Understanding social-ecological changes in Fairbairn village, Eastern Cape

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ABSTRACT

The world is becoming increasingly complex and uncertain due to increasing levels of social-ecological change. Rural communities in sub-Saharan Africa are faced with multiple interconnected challenges such as population growth, environmental change, economic recession and climatic changes, amongst others. Such challenges can play a key role in determining vulnerability and food security, particularly for natural resource product-dependent societies that have limited livelihood sources. Studies that consider understanding how society and ecosystems simultaneously interact and respond to new and exacerbated drivers are increasingly needed. Therefore, this study was conducted in Fairbairn village, Eastern Cape, South Africa with the purpose of exploring multi-scale historical processes and current related trends in livelihood and environmental change, and the implications for future trajectories under a changing climate.

This study applied social-ecological thinking and several conceptual approaches were combined to provide a lens for exploring the changes taking place. These included, *inter alia*, complexity theory, social-ecological systems, the sustainable livelihoods approach and the Intergovernmental Platform on Biodiversity and Ecosystem Services framework and principles. The study employed a mixed method approach to gather data, which included a household survey, aerial photography, historical records as well as Participatory Learning and Action, focus group discussions, and Participatory Scenario techniques. Quantitative data were analysed using Excel and Statistica version 13, whilst coding was used for thematic analysis of qualitative data. The main objective of this study was to explore multi-scale historical processes and current related trends of livelihood and environmental change, and the implications of these for future trajectories under a changing climate.

Livelihood and landscape changes in Fairbairn village are embedded within a history of direct state intervention and more recently, improvements in basic service delivery. The findings show that natural resource products still form an important part of people's livelihoods despite many other changes over the last fifteen years. A high proportion of households continue to utilise different products to meet household needs. The most widely used products are fuelwood, wild herbs and wild fruits. More so, my results revealed a significant increase in the number of people commercialising natural resource products over the past fifteen years. Furthermore, I found that rural livelihoods in Fairbairn are heavily

dependent on external income and consumption and have become increasingly divorced from local production patterns. My results depict a steady decline of cultivated fields with a corresponding increase of home gardens since the 1960s. Therefore, the results demonstrate that current livelihood strategies are an expression of historical processes interacting with current contextual complexities. Given the complex and multidimensional issues at play in Fairbairn, the study highlights that there is no straightforward answer regarding future livelihood strategies. However, participatory scenario deliberations revealed that the youth were much more open to diversified and even very different forms of livelihood strategies in the future, whilst community leaders and elders remained firmly attached to farming activities.

Understanding the diversity of past livelihood changes, together with current trends, can help to better contextualise future livelihood trajectories and this can therefore help rural communities identify and avoid undesirable futures under a changing climate

DECLARATION

I, Menelisi Falayi, hereby declare that the work described in this thesis was carried out in the Department of Environmental Science, Rhodes University under the supervision of Professor Sheona Shackleton and Dr. Georgina Cundill. The thesis has not been submitted to a university other than Rhodes University, Grahamstown, South Africa. The work presented here is that of the author unless otherwise stated.

Menelisi Falayi

Date: 17 MARCH 2017

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LIST OF ACRONYMS

CPI	Consumer Price Index
GPS	Global Positioning System
HACOP	Hertzog Agricultural Co-operative
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
SLF	Sustainable Livelihoods Framework
PLA	Participatory Learning and Action
PSP	Participatory Scenario Planning
PSD	Participatory Scenario Development
UTM	Universal Transverse Mercator

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Asina sihlobo esinjengo Jesu 2. The dream continues

CHAPTER 1: INTRODUCTION, THEORETICAL CONTEXT AND STUDY APPROACH

1.1 INTRODUCTION

Over the past 50 years, there has been a growing realisation that humans have become the driving force behind ecosystem change, more than in any other period of human environmental history (MA 2005, Blamey et al. 2015, Gumbo et al. 2016, Pullanikkatil et al. 2016). This change is attributed to the extensive use and dependence on renewable and non-renewable natural resource products for both social and economic development (van Jaarsveld et al. 2005, Shackleton et al. 2010, Chidumayo and Gumbo, 2010). In addition to these direct human pressures, it is expected that climate change, which is also human-induced, will amplify ecosystem change (MA 2005, Brown and Crawford 2009). Climate change is a 'threat multiplier' (Carius 2009) that will intensify existing problems and vulnerabilities, with sub-Saharan countries likely to be more vulnerable to the impacts of climate change because of low levels of development (Field et al. 2014, Ross 2015). Natural resource dependent communities tend to have a limited adaptive capacity to cope with unanticipated events and impacts of climate change (Shackleton et al. 2013b, Ford et al. 2015). Furthermore, climate change and related contextual complexities are likely to simultaneously increase vulnerability, erode livelihood, increase food insecurity and result in major landscape changes (Mareseni 2012, Shackleton et al. 2013b, Kamwi et al. 2015). The magnitude and direction of these manifestations are difficult to predict. Therefore "understanding how society and ecosystems simultaneously interact and respond to drivers, stressors and any form of change is critical in promoting sustainability in a changing world" (Shackleton et al. 2013b:136).

Rural communities in sub-Saharan Africa are faced with multiple interconnected challenges such as population growth, high levels of poverty and underdevelopment, environmental change and climatic variability and changes (Asaha and Deakin 2016, Foli and Abdoulaye 2016). Such challenges can play a key role in determining vulnerability and food security, particularly for smallholding farmers (Ulrich et al. 2012). For example, the major zone of crop agriculture in sub-Saharan Africa is in the forests and woodlands, much of which is rain-fed and therefore susceptible to climate variability (Chidumayo and Gumbo 2010, Kamwi et al. 2015). The climate of dry forests and woodlands is characterised by frequent droughts and floods that frequently cause crop failure (Chidumayo and Gumbo 2010). Harsh climatic events and climate variability expose rural food systems to shock and stresses (Palacios et al. 2013) and pose a threat to rural livelihoods. Furthermore, changing rainfall and temperature

patterns might have the capacity to reshape productive landscapes and exacerbate food, water and energy scarcities (Ross 2015). In addition, decreased water levels will not only affect agriculture but also might affect water quality and increase waterborne diseases (Madzwamuse 2010, Pullanikkatil et al. 2015). Recent studies in Malawi (Pullanikkatil et al. 2015, 2016) show that the bilharzia pandemic is spreading through irrigation systems that were originally designed to help rural farmers adapt to climate change. Rural farmers and households in sub-Saharan Africa thus face pre-existing stressors on their livelihood systems together with new stressors caused by climate change. Such risks and stressors are often complex and interact with one another in often unpredictable ways (Diaz et al. 2015).

A series of studies suggests that rural livelihoods in sub-Saharan Africa have become more diversified over time in response to the kinds of rapid human environmental change alluded to above (Shackleton et al. 2015, Robaa and Tolossa 2016). The mix of activities tends to include a combination of off-farm activities, harvesting of natural resource products and crop and livestock production (Hebinck and Lent 2007). Natural resource products may benefit rural households in a variety of ways, through a) direct household provisioning and consumption (*refer to Section 2.1.1.1, Chapter 2*); b) helping to save cash expenditure by provided free substitutes for particular needs (*refer to Section 2.1.1.2, Chapter 2*); c) being traded for cash income generation (*refer to Section 2.1.1.3, Chapter 2*); d) providing a fall-back option or safety net in times of need (*refer to Section 2.1.1.4, Chapter 2*); e) providing regulating services such as helping to enhance soil fertility; and f) possibly having cultural benefits and significance (Shackleton and Gumbo 2010, Shackleton et al. 2015, Mutandwa and Kanyarukiga 2016). Apart from natural resource products, rural households depend on other livelihood strategies such as informal employment, remittances and state welfare (Hussein and Nelson 2016, *refer to Section 3.3.3, Chapter 3*). For example, in Zimbabwe, migrant remittances from South Africa are proving to be a significant form of financing and livelihood income for rural households who have limited livelihood options (Nzima et al. 2016).

In South Africa, the range of income sources extends to access to state welfare in the form of different types of social grants (*refer to Table 1.1, Chapter 1; Section 3.3.3, Chapter 3*) which form a large part of household income (Shackleton et al. 2002, Thondhlana and Muchapondwa 2014, Mjoli and Shackleton 2015). Historians suggest that prior to 1994, rural livelihoods in South Africa revolved around "a clear relationship with the natural environment" (Hebinck and Lent 2007:65). However, the augmentation of state welfare post

1994 provided a key resource for contemporary livelihoods (Francis 2000, Hebinck and Lent 2007, Hebinck and Cousins 2013, *refer to Section 3.3.1.4, Chapter 3*). Recent livelihoods literature from the Eastern Cape province of South Africa suggests that people now rely largely on social grants, migratory labour and remittances for their livelihoods (Shackleton et al. 2007, Shackleton et al. 2013a, Shackleton and Luckert 2015). This may be one factor driving the level of field abandonment in the Eastern Cape (Hebinck and Lent 2007). Other factors or drivers might be related to a lack of access to equipment or farming inputs (Shackleton et al. 2013a). Correspondingly, these changes have shaped local landscapes over time in the Eastern Cape (Shackleton et al. 2013a, O'Connor et al. 2014, Stickler and Shackleton 2015, *refer to Section 3.3.2, Chapter 3*). Given the multiple factors at play in rural livelihoods, understanding drivers of change and their future impacts on climate change is challenging due to the high degree of uncertainty that it brings (*refer to Chapter 4*).

1.1.1 Gaps in understanding local level change and responses

From the preceding, climate change will affect communities that are already experiencing changes in their livelihoods and landscapes due to other factors. Both rural livelihoods and landscapes are influenced by long-term factors or drivers. In this context of thinking about a future impacted by climate change, an understanding is required of both present livelihood choices and long-term shifts that have influenced the present.

Despite an increasing number of studies in sub-Saharan Africa that show the importance of natural resource product use and sale to rural households' income (*refer to Section 2.1, Chapter 2*), few studies have managed to trace and identify changes in the use and sale of natural resources over time, particularly at local level (Shackleton et al. 2015). Some commentators suggest that follow-up surveys or repeated cross-sectional longitudinal analyses are critical in comprehending longer-term changes (Scoones 2009). Furthermore, looking at the same households or villages over time allows better understanding of how households or communities respond to continuous change (Kristjanson et al. 2010, Ulrich et al. 2012). Conducting follow-up surveys can however be challenging due to the difficulties involved in locating study sites where comprehensive livelihood surveys have previously been conducted, and whether these original surveys are still available.

Another, complementary, approach has been to understand livelihood and landscape trajectories over time through historical analysis (*refer to Section 3.1, Chapter 3*). Some commentators suggest that understanding local histories is key to understanding the

magnitude and direction of livelihood change (Mbow et al. 2008), and argue that land use strategies in particular can only be understood within the context of local histories, cultures, politics and market dynamics (Gumbo et al. 2016). It is therefore critical to understand livelihood and landscape trajectories from a multi-scale perspective. For example, while land use decisions take place at a household level, and directly influence local landscape change, these decisions are often driven by strong externalities such as government policies and markets (Amberntsson 2011, Deakin et al. 2016).

If understanding past livelihood trajectories is a challenge, efforts to project the future impacts of climate change on rural livelihoods are even more challenging. The future is increasingly complex and uncertain as a multitude of factors interacts simultaneously to influence people's choices (Freeth and Drimie 2016). Understanding the diversity of past livelihood changes, together with current trends and local views on acceptable responses to future changes, can help us generate knowledge to better envision potential futures under a changing climate (Wollenberg et al. 2000b, *refer to Section 4.3, Chapter 4*).

1.1.2 Key questions and objectives

This thesis aims to contribute both theoretically and empirically towards the growing literature on shifting livelihoods, landscapes and future scenarios under a changing climate. The aim of this study is to explore multi-scale historical processes and current related trends of livelihood and environmental change, and the implications of these for future trajectories under a changing climate.

Although each of the empirical chapters (*refer to Chapters 2, 3 and 4*) contains their own specific set of key questions, the overarching questions that my study seeks to answer are:

1. How have the uses and economic contribution of natural resource products to households changed over time?
2. How have historical and contemporary drivers and other changes influenced linked landscape and livelihood systems?
3. What are the plausible, resilient future livelihood pathways and trajectories given existing trends and changes, and future climate projections?

From the current theoretical literature and a consideration of social-ecological change, the following propositions can be drawn, which underlie this research:

I. The use of natural resource products and their role in rural livelihoods is declining as communities modernise.
II. Arable agriculture, as in other parts of the Eastern Cape, is declining and rural households have become reliant on other livelihood sources as proposed by Bryceson (2004) with her concept of deagrarianisation.
III. Future livelihood portfolios and pathways are viewed differently by different groups in the community and could take several directions and trajectories, adding to the uncertainty caused by climate change.

1.2 SELECTION AND DESCRIPTION OF STUDY AREA

The area selected for this study is Fairbairn village in the Eastern Cape Province of South Africa (Figure 1.1). One major reason for selecting this site was that a comprehensive baseline natural resource product use survey was conducted in Fairbairn village by Shackleton et al. (2002) approximately 15 years ago. I had access to both the original data and survey instruments from this study, providing a rare opportunity to conduct a repeated, cross-sectional longitudinal study of livelihood changes over the past 15 years. In this section, I provide a basic introduction to Fairbairn in terms of location, biophysical features, social-economic background, infrastructure and governance. More details emerging from my own empirical research are contained in Chapters 2, 3 and 4.

1.2.1 Location

Fairbairn village is located in the Kat River valley, in the Amatole District Municipality and in the Nkonkobe Local Municipality in the Eastern Cape Province of South Africa (32°32' 45.12''S) (Figure 1.1). The small towns that are within the local municipality include Alice, Hogsback, Balfour and Fort Beaufort. The average household size of Nkonkobe Local Municipality is 3.7, 50% of the households are female-headed (STATSA 2011) and most households rely on state-provided income, such as social grants, and remittances (*refer to Section 3.3.3, Chapter 3*).

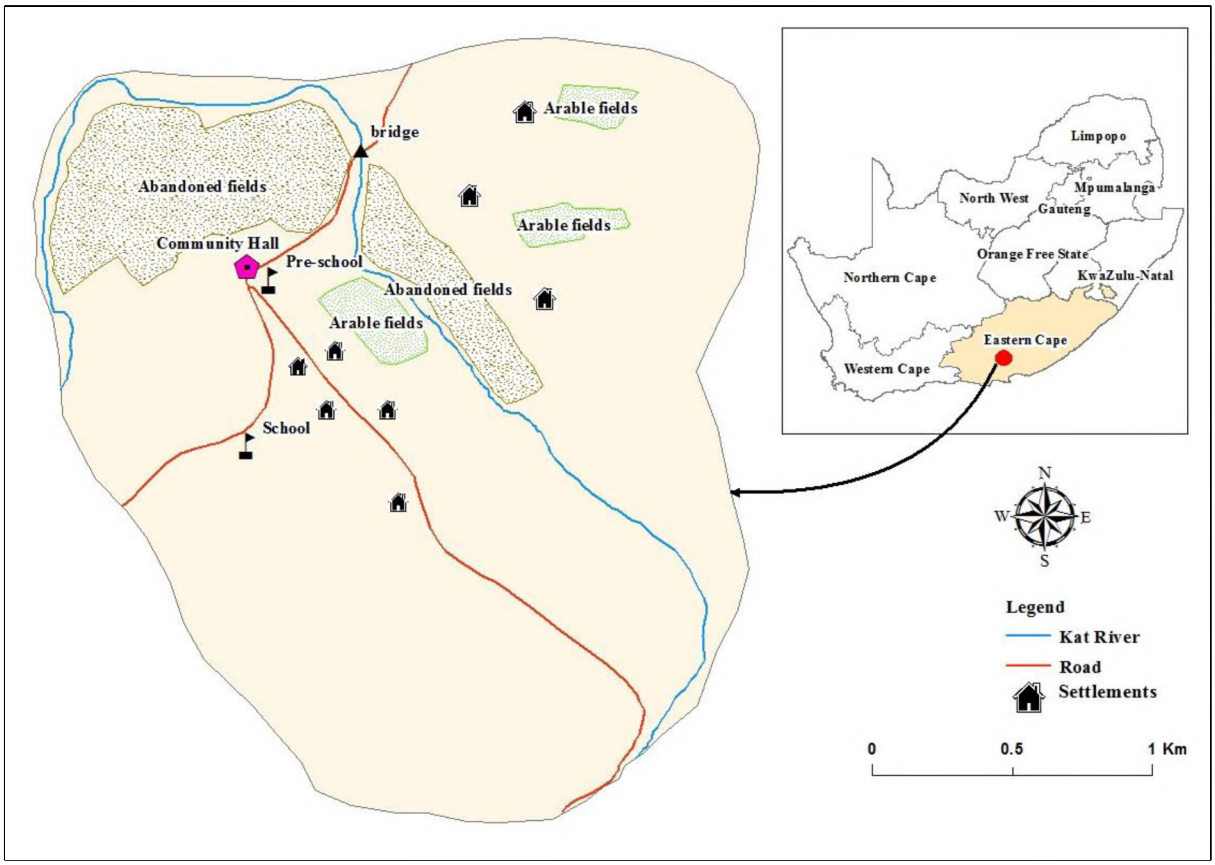

Figure 1.1 Location of Fairbairn village, South Africa

1.2.2 Biophysical characteristics: Climate, soils and vegetation

Fairbairn village is in a semi-arid area with a mean annual precipitation of 520 mm and a mean annual temperature of 16^{0}C (Mucina and Rutherford 2006). The mean monthly maximum and minimum temperatures for the area are 38.6^{o}C and -1.0^{o}C for January and July respectively (Climate Information Portal 2016). Frost is common in the area with 14-16 days per annum having temperatures below 0^{0}C. Rainfall is largely unreliable with an average coefficient variation of 25-36%. Climatic conditions are strongly influenced by topography. The dominant geological feature in the area is the 'east-west trending Cape Belt'. Sedimentary rocks such as the Dwyka and Ecca groups are found in the area. The soils from this area are derived from the Mudstone and Arenite of the Adelaide Subgroup (Mucina and Rutherford 2006). Overall, the soil structure is deep and well structured. The natural vegetation is the Albany Thicket Biome (characterised by semi-xeric conditions) but the location of Fairbairn is classified as an AT 13 Eastern Cape Escarpment Thicket (Mucina and Rutherford 2006). The vegetation type at Fairbairn village is characterised by bushveld dominated by *Vachellia karoo* (Shackleton et al. 2002) corresponding with a succulent

thicket in the south with a range of different species such as *Euphorbia spp., Diospyros dichrophylla and Oleo europea* (Shackleton et al. 2002, Mucina and Rutherford 2006). The mountain slopes, part of the Katberg, to the west of the village are covered in grasslands.

1.2.3 Social-economic characteristics: Population, employment and livelihoods

The national Census in 2011 estimated that the population of Fairbairn village was approximately 362 (StatsSA 2011). The population density is high with 146 people per square kilometre. Fifty-five percent of households are male-headed. Education levels are generally low with 9.7% of people having completed matric and no one was recorded as having a tertiary qualification (StatsSA 2011). There is a heavy reliance on state grants particularly the old age pension and child grants (Shackleton et al. 2002, 2007; *refer to Table 2.2, Chapter 2*) in Fairbairn village. Table 1.1 briefly outline the existing social assistance programmes.

Table 1.1: Forms of social protection/ support that benefited households in the village

Type of social assistance	Source	Beneficiary
Social Old Age Pension grants	Government	Payable to people of retirement age or older. The maximum monthly value in 2015 was ZAR 1350.
Disability grants	Government	Payable to individuals with a medical ailment. The maximum monthly value in 2015 was ZAR 1350.
Child grants	Government	Payable to households with children under the age of 14 years. The maximum monthly value in 2015 was ZAR 315.
Care dependency grants	Government	Payable for children under the age of 18 years, in permanent homecare and suffering from a severe mental or physical disability. The maximum monthly value in 2015 was ZAR 1350.
Foster grants	Government	Provided when a court with relevant jurisdiction is satisfied that a child needs foster care. The monthly value is ZAR 850.

Source: Pauw and Mncube (2007), the rand amounts were updated to current ones.

It is difficult to talk about rural livelihoods in South Africa without mentioning state-sponsored social security systems. Cash from social grants is often used in the Eastern Cape to support informal income-generating activities such as trade of natural resource products; especially fuelwood and prickly pear (*refer to Sections 2.3.3.1 and 2.3.3.3, Chapter 2*). Much of the population is unemployed (*refer to Section 2.3.1, Chapter 2*). Livestock ownership is one of the most important assets and livelihood activities in Fairbairn village, and the area is known for high numbers of sheep and goats (Shackleton et al. 2002; *refer to Table 2.2, Chapter 2*).

1.2.4 Infrastructure

Infrastructure and services in Fairbairn are generally poor although the whole village has recently been electrified. Despite electrification, the majority of the people still rely on fuelwood as the main source of energy (*refer to Section 2.3.3.1, Chapter 2*). Only 1.7% of households have access to piped water and no households have flush toilets connected to a sewerage system (StatsSA 2011). More than 6.7% of the households have rain-tank water and refuse is self-collected. There is a gravel road of approximately 15 km within the study area. Cellular phone coverage is available throughout the village. Ninety percent of the population has no access to internet. In terms of markets, Fairbairn is located close to the small towns of Fort Beaufort and Alice (approximately 20 km away). This geographical location provides access to some markets and is of significant value in supporting agricultural activities, namely livestock, poultry and vegetable production. Less than 40% of the households rely on any form of supplementary farming or gardening (Brooks 2016: *unpublished thesis*).

1.3 CONCEPTUAL FRAMEWORKS, CONCEPTS AND APPROACHES

In order to answer the overarching questions of this study (*refer to Section 1.1.3, Chapter 1*), a number of different conceptual frameworks were integrated to frame this research. The conceptual frameworks enabled the identification of key processes and outcomes involved in human-environmental change. To investigate issues of livelihood and landscape change over time as well as developing possible future scenarios, key conceptual insights have been drawn from *inter alia*, complexity theory (Cilliers 1999, Cilliers 2000, Manson 2001); social-ecological system thinking (Berkes and Folke 1998, Holling 2001, Berkes et al. 2003), the Sustainable Livelihoods Framework (Ellis 1998, Scoones 1998) and the Intergovernmental Platform on Biodiversity and Ecosystem Services Framework (Diaz et al. 2015).

1.3.1 Complexity theory and social-ecological systems

Complexity theory originates from the study of systems (Grobman 2005). This theory recognises that a number of elements interact dynamically by exchanging energy or information resulting in both exogenous and endogenous, nonlinear changes (Cilliers 2000). Every change within a complex system produces a stimulus for further change (Manson 2001, Capra 2002) and systems are adaptive in that they can (re-) organise their internal structure without the intervention of external changes (Cilliers 2000). Therefore, they are often referred to as complex adaptive systems. The behaviour of these systems is difficult to accurately predict through a narrow focus on individual variables (Cilliers 2000, Grobman 2005).

Complex adaptive systems are described as having a "memory" (Cilliers 2000:24), meaning that current and future changes are deeply influenced by changes that have occurred in the past. Understanding this highlights the importance of history in studies aimed at looking into the future, as is the case in this study. Of importance from a complex systems perspective is the need to trace patterns of change over time. As Chapter 3 will show, many of the contemporary tenure challenges faced by Fairbairn village residents, for example, can be traced back many generations, and can only be understood in the context of political changes over long periods of time.

Uncertainty is a key feature of complex adaptive systems. Complexity theory embraces multiple interacting drivers of change or factors, and recognises uncertainty in the future. In recent years, complexity theory has increasingly been used to understand interactions between social and ecological systems, an application relevant to this study.

A social-ecological system can be defined as a set of social and ecological components that interact in a constantly evolving and interdependent manner (Berkes and Folke 1998), in other words, a complex system. The concept of social–ecological systems is useful for understanding the interlinked dynamics of environmental and societal change (Fischer et al. 2015). A social-ecological perspective is important in this study because Fairbairn village is in a rural area (Nel and Hill 2000) where most households depend to some extent on ecosystems and their services for certain components of their livelihoods (*refer to Section 1.2, Chapter 1*). Social-ecological systems are specifically complex adaptive systems, in that interaction between components may give rise to emergent properties that cannot be explained or predicted by the properties of individual components on their own (Holling

2001, Manson 2001, Chapin et al. 2009). The interaction of different components takes place across multiple scales i.e. spatial and temporal; the feedbacks may either amplify or supress change. This concept is important for my study because it seeks to trace changes that have influenced linked environmental and livelihood systems in Fairbairn village. For example, Zheng et al. (2014) indicate that the complexity of social, economic and ecological changes interact at different scales thereby shaping rural livelihoods. These dynamics are intrinsic to environmental change.

One major limitation for only using complexity theory and social-ecological systems thinking in this thesis is that these two frameworks do not deal in any depth with rural livelihoods. Scoones (2009) has argued that the Sustainable Livelihoods Framework (SLF) can make up for this deficit by offering multiple ways of uncovering complexity and diversity. I will therefore combine complexity theory and social-ecological systems thinking with the SLF in order to develop a richer understanding of livelihoods in the context of complexity and change (*refer to Chapters 2, 3 and 4*).

