to determine the association between household asset profiles and the coping and adaptive strategies devised against environmental shocks and social stresses, the actual data were used. Once the asset indicator values were scaled and standardized they were suited for the principal components analysis where these asset indicators are weighed.

### 3.6.2 Objective weighting of indicators using principal components analysis

Not all of the indicators have equal importance in the livelihoods of different farmer groups so the challenge to find appropriate weights for each of the indicators was raised. After the indicators had been standardized (scaled) (Appendix C), it was necessary to assign weights to each indicator so that its relative influence is reflected in the overall index. To avoid the subjectivity arising from assigning weights arbitrarily, a PCA was applied. PCA is a type of factor analysis, a statistical procedure that does not incorporate any econometric model of the relationship between the given indicators. PCA mathematically quantifies the impact of each indicator on the total variation in the data (Filmer & Pritchett 2001). Studies in which PCA was used to assign weights include those of Bahry (2010), Córdova (2008), Filmer & Pritchett (2001), Li et al. (2014), Moser & Felton (2007), Sharp (2003), Xu et al. (2006), Yan et al. (2010) and Zeller et al. (2006).

Filmer & Pritchett (2001) note that PCA determines the weights for a composite index by extracting more basic and common indicators from the given set of indicators in such a way that the weights given maximize the sum of the squares of correlation, the best common information is captured. The crucial assumption, as Filmer & Pritchett (2001) point out, is that this undefined 'common information' is determined by the underlying phenomenon that the index is intended to measure ('household long-run wealth' in Filmer & Pritchett's (2001) case, but simply total assets in this study). As Sharp (2003) also points out, the most common use of PCA is for data reduction, that is to reduce



the number of indicators in a computation by detecting those that do not contribute significantly to the total variation. A second use, as adopted in this study, is to detect structure in the relationships between indicators (Sharp 2003). The validity of this assumption cannot be statistically verified. Rather, it depends on the correct identification of the relevant indicators, and is therefore largely a matter of judgement. PCA was used to determine the weights or scores assigned to a set of indicators selected to calculate total assets of each farming scale. The weights given to the indicators were chosen so that the principal components satisfy two conditions. First, the numbers of principal components are equal to the number of indicators and they are uncorrelated or orthogonal in nature. Second, the first principal component absorbs or accounts for the maximum possible proportion of variation in the set of indicators. The first stage of PCA extracted the principal components which could potentially explain the total variance (Filmer & Pritchett 2001). The significant components were extracted (based on the Kaiser criterion of an Eigenvalue greater than 1). Eigenvalues indicate the amount of variance explained by each factor.

After the principal components were extracted a simple formula for calculating weights was used:

$$W_{pca} = \frac{M}{N}$$

where M is the component score coefficients and N the characteristic roots. The sixteen asset indicators used in this study were each assigned a weight to ultimately calculate the total weighted asset scores of each household sampled. These total weighted asset values were then used to perform a spearman's rank correlation with the total number of coping and adaptive strategies used by each corresponding sampled household against environmental shocks and social stresses to establish if any noteworthy relationship exists between the two.

### 3.6.3 Spearman's rank correlation

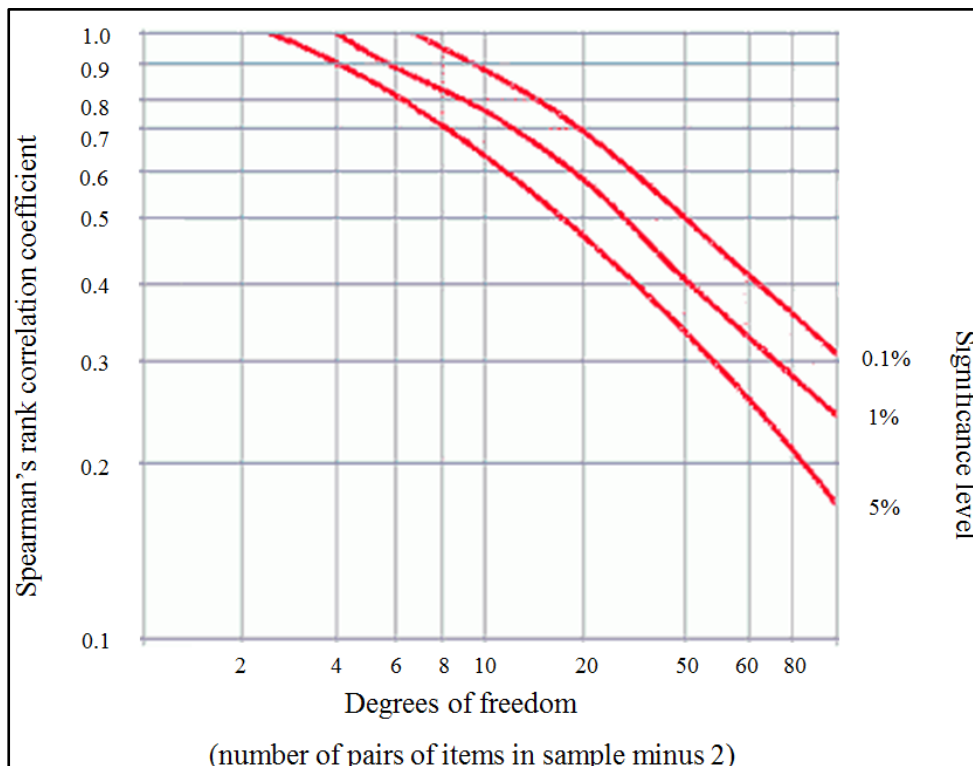
Spearman's rank correlation method was used to identify and test the strength of the relationships between two sets of data, the total amount of assets accumulated and the number of coping and adaptive strategies followed). It was decided to perform these correlations to determine if the capacity gained through assets influences one's ability to use coping and/or adaptive strategies. For purposes of this particular study, Spearman's rank correlation is more appropriate than Person's product-moment correlation, because the former requires ordinal rather than cardinal variables, and does not presume a linear relationship (it is a measure of monotone dependence) (Harvey 2014). The formula used to calculate Spearman's rank correlation is:

$$r = 1 - \left( \frac{6 \sum d^2}{n(n^2-1)} \right) = 1 - \left( \frac{6 \times 6}{n(n^2-1)} \right)$$

where  $d$  is the difference in the sum of the difference between the ranks and  $n$  the number of data sets. Once a correlation was established the Spearman's rank significance graph and critical values were used to determine the specific significance of this correlation.

### 3.6.4 Spearman's rank significance graph and critical values for correlation coefficients

To determine whether the  $r$  value is significant, a Spearman's rank significance graph (Figure 3.1) and/or table (Table 3.2) is used. By using the values for  $r$ , and with the help of the critical values for Spearman's correlation coefficients (two-tailed significant levels) indicated in Table 3.2, the significance level of a correlation can be illustrated in a graph as shown in Figure 3.1. According to Zar (1984), the significance levels indicated on the right in Figure 3.1 indicate the likelihood of the correlation occurring by chance. Any correlation not meeting at least the 5% significance line is regarded as insignificant and should be rejected. A 5% significance level means that a correlation is 95% reliable yet still significant enough, but with greater values this reliability becomes too great.



Source: Adapted from Royal Geographical Society (2013)

Figure 3.1 Graph for Spearman's rank correlation coefficient

Table 3.2 showing the critical values of the Spearman's rank correlation coefficient, was used to determine the significance of the correlations. One, for example, had 20 pairs of data and a value of  $r=0.53$ , a probability of between 0.01 and 0.005 that it had occurred by chance, and a probability level of between 1% and 5%. That is, this result could be expected to occur by chance once every 100 to 200 times. Such a result indicates a strong significant correlation between the two sets of data.

Table 3.2 Critical values of Spearman's rank correlation coefficient

$\alpha$ (2) n	0.500	0.200	0.100	0.05	0.02	0.01
4	0.600	1.000	1.000			
5	0.500	0.800	0.900	1.000	1.000	
6	0.371	0.657	0.829	0.886	0.943	1.000
7	0.321	0.571	0.714	0.786	0.893	0.929
8	0.310	0.524	0.643	0.738	0.833	0.881
9	0.267	0.483	0.600	0.700	0.783	0.833
10	0.248	0.455	0.564	0.648	0.745	0.794
11	0.236	0.427	0.536	0.618	0.709	0.755
12	0.217	0.406	0.503	0.587	0.678	0.727
13	0.209	0.385	0.484	0.560	0.648	0.703
14	0.200	0.367	0.464	0.538	0.626	0.679
15	0.189	0.354	0.446	0.521	0.604	0.654
16	0.182	0.341	0.429	0.503	0.582	0.635
17	0.176	0.328	0.414	0.485	0.566	0.615
18	0.170	0.317	0.401	0.472	0.550	0.600
19	0.165	0.309	0.391	0.460	0.535	0.584
20	0.161	0.299	0.380	0.447	0.520	0.570
21	0.156	0.292	0.370	0.435	0.508	0.556
22	0.152	0.292	0.370	0.425	0.495	0.544
23	0.148	0.278	0.353	0.415	0.486	0.532

Source: Zar (1984)

This chapter outlined and discussed the various methods and tools used to reach the objectives set out and to ultimately reach the aim of the study. These methods include a literature review, key informant interviews conducted, a questionnaire survey conducted with the sampled population, the sampling framework, data consolidation and the various tools used for the data analysis. Additional tools used for the data analysis are the scaling of indicator values to achieve standardization to be able to conduct a principal components analysis where the sixteen asset indicators were weighed. Where after Spearman's rank correlations were performed between the calculated total asset scores of farmers and the total number of coping and adaptive strategies used by each corresponding sampled household against environmental shocks and social stresses. Once a certain correlation was established the Spearman's rank significance graph and critical values were used to determine the specific significance of this correlation. The following three chapters display the results after these above methods and tools have been implemented in the field.

## **CHAPTER 4      SOCIODEMOGRAPHIC/ ECONOMIC PROFILE OF SAMPLED HOUSEHOLDS**

This chapter describes and interprets the socio-demographic livelihood profiles. First, the social, demographic and geographical characteristics of sampled households are discussed followed by the assets accumulated (socioeconomic profile). This will then be complemented by the livelihood strategies followed by the three stratified groups in the Langkloof, LMSF.

### **4.1      SOCIODEMOGRAPHIC/GEOGRAPHIC PROFILE OF SAMPLED HOUSEHOLDS**

The first part of chapter four discusses the socio-demographic characteristics (Table 4.1) of the sampled households in the Langkloof. This section is divided into four focus areas, the first three socio-economic indicators namely household size and household heads; language of households, race and marital status; highest education level of households. The last indicator is geographical namely settlement history and nearest town.

#### **4.1.1      Household size and household heads**

Table 4.1 shows that the average household size of LMSF is the same at three persons per household whereas the average SSF household is 3.57 persons. Notably the minimum (1) and maximum (7) sizes of households are exactly the same for each. The average household size of male- and female-headed households is 3.3 and 2.8 respectively.

Regarding the gender of the household heads, there is a striking difference. All of large- and medium-scale farm households are headed by males, whereas four out of 23 (17.4%) of the SSF households are headed by females. The survey further revealed that in 100% of the female-headed household heads are between 45-64 years old. Overall, 92% of sampled households are headed by males and only 8% by females. The average age of household heads of all three farmer groups is in the 45-64 age group. A noteworthy difference is the five (21.7%) SSF household heads who are aged 65+.

#### **4.1.2      Language of households, race and marital status**

Only two languages (Afrikaans (80%) and English (20%)) are spoken in the sampled households. A prevalence of Afrikaans- speaking households is evident in all three farmer groups, namely more than 90% is SSF households, more than 80% of the LSF and more than 60% of the MSF. Regarding population groups, only white and coloured farmers were sampled. All the LSF are white and 93% of the MSF. Some 74% of the SSF are coloured. Most of the household heads are married, namely 83%

of large-scale households, 87% medium-scale households and 74% of the small-scale households. Further, 50% of the small-scale, female-headed households are married. Overall, 80% of the respondents are married and 20 unmarried.

#### **4.1.3 Highest education level of households**

Substantial differences in the highest education level attained in households were found between LMSF and SSF. All the LSF households indicated tertiary level as the highest education and in MSF households it was 73% with 27% having a secondary education. Striking, in SSF households nearly 70% only had primary level education, 17% with a secondary education and 13% had obtained a tertiary qualification. Overall, 32% had primary school education, 16% secondary school education and 52% had a tertiary qualification.

#### **4.1.4 Settlement history and nearest town**

Settlement history refers to the manner in which the land was acquired. In the Langkloof most of the landowners either inherited or bought the land they farm. The large-scale farms were inherited (42%), hired (8%) or bought (50%). The majority (80%) of medium-scale farms were bought, 13% inherited and 6% obtained through government grants. Similarly, 74% of small-scale farms had been bought, 13% inherited, 4% hired and 9% acquired through government grants. The closest towns to the LSF are Uniondale and Avontuur with 75% closest to Uniondale. Uniondale is similarly closest to MSF, the other being Avontuur, Haarlem and Misgund. Most (nearly 70%) of the SSF live closest to Haarlem. Many of the SSF farm smallholdings in the town of Haarlem.

Table 4.1 Sociodemographic/geographical profiles of each farming types

Indicator	Farming scale							
	Large		Medium		Small		Total	
Household size	12	%	15	%	23	%	50	%
Average	3	n/a	3	n/a	3.6	n/a	n/a	n/a
Minimum	1	n/a	1	n/a	1	n/a	n/a	n/a
Maximum	7	n/a	7	n/a	7	n/a	n/a	n/a
Gender of household head	12	%	15	%	23	%	50	%
Male	12	100	15	100	19	82.6	46	92
Female	0	0	0	0	4	17.4	4	8
Age of household head	12	%	15	%	23	%	50	%
15-24	1	8.3	0	0	0	0	1	2
25-44	4	33.3	2	13.3	5	21.7	11	22
45-64	7	58.3	10	66.7	13	56.5	30	60
65+	0	0	3	20	5	21.7	8	16
Average	45-64	n/a	45-64	n/a	45-64	n/a	n/a	n/a
Language	12	%	15	%	23	%	50	%
Afrikaans	10	83.3	9	60	21	91.3	40	80
English	2	16.7	6	40	2	8.7	10	20
Settlement history	15	%	15	%	23	%	50	%
Inherited	5	41.7	2	13.3	3	13.0	10	20
Hire	1	8.3	0	0	1	4.4	2	4
Government grant	0	0	1	6.7	2	8.7	3	6
Bought	6	50	12	80	17	73.9	35	70
Nearest town	12	%	15	%	23	%	50	%
Uniondale	9	75	8	53.3	4	17.4	21	42
Avontuur	3	25	3	20	2	8.7	8	16
Haarlem	0	0	1	6.7	16	69.6	17	34
Misgund	0	0	3	20	1	4.4	4	8
Race	12	%	15	%	23	%	50	%
White	12	100	14	93.3	6	26.1	32	64
Coloured	0	0	1	6.7	17	73.9	18	36

The second section of this chapter discusses the socio-economic profiling of the sampled households in the Langkloof. This was done by conducting a principal components analysis. Asset indicator values of sixteen asset indicators first had to be scaled to establish standardization to then assign weights to these indicators by means of a principal components analysis where after the total asset scores for each household could be calculated.

## 4.2 SOCIOECONOMIC PROFILING OF HOUSEHOLDS USING PRINCIPAL COMPONENTS ANALYSIS

Not all indicators had equal importance in the livelihoods of different farming scales and therefore the challenge was to assign weights appropriate to each of the indicators. All the component indicators in the PCA-weighted index were entered simultaneously into the analysis, which quantifies their relative contribution to the underlying variance in the data. A PCA was then performed on these sixteen

indicators using SPSS. In this study 16 components were extracted (equal to the number of indicators). But on applying the Kaiser criterion of Eigen values, only 6 components were found to be significant (Appendix D). The first component explained a 27% of the variation, which was almost three times larger than the next two components, and it gives positive weights for all 16 indicators. The first component was chosen to assign the weight for the indicators. Factor scores are linear combinations of all the original attributes that were relevant in making new factors. Furthermore, the positive or negative sign given to each factor loading is induced by standardization of variables and is therefore meaningless (Xu et al. 2006).

Access to and ownership of assets is an aspect of the DFID SLF considered to have the most influence on livelihood outcomes. Direct access to assets (i.e. providing poor people with better access to assets that are foundations for their livelihoods) is very important. Because this element of the SLF is pivotal, an in-depth analysis was undertaken to calculate the total assets accumulated by each household.

Table 4.2 Indicators and corresponding questions in questionnaire

Dimension	Indicators	Question number in questionnaire
<b>Human capital</b>	1. Skills shortage	2.1.1
	2. Highest education level	1
	3. Access to number of information sources	2.1.2
	4. Household labour capacity	1
	5. Marital status	1
<b>Social capital</b>	6. Social support networks	2.2.1
	7. Access to number of institutions and organizations	2.2.2
<b>Physical capital</b>	8. Number of implements needed	2.3.1
	9. Access to number of health institutions	2.3.2
	10. Access to number of schools	2.3.3
<b>Financial capital</b>	11. Number of agricultural income sources	2.4.1
	12. Number of non-agricultural income sources	2.4.2
	13. Fodder relief	2.4.3
	14. Access to number of sources of credit	2.4.5
	15. Access to insurance	5
<b>Natural capital</b>	16. Access to number of natural resources	2.5

Appendix H gives the weighted household scores for each indicator and Appendix C sets out methods used to scale the indicators and the selection rationales. The SPSS output table of the component matrix is given in Appendix G and weights of variables in PCA are listed in Appendix E. Table 4.2 presents the sixteen indicators, the dimension to which each one belongs and the question in the questionnaire that relates to each indicator. The following subsections will discuss the five assets (human, social, physical, financial and natural) each with their respective indicators comprising that asset type. This section will be concluded with the total assets achieved by the three farming scales and consequently with various comparisons.

#### 4.2.1 Ownership and access to human assets

The indicators used to determine total human assets are skills shortage, highest education level, access to number of information sources, household labour capacity and marital status. The rationales for the selection of these indicators of human assets is explained here. Farmers in the Langkloof display traditional agricultural *skills* but often lack *skills* in the way of modern technologies like computers *skills* which if, applied correctly, hold significant for farming. A question was asked to determine what and how many modern *skills* are lacking. *Education* of household members is critical in enhancing or undermining the capability of households, their efficiency in livelihood activities or applying modern (agricultural) technologies. *Education* helps to develop skills, which are beneficial to more remunerative non-farm activities. Households having better educated members therefore have greater chances of success than households with less educated members. In this study, the highest education attained in the household was used to develop the index.

The obtaining of specific *information* about new trends and technologies for more effective crop and livestock production was regarded to be fundamental to the advancement of personal agricultural livelihoods. The specific aim of this question was also to determine the prominence of government state departments in providing agricultural support services. *Marital status* determines the presence of adult labour. In the case of a single female-headed household, the chances of adult male labour for farm work are decreased. Similarly, being a single male-headed household, means absence of an adult female for domestic work and child care. The final indicator used was *household labour capacity* which is determined by the composition of households, according to ages of its members.

Table 4.3 Household human assets by farming scale

Indicators	Farming scale		
	Large-scale farmers	Medium-scale farmers	Small-scale farmers
Skills shortage	0.03	0.03	0.03
Highest education level	0.19	0.17	0.13
Access to number of information sources	0.07	0.04	0.04
Household labour capacity	0.01	0.01	0.01
Marital status	0.05	0.05	0.04
<b>Human assets</b>	<b>0.07</b>	<b>0.06</b>	<b>0.05</b>

Analysis of these indicators revealed a number of differences as shown in Table 4.3. The differences between the indicators are reflected in significant differences regarding to total human assets. The values of 0.07, 0.06 and 0.05 for LMSF respectively, indicate decreasing human assets as farming scale decreases, i.e. there is a direct relationship. Values for *skills shortage* ranked relatively low for all farming scales compared to other indicators. This is because this indicator has significantly low statistical importance. A score of about 0.03 was recorded for all three farming scales. *Education* has



statistically the highest importance. Therefore weighted values were expected to be significantly higher than for the other indicators. LSF rank highest which is not surprising given that every farmer had attained tertiary-level education and therefore perfect scores. MSF ranked second as many of these farmers had tertiary qualifications. The low score of SSF reflects the majority of them only having primary-level education. Again, there is direct relationship between level of education and farming scale. Statistically, *access to information sources* has low importance compared to the other indicators. MSF and SSF have similar values (0.04), whereas LSF have a higher value (0.07) which indicates their greater access to *information sources*. This may be due to similar trends in education levels where LSF also have the highest score which may indicate that they have a greater capacity to understand various information sources. Because *household labour capacity* has the lowest statistical importance, scores were expected to be equally low. The final scores for this indicator are the same (0.01) for LMSF. *Marital status* also recorded low importance statistically. Final scores were quite similar with 0.05, 0.05 and 0.04 for the three farming scales respectively. Thus access to information source, household capacity and marital status all relate directly to decreasing farming scale.

#### 4.2.2 Ownership and access to social assets

*Social support networks* and access to number of institutions and organizations were the two indicators used to determine total social assets. The rationale for the selection of the *social support networks* indicator was whether the household has relatives or friends relatively close by in another town where they can ask for assistance in any form when needed. The assumption is that people who are more socially active have a wider network of contacts and mutual obligations to call on for various types of support and resource access. The level of social activity itself reflects a household's material prosperity, social standing and available time or labour. The second indicator simply adds the *number of social institutions or organizations* participated in by any member(s) of the household during the previous twelve months. To promote comparability across the study area, responses were limited to a set of five institutions predefined by pilot fieldwork and secondary information. These were local cooperations, Community based organizations (CBOs), NGOs, religious and cultural institutions. Regarding total social assets, Table 4.4 indicates that SSF have the highest value of 0.04, followed by MSF and LSF each with 0.03 and 0.03. An indirect relationship therefore appears to exist between farming scale and social assets.

Table 4.4 Household social assets by farming scale

Indicators	Farming scale		
	Large-scale farmers	Medium-scale farmers	Small-scale farmers
Social support networks	0.000	0.01	0.05
Access to number of institutions and organisations	0.05	0.04	0.04
<b>Social assets</b>	<b>0.03</b>	<b>0.03</b>	<b>0.04</b>

*Social support networks* acquired a relatively high degree of statistical importance. Table 4.4 indicates that LSF have no access to social support networks, whereas MSF have a score of 0.01 and SSF have a significantly higher score of 0.05. The latter appear to be quite reliant on their social networks. *Access to a number of institutions and organizations* has an opposite relationship to social assets than with social support networks to social support networks. LSF gained a higher score (0.05) than MSF and SSF (0.04). A direct relationship is suggested.

#### 4.2.3 Ownership and access to physical assets

Total physical assets scored higher than any of the other types of assets. This may be due to the absence of financial indicators such as savings and investments in this study. On average the three indicators used to determine total physical assets also had the highest scores of all the indicators. The three indicators were used to determine total physical assets, namely *implements needed for production purposes*, *access to health institutions* and *access to schools*. Farmers were asked indicate the *number of implements* they lacked for farming and production. Interviews revealed shortages of certain implements, especially regarding SSF. Such shortages were regarded to constitute an obstacle that poses challenges to agricultural production. Access to *health institutions* is essential to human well-being that due to the rural nature of the study area, such access may be restricted. Respondents were asked to indicate how accessible six different types of health institutions were. The same rationale applies to access to *schools*. In this case respondents were asked how accessible four different levels of education were. Table 4.5 shows that the total scores for LMSF are similar with values of 0.13, 0.13 and 0.12 respectively. These values suggest a direct relationship between farming scale and physical assets. Importantly, the low scores of LMSF for the access to schools indicator may be biased by respondent's perception of the adequacy of schooling in the area.

The *number of implements needed for production purposes* was the second indicator on which inverted scaling was performed. This indicator has a relatively high statistical significance compared to the other indicators. LSF and MSF have the same score of (0.17), whereas SSF scored significantly lower (0.06) (Table 4.5). This result points to LSF and MSF having no lack of farming resources, whereas SSF tend to lack a considerable number of farming tools needed for their agricultural livelihood activities. The relationship is again direct.

Table 4.5 Household physical assets by farming scale

Indicators	Farming scale		
	Large-scale farmers	Medium-scale farmers	Small-scale farmers
Implements needed for production purposes	0.17	0.17	0.06
Access to health institutions	0.15	0.16	0.18
Access to schools	0.07	0.05	0.12
<b>Physical assets</b>	<b>0.13</b>	<b>0.13</b>	<b>0.12</b>

*Access to health institutions* has the third highest degree of statistical importance so that the scores are also significantly high. Scores for LSF and MSF are similar with 0.15 and 0.16 respectively, whereas SSF scored 0.18. When interviewed the majority of LSF and MSF indicated that some elements of local health care such as sufficient trained personnel, primary care, chronic care, child care and private care are currently lacking or not up to standard, whereas SSF were satisfied with the condition of all types of health care. For LSF and MSF, private care is often significantly farther away compared to the public health care.

*Access to schools* registered fifth highest statistically of any indicator. MSF (0.05) and LSF (0.07) had relatively low scores, while SSF scored highest (0.12). The scores for this indicator and are probably result from similarities given for access to health services. SSF had a significantly higher score due to most of the LSF and MSF considering local secondary education to be inadequate and therefore have to send their children to schools elsewhere. Qualitatively it was also confirmed that local schools currently lack discipline and therefore children are increasingly sent away to boarding schools, significantly further from the Langkloof. In contrast, most SSF rated local secondary school education to be adequate. As a result the accuracy of the relative weighting of this indicator may be compromised as LMSF do have access to adequate schooling for their children – it just happens to be far away from the farm.

#### 4.2.4 Ownership and access to financial assets

The five indicators used to determine financial assets are the *number of agricultural income sources*, *number of non-agricultural income sources*, *fodder relief received*, *access to number of credit sources* and *access to insurance*. Obstacles to collecting information about *income* were expected and confirmed by the literature. Examples of studies which did not include these indicators in their financial asset analyses are Córdova (2008), Filmer & Pritchett (2001), Li et al. (2014), Sharp (2003) and Zeller et al. (2006). The main reasons for excluding these indicators are ethical considerations and non-responsiveness of subjects regarding their finances. Górdova (2008) noted that questions about income-based indicator have relatively high non-response rates as well as over- and under-reporting. Moser & Felton (2007) observed that collecting of income data is sensitive and holds limitations in

both accuracy and measurement, particularly in developing countries. Furthermore, a total asset analysis may be more useful than an income snapshot because the former has been accumulated over time and lasts longer. Even though expenditure is often considered as an alternative to as it overcomes some of the challenges, some of the same difficulties apply to expenditure (Moser & Felton 2007).

Despite these complications the income question was asked in the field but due to the reluctance of farmers to accede, information on savings and total income could not be obtained to constitute a financial indicator. Even in the case of willing farmers the information given was vague and quite likely inaccurate. Ethical norms and inherent inaccuracies dictated that income, and expenditure for that matter were no considered as a financial indicators.

The rationales for selecting the other financial indicators were nonetheless sound. *Non-agricultural incomes* are additional sources of income that increase a household's diversity which in turn is invaluable in times of stress and shock. Non-farm income is a source of farm household savings used to cope and adapt during difficult times when agricultural incomes may fluctuate. Hence, households with no off-farm income were considered to be more fragile than those having these options. Access to *insurance* is used to determine total financial assets because insurance is a means of coping and adaptive to environmental shock. The acquisition of *fodder relief* in the Langkloof implied that a farmer had the financial means to pay 10% of the total amount applied for and this indicates a farmer's financial situation. For this reason this indicator was included to serve as financial indicator in addition to number of agricultural and non-agricultural income sources. Access to good and effective financial and *credit services* is one of the most important factors in development. Kebede (1995) as cited in Berhanu (2005: 11) has explained the importance of credit for the rural poor as follows:

Credit makes traditional agriculture more productive through the purchase of farm equipment and other agricultural inputs, the introduction of modern irrigation systems and other technological developments. Credit can also be used as an instrument for market stability. Rural farmers can build their bargaining power by establishing storage facilities and providing transport systems acquired through credit. Credit plays a key role in covering consumption deficits of farm households. Moreover, credit encourages savings and savings held with rural financial institutions that could be channeled to farmers for use in agricultural production.