1.3.2 The Sustainable Livelihoods Framework

Ellis (2000:10) suggest that "a livelihood comprises the assets (natural, physical, human, financial and social capital), the activities, and the access to these (mediated by institutions and social relations) that together determine the living gained by the individual or household." For the purpose of this thesis, a livelihood is defined as a system in which people construct a living (Figure 1.2; Chambers and Conway 1992, Ellis 2000, Hebinck and Lent 2007). This system includes capabilities, assets and activities that are used by communities in attempts to make a living. Rural communities use a variety of resources such as land, capital, knowledge, and harvest from natural resources to generate household income (Hebinck and Lent 2007). In livelihood studies, resources are viewed as a base of power and wealth from which communities create a living (Gumbo et al. 2016), therefore, from this perspective, livelihoods revolve around the utilisation of all resources or assets. However, it is also acknowledged that institutions play a major role in influencing the utilisation of assets and resources (Cundill 2005) and they shape human interactions (Hebinck et al. 2007). Assets are in turn influenced by the local vulnerability context (*refer to Chapter 5*) consists of shock, trends and secondary climate change will bring new shocks and trends. These effects need to be understood in terms of livelihood outcome (*refer to Chapter 4*). It is important to note that this thesis deals with a partial list of livelihood assets, namely natural, physical and to some

extent financial capital, while social and human capital are not addressed directly or explicitly.

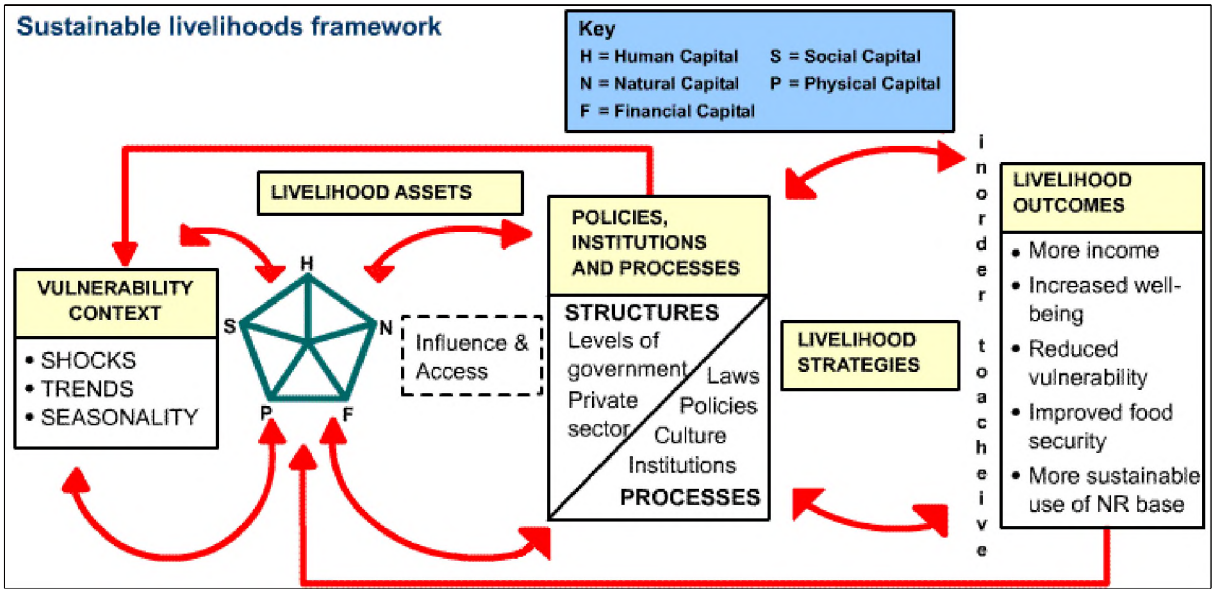

Figure 1.2 Sustainable Livelihood Framework (Farrington et al. 1999)

The SLF was remodelled by Hajdu (2006) (Figure 1.3). An important aspect of the customised SFL is that it highlights the way in which rural households depend on multiple livelihood strategies, and provides more detail on sources of income that households have access to (Hadju 2006). This is important for my study as I previously noted in Sections 1.2.2 and 1.2.3 that households in Fairbairn village combine various types of livelihood activities, and state grants in particular play a major role.

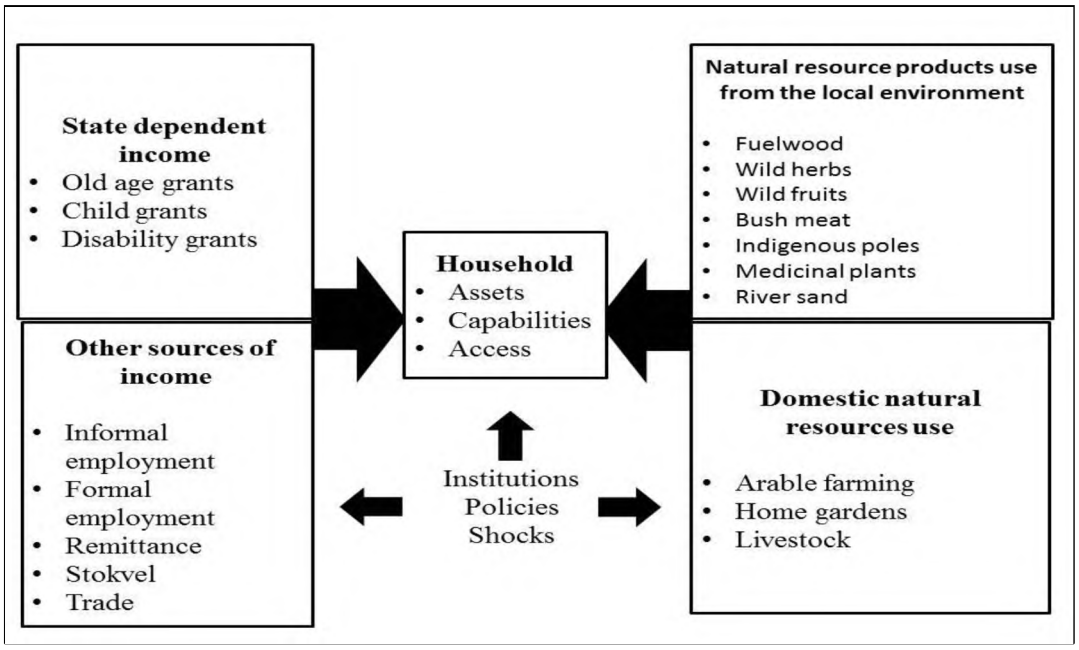

Figure 1.3 Customised SFL describing potential livelihood portfolios (Hadju 2006)

Livelihood trajectories are referred to as pathways through time (Murray 2001, Butler et al. 2014). In this study, livelihoods will be studied in their historical, current and future contexts, and focus emphasised by my recognition of complexity. The SLF accommodates this emphasis on multi-scale components of systems by acknowledging that rural livelihoods are affected by external factors. Despite being described as a people-centred approach (Hadju 2006), the SFL is criticised for not capturing the importance of power and politics (Scoones 2009) which are viewed as having a key influence on access to assets. More so, this framework tends to represent livelihoods as materialistic (King 2011). Despite these noted shortcomings, however, the SLF offers an "important lens for understanding complex rural development questions" (Scoones 2009: 191).

1.3.3 Intergovernmental Platform on Biodiversity and Ecosystem Services

The IPBES framework (Figure 1.4) illustrates the relationships between key social and ecological components of systems, and in some ways acts as a meeting point between complexity theory and the SLF. Most importantly, this framework accommodates ways of conceptualising these relationships from multiple knowledge systems i.e. indigenous knowledge systems and Western knowledge systems. Knowledge co-production is one of the key aspects in my study (*refer to Section 1.4, Chapter 1*) because multiple knowledge systems will be used to make sense of past changes and potential future trajectories. This framework builds on the basics of the Millennium Ecosystem Assessment (Diaz et al. 2015).

The IPBES has six key interlinked elements representing the natural and social systems that operate at various scales in time and space: nature; nature's benefit to people; anthropogenic assets; institutions and governance systems and other indirect drivers of change; direct drivers of change; and a good quality of life (Figure 1.4).

One important aspect of this framework for this study is the concept of drivers of change (Figure 1.2). A driver (natural or anthropogenic) is a factor that can change the structure and/or function of a social or ecological system (MA 2005, Diaz et al. 2015). Drivers of change (indirect or direct) operate on all scales from household to global levels. Direct drivers of change "unequivocally influence ecosystem processes and such drivers can be measured with differing degrees of reliability" (Diaz et al. 2015:7); whilst indirect drivers "operate more diffusely, by altering one or more direct drivers and include demographic composition, technology, culture and religion" (*ibid*: 7). Indirect drivers are considered to be complex, long-term and often anthropogenic in origin (Nelson et al. 2006). Furthermore, it is important to note that non-climatic drivers are agencies that influence the human or natural system outside the climatic system (Stocker et al. 2013).

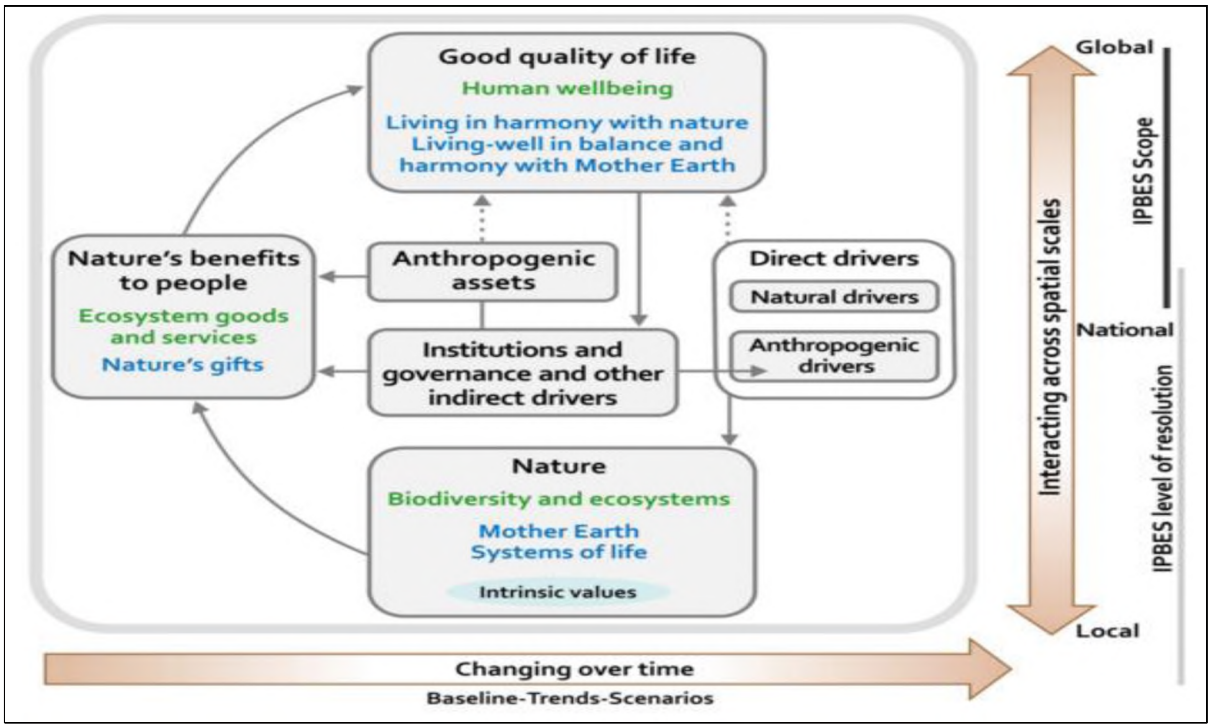

Figure 1.4 The IPBES conceptual framework (Diaz et al. 2015)

Of key interest to this study is the IPBES concept of 'nature's benefit to people'. This refers to all benefits that households or individuals obtain from nature (Figure 1.4). Landscapes provide ecosystem services that are pivotal to rural households (Chidumayo and Gumbo 2010, Shackleton et al. 2015). Rural communities in sub-Saharan Africa rely heavily on natural resources to sustain their livelihoods (Shackleton et al. 2015). Some of the direct benefits from landscapes include fuelwood, medicinal plants, leafy vegetables, fruits, grazing pastures and bush meat (Grosskinsky 2000, Shackleton et al. 2002, Shackleton et al. 2015). Indirect benefits include water regulation and climate regulation (Diaz et al. 2015). For the purpose of this thesis, I will only focus on the direct benefits from nature (*refer to Chapters 2 and 3*), following the lead of the SLF in this case. Another important aspect highlighted in the framework is the recognition it provides for expressing the importance of ecosystem services in a diverse set of valuation approaches and methods. This assisted me to trace changes in the economic contribution of different natural resource products to household income over time (*refer to Table 2.5, Chapter 2*).

Furthermore, this framework acknowledges that people have shaped landscapes over millennia in terms of the use of natural resource products. It is important to note that many of the numerous strategies in which rural communities engage for their livelihood security are based on access to land, including cultivation, animal husbandry and natural resource use (Chidumayo and Gumbo 2010, Shackleton et al. 2015). Landscapes undergo changes at different levels, with a multiplicity of drivers, processes, actors, and outcomes (Anglestam et al. 2013, Sayer et al. 2013). This framing helps my study to trace historical and contemporary drivers and changes that have influenced the linked environmental and livelihood systems in Fairbairn village (*refer to Chapter 3*).

The concepts of baseline-trends and scenarios highlighted by the IPBES framework are important in my study because they bring to the fore the importance of visioning exercises that engage multiple knowledge systems (*refer to Section 4.3.3, Chapter 4*). This framing encourages a focus on questions such as what does the future hold for rural communities?' (*refer to Chapter 4*).

1.3.4 Integrating the conceptual frameworks

The integrated model developed for this study and represented visually in Figure 1.5, illustrates the benefits of nature to people (*Box A*), the key interactions and processes between global drivers of social-ecological change (*Box B*), their impacts on livelihood opportunities

(*Box C*), household responses and livelihood outcomes over time (*Box D*), and possible future pathways and scenarios (*Box E*). This integrated model is nested in the theoretical discussions of Complexity Theory and social-ecological systems thinking (*refer to Section 1.2.1, Chapter 1*), the SLF (*refer to Section 1.2.2, Chapter 1*) and the IPBES framework (*refer to Section 1.2.3, Chapter 1*).

Box A: Figure 1.5 represents the natural resource products collected by the community of Fairbairn from their local environment (*refer to Chapter 2*). This thesis will focus mainly on provisioning services such as energy, medicines, fibre, construction and craft material (*refer to Table 2.4, Chapter 2*). It is important that nature's benefits to the community of Fairbairn are studied in the historical and current context facilitated through a repeated, cross-sectional longitudinal study or repeat survey (*refer to Section 2.1.2, Chapter 2*). For the purpose of this study this is defined as an observational study in which data is gathered for the same site repeatedly over a period of time, in this instance over a fifteen year period (*refer to Section 2.1.2, Chapter 2*).

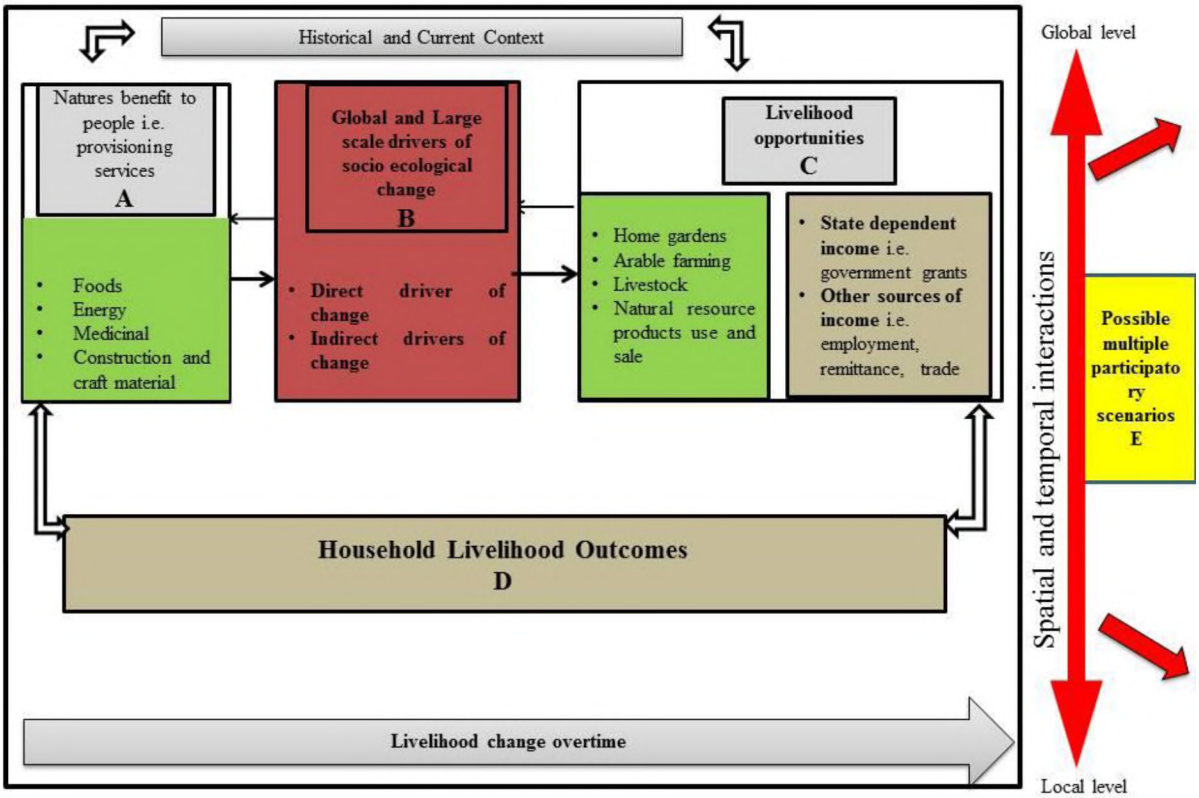

Figure 1.5 An integrated model of the complex social-ecological system of Fairbairn village. This model links drivers of social-ecological systems from the global to local level and the

variable outcomes associated with change over time. Key aspects of this study are highlighted in grey.

This integrated model realises that the harvesting of natural resource products occurs in the broader social-ecological system. Therefore, global and large-scale drivers of change (*Box B*) such as biophysical and social-economic changes alter, over time, the a) natural resource products harvested and b) the economic contribution of different natural resource products to household income. The interaction is not one way, as indicated by the two arrows, as these system processes occur at multiple and overlapping spatial and temporal layers.

The integrated model (Figure 1.5) takes into account that households in Fairbairn village are likely to employ a range of coping and adaptive responses to change, which manifest as livelihood strategies and land use practices (*Box C*); these include use of natural resource products from the local environment, and state income; such thinking is linked to the Sustainable Livelihoods Framework (Figure 1.2). Although it is difficult to visualise, the integrated model acknowledges that land use and natural resource product utilisation are related to livelihood strategies, which are also related to historical processes occurring at multiple and overlapping spatial and temporal scales. A particularly pertinent issue in Fairbairn village, in relation to the past influencing the present, (*refer to Section 3.3.1, Chapter 3*) is how Apartheid planning still affects the land tenure system (Ross 2013b). Therefore, this understanding will help in tracing the historical and contemporary drivers and changes that have influenced the linked environmental and livelihood systems in Fairbairn village since the 1830s (*refer to Chapter 4*).

The need to adapt to social and environmental change is now recognised worldwide (Wise et al. 2014). This integrated model acknowledges that by understanding the diversity of past livelihood changes, together with current trends, it is possible to generate knowledge to better envision potential futures under a changing climate (*Box E*).

In conclusion, this section introduced the frameworks used for this study, which informed my research design, method identification and data analysis. The integrated framework (Figure 1.5) introduced in this section enabled me to explore multi-scale historical processes and current related trends in livelihood and environmental change, and the implications for future trajectories under a changing climate (*refer to Section 1.1.3, Chapter 1*).

1.4 PUTTING FRAMEWORKS INTO PRACTICE: AN OVERVIEW OF METHODS

1.4.1 Overview of methods

This study is necessarily interdisciplinary in design, by virtue of the conceptual frameworks employed. Given its interdisciplinary nature, different methods (*refer to Chapters 2.2, 3.2 and 4.2*) were drawn from different disciplines to explore multi-scale historical processes and current related trends in livelihood and environmental change, and the implications for future trajectories under a changing climate. An interdisciplinary approach is essential in providing a holistic interpretation of the system investigated (Klein 2004) and appropriate tools that involve a mixed methods approach are needed (Agrawal 2010, Mustelin et al. 2013). A mixed methods approach involves the collection and analysis of both qualitative and quantitative data based on research questions (Clark and Creswell 2011). Qualitative approaches tend to include people's perceptions through the collection of data using focus group discussions, interviews and review of archival records (Newing 2010, Angelsen 2011, Babbie 2015), whilst a quantitative approach involves gathering numerical information, for example, household surveys and historical mapping (Newing 2010, Babbie 2015). The combination of both qualitative and quantitative approaches provides a more holistic analysis of variables or problems and the opportunity for triangulation (Clark and Creswell 2011). In this section, I will briefly explain the methodology and different methods used in collecting data. Details of the methods used are provided in each of the results chapters (*refer to Chapters 2, 3 and 4*).

The empirical foundation of Chapter 2 is based on a quantitative household questionnaire that was developed by Shackleton et al. (2002) for Fairbairn village. As indicated in Sections 1.1.2 and 1.2, I conducted a repeated cross-sectional longitudinal study or follow-up survey in order to trace a) changes in the use of natural resource products by households in Fairbairn village (Figure 1.1), and b) changes in the economic contribution of different natural resource products to household income (both in cash and kind), over a period of fifteen years. Scoones (2009) argues that a repeated cross-sectional longitudinal study is a useful way of understanding long-term changes. This was complemented by the results from key informant interviews and the Participatory Learning and Action (PLA) workshops described below.

The empirical foundation of Chapters 3 and 4 is the results from PLA workshops (Photo 5, Figure 1.1). In order to identify how livelihoods and landscapes have changed over longer periods of time than covered by the longitudinal survey, as well as drivers of change and

future trajectories, a series of participatory workshops were held. Participatory workshops are a common method in community-level research (Newing 2010; Kamble 2014), of specifically obtaining and understanding in-depth community perceptions on livelihood change over time (Shivakoti et. al 2009). In this study a variety of techniques was employed, which are explained in Chapter 3. PLA workshops were organised in a way that acknowledged gender- and age-related issues that might impede participants' willingness to engage fully in workshops. In *Xhosa* communities, age and gender play important roles in influencing whose voices are heard in meeting situations. Furthermore aerial photography analysis was used to understand changing landscape dynamics in Fairbairn (*refer to Section 3.2.2, Chapter 3*)

In order to explore future scenarios with the community of Fairbairn for adaptation to current and future change, including climate change, I used participatory scenario planning (*refer to Chapter 4*). Both qualitative and participatory techniques were applied in participatory scenario planning exercises. Participatory scenario planning is a tool used for exploring and planning potential future outcomes (Wollenberg et al. 2000b, Chirozva et al. 2013, Malinga et al. 2013).

There are several arguments supporting the rationale behind the use of participatory scenario planning when planning for the future (Wollenberg et al. 2000b). First, the participatory scenario planning approach creates space for community members, rural extension services and researchers to share both scientific and traditional local knowledge and this is an important aspect. This was achieved through storylines (*refer to Section 4.3.1, Chapter 4*). Second, this approach supports decision-making under uncertainty and appropriate contingency planning at community level. Third, it gives access to practical knowledge and experience, and an opportunity to learn about new problem perceptions and to identify new challenging questions. Lastly, it helps gather diverse, extensive and context-specific knowledge to take more careful and explicit account of divergent values and interests (Beach and Clark 2015). For a detailed account of the theoretical thinking behind participatory scenario planning, refer to Chapter 4.

In conclusion, this study employed a mixed methods approach consisting of quantitative household surveys and economic valuation, with more qualitative participatory techniques and archival research.

1.4.2 Ethical considerations

The Rhodes University ethical policy (Rhodes University 2014) was strictly adhered to throughout the research process of this project. Prior to contact with any respondents, the Sandisa Imbewu research team was introduced to the community to explain the key research objectives. Once the community gave permission, the researcher approached different households for participation. All respondents were offered anonymity in line with Section 2.4 of the ethical policy (Rhodes University 2014). All views and perceptions of every participant were recorded as accurately as possible. Given the participatory nature of this research, Participatory Learning and Action techniques (PLA) posed some ethical and methodological challenges, highlighting how these methods are only possible with people's willingness to participate. Participant anonymity cannot be guaranteed in a workshop setting, for example during the Participatory Scenario development workshop, the youth felt stigmatised by the community leaders and the elders, when they mentioned the level of corruption in the village. Furthermore, working with a translator posed the challenge of trust. For example, the understanding of research questions and meaningful communication with participants and respondents was pivotal. This was particularly important when dealing with issues of drivers of change, as this proved to be a difficult concept to grasp and necessitated regular feedback with the translator. In addition, Newing et al. (2010) articulates the importance of providing research feedback to the community involved in research. An *Imbizo,* or community meeting, was held on the 26th May 2016 for research feedback. In addition to a verbal summary of the research findings, all participatory scenario narratives were translated into both English and *Xhosa*, and were handed over to the community, as well as the maps produced and the thesis. I stayed in the village for approximately forty days and I also observed village life during this period.

1.5 STRUCTURE OF THE THESIS

This thesis is organised into five chapters. **Chapter 1** (this chapter) introduces and sets the context for the study. It provides a) a brief insight into the background and discourses that influenced the study from the global context to the local level; b) the study aim, objectives and research questions; c) a description of the study area; d) the conceptual frameworks that guided the research design and approach; and e) an overview of methods used. The review of literature in this chapter is kept short, with other details being presented in the introductory sections of the empirical chapters (*refer to Sections 2.1, 3.1 and 4.1, Chapters 2, 3 and 4*).

Chapters 2, 3 and 4 are presented in a paper format, meaning that each chapter has its own detailed background/introduction, methodology, methods, results, discussion and conclusion. **Chapter 2** is the repeated cross-sectional longitudinal survey to the study that was conducted by Shackleton et al. (2002) in the Kat River valley. **Chapter 3** traces historical and contemporary drivers and changes that have influenced linked environment and livelihood systems in Fairbairn village, while **Chapter 4** explores future scenarios with communities for adaptation to current and future change, including climate change. Within these three chapters, results are discussed and compared to related literature. Lastly, **Chapter 5** reflects on the implications of these findings for livelihoods and landscapes in Fairbairn, and discusses what is needed to ensure resilience into the future.

Figure 1.6 Examples of research activities conducted in Fairbairn village. Photos by Mr W. Mpevana and Menelisi Falayi. Photo 1: ground truthing exercise, Photo 2: semi-structured interview with the traditional healer, Photo 3: measuring fuelwood used and Photo 4: Participatory Learning and Action workshop.

CHAPTER 2: A REPEATED CROSS-SECTIONAL LONGITUDINAL STUDY ON NATURAL RESOURCE PRODUCT USE AND SALE IN THE KAT RIVER VALLEY

"Forests will remain our natural supermarkets for millions of years to come"- Sheona Shackleton

2.1 INTRODUCTION

2.1.1 Natural resource products and livelihoods

Traditionally, rural households in sub-Saharan Africa have been viewed as being comprised of primarily smallholder farmers (Helliker and Murisa 2011), with household livelihoods being seen as underpinned by crop or livestock production (Ellis 2000). However, this may be too simplistic; contemporary evidence shows that rural livelihoods are diverse and dependent on several livelihood sectors, with the contribution of these sectors varying across different types of households. Some authors have even argued that a process of de-agrarianisation or agricultural decline is taking place on the sub-continent, with this being clearly observed in South Africa (Bryceson 2004). Over the last 20 years, livelihood research across the region has shown that most rural households depend on a mix of activities that include a range of off-farm formal and informal employment opportunities, the harvesting and sale of natural resource products, as well as more traditional crop and livestock production (Hebinck and Lent 2007, Walelign 2016a). In South Africa, the range of income sources extends to access to state welfare in the form of different types of social grants (*refer to Table 1.1, Chapter 1*) which form a large part of household income (Shackleton and Luckert 2015). The actual mixture of activities is contingent on a variety of factors, ranging from the biophysical to socio-economic, political and demographic. This chapter focuses on the role of natural resource products as a key component of diversified livelihoods, and investigates how use of and dependence on these products may be changing with time. Natural resource products are seen as important in enhancing rural livelihoods by providing a means for diversifying the livelihood portfolio as well as reducing dependence on a more climate-sensitive, and, therefore, risky farming sector (Cavendish 2000, Shackleton et al. 2002, Shackleton and Gumbo 2010).

Natural resource products harvested from the local environment are an important source of livelihood for billions of people worldwide in both rural and urban areas (Shackleton and Gumbo 2010, Shackleton et al. 2015, Ndoye et al. 2016). Most communities around the world have incorporated numerous plants, animal, and other non-biological products into their economies, cultures, traditions and histories (Shackleton et al. 2015, Mukul et al. 2016). Many of these products and services are considered essential for human wellbeing. Some of the products collected are used as subsidies in agriculture (e.g. browse, leaf mulch), while others provide for basic needs, such as food, shelter and health (Shackleton et al. 2002,

Arnold et al. 2011, Shackleton et al. 2015, Ryan et al. 2016). Examples of biotic and abiotic products collected from forests and other natural and modified areas in the landscape include fruits, leafy vegetables, woody foliage, roots and tubers, wild cereals and grains, seeds; many of these products may be processed into food substances such as crafts, alcohol (Cavendish 2000, Shackleton et al. 2002, Shackleton and Gumbo 2010, Shackleton et al. 2015). Given the realisation of the importance of these products for rural livelihoods, they have received increased research attention over the last decade and have been extensively studied both locally in South Africa (Shackleton et al. 2002, Paumgarten 2005, Shackleton and Shackleton 2006, Shackleton 2014, Adam and Shackleton 2016, Baiyegunhi and Oppong 2016) and internationally (Cavendish 2000, Chidumayo and Gumbo 2010, Maroyi 2013, Rowland et al. 2015, Endamana et al. 2016).

Over the last two decades, numerous terms and definitions have been used for natural products collected from local landscapes (Shackleton et al. 2015). Some scholars refer to these products as non-timber forest products, non-wood forest products, natural resource products or environmental resources (de Beer and McDermott 1989, FAO 1995, Cavendish 2000, Shackleton and Shackleton 2007). de Beer and McDermott (1989) define non-timber forest products as "all biological materials other than timber, which are extracted from forests for human use" (cited in Shackleton et al. 2011:4). FAO (1995:1) defines non-wood forest products as "all biological materials other than wood that are extracted from forests for human use". These definitions exclude wood and timber in all its forms, but it is important to note that timber and wood are of significant value to local people and their economies (Shackleton and Gumbo 2010). On the other hand, Fabricius et al. (2013: XIII) broadly defines natural resource products and services as covering "agriculture, forestry, conservation, tourism, fisheries and everyday resources such as bees, brush, water and fuelwood". Contrastingly, in his paper, Cavendish (2000) defines environmental resources as any resources freely provided by nature. This definition not only includes the collection of wild resources but also abiotic products such as soils and gold. There has been a lesser agreement on the definition that encompasses both biotic and abiotic resources worldwide. Drawing from these definitions, this study refers to products collected from the local environment as natural resource products. For the purpose of this thesis, natural resource products are defined as any raw or processed products (biotic or abiotic) collected from people's local environment that are harvested for either domestic consumption or trade.

These products can be collected from a modified system (agro-ecological) as well as natural ecosystems like forests and wetlands (Bakkegaard et al. 2016).

Several studies have managed to measure the overall value and role of woodlands and forests in rural livelihoods (e.g. Paumgarten and Shackleton 2011, Thondhlana and Muchapondwa 2014, Ntuli and Muchapondwa 2016, Walelign et al. 2016b). The different roles that natural resource products play in livelihoods have been classified into five types of benefits and functions. These are: a) they may be used for direct household provisioning and consumption; b) they can help save cash expenditure by provided free substitutes for particular needs; c) they can be traded for cash income generation; d) they may provide a fall-back option or safety net in times of need; e) they can provide regulating services such as helping to enhance soil fertility; and f) they may have cultural benefits and significance (Shackleton and Gumbo 2010, Shackleton et al. 2015). This chapter focuses on the household provisioning, cash saving, cash income generation and safety net roles of natural resource products as detailed below.

2.1.1.1 Direct household provisioning

Rural households in sub-Saharan Africa have been collecting natural resource products for household provisioning over millennia (Shackleton and Shackleton 2004), mainly to meet basic needs (Shackleton et al. 2002, Kalaba et al. 2013, Bvenura and Afolayan 2015). Forests, woodlands, grasslands, fields, and wetlands provide a wide range of natural resources to rural households (Bakkegaard et al. 2016). For example rural households in the Eastern Cape Province of South Africa use between 95 and 103 species from their local environment to meet basic needs, thereby contributing to food and nutrition security (Cocks and Wiersum 2003). The most widely used natural resource products in South Africa are fuelwood, grass hand- brushes, edible fruits, wild spinaches and twig hand-brushes (Shackleton and Shackleton 2004). The amounts used per household vary between the types of natural resource materials, from a few pieces of tuber to a few kilogrammes of fuelwood per week (Shackleton et al. 2002, Shackleton and Shackleton 2004).

2.1.1.2 Cash saving

In a region where poverty appears to be intractable, the daily use of natural resource products allows households to save cash (Shackleton and Shackleton 2004, Shackleton and Pandey

2014). The daily use of free natural resource products in the provision of household needs, alleviates some of the direct fiscal costs if they, or alternatives, were to be purchased. For example, the free provision of significant quantities of fuelwood, medicines, and timber for construction means that in cash-starved households, the small amounts of cash available may be directed to other household needs such as agricultural inputs and school fees (Shackleton et al. 2015).

2.1.1.3 Cash income generation

Some of the harvested natural resource products are used within the household, but others are commercialised for household income generation (Shackleton et al. 2002), thereby allowing for cash income generation. The contribution of the natural resource products trade to livelihoods range from 5% to over 60% of total household income depending on the product and whether collection is supplementary or full-time (Shackleton et al. 2003, Thondhlana et al. 2012, Asfaw et al. 2013, Mutamba 2013). In South Africa, commercialisation of natural resource products is a growing livelihood strategy (Shackleton and Shackleton 2004). This growth is driven by a greater need for scarce cash income (Shackleton and Gumbo 2010). In South Africa alone, it is estimated that three to fourteen percent of rural households, within the savanna biome alone, trade in at least one natural resource product (*ibid*). For example, Mjoli and Shackleton (2015) reported that commercialisation of palm brushes is one valuable livelihood strategy for rural communities in coastal areas of the Eastern Cape.

2.1.1.4 Safety nets

Natural resource products can be used as a fallback option or as a coping strategy during times of household shocks and stress (Chidumayo and Gumbo 2010, Angelsen et al. 2014). Such difficult times include droughts, floods, loss of crops or death of a family member. Shackleton and Shackleton (2004) suggest, "Households often sell more than one natural resource product so as to ensure a more reliable income and reduce exposure to risk". The use of natural resource products in response to shocks and stressors can take three possible forms (Shackleton and Shackleton 2004). The first is to increase the use of natural resource products to household consumption. For example, during times of drought or crop failure, households may increase the use of leafy vegetables. Secondly, a household might start trading one or more natural resources on local or regional markets, for example trade of palm

frond hand-brushes (Mjoli and Shackleton 2015). Lastly, some households may adopt the use of different natural resource products that are absent or scarce in their daily use.

Other roles of natural resource products include the less tangible regulating and cultural services. Most natural resource products are well embedded in the cultures of communities (Shackleton et al. 2015). Certain plant species are used for ethno-veterinary and ethno-pharmaceutical purposes, and for rituals and/or ceremonies (Maroyi 2011, Maroyi 2013). Some plant species provide habitat and food or nest sites to other important species (vertebrate and invertebrate). Furthermore, natural resource products as a whole constitute a significant proportion of overall species richness. This therefore plays an important role in community ecology and resilience (Shackleton et al. 2015, Bakkegaard et al. 2016, Ryan et al. 2016).

2.1.2 Repeated cross-sectional longitudinal studies of livelihoods and natural resource product use

Despite increasing studies that show the subsistence, cultural and economic benefits of natural resource products towards rural livelihoods, there are relatively few repeated cross-sectional longitudinal study that consider changes in natural resource product use and sale over time. Such studies would lend insight into the shifting role of these products in rural livelihoods, and what this means for future livelihood trajectories in the context of rapid, global social-ecological change.

For the purpose of this chapter, a repeated cross-sectional longitudinal study will be defined as an observational study in which data is gathered for the same subjects repeatedly over a period of time. In this instance, the period is fifteen years. Repeated cross-sectional longitudinal study or follow-up studies are important in understanding how rural households and livelihoods are affected by and respond to changes in the social, political, economic biophysical and ecological environment both at local and national level. Rural communities in South and southern Africa face multiple interconnected challenges such as population growth, environmental degradation, declining agriculture, and climatic changes (Asaha and Deakin 2016, Foli and Abdoulaye 2016). Therefore, repeated cross-sectional longitudinal analysis is one way to comprehend long-term changes in how people construct their livelihoods (Scoones 2009).

Some examples of repeated cross-sectional longitudinal study of livelihoods in sub-Saharan Africa include those of Gill et al. (2012), Coad et al. (2013), and Mushongah and Scoones (2012). For example, the study of Mushongah and Scoones (2012) explored the changes in livelihood strategies in Zimbabwe over 20 years, but there was little data on natural resource product utilisation. The studies of Gill et al. (2012) and Coad et al. (2013) primarily focused on the social-ecological changes in the hunting systems of communities in Gabon and Equatorial Guinea over time, with the focus being specifically on hunting rather than other changes in the use of forest products. Some examples of longitudinal studies conducted in South Africa include those of Bryceson (2004), Hebinck and Lent (2007) and Mtati (2014). The study conducted by Hebinck and Lent (2007) focused on changing agricultural production over time. This study depicted a steady decline in cultivation from past to present. Again, the study of Bryceson (2004) focused on policy changes and its implications for agricultural production in South Africa. Most of these studies do not provide any information on the changing role of natural resource products in the livelihood portfolio.

Shackleton et al. (2015:270) suggest, "There are almost no longitudinal studies" that focus on the changing role of natural resource product use and sale worldwide. In the Eastern Cape Province, there has been one recent unpublished repeated cross-sectional longitudinal study, which was conducted by Mtati (2014) in the villages of Guquka and Koloni. In this study Mtati, (2014) managed to explain the long-term proportional changes in the use of different natural resource products by households in the two villages. This study did not explain or mention the changes in the economic contribution of different natural resource products to household income.

2.1.3 Purpose of the chapter

Therefore, building on the above understanding of natural resource products and livelihoods and the gap in the literature regarding repeated cross-sectional longitudinal studies, this study set out to examine changes in natural resource product use and value in Fairbairn village in the Eastern Cape, South Africa. The study by Shackleton et al. (2002), conducted in 2000 in Fairbairn, provided the baseline data and information necessary for a comparative study over a period of 15 years. The objectives of this chapter are to identify: a) changes in the number of households collecting natural resource products and volumes of the products used by households between 2000 and 2015, and b) changes in the economic contribution of the

different natural resource products used or sold, to household income (i.e. both in kind and cash income through sales) over the same period.

Figure 2.1 Some of the natural resource products collected in Fairbairn village. Photos by Mr W. Mpevana. Photo 1 show the horizontal woodstacks namely amagoqo, Photo 2 shows leafy vegetables harvested from disturbed sites, Photo 3 shows wood carvings made from indigenous timber and Photo 4 shows medicinal plants sold by a traditional healer.

2.2 METHODS

This study used both qualitative and quantitative methods, as discussed below, in a place-based case study approach. This approach made it possible to draw together historical factors that may have influenced any changes in natural resource product use and economic contribution over time. The bulk of the data were obtained by utilising the household survey from the original study by Shackleton et al. (2002). This was complemented by other

qualitative methods, secondary information and some of the findings from other chapters of this thesis (*refer to Section 3.3.1, Chapter 3*).

2.2.1 Household survey

The household survey from the 2000 study was re-used in order to identify changes in the use of natural resource products and in their economic contribution to household income (both in kind and cash) over a fifteen year period.

In the original study (Shackleton et al. 2002), a random sample of forty households was obtained, but these were not mapped and so could not be revisited in 2015. Instead, a new random sample was drawn from the households in the village. To select these forty households for the interviews, I used the following steps: a) I uploaded coloured aerial photos for Fairbairn village from 2012 (3226 DA) into Arc Map 10.2 b) I then created a polygon around the outskirts of the village, and c) I then created a grid of 50 m x 50 m using a 'fishnet' tool (Shackleton et al. 2013a). Only randomly selected grid squares falling within the boundary were selected. The grids were exported to Microsoft Excel 2008 where a random sample of 40 households was selected. These were then imported back to Arc Map using the join and relate functions and the aerial photograph was printed. Households located near the top right hand corner of the grid were selected for interviews. Interviews were conducted with the aid of a *Xhosa* translator. The household head was interviewed and in some instances when household heads were not available, appointments were made and the household revisited at a later stage.

The questionnaire was divided into two main sections; background information on the household, and a series of questions related to the different natural resources used by households. The background information included the social-economic characteristics of households. In this section, respondents were asked to provide information on the major household income sources, household size, and the number of livestock each household owned. The natural resource product use and sale section was designed to collect information on all types of the resources harvested by individual households. Questions included amounts of products harvested, harvesting frequency, harvesting location, use of product and whether this was for household use or for selling, frequency of buying and selling, markets and associated mean price per unit of product. Data concerning the time spent collecting is not reported in this chapter because it was similar to the study in 2000.

Only fuelwood was physically measured at the homestead to estimate quantities harvested per household per day. I calculated the anticipated winter (May to August i.e. 121 days) demand as 35% more than the summer demand, based on the findings of Griffin et al. (1992, cited in Shackleton et al. 2002). The economic valuation of wild herds was compromised by the absence of trade of the product in both 2000 and 2015. No households bought nor sold the product. As in the original study, I used cabbage as a suitable replacement to calculate the economic value of wild herbs (Shackleton et al. 2002). Species harvested were identified by using the preliminary list of *Xhosa* plant names from Eastern Cape, South Africa (Dold and Cocks 1999).

Gross annual direct-use values were calculated as the product of the amount of each resource used per year and the mean local price (Shackleton et al. 2002, Shackleton and Gumbo 2010). Gross annual values are reported in South African Rand (ZAR). The 2000 values were adjusted for inflation using the Consumer Price Index (CPI) figures provided by STATS SA (2016). Inflation-adjusted values for 2000 made it easier to compare the values with those of 2015. I used the formula suggested by Mohr (2005) to adjust the 2000 values (Box 2.1). The inflation rate between the period 2000 and 2015 was 131.25% and the real growth rate was 6.1% per annum (*refer to Appendix 1*).

Box 2.1 Inflation adjusted formula

$$Inflation\ adjusted\ values = \frac{\text{CPI (2015)} - \text{CPI (2000)}}{CPI(2000)} x\ 100$$

I prepared a database in Microsoft Excel 2008 to capture and organise information from the forty household surveys. The data were then exported to Statistica software for analysis. I used raw data from both the 2000 study and my study in 2015 to identify changes.

Continuous data were analysed using descriptive statistics and are presented as means with a standard error. I used the Kolmogorov-Smirnov method to test for normality and found that the bulk of the data were not normal. Since the data were not normally distributed, a non-

parametric Mann-Whitney u-test was used to determine the differences between the years in terms of a) mean amounts of different products harvested per year or season (i.e. between the 2000 study and 2015 study), b) unit price changes over time and c) gross annual values to user households over time. In the results section Mann-Whitney u-tests are reported as ***u***. For frequency data, i.e. counts of responses, I used Chi-square tests to compare results between the two time periods. Chi-square contingency tables were used to compare percentage changes in a) the proportion of households using different products, b) the proportion of households only collecting natural resource products, c) the proportion of households only buying, and d) the proportion of households doing both. In the results section Chi-square is reported as χ^2. Five percent was the level of significance set for all statistical tests and I used unlike superscripts to show significant differences in the different results tables.

The unit of measurement was litres rather than kilogrammes for prickly pear (*Section 2.3.3.3, Chapter 2*) because households tended to collect or sell the fruit in a variety of containers (buckets and basins) of different volumes. In terms of medicinal plants (*Section 2.3.3.4, Chapter 2*), it was difficult to quantify them because; a) so many different plant species are used, b) households were often reserved in discussing with a stranger certain illnesses from which they may suffer and c) recall on amounts of plants used and frequencies of illness or use of treatments across all the members in a household is weak. Hence, it is usually easier to interview traditional healers and work backwards towards a value for households. In the 2015 study, I interviewed two traditional healers at Fairbairn. With regards to river sand (*Section 2.3.3.7, Chapter 2*), the unit of measure was the number of donkey-cart loads rather than tonnes because households tended to collect or sell river sand using donkey-carts. For products such as poles for housing, *Oxalis* nut, reeds for construction and weaving, seeds, edible mushrooms, bird eggs and wood for carving, no stats were conducted because of similar proportions across years or data being unavailable (*Tables 2.3, 2.4 and 2.5, Chapter 2*).

2.2.2 Semi-structured interviews

Key informant interviews provided key qualitative information to interpret changes in the use of natural resource products and their contribution to household income (in both kind and cash) over the past fifteen years. Key informants included traditional healers, community leaders and vendors (Table 2.1). For the purpose of this chapter, I conducted seven interviews.

Table 2.1 Key informants and key questions

Information	Key informants
Changes in natural resource use over the past fifteen years	Vendors (Fuelwood; Prickly pear) Village Leaders Agricultural extension officers Traditional Healers
History of the area since 2000-2015	Former Agricultural Project leader
Economic changes in the village	Vendors (Fuelwood; Prickly pear) Local Spaza Shop owner (male and female)

A snowball sampling technique was used to identify key informants such as chiefs/headmen and rural extension officers (Table 2.2) that live and work directly with the community at Fairbairn village. Snowball sampling involves the referrals from people who know one another and who would recommend other people who might meet the research criteria (Newing 2010). Coding was done manually and themes were redefined in accordance with the research objectives of this chapter (Yin 2011). New subcategories were created and coded.

2.2.3 Archival and other secondary sources

Archival research and secondary sources of data were used to triangulate information emerging from interviews with key informants. These records were obtained from the Cory Library in Grahamstown and Statistics South Africa online (*refer to Table 3.1, Chapter 3*). These records included the history of the Kat River valley and the economic changes that have happened in the Eastern Cape over time.

2.3 RESULTS

2.3.1 Changes in general household characteristics from 2000 to 2015

Table 2.2 presents a summary of household characteristics in 2000 and 2015. There were no significant differences in any of the variables between 2000 and 2015, although some trends

can be observed. There was a decline in the number of permanent residents in households between 2000 and 2015 from between 7-8 members to about five, though this was not significantly different (Table 2.2). The proportion of households having formally employed people had declined by almost 12% between 2000 and 2015, though again this was not statistically significant. There has been a decline in livestock ownership and a move from large stock to small stock, with the mean number of cattle per household declining, while there was an increase in the mean number of goats reared. These changes, however, were again not statistically significant.

Table 2.2 Household characteristics for 2000 and 2015(unlike superscripts indicate a significance difference at $p<0.05$)

Characteristics	Year of study mean±		
	2000	2015	Significance (X^2 and u tests)
No. of permanent residents per household	7.68 ± 3.97^a	4.85 ± 3.18^a	u=1.55; p>0.12
Full-time formal jobs per household	1.4 ± 0.17^a	0.33 ± 0.47^a	u=1.25; p>0.21
Proportion of households with at least one full-time job (%)	52.5^a	43.3^a	x^2=1.32; p>0.25
Old-age pension per household	1.2 ± 0.90^a	1.8 ± 0.48^a	u=0.14; p> 0.89
Proportion of household with at least one old-age pension (%)	82.5^a	85^a	x^2=0.15; p>0.70
Proportion of household not owning livestock (%)	30^a	15^a	x^2=6.45; p>0.11
Mean no. of cattle per household	7.68 ± 3.90^a	4.85 ± 3.12^a	u=-0.52; p>0.61
Mean no. of goats per household	5.75 ± 1.19^a	8.13 ± 1.59^a	u=-0.93; p>0.35
Mean no. of sheep per household	1.0 ± 0.55^a	2.15 ± 1.27^a	u=-0.51; p>0.61
Mean no. of chickens per household	6.53 ± 0.57^a	8.10 ± 0.96^a	u=1.13; p>0.25

2.3.2 Changes in proportion of households using specific products between 2000 and 2015

A wide range of natural resource products was used by households in both 2000 and 2015 (Table 2.3), although some products had been dropped by 2015. Eighteen different products were used by households in 2000 compared to twelve in 2015.