Table 4.6 indicates that LSF have the highest total score (0.06), with MSF (0.03) and SSF (0.03) almost tied. A direct relationship is apparent between farming scale and financial assets as a whole. The first indicator used was the number of *agricultural income sources*. Statistically, this had the second highest importance of all the financial asset indicators. Scores clearly decrease with decreasing farming scale. *Non-agricultural income sources* displayed the lowest statistical importance of the financial indicators and second lowest of all the indicators. The scores are essentially the same (0.01). No definite relationship is evident.

Table 4.6 Household financial assets by farming scale

Indicators	Farming scale		
	Large-scale farmers	Medium-scale farmers	Small-scale farmers
Number of agricultural income sources	0.06	0.04	0.03
Number of non-agricultural income sources	0.01	0.01	0.01
Fodder relief	0.04	0.03	0.07
Access to number of credit sources	0.03	0.02	0.02
Access to insurance	0.19	0.06	0.000
<b>Financial assets</b>	<b>0.06</b>	<b>0.03</b>	<b>0.03</b>

The use of *fodder relief* had the third highest statistical importance of the financial indicators and is the only financial indicator with a significant score anomaly. In Table 4.6 LSF and MSF have relatively low scores (0.04 and 0.03 respectively) compared to SSF with almost double (0.07) their scores. This is very likely because relatively more SSF keep livestock and disaster relief was only granted in the form of feed for livestock. *Access to number of credit sources* had below average statistical importance. The scores suggest a weak direct relationship between credit and LSF (0.03), MSF (0.02) and SSF (0.02). Referring back to institutional service delivery under PIPs, most farm incomes are seasonal and therefore loans from commercial banks are difficult to be attained because monthly instalments are required. Additionally, due to the Langkloof's high disaster risk status, chances of loans from banks are significantly decreased. In cases where loans have been approved and repaid, interest rates are extremely high. Finally, according to many farmers, from an institutional perspective, as long as the government is considering land reform, no institution, including banks will loan money to farmers, because of uncertainty whether loans can be reimbursed. The *insurance* indicator had the second highest overall significance and the highest statistical significance of all the financial indicators. Again, a direct relationship exists between insurance and farming scale correlation exists with decreasing farming scale, i.e. LMSF have scores of 0.12, 0.06 and 0.00 respectively. These figures paint a picture of all LSF having insurance against disasters, some MSF with insurance and none of the SSF.

#### 4.2.5 Ownership and access to natural assets

The final indicator, the access to and use of a number of natural resources, acquired a below average statistical importance. Only one question was posed to determine this asset because it was only necessary to establish the number of natural resources being used. This question was posed as an indication of the amount of possible money saved by using natural resources as opposed to buying these resources. The results in Table 4.7 suggest that SSF (0.04) are more inclined LSF and MSF (both 0.03) to use natural resources as assets.

Table 4.7 Household natural assets by farming scale

Indicators	Farming scale		
	Large-scale farmers	Medium-scale farmers	Small-scale farmers
Access to number of natural resources	0.03	0.03	0.04
<b>Natural assets</b>	<b>0.03</b>	<b>0.03</b>	<b>0.04</b>

Figure 4.15 plots the scores of the sixteen indicators used to determine total livelihood assets and graphically summarizes the above discussion. A number of features emerge. One is that the inclusion of all indicators in one diagram gives an overall picture. Also, the significantly greater importance of some indicators compared to others is evident. Finally, all three farming scales exhibit similar results regarding a number of indicators. Level of education is an indicator of which the statistical weight was significantly high for LSF and MSF and appreciably high for SSF. The spiked feature of this indicator is striking.

Overall physical assets scored higher (see Table 4.8) than any other group of assets because the three representative indicators all have high statistical importance and also combined with individual household values being generally high. For example, Figure 4.1 indicates that LSF and MSF all reported no shortage of farming equipment which produced very high scores of 0.17 (nearly 0.2) in contrast to SSF, most of whom reported shortages, so reducing their score to 0.06. Access to health institutions had high statistical importance which led to high scores of all three farming scales but with SSF being more prominent. Another indicator of physical assets, access to schools, produced a result with SSF being conspicuously higher than the other two farming scales. One financial assets indicator, insurance, featured LSF to be very prominent as opposed to the zero score of SSF.

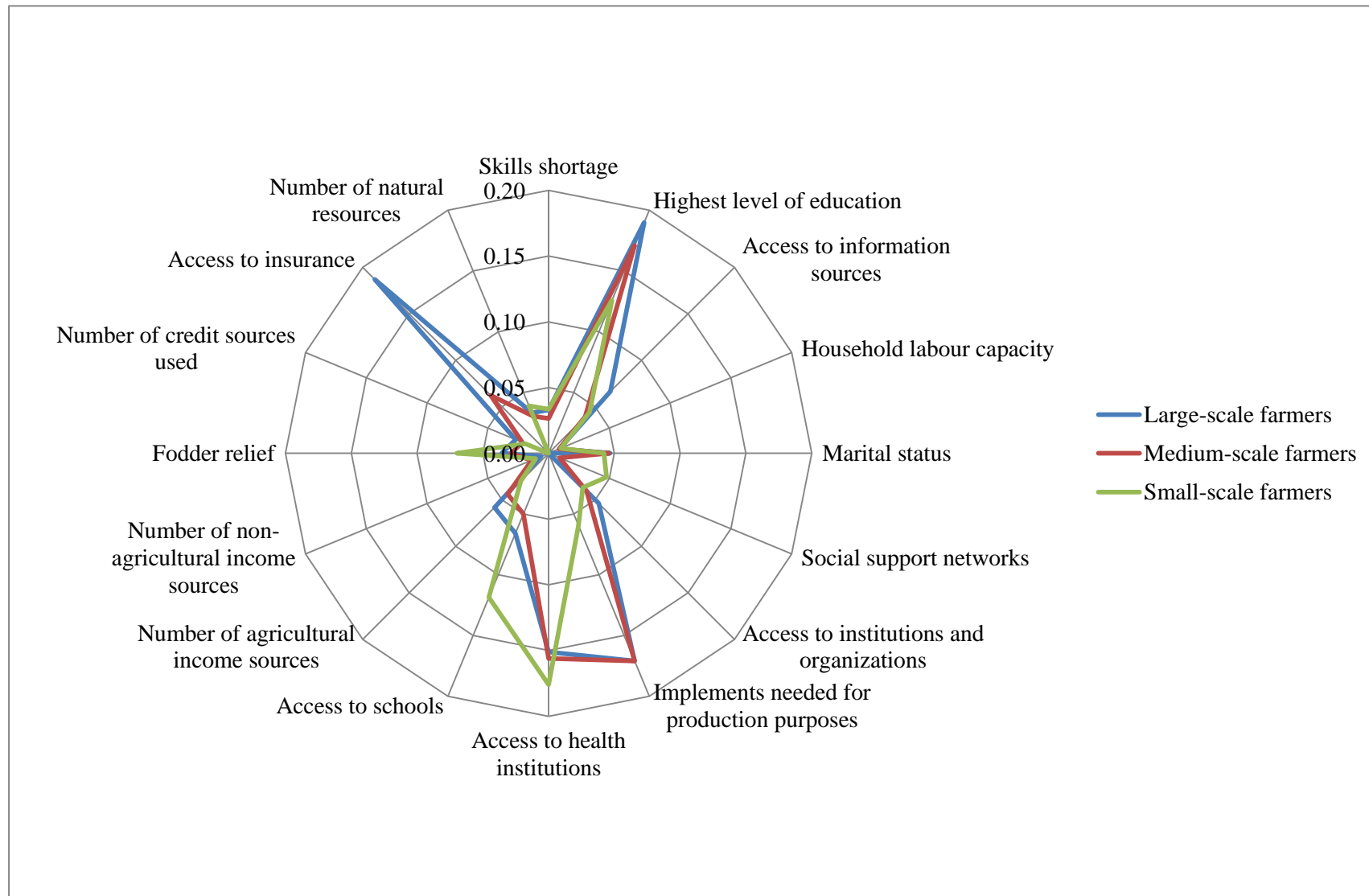


Figure 4.1 Scores obtained by each indicator of assets

Table 4.8 summarizes the indicators contributing to sustainable livelihood capitals enabling comparisons to be made between farming scales, types of assets and total assets accumulated. LSF scored highest in human, physical and financial assets whereas SSF scored highest in social and natural assets. LSF achieved the highest livelihood index score but surprisingly SSF finished marginally ahead of MSF.

Table 4.8 Household total assets by farming scale

Indicators	Farming scale		
	Large-scale farmers	Medium-scale farmers	Small-scale farmers
<b>Human assets</b>	<b>0.07</b>	<b>0.06</b>	<b>0.05</b>
<b>Social assets</b>	<b>0.02</b>	<b>0.03</b>	<b>0.04</b>
<b>Physical assets</b>	<b>0.13</b>	<b>0.13</b>	<b>0.12</b>
<b>Financial assets</b>	<b>0.06</b>	<b>0.03</b>	<b>0.03</b>
<b>Natural assets</b>	<b>0.03</b>	<b>0.03</b>	<b>0.04</b>
<b>LIVELIHOOD RESOURCE INDEX</b>	<b>0.32</b>	<b>0.27</b>	<b>0.28</b>

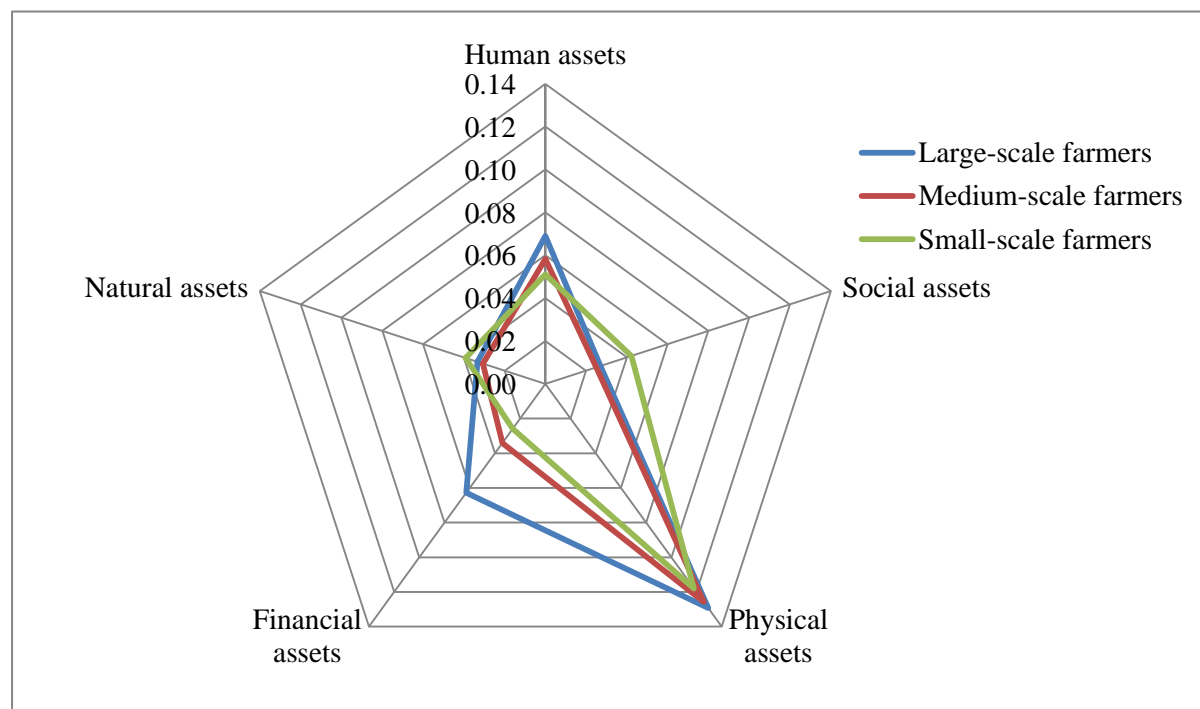


Figure 4.2 Total livelihood asset scores

Figure 4.2 graphically illustrates the total scores for the five types of assets achieved by each farming scale. The outstanding importance of physical assets for all three farming scales is evident. Accumulation of financial assets is clearly a characteristic of LSF. After an extensive investigation of the asset capacities of farmers in Langkloof a detailed discussion follows of farmers' livelihood strategies with which livelihood assets have a complementary relationship.



### 4.3 LIVELIHOOD STRATEGIES EMPLOYED

Survey results about the various livelihood strategies adopted by the sampled households covered agriculture as a primary source of income and crop cultivation versus livestock farming are reported below.

#### 4.3.1 Agriculture as primary source of income

Figures 4.3, 4.4 and 4.5 clearly show that agricultural activities are the mainstay for households of all three farming scales, where agricultural contributions to total household income are significantly higher than any other livelihood strategy reported. Also evident is that LSF have a markedly greater share (80%) of their income from agricultural activities compared to SSF (50%) or MSF (43%). It is also noteworthy that with decreasing scale of farming there is an increase in the number of income sources. LSF had only four livelihood strategies, MSF eleven and SSF fifteen.

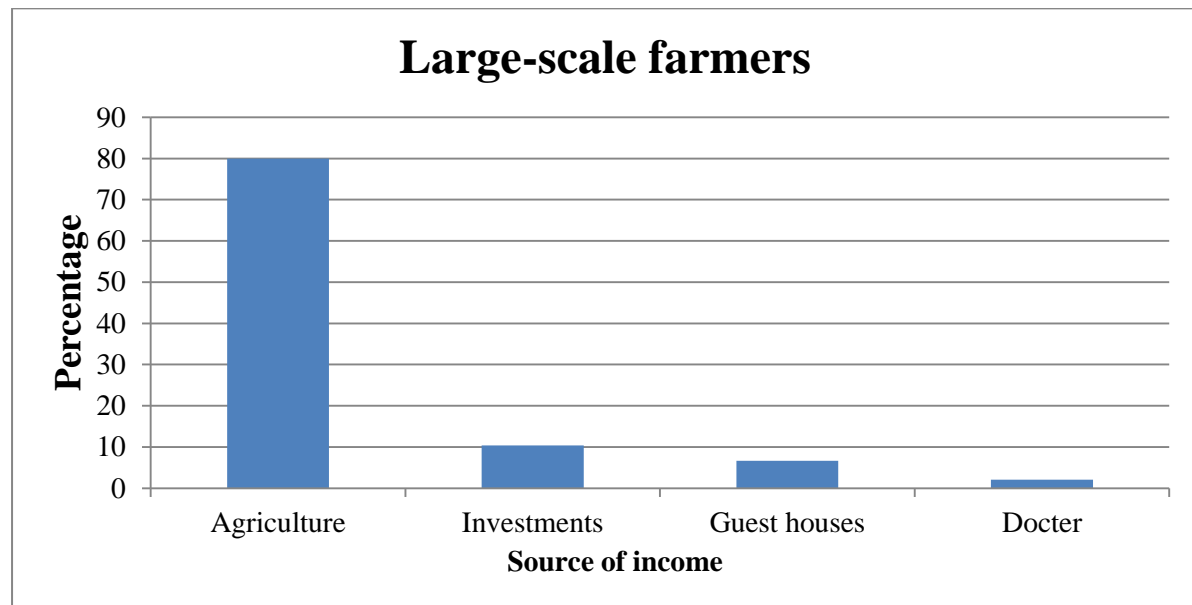


Figure 4.3 Sources of income of LSF

A noteworthy feature of the livelihood strategies is that MSF rely more on investment incomes (25%) than do the LSF (10%) or SSF (6%). State pensions (all payment) are a notable income source only for SSF where it accounts for 16% of household income. This relatively high proportion of passive income contrasts with other income sources identified for SSF and its absence from the income sources of both MSF and LSF. A passive income is regular income received without actively working for it.

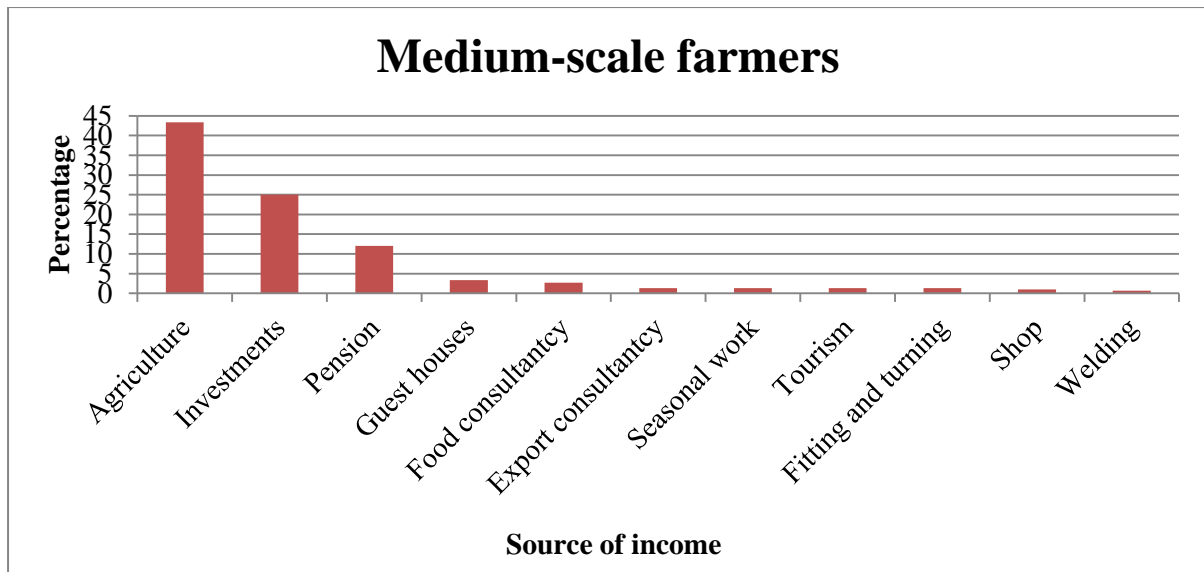


Figure 4.4 Sources of income of MSF

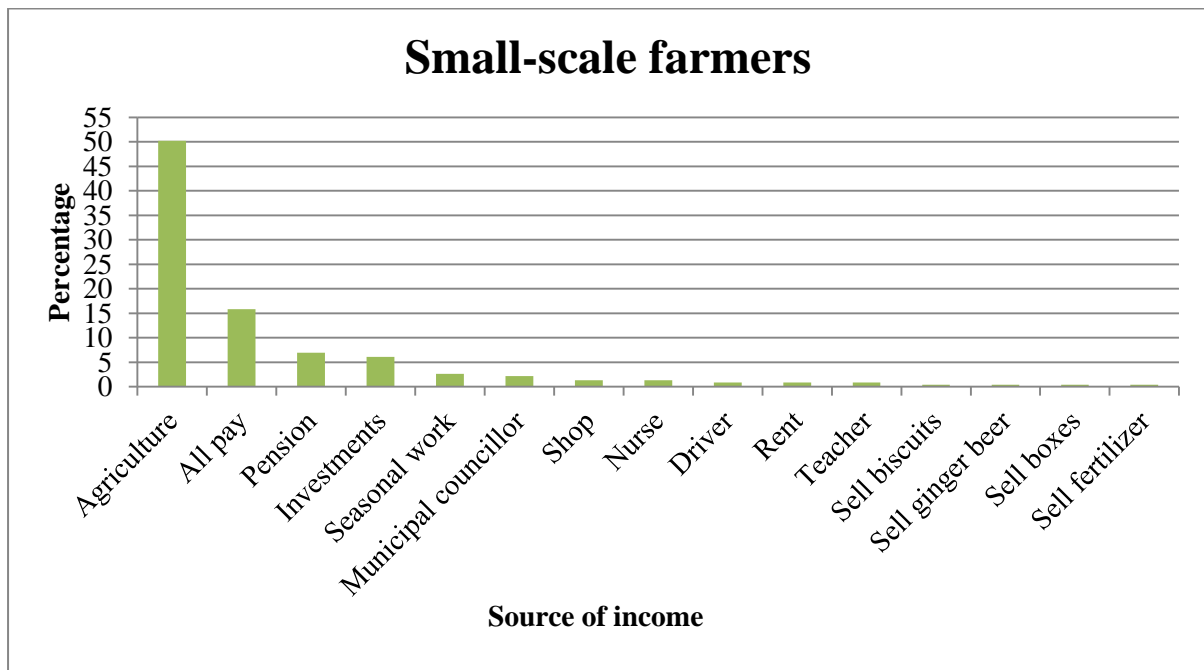


Figure 4.5 Sources of income of SSF

Agriculture, the practice of farming, including cultivation of the soil for growing crops and the rearing of animals to provide food and other products is, as evidenced here, the primary source of income of farmers in the Langkloof. The next section examines crops and livestock as income sources.

#### 4.3.2 Crop cultivation versus of livestock farming

The livelihood activities of the sampled Langkloof primarily involve the cultivation of various crops the sale of livestock and livestock products. The survey results reveal three different agricultural

activity scenarios for the three farming scales. Figure 4.6 indicates that LSF earn more than 60% of their agricultural income from apple and pear cultivation. Their third, fourth and sixth largest contributors are sheep and cattle which together make up 19% of agricultural income.

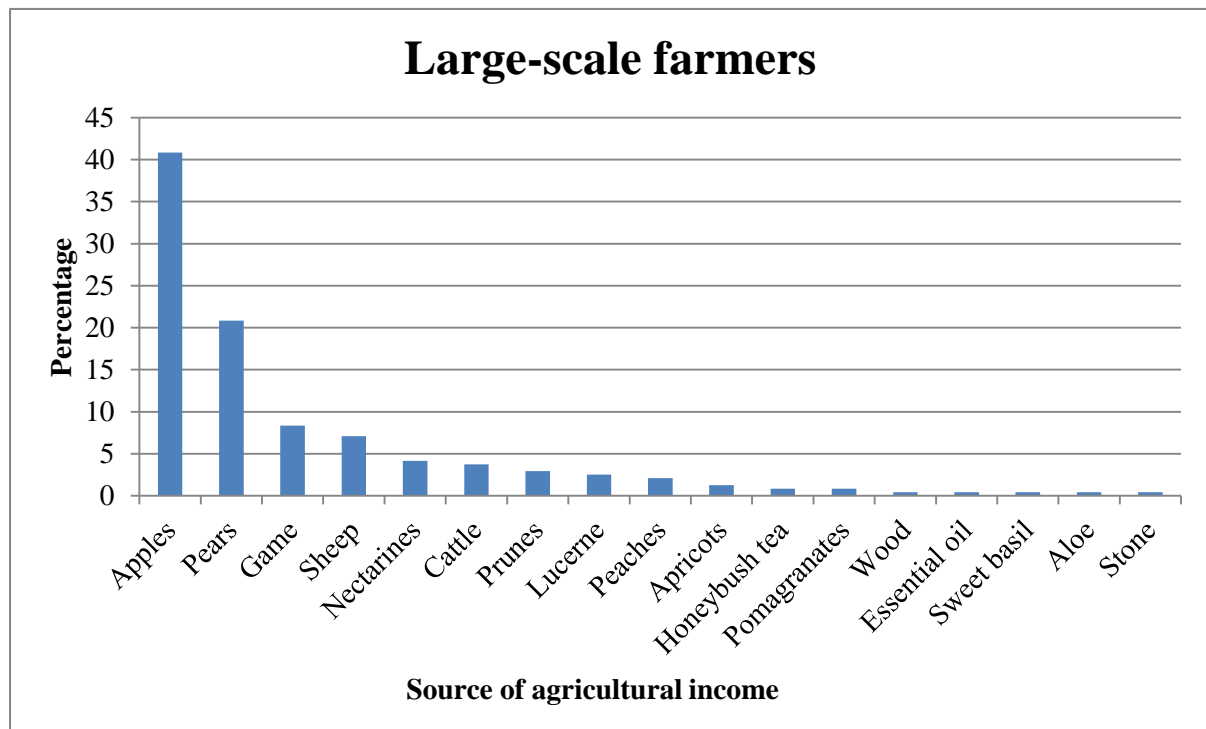


Figure 4.6 Sources of agricultural income of LSF

The breakdown of the agricultural earnings of MSF is strikingly different (Figure 4.5) as livestock farming is the clear main source of income. The sale of livestock and livestock products (cattle, sheep, cattle, game, dairy, trout, wool and ostriches) contribute 68% of medium-scale agricultural household income. Crop cultivation by MSF (Figure 4.7) depended mainly on apples and pears (22%) with the rest comprising a diverse mix (nuts, peaches, prunes, nectarines, apricots, lucerne, oats, vegetables and honeybush tea).

The range of agricultural activities of SSF in pursuit of a livelihood differ considerably from the strategies pursued LSF and MSF. Figure 4.8 clearly illustrates that vegetable cultivation is the mainstay of SSF agricultural income. No distinction has been made between the different types of vegetables SSFs produce because most of the respondents indicated that the products are diverse and varied every year. This did not allow income from vegetable crops to be reported. Apart from the sale of fruit and honeybush tea, the rest of their income was derived from the sale of livestock and livestock products with sheep (12%) and cattle farming (8%) contributing the most. Compared to the LSF and MSF, fruit farming is notably unimportant to the SSF as agricultural household income.