Table 2.3 Proportion of households using specific natural resource products over time (unlike superscripts and grey cells show significant differences at $p<0.05$ between proportions of households using natural resources)

Resource	Proportion of households (%)		Significance (X^2 tests)
	2000 study	2015 study	
Fuelwood	100[a]	100[a]	Not tested
Wild herbs	95[a]	95[a]	Not tested
Wild fruits	95[a]	95[a]	Not tested
Poles for fencing and kraals	82[a]	75[a]	Not tested
Medicinal plants	44[a]	85[b]	x^2=36.71; P<0.05
Bush meat	39[a]	37[a]	Not tested
Poles for housing	28	0	Not tested
Umuncwane	28[a]	30[a]	x^2=0.10; P>0.05
***Oxalis* nut**	28	0	Not tested
Sand	20[a]	75[b]	x^2=60.65; P<0.05
Reeds for weaving	20	0	Not tested
Fish	5.1[a]	10[a]	x^2=1.80; P>0.05
Traditional beer	15[a]	7[a]	x^2=3.27; P>0.05
Seeds	12	0	Not tested
Edible mushrooms	7	0	Not tested
Bird eggs	2.5	0	Not tested
Thatch grass	2.5[a]	2.5[a]	Not tested
Wood for carvings	2.5	0	Not tested
Reeds for construction	0	35	Not tested

Reeds for construction was the only new product being collected in 2015. When asked why reeds for construction had become popular, households collecting the product suggested that they used them to construct fowl runs for the increasing poultry holdings in the village (Table 2.2). No households in 2015 reported using poles for construction, *Oxalis* nut, reeds for weaving, seeds, edible mushrooms and bird eggs. One elderly female interviewed suggested that she no longer collected mushrooms because the collection sites were far from her homestead. The youth interviewed suggested that they had no knowledge of types of mushrooms to collect in the wild. No households were recorded as consuming edible insects in both 2000 and 2015. Resources such as *Umuncwane* (the local name for a type of tuber used for brewing honey beer), *Oxalis* nut and bird eggs tend to be collected mainly by children whilst herding cattle and were difficult to quantify. None of these was mentioned by households in 2015. There were no significant changes in the proportion of households utilising the top three resources in both 2000 and 2015. These resources, in terms of the proportion of households using them, were fuelwood, wild herbs and wild fruits. There were significant differences in the proportion of households utilising medicinal plants, poles for housing and river sand (Table 2.3).

2.3.3 Changes in the amounts, values and sources of selected important products used between 2000 and 2015

2.3.3.1 Fuelwood

Fuelwood was the most widely used resource in both 2000 and 2015 (Table 2.3). The proportion of households only purchasing fuelwood (Table 2.4), significantly increased from 6% in 2000 to 80% in 2015 (χ^2= 81.25; df=1; $p<0.05$). The proportion of households only collecting fuelwood significantly declined from 66% in 2000, to 5% in 2015 (χ^2= 111.71; df=1; $p<0.05$). One vendor suggested that the proportion of households purchasing fuelwood had increased over the past fifteen years because of the increase in 'door-to-door marketers'. Further probing revealed that households could pay for fuelwood using instalments thus promoting purchasing. The total amount of fuelwood used by households in 2015 was slightly higher than in 2000, though not significantly different (Table 2.5). This higher amount was skewed by some households, which were brewing traditional beer and were using up to 50 kg of fuelwood per 80 litres of traditional beer. Fuelwood vendors interviewed suggested that this increase in fuelwood consumption per household might be directly linked to the increase of the pioneer tree *Vachellia karoo* in the village.

Table 2.4 Changes in proportion of households, buying or collecting (or both) natural resource products (unlike superscripts and grey cells show significant differences at $p<0.05$ (tested using a X^2 test) between percentages of households buying, collecting or both)

	2000 STUDY			2015 STUDY		
Natural resources	Proportion of households only collecting (%)	Proportion of households only buying (%)	Proportion of households buying and collecting (%)	Proportion of households only collecting (%)	Proportion of households only buying (%)	Proportion of households buying and collecting (%)
Fuelwood	66[a]	6[a]	28[a]	5[b]	80[b]	15[b]
Wild herbs	100[a]	0	0	100[a]	0	0
Prickly pear	72[a]	18[a]	2[a]	14[b]	68[b]	18[b]
Traditional beer	85[a]	15[a]	0	97.5[b]	2.5[b]	0
Medicinal plants	100[a]	0	0	100[a]	0	0
Bush meat	87.5[a]	12.5[a]	0	97.5[a]	2.5[a]	0
Sand	100[a]	0	0	15[b]	60	25

Based on 2015 household interviews, 100% of respondents suggested the availability of fuelwood had increased over the past fifteen years. The unit price of fuelwood significantly decreased from ZAR 0.61±0.1 per kg in 2000 to ZAR 0.40±0.02 kg in 2015 ($u=72.50$; $p<0.05$). Fuelwood vendors interviewed suggested that the unit price of fuelwood had declined over the past five years because of the availability of electricity (*refer to Section 3.3.1.4, Chapter 3*). Based on these unit prices, the gross annual value of fuelwood to user households significantly increased from ZAR 2585.58±232.19 in 2000 to ZAR 2639.53±423.30 in 2015 ($u=2.25$; $p<0.05$). There were no changes in the preferred plant species harvested. Households mainly collected *Vachellia karoo*, *Tarconanthus camphoratus* and *Coddia rudis*. Based on field observations, *Vachellia karoo* grows in abundance on abandoned fields and therefore in close proximity to households (*refer to Section 3.3.3, Chapter 3*).

2.3.3.2 Wild herbs

The proportion of households consuming wild herbs in the summer season was 95% both in 2000 and 2015 (Table 2.3), whereas in the winter season, only 5% of the households in 2015 consumed the resource, which was significantly lower than 95% in 2000 ($\chi^2= 162.00$; df=1 $p<0.05$). No households reported selling or buying wild herbs in either 2000 or 2015 (Table 2.4). The mean amount of wild herbs used per year significantly decreased by 10 kg, from 15.66±2.34 kg per household in 2000 to 4.23±0.63 kg in 2015 ($u=125.00$; $p<0.05$). One elderly woman interviewed suggested that this decline over the past fifteen years was linked to field abandonment (*refer to Section 3.3.2, Chapter 3*) and some of the active farmers were now planting lucerne. Lucerne is used as stock feed in the village and out-competes the weedy wild herbs. The mean price of wild herbs did not vary significantly between the two periods (Table 2.5). The gross annual value of wild herbs to user households significantly decreased by over ZAR 166.81 over the past fifteen years ($u=97.00$; $p<0.05$). In the same way, the gross annual values across all households decreased from ZAR 218.46±37.91 in 2000 to ZAR 51.65±6.98 in 2015 (Table 2.6). There were no changes in the different types of preferred species, which included *Taraxacum officinale, Chenopodium album, Urtica urens* and *Raphanus raphanistrum*. Most households collected wild herbs from nearby fields and forests. Eighty percent of the households interviewed indicated that the availability of wild herbs had declined over the past fifteen years.

Table 2.5 The amount and direct-use values of natural resource products used in 2000 and 2015 (there may be small discrepancies in the values based on the method of calculation; unlike superscripts and grey cells show significant differences at $p<0.05$ (tested using a X^2 test) between percentages of households using natural resources; gross annual values for the 2000 study have been adjusted for inflation)

CHARACTERISTICS		**2000 STUDY**				**2015 STUDY**		
Natural resource	UNITS	Mean amount used per year./hh	Price per unit (R) *(in 2015 terms)*	Gross annual value to user hh (R) *(in 2015 terms)*		Mean amount used per year./hh	Price per unit (R)	Gross annual value to user hh (R)
Fuelwood	kg	4235.20±1.45[a]	0.61±0.1[a]	2585.58±232.19[a]		6598.80±1.91[a]	0.40±0.02[b]	2639.52±423.30[b]
Wild herbs	kg	15.66±2.34[a]	13.95±0.05[b]	218.46±32.91[a]		4.23±0.63[b]	12.21±0.35[b]	51.65±6.98[b]
Prickly pear	litres	140.54± 13.57[a]	3.29±0.23[a]	462.38±30.81[a]		74.47±9.04[b]	15.45±1.20[b]	1150.00±134.80[b]
Traditional beer	litres	561.25±48.56[a]	6.15±1.5[a]	3451.69±289.63[a]		15.00±0.79[b]	15.00±0.16[b]	225.67±12.78[b]
Medicinal Plants	trips	5.00±0.34[a]	60.12±0.1[a]	300.60±21.96[a]		3.00±0.25[b]	49.00±2.43[b]	147.00±14.42[b]
Bush meat	kg	258.90±93.30[a]	18.50±2.23[a]	4789.67±89.00[a]		31±4.24[b]	50.00±3.31[b]	1550.00±5.51[b]
Sand	loads	0.15±0.01[a]	0	0		3.56±0.58[b]	191.00±31.30	679.96±5.93

2.3.3.3 Prickly pear

Approximately 95% of the households consumed prickly pear (*Opuntia ficus-indica*), both in 2000 and 2015 (Table 2.3). The proportion of households only purchasing prickly pear (Table 2.4), significantly increased from 18% in 2000 to 68% in 2015 (χ^2= 51.00; df=1; p<0.05). Prickly pear vendors interviewed suggested most households in Fairbairn no longer collect prickly pear from the area because of the increase in door-to-door vendors. Statistical analysis shows that the proportion of households only collecting prickly pear has significantly declined from 72% in 2000 to 14% in 2015 (χ^2= 68.63; df=1; p<0.05) (Table 2.4). On average, households in 2000 were consuming 140.1±13.57 litres[1] of prickly pear per season which was significantly more than 74.47±9.4 litres in 2015 (u= 367.5; p<0.05). Interestingly, the mean unit price of prickly pear was ZAR15.45±1.20 per litre in 2015, which was significantly higher than ZAR 3.29±0.23 per litre in 2000 (u=5; p<0.05). Based on these prices, the gross annual value to user households was ZAR 1150.00±134.80 and ZAR 462.38±30.81 respectively indicating a large change (u=22; p<0.05) (Table 2.5). The gross value across all households was ZAR 1092 and ZAR 439.26 respectively, indicating a large change (Table 2.6). The most widely used fruit species in both 2015 and 2000 were *Opuntia ficus-indica, Scutia myrtina, Dovyalis rotundifolia* and *Pappea capensis*. Households interviewed intimated that they collect this fruit in the nearby forests and woodlands. All of the households interviewed in 2015 indicated an increase in the availability of prickly pear over the past fifteen years.

2.3.3.4 Medicinal plants

In 2015, 85% of the households collected medicinal plants, which is significantly more than the 44% reported in 2000 (χ^2= 28.28; df=1 p<0.005) (Table 2.3). One traditional healer interviewed linked this difference to the season in which my 2015 study was conducted. The traditional healer suggested, "During the October to December season, most households perform traditional ceremonies to appease ancestors and ask for direction". The mean consultation fee when visiting a traditional healer was ZAR 49.00±2.43 in 2015, which is significantly lower than ZAR 60.13±0.1 in 2000 (u= 3.00; p<0.05). Based on these prices, the gross annual value per user household significantly decreased from ZAR 300.60±21.96 in

[1] The unit of measure for prickly pear is litres and Medicinal plants are number of visits to the traditional healer (*refer to Section 2.2.1, Chapter 2*)

2000 to ZAR 147.00±14.42 in 2015, (u=3.00; p<0.05). The gross value across all households amounted to ZAR 300.60 in 2000 and ZAR 124.95 in 2015 (Table 2.6). *Artemisia ara* and *Aloe ferox* juice were the most commonly used medicinal plants across all households both in 2000 and 2015. Sixty percent of the households interviewed in 2015 indicated an increase in the availability of medicinal plants in the area, over the past fifteen years. No households were reported to be purchasing medicinal plants although they did visit healers. Respondents reported that some of the medicinal plants are self-prescribed and some prescribed via a traditional healer. Some of the respondents identified *Vachellia karoo* as a medicinal plant that was vital for both humans and animals. The number of visits to a traditional healer did not vary significantly between the two periods; in 2000 households visited a traditional healer four times per year as compared to three times in 2015.

2.3.3.5 Bush meat

Bush meat was consumed by just over a third of households both in 2000 and 2015 (Table 2.3). The proportion of active hunters increased from 88% in 2000 to 98% in 2015, though this was not significantly different (χ^2= 7.68; df=1 p>0.05) (Table 2.4). The mean number of hunting trips significantly declined from 41.5±14.5 in 2000 to 3.33±0.52 in 2015 (u-2.087; p<0.05). Again the mean amounts of bush meat consumed per year significantly declined from 258.9±93.3 kg in 2000 to 31±4.24 kg in 2015 (u= 2.17; p<0.05). One active hunter interviewed linked this decline to the newly established conservancy in the Katberg district. Katberg conservancy is viewed as a 'safe haven' for animals and there are strict laws prohibiting hunting. As expected the mean unit price of bush meat significantly increased from ZAR 18.50±2.23 in 2000 to ZAR 50.00±3.31 in 2015 (u= 3.05; p<0.05). Based on these prices, the gross annual value per user household significantly decreased from ZAR 4789.87±89.00 in 2000 to ZAR 1550.00±5.51 in 2015 (u=300; p<0.05). The gross value across all households was ZAR 1915.87 and ZAR 581.25 respectively, indicating a large change. The most commonly hunted species included scrub hare, common duiker and bushbuck. Active hunters interviewed in 2015 suggested that they got their prey in forests and woodlands. Some suggested that during the rainy season they hunted for wild pigs near the fields. Based on 2015 household interviews 87% of the households suggested that bush meat was declining in the area.

2.3.3.6 Traditional beer

Fifteen percent of the households brewed *iqilika* in 2000 as compared to eight percent in 2015 (Table 2.3). The proportion of active brewers significantly increased from 85% in 2000 to 98% in 2015 (χ^2= 10.86; df=1; p<0.05). The proportion of households only purchasing decreased from 12.5% in 2000 to 2.5% in 2015, though this is not significantly different. On average, active brewers used nearly 50 kg of fuelwood per week to brew traditional beer. The mean quantity of *iqilika* brewed by households in 2000 and 2015 was 561±48.56 litres and 15.66±0.79 litres per year respectively, indicating a significant decline (u=1.00; p<0.05). The mean unit price of *iqilika* significantly increased from ZAR 6.15±1.5 in 2000 to ZAR 15.00±0.16 in 2015 (u=1.00; p<0.05). Most active brewers suggested that this increase was related to the traditional ceremonies that were being held during the data collection period. The gross annual value per user household decreased significantly from ZAR 3451.85±289.63 in 2000 to ZAR 225.67±12.78 in 2015 (u=1.00; p<0.05). Likewise, the gross value across all households was ZAR 1915.87 and ZAR 581.25 respectively, indicating a decline. *Imula* plants are collected for brewing and most households indicated that there were enough for everyone.

2.3.3.7 River sand

In 2015, 75% of the households used sand from the Kat River (Table 2.3) as compared to 20% in 2000 (χ^2= 60.65; df=1 p<0.005). No households were recorded to be purchasing sand (Table 2.4) in 2000 as compared to 60% in 2015. In 2015, households used 9.6±0.5 tonnes of sand per year which was significantly higher than 0.2±0.01 tonnes in 2000 (u=3.00; p<0.05). Sand vendors interviewed suggested that the commercialisation of sand was a lucrative business for the unemployed youth. The mean unit price for river sand increased from ZAR 0 to ZAR 191.00. This resulted in a gross annual value to user households of ZAR 687.00, and across all households ZAR 515.25 in 2015. There was no economic value attached to river sand in 2000. Households interviewed indicated that they collected sand from the Kat River valley and it was widely available for everyone though there is rampant poaching and this activity is not legal and could have long-term negative impacts on the flow of the river and the stability of its banks.

2.3.3.8 A synthesis of gross annual direct-use values

Figure 2.2 provides a summary of the changes in the proportion of the total natural resource product income of the top six products. This is expressed as a proportion of the total natural resource product income across all households for both 2000 and 2015. Fuelwood was the only resource used by all households in both 2000 and 2015. In the same way, fuelwood was the highest contributor to the total value of natural resource product income. It contributed 51 % to the total value in 2015 and 38% in 2000, given the advent of rural electrification (*refer to Section 3.3.1.4, Chapter 3*). In contrast, there was also widespread use of wild herbs (95%) in both 2000 and 2015, but the resource contributed relatively little to the total value of natural resource products, at 3% and 1%, respectively.

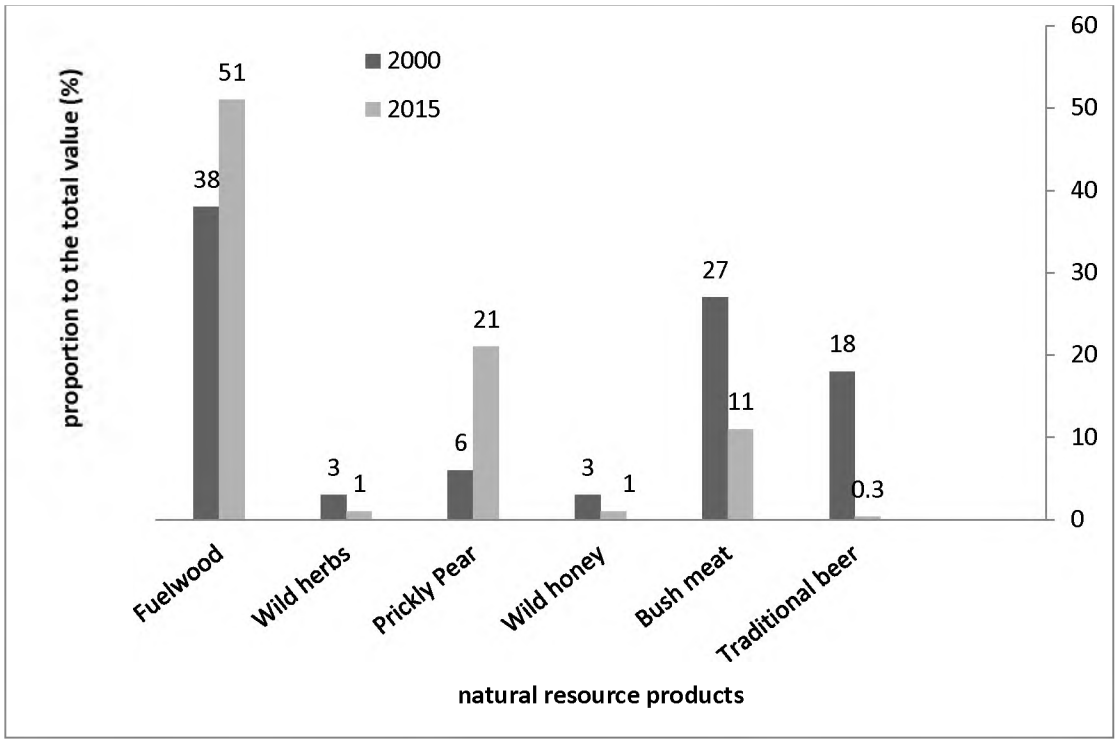

Figure 2.2 Percentage of total value of natural resource products contributed by specific resources

The contribution of prickly pear to the total natural resource product value increased by over 15% during the past 15 years. The gross annual direct-use values to user households,

excluding trade, declined from ZAR 12304.04 in 2000 to ZAR 7149.44 in 2015, though was not significantly different (u=83.50; p>0.05) (Table 2.5).

Table 2.6 Changes in the gross annual direct-use values over time

	2000 values		2015 values	
Products	**To user households (R)**	**Across all households (R)**	**To user households (R)**	**Across all households (R)**
Fuelwood	2585.58	2585.58	2639.52	2639.52
Bush meat	4789.87	1915.87	1550	581.25
Traditional beer	3451.69	1294.07	225.67	15.8
Prickly pear	462.38	439.26	1150	1092.5
Wild herbs	218.46	207.54	51.65	49.07
Wild honey	346.67	224.58	68.04	32.32
Mushrooms	9.14	0.71	0	0
Poles for fencing and kraals	119.34	65.54	0	0
Housing poles	20.31	5.74	0	0
Reeds for construction	0	0	537.6	118.16
Fish	0	0	100	12.5
Medicinal Plants	300.6	300.6	147	124.95
Sand	0	0	679.96	509.97
Total	12 304.04	7039.49	7149.44	5176.04

In 2000, fuelwood, bush meat and traditional beer contributed the most to total household income. Together they contributed 88% of annual gross value to user households and 83% across all households. However, in 2015, the top three resources that contributed most to the total value were fuelwood, bush meat and prickly pear. Together they contributed 91% of the annual gross value to user households and 83% of the value across all households. Averaged across all households (i.e. users and non-users), the gross annual value was ZAR 7039.49 in 2000 and ZAR 5176.04, indicating minimal insignificant change ($u=79.50$, $p>0.05$) (Table 2.5). Resources such as mushrooms, poles for fencing and housing poles had no economic value attached to them in the 2015 study.

2.4 DISCUSSION

In general, households in Fairbairn village continue to benefit from a wide range of natural resource products from their local environment. Households in Fairbairn have retained use of a range of different products for food, energy, medicine, construction and fencing. The most widely used products in 2015 were fuelwood, wild herbs, indigenous fruits, especially prickly pear, which is similar to the past findings from 2000. However, some identified changes were observed in the range of products that were utilised for direct household consumption and sale. For example, there were significant shifts in terms of the proportion of households utilising wild herbs and medicinal plants. With regards to access and availability of different products, only bush meat was recorded as becoming depleted since 2000 while other resources are still widely available. On the whole, the findings suggest that the financial contributions of different natural resource products to household income have decreased since 2000, although commercialisation trends have increased in the area. Some of the reasons linked to the changes mentioned above were changing diets, technology and field abandonment. Therefore results from Chapter 1 suggest that that changes mentioned above occur within the broader social-ecological system changes (*refer to Section 1.3.1, Chapter 1*).

The persistent use of natural resource products by households mirrors findings from elsewhere in South Africa and the world, where a high proportion of households continue to utilise different products to meet households needs (Kar and Jacobson 2012, Thondhlana et al. 2012, Mutamba 2013, Mtati 2014, Ncube et al. 2016). Further analysis revealed that some products however have been dropped. For example, poles for housing, *Oxalis* nut, seeds, edible mushrooms and woodcarvings were no longer being collected/ produced by households in 2015. There are a number of reasons for this, one being that households have

shifted from building traditional *rondavel* (round) houses to brick houses. Secondly, in terms of edible mushrooms and *Oxalis* nuts, households interviewed indicated changes in their diets and a loss of local ecological knowledge, especially amongst the youth, regarding what wild foods can be safely eaten. Another dimension might be that the older generation have lost energy to walk to the collection sites, which are characterised by a steep terrain. Lastly, the steady expansion of home gardening (*refer to Section 3.2.2, Chapter 3*) might be a reason behind households in 2015 ceasing the collection of mushrooms. Therefore, the study suggests that the decline in the number of products collected by households might be related to changing household preferences rather than resource depletion in the area.

Although the results show a high proportion of households utilising different products, for some of the products the mean amounts used per household have significantly declined over the past fifteen years. These include prickly pear, wild herbs, bush meat and traditional beer. Reasons behind this decrease could be due to changing life styles, loss of knowledge and changes in preferences. In terms of wild herbs, my results mirror the findings of Mtati (2014) in the Eastern Cape, where only a handful of households mentioned consuming wild herbs during the winter season. These findings for the Eastern Cape suggest that the use of wild herbs is on the decline. One might link the decline in the use of wild herbs to continued abandonment of fields in the Eastern Cape region (Hebinck and Lent 2007, Shackleton et al. 2013a), because many of the wild herbs are weed species that are collected in agricultural fields or disturbed sites. Aerial photography analysis in Chapter 3, Figure 3.4 also reflects a decline in the number of cultivated fields. Lastly, one might link the decline in the use of wild herbs to the expansion of lucerne in the area. Lucerne is viewed as a 'competitor' because it does not allow these weedy plants to establish. Preference for purchased vegetables and other foodstuffs might also be an indicator as to why the community generally consumes less wild foods (bush meat included) than the 2000 community. Therefore it is very clear that these fluctuations or changes in natural resource product use might be linked to ubiquitous drivers (*refer to Section 3.3.1, Chapter 3*) such as globalisation and modernisation, landscape change and change in technology. Understanding these drivers provides a context in which these fluctuations occur and possible future pathways (Shackleton et al. 2015).

The volume of fuelwood used over the past fifteen increased by 15%, despite the village being electrified. These results seem to reveal that the provision of electricity has had little bearing on fuelwood demand. A similar comparison by Madubansi and Shackleton (2007), and Vasicek and Gaugris (2014), confirmed a widespread use of fuelwood despite rural

electrification. There are a number of reasons that could be related to the 15% increase of fuelwood use in Fairbairn village over the past fifteen years. First, seventy percent of the households interviewed linked this increase to the notion that households could not afford prepaid electricity. A closer examination revealed that this increase might be viewed as a tangible saving mechanism to households whose primary source of income is government pensions or other grants such as chid grants (*refer to Table 3.5, Chapter 3*). Second, I conducted my study during the traditional ceremonies period and households had harvested extra fuelwood for brewing, braai-ing (barbequing) and cooking. On average, active brewers used 50 kg of fuelwood to brew twenty litres of traditional beer. This confirms that fuelwood continues to play a significant role in rural energy systems.

Households in Fairbairn procure products either through self-collection or by purchasing. This study found that the proportion of households collecting natural resource products for their household use has significantly declined over the past fifteen years indicating that households now prefer to purchase such products. In 2015, households purchased five or more products compared to three or less in 2000. There are a number of factors linked to this change. Vendors interviewed indicated that most households purchased some products because of the expansion of government social grants and a greater access to cash (*refer to Section 3.3.1.4, Chapter 3*). In terms of fuelwood and river sand, some vendors linked the increased purchasing rates to shortage of household labour. This is supported by survey results, which although not significant, revealed that household size in Fairbairn has decreased over the past fifteen years; the population structure is largely composed of an ageing population and young children (*refer to Section 1.2.3, Chapter 1*). Lastly, one might relate the increase in purchasing to the expansion of 'door-to-door' markets. When vendors were specifically asked about this issue, they mentioned that households did not have to pay cash upfront for the products upon delivery, but that payment could be made in instalments. Vendors mostly targeted households that received social grants, thereby encouraging purchase of these products over time. Consequently, one might conclude that the steady expansion of household income through government social grants has enabled households to purchase natural resource products rather than collect these for themselves.

Studies worldwide have reported an increase in the number of people engaging in the commercialisation of natural resources (Campbell et al. 2002, Shackleton et al. 2007, Cunningham 2011). Similarly, my results revealed a significant increase in the number of people commercialising natural resource products over the past fifteen years. One major

reason behind the increase is the effort to diversify livelihood income (*refer to Table 3.5, Chapter 3*). This study reveals that commercialisation of natural resource products is a key income source especially for the unemployed youth; this is further illustrated in Section 3.3.3, Chapter 3 and the scenarios chapter (*refer to Section 4.2.3.1, Chapter 4*).

The economic contribution of different products to the total household value for all products has declined over the past fifteen years, except for fuelwood, river sand and prickly pear. Gross annual values for both 2000 and 2015 were lower than the range of ZAR 7000 to ZAR 12 000 (inflation adjusted) summarised by Shackleton and Shackleton (2004) for the whole country. Further analysis revealed that wild herbs and honey in Fairbairn village have low values attached to them, unlike the study of Dovie et al. (2005) who reported a gross annual value for wild herbs across all households as ZAR 423.01 (inflation adjusted). These differences are likely linked to the differences in vegetation type, with the latter being in the savanna biome. Other examples include honey, which is not common in the thicket, grassland and forest vegetation of Fairbairn compared to savannas or dry woodlands. From an Eastern Cape perspective, the gross annual values for Fairbairn village were much higher than those reported by Mtati (2014) in Guquka and Koloni, which was about ZAR 1800. One reason behind these differences might be that Guquka and Koloni are much drier and there are fewer natural resource product markets, compared to Fairbairn village. Even though the economic values of different products have declined over the past fifteen years, income from natural resource product trade continues being used to cater for households' needs and recent studies illustrate similar findings (Mtati 2014, Baiyegunhi and Oppong 2016).

2.5 CONCLUSION

Although there have been changes, this chapter has reaffirmed the importance of natural resource products in rural livelihoods despite many other changes over the last fifteen years. Natural resource products still form an important part of people's livelihoods and are likely to continue to do so in the foreseeable future, certainly for the current generation of older people. The continued use and commercialisation of natural resource products still forms an integral part of rural income diversification and this growth in sales is driven by a greater need for scarce cash income. Although the economic contribution of natural resource products might have declined over the past fifteen years, these results suggest that natural resource product income continues to provide a safety net for rural households who have limited sources of income. Generally, it is worth imagining that natural resource products

have the potential to contribute to household food security both directly, as food and indirectly, when they are sold for income to buy the food. This study contributes to the knowledge gap identified by Shackleton et al. (2015), thereby promoting opportunities for greater objective analysis and understanding of the changes involved in natural resource products use and sale over time in rural contexts. While Chapter 2 looked at the current contemporary changes that have influenced the changing role of natural resource product use and sale, Chapter 3 will trace historical changes that have influenced the linked environment and livelihood systems in Fairbairn village.

CHAPTER 3: THE HISTORY OF ENVIRONMENTAL CHANGE IN THE KAT RIVER VALLEY: DRIVERS OF CHANGE AND PERCEPTIONS

"History is more than the path left by the past. It influences the present and can shape the future"- John Bercow

3.1 INTRODUCTION

Natural resource dependent communities in sub-Saharan Africa are facing rapid and erratic change of the environment driven by a range of human and natural factors (Mbow et al. 2008). In accordance with the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) conceptual framework (*refer to Section 1.3.3, Chapter 1*) a driver of change is defined as a natural or anthropogenic factor that directly or indirectly causes a change in a social or ecological system (Diaz et al. 2015). A direct driver refers to a factor that operates directly on nature or landscape; it is sometimes called a pressure. Indirect drivers operate by altering the level, directions or rate of change of one or more direct drivers. Drivers of change, whether direct or indirect, can exacerbate or reduce the depletion of ecosystem services (Shackleton et al. 2010) and in turn may either increase or decrease the rate of household exposure to climate change. Therefore, understanding drivers of change is important in tracing historical changes that have influenced contemporary linked environment and livelihood systems.

As explained by the Sustainable Livelihoods Framework (*refer to Section 1.3.2, Chapter 1*) a livelihoods is described as a system in which people construct a living (Chambers and Conway 1992, Ellis 2000). This system includes capabilities, assets and activities that are used by communities in attempts to make a living. Rural communities use a variety of resources such as land, capital, knowledge, and harvest from natural resources to generate household income (Hebinck and Lent 2007). Rural livelihood strategies can be categorised as agricultural intensification, diversification or migration (Ellis 2000). In livelihood studies, resources are viewed as a base of power and wealth from which communities can create a living (Peach and Constatin 1972 cited in Hebinck and Lent 2007); therefore livelihoods revolve around the utilisation of resources. In this study, livelihoods are studied in their historical (*this Chapter 3*), current (*refer to Chapter* 2) and future (*refer to Chapter 4*) contexts. This has the advantage of understanding the historical micro and macro components of change over time.

In South Africa, land is distributed based on tenure. Land tenure is the "relationship, whether legally or customarily defined, among people, as individuals or groups, with respect to land and associated natural resources, including water, trees, minerals and wildlife. Moreover it can be defined as the terms and conditions under which land is held, used and transacted, determining who can use what resources for how long, and under what conditions (Clover

and Erikens 2009:53). Changes to land tenure have been among the major social and environmental transformations facing Southern African communities over the past century (*ibid*), and must therefore necessarily be included in any research into the drivers of livelihood change in the region.

Indeed, more generally, historical overviews are of prime importance in understanding contemporary landscapes and livelihood change. Policies "have left their historical traces" as James (2010:222) points out, and some of these traces are still visible and widely felt to date (Amberntsson 2011, Hebinck 2013). A study conducted by Hoffman and Rohde (2007) concluded that the Namaqualand landscapes of South Africa, for example, have changed significantly in response to the wide range of social, political, cultural and environmental influences. For example, apartheid planning and the creation of separate so-called Bantustans or homelands (implemented in 1948) affected rural livelihoods as most of 'black' South African peoples lost their land and way of living. Some of the undesirable aspects of this apartheid planning, and the subsequent betterment planning or villagisation that took place in many of the homelands and Bantustans, included the loss of access to arable land for 'black communities', longer distances to collect natural resources products such as fuelwood and water, and a loss of assets due to physical removal of households in some cases (de Wet and Mgujulwa 2010). Scholars like Helliker and Murisa (2011) suggest that such direct state intervention created marginalised agrarian communities. As a result, Hoffman (2014:1) recommended that in order to understand long-term human environmental changes, assessments need to be "contextualised within the political history of the country, with its successive colonial and apartheid governments, which divided the land into separate areas of very different sizes reserved for different race groups". Therefore, it is important to consider a complexity of environmental, political and social changes in order to understand landscape and livelihood change in a South African context.

Numerous commentators on livelihood and landscape change in South Africa have shown that direct state interventions significantly reshaped livelihoods and landscapes for 'black' communities (Walker 2010, King 2011, Hebinck and Cousins 2013). Key to this process was the Land Act No. 18 of 1936, which identified the areas that were set aside for 'black' people. This act gradually reshaped social dynamics of 'black' communities and had devastating impacts on 'black' African farming. For the purpose of this chapter, "black rural African farmers" will be referred to as smallholder farmers. Smallholder farmers are also defined as those "farmers having small-based plots of land on which they grow subsistence crops

relying almost exclusively on family labour" (DAFF, 2012). Historical evidence suggests that by the late 1950s, smallholder farming was already declining (Hebinck and Lent 2007) because some 'blacks' were selling labour to white farmers or seeking formal urban employment. In short, Bundy 1979 (cited in Hebinck and Lent 2007) described this process as a "sequence of *peasantisation* succeeded by *de-peasantisation* and *proletarianisation* in both the Ciskei and Transkei.

Recent work in the Eastern Cape suggests that arable farming is on the decline, and some studies also reveal a shift to more intensive cultivation of home gardens (Hebinck and Lent 2007, Shackleton et al. 2013a, Shackleton and Luckert 2015). A study conducted by Shackleton and Luckert (2015) revealed that cultivated field cover declined by over 10% and abandoned field cover increased by over 5% since the early 1960s in one part of the former Transkei homeland. It is important to note that the way in which the land is used, and altered, affects its production potential and thus also the livelihood options available to its users (Hoffman 2014). Abandoning land can affect vegetation cover and composition and this can have either positive or negative implications on land-based livelihoods. Most commentators suggest that some of the drivers related to field abandonment in South Africa might be linked to the increase in disposable cash, urbanisation, expansion of retail supermarkets and state social grants, amongst others (Hebinck and Lent 2007, Neves and du Toit 2013, Shackleton et al. 2013a, Shackleton and Luckert 2015). The result is that agricultural income is now regarded as a minor contributor to rural livelihoods.

Changing rainfall and temperature patterns have the capacity to reshape the productivity of landscapes and exacerbate food, water and energy scarcities (Ross 2015). Indeed, climate variability is one of the major drivers affecting livelihoods of many rural communities worldwide (MA 2005). Climate change is expected to intensify existing problems and create new combinations of risks, particularly in Africa (Ziervogel and Zermoglio 2009). Most of the farmers in sub-Saharan Africa rely on rain-fed agriculture (Madzwamuse 2010, Kamwi et al. 2015) and seasonal agriculture is facing serious economic loss and shorter recovery periods due to rainfall variability and droughts (Brown and Crawford 2009). It is projected that by 2020 rain-fed agricultural produce could be reduced by 50 % for some sub-Saharan countries (Parry et al. 2007). Therefore, climate variability can contribute to direct and indirect drivers of destabilisation and unregulated population movement, resulting in changes in rural livelihoods and landscape productivity.

Recent studies reveal that social grants form the largest percentage share of livelihood income in most of the rural households in South Africa (Shackleton and Luckert 2015, *refer to Table 2.2, Chapter 2*). Old-age grants and a range of social grants constitute the core of the South African post-apartheid state social policy (Hebinck 2013, *refer to Section 2.3.1, Chapter 2*). The South African Social Security Agency (SASSA 2015) reported that the Eastern Cape region is the second highest recipient of state social grant protection as at June 20, 2015 in South Africa. Most households use social grants (old-age, disability, veteran, foster and child grants) and these are pivotal in providing food security, health and paying for children's education (Shackleton and Luckert 2015). Neves and du Toit (2013) observed that state cash transfer (social grants) by the post-apartheid government is the largest regular infusion of cash in rural areas. The cash transfers allow people to purchase food, clothes and other basic household goods (Hebinck 2013). The same authors suggest that this contribution has become increasingly important, as other sources of income such as remittances have declined over time. Rural livelihoods in South Africa these days are thus heavily dependent on external income and consumption and have become increasingly divorced from local production patterns (Hebinck and Lent 2007).

3.1.1 Purpose of the chapter

This chapter seeks to trace historical and contemporary drivers and changes that have influenced linked landscape and livelihood systems in Fairbairn village through a systems perspective and interdisciplinary approach. From the preceding section, it is clear that understanding trajectories of change is a significant challenge and therefore historical data are essential in analysing complex human-environmental interrelationships. Trajectory of change is defined as a "dynamic process of individual, group and/or societal responses to change which creates further change and responses with outcomes that reflect the cumulative properties of that process" (Fazey et al. 2011:1276). Livelihood analysis has been of great importance in understanding how rural communities or households make a living in diverse local settings (Amberntsson 2011). It is therefore crucial to understand livelihood and landscape trajectories from a multi-scale driver perspective. Amberntsson (2011) further suggests that long-term historical processes, contemporary global macro-economic features and modernity dominate households' livelihood situation and room for manoeuvre. Therefore, in order to understand livelihood change over time, one has to consider both empirical and theoretical framing. For example, while land use decisions take place at a

household level, and directly influence local landscape change, these decisions are often driven by strong externalities such as government policies and markets (Deakin et al. 2016).

Overarching objective of this chapter

This chapter seeks to trace historical and contemporary drivers and changes that have influenced linked landscape and livelihood systems in Fairbairn village.

Main research questions:

1. What are the main environmental and social changes, and the drivers behind these changes, that have affected Fairbairn village since 1830?
2. How has the local landscape in Fairbairn changed over time since the 1960s?
3. In what ways have people's livelihoods changed over the same time period and how are these interconnected to landscape change?
4. What do these changes mean for current livelihoods and their sustainability now and into the future?

3.2 METHODS

This study used a mixed methods approach, which combined aerial photography, Participatory Learning and Action workshops (PLA), semi-structured interviews and archival document analysis. I used a single case study approach to trace historical and contemporary drivers and changes that have influenced linked environmental and livelihood systems in Fairbairn.

3.2.1 Archival research and other secondary sources

Archival research involves the historical analysis of literature related to a specific topic (Mbow et al. 2008). Archival research was used to trace historical and contemporary drivers and changes that have influenced landscapes in Fairbairn and to triangulate information emerging from PLA workshops. For my archival research, I used documents housed at the Cory and Rhodes Libraries (Table 3.1). The earliest documents related to the history of the Kat River Valley dating from the early 1800s. These records and pamphlets gave a detailed account of the main environmental and social changes that have affected Fairbairn village since the early 1800s.

Table 3.1 Historical documents, pamphlets and theses used for document analysis

Document reference	Brief description
Ross, R. (1954). "The Kat River Rebellion and Khoi-Khoi nationalism: the fate of an ethnic identification". Unpublished, Cory library, Rhodes University.	This paper explains the pre-colonial history (1820s to 1950).
Mathews, H.T (1958). A guide and history of Fort Beaufort. Unpublished, Cory library, Rhodes University.	Historical report and notes regarding Kat River communities (1900 to 1930).
de Wet C, Lujabe, P and Metele, N (1996). "Resettlement in the Border/Ciskei region of South Africa". Unpublished, Cory library, Rhodes University.	A collection of historical pamphlets from the Kat River Valley (1970 to 1993).
Nel, E.L. and Davies, J. (1999). "Farming against the odds: an examination of the challenges facing farming and rural development in the Eastern Cape province of South Africa. Applied Geography", 19 (3). pp. 253-274. ISSN 0143-6228	A paper about historical challenges that were faced by the Kat River farmers (1800 to 1994).
Nel, E.L. and Hill, T.R. eds. (2000). "An evaluation of community-driven economic development, land tenure, and sustainable environmental development in the Kat River Valley". HSRC Press. Cory library, Rhodes University.	A book tracing the main environmental and social changes in the Kat River valley (1800 to 1994).
Motteux, N., 2002. "Evaluating people-environment relationships: developing appropriate research methodologies for sustainable management and rehabilitation of riverine areas by communities in the Kat River valley, Eastern Cape Province, South Africa". Cory library, Rhodes University.	This has a chapter on the history of the Kat River (1800 to 2001).

For the purpose of this chapter, racial terminology will be written in an apologetic manner in instances where using racially explicit language is necessary to offer clarity for the reader. This is particularly the case for the historical account of Fairbairn, since not only were past policies racially explicit, but the historical accounts themselves are written in such language and do not distinguish between subgroups within racial categories. I will use inverted commas to refer to key racial terms such as 'blacks', referring to *Xhosa* speaking people; 'whites' referring to the English and Dutch speaking people, and 'coloureds' referring to Khoi-San or Khoi-Khoi.

Coding was used for thematic analysis for archival and other secondary sources. Coding was done manually and themes were defined in accordance with the research objectives of this chapter (Yin 2011). The top five themes that emerged from archival and secondary sources of data and my study were land tenure, home gardening, climate variability, field abandonment and emerging *Vachellia karoo*. Thereafter new subcategories were created and coded.

3.2.2 Aerial photography

Aerial photograph analysis was used to identify landscape change over the past forty-five years (1967-2012, *Section 3.3.2, Chapter 3*). Paine and Kiser (2012) describe aerial photography as a method of obtaining images of the earth's land from an overhead perspective. Time series aerial photograph analysis is a common technique used in evaluating and analysing LULC change statistics in landscapes studies (Shackleton et al. 2013a, Stickler and Shackleton 2015). The steps taken to identify landscape change are explained below.

To assess landscape change, I ordered aerial photographs from the Department of Rural Development and Land Reform. Only the 1967 and 1996 aerial photographs covered the entire Fairbairn village. This was one limitation of this method in that there were no complete sets of aerial photographs that covered the entire area from 1968 to 1995. The 2012 image was downloaded from the Rhodes University, Geography Department website. Therefore, for this study, I used 1967, 1996 and 2012, as full sets of images were available for these years. The 2012 photograph was the only ortho-rectified and georeferenced image. The 1967 and 1996 photographs were cropped in Microsoft Picture Viewer 2008 and georeferenced based on six points matched to the 2012 image using Arc Map 10.2. The *World Geodetic System* (WGS) of 1984 was used to place coordinates on all the images (1967, 1996 and 2012). The picture quality varied across the years. Over 450 plots or cells (50m x 50m) were randomly

selected for each photograph. This represented 7% of the study area. I followed the methodology of Shackleton et al. (2013), and Stickler and Shackleton (2015) to identify how land cover and land use have changed in Fairbairn since the 1960s.

Randomly selected cells or plots were consulted for each photograph to establish landscape changes from 1967 to 2012 and a unique script was run for each viewing of the photograph. The photography was viewed at a constant scale of 1: 5 000m to determine land cover and use types. Land cover and use were classified based on the land cover falling on the point beneath the upper-right-hand corner of each randomly selected grid cell (Stickler and Shackleton 2015). This method was repeated at least three times for each image to generate standard error. Ground truthing was conducted in April 2016 in order to determine whether the fields were being utilised. Ten percent of the grids were randomly selected for ground truthing. At each point selected, Universal Transverse Mercator (UTM) coordinates were recorded using a Global positioning system (GPS). Photos were taken of each plotting recorded. Three member of the community participated in ground truthing exercise. The GPS coordinates of each land category were recorded in a notebook. These were transferred into an Excel spreadsheet, sample points were overlaid on the 2012 land cover and land use map. Cross-tabulation was used to ensure accuracy. Of the 45 measured points, 39 points were classified in the 2012 land cover map; the overall accuracy was 87%.

Vegetation types and land use zones reported by Soviti (2002) were consulted when necessary for substantiating the cover types as defined by the selected point in the black and white aerial photographs. From this analysis, I identified seven land cover types, which included bare ground, abandoned fields, home gardens, cultivated fields, grassland, forests and woodlands. Points labelled abandoned fields included areas that displayed no visible signs of ploughing and/or the point showed signs of non-agricultural vegetation. Points labelled cultivated fields included areas that displayed visible signs of ploughing and/or did not show evidence of non-agricultural vegetation. The bare ground category included areas that showed no visible signs of any vegetation. The home garden category included areas that showed visible signs of ploughing near households. The grassland category was distinguished by the dominance of non-woody and non-agricultural vegetation. The forests category included areas that were densely dominated by woody vegetation, whilst woodlands were distinguished by woody vegetation that was sparsely populated. Most of the woodlands were identified in old fields.

Results of this analysis were recorded separately as a percentage of the points sampled for each land cover category and averaged across each of the three analyses per year (Stickler and Shackleton 2015). The land cover and land use plots or cells were analysed using the software programme Statistica. Since the data were normally distributed, a one-way anova was used to test for significant differences between the three data sets (1967, 1996 and 2012). A one-way anova test will be reported as ***F*** and five percent was the level of significance set for all statistical tests (*refer to Section 2.2.1, Chapter 2*).

3.2.3 Semi-structured interviews with key informants

Semi-structured interviews were used to further explain key changes emerging from aerial photography analysis. Semi-structured interviews are pre-arranged interviews based on a prepared interview guide (Newing 2010). For example, Muller and Shackleton (2014) used semi-structured interviews with key informants to understand perceptions of farmers regarding global climate change in South Africa. For this chapter I conducted five interviews with different key informants. Table 3.2 shows the key informants that were interviewed and these included a rural extension officer, three or four local leaders, a local shop owner and a fuelwood vendor.

Table 3.2 Key informant interviews and key questions

Information	Key informants
Past and present land use strategies	Department of Agriculture Extension Officer Informal local leaders
Basic services provision	Local leader: prospective ward councillor
Economic changes in the village	Fuelwood vendor and local shop owner

3.2.4 Participatory Learning and Action

Participatory Learning and Action (PLA) workshops were used to understand how people's livelihoods changed over time and how these were connected to landscape change *(refer to Section 3.3.2, Chapter 3*). I conducted four gender and age specific workshops with women, men and youth separately (Figure 3.1), where each workshop was attended by 9-12 people. A selective technique was used to identify workshop participants. In order to gain a longer-term

perspective of changes in Fairbairn, participants who were invited for the female and male groups were aged 45 years and above. Young participants aged 18 years and above were invited to attend the youth workshop. The youth were asked to describe and explain the current related changes that have affected the village and how these changes have influenced landscapes and in turn their livelihoods. The final workshop was a mixed gender workshop; it brought together participants from the age specific workshops to discuss the outcomes of the separate workshops. The same PLA techniques were used in all four workshops and are explained below. It is important to note that the same workshop participants were later invited for the participatory scenario workshop (*refer to Section 4.2.3, Chapter 4*).

3.2.4.1 Buzz groups

Buzz groups are discussions conducted in small active groups (Newing 2010) and are a common technique used in brainstorming exercises (Bishop and Scoones 1994). Buzz groups were used to understand livelihood trajectories and drivers (direct and indirect) behind observed changes over time (Figure 3.1). Buzz groups consisted of four randomly selected members for each gender and age specific group.

3.2.4.2 Pie charts

Pie charts were used as a diagrammatical representation of how people's livelihoods changed over time (*refer to Section 3.3.3, Chapter 3*). The pie chart technique is described as a graphical method of displaying the breakdown of data or compacting size, amount and quantities of various items (Narayanasamy 2009). The pie chart exercise helped workshop participants to illustrate the changing importance of key land uses in local livelihoods. In order to illustrate what has happened to people's livelihoods over time, and the relative importance of different livelihood sources, an idea of "CAKE" was used. Different slices of cake explained the relative importance of different livelihood sources over time. The translator directly translated the following phrase in *Xhosa*: Imagine when a cake is bought during the Christmas holidays, how would you share the cake? I believe the father gets the largest piece, followed by the mother and children according to their ages. This analogy was well received and assisted the groups in understanding the concept of a pie chart.

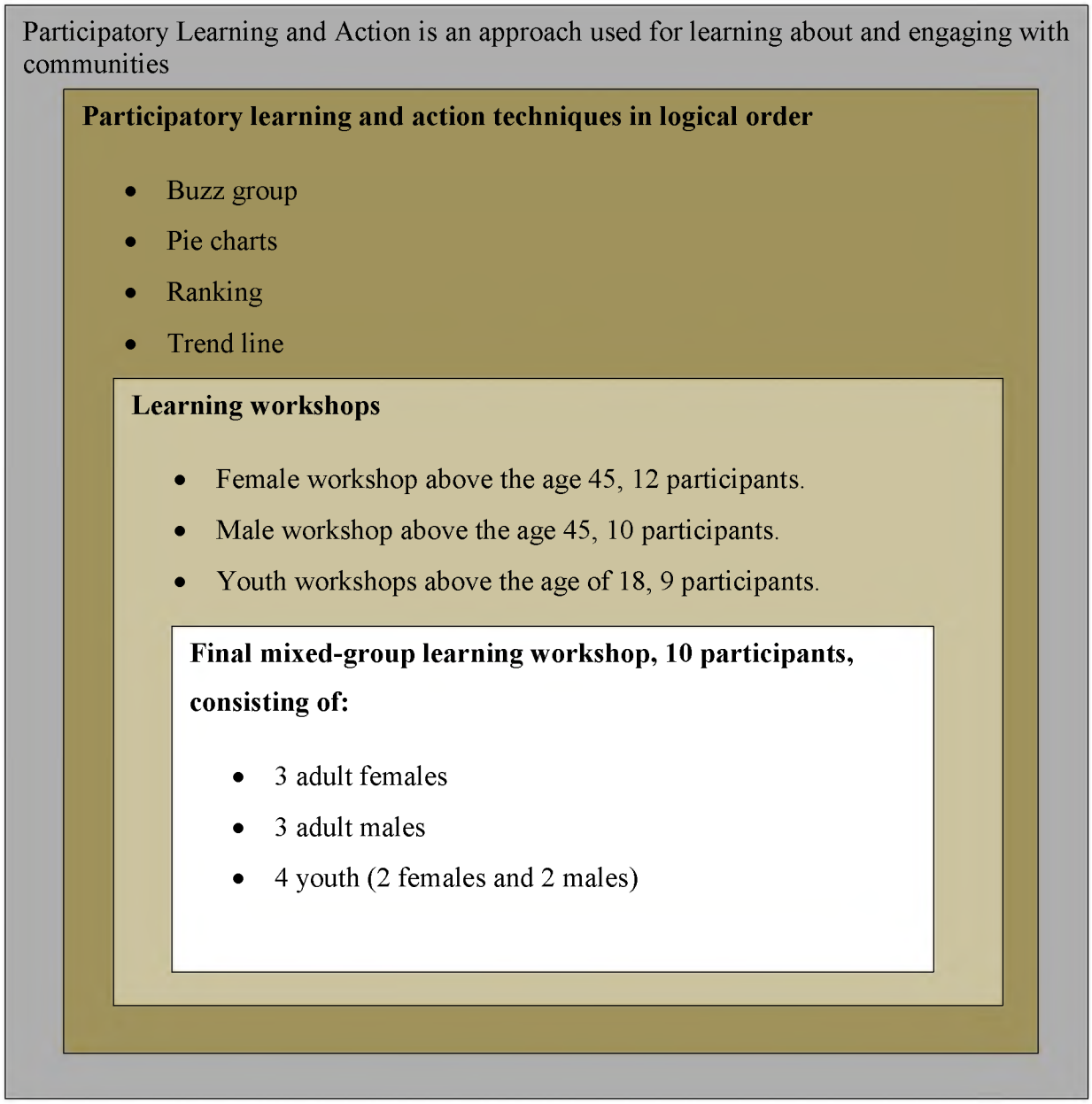

Figure 3.1 The methodological framework guiding Participatory Learning and Action for this chapter

3.2.4.3 Ranking

Ranking techniques were used to determine the most important livelihood activities currently, and in the past (*refer to Table 3.5, Chapter 3*). Ranking involves putting a list of objects in their order according to specified criteria (Newing 2010). Biggs and Watmough (2012) used this technique to rank key issues that affected livelihood diversification in Nepal. Ranking and pie chart techniques were used simultaneously in order to determine the influence of particular drivers of change on both livelihood strategies and land use. For example, workshop participants were asked to rank different sources of livelihood in order of

importance for different periods in the past. Similarly, participants ranked drivers in order of importance for different periods in the past.