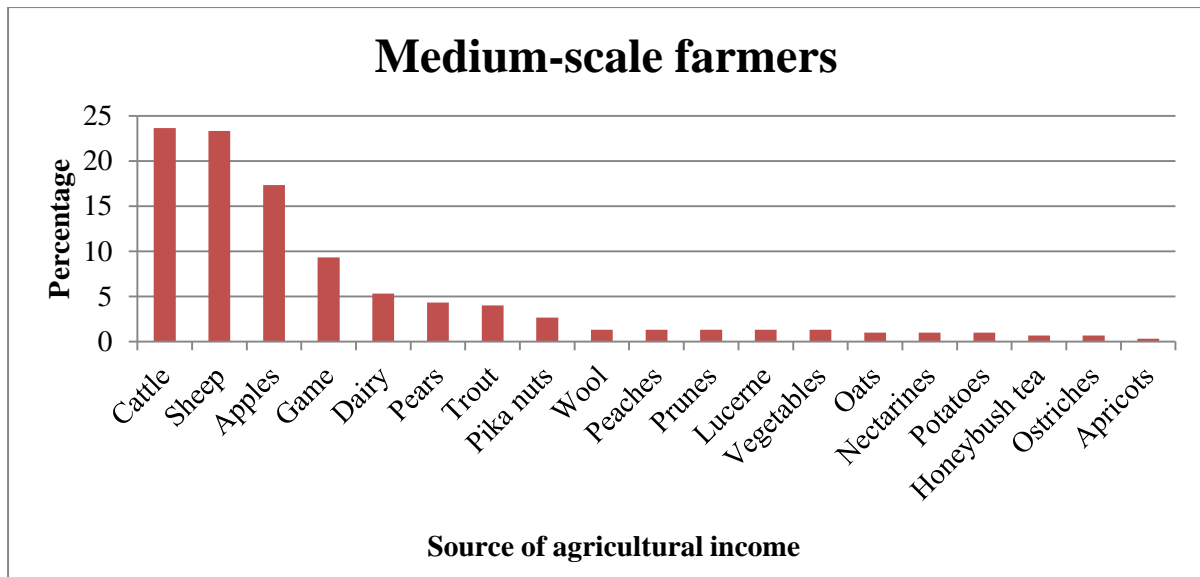


Figure 4.7 Sources of agricultural income of SSF

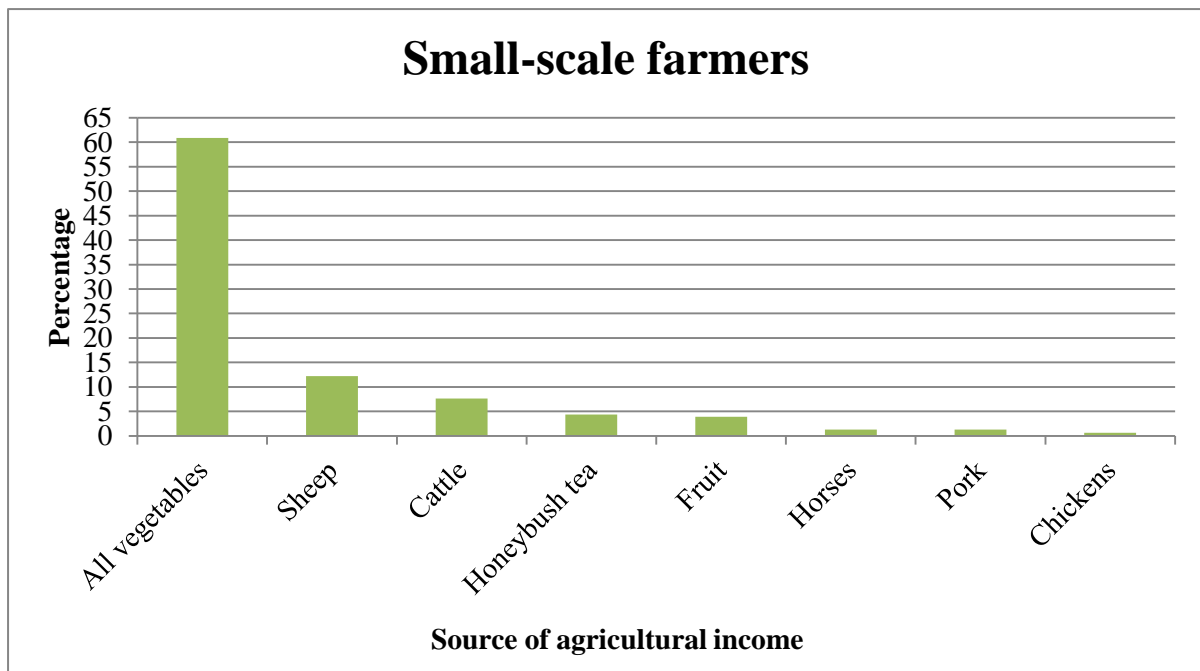


Figure 4.8 Sources of agricultural income of SSF

This chapter discussed, in the first instance, the socio-demographic/geographic profile of the sampled households in the Langkloof where a number of interesting findings were revealed. This was followed by the quantification of farmers' livelihood assets by means of a principal components analysis. Sixteen asset indicators were weighted to calculate the total asset scores of farmers. The discussions on the various profiles of farming scales led to the consequent livelihood strategies farmers are able to employ. Moving away from farmers' capacities the next chapter investigates the vulnerability context in which farmers pursue a livelihood and the state of institutional support farmers receive.

## **CHAPTER 5        VULNERABILITY CONTEXT AND THE STATE OF INSTITUTIONAL SUPPORT**

This chapter gives an account of the findings about around the vulnerability context of farmers in the Langkloof in accordance with the DFID SLF guidelines. By drawing on qualitative and quantitative primary data collected in the questionnaire survey and through key informant interviews, the vulnerability characteristics and drivers which influence other aspects of livelihood are reported. The guiding questions posed to the key informants are listed in Appendix A. This chapter also reveals the feedback with regards to institutional support from an external environment including the provision of essential services and the policies and processes influencing the pursuit of livelihoods.

### **5.1    THE    VULNERABILITY    CONTEXT    OF    FARMERS    IN    THE LANGKLOOF**

A number of vulnerability characteristics have been identified during interviews with informants, which are revealed below. A number of these characteristics are supported by quantitative information (Figure 5.1, 5.2 and 5.3) provided by the sampled farmers.

#### **5.1.1    At the mercy of nature**

The key informants identified a number of factors that enhance the vulnerability of LMSF in the Langkloof to external shocks and stresses. Because farmers are directly dependent on and at the mercy of nature and climate, they are inherently subjected to the natural hazards they pose. Consequently, farmers in the Langkloof can expect challenges from natural hazards such as hail, flooding, drought, wildfires and heatwaves. One key informant, who is also a MSF, commented that the occurrence of hazards affecting the agricultural sector is not a matter of “if it is going to happen” but rather, “when it is going to happen” so that a farmer’s best option is to have a degree of preparedness and response/mitigation strategies in place to minimize damages. Another comment was that one should plan for the worst-case scenario. High exposure to natural hazards is therefore a significant driver of vulnerability and disaster risk in the Langkloof area.

#### **5.1.2    Vegetation and debris in rivers**

Regarding wildfire hazards, the vegetation in the Langkloof area largely comprises of fynbos, which, by nature, is a good fuel for fires to ignite and flourish. Inhabitants of the area, especially farmers of all three farming scales experience increased vulnerability to wildfires due to their settlement in a region where the vegetation has a high burning potential. Related to the vegetation in the region, many of the key informants noted that increased vulnerability, especially for MSF and LSF, was

created when black wattle trees located below river flood-lines were cut and simply left on the riverbanks. The MSF and LSF were affected because they live close this affected river passing through Uniondale. Debris washed downstream and created substantially more damage than a river carrying no debris would have caused. According to key informants engineers and hydrologists there would have been a 90% decrease in damages in the 2007 floods if trees had been cut, removed from riverbanks and kept cut. Low-water bridges were designed to withstand 'normal' conditions of discharge, but not the volumes of added debris. After the flood in 2007 Fire and Rescue services and Uniondale Integrated Empowerment Projects (UNIEP) worked together to clean up the damages while their efforts also created employment. Related to flooding hazard is the increased vulnerability reported by key informants because farmers' dam are located along a river course.

### **5.1.3 Location of farm dams and water supply for Haarlem**

A phenomenon that increased the vulnerability of farmers of all three scales are farm dams built along a river course being damaged or destroyed when the dam highest up in a river bursts and compromises those downstream. The domino effect occurred during flooding in 2007 when the dam wall of the topmost (and largest) broke, so compromising downstream dams which gave away to the flooding river. This failing of dams in the face of a meteorological drought in 2008, caused significant additional vulnerability due to a shortage in water-storage capacity. The precipitation deficiency resulted in an agricultural drought where the available water no longer satisfied the crop needs in the area. The drought had significant socio-economic impacts in which human livelihoods were severely challenged. Farmers did not have the money to repair the dam walls so many of the dams are still damaged and out of service. Effects were felt in Haarlem where its residents and all its SSF on smallholdings received water from the Haarlem dam for irrigation purposes and domestic usage, as the dam was also compromised during the flooding in 2007. The vulnerability of the residents of Haarlem and the farmers is considerable due to the many people dependent on one source of water- a dam, which, if compromised due to flooding or drought, will adversely affect all Haarlem's residents and their livelihoods and they will be obligated to seek water from other sources. The last vulnerability characteristic related to flooding to be discussed is the settlement of farmers in flood plains.

### **5.1.4 Settlement in flood plains**

Many SSF in Haarlem have established their farms in the flood plain significantly increasing their exposure to flooding. Farmers situated relatively close to the river passing through Haarlem suffered significantly more flood damage than those farther away. Unfortunately settlement laws forbid the forcing of people to resettle, so by continuing to live there farmers are perpetuating their own vulnerability. Survey results (see Figure 5.1) reveal that the dominant external shocks and stresses

(hazards) in the Langkloof are natural hazards and the health of livestock and crops. Respondents were asked to rank five stressors on a scale of 1-5 in terms of their relevance to pursuing a livelihood, where 5 indicated the most possible influence and 1 the least possible influence. These findings that reveal farmers' perspectives strongly agree with the first four vulnerability characteristics (sections 5.1.1 to 5.1.4) identified by the key stakeholders. Regarding shocks (Figure 5.1) it is clear that natural hazards and livestock and crop health is seen as the most significant stressor. The first subsection (5.1.1) discusses the danger of natural hazards in general and the other three subsections deal with natural hazards namely wildfires, flooding and drought. A clear connection can be seen between the natural hazards highlighted by the key informants and the perceptions of sampled farmers who rank natural hazards very high (Figure 5.1). Livestock and crop health is the other shock highlighted by sampled farmers because the above natural hazard connection mentioned has direct implications for the health of livestock and crops.

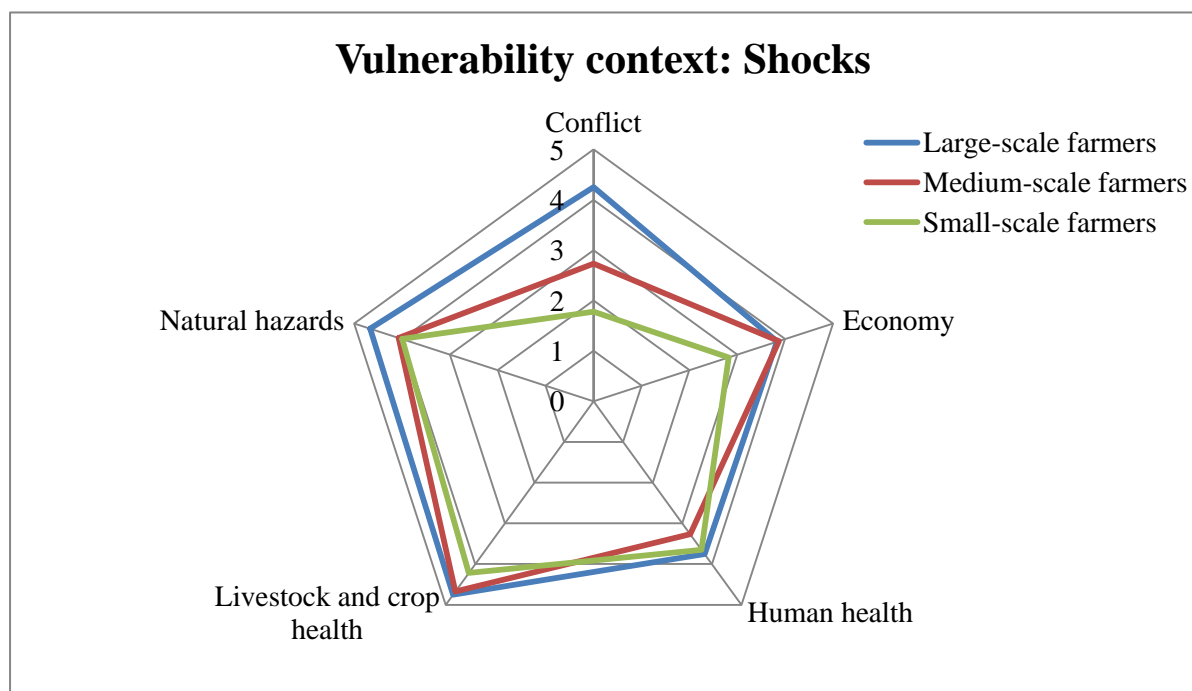


Figure 5.1 Dominant shocks and stresses in the Langkloof

Figure 5.2 displays farmers' perceptions on trends that contribute to vulnerability. Three trends: government politics, the economy, and natural resources are regarded to have the most relevance regarding their effect on vulnerability. There consensus among all three farming scales that governance is paramount trends in local, national and international economies and were seen by LSF and MSF to have much relevance. Natural resources were ranked equally by LSF and MSF.

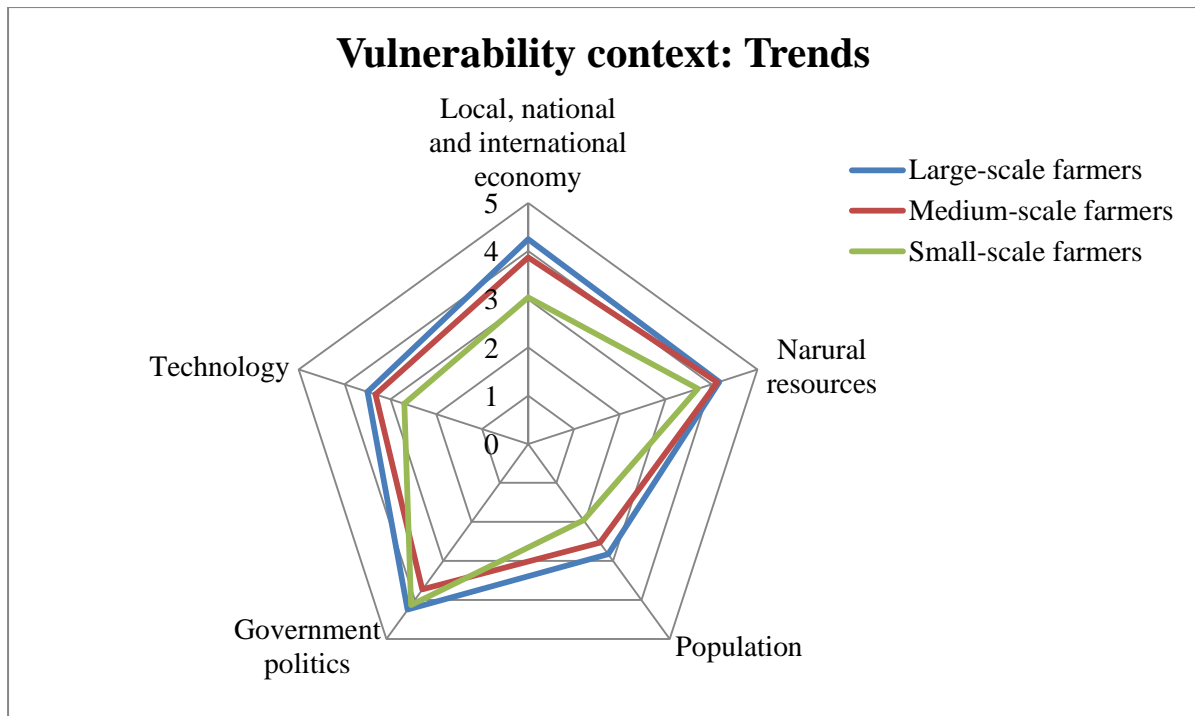


Figure 5.2 Trends in the Langkloof

### 5.1.5 Seasonal crop cultivation

As in any agricultural region, there are defined planting and harvesting seasons in the Langkloof too. All three farming categories plant crops for approximately three months and donate another three months to harvesting. During the remaining six months of the year, frost is a potential hazard to crop cultivation. Figure 5.3 illustrates farmer perspectives on seasonality. In this case production and price fluctuations were regarded as the primary elements that contribute to vulnerability. Production and seasonality specifically imply fluctuations in the conditions (weather, soil and water) that influence inputs (planting), growing periods and ultimately harvests. Price fluctuations, especially affecting LSF and MSF, have a significant influence on agricultural outputs. The key informants agreed that because crop cultivation is seasonal, vulnerability increases when income fluctuates rather than being continuous throughout the year.



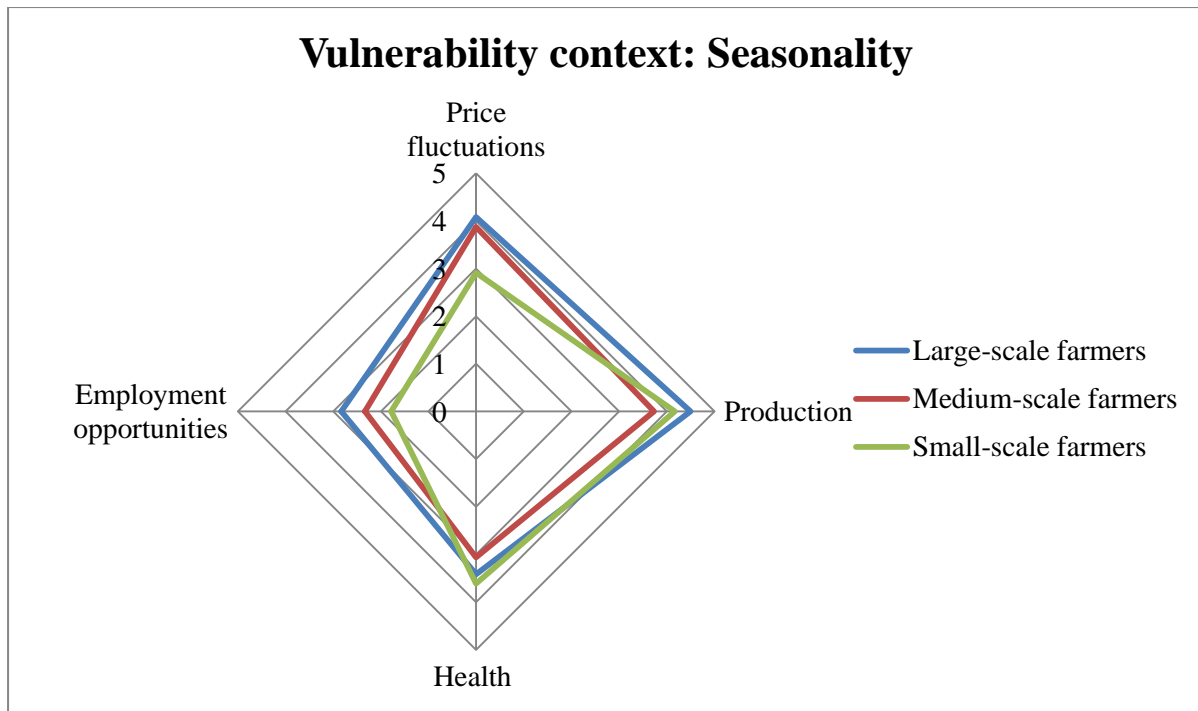


Figure 5.3 Seasonality in the Langkloof

The above discussion painted a picture of the various vulnerability aspects which challenge farmers' ability to pursue a positive livelihood. Interviews with key informants first revealed these characteristics followed by farmers' qualitative and quantitative perspectives which confirm a number of the issues highlighted by the key informants. The adequate access to and performance of policies, institutions and processes (PIPs) in the area also challenge farmers' attempt toward a positive livelihood.

## 5.2 THE STATE OF INSTITUTIONAL SUPPORT

Similar to the discussion on vulnerability, interviews with key informants also revealed a number of characteristics which challenge farmers. Thereafter farmers' perspectives also support and confirm a number of these issues highlighted, quantitatively (Figure 5.4, 5.5, 5.6 and 5.8) and qualitatively. These challenges include agricultural service delivery by state institutions, the provision of essential health and education institutions, access to credit source, the accessibility to the local farmers' cooperative, access to insurance, the authority of the local municipality, and the state of disaster risk governance.

### 5.2.1 Agricultural service delivery by state institutions

Shortcomings in service delivery, particularly agricultural support services by government departments (including the Department of Agriculture, Water Affairs, and SANRAL) was a recurring

theme in the interviews with key informants. The questionnaire surveys also elicited information about this topic from farmers. According to a key informant and various MSF an operational 'community' disaster response system functioning at ground level still exists in the Langkloof. Self-help and the use of local knowledge are common practice and they consider these as their first resort as opposed to waiting for a response from government departments. Farmers in the area are reliant on themselves and one another for help during periods of stress and shock. This strategy has proven effective with farmers being particularly proactive when given early warning of impending hazards. The fire department in Uniondale received no additional support in the form of money, manpower nor equipment to assist people in Avontuur during the year-long road closure after the 2007 flood. During that year a number of fires affected the area but response time was critically lengthened due to the road closure.

An informant reported that farmers in Haarlem received R46 000 worth of diesel to help rehabilitate their lands after the devastating flood of 2007. No money, however, was allocated for the maintenance of machinery (such as tractors), which led to many farmers having to use livestock to plough their lands. When Haarlem was adversely affected by the hailstorm in 2006 no relief was received, although LSF and MSF elsewhere did receive assistance. Regarding the 2008 drought, most livestock farmers in Haarlem received fodder relief which was greatly appreciated. Water shortages, however, had to be dealt with by transporting additional water to Haarlem for irrigation and domestic use.

All the farmers agree with the key informants that contemporary technical agricultural support from the government is now substantially weaker than its value and importance were in the recent past. This is indicated by Figures 5.4 and 5.5 where benefits from state departments and the level of prominence are respectively used as indicators. Figure 5.4 clearly illustrates a perceived relatively low to substantially low degree of support from state departments and thus corresponds with the findings of key informants. Forty-two per cent of farmers reported perceiving low to substantially low benefits and support while 33% described the support given as average. Thus, only 25% of the LSF indicated above-average benefits from state departments. One must conclude that the institutions and policies in place to assist local farmers in the area have been compromised and that farmers are mistrustful of government departments. Some ninety-three per cent of MSF felt that the state benefits are below average. Similarly, 83% of SSF indicated that the benefits were below average.

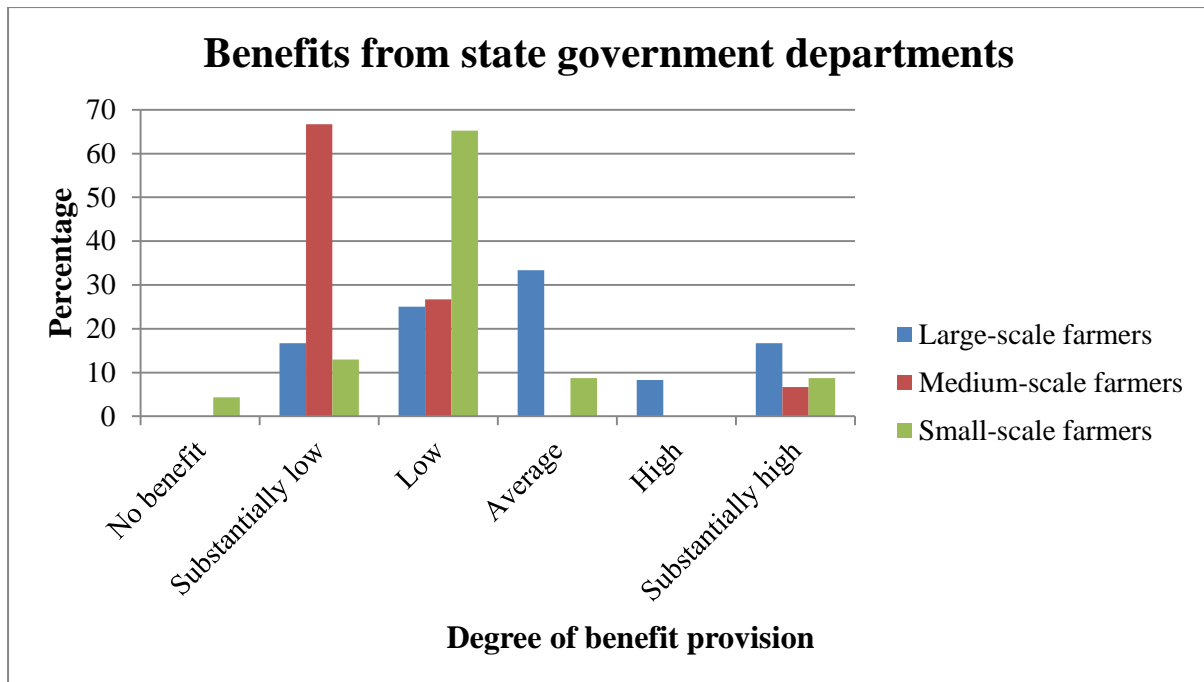


Figure 5.4 Technical agricultural support by state departments for disaster relief

Figure 5.5 illustrates the respondents' stance whether the level of prominence of state departments should increase. All farmers felt that state departments should increase their prominence, some even drastically. Eighty-three per cent of LSF felt that state department prominence should increase or even do so drastically. Notably, 80% of MSF called for a drastic increase in prominence. SSF were even more adamant that state department prominence must increase, some 91% insisting on an increase or a drastic increase. On average of 50% of all farmers called for a drastic increase in prominence, 40% and increase and only 10% were at one that no increase is needed.

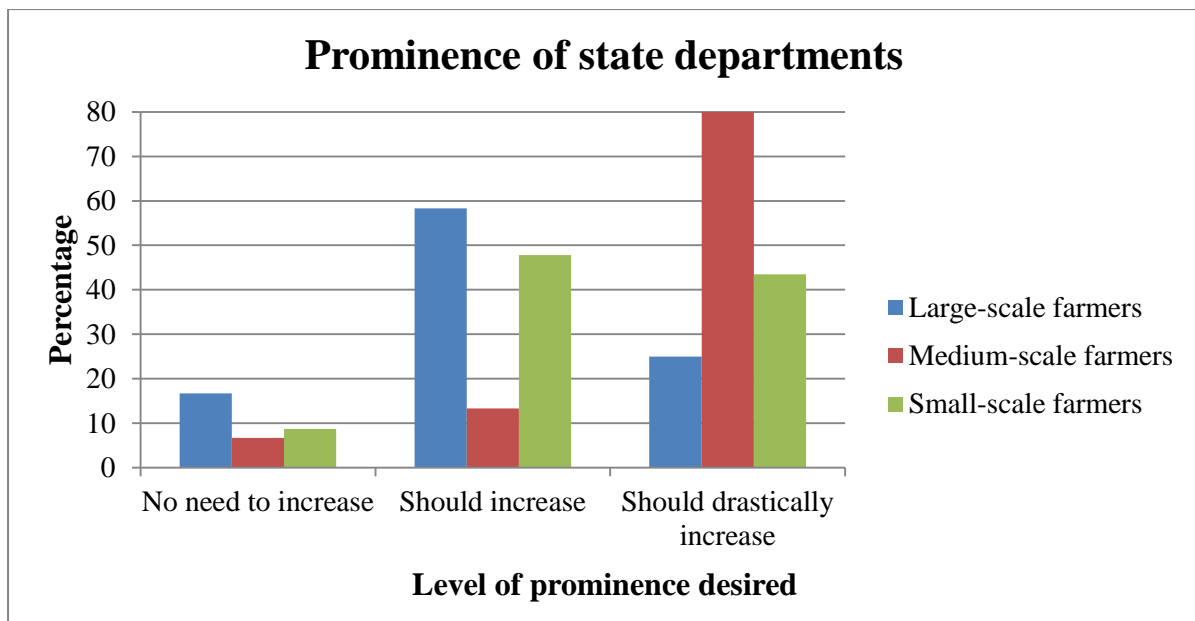


Figure 5.5 Farmers' desire for prominence of state departments to increase

There is a strong agreement between the survey results presented above and qualitative information acquired through the interviews with key informant. Shortcomings in the government's agricultural support services were a recurring theme during the interviews. Figures 5.4 and 5.5 indisputably show the farmers' perceptions regarding the ineffectiveness and inadequacy of state departments in providing agricultural support and services. The next section addresses related issues in the provision of essential health and education services.

### **5.2.2 Provision of essential health and education institutions**

The majority of LSF and MSF indicated, during interviews, that certain elements such as sufficient trained personnel at local primary health care, chronic care, child care and private care are, compared to the past, currently lacking, or not up to standard. Interestingly, SSF were still satisfied with the condition of all types of health care. For LSF and MSF, private health care is often significantly further away compared to the public health care. Similar feedback was received especially by LSF and MSF who described the local schools as currently lacking discipline. As a result parents increasingly sending their children to boarding schools, significantly further from the Langkloof. On the other hand, the majority SSF considered local secondary education as adequate.

### **5.2.3 Access to credit sources**

Most farm incomes are seasonal resulting in reduced access to loans from commercial banks because monthly instalments are demanded. Banks also consider farming, especially in the Langkloof, high risk because of the continuous disaster events, hence decreasing the chances of acquiring loans. Apart from the difficulty accessing loans, many farmers find the interest rates too high to repay loans. Many of the farmers reported that the government's plans for land reform discourage institutions, even banks to lend money to farmers because of the uncertainty whether loans can be reimbursed. In order to cope with some of these problems, the Langkloof farmers have a strong spirit of cooperation and community which provides support in terms of financial, physical and social capital.