3.2.4.4 Trend line

Trend lines were used to explain the changes in number of fields cultivated. Trend lines involve changes of specific themes over a period of time (Newing 2010; *refer to Table 3.4, Chapter 3*) and are used to explore temporal dimensions of change (Narayanasamy 2009). Cundill (2005) used trend lines to illustrate changes to the amount of fuelwood used in villages in the Eastern Cape. Workshop participants were asked to identify key dates when changes occurred. Stones were placed next to each date to indicate the level of cooperation and many stones indicated that many people were involved, while fewer stones indicated that less people were involved in agriculture. Participants then explained why they thought the identified changes had occurred.

3.2.4.5 Timelines

Timelines were used to account for chronological events that the community remembered (*refer to Section 3.3.1, Chapter 3*). Timelines were developed as other exercises were taking place. When a key date or issue was raised, I added it to the timeline. Historical documents and pamphlets (*refer to Section 3.3.1, Chapter 3*) were used to further construct the timelines presented in the next section and to build on the historical events recalled during PLA workshops. The timeline is divided into four periods: early nineteenth century (1800-1829), colonial, union years and early apartheid years (1830-1967), last years of the apartheid period (1970-1993) and post-apartheid period (1994-2015).

Pie charts, ranked lists, trend lines and the timelines are presented here as they were developed by PLA participants. Notes taken during the workshops were analysed using thematic analysis (*refer to data analysis from Section 3.3.2.1, Chapter 3*), specifically focussing on the five themes identified for the archival analysis: land tenure, home gardening, climate variability, field abandonment and *Vachellia karoo*.

3.3 RESULTS

The results section begins by tracing historical and contemporary drivers and changes that have influenced linked environmental and livelihood systems in Fairbairn village since the

1830s. Thereafter, I will look at how landscapes have changed since the 1960s. The final section will demonstrate how people's livelihoods have changed over time and how these are interconnected to landscape change.

3.3.1 Historical Analysis of Fairbairn village since 1830

Table 3.3 shows a chronological timeline of events (environmental, social, political and social) that have affected Fairbairn village since 1830. The timeline is divided into four periods; early nineteenth century (1820-1829), colonial, union years and early apartheid years (1829-1967), last years of the apartheid period (1970-1993) and post-apartheid period (1994-2015). Each period is explained below.

3.3.1.1 Period 1: Early nineteenth century history (1820-1829)

The Kat River valley (Figure 1.1) is one of the most highly contested areas in South Africa (Ross 1954, Mathews 1958, Nel and Hill 2000). Some of the reasons for this are; a) the Kat River is one of the most reliable rivers in South Africa, b) the valley soils are exceptionally fertile, c) abundant natural forests occur in the area, and d) the area has consistent rainfall patterns (Nel and Hill 2000; *refer to Section 1.2, Chapter 1*). These features have resulted in a landscape where human settlements line the riverbanks and tributaries (Ross 2013a). Communities such as Fairbairn, Hertzog and Blink Water are dotted along the Kat River valley. Historians describe the Kat River area as the primary contact zone between the *Xhosa*, 'whites' and the 'coloured' people during South Africa's early colonial period. Some scholars suggested that the area was largely controlled by the *Xhosa* people prior to 1829 (Nel and Hill 2008). It is important to note that some minority groups lived in the area i.e. the 'coloureds'. It is unclear how the 'coloureds' ended up settling in the Kat River valley since the area was predominately controlled by *Xhosa* speaking people. The 'coloureds' were predominately made up of the Khoi-san people as well as freed slaves (Motteux 2002).

The presence of the large *Xhosa* population in the valley was seen as a threat by 'white' farmers who had occupied the land in the valleys to the west, notably Fort Beaufort (Ross 2013a). In 1822, the 'whites' tried to expel Chief Maqoma of the *Xhosa* tribe from the Kat River valley; however the chief managed to plead with the 'whites' that the area was his home, and he was given permission to settle once again. Sir Andries Stockenstroom, the commissioner general, was not happy with this concession because he wanted to expel the *Xhosa* people from the Kat River valley. In 1825, Sir Lowry Cole decided to permanently

hand over the Kat River valley area to the 'coloureds' as a reward for their loyalty to the British Crown during the recent war (the coloureds fought for Queen Victoria during the frontier wars). Sir Stockenstroom saw this as a perfect opportunity to expel the *Xhosa* people from the Kat River valley (Ross 2013b). He argued that Chief Maqoma had been involved in succession disputes and he was destabilising the peace within the Kat River valley. Through this argument, Sir Andries Stockenstroom pushed the Cape Colony government to pass Ordinance 50 of 1828. The Ordinance stated that the Kat River valley area should be handed over to the 'coloureds' and the *Xhosa* speaking people should be expelled from the area. The following section investigates key changes enacted by the Cape Colony government from this period onward.

3.3.1.2 Period 2: Colonial, union years and early apartheid years (1829-1969)

In support of Ordinance 50, in 1829 Chief Maqoma of the *Xhosa* tribe was expelled from the Kat River by the colonial government. Chief Maqoma was expelled to Tyhume valley outside the Kat River (Ross 2013b). This marked the establishment of a 'coloured' area in Fairbairn by the colonial government (Nel and Hill 2000, Ross 2013b). The primary reason for allocating the Kat River valley to the 'coloured' settlers was their envisaged role as a military barrier for 'white' settlers against the *Xhosa* people. This new planning led to all *Xhosa* people losing their grazing pastures. The 'coloureds' used the land for tobacco and citrus farming. From 1830 up until 1851 the 'coloureds' had ownership of the land. The *Xhosas* continued to attack the 'coloureds' throughout this period because they were viewed as land invaders. The violence between the 'coloureds' and the 'blacks' crippled the farming activities in the Kat River valley (Stockenstroom 1854). The Cape Colony government then decided to train and equip 'coloured' soldiers to crush the *Xhosa* uprisings. Although the 'coloureds' were militarily equipped, they failed to crush the Xhosa uprisings. On 29 December 1850, the Cape Colony government then sent over 650 soldiers to crush the *Xhosa* people "once and for all" (Ross 2013b: 10).

On 3 January 1851 a major war, termed Mlanjeni's War, broke out between the *Xhosa* and the 'whites' (Birkholz 2009). The *Xhosa* lost the war and this marked the end of Xhosa uprisings in the area. Soon after the 1851 war the 'white' Cape Colony government decided to forcefully evict the 'coloureds' from the area because the 'coloureds' had failed to crush *Xhosa* uprisings prior to 1850. This period marked the beginning of 'white' commercial farming in the Kat River Valley. The 'white' settlers ultimately controlled vast portions of the

land, common grazing and water distribution (Nel and Hill 2000). This resulted in both the *Xhosa* people and 'coloureds' being forced to become farm labourers on white commercial farms.

In 1905, the Cape Colony government passed the Boedel Erven Act (Table 3.3). The Boedel Erven act of 1905 referred to land granted to Kat River settlers (both 'coloureds and 'whites') between 1836 and 1865 as the owners of the land – settlers who had not received the title deeds due to them. The Act stated that these Erven would be transferred on condition that they were at least 300 square rods (1300 m^2). This law was specifically enacted to benefit 'white' commercial farmers and a few loyal 'coloureds'. The act therefore resulted in the elimination of *Xhosa* small farming plots, which had been in existence until this period. Some of the few *Xhosa* villages were consolidated into more regularly sized commercial farms (Nel and Hill 2000, Ross 2013b). The Boedel Erven Act (1905) significantly changed the landscapes and livelihoods of *Xhosa* people. Through this Act, the *Xhosa* people lost their access to natural resources, farming and grazing fields.

Early apartheid years

During the early 1950s Mr Fenner-Solomon, a lawyer, effectively defrauded the remaining few 'coloureds' who had title to the land (Ross 2013a), and from 1905 to 1970s most 'blacks' and 'coloureds' were employed as farm labourers on 'white' commercial farms. 'White' commercial farmers employed over 80% of the *Xhosa* population in Fairbairn village (Motteux 2002). Irrigated agriculture was the primary economic industry in the area. The building of the Kat River Dam in 1969 was one of the major drivers of change, as this enhanced citrus production in the area. One respondent interviewed suggested that farm labourer households were not allowed to rear more than five cattle and ten goats and this resulted in most households relying on farm food parcels. Farm parcels included 2 kg rice, sugar, beans and fresh farm produce. Each farm labourer was given this parcel every fortnight as a form of salary.

In general, the period 1829-1969 was therefore characterised by a shift from small-scale farming towards large-scale commercial farming. In addition, *Xhosa* livelihoods became dependent on 'white' commercial farms, with decreasing reliance on small stock rearing. The following section investigates key changes and effects of apartheid planning, which followed this period

Table 3.3 Chronological summary of key events in the Kat River valley

Date	Key event
1825	Attempt to expel the *Xhosa* from the Kat River valley.
1828	Ordinance 50 of 1828 was passed which permitted the Kat River area to be owned by the 'coloureds'.
1829	Chief Maqoma and his people (*Xhosa* people) expelled from the Kat River.
1830	Kat River valley designated for the 'coloured' people.
1851	Kat River valley designated for 'white' farmers.
1905	Boedel Erven Act of 1905 referred to land granted to Kat River settlers between 1836 and 1865. This meant the land was owned by 'white' farmers and a few 'coloured' people, and excluded the *Xhosa*.
1913	Native Land Act of 1913 forcibly displaced the local indigenous communities across the country.
1948	Early apartheid years.
1951	Bantu Authorities Act of 1951 resulted in promotion of Bantu self-government.
1970	The establishment of the Ciskei homeland in Fairbairn village.
1970	Abandonment of farms by white farmers.
1980	Emergence of *Vachellia karoo.*
1984	Ciskei Agricultural Corporation takes over the farms and training of black farmers.
1987	Drought hampered farming in the Katala District.
1994	New South Africa.
1996	Social grants form main source of livelihood.
1996	HACOP project established.
2000	Rural electrification begins but only **three** households are electrified.
2000	World Vision Farming project. This programme promoted home gardens.
2003	Bridge construction.
2005	The railway line removed.
2013	Rural electrification for all.
2014	Municipality tap water installation.

3.3.1.3 Period 3: Last years of the apartheid period (1970-1993)

This section explains changes that occurred during the apartheid period. During the 1970s, the Cape Colony Government passed the National State Act (Table 3.3) and this resulted in the establishment of the Ciskei Homeland, in which Fairbairn was located. Some scholars claim that the Kat River valley was transferred into the Ciskei Homeland in the early 1970s (Nel and Davies 1999, Motteux 2002, Birkholz 2009) whilst others suggest the transfer occurred in 1982 (Ross 2013b). Although there is much debate on the actual date of transferral it is important to note that there were several consequences that attended to this transfer of the territory. The Ciskei Homeland became a focus for massive population relocation. The apartheid planning further altered the landholding, farming and demographics in Fairbairn. This act resulted in the outward migration of most 'white' farmers, resulting in commercial farm abandonment. According to Birkholz (2009), 'white' farmers were forced to leave the farms under the new apartheid planning. Farming operations did not continue on anything like the level at which they had previously been pursued. Former farm labourers, 'blacks' and 'coloureds', "effectively took over the farms and established their dwellings on abandoned land and unclaimed land" (Ross 2013b:154). The same author suggests that approximately 150 farms were abandoned and most 'black' farm labourers lost their jobs resulting in many of the youth migrating to bigger towns around South Africa. One elderly woman in the PLA workshop suggested that most of the former farm labourers migrated to Johannesburg in search of mining jobs. There was a sharp increase in unemployment. In 1984, after fourteen years of commercial farm abandonment, the Ciskei Agricultural Corporation, Ulmicor, took over most of the citrus and tobacco farms in Fairbairn (Motteux 2002). The Ciskei government put in place a co-operative to train interested 'black' farmers in commercial agriculture; however, most of the 'black' farmers resisted the offer. There was no clear policy and the local people were not given access to the land for farming.

Another large event during the period 1970-1993 was an extreme and severe drought in 1987. Figure 3.2 shows the historical monthly rainfall, including the1987 drought, for the Somerset East weather station, which covers Fairbairn village, which resulted in most of the households losing their farm produce and livestock (Motteux 2002).

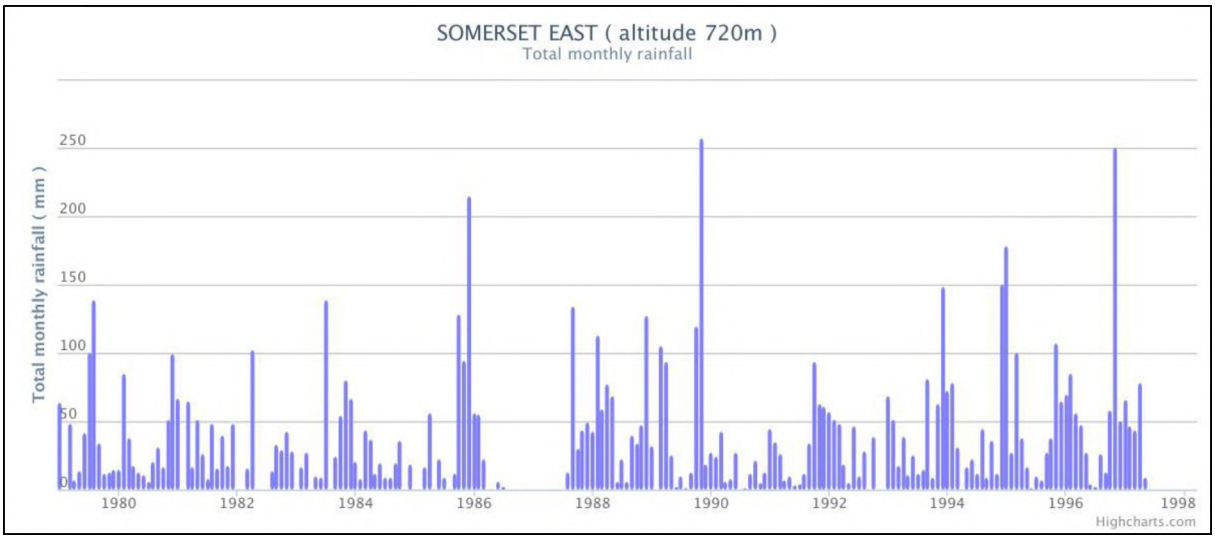

Figure 3.2 Total monthly rainfall (1980-1998) for Fairbairn village

The workshop participants agreed that the 1987 drought resulted in the death of livestock and massive crop failure. Most workshop participants suggested that during the 1987 drought, households were involved in gathering natural resource products from the woodlands and forest as one of the coping strategies. Despite the drought of 1987-88, many participants agreed that small-scale arable farming and livestock rearing remained central to household livelihoods. Most of the workshop participants suggested that the prolonged dry spell resulted in most of the males migrating from the area. Moreover, a number of 'false rainfall starts' during the early 1990s made it difficult for most of the households to know when to sow seeds.

In 1993, the people in the villages of Fairbairn, Hertzog and Phillipton were given a six-year term lease agreement by the Department of Land Affairs for land utilisation (Table 3.2). Lack of extension support from the Department of Land Affairs however, resulted in much of the leased land being abandoned.

In general the period 1970-1993 was thus characterised by massive commercial farm land abandonment by 'whites' and lack of rural extension support to interested 'black' farmers. A number of 'false rainfall starts' exacerbated food insecurity coupled with unclear land tenure. Despite the massive decline in agricultural production, arable farming remained central to household livelihoods. The following section investigates key changes that occurred after the democratic elections of 1994.

3.3.1.4 Period 4: Post-apartheid period (1994-2015)

In terms of land tenure, Ross (2013b: 154) states, "with the change in the political order of South Africa in 1994, the situation in the valley became even more confused." There were attempts made for land restitution in the area and Ross (2013b:156) summarises this confusion: "to whom, for example should the land be returned to? In principle there can be up to three to five *de jure* or *de facto* claimants for every hectare of ground, a) those 'coloureds' who feel they lost their land as a result of fraudulent legal practices, b) the farm workers who had been on the land for generations, c) the *Xhosa* who lost their land in 1830, and d) Chief Maqoma's descendants who are currently settled in Tyhume valley". Further probing during the PLA workshops revealed that no households had title to the land except one 'coloured' family.

After the 1994 elections, and the re-integration of the Ciskei homeland into South Africa, the government embarked on a Reconstruction and Development Programme (RDP). This programme was meant to identify areas that needed development in South Africa. The newly elected 2016 ward councillor suggested that lack of community development is a key driver of continued poverty in the area. Provision of basic services in Fairbairn village was considered by respondents to be one of the most important drivers of livelihood and landscape change. In general, most workshop participants articulated that development projects in the village provide household income for the unemployed. More so, this has paved the way for hand irrigated home gardens, which are pivotal to household food security and nutrition, as was explained by a female participant. The Kat River is significant to livelihoods and social concerns of communities in the area (Motteux 2002, Fox 2005). Workshop participants suggested that the river has social, cultural and spiritual importance for their wellbeing. The river provides important goods and services such as fish, reeds, mud and medicines (Fox 2005).

High levels of poverty and unemployment and the need for change inspired the community of Fairbairn to open a farming cooperative known as the Hertzog Agricultural Co-operative (HACOP) in 1996. The main aim of this co-operative was to utilise the large commercial abandoned fields and infrastructure in the area. An elderly woman aged 67, involved in the co-operative, stated:

...HACOP helped community members to acquire employment and cash income through the sale of fresh farm produce...

Over 40% of the population in Fairbairn joined HACOP in order to get a job and a source of income (Nel and Hill 2000). However, some respondents from my PLA workshops did not agree with these figures, and indicated that HACOP only benefited a few 'corrupt' individuals. In addition, this project became marred by a lack of adequate water pumps. Some respondents suggested that there was little unity between the 'coloureds' and the *Xhosa* people and this was a driver of the failure of HACOP. Motteux (2002:64) suggested that:

"During the six years of my research, HACOP members did secure support from NGOs for crop inputs such as seed, irrigation pipes and, later, administration support. However, HACOP's efforts were also hampered by bank debts, frost, drought, produce rotting due to heavy rains, fraudulent buyers, a lack of record-keeping, the departure and later death of the 'coloured' leader, a lack of committee elections, no buyers and poor marketing'.

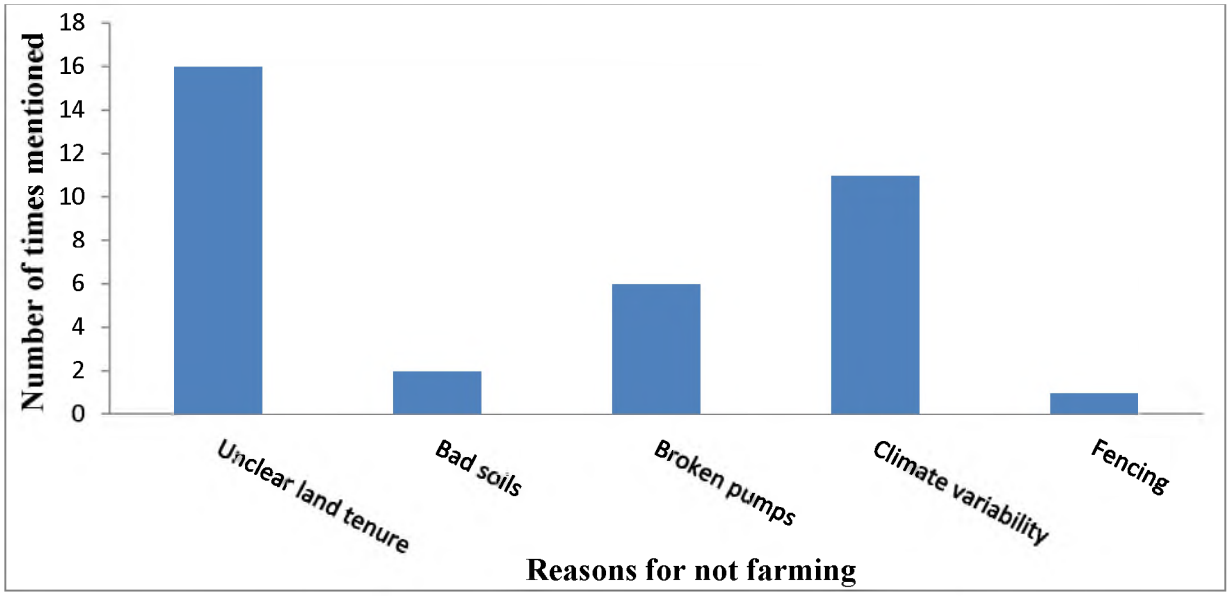

Figure 3.3 Reasons for not farming in Fairbairn village

PLA workshop participants mentioned the main reasons for not growing crops were unclear land tenure, followed by climate variability and failed agriculture (Figure 3.3).

..Unclear land tenure has made us abandon the fields, as you can see Vachellia karoo has taken over the abandoned fields…This has changed the landscape of Fairbairn since the 1970s.

Further probing revealed that marketing problems have been one of the major obstacles to maintaining the viability of small-scale commercial agriculture. External assistance from Non-Governmental Organisations (NGOs) is another important driver of livelihood change in Fairbairn village. In 2000/2001 World Vision established a farming cooperative and nutrition gardens in the area. However, the farming cooperative is said to have failed because of unclear land tenure and corruption. Nevertheless, some home gardens have continued as a result of this project (*refer to Section 4.3, Chapter 4*).

On May 29 2012, the community of Fairbairn held a protest in demand for electricity (SABC NEWS 2012). According to workshop participants, rural electrification since then has ensured changes in people's livelihoods in the area. Some of the shop owners interviewed expressed that business has increased, especially in the beverage sector, and some backyard industries such as welding are important for livelihood diversification in the area. Expansion of government grants is seen as an important driver of change in the village. Shackleton et al. (2002) suggested that government pensions are the primary source of income for the community of Fairbairn. Most households use social grants (old-age, disability, veteran, foster and child grants) and these are pivotal to providing food security, health and paying for children's education. Therefore, most respondents viewed social grants as one of the most important drivers of change. Interviewees acknowledged that social grants have helped most households to increase their household income level.

A study by Shackleton et al. (2002) concluded that the Fairbairn community use biological products from the wild extensively (*refer to Section 2.3, Chapter 2*). More so, the use of natural resource products is a viable strategy for improvised households, both for direct provisioning as well as for income generation (*refer to Section 2.3.3.8, Chapter 2*). One fuelwood vendor suggested that commercialisation of fuelwood limited damages from household shocks and stressors. The youth suggested that unemployment and limited opportunities for matriculants were one of the key drivers for outward migration (*refer to Section 4.3.2, Chapter 4*). Migration was noted as a key coping strategy during the workshop. One youth respondent explained why migration is a coping strategy:

...since the beginning of 2000, the youth are migrating from Fairbairn to look for greener pastures in other big cities in South Africa; here in Fairbairn there are few job opportunities....

In summary, the period 1994-2015 was characterised by a steady decline in agricultural production and the parallel increase in dependence on social grants. Unresolved land tenure, climate variability and broken farming pumps were some of the reasons linked to the decline in agricultural production. Respondents claim that the rate of unemployment has increased; however small scale informal activities such as commercialisation of fuelwood and backyard industries have increased (*refer to Table 2.2, Chapter 2*). The post-apartheid period is also marked by an advent of developmental programmes such as the provision of basic services. Workshop participants explained that the provision of municipality tap water has resulted in an increase in the number of home gardens.

3.3.2 Land use and cover percentage change (1967-2012)

In this section, I will explore land use and cover changes. Figure 3.4 shows the proportional area covered by each of the land cover and use types. This indicates an increase in the percentage cover of forests and woodlands and a decline in grasslands over the past 45 years in Fairbairn village.

The largest changes in land use and cover occurred between 1967 and 1996 whilst minimal change occurred between 1996 and 2012. The proportional area covered by forests increased from 10.96±1.05% in 1967, 12.96±0.14% in 1996 and to a maximum of 14.96±0.14% in 2012. Forest cover thus increased by 4% between 1967 and 2012 ($F_{2;\,6}$ 105.59; $P<0.01$). The proportional area covered by woodlands increased from 22.52±0.7% in 1967 to 24.15±2.7% in 1996, thus increasing by a significant 5% between 1967 and 2012 ($F_{2;\,6}$ 8.46; $P<0.15$). In contrast, the area covered by grassland declined from 21.93±5% in 1967 to a minimum of 4.2±1.45% in 2012 ($F_{2;\,6}$ 62.02; $P<0.01$).

Bare ground increased by 6.04% between 1967 and 1996 ($F_{2;\,6}$ 105.30; $P<0.01$), whereas there was a 4.0±0.07% decline of bare ground between 1996 and 2012. The proportional area covered by cultivated fields changed from a high of 33.30±0.24% in 1967 to 5.49±0.07% in 1996 ($F_{2;\,6}$ 495.19; $P<0.01$). From 1967 to 1996, cultivated field cover reduced by 27.37% and from 1996 to 2012 field cover was reduced by a further 0.74%. (Figure 3.4). In like fashion the proportional area covered by abandoned fields significantly increased from

3.04±0.14% in 1967 to 36.00±0.40% in 1996 ($F_{2;\,6}$ 155.37; P<0.01), whereas the proportional area covered by abandoned fields slightly increased by roughly 1% between 1996 and 2012. PLA workshop participants stated that they collected *Vachellia karoo, Diospyros lycioides* and *Acacia ataxacantha* from abandoned fields.

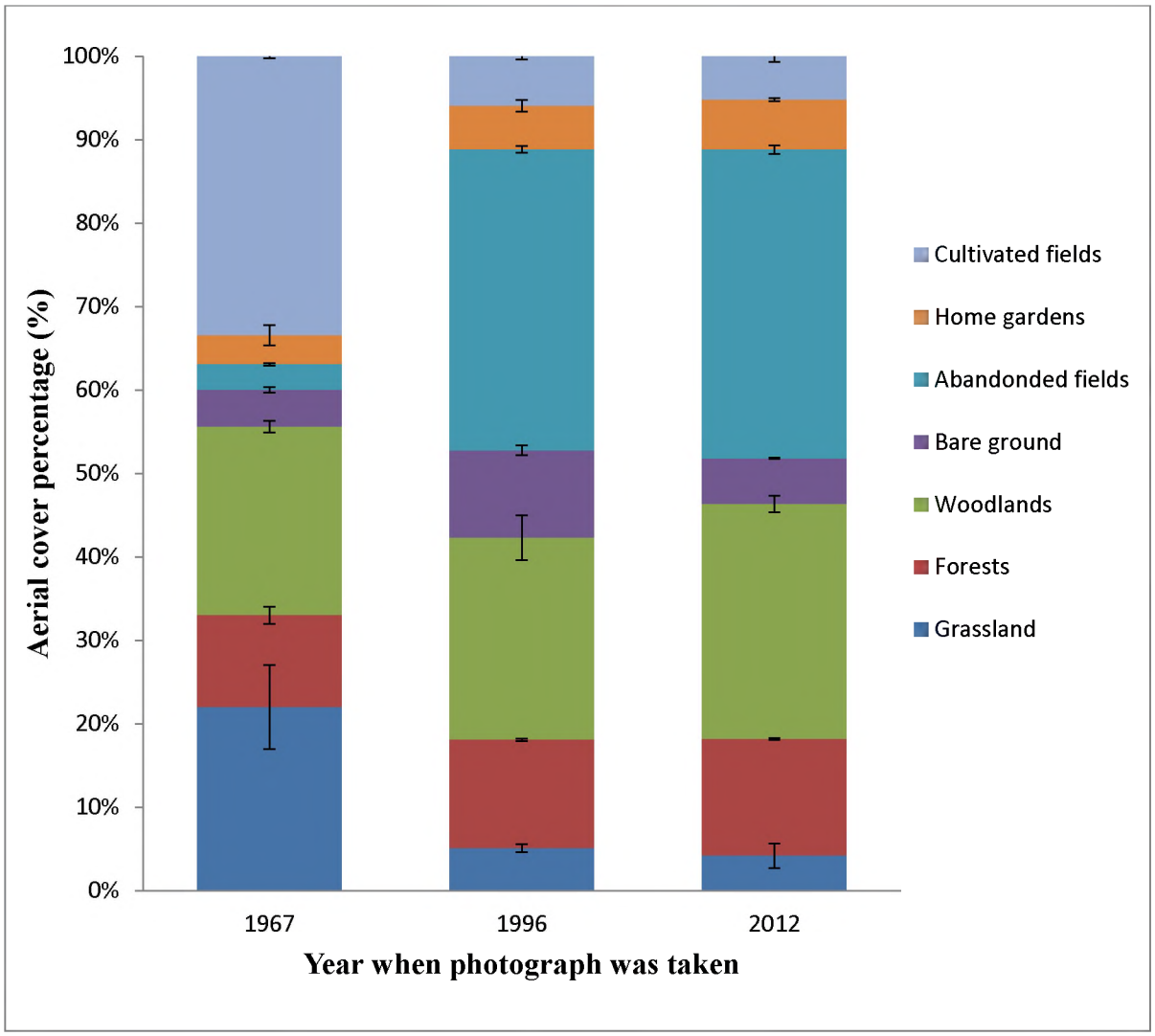

Figure 3.4 Proportional area of land use and cover types in Fairbairn village (1967-2012)

The proportional area covered by home gardens increased from 3.48±1.20% in 1967 to 5.93±1.70% in 1996. However the proportional area covered by home gardens significantly increased by 6% between 1967 and 2012 (F2; 6 62.02; P<0.01). These results support claims made by participants in PLA workshops (Table 3.4). According to workshop participants, some of the drivers linked to the increase in home gardens are field abandonment, the provision of tap water, which allowed people to irrigate gardens, better security and lower requirements for investment and labour.

Table 3.4 Trend line exercise in Fairbairn village where all participants were asked to indicate changes (scores) in the number of home gardens by identifying key dates when changes occurred

Year	Score	Explanation
1980	1	People received food parcels at the end of which week. These food parcels included crop and vegetable crops from the 'white'-owned fields. Hence, there was little need for us to have home gardens.
1990	6	After the 'white' farmers abandoned the farms, most households were food insecure; this resulted in households cultivating home gardens.
2000	10	World Vision Programme that promoted home gardens. The programme provided fencing. Less investment and cash is need.
2015	15	We use home gardens to enhance household food security. More so home gardens help us to save much-needed cash. These are critical for food and nutrition. Due to lack of clear land tenure of the fields, it is easy for the households to utilise home gardens. Provision of tap water has resulted in this increase.

Overall, during the last four decades, cultivated field cover has significantly decreased, with most of the field abandonment occurring prior to 1996. In like fashion, my results show that woody cover has increased over the past 45 years. More so, my results depict the steady deterioration in arable agricultural production and the corresponding small increase in home gardening. These LULC changes are linked to drivers identified in Section 3.4.1, including issues around tenure emanating from the apartheid period, and basic service provision post-apartheid.

3.3.3 Household livelihood changes (1990-2015)

In this section I will explore the related changes in livelihood patterns that are either impacted by, or more impacting changes observed in the previous section. In this section, I will consider changes in income, energy, and food sources and livestock ownership patterns

specifically in relation to livelihood change. Table 3.5 shows a ranked list of sources of household income in Fairbairn between the 1990 and 2015 (apartheid and post-apartheid).

Table 3.5 Ranked order of rural income over time (1990-2015)

Livelihood	1990 (Apartheid) Ranked source of income	2015 (Post-Apartheid) Ranked source of income
Government Grants	5	1
Sale of fuel wood	4	2
Home Gardens Produce	7	3
Sale of Livestock	6	4
Remittance from migrant workers	2	5
Fields	Not ranked[2]	6
Formal employment	1	7
Food Parcels	3	-

There have been changes in sources of income between the period 1990 and 2015 in Fairbairn. Twenty-five years ago in Fairbairn (1990) formal employment and remittance from migrant workers were ranked as the most important sources of income. However, after the democratic elections of 1994, government social grants became the primary source of income in Fairbairn village (*refer to Section 2.3.1, Chapter 2*). Mrs P (name withheld) explained the importance of government social grant to her household:

*Social grants are important because I can afford to buy retail food and send my grandchildren to school. As you can see in my household I have five child grants (5*ZAR 800), two old peoples grants (2*ZAR 1 400) and one disability grant (1*ZAR 1 400). This amounts to ZAR 8 200. I want to thank the government of South Africa. Without the grants, what kind of a life would it have been?*

Sale of fuelwood was ranked the second most important source of income in 2015 whilst in 1990 it was ranked fourth. Workshop participants related this change to the increase of

[2] Not ranked because most households had no access to land due to unclear land tenure

woody species in the area. Commercialisation of fuelwood is one of the most important livelihood strategies for the unemployed youth (*refer to Section 2.3.3.1, Chapter 2*). In particular, Table 3.6 suggests that access to fuelwood is a fallback strategy during times of financial need, as indicated by people saying they use much more fuelwood since the price of electricity increased.

Table 3.6 Results of a trend line exercise in Fairbairn village where participants were asked to indicate changes in the reliance on fuelwood over time (refer to Section 3.2.4.4 for explanation of how scores were determined)

Year	Score	Explanation
1990	5	The use of fuelwood was low because of the oppressive apartheid laws. Therefore, most households could not access the fuelwood.
2000	16	The use was higher compared to 1990 because most households had access to woodlands and forests.
2013	7	The use was low as compared to 2015 because of rural electrification of households. The electricity tariffs were much more affordable.
2015	19	Due to high price of electricity, households now use fuelwood extensively to supplement household cash. It is much cheaper to use fuelwood than electricity.

Food parcels were ranked the third most important source of household income in the 1990s because most households worked on commercial citrus and tobacco farms. The food parcels were given to the farm labourers each fortnight (*refer to Section 3.3.1.1, Chapter 3*). This was essential to the households that solely depended on working on the tobacco and citrus farms. Food parcels were essential as a source of livelihood as most of the *Xhosa people* had lost their land through the Boedel Erven Act of 1905 (*refer to Section 3.3.1.1, Chapter 3*). Food parcels were replaced by home gardens and over 80% of the households in Fairbairn now have home gardens. Home gardens were ranked third in 2015. Livestock rearing was ranked the fourth most important livelihood source in 2015 while in 1990 it was ranked sixth. According to Section 2.3.1, Chapter 2, in 2015, 80% of the households owned livestock. Although livestock has a high economic value, livestock were ranked considerably lower

than fuelwood because livestock is seen primarily as of cultural importance and are seldom sold. Fields were ranked sixth in 2015 and other sources of income that were mentioned but not ranked were *stokvel* (saving clubs), and selling of wild honey. These were not ranked because most workshop participants disagreed on their importance to household income. However all participants agreed that natural resource products play a fundamental role in household income (Figure 3.5; *refer to Section 2.3.3.8, Chapter 2*).

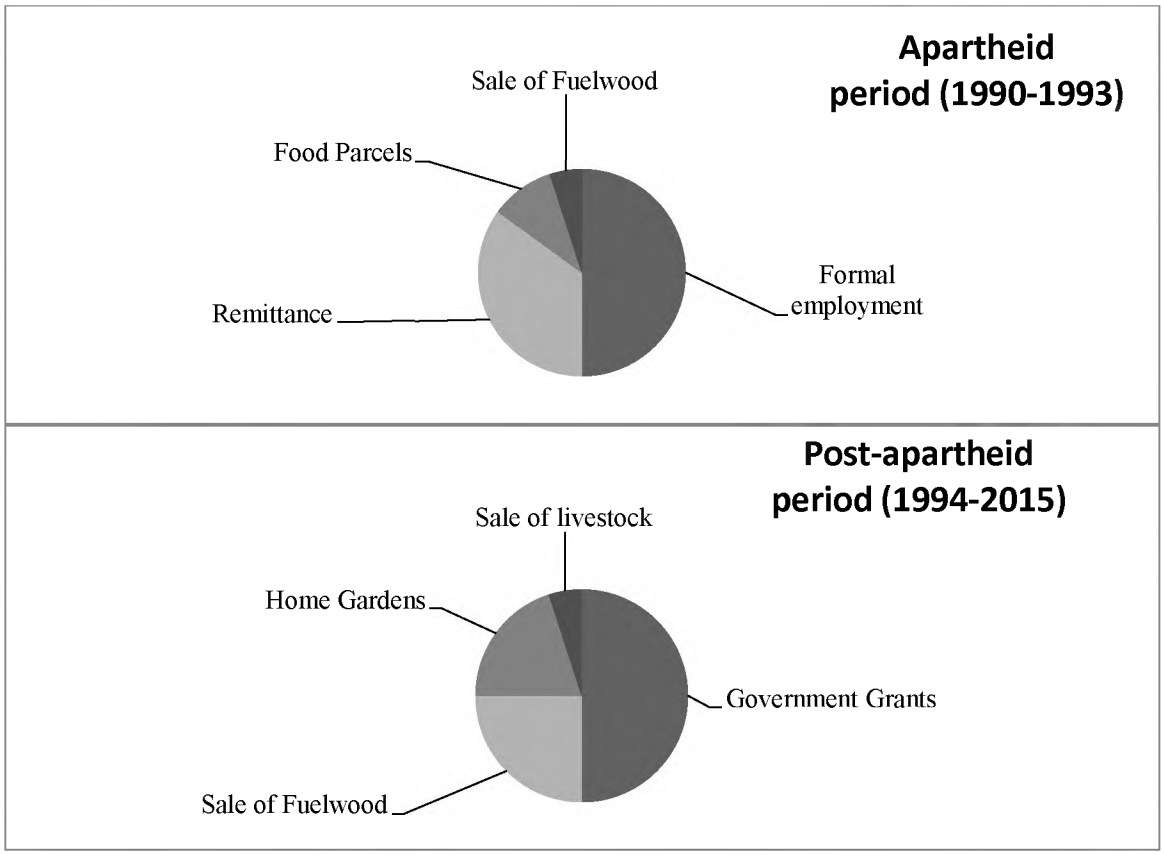

Figure 3.5 Comparison of livelihood changes in Fairbairn village between 1990 and 2015 (these are relative estimates, not actual measurements)

In general then, since 1990, livelihoods in Fairbairn have been increasingly centred on off-farm sources of income. These results depict a huge shift to dependence on social grants, as well as the disappearance of formal employment. However, the post-apartheid period has seen the emergence of commercialisation of livestock and fuelwood, and the increased use of home gardens, which are natural resource based activities.

3.4 DISCUSSION

Landscape dynamics and livelihood trends in Fairbairn village are linked to political, economic, environmental and social drivers since at least the early 1830s. Three key land use and cover changes that have occurred since the 1960s in response to these drivers, include commercial field abandonment, agricultural decline and woody cover increase between 1967 and 1996. Gradual field abandonment has led to woody plants increasing in the area with the dominant species being *Vachellia karoo*. Workshop participants highlighted that there were various factors behind changes; land tenure dynamics appeared to be central. The post-apartheid period marked a profound shift of household livelihood portfolios, with government social grants becoming the primary source of income. Other minor changes in terms of land use and cover occurred during the post-apartheid period with one interesting dimension being the shift from small-scale farming towards home gardening. In general, post-apartheid household livelihoods are increasingly becoming off-farm orientated and most households are increasingly divorced from local production patterns, although livestock and natural resource gathering remain important. The findings therefore indicate that long-term human-environmental change is a complex issue linked to political, economic and social change.

Both the historical review and PLA workshops revealed that changes in land tenure are among the key changes that have occurred since the early 1830s. Prior to the union and apartheid periods, landholdings were based on communal ownership, which involved joint ownership of grazing and farming fields. However, apartheid legislation created an individualistic system that benefited 'white' farmers at the expense of indigenous populations, namely the *Xhosa*. Communal fields were converted to large-scale commercial farms and the *Xhosa* lost their farming and grazing fields. The best agricultural fields were assigned to 'white' farmers as formal private land tenure, while the dispossessed 'blacks' became farm labourers under the new system. Similarly in sub-Saharan Africa, colonial changes in land tenure resulted in key changes in terms of landscapes and livelihoods (Deakin et al. 2016). This investigation found that both minor and major changes that have occurred in Fairbairn village are closely interconnected to changes in land tenure over time.

One major change has been field abandonment. Large-scale field abandonment occurred with the inclusion of Fairbairn village into the Ciskei, and this was largely by 'white' commercial farmers. Both PLA and archival data seemingly indicated that the process of field abandonment was largely related to direct state intervention that demarcated where 'whites'

and 'blacks' could live. During the 1970s, the apartheid government allocated Fairbairn to 'blacks' and this resulted in outward migration of 'white' commercial farmers. Indeed, evidence from Zambia (Gumbo et al. 2016) and South Africa (Hebinck and Lent 2007) suggests that state-led intervention is one of the main drivers that have affected rural landscapes and livelihoods. Furthermore, results highlight that other factors such as a) unclear land tenure after the outward migration of the 'whites', b) lack of agricultural extension support during the apartheid period, and c) 'black' farmers being cautious in taking over 'white' commercial fields, enhanced field abandonment in the apartheid period; also 'black' previous farm workers did not have the necessary finances to invest in farming. These multiple factors resulted in households changing their daily practices and in turn shaping landscapes.

As a result of this new apartheid planning, rural income sources shifted from farm labouring to formal employment in the mine and steel industries. A critical analysis might reveal that the departure of 'white' commercial farmers may have resulted in the loss of 'black' male agricultural labour to the mine and steel industries or the loss of livelihood options might have discouraged or reduced the investment of scarce household resources into cultivation. This resulted in further field abandonment, which made way for bush encroachment by *Vachellia karoo*. Therefore, these results indicate that the changes in the macro political landscape altered social paradigms and contributed to both landscape and livelihood change at local level.

Key informants highlighted that soon after the new political dispensation of 1994 there was a minor increase in terms of cultivated field cover, during the period when HACOP was active in the community. This period is not included in my land use and cover change data because my ortho-photos did not cover this period. Reasons given by respondents to explain this increase were largely centred on a) improved irrigated cultivation, b) improved seedlings, and c) rural extension support during that period. The HACOP scheme provided employment for most of the households, and individual families made a profit of ZAR 3 000 - ZAR 23 000 (inflation adjusted) per growing season (Nel and Hill 2000). High yields were reported despite tensions related to land tenure insecurity. Immediately after the year 2000, households began deserting the HACOP scheme. Some of the reasons given behind this decision were land tenure insecurity, lack of markets, bank debts, drought, fraudulent buyers and the death of the 'coloured' leader. My results reflect the findings of agricultural economists (e.g.

Wiggins 2002), who argue that farming is dependent on access to markets, effects of economic policies and good governance.

Interestingly, in Fairbairn, respondents did not link the increase in social grants to field abandonment in the post-apartheid period. Further probing revealed that most households utilised social grants income to purchase home gardening inputs. However, most commentators in the working in the Eastern Cape suggest that the increase of social grants is one of the drivers that might be linked to field abandonment (Hebinck and Lent 2007, Kepe and Tessaro 2014, Shackleton and Luckert 2015). This difference of opinion could be explained by the location of Fairbairn; my study focused on former 'white' commercial farms whereas Hebinck and Lent (2007) and Shackleton and Luckert (2015) focused on *Xhosa* communities that have resided on their own land for many generations and who have not experienced the same land tenure issues as Fairbairn. Even though cultivated field cover has declined in Fairbairn village, most workshop participants view cultivation as a key livelihood strategy. Cultivation is seen as a potential source of income (*refer to Section 4.3.4, Chapter 4*) although most households remain unwilling to invest time and labour in former 'white'-owned land due to land tenure insecurity.

Another minor change in terms of land use dynamics is the increase of home garden cover. Although other researchers in the area claim that home gardening is a response to declining arable farming activities (Andrew and Fox 2003), PLA workshop participants suggested that this increase might be related to basic service provision i.e. municipal tap water, which enables hand irrigation. Further probing revealed that home gardens are less likely to be affected by climate variability as most households could easily hand irrigate crops. Workshop participants suggested that home gardening takes place closer to homesteads, simplifying their cultivation. Others suggested that home gardening is a response to declining agricultural labour in the area. The increase in home gardening might also be related to land tenure insecurity because home gardening is not affected by the land tenure issues that affected agricultural fields. Another possibility is that home gardening is the only viable agricultural option given income constraints faced by households. This possibility is supported by research within the Eastern Cape that showed that the increase of home gardens corresponds with arable field cultivation decline (Adekunle 2013, Shackleton and Luckert 2015). Whatever the complex interplay of drivers behind this shift, it is clear that home gardening represents a livelihood diversification activity in the village, and is linked to the decline of cultivated fields.

Another major landscape change has been the increase in woody cover as a consequence of field abandonment. Based on field observations together with aerial photography data, *Vachellia karoo* grows in abundance on abandoned fields. Other mentioned drivers linked to woody cover increase discussed by workshop participants were changes in land use practices and reduced use of both woodlands and forests. Evidence within the Eastern Cape region has shown similar trends with regard to woody cover increase (Chalmers and Fabricius 2007, Stickler and Shackleton 2015).

Interestingly, PLA workshop participants reported that abandoned fields were one of the primary sites for collecting natural resources. These assertions by research participants support the sentiments of Kepe and Tessaro (2014) who argue that the presence of fallow/abandoned fields does not necessarily mean wasted land. Younger participants in my study stated that woody cover increase is beneficial to their livelihoods as some of the youth are engaged in the commercialisation of fuelwood. Evidence from ranked sources of income puts commercialisation of fuelwood as the second best household income provider today. This evidence not only supports assertions that forest based activities such as commercialisation of fuelwood are central to rural livelihoods (Shackleton et al. 2015), but shows their increasing importance over time (*refer to Table 3.6, Chapter 3*).

Detailed studies of rural livelihoods in former homeland areas reveal that most households depend on multiple sources of income (Hebinck and Lent 2007). One significant change in the immediate post-apartheid period in this study was the expansion of government social protection. Beinart (2001) suggested that this would lead to the emergence of *rural pensionariat*. Indeed, more recent research has suggested that rural livelihoods in South Africa are heavily dependent on external income and consumption, and have become increasingly divorced from local production patterns (Hebinck and Lent 2007). This is a similar pattern to what is happening in Fairbairn village. The drivers behind this shift are diverse. Firstly, households view arable farming as a risk, due to climate variability. Secondly, on-farm activities are less profitable compared to off-farm activities. Thirdly, the expansion of social assistance and retail supermarkets has influenced rural livelihoods. Lastly, infrastructural improvement has facilitated this shift, for instance the availability of electricity has facilitated 'backyard industries' such as welding and Spaza shops, as alternative options to agriculture. In some respects, infrastructural improvement has enhanced livelihood diversification as well as increased household cash inflow. Pursuing non-

agricultural activities therefore represents a risk minimisation strategy to achieve basic household subsistence needs.

Given that climate change will act as a threat multiplier in intensifying existing problems and vulnerability in Fairbairn village, the question now becomes whether the current land use and households strategies can ensure food security for households. First, observed trends from this study revealed a greater reliance on government social grants, and that livelihood activities are narrowing and agriculture has declined. Together these trends could increase vulnerabilities amongst households in Fairbairn village in that a heavy dependence on social grants might depress innovation and productivity in the area (Shackleton et al. 2013a), which in turn might exacerbate food insecurity (*refer to Section 4.4, Chapter 4*). It is also important to consider that a heavy reliance on social grants might contribute to food security (Hagen-Zanker et al. 2011, Ndlovu, 2012) in that households would have cash to purchase food. Again, social grants might support other livelihood activities such as commercialisation of natural resource products (*refer to Section 2.2, Chapter 2*) and this might reduce vulnerabilities in the area. Second, given the decline in agriculture over time, one might argue that this trajectory might narrow household options and place people in a state of greater vulnerability. For example, the current trends of high reliance on purchased food might be detrimental due to an increased need for scarce cash. Furthermore, the reliance on purchased food might become a more serious problem as food prices might rise with impacts of climate change (Schmidhuber and Tubiello, 2007), leaving households food insecure. Last, given the trends of declining remittances (*refer to Section 3.3, Chapter 3*), and high unemployment, one might suggest that such a trajectory might have the effect of squeezing the cash obtained from social grants and this might further exacerbate vulnerabilities for households who have limited sources of income. All these factors mentioned above might exacerbate vulnerabilities of households in Fairbairn village but given the complex and multidimensional contexts in my study area, there are no straightforward answers.