### **5.2.4 Accessibility of the local farmers' cooperative**

The local farmers' cooperative where various agricultural necessities are acquired is perceived by farmers and many key informants to be too expensive, especially for SSF. Many farmers referred specifically to the price of fertilizer, which at R600 per bag, is unaffordable to SSF. Figure 5.6 shows that 50%, 87% and 91% for LSF, MSF and SSF respectively maintain that the cooperative should be less expensive to local farmers. Clearly, the desire for lower prices increases with decreasing farming scale.

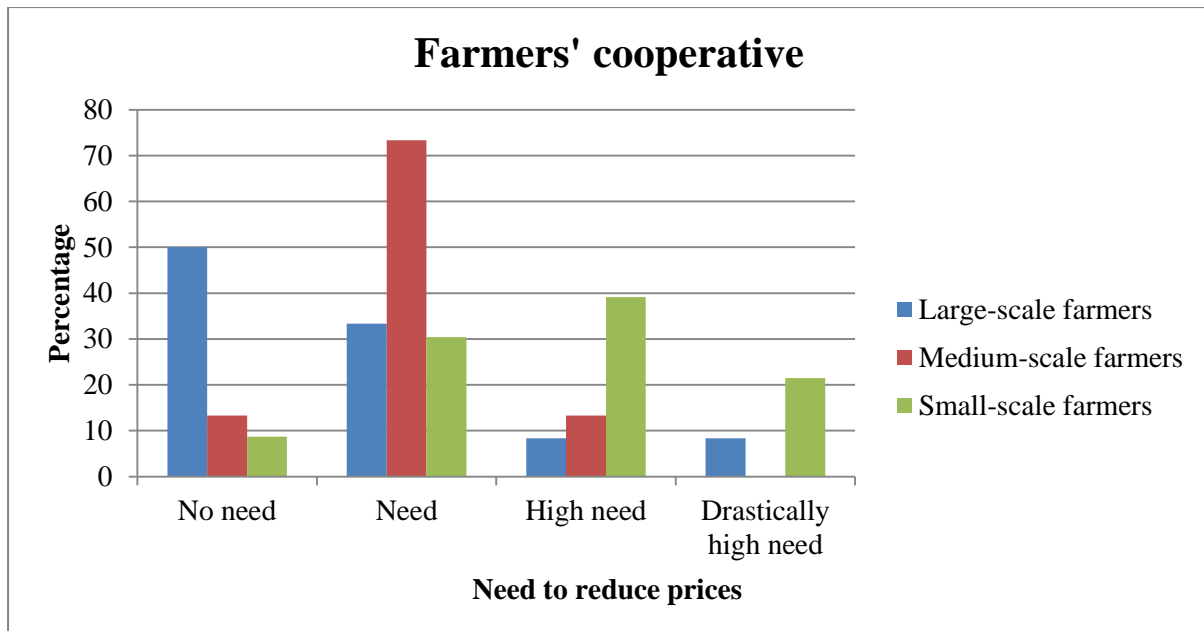


Figure 5.6 Farmers' view of the cooperative's prices for agricultural requirements

### 5.2.5 Access to insurance

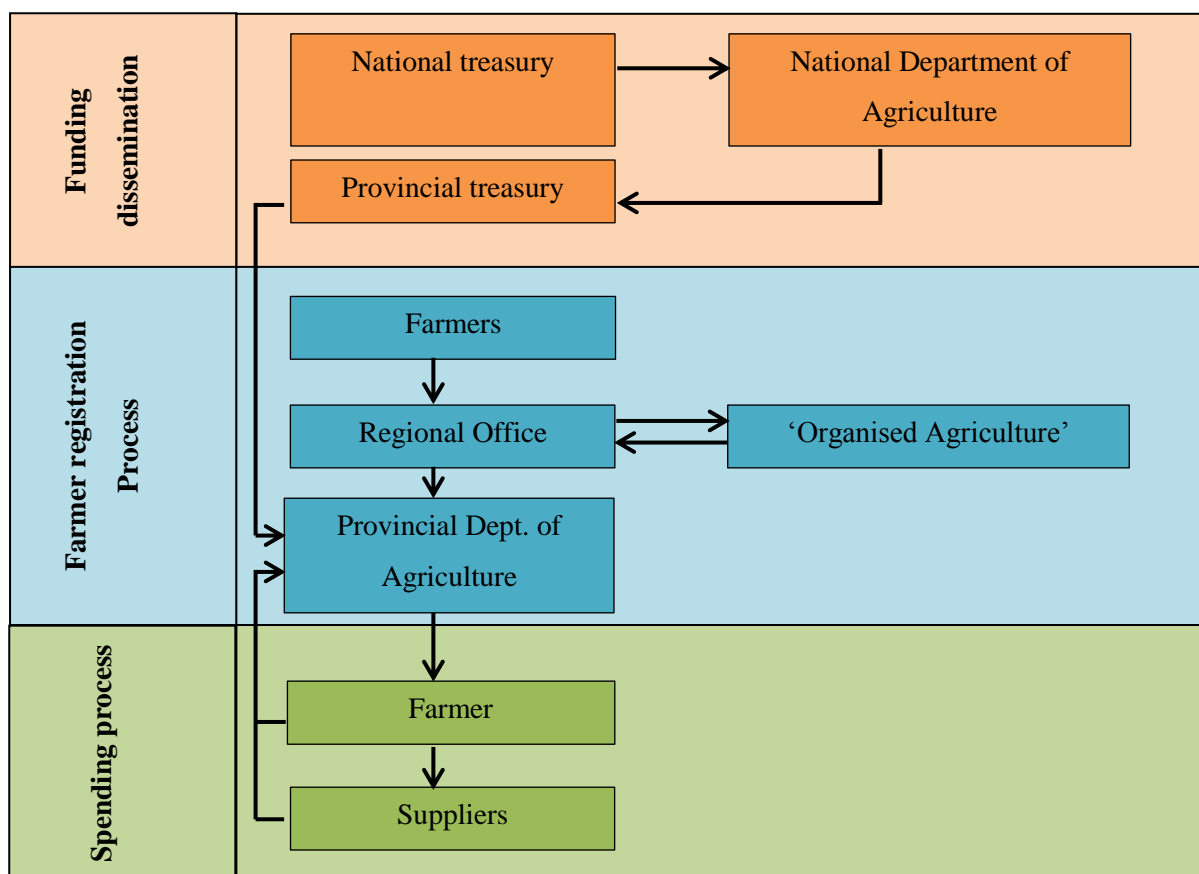
Insurance plays a significant role in reducing vulnerability by enhancing peoples' resilience. In the Langkloof, however, several issues became evident during fieldwork. LSF and most MSF are unable to insure their fruit trees (where only harvests can be insured) and SSF cannot afford insurance at all due to the high costs involved. A key informant, who is a disaster manager, explained that damages to fruit trees and harvests during the 2006 hailstorm were difficult to quantify, which challenges farmers to calculate the damages sustained. Furthermore, the adverse impacts of such a hazard can only be insured against for a certain period, defined as a 'hail season'.

### 5.2.6 Authority of the local municipality

Another key informant noted that the municipality was only involved during the response to the 2007 flood and only at the Uniondale 'Poort'. This action occurred as the municipality only has authority when the town is affected and not rural areas. The flood caused substantial damage in Uniondale and subsequently the municipality was directly involved in the provision of assistance and repairs. Flood damage is largely managed by the George Local Municipality but when dealing with affected farm roads, it is the responsibility of the provincial government to assist and make the necessary repairs. This matter highlights the state of disaster risk governance in South Africa and in the Langkloof area.

### 5.2.7 Disaster risk governance

The key informants noted several shortcomings in disaster risk management and risk governance in the Langkloof. Regarding response governance, it is perceived that the government should consider declaring the Langkloof a hazard-prone (disaster area) area in order to enable rapid response and release funds from national treasury. As it stands, difficulties still arise when attempting to determine the criteria an area has to fulfil to ultimately be declared a disaster area. Assistance from government to farmers during times of external shock is either non-existent or extremely delayed due to the involved process of declaring a disaster and allocating funds. Valuable time is lost, which is described by farmers and key informants as crippling given the nature of disasters where response time and rapid assistance are crucial. There is also a perception, that at national level, disaster management lacks the capacity to respond to disaster events. This is evident from it being much easier to acquire assistance from local municipalities than from provincial or national government. The disaster management chain of command regarding assistance is illustrated in Figure 5.7 and helps one to understand this dilemma.



Source: Adapted from Holloway et al. (2012)

Figure 5.7 The process chain for allocating disaster-relief funds

Most often, time is wasted at treasury where the process is delayed. There is some frustration at local level government with the national processes where nobody at any level is prepared to write a request for relief. In the Langkloof local disaster management made immediate decisions and took responsibility for mistakes, so that assistance was provided in time when those affected needed it most. The Department of Agriculture is a very important role player but is often inexplicably hesitant to allocate money for disaster response. Another challenge to risk governance in the study area are the pronounced gaps created when the army withdrew from assisting the agricultural sector with disaster response, especially firefighting and the capacity to quickly make large quantities of food available. Furthermore, two urgent challenges that need to be confronted are:

- Red tape must be reduced (especially for declaring an event as a disaster so as to secure more rapid assistance); and
- National disaster management must become more involved and more efficient.

Figure 5.8 graphically summarizes the survey results regarding farmers' opinions on governance, policies and policy processes, institutional arrangements, service delivery, political and social organizations and social relationships affecting their pursuit of a positive livelihood. Respondents were asked to rank the six elements on a scale of 1-5 according to their influence on pursuing a livelihood. A rating of 5 indicated substantial positive impact and 1 was substantial negative impact. Figure 5.8 shows a clear correspondence in the responses by LMSF across five of the elements with service delivery and governance regarded as having the most significant influence on their livelihoods. These feelings correspond with the above discussion on the shortcomings of state departments in providing agricultural support services. With regards to the other four elements, i.e. policies and policy processes, social relationships, social and political relationships, responses on average from all three farming scales are significantly related. The local cooperative, part of resource access organizations, is regarded by MSF as being significantly influential compared to LSF and SSF.

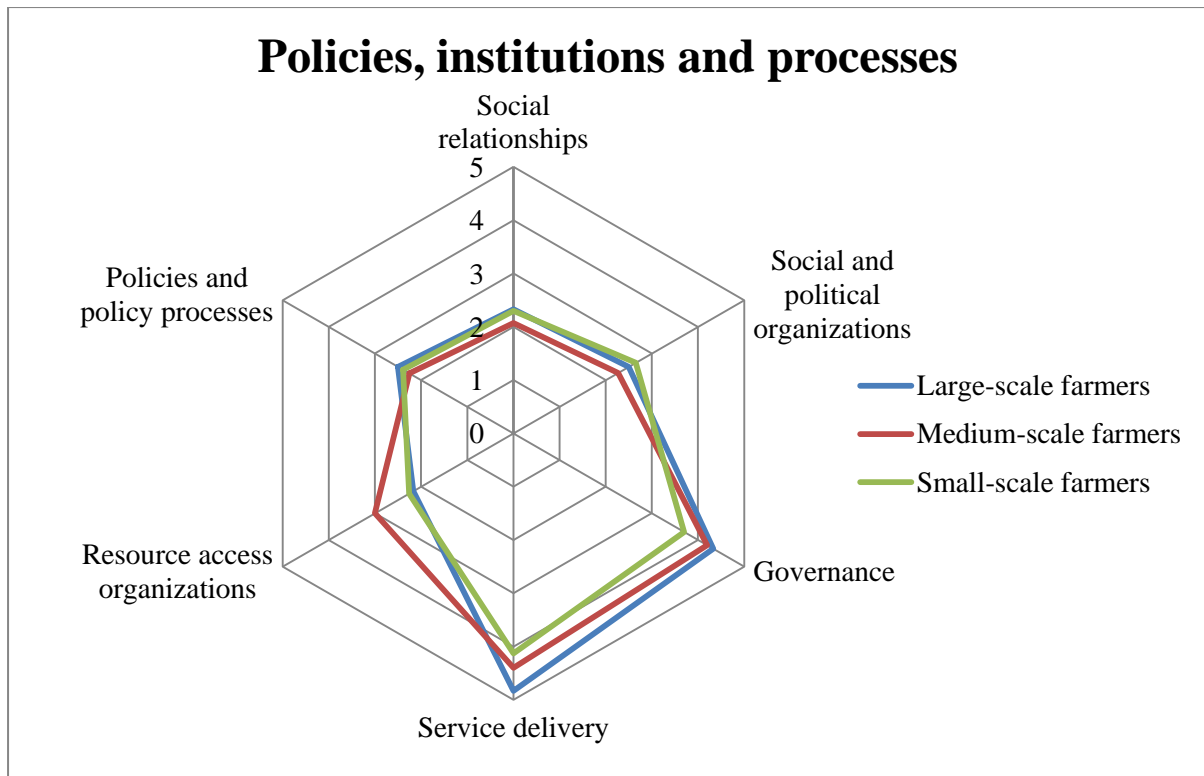


Figure 5.8 Overall scores for policies, institutions and processes

To conclude the section about the PIPs, a key informant stated that farmers in the community have started to live by the following motto: *One for all and all for one*. Chapter five gave a detailed account of the most concerning vulnerability aspects facing farmers in the Langkloof followed by the PIPs in the external environment affecting these farmers. Information given by the key informants about a number of these obstacles also corresponds with the views of farmers in the Langkloof regarding the same challenges. The next chapter investigates the coping and adaptive strategies used by farmers in the Langkloof to mitigate the damages inflicted by various hazards which include hail, drought, flooding, wildfires and heatwaves.



## **CHAPTER 6      COPING AND ADAPTIVE STRATEGIES EMPLOYED AGAINST ENVIRONMENTAL SHOCK AND SOCIAL STRESS**

This chapter reveals the individual strategies employed by farmers against the five natural hazards relevant in the Langkloof namely hail, drought, flooding, wildfires and heatwaves. This is followed by collective strategies used by various organizations to benefit the entire Langkloof farming community. The correlation analysis between the individual strategies of farmers and their total calculated asset scores was done to establish if any significant relationships exist between farmers capacity (total asset scores) to employ strategies and their actually strategies employed.

### **6.1      INDIVIDUAL STRATEGIES EMPLOYED**

In light of the several environmental shocks and social stresses that struck the Langkloof, farmers were asked a) to name the coping strategies they resorted to during the period 2006-2012 and b) their adaptive strategies to mitigate damages from future events. No distinction was been made between the strategies of farmers who were affected by the events and those who were not affected because farmers should have strategies in place regardless of being affected or not. The different strategies employed by famers against each of the five hazards mentioned are discussed below.

#### **6.1.1      Hail**

LSF only implemented two adaptive strategies (insurance and shade-nets) to adapt to the hail hazard (Figure 6.1). It is noteworthy that MSF applied five different strategies so providing extra safety nets should one strategy not work. Their two most popular coping strategies were treating trees at the time the hail disaster struck and reducing general expenses. Their other three adaptive strategies were diversification, the correct trimming techniques and insurance, the latter being made use of the most. It is surprising that no coping or adaptive strategies were or are currently used by SSF against a hazard that caused them substantial damage in 2006.

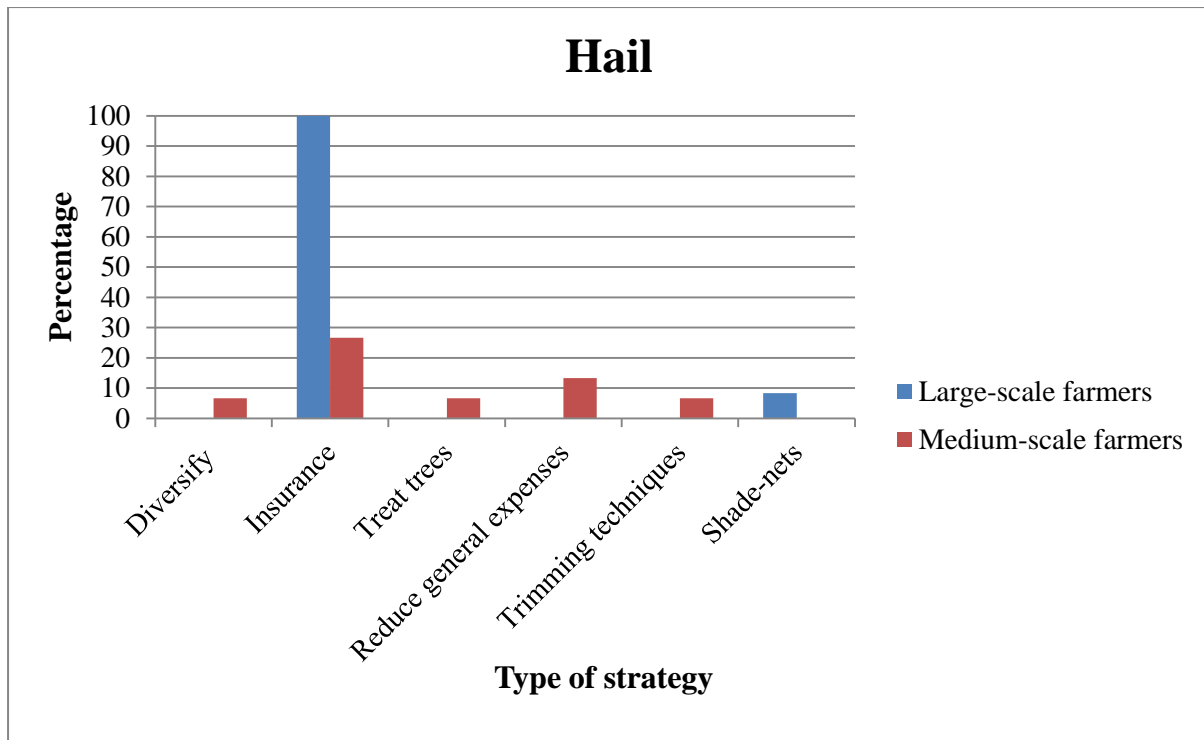


Figure 6.1 Strategies to mitigate hail damages

### 6.1.2 Drought

The drought hazard convinced farmers at all three scales to put a diversity of coping and adaptive strategies into practice (Figure 6.2). LSF used the most strategies (10), SSF (six) and MSF (five). A reduction of livestock (a short-term coping strategy), the accumulation of feed (a long-term adaptive strategy), use of water reserves (coping) and the change from macro irrigation systems to micro are the four preferred strategies among LSF. More than 40% of LSF made use of or currently have these strategies in place. They seem to favour the adaption of macro irrigation systems into micro, but also bought animal feed as a coping strategy. Their other strategies include the reduction of livestock, the accumulation of feed, rotational grazing and the use of reserved water.

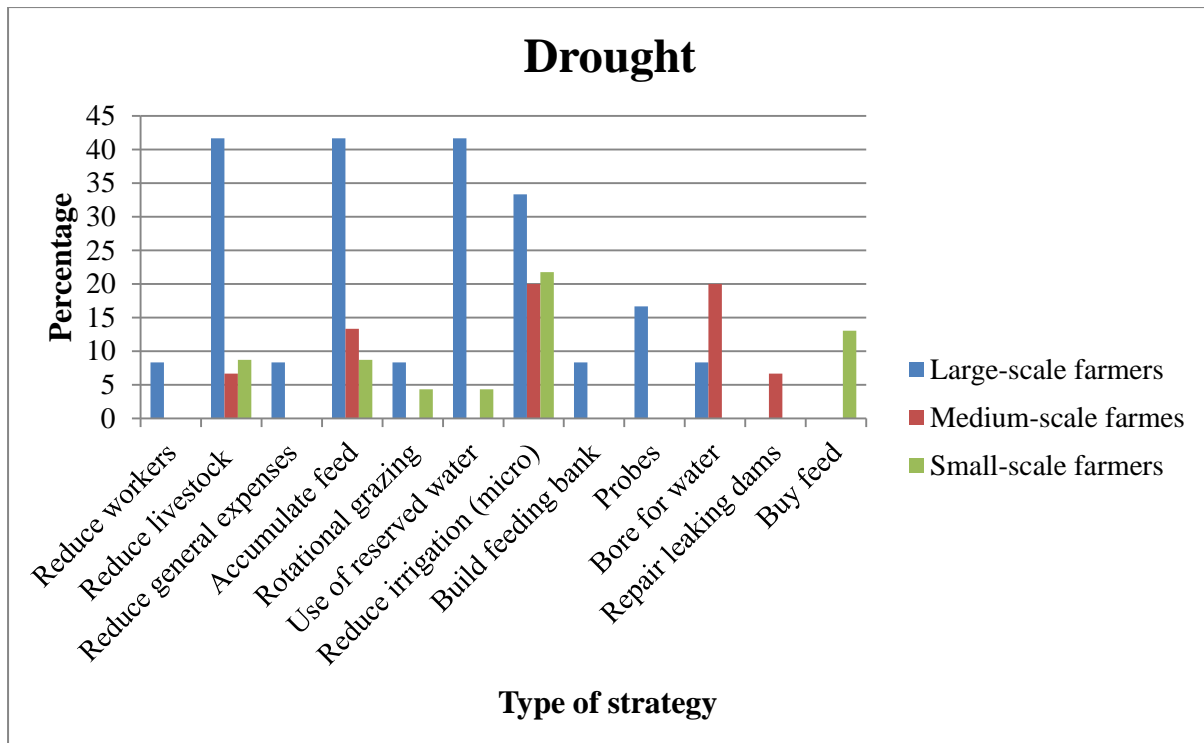


Figure 6.2 Strategies to mitigate drought effects

MSF employed the fewest strategies in relation to the drought hazard. The adaption of irrigation systems and boring for water are equally popular practices. Their other strategies include the reduction of livestock, the accumulation of feed and repairing leaking dams. Overall the most popular strategy among all the farmers is the adaption of irrigation systems to save water and the accumulation of feed (an adaptive strategy).

### 6.1.3 Floods

The many coping and adaptive strategies employed against floods are presented in Figure 6.3. LSF and MSF have implemented 11 strategies, SSF only four. The most popular (60%) strategy of LSF is the adaptive practice to widen river run-outs. Two other adaptive strategies applied are the building of down-flows – to force water down a specific channel instead of allowing surface water flow which has adverse effects – and keeping rivers clear of debris such as boulders, logs and branches which have been the cause of increased damage during flooding.

Strategies employed by MSF are different to LSF. For one, they place rocks and boulders in rivers (adaptive) to decrease the power of water during floods and they strengthen dam walls (adaptive) so decreasing the probability of dam walls breaking. Their other strategies are diversification of income (adaptive), the construction of contours (adaptive) to reduce the velocity of running water, repairing

leaking dams (adaptive), planting grass (adaptive) which can absorb more water and the reduction of general expenses (coping).

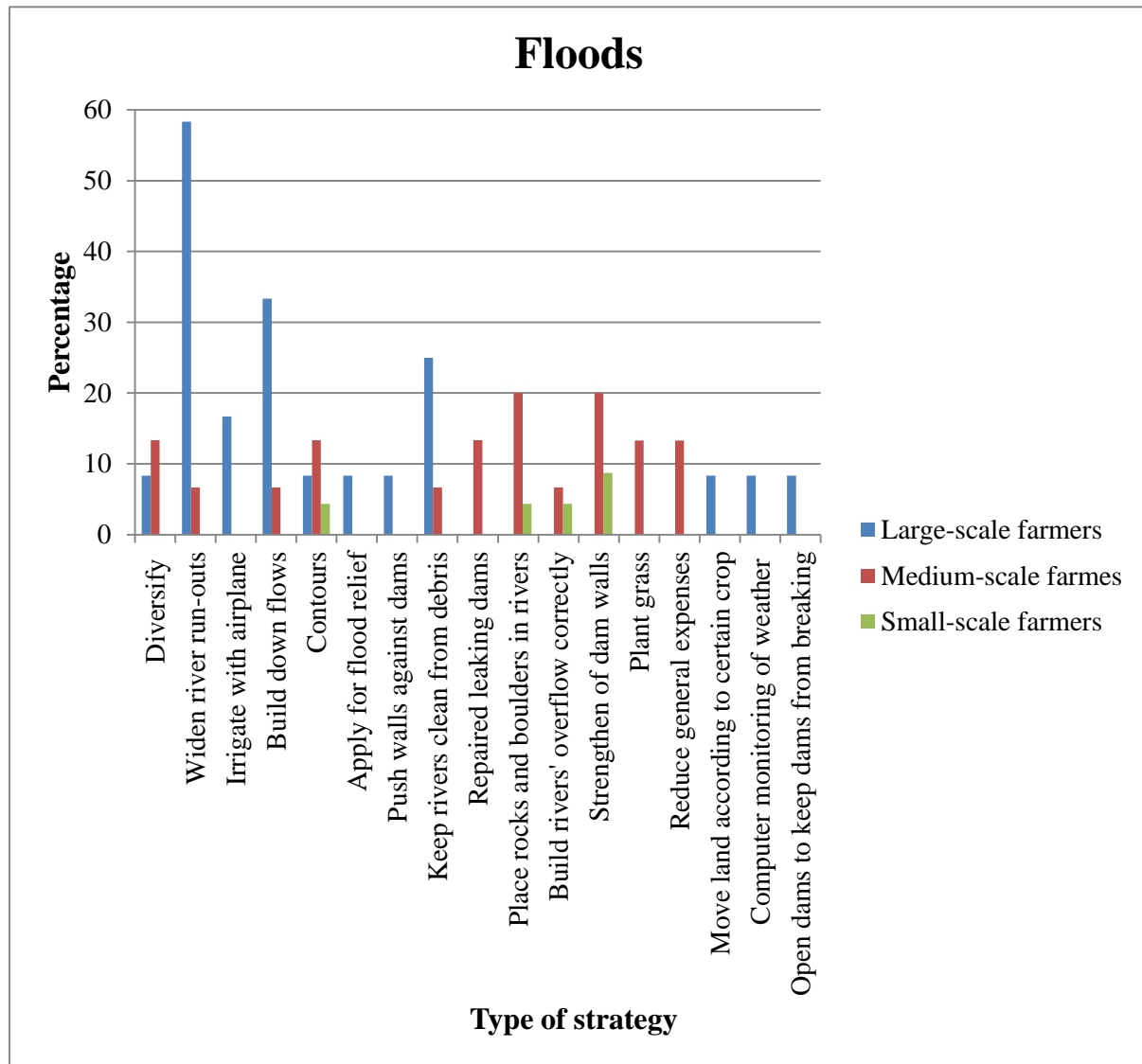


Figure 6.3 Strategies to mitigate flooding

The four strategies used by SSF in times of flood disasters are the strengthening of dam walls, the construction of contours, the placing of rocks and boulders in rivers and the correct construction of rivers' overflow to decrease the probability of riverbanks breaking.

#### 6.1.4 Wildfires

LSF have used or currently use the widest variety of strategies to mitigate wildfire damages. Of the twelve listed in Figure 6.4, LSF employ 11 strategies to varying degrees. Among the eleven, five stand out with the most popular one being the construction of firebreaks (almost 60% of LSF employ this adaptive strategy). Two other adaptive strategies that rank equally high are the use of basic

equipment (bush beaters, rakes and hoses) and the establishment of the FPA (Fire Protection Association). Two other relatively high-ranking strategies are the clearing of bushes, which act as fuel for fires to thrive and the training of farm workers in firefighting. Both strategies are adaptive in nature.

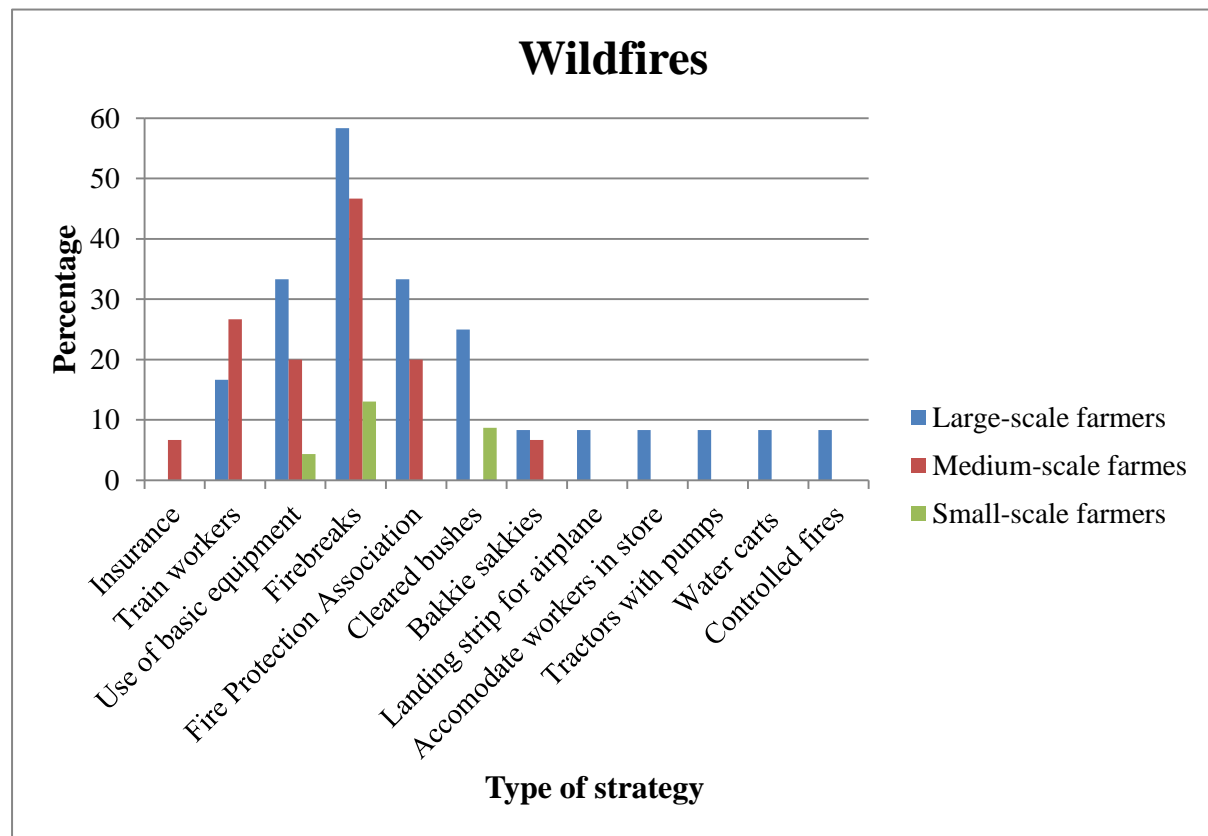


Figure 6.4 Strategies to mitigate wildfire threats

The most popular strategy of MSF is also the construction of firebreaks, followed by the training of farm workers, the use of basic equipment (bush beaters, rakes and hoses) and the FPA. SSF reported only three strategies, namely the construction of fire breaks use of basic equipment and clearing of bushes.

### 6.1.5 Heatwaves

Figure 6.5 presents the coping and adaptive strategies used by farmers concerning heatwaves and, as expected, LSF have the most strategies. Their three popular strategies are the construction of micro irrigation systems, using the correct trimming techniques and applying correct orchard row orientation. MSF reported one coping strategy (in the form of spraying fruit trees from a helicopter) and three adaptive strategies namely the construction of micro-irrigation systems, using correct trimming techniques and the installation of shade nets. Not surprising, SSF did not employ any coping strategy

at the time of the disaster nor do they make any adaptive provision for the occurrence of heatwave disasters.

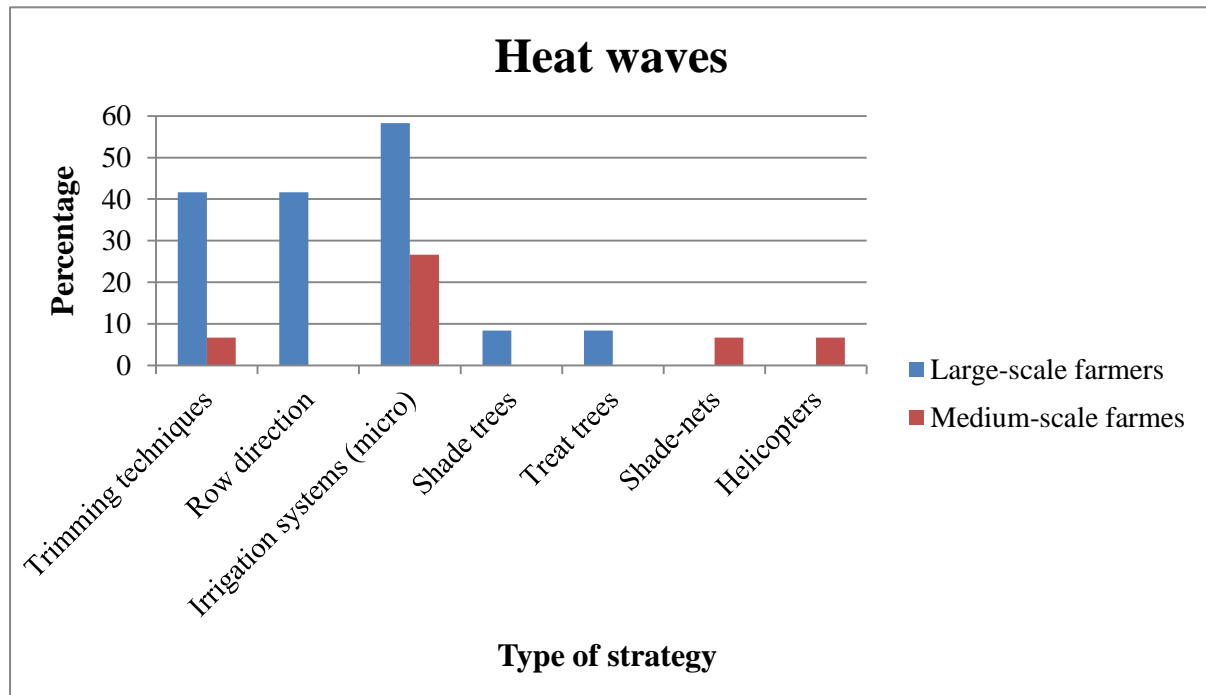


Figure 6.5 Strategies to mitigate heatwave effects

Figure 6.6 summarizes the average number of household short-term coping strategies to mitigate the disaster damages that were sustained and the long-term adaptive strategies implemented against future events. With an average of nine strategies used by LSF, they appear to be more concerned, able and proactive than the MSF and SSF who average just over four and one strategies respectively. The direct relationship between the number of strategies employed and increasing farming scale is again confirmed.

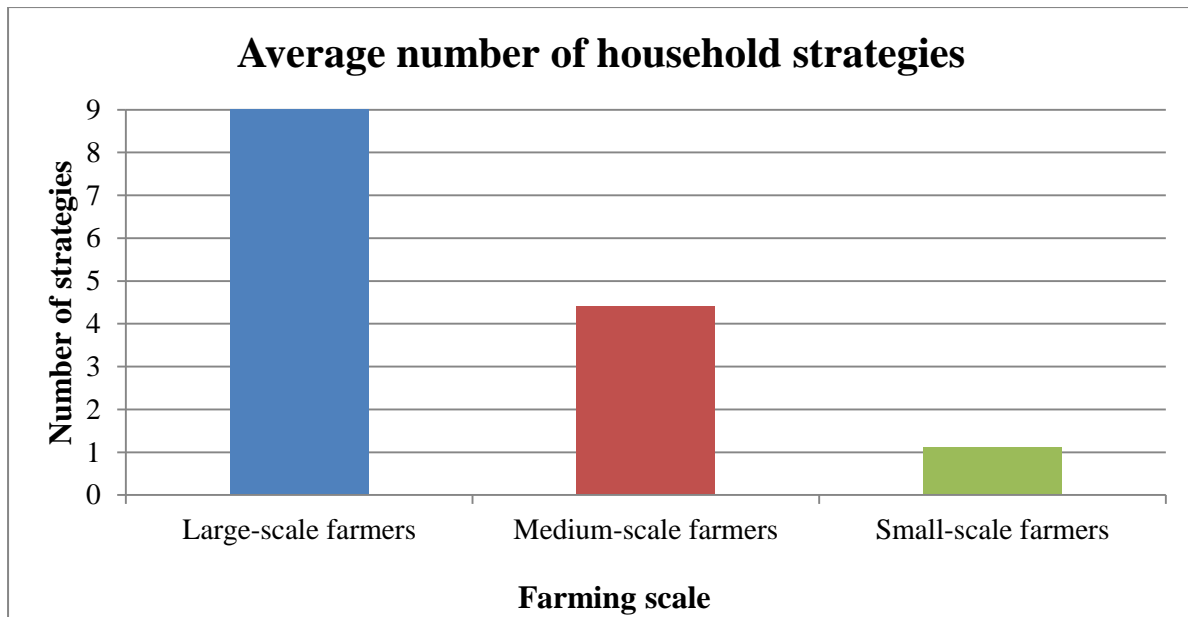


Figure 6.6 Average number of household strategies used against all hazards

These results paint a picture of the variety of strategies put into practice by farmers to make the adverse effects of five hazards less severe. It is noteworthy that most of the strategies are adaptive (long term) in nature. This tendency was revealed for each farming scale. Regarding hail, LSF strategies are all adaptive, more than 60% MSF strategies were adaptive and SSF have no hail-mitigating adaptive strategies. Strategies to lessen the severity of drought impacts recorded an indirect relationship between the number of strategies used and decreasing farming scale (adaptive strategies constituted marginally less than 50% of all strategies for LSF, 50% for MSF and almost 60% for SSF). The strategies for flood mitigation were overwhelmingly adaptive, again with an indirect relationship with farming scale, LSF applying almost 90% adaptive strategies, MSF 90% and SSF 100%. Regarding wildfires, the strategies of all three farming scales are all adaptive. Similarly all the strategies resorted to for heatwaves are adaptive, except for SSF who have none.

Figure 6.7 indicates the proportion that average coping and adaptive strategies constitute of all strategies used by each farming scale. Clearly the majority of total strategies employed by all three farming scales are adaptive (long term) and the respective proportions are similar. Over 80% of LSF and MSF' strategies are adaptive and that of SSF is marginally lower. According to a number of key informants this may be due to the majority of strategies being farming practices employed by past generations and are still in practice and because farmers in the past strongly believed that prevention (long term adaptive strategies) is better than cure (short term coping strategies).

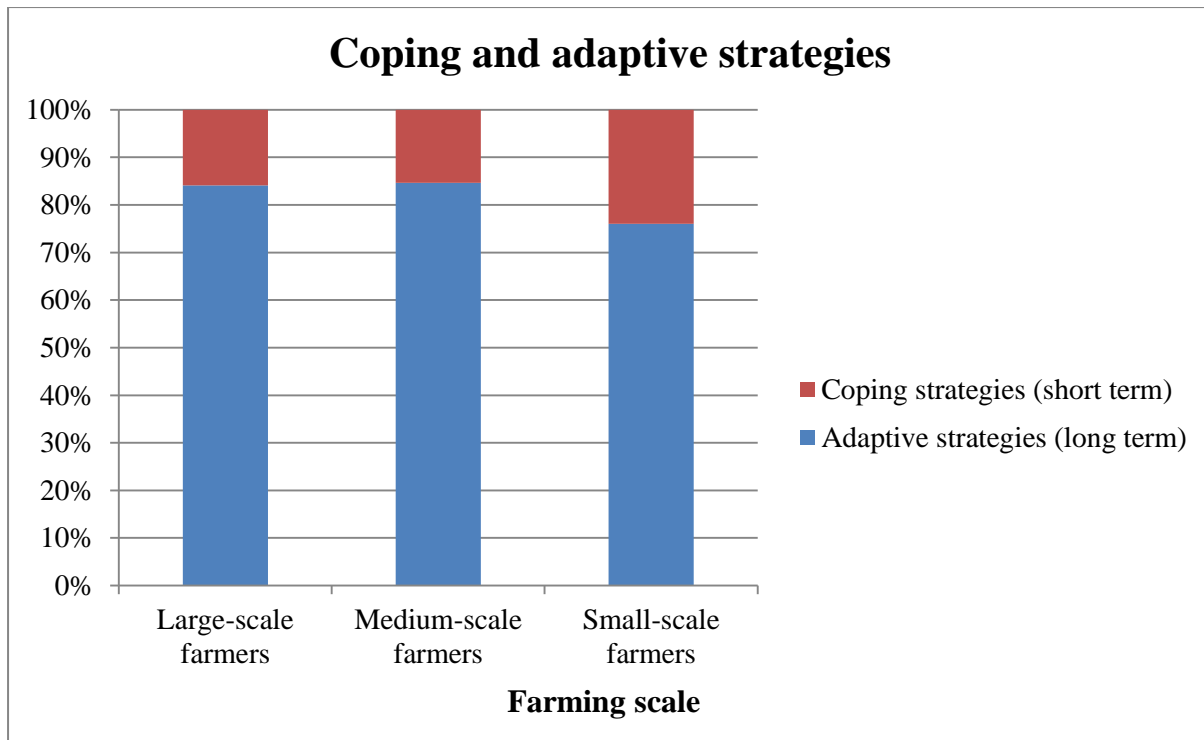


Figure 6.7 Use of coping strategies as opposed to adaptive strategies according to farming scale

The results indicating the individual strategies employed revealed a number of different concerns. Strategies against the hail hazard – the cause of such significant damage in 2006 – had the fewest number of strategies with SSF farmers employing none. With drought LSF employed the most strategies and, interestingly MSF the fewest. Flooding revealed the most strategies employed of all the hazards. LSF and MSF also used the same number of strategies. LSF again used the most strategies against wildfires, followed by MSF and then SSF. Only LSF and MSF used strategies against heatwaves. These were all strategies employed by farmers individually whereas the collective strategies used, involving organisations that benefit the entire farming community, are discussed below.

## 6.2 COLLECTIVE STRATEGIES EMPLOYED

General strategies which are not aimed at a specific hazard are discussed first. Thereafter a number of strategies aimed to mitigate the damages caused by wildfires and flooding are discussed.

### 6.2.1 General

A *Gemeenskaplike Operasie Sentrum* (Community Operational Centre), of which many farmers are participants, via cellphone by which emergencies can be communicated with a quick response from neighbouring farmers has been established in the Langkloof. Regarding the SSF community, a disaster committee has been established in collaboration with an influential key informant and all SSF,



municipal committee members and farmworkers. Social welfare has also been included to assist failed SSF get back on their feet. Another key informant reported that the establishment of the committee owes much to the perseverance of a key informant who secured a visit from officials of national government to investigate the losses sustained by SSF as well as the social knock-on effects. The committee also distributed food parcels and created jobs for people to clear black wattle trees from the riverbanks. During times of stresses and shocks, farm labourers were exchanged between farms to ensure some income for those affected. A number of additional hazard-specific coping and adaptive strategies have been identified which are in place to benefit the entire Langkloof farming community.

### **6.2.2 Wildfires**

The first collective adaptive strategy against wildfires is the reduction of fuel loads and fire loads through prescribed burning, in association with landowners. A key informant noted a decrease in wildfire occurrences since 2006, no doubt due to the effectiveness of this strategy. Areas such as De Vlugt, however have too high a risk to perform prescribed burning. Other strategies are:

- During the fire season (which starts November) more trained personnel from Uniondale are employed on contract for six months.
- A helicopter based in Knysna serves the Langkloof, but it is not always available and not sufficient because severe wildfires call for more than one helicopter to bring them under control.
- Two teams of 22 trained firefighters, based at Cape Nature outside Uniondale, are on standby 24/7 with basic equipment.
- A reason why the Western Cape has one of the best firefighting systems in the country is that all the fire stations in the province have standardized awareness campaigns that distribute the same information on pamphlets about wildfires.
- Fire awareness projects, such as accredited training with continuous follow-up training regarding general housekeeping, are in place and are functional at farms (farmers and workers), schools and in the town.

Collaboration by land owners, FPA and the municipality has ensured the introduction of cutting firebreaks at strategic places as an adaptive strategy. Implementation and maintenance (every 2-3 years) is, however, expensive and big fires often ‘jump’ the firebreaks which therefore only serve to buy time for help to arrive. Through the FPA and the Eden District Municipality five ‘bakkie sakkies’ (portable water tanks, to be used during wildfires) with basic firefighting equipment are located in strategic places. The combined efforts by farmers, volunteers, firefighters, the municipality and the FPA have shown their worth.

### 6.2.3 Floods

A key informant specified a number of novel strategies used during times of flooding namely:

- A bow and arrows have been used to shoot medicine across a river to people in the case of a medical emergency.
- Miniature airplanes with a camera attached have been used to investigate areas inaccessible to people.
- Diving equipment has been used where necessary.
- Farmers with tractors or bulldozers have cleared roads to make them passable for vehicles.

Another adaptive strategy for flood events is an early warning system using the Short Messaging Service (SMS) of cellphones. Two to three days before heavy rain, coordinators (key informants) receive warnings and send text messages to every farmer informing them about the threat and enabling them to take the necessary precautions and stock up on supplies of food and medicine, and check their emergency generators. Eighty per cent of the farmers usually take these precautions but in cases where farmers are caught unprepared, food parcels are delivered. Sections 6.1 and 6.2 are evidence of a significant number of precautions being taken by farmers, individually and collectively. The next section uses the livelihood assets calculated in chapter four and the above individual strategies against hazards to compute the correlations between the two using the Spearman's rank correlation.

## 6.3 CORRELATIONS OF FARMERS' TOTAL ASSETS AND STRATEGIES AGAINST HAZARDS

In this section correlations are performed between the strategies investigated above and the total household livelihood assets calculated in chapter four. It was decided to perform these correlations to determine if any significant relationships exist between the two, if the capacity gained through assets influences one's ability to use coping and/or adaptive strategies. To determine if the correlation coefficient  $r$  value is significant, a Spearman's rank significance table or/and graph has been used. When using the graph in Figure 6.8, the degrees of freedom must be calculated simply as the sum ( $n-2$ ) (samples - 2). Using this number, the values for  $r$  and the critical values for Spearman's correlation coefficients (two-tailed significance levels) indicated in Table 6.4, the significance level of the results is shown by the yellow lines in the graph. According to Zar (1984) the significance levels (0.1%, 1% and 5%) on the right of the figure indicate the likelihood of the correlation occurring by chance and therefore any correlation not meeting at least the 5% significance line is not significant and should be rejected. A 5% significance level means that a correlation is only 95% reliable but still significant enough to be accepted. Figure 6.8, in combination with Tables 6.1 and 6.4, indicates that the

significance level of the correlation for LSF is significantly below the red lines where the value should lie for at least a high correlation. From Table 6.4 one can deduce that the significance level is even greater than 50%. A correlation coefficient of -0.173 (Table 6.1) indicates a slight correlation, an almost negligible relationship between total assets and their coping and adaptive strategies adopted against environmental shocks and social stresses.

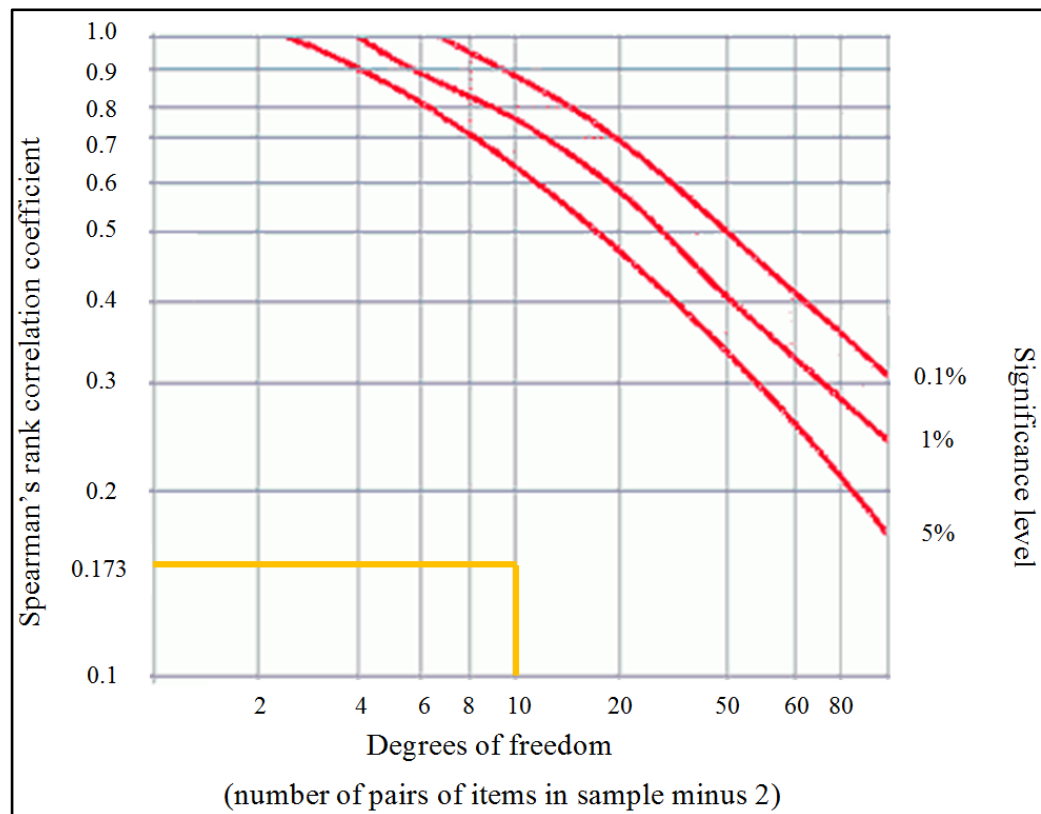


Figure 6.8 Significance of correlation coefficients for large-scale farmers

Table 6.1 Correlation between total assets and the strategies of large-scale farmers

		<b>Strategies employed</b>	<b>Total assets</b>
<b>Total assets</b>	Correlation coefficient ( <i>r</i> )	1	-0.173
	Significance (2-tailed)		0.592
	N	12	12
<b>Strategies</b>	Correlation coefficient ( <i>r</i> )	-0.173	1
	Significance (2-tailed)	0.592	
	N	12	12

Considering MSF, (Figure 6.9 with the help of Table 6.4) a correlation with a significance level of 1-2% is indicated. A correlation coefficient of 0.609 (Table 6.2) indicates a moderate correlation and a substantial relationship between MSF' total assets and their coping and adaptive strategies adopted against environmental shocks and social stresses.

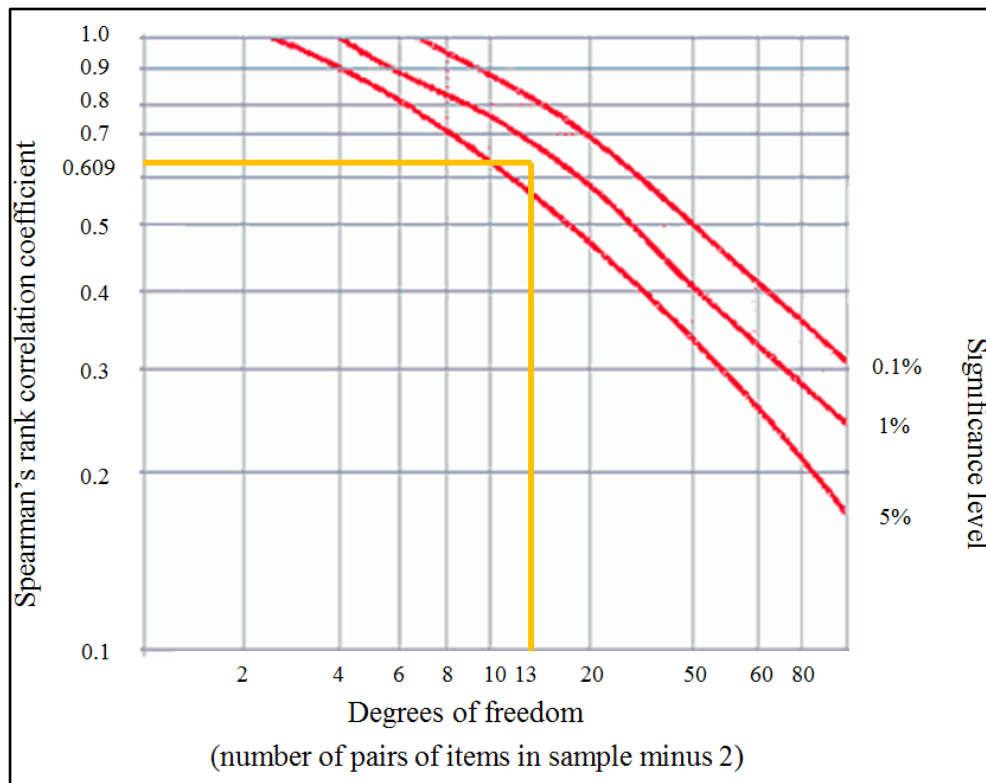


Figure 6.9 Significance of correlation coefficients for medium-scale farmers

Table 6.2 Correlation between total assets and the strategies of medium-scale farmers

		<b>Strategies employed</b>	<b>Total assets</b>
<b>Total assets</b>	Correlation coefficient ( <i>r</i> )	1	0.609*
	Significance (2-tailed)		0.016
	N	15	15
<b>Strategies</b>	Correlation coefficient ( <i>r</i> )	0.609*	1
	Significance (2-tailed)	0.016	
	N	15	15

\* Correlation is significant at the 1-2% level

Concerning SSF, (Figure 6.10 along with Table 6.4) a correlation with a significance level of 20-50% is evident. A correlation coefficient of 0.154 (Table 6.3) indicates, as with LSF, a slight correlation and an almost negligible relationship between total assets and their coping and adaptive strategies to mitigate environmental shocks and social stresses.

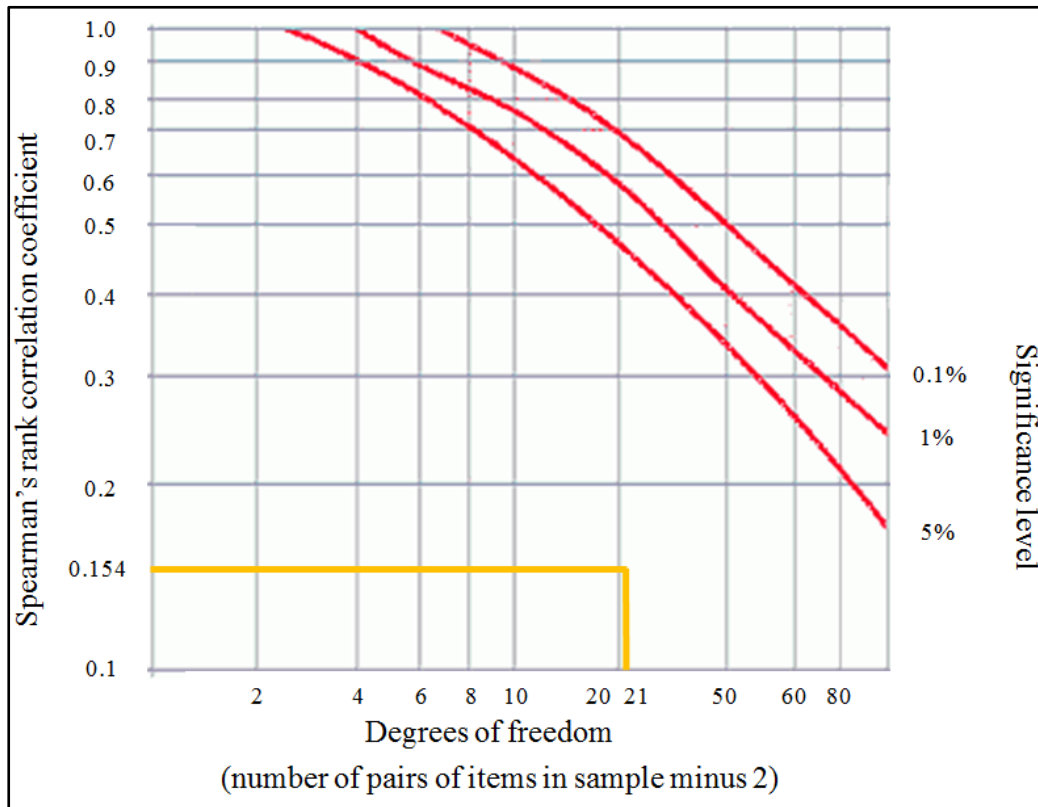


Figure 6.10 Significance of correlation coefficients for small-scale farmers

Table 6.3 Correlation between total assets and the strategies of small-scale farmers

		Strategies employed	Total assets
<b>Total assets</b>	Correlation Coefficient ( $r$ )	1	0.154
	Significance (2-tailed)		0.482
	N	23	23
<b>Strategies</b>	Correlation Coefficient ( $r$ )	0.154	1
	Significance (2-tailed)	0.482	
	N	23	23

Table 6.4 Critical values of Spearman's rank correlation coefficient

$\alpha$ (2) n	0.500	0.200	0.100	0.05	0.02	0.01
4	0.600	1.000	1.000			
5	0.500	0.800	0.900	1.000	1.000	
6	0.371	0.657	0.829	0.886	0.943	1.000
7	0.321	0.571	0.714	0.786	0.893	0.929
8	0.310	0.524	0.643	0.738	0.833	0.881
9	0.267	0.483	0.600	0.700	0.783	0.833
10	0.248	0.455	0.564	0.648	0.745	0.794
11	0.236	0.427	0.536	0.618	0.709	0.755
12	0.217	0.406	0.503	0.587	0.678	0.727
13	0.209	0.385	0.484	0.560	0.648	0.703
14	0.200	0.367	0.464	0.538	0.626	0.679
15	0.189	0.354	0.446	0.521	0.604	0.654
16	0.182	0.341	0.429	0.503	0.582	0.635
17	0.176	0.328	0.414	0.485	0.566	0.615
18	0.170	0.317	0.401	0.472	0.550	0.600
19	0.165	0.309	0.391	0.460	0.535	0.584
20	0.161	0.299	0.380	0.447	0.520	0.570
21	0.156	0.292	0.370	0.435	0.508	0.556
22	0.152	0.292	0.370	0.425	0.495	0.544
23	0.148	0.278	0.353	0.415	0.486	0.532

Source: Zar (1984)

Even though one moderate correlation and a substantial relationship (significance level of 1%-2%) between total assets and strategies was calculated for MSF, no conclusive deduction can be made that overall, total assets correlate with strategies employed. Nonetheless, a relationship exists between the number of coping and adaptive strategies employed by farmers, and decreasing farming scale. LSF therefore employ the most number of strategies and SSF the fewest. Furthermore, a relationship exists between the decreasing scores for financial assets and the average number of household coping and adaptive strategies employed against shocks and stresses, according to decreasing farming scale. LSF employ, by a significant margin, the most strategies (9), with a financial asset score of 0.06, followed by MSF (4.4), with a financial asset score of 0.03 and SSF employing the fewest (1.1), with a financial asset score of 0.03. The following chapter discusses the relationship between the research findings and the literature reviewed and aims and objectives in chapters 1 and 2.

## **CHAPTER 7      DISCUSSION**

This chapter discusses the integration of the study findings with the relevant literature reviewed in Chapters 1 and 2 where leading disaster risk theories on vulnerability and hazards; the various components of DFID sustainable livelihoods framework (the vulnerability characteristics, livelihood strategies, PIPs, the assets capacities and livelihood outcomes); and coping and adaptive strategies adopted against environmental shocks and social stresses were reviewed. Figure 7.1 is a synopsis of the findings of this study's application of the DFID sustainable livelihoods framework. This chapter will furthermore recapture the research findings and demonstrate that the objectives and ultimately the aim of the study have been reached. The subsections 7.1-7.4 and 7.7 will again confirm that the study has successfully reached its second objective which was to determine the livelihood components of farmers according to the DFID SLF, which also includes comparisons between farming scales as well as certain conclusions.

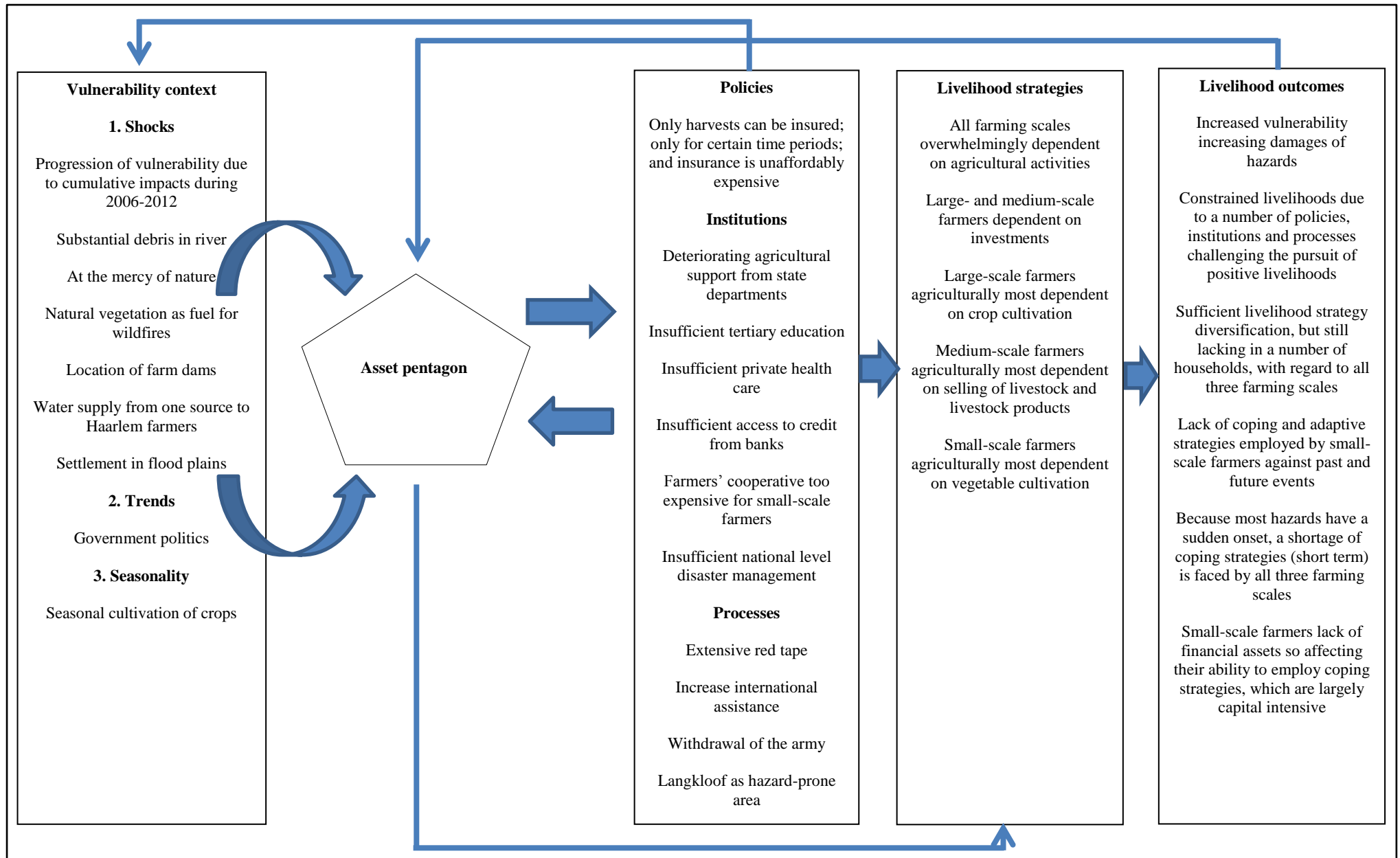


Figure 7.1 Synopsis of results of an application of the DFID sustainable livelihoods framework



## 7.1 KEY FACTORS INCREASING FARMERS' VULNERABILITY

According to DFID (1999) the vulnerability context is the external environment in which people pursue their livelihoods, and this is largely influenced by trends, shocks and seasonality. With a thorough understanding of the vulnerability context, within the DFID framework, the following findings and deductions were made. The exposure to hazards in the Langkloof area was found to be exceptionally high during a succession of cumulative, reinforcing, adverse events over the period 2006-2012, but susceptibility to negative outcomes was exacerbated by compromised resistance and resilience as well as shortcomings in transforming structures and processes (also outlined in DFID's livelihoods framework). A key informant reported that farmers in the Langkloof sustained losses estimated at R600m during the period 2006-2012, for which the government only provided approximately R12 million in relief. Due to the progression in vulnerability, along with the vulnerability characteristics investigated during fieldwork, many SSF in Haarlem, but also a number of LSF and MSF did not 'survive' this period. Many SSF in Haarlem had to seek alternative work on neighbouring farms as a result of the cumulative damages and their adverse impacts. The non-static nature of the vulnerability context is decidedly evident in the case of the Langkloof.

Shocks have the ability to directly destroy assets. As figure 7.1 indicates the relevant shocks experienced in the Langkloof during the study period are hail, floods, drought, heatwaves and wildfires. Such events force people to apply coping and adaptive strategies (some quite surprising) such as the premature disposal of assets (e.g. land). The research added an additional number of vulnerability characteristics also categorized as shocks, including the above hazardous events. A number of key stakeholders pointed out that the natural vegetation served as 'good' fuel for wildfires to ignite and continue to burn, thereby increasing the vulnerability of farmers in the Langkloof. All the key stakeholders confirmed increased vulnerability due to substantial black wattle debris left in the main river passing through Uniondale. This vulnerability proved to be substantial when flooding occurred in 2007, which exacerbated damages compared to what damages were estimated to be with no debris in the river. Because farm dams are constructed linearly along rivers it caused a domino effect when the top most dam broke leading the dams downstream to also break. It is clear that the source of vulnerability is natural hazards and/or various characteristics contributing to increased damages during disaster events. To corroborate this, farmers perspectives, quantitatively and qualitatively indicated that the predominant shocks adding to vulnerability are considered at all farming scales to be the occurrence/frequency of natural hazards and also livestock and crop health. Farmers' perspectives agree with those of key stakeholders who also saw natural hazards and other aspects to contribute to increased vulnerability.

Seasonal shifts such as price changes, employment opportunities and food availability are some of the greatest and most enduring sources of hardship for poor people in developing countries (DFID 1999). The research found that farmer perspectives view the seasonal production of crops and seasonality regarding the sale of livestock and livestock products as primary elements contributing to vulnerability. Farmers' perspectives also agree with those of the key informants that hold that the seasonal nature of crop cultivation increases vulnerability when seasonal income is compared to continuous annual income. Trends may be more non-threatening than shocks and seasonality as trends are more predictable. According to DFID (1999) they have a particularly important influence on the choice of livelihood strategies. The investigation of farmers' livelihood assets formed part of their socio-economic profile discussed in chapter four and will be revisited below.

## 7.2 LIVELIHOOD ASSETS

According to Scoones (2009) assets are different types of resources (human, social, physical, financial and natural) that people use in two ways, namely a) to own or directly control (have decision-making power about how they are used), or b) to have access to resources that do not belong to them but are also sources of livelihoods, that are affected by historical trends and seasonality. Assets can be destroyed or created as a result of the trends, shocks and seasonal changes in the vulnerability contexts within which people live. PIPs can significantly influence access to and ownership of assets. An in-depth analysis of assets was done from which trends became apparent.

According to De Satgé (2002) and Reid & Vogel (2006) *human assets* are required to enable the use of the four other types of assets. The analysis of farmers' human assets involved five key indicators, namely skills shortages, highest level of education attained, access to number of information sources, household labour capacity and marital status. Lack of education is a major concern for SSF, for whom the indicator score was considerably lower than that of MSF and much lower than that of LSF. A direct relationship exists between declining education level scores and declining farming scale. It appears that with decreasing farming scale, decreased access to educational opportunities is present. Another anomalous situation is the difference between the access to information sources of LSMF. This may be due to decreasing education levels, where, for example, LSF have the highest score for education levels and they are able to better understand various forms and origins of information and can therefore access more information sources compared to MSF and SSF. For the other human asset indicators (skills shortage, household labour capacity and marital status) similar scores between the different farming scales were recorded. A direct relationship exists between total human assets and decreasing farming scale.

De Satgé (2002: 62) defines *social assets* as “social resources which people draw upon in pursuit of their livelihood objectives, which include a variety of sources such as social networks, organisations,

the relationships of trust within and between families, within social networks and in communities as well as the support provided by religious, cultural and informal organisations.” Social support networks and access to a number of institutions and organizations were selected as indicators to determine total social assets. It was found that LSF have no social support networks to call on in times of need, whereas MSF have a number of social support networks. SSF have significantly more social support networks which may indicate a valuable resource or a reliance on others as a source of support in times of need. Although LSF have the highest score for access to a number of institutions and organizations, followed by MSF and then SSF, the latter have the highest total social assets count.

*Physical assets* “include farm equipment, shelter and infrastructure” (De Satgé 2002: 63) and are essential for people to be able to carry out livelihood activities. For an analysis of total physical assets three indicators were used: implements needed for production purposes, access to health institutions and access to schools. Total physical assets gained the highest scores of all the types of assets and the three indicators used to determine total physical assets also, on average, have the highest scores of all the indicators. The scores of the indicators used to determine physical assets revealed a number of important results. A disturbing factor regarding SSF is their shortage of implements for production purposes. LSF and MSF indicated no shortage of implements, whereas SSF reported that their need for implements restricted their agricultural productivity. Access to health institutions and access to schools produced similar trends in scores and also similar reasons for these trends. Many LSF and MSF submitted that, concerning certain health institutions and schools, the quality of care and education is not up to standard and therefore they had to resort to private healthcare institutions and private schools, often significantly further away from home. The majority of SSF felt that the quality of health care and education is up to standard. Due to this significant anomaly the PCA analysis calculating the indicator weights which was used to calculate the asset scores could have been distorted which would have biased the results.

Because *financial assets* include the “entitlements that have a cash value” (De Satgé 2002: 63) five such indicators were used, that is the number of agricultural income sources, non-agricultural income sources, access to fodder relief, access to credit sources and access to insurance. Due to the relatively low statistical importance of most of these indicators, the total scores of all three farming scales are low. The financial indicators produced the most valuable information because, to a large extent, they indicate the resources (financial or other asset indicators) on which farmers rely to cope with and adapt to environmental shocks and stresses. Agricultural income sources showed that LSF rely more on the diversification of agricultural activities than MSF and SSF, whereas with non-agricultural income sources MSF have the highest value followed by SSF and LSF who rely least on non-agricultural activities. SSF rely appreciably more on fodder relief during periods of stress and shock than farmers of the other two farming scales. The opposite situation exists regarding the number of

credit sources used and access to insurance. A direct relationship exists between decreasing financial indicator scores and decreasing farming scale. All the LSF draw on insurance during times of shock or stress, some MSF and no SSF can afford to insure, which therefore indicates another direct relationship with decreasing farming scale. Total financial assets, have a direct relationship with decreasing farming scale. Regardless of the challenges faced to obtain average household income data the above relationship between total financial assets and decreasing farming scale may be significantly indicative of its importance in building resilience because most strategies are capital intensive which will therefore be increasingly challenging to employ as farming scale decreases. Income data will however be valuable to calculate the relationship between households' income and the capital intensive strategies they are able to employ.

*Natural assets* refer to the “land and the natural resource base” (De Satgé 2002: 62) people use to enhance livelihood outcomes. Only one simple overarching indicator was used to determine total natural assets that is the number of natural resources used, however, this included access to water (tap, covered well, uncovered well, pond, river/stream, canal, rain water tanks and a spring), wood, marine resources and medical plants. Not surprisingly, SSF scored the highest.

LSF acquired the highest total asset score followed by SSF and marginally thereafter MSF. Regarding the different types of assets, different farming scales draw on different assets to cope with and adapt to environmental shocks and social stresses. LSF draw predominantly on human assets (education levels and access to information sources), certain physical assets (implements acquired for production purposes) and financial assets (access to insurance, credit sources and number of agricultural income sources), whereas MSF tend to rely more on financial assets (access to insurance and number of agricultural income sources), and certain physical assets (implements acquired for production purposes). SSF tend to draw on social assets (social support networks), physical assets (access to health and education institutions), financial assets (fodder relief) and natural assets (natural resources). As with the vulnerability context, the PIPs, discussed below, in the external environment also revealed significant challenges to farmers' livelihoods.

### **7.3 KEY POLICY, INSTITUTIONAL AND PROCESS CHALLENGES**

According to Scoones & Wolmer (2003) PIPs in the external environment cover the complex social, economic and political context in which people pursue their livelihoods strategies. PIPs operate at global, national, regional, district and local levels. The key to understanding their impact on local livelihoods is an analysis of the operation, or their absence, of links between micro, meso and macro levels. Figure 7.1 presents the PIPs in the external environment which challenge farmers and their pursuit of a livelihood.

Concerning institutional arrangements, the service delivery support and particularly *agricultural support services by government* departments was a recurring theme during interviews with the number of key informants, but also in the survey of sampled farmers in the Langkloof. Generally, respondents representing all three farming scales declared that they received little support from state departments and they were unanimous about the need for state departments to increase their prominence in the farming communities. Survey results also emphasised a need voiced by farmers at all three farming scales for a tertiary education institution in the area. A need for a private health care institution in the area was a recurrent appeal.

Another service orientated concern involves access to *credit facilities*. Most farm incomes are seasonal, hence loans from commercial banks are difficult to attain because they demand monthly instalments so that only the wealthy farmers are successful recipients of loans. The banks consider farmers in the Langkloof as ‘high risk’ because of the hazards that endanger farming in the area. This consequently decreases their eligibility for loans. According to many of the respondents and key informants, in cases of approved loans high interest rates put strain on farmers’ financial assets. Finally, for many farmers the uncertainties about land reform by the government are jeopardising their chances to secure loans from any institution, including commercial banks.

A number of key informants assented that *insurance* is a major policy constraint posing challenges to farmers. Fruit trees cannot be insured, only harvests, therefore when the hailstorm of 2006 struck, many farmers were adversely affected. Reduced harvests due to hail damage can only be insured for a certain time of the year, the so-called ‘hail season’. Damages to trees and harvests during the 2006 hailstorm were unquantifiable and therefore difficult to determine exact losses. This type of capital-intensive insurance might be affordable to LSF and MSF but SSF typically do not have the financial means to afford insurance.

Due to the prescriptions of *municipal* demarcations and *responsibilities* for dealing with disasters such as flooding, it is the responsibility of the provincial government to assist and make necessary repairs to affected farm roads. Only affected urban areas, as in the case of the 2007 flood, are the responsibility of the local municipality to provide assistance. Moreover, a key informant pointed out that many of the farmers are unable to afford to buy their farming necessities at the local *farmers’ cooperative*. It was found that especially the SSF voiced a strong desire for the cooperative to increase its benefit to farmers by reducing prices.

A number of challenges exist regarding *governance*, especially according to all the key informants. A number of key informants contended that government should consider declaring the Langkloof as a hazard-prone area in order to establish criteria which will streamline proceedings to free funds to disaster areas. Governance-posed challenges include too much red tape and time wasting in allocating

funds to affected areas. A need exists to increase efficiency at national disaster management level. Finally, gaps left following the withdrawal of the national army affect assistance in disaster areas unfavourably. The following subsection revisits the livelihood strategies farmers employ with agricultural strategies the predominant trend.

#### **7.4 AGRICULTURE AS PRIMARY LIVELIHOOD STRATEGY**

Livelihood strategies are the combination of activities that people undertake to achieve their livelihood goals. Livelihood strategies can be categorized according to three types, namely agricultural intensification and extensification, livelihood diversification (paid employment and rural enterprises) and migration (in search of better livelihood opportunities) (Bahry 2010).

Using this livelihood strategy classification, it was found that agricultural activities (agricultural intensification) are the mainstay for households of LMSF where agricultural contributions to total household income are significantly higher than those of the other strategies. All the agricultural activities in the Langkloof are strongly intensified. Regarding strategy diversification, only four livelihood strategies were identified for LSF, eleven for MSF and fifteen for SSF. The number of livelihood strategies is indirectly related to farming scale. Various investments are the second most popular strategy for LSF (10% of household income) and MSF (25%) whereas the share for SSF is 6% of total household income. All pay is a significant contributor (16%) to household income of SSF only.

Regarding agricultural diversification, three scenarios are present among the farming scales. LSF diversify significantly regarding crop cultivation, specifically fruit, MSF rely strongly on the sale of livestock and livestock products and SSF are dependent on the cultivation of various vegetables. Significant challenges face farmers concerning the degree of diversification of livelihood strategies. LSF lack diversity regarding general strategies but they are compensating by having sufficient agricultural strategies. MSF have adequate livelihood strategies, both general and agricultural, whereas SSF have sufficient general strategies but they still lack diversification in their agricultural livelihood strategies. A lack in livelihood diversification manifested as having direct impacts on vulnerability. By adding an investigation into farmers' coping and adaptive strategies against environmental shock and social stress this study made an addition to the conventional livelihoods analysis. Firstly, the individual strategies employed by farmers were investigated which was followed by collective strategies used by organizations to benefit the entire Langkloof farming community.

#### **7.5 INDIVIDUAL COPING AND ADAPTIVE STRATEGIES ADOPTED**

Coping strategies are short-term responses to a specific, sudden, unpredictable, and traumatic shock such as drought, hail, flood, fires and heatwaves. Adaptive strategies entail long-term change in behavioural patterns, usually as a result of stresses which are typically continuous, predictable and

distressing such as seasonal shortages, reduced labour demand, rising populations or declining resources (Krantz 2001). This subsection discusses the results of identifying and distinguishing the coping and adaptive strategies of farmers in the Langkkloof.

Significantly, few coping strategies (short term) were employed by farmers compared to the number of adaptive strategies (long term) used. Most of the adaptive strategies are basic farming practices which are predominantly continued from one generation to the next. Most of the strategies employed by each farming scale are adaptive and the percentage distribution of these among the farming scales is quite similar. LSF and MSF indicated a percentage of 80-90% and SSF 70-80%. The percentages defining each hazard type follow the same tendency. Given that most hazards have sudden onsets, there appears to be a shortage of coping strategies for all three farming scales.

*Hail* mitigation strategies, of which harvest insurance is overwhelmingly the most popular, were mostly adaptive in nature. It is noteworthy that no strategies were employed by SSF against a shock which has caused extensive damage to them in the past. *Drought* mitigation strategies are more numerous than those for hail and there is a more equal distribution between coping and adaptive strategies. LSF use the most strategies, of which the reduction of livestock, resorting to water reserves, the accumulation of feed and the adaption to micro irrigation were the most popular. MSF and SSF also made use of a number of strategies, of which the adaption to micro irrigation is also their most popular. In the case of *flooding*, more strategies were used than for the other four hazards in question. Most of the flood-mitigating strategies are adaptive – with the widening of river run-outs, the building of down-flows, contours and the keeping rivers clean from debris being the most popular. The *wildfire* hazard produced a variety of strategies of which LSF adopted the most, followed by MSF and SSF. For all three farming scales the most popular strategies were to have access to basic firefighting equipment and the construction of firebreaks. Regarding *heatwaves*, LSF used the most strategies, principally the adaption of irrigation systems from macro to micro, the correct trimming techniques and the correct row direction of fruit trees.

Analysis of the average household coping strategies adopted against hazards and the long-term strategies for future events revealed an average of nine strategies applied by LSF, four by MSF and only one by SSF. A direct relationship exists between the average number of strategies employed and increasing farming scale. After the total livelihood assets of farmers were calculated correlations were made with the above strategies used by farmers to establish if any significant relationship exists between farmers' assets (their capacity to employ coping and adaptive strategies) and their actual strategies employed.



## **7.6 CORRELATIONS BETWEEN TOTAL ASSETS AND COPING AND ADAPTIVE STRATEGIES EMPLOYED**

For LSF the correlation coefficient of -0.173, a significance level of greater than 50%, indicated a slight correlation, an almost negligible relationship between total assets and their coping and adaptive strategies adopted against environmental shocks and social stresses. For MSF a correlation with a significance level of 1-2% was calculated. A correlation coefficient of 0.609 indicated a moderate correlation and a substantial relationship for MSF. Concerning SSF a correlation coefficient of 0.154 and a correlation with a significance level of 20-50% indicates, as with LSF, only a slight correlation, and an almost negligible relationship.

Even though a moderate correlation and a substantial relationship were calculated in the case of MSF, no conclusive deductions were made that total assets correlate with strategies employed. Nonetheless, a relationship exists between the number of coping and adaptive strategies employed by farmers, and decreasing farming scale. LSF therefore employ the most strategies and SSF the fewest. Furthermore, a relationship exists between the decreasing scores for financial assets and the average number of household coping and adaptive strategies employed against shocks and stresses, according to decreasing farming scale. LSF employ, by a significant margin, the most strategies (9), with a financial asset score of 0.06, followed by MSF (4.4), with a financial asset score of 0.03 and SSF employing the fewest (1.1), with a financial asset score of 0.03. Based on the presumption that a relationship exists between average household income and decreasing farming scale, it would be expected that if average household income data was available the relationship between decreasing scores for financial assets and the average number of household coping and adaptive strategies employed against shocks and stresses would be enhanced.

During the period 2006 to 2012 SSF in the Langkloof were particularly badly affected, mainly due to the lack of asset resources (especially financial assets), which checked their ability to employ coping and adaptive strategies against external shocks and stresses. Almost all LSF, who have significantly more financial asset resources (especially the number of agricultural income sources and access to insurance), were able to employ proportionately more strategies than MSF and SFF. Many of these strategies are basic farming practices but they are capital intensive. Although MSF have marginally less total asset resources, they have more financial assets (especially the number of agricultural income sources and access to insurance) compared to SSF and were so able to employ more strategies. Direct relationships thus exist between a) financial assets and farming scale, and b) between the average number of household coping and adaptive strategies employed against shocks and stresses. LSF avail themselves of the most strategies (9), MSF four and SSF the fewest (1).



## 7.7 LIVELIHOOD OUTCOMES

Livelihood outcomes, positive or negative, are the result of livelihood strategies pursued but they are also influenced by the vulnerability context, PIPs and livelihood asset resources. Analyses (Figure 4.27) revealed a number of livelihood outcomes prevalent in the Langkloof, of which most are negative. A prime livelihood outcome was increased vulnerability which exacerbates the impacts of environmental shocks and social stress events compared to events where lower vulnerability was present. Examples include the additional damage caused by large amounts of vegetation debris in the river passing through Uniondale. The linear location of farm dams along rivers caused a domino effect when the topmost, and also the largest dam, was compromised during the 2007 flood event, resulting in dams downstream to fail. This caused a shortage in water storage capacity that led to increased vulnerability due to the onset of a meteorological drought in 2008. The meteorological drought resulted in an agricultural drought where the available water no longer met the demand by crops and livestock in the area. Haarlem was adversely affected by their created vulnerability of depending on only one water source, the Haarlem dam, which also perished during the 2007 flood. This had socio-economic impacts where human livelihoods were severely affected due to reduced yields and water shortages. Another vulnerability characteristic that exacerbated damages caused by the 2007 flood event is that farmers tend to settle on flood plains. Vulnerability related to the seasonal cultivation of crops in the area, affected seasonal income and this increased income vulnerability when crops are compromised.

Another livelihood outcome is livelihoods which are severely constrained due to a number of PIPs in the external environment which pose challenges to the pursuit of positive livelihoods. One of these is lack of institutional agricultural service delivery provided by the various applicable state departments, including the Department of Agriculture, Water Affairs and SANRAL. Another challenge caused by PIPs is that nothing on a farm except a harvest can be insured and this type of insurance is too expensive, especially for SSF. Moreover, the local farmers' cooperative, where various agricultural necessities are acquired, is too expensive especially for SSF. A great challenge is posed by red tape that causes delayed response in the allocation of funds to affected areas. Most of the LSF and MSF considered all levels of education institutions and most levels of health institutions in the area to be characterized by incompetency and inefficiency. Consequently, these farmers have to resort to using other institutions, further away, thereby affecting their livelihoods, especially financially. A final challenge related to PIPs is that credit is difficult to obtain from commercial banks because of the Langkloof's high-risk status. The limited financial resources of SSF makes it even more difficult for them to obtain loans. A lack of diverse income sources is a livelihood outcome especially notable for LSF. Decreased livelihood activity diversity has direct implications for a household's asset base and ultimately vulnerability which consequently increases, because a household would have fewer options

as backup in times of shock or stress and therefore also limit a household's capacity to implement coping and adaptive strategies.

An important group of livelihood outcomes is the coping and adaptive strategies of farmers in the Langkloof. The number of coping and adaptive strategies used by SSF to mitigate the effects of environmental shocks was small compared to the other two farming scales. All three farming scales are characterized by shortages of adequate coping strategies. SSF experience a lack of financial assets and this limits their ability to adopt coping and adaptive strategies which are predominantly capital intensive.

## CHAPTER 8 CONCLUSION AND RECOMMENDATIONS

By using the DFID sustainable livelihoods framework a comprehensive livelihoods analysis and comparison was conducted of LMSF. The aim was to assess the livelihoods of the LMSF, by concentrating on their adaptive and coping strategies adopted during periods of severe environmental shocks and social stresses. With the help of the PAR model the applicable hazards in the area were established and the DFID SLF of analysis was used to determine farmers' vulnerability context, the external institutional arrangements influencing the pursuit of positive livelihoods and the livelihood strategies. Weighted total assets for each household were calculated using principal components analysis and a Spearman's rank order correlation was calculated between the above total assets and the coping and adaptive strategies of the three farmer groups.

It was confirmed that there is a significant dependence on agricultural activities in the Langkloof. Sufficient livelihood diversification was detected, though there is room for improvement at all three farming scales. LSF lack diversity regarding general strategies but they are compensating for this by having a wide range of agriculture-based coping and adaptive strategies. MSF have sufficient livelihood strategies, both general and agricultural, whereas SSF have more diverse general coping and adaptive strategies but lack diversification of agricultural livelihood strategies.

Regarding the vulnerability context of farmers in the Langkloof, a number of characteristics exist which increase their exposure to the hazards prevalent in the area and the damages suffered during disaster events. Qualitative information gathered from key informants confirmed the local farmers' information provided during questionnaire surveys. The most striking characteristics are:

- An inherent vulnerability to various environmental hazards when farming;
- Presence of natural vegetation suitable for wildfires to ignite and flourish;
- A substantial amount of debris left in the river passing through Uniondale, causing significant additional damage during the 2007 flood;
- The location of farm dams in an aligned manner, causing many dams downstream to fail during the 2007 flood, including the Haarlem dam;
  - The town of Haarlem is dependent on only one water source, the Haarlem dam, therefore the town was subjected to severe stress, especially with the onset of a meteorological drought in 2008.
- The settlement of many farmers on flood plains, increasing the vulnerability to flood events; and
- Seasonal crop cultivation in the Langkloof which increases vulnerability because of the dependence on seasonal income.

In the external environment, policies, institutions and processes (PIPs) can play a significant role in increasing or challenging farmers' access to assets. Most PIPs revealed during fieldwork and data analysis pose serious challenges to farmers of all three farming scales in the Langkloof. A disturbing recurring theme that emerged during fieldwork is the lack of institutional capacity in the provision of essential, general and agriculture-specific support services, including on-site agricultural advice. A notable obstacle is the extensive red tape regarding the declaration of a disaster area and ultimate allocation of funding to affected areas. Improvement is called for concerning the declaration of certain areas, such as the Langkloof, as 'disaster areas', in order to make these areas eligible for 'special relief'.

Correlation analyses were conducted for assets accumulated and strategies employed against shocks and stresses. A moderate correlation and a substantial relationship was found to exist in the case of MSF but were inconclusive for the other two farming scales. An important finding was that a strong correlation does exist between the average number of household strategies employed, and decreasing farming scale. SSF employed the fewest strategies, a finding that is quite disturbing. Although no relationship was found between total assets and strategies, the various vulnerability characteristics and challenges posed by a number of PIPs affect the capacity of farmers to make use of coping and adaptive strategies in the face of environmental shocks and social stresses.

Generally if people have better access to assets they will have greater ability to influence structures and processes so that these become more responsive to their needs. The DFID SLF considers two very important areas to make effective contributions. The one is direct support to assets, including access to assets and the other, support to increase effective functioning of the structures and processes that influence access to assets and livelihood strategy opportunities.

Concerning the period of 2006 to 2012 in the Langkloof, SSF were particularly badly affected, mainly due to the lack of asset resources (especially financial assets), which influenced their ability to employ coping and adaptive strategies against external shocks and stresses. Most of the LSF, who have significantly more financial asset resources (especially the amount of agricultural based income and access to insurance), were able to employ proportionately more strategies, of which most are capital-intensive, basic farming practices. Although MSF have fewer total asset resources but more financial assets (especially number of agricultural income sources and access to insurance) compared to SSF, they were able to employ more strategies. A relationship was established between the decreasing scores achieved for financial assets and farming scale, and between the average number of household coping and adaptive strategies employed against shocks and stresses and farming scale.

Regarding livelihood outcomes, most were found to be negative. Increased vulnerability exacerbates the damages caused by environmental shock and social stress compared to events where vulnerability

is less. Another notable livelihood outcome was constrained livelihoods due to a number of PIPs in the external environment that challenge the pursuit of positive livelihoods. A lack of livelihood strategy diversification was also evident. LSF lack general strategies. MSF have a sufficient number of both general and agricultural livelihood strategies, whereas SSF have a sufficient number of general strategies but lack more diverse agricultural strategies.

Other livelihood outcomes are concerned with farmers' livelihood assets and the coping and adaptive strategies to mitigate the effects of environmental shock and social stress. SSF were found to have fewer strategies than LSF and MSF. All three farming scales have a shortage of coping strategies (short term) necessary for the sudden onset of most of the hazards experienced in the study. Another outcome specifically applies to SSF who lack financial assets which curbs their ability to employ coping and adaptive strategies, which are predominantly capital intensive.

The four overarching objectives were to identify the environmental and social hazards in the Langkloof and to assess the magnitude of each hazard; to determine the livelihood components of farmers according to the DFID SLF; to identify and distinguish the coping and adaptive strategies of farmers during times of environmental shock and social stress; and to calculate the correlations between the total weighted assets accumulated by farmers and their strategies employed against environmental shock and social stress. Along with the research findings of this study a number of recommendations were necessary.

## **8.1 RECOMMENDATIONS**

The literature review and the research highlighted the constraints on gathering household income and expenditure data which are invaluable financial asset indicators. Further research should be undertaken into ways to overcome these constraints. Regarding the provision of relief from the government, legislation should be institutionalized so that according to set criteria, areas can be declared as hazard prone. This would distinguish areas to make them eligible for quicker relief. The research uncovered problems faced after the 2006 hail disaster regarding the quantification of damages. Methods must be devised to mathematically and statistically quantify damages suffered so as to secure more accurate loss data which will quicken the process when claims are submitted. The study has shown that SSF lack financial assets (especially number of agricultural income sources (main livelihood strategy) and access to insurance), leading to decreased capacity to implement sufficient coping and adaptive strategies which are predominantly capital intensive. Private insurance companies should be approached with proposals to initiate programmes which will enhance farmers' access to crop insurance, especially for SSF.

Concerted efforts should be made by relevant state department to decrease their red tape in the processes of declaring a disaster and also regarding the allocation of funds to these areas. This is of paramount importance, because time is of the essence in disaster situations and, more often than not, is wasted due to various protocols. The study has proved that, after the Langkloof area was significantly affected by numerous shocks and stresses over the period 2006 to 2012 with detrimental consequences for many farmers' livelihoods and posing serious challenges to their coping and adaptive strategies, certain vulnerability characteristics have aggravated these impacts while a number of PIPs have failed to respond and support farmers during this time in the form of relief and also providing support before any disaster. It is for this reason why PIPs have been highlighted here in the recommendations.

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## PERSONAL COMMUNICATIONS

Hodgson D 2013. Coordination and planning of Avontuur Agriculture Uniondale, Chairman (AfriForum). Uniondale. Interviewed on 18 October 2013

Kemp F 2013. Coordination of agricultural insurance in the Langkloof (Santam). Uniondale. Interviewed on the 19 October 2013

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Maclune G 2013. Chair, Small-scale Farmers' Association. Haarlem. Interviewed on 23 October 2013.

Du Preez J 2013. Municipal Manager, George District Municipality (Uniondale Office). Uniondale. Interviewed on 18 October 2013.

## **APPENDICES**

Appendix A	Key informant questions
Appendix B	Questionnaire survey
Appendix C	Scaling of indicators and the rationales for selection
Appendix D	Eigenvalues and percentage of variance of each indicator
Appendix E	Weights of variables in principle components analysis
Appendix F:	Calculation of indices
Appendix G	Component coefficients of the sixteen variables selected
Appendix H	Weighted household scores for each indicator



## APPENDIX A: KEY INFORMANT QUESTIONS

- What are the major hazards that threatened the Langkloof from 2006-2012?
- What are the most significant factors increasing vulnerability of large, medium and small scale farmers?
- What role does PIPs (policies, institutions and processes) play in the Langkloof i.t.o peoples' ownership and access to assets?
- What are the general household strategies people pursue, by means of their assets, in order to reach positive livelihood outcomes?
  - How do these differ between large, medium and small scale farmers?
- What are the general coping and adaptive strategies employed by large, medium and small scale farmers during this period mentioned above?
  - How do these differ between large, medium and small scale farmers?
    - What are the reasons why many farmers did not redeem their fodder relief vouchers?

## APPENDIX B: QUESTIONNAIRE SURVEY



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*Geografie en Omgewingstudie*  
*Geography and Environmental Studies*

24 October 2013

**Research survey: Department of Geography and Environmental Studies, Stellenbosch University**

**Mr Carinus de Kock (Student number 15291677)** is a student in the Department Geography and Environmental Studies at the University of Stellenbosch. **He** is officially registered for the Master's Programme in **Geography and Environmental Studies**. **He** is currently working on an approved research project titled:

**Sustainable livelihoods framework applied to farmers in the Langkloof**

The particulars or data about, or views and experiences regarding this topic, from you or your establishment are crucially important for the outcomes of the research. It is therefore crucial that you or a suitably qualified designated representative of your establishment could spend a short time assisting the researcher with providing the requested information. The Department and the researcher involved undertake to strictly adhere to all rules of ethically sound research conduct and to meet your stated requirements regarding the confidentiality of the survey and data generated in the process. Please direct further enquiries regarding this request and pledge to the undersigned or the designated research supervisor.

Thank you for your cooperation and time

Yours faithfully

A handwritten signature in black ink, appearing to read 'JH van der Merwe'.

Prof JH van der Merwe

*Departmental Chair*

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RADAR (Research Alliance for Disaster and Risk Reduction)

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**1 GENERAL HOUSEHOLD INFORMATION**

Please complete the table below by selecting the appropriate codes following the table.

Person/s in household	1	2	3	4	5	6	7	8
Sex								
Age								
Language								
Race								
Relation to household head								
Education (human assets)								
Marital status								
Contribution to household (occupation)								
Health status (human assets)								
History of settlement								
Town								

Sex: 0=male, 1=female

Age: 0=0-14, 1=15-24, 2=25-44, 3=45-64, 4=65+

Language: 0=Afrikaans, 1=English, 2= isiXhosa, 3=isiNdebele, 4=isiZulu, 5=other (specify)

Race: 0=White, 1=Coloured, 2=Black, 3=Indian

Relation to HH: 0=wife, 1=husband, 2=child, 3=grandchild, 4=brother, 5=sister, 6=hired labour, 7=other, specify

Education: 0=illiterate, 1=read and write, 2=primary (grade 0-7), 3=secondary (grade 8-12), 4=tertiary (12+), 5=other, specify

Marital status: 0=married, 1=unmarried

Contribution to household: 0=dependent, 1=student, 2=off-farm, 3=on-farm (farming), 4=hired labourer, 5=other, specify

On-farm activities	Off-farm activities
Large scale farmer	Cooking
Small farmer	Child care
Land preparation	Animal rearing
Sowing	Health care
Weeding	Purchase of essential commodities
Inter-culture	Purchase of input
Harvesting	Selling of output
Herding	Building networks
	Business
	Service

Health status (ability to do labour): 1=excellent, 2=good, 3=average, 4=bad, 5=extremely bad

History of settlement: 0=land inherited, 1=renting land, 2=government grant, 3=other, specify

Town: 0=Uniondale, 1- Avontuur, 2=Haarlem, 3=Misgund, 4=Joubertina, 5=Kareedouw

## 2 ASSETS

### 2.1 Human assets

2.1.1 Skills (other than education and farming) (e.g. financial, languages etc.).

Would like to learn	Reason for shortage

2.1.2 Please choose (where applicable) the appropriate code from the list beneath the table to rate the following knowledge sources according to the criteria set.

Knowledge source type	Criteria		
	Usage	Prominence	Reason to increase prominence
Radio			
TV			
Internet			
Non-governmental organisation (NGO) worker			
State departments			
Cell phone			
Books (Farmers' weekly)			

Usage: 5=substantial use, 4=high use, 3=average use, 2=little use, 1-substantial limited use

Prominence: 5=should drastically increase prominence, 4=should increase prominence, 3=no need to increase prominence

### 2.2 Social assets

2.2.1 Do you have someone from which you receive assistance (remittance) in times of need? If 'yes', please complete the following questions. If 'no', please move to question 2.2.2.

Relationship to person/s (e.g. brother) \_\_\_\_\_

Nature of assistance (e.g. money, food) \_\_\_\_\_

Amount of assistance (e.g. R20 000/ annually) \_\_\_\_\_

Reason for assistance (e.g. disasters) \_\_\_\_\_

Predominant time of need (e.g. harvest-December) \_\_\_\_\_

Where does help come from? (e.g. Uniondale) \_\_\_\_\_

2.2.2 Please choose (where applicable) the appropriate code from the list beneath the table to rate the following organisation/institution according to the criteria set

Type	Criteria					
	Name	Distance (km)	Usage	Benefit	More beneficial?	Reason if unbeneficial
Cooperative societies						
Community based organisations (CBOs)						
NGOs						
Religious						
Cultural						
Informal organisations						
Other						

Usage: 5=substantial use, 4=high use, 3=average use, 2=little use, 1=substantial limited use

Benefit (Importance): 5=substantial benefit, 4=much benefit, 3=average benefit, 2=little benefit, 1=substantially unbeneficial

Need to be more beneficial: 5=substantial need, 4=high need, 3=need, 2=no need to be more beneficial

## 2.3 Natural assets

Please complete the following table according to the criteria set.

Resource	Criteria		
	Distance (m)	% of household	Amount saved/month
Water			
Tap			
Covered well			
Uncovered well			
Pond			
River/stream			
Canal			
Rain water tanks			
Spring			
Wood			
Marine			
Grass			
Medical plants			

## 2.4 Physical assets

### 2.4.1 Shelter

Please indicate the percentage (%) that each type of material comprise towards your shelter

	<b>%</b>
Brick	
Cement	
Clay	
Wood	
Corrugated iron	
Scrap metal	
Other	
<b>Total</b>	<b>100</b>

### 2.4.2 What farm equipment do you lack for production purposes?

<b>Implement</b>	<b>Reason for shortage</b>

2.4.3 Please choose (where applicable) the appropriate code from the list beneath the table to rate the following health care institutions according to the criteria set.

<b>Criteria</b>	<b>Type of health care institution</b>					
	<b>Primary</b>	<b>Children</b>	<b>Chronic</b>	<b>Clinic</b>	<b>Public hospital</b>	<b>Private hospital</b>
Condition						
Distance (km)						
Use						
Reason if little use						
Primary purpose						
Opinion on cost						

Condition: 5=excellent, 4=very good, 3=fairly good, 2=not very good, 1=not good at all

Distance: 5=very close, 4=close, 3=average, 2=far, 1=very far

Use: 5=never, 4=1/year, 3=1/6 months, 2=1/month, 1=1/week

Opinion on cost: 5=cheap, 4=affordable, 3=average, 2=expensive, 1=unaffordable

2.4.4 Please choose (where applicable) the appropriate code from the list beneath the table to rate the following type of schools according to the criteria set.

Criteria	Type of school			
	Kindergarten	Primary School	Secondary school	Tertiary institution
Condition				
Distance (m)				
Use				
Reason for no use				
Opinion on price				

Condition: 5=excellent, 4=very good, 3=fairly good, 2=not very good, 1=not good at all

Distance: 5=very close, 4=close, 3=average, 2=far, 1=very far

Use: 1=yes, 2=no

Opinion on price: 5=cheap, 4=affordable, 3=average, 2=expensive, 1=unaffordable

#### 2.4.6 Energy sources

Please indicate the % of each type of energy source used.

	%
Gas	
Wood	
Paraffin	
Coal	
Electricity	
<b>Total</b>	<b>100</b>

2.4.7 What is the market (location) of your produce? Please indicate the product, as well as the appropriate % fitting the market aim.

	Product			
<b>Export</b>				
<b>Local shop</b>				
<b>Shop somewhere else</b>				
<b>Self-use</b>				
<b>Packing facilities</b>				

## 2.5 Financial assets

### 2.5.1 Agricultural income (the past 12 months)

<b>Agricultural practice</b>	<b>Distance to each (km)</b>	<b>Land used (ha)</b>	<b>Production expenses (PE) (month)</b>	<b>Income from sales of output</b>	<b>Net income (NI)</b>	<b>Ration PE:NI</b>
<b>Grazing</b>						
<b>Vegetable farming (specify below)</b>						
<b>Fruit (specify below)</b>						
<b>Livestock (specify below)</b>						
<b>Other (specify below)</b>						

2.5.2 Please indicate your current NETTO household's income other than farm income (the past 12 months).

<b>Source of income</b>	<b>Seasonality (when activity is carried out)</b>



## 2.5.3 Did you apply for fodder relief during disaster periods?

Yes and redeemed			No and not redeemed
			Reason not redeemed
2008	When applied		
	When received		
	Type/Amount		
2009	When applied		
	When received		
	Type/Amount		
2010	When applied		
	When received		
	Type/Amount		
2011	When applied		
	When received		
	Type/Amount		
2012	When applied		
	When received		
	Type/Amount		

## 2.5.5 Sources of credit (the past 12 months).

Source of credit	%
Local money lender	
Friends and family	
Self-help groups (SHGs)	
Bank	
NGOs	
Church	
Micro finance institutions	
Other (please specify below)	

## 2.5.6 How do you used your credit?

Credit expenditure	%
Small business	
Food	
Debts	
Church	
Festivals and rituals	
Funeral	
Farming purposes	
Other	

## 2.5.7 Welfare beneficiaries in household

Please indicate the number of welfare beneficiaries according to age. Please also indicate the type of welfare, and also the number of dependants in the household according to age.

Age	Number	Please specify	Dependants in household
≤15			
16-21			
22-40			
41-60			
61-8			
>80			

## 2.5.8 Source of savings (the past 12 months).

Source of savings	%
Cash in hand	
Group savings	
Investment funds	
Farming	
All pay	

## 2.5.9 How do you used your savings?

Use of savings	%
Small business	
Food	
Debts	
Church	
Festivals and rituals	
Funeral	
Farming purposes	
Retirement	
Investments	

**3 VULNERABILITY CONTEXT**

Please rate each vulnerability aspect 1-5 (1-least relevant, 5-most relevant)

<b>Shocks/stressors</b>	
Conflict	
Economic	
Human health	
Crop/livestock health	
Natural disasters	
<b>Trends</b>	
Local, national and international economy	
Resources	
Population	
Government politics	
Technology	
<b>Seasonality</b>	
Price fluctuations	
Production	
Health	
Employment opportunities	

**4 PIPs (POLICIES, INSTITUTIONS AND PROCESSES)**

How did the following influence your ownership of assets, access to assets? (1-substantial negative impact, 2-negative impact, 3-no impact, 4-positive impact, 5-substantial positive impact).

<b>Social relationships</b>	
Gender	
Ethnicity	
Culture	
History	
Religion	
<b>Social and political organizations</b>	
Decision-making processes	
Civil bodies	
Social rules and norms	
Democracy	
Leadership	
Power and authority	
Rent-seeking behaviour	
<b>Governance</b>	
Structures	
Power	
Efficiency and effectiveness	
Rights and representation	
<b>Service delivery</b>	
Effectiveness and responsiveness of private sector (education, health, water and sanitation)	
Effectiveness and responsiveness of public sector (education, health, water and sanitation)	
<b>Resource access institutions</b>	
Social norms	
Customs	
Behaviours	
<b>Policy and policy processes</b>	

## 5 COPING AND ADAPTION STRATEGIES DURING TIMES OF ENVIRONMENTAL SHOCK AND SOCIAL STRESS

On a scale of 1-5 (5- most significant impact), what was the impact of the following disasters on the various assets covered previously? Then indicate with appropriate number from the table provided, the coping and adaptive strategy employed against each disaster.

	Hail	Drought	Flood	Wildfire	Heatwave	Coping strategy	Adaptive strategy
<b>Human assets</b>							
Occupation							
Source of information							
Education							
Health status							
<b>Social assets</b>							
Organisations/Institutions							
Social networks							
<b>Natural assets</b>							
Source of water							
Distance to water							
Wood							
Marine							
Grass							
Medical plants							
<b>Physical assets</b>							
Shelter							
Mode of transport							
Farm equipment							
Household items							
School							
Health care institutions							
Energy sources							
<b>Financial assets</b>							
Grazing for livestock							
Vegetables (specify below)							
Fruit (specify below)							
Livestock (specify below)							
Income							

Credit							
Remittances							
Savings							

## APPENDIX C: SCALING OF INDICATORS AND THE RATIONALES FOR SELECTION

### Human assets

#### Skills shortage

Households who indicated a skills shortage of 4 (maximum) received a scaled value of 0, whereas households with a zero skills shortage received a value of 1.

Scaled values for indicator 1 (skills shortage)

<b>Data value</b> <b>Number of skills indicated as being short</b>	<b>Scaled value</b>
4	0
3	0.25
2	0.5
1	0.75
0	1

#### Education

The values assigned for scaling were: zero for those household with all members have no education, 1 for those households with a member/s having attained to the ability to read and write, 2 for those households with a member/s having attained a primary education level (grade 1-7), 3 for those with a member/s having attained secondary education (grade 8-12) and 4 for those households with a member/s who have attained a tertiary education (any training following secondary education, with that education as a prerequisite).

Scaled values for indicator 2 (highest education level)

<b>Data value</b> <b>Level of education</b>	<b>Scaled value</b>
4	1
3	0.75
2	0.5
1	0.25
0	0

#### Information sources

Households who indicated access to maximum information sources indicated (7) received a scaled value of 1, whereas households with a zero (minimum) access to information sources received a value of 0.

Scaled values for indicator 3 (access to information sources)

<b>Data value</b> <b>Number of information sources indicated</b>	<b>Scaled value</b>
7	1
6	0.86
5	0.71
4	0.57
3	0.43
2	0.29
1	0.14
0	0

### Household labour capacity

The table below illustrates a composition of categories with their conversion factors. These values were initially derived from anthropological work by Yared Amare in North Shewa and South Wollo. Sharp (2003) made certain adjustments for her destitution study. Dr. Yared's original age-based weights are: small child (less than 6 years old) and 'retired person' (over 60) = 0; working child (6–10) = 1; adult assistant (10–13) = 2; and adult (over 13 years old) = 3. The scale defined by Sharp (2003) uses the same ratios, but with the following adaptations: 1 is set equal to an able-bodied adult equivalent; an additional weight is added for the working elderly, set at 0.5. After recoding the raw questionnaire responses for each individual to the conversion factors above, these were summed to give a measure of each household's total labour capacity. For scaling, the actual data minimum of 0 was used, while the maximum was at 5 adult equivalents.

<b>Category</b>	<b>Explanation</b>	<b>Conversion factor ('labour capacity units')</b>
Child	too young to work	0
Working child	e.g. herding livestock; doing domestic chores including childcare; may be hired or fostered out	0.3
'Adult assistant'	e.g. boys helping in the fields but not ploughing, girls helping in the kitchen (making sauce but not the staple dish)	0.6
Adult	able to do a full adult workload	1
Elderly	working, but not able to do a full adult workload	0.5
Permanently disabled	unable to work	0
Chronically ill	unable to work for the past 3 months or more	0



Scaled values for indicator 4 (household labour capacity)

<b>Data value Total household labour capacity units</b>	<b>Scaled value</b>
5+	1
4.3	0.86
4	0.8
3.6	0.72
3.5	0.7
3.3	0.66
3.1	0.62
3	0.6
2.9	0.58
2.6	0.52
2.5	0.5
2	0.4
1.5	0.3
1	0.2
0	0

### **Marital status**

For scaling a value of 0 was assigned for single female headed households, 1 for single male headed households and 2 for married households. Note that those who reported they are widowed and divorced are considered here as single.

Scaled indicators for indicator 5 (marital status)

<b>Data value Marital status</b>	<b>Scaled value</b>
2	1
1	0.5
0	0

### **Social assets**

#### **Social support networks**

Households with access to at least one social support network received a scaled value of 1 whereas households with no access received a value of 0.

Scaled values for indicator 6 (social support networks)

<b>Data value</b> <b>Access to social support networks</b>	<b>Scaled value</b>
0	0
1	1

#### **Access to social institutions/organizations**

The minimum was set at the actual data minimum of 0 and a maximum of 5.

Scaled values for indicator 7 (access to social institutions/organizations)

<b>Data value</b> <b>Number of institutions/organisations indicated</b>	<b>Scaled value</b>
5	1
4	0.8
3	0.6
2	0.4
1	0.2
0	0

#### **Physical assets**

##### **Number of implements needed for production purposes**

Households with three implements lacking received a scaled value of 0 whereas households with no implements lacking received a value of 1.

Scaled values for indicator 8 (number of implements needed)

<b>Data value</b> <b>Number of implements indicated</b>	<b>Scaled value</b>
3	0
2	0.33
1	0.67
0	1

**Access to health institutions**

Households with access to all six received a scaled value of 1 whereas households with no access to institutions received a value of 0.

Scaled values for indicator 9 (access to health institutions)

<b>Data value</b> <b>Number of health institutions indicated</b>	<b>Scaled value</b>
6	1
5	0.83
4	0.67
3	0.5
2	0.33
1	0.17
0	0

**Access to schools**

Households with access to all four levels received a scaled value of 1 whereas households with no access to any level of education received a value of 0.

Scaled values for indicator 10 (access to schools)

<b>Data value</b> <b>Number of schools indicated</b>	<b>Scaled value</b>
4	1
3	0.75
2	0.5
1	0.25
0	0

**Financial assets****Agricultural income sources**

Households with the maximum number (10) of agricultural income sources indicated received a scaled value of 1 whereas households with the minimum (0) received a value of 0.

Scaled values for indicator 11 (number of agricultural income sources)

<b>Data value</b> <b>Number of agricultural income sources indicated</b>	<b>Scaled value</b>
10	1
9	0.9
8	0.8
7	0.7
6	0.6
5	0.5
4	0.4
3	0.3
2	0.2
1	0.1
0	0

Households with no off-farm income were considered more fragile and assigned a value of 0 for scaling whereas the maximum number of non-agricultural were four and received a scaled value of 1.

Scaled values for indicator 12 (number of non-agricultural income sources)

<b>Data value</b> <b>Number of non-agricultural income sources indicated</b>	<b>Scaled value</b>
4	1
3	0.75
2	0.5
1	0.25
0	0

#### **Access to fodder relief**

Households with access to fodder relief received a scaled value of 1 whereas households with no access received a value of 0.

Scaled values for indicator 13 (access to fodder relief)

<b>Data value</b> <b>Access to fodder relief</b>	<b>Scaled value</b>
1	1
0	0

### Credit

Households with the maximum indicated credit sources (3) were assigned a value of 1 compared to households with no access were assigned a value of 0.

Scaled values for indicator 14 (access to number of credit sources)

<b>Data value</b> <b>Number of credit sources indicated</b>	<b>Scaled value</b>
3	1
2	0.67
1	0.33
0	0

### Access to insurance

Households with access to insurance received a scaled value of 1 whereas households with no access received a value of 0.

Scaled values for indicator 15 (access to insurance)

<b>Data value</b> <b>Access to insurance indicated</b>	<b>Scaled value</b>
1	1
0	0

### Natural assets

The maximum number of natural resources indicated being used were five. Households which indicated the maximum received a scaled value of 1 whereas households using no natural resources received a scaled value of 0.

Scaled values for indicator 16 (access to natural resources)

<b>Data value</b> <b>Number of natural resources used</b>	<b>Scaled value</b>
5	1
4	0.8
3	0.6
2	0.4
1	0.2
0	0

## APPENDIX D: EIGEN VALUES AND PERCENTAGE (%) OF VARIANCE OF EACH INDICATOR

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	4.363	27.266	27.266
2	1.740	10.873	38.138
3	1.657	10.355	48.493
4	1.356	8.476	56.970
5	1.247	7.791	64.761
6	1.027	6.418	71.179
7	0.953	5.957	77.136
8	0.907	5.668	82.804
9	0.590	3.685	86.489
10	0.518	3.240	89.729
11	0.429	2.681	92.409
12	0.373	2.330	94.739
13	0.250	1.561	96.300
14	0.243	1.517	97.817
15	0.212	1.324	99.141
16	0.137	0.859	100.00

Source: SPSS output table

## APPENDIX E: WEIGHTS OF VARIABLES IN PRINCIPAL COMPONENTS ANALYSIS

Rank by score	Variable	Score (weight under PCA)
1	Highest education level	0.190
2	Access to insurance	0.187
3	Access to number of health institutions	0.176
4	Number of implements needed	0.171
5	Access to number of schools	0.158
6	Social support networks	0.137
7	Number of agricultural income sources	0.127
8	Fodder relief	0.107
9	Access to number of organizations/institutions	0.083
10	Access to number of information sources	0.078
11	Access to number of sources of credit	0.070
12	Marital status	0.051
13	Access to number of natural resources	0.050
14	Skills shortage	0.044
15	Number of non-agricultural income sources	0.027
16	Household labour capacity	0.017



**APPENDIX F: CALCULATION OF INDICES**

<b>Example household: HH 1 of large scale farmers</b>				
<b>Indicators</b>	<b>Data value</b>	<b>Calculation</b>	<b>Scaled values</b>	<b>Weighted value</b>
Skills shortage	0	$(4-0)/(4-0) =$	1.00	0.044
Highest education level	4	$(4-0)/4-0) =$	1.00	0.190
Access to number of information sources	7	$(7-0)/(7-0) =$	1.00	0.078
Household labour capacity	2	$(2-0)/(5-0) =$	0.40	0.007
Marital status	2	$(2-0)/(2-0) =$	1.00	0.051
<b>HUMAN ASSETS</b>		<b>AVG (0.043,0.221,0.065,0.005,0.059)</b>	<b>0.88</b>	<b>0.074</b>
Social support networks	0	$(0-0)/(0-0) =$	0.00	0.000
Access to number of institutions/organisations	3	$(3-0)/(5-0) =$	0.60	0.050
<b>SOCIAL ASSETS</b>		<b>AVG (0.000,0.045)</b>	<b>0.30</b>	<b>0.025</b>
Implements needed for production purposes	0	$(1-0)-(1-0) =$	1.00	0.171
Access to health institutions	5	$(5-0)/(6-0) =$	0.83	0.146
Access to schools	3	$(3-0)/(4-0) =$	0.75	0.119
<b>PHYSICAL ASSETS</b>		<b>AVG (0.206,0.174,0.149)</b>	<b>0.86</b>	<b>0.145</b>
Number of agricultural income sources	9	$(9-0)/(10-0) =$	0.90	0.114
Number of non-agricultural income sources	1	$(1-0)/(4-0) =$	0.25	0.007
Fodder relief	0	$(0-0)/(1-0) =$	0.00	0.000
Number of credit sources used	1	$(1-0)/(3-0) =$	0.33	0.023
Access to insurance	1	$(1-0)/(1-0) =$	1	0.187
<b>FINANCIAL ASSETS</b>		<b>AVG (0.012,0.003,0.000,0.026)</b>	<b>0.37</b>	<b>0.066</b>
Access to number of natural resources	4	$(4-0)/(5-0) =$	0.80	0.040
<b>NATURAL ASSETS</b>		<b>Indicator 15</b>	<b>0.80</b>	<b>0.040</b>
<b>LIVELIHOOD RESOURCE INDEX</b>		<b>AVG</b>	<b>0.64</b>	<b>0.070</b>

## APPENDIX G: COMPONENT COEFFICIENTS OF THE SIXTEEN VARIABLES SELECTED

Component matrix						
	Component					
	1	2	3	4	5	6
Variable 1	-0.191	-0.212	-0.684	0.395	0.251	0.131
Variable 2	0.832	-0.013	0.044	-0.094	0.044	-0.128
Variable 3	0.339	0.573	-0.498	0.006	0.058	0.100
Variable 4	-0.072	0.112	0.350	0.227	0.543	0.098
Variable 5	0.222	-0.073	0.094	0.088	0.137	0.846
Variable 6	-0.598	0.229	-0.131	-0.551	0.067	0.013
Variable 7	0.363	0.531	0.124	-0.106	-0.417	0.020
Variable 8	0.747	-0.200	0.050	0.042	0.033	-0.135
Variable 9	-0.769	0.277	0.131	-0.015	-0.212	0.040
Variable 10	-0.691	0.514	0.087	0.253	-0.068	-0.028
Variable 11	0.552	0.361	0.267	-0.269	0.282	0.188
Variable 12	-0.119	-0.344	0.697	-0.143	-0.142	0.126
Variable 13	-0.474	0.209	0.030	-0.420	0.588	-0.060
Variable 14	0.305	0.190	0.282	0.315	0.413	-0.416
Variable 15	0.815	0.419	-0.072	-0.049	-0.102	0.064
Variable 16	-0.217	0.358	0.325	0.617	-0.094	0.063
Variance explained (%)	27.266	10.873	10.355	8.476	7.791	6.418
Cumulative variance explained (%)	27.266	38.138	48.493	56.970	64.761	71.179

**APPENDIX H: WEIGHTED HOUSEHOLD SCORES FOR EACH INDICATOR**

<b>LARGE-SCALE FARMERS</b>						
<b>Indicators</b>	<b>HH1</b>	<b>HH2</b>	<b>HH3</b>	<b>HH4</b>	<b>HH5</b>	<b>HH6</b>
Skills shortage	0.044	0.033	0.022	0.033	0.022	0.033
Highest education level	0.190	0.190	0.190	0.190	0.190	0.190
Number of information sources	0.078	0.055	0.044	0.059	0.067	0.059
Household labour capacity	0.007	0.010	0.003	0.009	0.017	0.010
Marital status	0.051	0.051	0.026	0.051	0.051	0.051
<b>Weighted human assets</b>	<b>0.074</b>	<b>0.068</b>	<b>0.057</b>	<b>0.068</b>	<b>0.069</b>	<b>0.068</b>
Social support networks	0.000	0.000	0.000	0.000	0.000	0.000
Number of institutions/organizations	0.050	0.066	0.050	0.083	0.033	0.033
<b>Weighted social assets</b>	<b>0.025</b>	<b>0.033</b>	<b>0.025</b>	<b>0.042</b>	<b>0.017</b>	<b>0.017</b>
Implements needed for production purposes	0.171	0.171	0.171	0.171	0.171	0.171
Number of health institutions	0.146	0.146	0.146	0.146	0.146	0.146
Number of schools	0.119	0.079	0.000	0.119	0.040	0.079
<b>Weighted physical assets</b>	<b>0.145</b>	<b>0.132</b>	<b>0.106</b>	<b>0.145</b>	<b>0.119</b>	<b>0.132</b>
Agricultural income sources	0.114	0.038	0.076	0.051	0.127	0.051
Non-agricultural income sources	0.007	0.000	0.007	0.007	0.027	0.000
Fodder relief	0.000	0.000	0.107	0.000	0.107	0.107
Credit sources	0.023	0.023	0.047	0.023	0.023	0.023
Access to insurance	0.187	0.187	0.187	0.187	0.187	0.187
<b>Weighted financial assets</b>	<b>0.066</b>	<b>0.050</b>	<b>0.085</b>	<b>0.054</b>	<b>0.094</b>	<b>0.074</b>
Natural resources	0.040	0.030	0.020	0.040	0.040	0.040
<b>Weighted natural assets</b>	<b>0.040</b>	<b>0.030</b>	<b>0.020</b>	<b>0.040</b>	<b>0.040</b>	<b>0.040</b>
<b>WEIGHTED LIVELIHOOD RESOURCE INDEX</b>	<b>0.070</b>	<b>0.063</b>	<b>0.058</b>	<b>0.070</b>	<b>0.068</b>	<b>0.066</b>

<b>LARGE-SCALE FARMERS</b>							
<b>Indicators</b>	<b>HH7</b>	<b>HH8</b>	<b>HH9</b>	<b>HH10</b>	<b>HH11</b>	<b>HH12</b>	<b>Average</b>
Skills shortage	0.033	0.033	0.022	0.044	0.033	0.044	0.033
Highest education level	0.190	0.190	0.190	0.190	0.190	0.190	0.190
Number of information sources	0.067	0.067	0.078	0.078	0.078	0.067	0.066
Household labour capacity	0.010	0.014	0.011	0.007	0.007	0.003	0.009
Marital status	0.051	0.051	0.051	0.051	0.051	0.026	0.047
<b>Weighted human assets</b>	<b>0.070</b>	<b>0.071</b>	<b>0.070</b>	<b>0.074</b>	<b>0.072</b>	<b>0.066</b>	<b>0.069</b>
Social support networks	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Number of institutions/organizations	0.066	0.033	0.066	0.066	0.066	0.033	0.054
<b>Weighted social assets</b>	<b>0.033</b>	<b>0.017</b>	<b>0.033</b>	<b>0.033</b>	<b>0.033</b>	<b>0.017</b>	<b>0.027</b>
Implements needed for production purposes	0.171	0.171	0.171	0.171	0.171	0.171	0.171
Number of health institutions	0.176	0.146	0.146	0.146	0.176	0.146	0.151
Number of schools	0.158	0.000	0.079	0.079	0.040	0.000	0.066
<b>Weighted physical assets</b>	<b>0.168</b>	<b>0.106</b>	<b>0.132</b>	<b>0.132</b>	<b>0.129</b>	<b>0.106</b>	<b>0.129</b>
Agricultural income sources	0.038	0.051	0.051	0.051	0.038	0.013	0.058
Non-agricultural income sources	0.000	0.007	0.000	0.000	0.014	0.007	0.006
Fodder relief	0.107	0.000	0.000	0.000	0.000	0.000	0.036
Credit sources	0.047	0.023	0.023	0.023	0.023	0.023	0.027
Access to insurance	0.187	0.187	0.187	0.187	0.187	0.187	0.187
<b>Weighted financial assets</b>	<b>0.076</b>	<b>0.054</b>	<b>0.052</b>	<b>0.052</b>	<b>0.052</b>	<b>0.046</b>	<b>0.063</b>
Natural resources	0.040	0.030	0.030	0.030	0.030	0.030	0.033
<b>Weighted natural assets</b>	<b>0.040</b>	<b>0.030</b>	<b>0.030</b>	<b>0.030</b>	<b>0.030</b>	<b>0.030</b>	<b>0.033</b>
<b>WEIGHTED LIVELIHOOD RESOURCE INDEX</b>	<b>0.078</b>	<b>0.055</b>	<b>0.064</b>	<b>0.064</b>	<b>0.063</b>	<b>0.053</b>	<b>0.064</b>

<b>MEDIUM-SCALE FARMERS</b>							
<b>Indicators</b>	<b>HH1</b>	<b>HH2</b>	<b>HH3</b>	<b>HH4</b>	<b>HH5</b>	<b>HH6</b>	<b>HH7</b>
Skills shortage	0.000	0.044	0.033	0.022	0.044	0.011	0.000
Highest education level	0.190	0.190	0.190	0.190	0.143	0.190	0.190
Number of information sources	0.055	0.044	0.067	0.055	0.055	0.011	0.023
Household labour capacity	0.007	0.005	0.003	0.009	0.014	0.012	0.010
Marital status	0.051	0.051	0.000	0.051	0.051	0.026	0.051
<b>Weighted human assets</b>	<b>0.061</b>	<b>0.067</b>	<b>0.059</b>	<b>0.065</b>	<b>0.061</b>	<b>0.050</b>	<b>0.055</b>
Social support networks	0.000	0.000	0.137	0.000	0.000	0.000	0.000
Number of institutions/organizations	0.066	0.033	0.033	0.050	0.033	0.033	0.083
<b>Weighted social assets</b>	<b>0.033</b>	<b>0.017</b>	<b>0.085</b>	<b>0.025</b>	<b>0.017</b>	<b>0.017</b>	<b>0.042</b>
Implements needed for production purposes	0.171	0.171	0.171	0.171	0.171	0.171	0.171
Number of health institutions	0.176	0.146	0.176	0.146	0.146	0.146	0.176
Number of schools	0.119	0.158	0.119	0.000	0.000	0.119	0.119
<b>Weighted physical assets</b>	<b>0.155</b>	<b>0.158</b>	<b>0.155</b>	<b>0.106</b>	<b>0.106</b>	<b>0.145</b>	<b>0.155</b>
Agricultural income sources	0.076	0.025	0.038	0.064	0.038	0.025	0.076
Non-agricultural income sources	0.020	0.014	0.007	0.007	0.007	0.020	0.014
Fodder relief	0.000	0.000	0.107	0.000	0.000	0.000	0.000
Credit sources	0.023	0.023	0.000	0.023	0.023	0.070	0.023
Access to insurance	0.187	0.187	0.000	0.187	0.000	0.000	0.187
<b>Weighted financial assets</b>	<b>0.061</b>	<b>0.050</b>	<b>0.030</b>	<b>0.056</b>	<b>0.014</b>	<b>0.023</b>	<b>0.060</b>
Natural resources	0.050	0.040	0.020	0.030	0.030	0.040	0.020
<b>Weighted natural assets</b>	<b>0.050</b>	<b>0.040</b>	<b>0.020</b>	<b>0.030</b>	<b>0.030</b>	<b>0.040</b>	<b>0.020</b>
<b>WEIGHTED LIVELIHOOD RESOURCE INDEX</b>	<b>0.072</b>	<b>0.066</b>	<b>0.070</b>	<b>0.056</b>	<b>0.045</b>	<b>0.055</b>	<b>0.066</b>

<b>MEDIUM-SCALE FARMERS</b>									
<b>Indicators</b>	<b>HH8</b>	<b>HH9</b>	<b>HH10</b>	<b>HH11</b>	<b>HH12</b>	<b>HH13</b>	<b>HH14</b>	<b>HH15</b>	<b>Average</b>
Skills shortage	0.044	0.033	0.011	0.022	0.044	0.022	0.022	0.044	0.026
Highest education level	0.190	0.143	0.190	0.190	0.000	0.190	0.190	0.190	0.171
Number of information sources	0.034	0.023	0.034	0.034	0.023	0.044	0.044	0.044	0.039
Household labour capacity	0.005	0.007	0.007	0.007	0.007	0.017	0.015	0.007	0.009
Marital status	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.046
<b>Weighted human assets</b>	<b>0.065</b>	<b>0.051</b>	<b>0.058</b>	<b>0.061</b>	<b>0.025</b>	<b>0.065</b>	<b>0.064</b>	<b>0.067</b>	<b>0.058</b>
Social support networks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009
Number of institutions/organizations	0.033	0.050	0.033	0.033	0.033	0.066	0.033	0.000	0.041
<b>Weighted social assets</b>	<b>0.017</b>	<b>0.025</b>	<b>0.017</b>	<b>0.017</b>	<b>0.017</b>	<b>0.033</b>	<b>0.017</b>	<b>0.000</b>	<b>0.025</b>
Implements needed for production purposes	0.171	0.171	0.171	0.171	0.171	0.171	0.171	0.171	0.171
Number of health institutions	0.146	0.176	0.146	0.176	0.146	0.146	0.146	0.146	0.156
Number of schools	0.000	0.000	0.000	0.000	0.000	0.119	0.000	0.000	0.050
<b>Weighted physical assets</b>	<b>0.106</b>	<b>0.116</b>	<b>0.106</b>	<b>0.116</b>	<b>0.106</b>	<b>0.145</b>	<b>0.106</b>	<b>0.106</b>	<b>0.126</b>
Agricultural income sources	0.013	0.076	0.076	0.025	0.025	0.025	0.025	0.051	0.044
Non-agricultural income sources	0.014	0.014	0.014	0.020	0.014	0.020	0.014	0.014	0.014
Fodder relief	0.000	0.107	0.000	0.000	0.107	0.107	0.000	0.000	0.029
Credit sources	0.000	0.023	0.023	0.000	0.023	0.023	0.023	0.023	0.022
Access to insurance	0.000	0.000	0.187	0.000	0.000	0.000	0.000	0.000	0.062
<b>Weighted financial assets</b>	<b>0.005</b>	<b>0.044</b>	<b>0.060</b>	<b>0.009</b>	<b>0.034</b>	<b>0.035</b>	<b>0.012</b>	<b>0.017</b>	<b>0.034</b>
Natural resources	0.020	0.030	0.050	0.030	0.020	0.030	0.030	0.020	0.031
<b>Weighted natural assets</b>	<b>0.020</b>	<b>0.030</b>	<b>0.050</b>	<b>0.030</b>	<b>0.020</b>	<b>0.030</b>	<b>0.030</b>	<b>0.020</b>	<b>0.031</b>
<b>WEIGHTED LIVELIHOOD RESOURCE INDEX</b>	<b>0.042</b>	<b>0.053</b>	<b>0.058</b>	<b>0.046</b>	<b>0.040</b>	<b>0.062</b>	<b>0.046</b>	<b>0.042</b>	<b>0.055</b>

SMALL-SCALE FARMERS											
Indicators	HH1	HH2	HH3	HH4	HH5	HH6	HH7	HH8	HH9	HH10	HH11
Skills shortage	0.033	0.044	0.044	0.022	0.022	0.044	0.033	0.022	0.033	0.022	0.033
Highest education level	0.095	0.143	0.095	0.143	0.095	0.095	0.190	0.095	0.143	0.095	0.190
Number of information sources	0.044	0.044	0.044	0.055	0.034	0.044	0.034	0.044	0.044	0.044	0.023
Household labour capacity	0.010	0.017	0.007	0.009	0.009	0.012	0.003	0.005	0.014	0.007	0.012
Marital status	0.051	0.026	0.051	0.026	0.051	0.026	0.051	0.051	0.051	0.051	0.051
<b>Weighted human assets</b>	<b>0.047</b>	<b>0.055</b>	<b>0.048</b>	<b>0.051</b>	<b>0.042</b>	<b>0.044</b>	<b>0.062</b>	<b>0.044</b>	<b>0.057</b>	<b>0.044</b>	<b>0.062</b>
Social support networks	0.000	0.137	0.137	0.137	0.137	0.000	0.000	0.137	0.000	0.137	0.000
Number of institutions/organizations	0.050	0.033	0.066	0.033	0.033	0.033	0.050	0.033	0.033	0.033	0.033
<b>Weighted social assets</b>	<b>0.025</b>	<b>0.085</b>	<b>0.102</b>	<b>0.085</b>	<b>0.085</b>	<b>0.017</b>	<b>0.025</b>	<b>0.085</b>	<b>0.017</b>	<b>0.085</b>	<b>0.017</b>
Implements needed for production purposes	0.000	0.000	0.000	0.000	0.000	0.171	0.171	0.000	0.000	0.000	0.171
Number of health institutions	0.176	0.176	0.176	0.176	0.176	0.176	0.176	0.176	0.176	0.176	0.176
Number of schools	0.119	0.119	0.119	0.119	0.119	0.119	0.119	0.119	0.119	0.119	0.119
<b>Weighted physical assets</b>	<b>0.098</b>	<b>0.098</b>	<b>0.098</b>	<b>0.098</b>	<b>0.098</b>	<b>0.155</b>	<b>0.155</b>	<b>0.098</b>	<b>0.098</b>	<b>0.098</b>	<b>0.155</b>
Agricultural income sources	0.013	0.038	0.025	0.038	0.025	0.025	0.038	0.038	0.013	0.025	0.025
Non-agricultural income sources	0.014	0.014	0.014	0.007	0.014	0.014	0.007	0.020	0.007	0.007	0.007
Fodder relief	0.000	0.107	0.107	0.107	0.107	0.107	0.107	0.107	0.000	0.107	0.107
Credit sources	0.000	0.023	0.023	0.023	0.000	0.023	0.023	0.023	0.023	0.000	0.023
Access to insurance	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
<b>Weighted financial assets</b>	<b>0.005</b>	<b>0.036</b>	<b>0.034</b>	<b>0.035</b>	<b>0.029</b>	<b>0.034</b>	<b>0.035</b>	<b>0.038</b>	<b>0.009</b>	<b>0.028</b>	<b>0.032</b>
Natural resources	0.040	0.050	0.040	0.030	0.020	0.040	0.040	0.050	0.050	0.040	0.050
<b>Weighted natural assets</b>	<b>0.040</b>	<b>0.050</b>	<b>0.040</b>	<b>0.030</b>	<b>0.020</b>	<b>0.040</b>	<b>0.040</b>	<b>0.050</b>	<b>0.050</b>	<b>0.040</b>	<b>0.050</b>
<b>WEIGHTED LIVELIHOOD RESOURCE INDEX</b>	<b>0.043</b>	<b>0.065</b>	<b>0.064</b>	<b>0.060</b>	<b>0.055</b>	<b>0.058</b>	<b>0.063</b>	<b>0.063</b>	<b>0.046</b>	<b>0.059</b>	<b>0.063</b>

SMALL-SCALE FARMERS													
Indicators	HH12	HH13	HH14	HH15	HH16	HH17	HH18	HH19	HH20	HH21	HH22	HH23	Average
Skills shortage	0.033	0.033	0.044	0.044	0.033	0.044	0.033	0.033	0.033	0.033	0.022	0.033	0.032
Highest education level	0.143	0.143	0.190	0.095	0.095	0.095	0.095	0.143	0.143	0.143	0.143	0.095	0.125
Number of information sources	0.044	0.034	0.067	0.034	0.044	0.023	0.055	0.044	0.067	0.044	0.044	0.055	0.041
Household labour capacity	0.011	0.014	0.012	0.005	0.017	0.005	0.005	0.014	0.017	0.007	0.014	0.007	0.009
Marital status	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.026	0.051	0.051	0.000	0.000	0.044
<b>Weighted human assets</b>	<b>0.056</b>	<b>0.055</b>	<b>0.073</b>	<b>0.046</b>	<b>0.048</b>	<b>0.044</b>	<b>0.048</b>	<b>0.052</b>	<b>0.062</b>	<b>0.056</b>	<b>0.045</b>	<b>0.038</b>	<b>0.050</b>
Social support networks	0.000	0.137	0.000	0.000	0.000	0.000	0.137	0.000	0.000	0.000	0.000	0.000	0.075
Number of institutions/organizations	0.033	0.050	0.033	0.033	0.017	0.033	0.017	0.033	0.033	0.033	0.050	0.050	0.039
<b>Weighted social assets</b>	<b>0.017</b>	<b>0.093</b>	<b>0.017</b>	<b>0.017</b>	<b>0.008</b>	<b>0.017</b>	<b>0.077</b>	<b>0.017</b>	<b>0.017</b>	<b>0.017</b>	<b>0.025</b>	<b>0.025</b>	<b>0.057</b>
Implements needed for production purposes	0.000	0.000	0.171	0.000	0.171	0.171	0.171	0.000	0.000	0.000	0.171	0.000	0.047
Number of health institutions	0.176	0.176	0.176	0.176	0.176	0.176	0.176	0.176	0.176	0.176	0.176	0.176	0.176
Number of schools	0.119	0.119	0.119	0.119	0.119	0.119	0.119	0.119	0.119	0.119	0.119	0.119	0.119
<b>Weighted physical assets</b>	<b>0.098</b>	<b>0.098</b>	<b>0.155</b>	<b>0.098</b>	<b>0.155</b>	<b>0.155</b>	<b>0.155</b>	<b>0.098</b>	<b>0.098</b>	<b>0.098</b>	<b>0.155</b>	<b>0.098</b>	<b>0.114</b>
Agricultural income sources	0.038	0.038	0.064	0.013	0.051	0.013	0.038	0.038	0.025	0.025	0.013	0.025	0.028
Non-agricultural income sources	0.020	0.014	0.014	0.014	0.007	0.014	0.000	0.000	0.007	0.007	0.020	0.007	0.011
Fodder relief	0.107	0.107	0.000	0.000	0.107	0.000	0.107	0.107	0.107	0.000	0.000	0.000	0.088
Credit sources	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.000	0.023	0.017
Access to insurance	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
<b>Weighted financial assets</b>	<b>0.038</b>	<b>0.036</b>	<b>0.020</b>	<b>0.010</b>	<b>0.038</b>	<b>0.010</b>	<b>0.034</b>	<b>0.034</b>	<b>0.032</b>	<b>0.011</b>	<b>0.007</b>	<b>0.011</b>	<b>0.029</b>
Natural resources	0.030	0.020	0.050	0.050	0.050	0.040	0.040	0.030	0.020	0.030	0.040	0.050	0.041
<b>Weighted natural assets</b>	<b>0.030</b>	<b>0.020</b>	<b>0.050</b>	<b>0.050</b>	<b>0.050</b>	<b>0.040</b>	<b>0.040</b>	<b>0.030</b>	<b>0.020</b>	<b>0.030</b>	<b>0.040</b>	<b>0.050</b>	<b>0.041</b>
<b>WEIGHTED LIVELIHOOD RESOURCE INDEX</b>	<b>0.048</b>	<b>0.061</b>	<b>0.063</b>	<b>0.044</b>	<b>0.060</b>	<b>0.053</b>	<b>0.071</b>	<b>0.046</b>	<b>0.046</b>	<b>0.042</b>	<b>0.054</b>	<b>0.044</b>	<b>0.058</b>



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Is the research title appropriate and suitable?	X
Are the abstract (English and Afrikaans) and list of keywords included?	X
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Has the research question been clearly identified?	X
Are the conceptualisation and the rationale of the research clear?	X
Has the method of research been described clearly and adequately, in other words, can the research be repeated elsewhere on the basis of the description given?	X
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