3.5 CONCLUSION

The aim of this chapter was to trace historical and contemporary drivers and changes that have influenced linked environmental and livelihood systems in Fairbairn village. Human-environmental change has been caused by both internal and external factors that have interacted at different levels in Fairbairn. Evidence from this study indicates a long-term process of field abandonment that corresponds with woody cover increase in the area. In

general, evidence from Fairbairn village shows field abandonment is one of the most significant drivers of landscape change since the 1960s, and this change has been linked to direct state interventions and the resulting lack of clarity over land tenure. Despite declining agricultural production, respondents claim that arable farming remains an important option for household livelihoods (*refer to Chapter 4*). This study also highlights the continued importance of home gardening at household level. It indicates that despite unclear land tenure and increased climate variability, home gardening can contribute to household food security as a supply of food, as well as enabling households to save limited income. Diversification of livelihood strategies is apparent, and it is likely that the economy of Fairbairn village will continue to be dependent on multiple sources of income. The findings also highlight the importance of considering multiple drivers and their interconnecting impacts in order to understand current livelihood trajectories. The ways in which such trajectories will play out in the future is the subject of the next chapter.

CHAPTER 4: ENVISIONING FUTURE LIVELIHOODS UNDER A CHANGING CLIMATE - AN EASTERN CAPE EXPERIENCE

"Not everything that is faced can be changed but nothing can be changed until it is faced"- James Balden

4.1 INTRODUCTION

The need to adapt to social and environmental change is these days recognised worldwide (Wise et al. 2014). Importantly, most natural resource dependent communities are more vulnerable than others are to unanticipated events including the impacts of climate change (Shackleton et al. 2013b). The magnitude and direction of social and environmental changes are difficult to predict, and therefore tools like adaptive management and participatory scenario planning have been developed to enable decision makers, including rural communities, to deal with the uncertainties and complexities of such changes (Schoemaker 1995, Wollenberg et al. 2000a, Serrao-Neumann and Low 2014).

Schoemaker (1995:25) defines scenario planning as a "disciplined method for imagining possible futures that can be applied to a range of issues". According to the same author, historically scenario planning was mainly used by multi-national companies such as the Royal Dutch shell petroleum company and the Anglo-American Corporation. For example in the early 1980s the Anglo-American Corporation used scenario planning to explore South Africa's possible futures through a process of scenario development, and this was said to have provided a catalyst for profound political reform (Schoemaker 1995). Half a decade later, Wollenberg et al. (2000b) defined scenario development as a tool used for creatively planning for the future. This conceptualisation primarily focused on scenario development as a tool for adaptive forest management. Building on these definitions, participatory scenario planning is defined here as a tool used for developing plausible narratives of how the future might unfold, based on a coherent set of assumptions of key elements and drivers of change (Carpenter et al. 2005).

Scenario planning can be either participatory or expert-led (van Notten et al. 2003), and can be performed on a local or global scale, or across scales (Diaz et al. 2015). Expert-led scenario planning has been used in numerous regional-scale assessments, for example in Sweden scenarios were used to assess the direct and indirect effects of climate change on herbicide leaching (Steffens et al. 2015). There are also numerous participatory scenario case studies across the world, for example in Tanzania (Enfors et al. 2008), Spain (Palomo et al. 2011), East Africa (Tschakert et al. 2014), Australia (Mitchell et al. 2016) and Zimbabwe (Chirozva et al. 2013).

A variety of steps or stages have been adopted in the development of scenarios. Schoemaker (1995) described ten different steps involved in scenario development. Most participatory scenario planning case studies use only the first six steps (Enfors et al. 2008, Chirozva et al. 2013, Beach and Clark 2015). These steps include the definition of scope, identification of major stakeholders, identification of basic trends, identification of key uncertainties, construction of scenario themes, and checking for consistency and plausibility. For example, Malinga et al. (2013) used five similar steps in developing their scenarios in the Drakensberg, South Africa. In their study they began by identifying key drivers of change through interviews, thereafter they analysed these key drivers of change. This was followed by scenario development and testing for consistency and plausibility.

In addition to involving different sequential steps, scenarios can also take different forms in terms of presentation, depending on the audience (Wollenberg et al. 2000b). The same authors suggested that scenarios could take the form of pictures, photographs, storylines (narratives), poems or mathematical equations. The most common form used in developing participatory scenarios is storylines (Enfors et al. 2008, Malinga et al. 2013, Chirozva et al. 2013, Beach and Clark 2015). For example, in Tanzania Enfors et al. (2008) used storylines to explore alternative scenarios for catchment management. In the same study, pictures were used to illustrate the developmental paths of the Makanya catchment. The major limiting factor in choosing a scenario form is the imagination of the people using them and the interest of people participating in creating them (Wollenberg et al. 2000b, Mitchell et al. 2016).

Schoemaker (1995) suggests that scenario planning attempts to address two errors that most decision makers and researchers make. These errors include underestimating unpredictability and over-confidence when predicting change. Participatory scenario planning helps to address the problem of a narrow paradigmatic lens when dealing with future uncertainties and change (Beach and Clark 2015). Evans (2011) is of the view that, participatory scenario planning has the ability to connect adaptation and strategy.

Consequently, the key aims for participatory scenario planning are to generally evoke and communicate people's ambitions, plans and perceptions of change, as well as to help rural communities to adapt to change and accomplish their vision of the future (Wollenberg et al. 2000a). A wide variety of potential benefits is associated with participatory scenario planning. For example, participatory scenario planning holds the potential to provide a platform for learning, unlearning and awareness building (Chirozva et al. 2013, Berbés-

Blázquez et al. 2016), and multi-sectorial participation and engagement can support the development of detailed narratives that are easy to understand by a wide audience (Enfors et al. 2008, Chirozva et al. 2013, Raford 2015). Schoemaker (1995) suggests that involving people in developing participatory scenario planning is helpful in bringing forth different ideas and diverse perspectives. More so, the involvement of different stakeholders in private and public sectors can help improve decision-making (Palomo et al. 2011). A study conducted by Beach and Clark (2015) suggested that scenario development enables the building and strengthening of institutional linkages at community level. One advantage of involving diverse local stakeholders is that the decisions identified and developed are consistent with local culture and institutions (Reed et al. 2013).

Participatory scenario planning also provides a platform for knowledge co-production; this involves the use of both traditional and non-traditional knowledge systems (Tschakert et al. 2014). Both traditional ecological knowledge and Western knowledge systems are regarded as essential for adaptive capacity and anticipatory learning (Berkes et al. 2000, Tschakert et al. 2014). Tschakert et al. (2014) stress that the use of climatic data in participatory scenario building is critical as it elicits perspectives beyond embodied experiences. More so, scenario building provides a platform from which participants can distil scientific information and critically understand complex feedbacks across different scales.

Despite these benefits, participatory scenario planning does face a variety of challenges. One challenge of participatory scenario planning is that participants, depending on the context, can find it difficult to understand Western knowledge (Marx et al. 2007). This is particularly the case with downscaled climate projections (Tschakert et al. 2014). Pidgeon and Fischhoff (2011) argue that the major challenge facing climate scientists is explaining to non-specialists the risks and uncertainties surrounding potential changes over the coming years, decades and centuries. To overcome this problem researchers have used visuals, narratives and practical experiments and dramas to explain Western scientific concepts and models (Wollenberg et al. 2000a, Tschakert and Dietrich 2010). Despite the challenges outlined above, participatory scenario planning remains a strategic planning approach that holds potential to help communities and researchers make decisions in the face of uncertainties and rapid change

4.1.1 Purpose of the chapter

There is a growing need for studies that seek to understand the magnitude and direction of social and environmental changes. These can help identify opportunities and constraints that rural communities might face in relation to a changing climate. As highlighted by van der Heijden (2005), scenario analysis involves the development of more than one scenario, and the subsequent comparison of those scenarios in some way. Therefore, this chapter seeks to reflect on an effort to explore future scenarios with the community of Fairbairn for adaptation to current and future change, including climate change. Furthermore, it establishes how different groups within the community envision the future, and the kinds of drivers and local responses that community members envision as important going forward. This chapter also reflects on the value that participatory approaches to scenario development could add to research into adapting to climate change.

Research objective

By exploring with communities, future scenarios under a changing climate, this chapter sets out to answer the following research questions:

1. How do different groups within the community see the plausible futures of Fairbairn in terms of key drivers and likely responses?
2. What do different groups within the community regard as the desired future for Fairbairn?
3. What value does a participatory approach to scenario development add to research into adapting to climate change?

4.2 METHODS

A qualitative case study approach was taken for this research. In this process of developing and assessing scenarios within the community, I used various steps suggested by Wollenberg et al. (2000b) and Enfors et al. (2008). The participatory scenario process consisted of three main stages (Figure 4.2). The first stage was of scenario development (Figure 4.2: Stage 1), followed by the stage of organising and facilitating the participatory scenario workshop (Figure 4.2: Stage 2) and lastly the analysis stage (Figure 4.2: Stage 3). The stages and associated steps taken in scenario development are explained in the following sections.

4.2.1 Stage 1: Scenario development

The scenario development process developed two alternative scenarios for the future of Fairbairn village, describing in qualitative terms the key drivers, livelihood responses, agro ecological conditions and lifestyles around the year 2050, which I developed in the form of storylines (narratives). The various steps involved in scenario development are explained below.

4.2.1.1 Step 1: Identification of the past and future changes from Chapters 2 and 3

In the first step, I distilled key themes that emerged from Chapters 2 and 3, and used these to develop two different scenarios for Fairbairn village (Figure 4.2). Key themes that emerged from Chapters 2 and 3 were: the expansion and greater dependence on government social grants; bush encroachment into the old fields; increased trading in fuelwood; woody cover increase, and decline in agriculture reflected in the increase of bush encroachment and no support of insecure tenure. After identifying the key themes, I then developed two storylines i.e. "*Umnga Everywhere*" and "*Urban Future*". Techniques used in developing the storylines are explained in the following section.

4.2.1.2 Step 2: Development of the Umnga Everywhere and the Urban Future scenarios as storylines

Storylines are narratives of the future (Wollenberg et al. 2000b). I used storylines because they encourage imagination and creativity. More so, storylines promote a non-threatening atmosphere. Relaxation of participants is a key component in participatory research because this increases willingness of participants to communicate their thoughts and feelings openly. The techniques used in developing the two storylines are explained below.

For both scenarios described in this chapter, downscaled climate projections were used. This is the general name for a procedure that takes large-scale climatic information to make predictions at a local level. This climatic information was important in developing plausible storylines that were aligned with the Eastern Cape future climate (Figure 4.1, Climate Information Portal 2016). I used the downscaled climate projections for Somerset East, which include Fairbairn, to develop the *Umnga* Everywhere and Urban Future scenarios (Box 4.1).

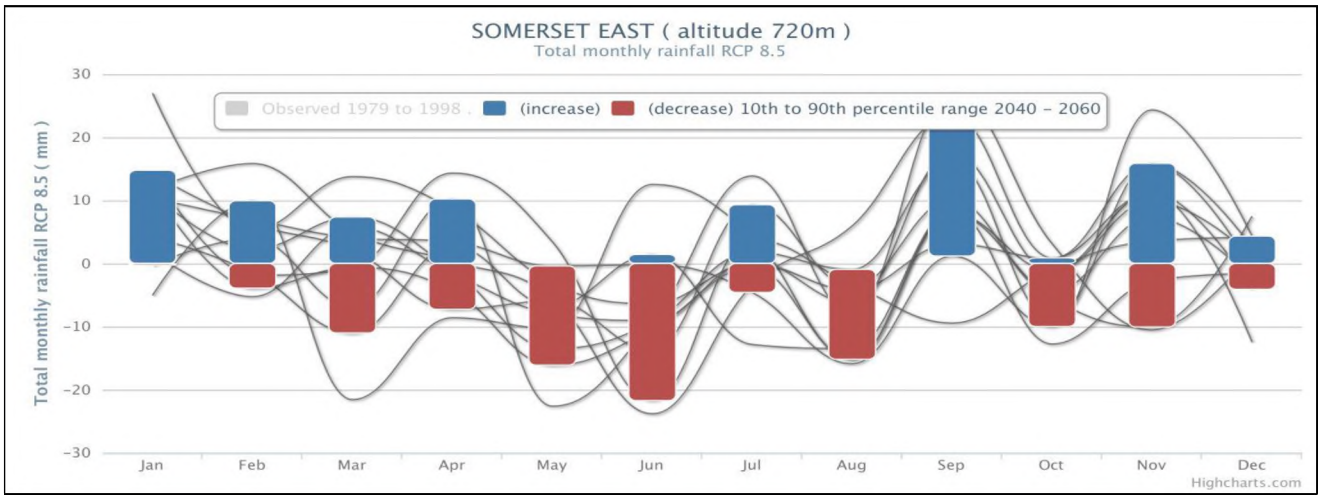

Figure 4.1 Total monthly rainfall projections for Fairbairn village between 2040 and 2060 (Source: Climate Information Portal 2016)

Box 4.1 Summary of downscaled climate projection for Somerset East (this area covers Fairbairn village) (Source: Climate Information Portal 2016)

Rainfall

- Increase of rainfall in the months of January, February and September. The implications of this data are that by 2050, we might receive good rains in the month of November.
- Decrease of rainfall in the months of May, June, August and October. The implications of this data are that by 2050, we are likely to experience a drier winter.

Annual number of wet days

- The number of wet days are likely to decrease from May to October and increase in January and April.

Temperature

- Temperatures are likely to increase throughout the year and we are likely to have warmer winters (this will mean higher evapotranspiration).

Umnga Everywhere storyline

The *Umnga* Everywhere storyline was developed using the projection technique (Wollenberg et al. 2000b). The projection technique was used to evoke people's expectations of the future using past and current drivers of change identified in Stage 1: Step 1 (Figure 4.2). I developed this storyline in order to understand how different groups within the community see the possibility of a future in which bush encroachment continues unabated and in which agriculture continues to decline. These changes continue in the context of increasingly variable rainfall predicted for this region based on downscaled climate projections (Figure 4.1 and Box 4.1). Umnga is a *Xhosa* term used to refer to *Vachellia karoo*. Box 4.2 contains a summary of the storyline and Appendix 1 contains the full version of the story.

Box 4.2 Summary of Scenario 1, 2050: Umnga Everywhere

Trends that began more than 50 years ago, in the early 2000s, have continued into the present. *Umnga* has taken over old fields and is now woodland that surrounds the village of Fairbairn. Only a handful of people continue to cultivate their land, while others have moved on to other activities. Food security is a concern for everyone in the village. The biggest worry today, in 2050, is the unpredictability of the rainfall. For example, this year although the Department of Agriculture predicted normal to above normal harvests for the province of the Eastern Cape, in Fairbairn extreme heat and very little rainfall have affected the harvest badly. This kind of thing has become common over the past 20 years, where rainfall predictions do not mean much to local farmers – they no longer pay any attention to official predictions, and have come to rely more on their own local knowledge. This year, harsh climatic conditions have created cracked earth and maize (corn) is drying from the bottom up. Local farmers believe that the drought will continue into next year. Since 2020, the government has been implementing their Rural Modernisation Programme (RMP). Over the past 30 years, there has been massive investment in rural development by the government. Importantly for Fairbairn, the government committed funds to open a tarred road that links Fairbairn with the R63, which leads to the town of Fort Beaufort. The R63 has also been upgraded, and an abattoir that services the whole province has been built in Fort Beaufort. There are now regular livestock collection trucks that take Fairbairn stock to the market in Fort Beaufort. This has left small stockholder farmers smiling as it has made the market more accessible.

Urban Future storyline

The Urban Future storyline was developed using an alternative technique, which was intended to explore extreme outcomes, not just the predictable ones (Wollenberg et al. 2000b). This narrative included extreme outcomes such as the removal of social grants and extreme climate temperatures (Box 4.3). I developed this storyline in order to understand how different groups within the community see the possibility of these potential drivers by 2050, and how they think they would respond. This approach was used to broaden the community's thinking about the future by exploring a wide range of issues (Wollenberg et al. 2000b, Chirozva et al. 2013), and to help the researcher better understand locally acceptable coping and adaptive responses.

Box 4.3 Summary of scenario 2, 2050: Urban Future

Over 2.1 million people in the Eastern Cape Province are in need of emergency food aid. This figure might rise to 5 million in 2051 unless the international community steps up with donations. Like other parts of the province, over the past 20 years, the Fairbairn community has suffered from severe weather conditions but the drought of 2050 is likely to be one of the worst in recent memory. Frequent heat weaves, low temperatures in winter, and loss of surface water have quickened food insecurity. To add on to these difficulties and uncertainties affecting the rural poor, pro capitalist policies that began way back in 2030 resulted in the cancellation of social grants by government. The current tragedy has been exacerbated by maladministration within government, a lack of skills and low levels of primary education within the community, mainly as a result of a failing school system. However, through these seemingly dark times, non-governmental organizations (NGOs) have played a major role in developing household resilience and their ability to cope with the uncertainty that they face. Extreme weather conditions have been the norm for the past two decades, making livelihood diversification mandatory for Fairbairn community members. An NGO called the Safety Net Programme: Failed Rain doesn't mean Failed Life" run adaptation programmes that help farmers adapt to the changing climate.

4.2.2 Stage 2: Organising and facilitating the participatory scenario workshop

Adopting Reed's et al. (2013) perspective of having different views and values in a scenario exercise, I organised a one-day workshop that included different stakeholders within the

village i.e. youth, elders, community leaders and rural extension service officers (Stage 2: Step 3).

The workshop had a total of eight older members of the community above the age of 45 and included five women and three males (referred to here as 'elders' to distinguish them from the community leaders). Nine youth attended the workshop; this included five women and four men. Four community leaders and three rural extension officers also attended the workshop (Stage 2: Step 3). I invited the same workshop participants who had participated in my PLA workshops and this ensured continuity (*refer to Section 3.2.4, Chapter 3*).

4.2.2.1 Step 3: Participatory discussion of the two scenarios

At the start of the workshop, which took place in February 2016, the role of scenarios as storylines that can help people to think and talk about the future was explained. It was stressed that the scenarios I was about to present were not 'true predictions', but only stories and that I wanted to hear their opinions on how plausible they were. Prior to sharing the actual storylines, the downscaled climate projections were explained to the community (Box 4.1). This was explained as being the only part of the stories that were based on scientific projections, but again the uncertainties inherent in these projections were explained. To facilitate discussion, the storylines for each scenario (Box 4.1 and 4.2) were read in *Xhosa*, one at a time. For each scenario the workshop participants were divided into three buzz groups (*refer to Section 3.2.4.1, Chapter 3*), i.e. elders, youth and community leaders to discuss the storyline. Each buzz group was given thirty minutes to discuss if they agreed with the given scenario in terms of how people would respond to the trends described. After thirty minutes, the buzz groups presented their discussion and this facilitated further discussions. These same steps were repeated for both storylines (Stage 2: Step 3). Flip charts were used to record the main ideas.

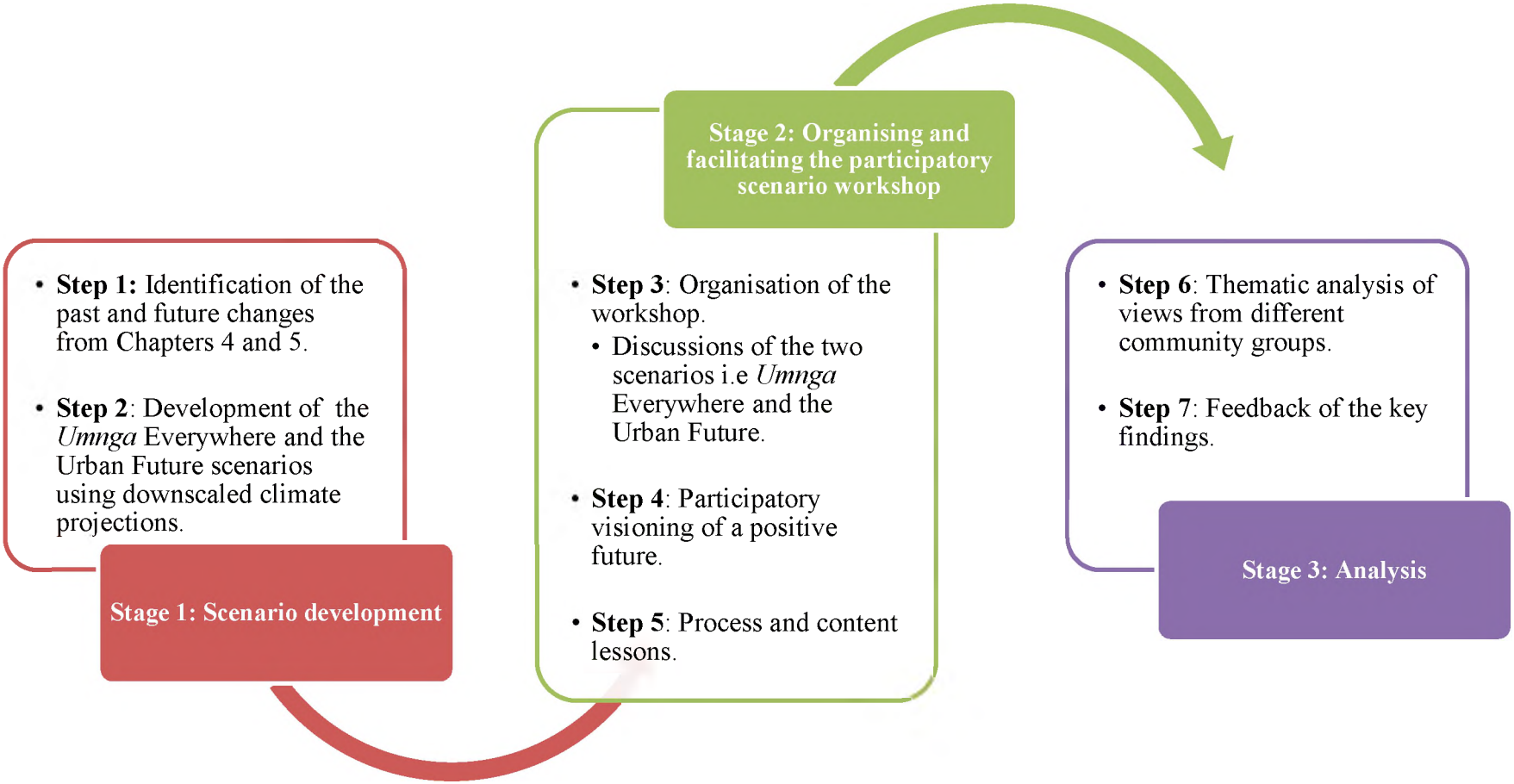

Figure 4.2 Sequence of methods in participatory scenario planning in Fairbairn village

4.2.2.2 Step 4: Participatory visioning of a positive future

Later on the same day, workshop participants were asked to envision a positive future (Stage 2: Step 4). In the visioning exercise, participants were asked to express their desires for the future. The visioning technique is useful in situations of high uncertainty and change (Peterson et al. 2003) because it enables people to articulate their hopes and build awareness about these (Wollenberg et al. 2000b). Workshop participants were asked to answer the following questions while envisioning a positive future:

- What kinds of livelihoods do you want in the future?
- How are you going to get there?
- What are the specific strategies recommended for achieving the desired future?

Workshop participants were once again divided into three buzz groups (*refer to Section 3.2.4.1, Chapter 3*) once again i.e. elders, youth and community leaders. Each group was given thirty minutes to develop their own desired plausible future. After thirty minutes, each group presented their envisioned scenario and further discussion was facilitated around each of these.

4.2.2.3 Step 5: Process and content lessons

Lastly, at the end of the workshop, participants were asked to share their personal reflections on the participatory scenario building process (Figure 4.2: Step 5). This is because one of my key questions centred on the value of a participatory approach to scenario development in supporting climate change adaptation. Each of the workshop participants were asked to reflect on lessons they had learned by being part of the day's workshop. Flip charts were used to record the main ideas.

4.2.3 Stage 3: Thematic analysis of the views from different community groups

After the workshop, I analysed the discussion about the scenarios based on the views of the different groups i.e. elders, youth and community leaders (Stage 3: Step 6). To clarify each storyline description and facilitate comparison, I broke down the scenarios and restructured them according to the main drivers and local responses associated with each one (Tables 4.1, 4.2 and 4.3). By doing so, I was able to identify key contrasts between views and the level of

agreement between groups for different aspects of each scenario (Enfors et al. 2008). Lastly, I presented the key differences that emerged from the participatory scenario planning at an *Imbizo* (community meeting, *refer to Section 1.1.4, Chapter 1*) in Fairbairn village in June 2016 and received feedback from the community (Stage 3: Step 7).

4.3 RESULTS

The first two sections of my results begin by reflecting on the ways in which different groups within the community responded to the scenarios that I developed out of Chapters 2 and 3 i.e. *Umnga* Everywhere and Urban Future. The third section compares and contrasts what different groups in Fairbairn village regard as the desired future. For the purpose of this chapter only, question three (what value does a participatory approach to scenario development add to climate change adaptation research?) will be dealt with in the discussion.

4.3.1 Community's perspective on the '*Umnga* Everywhere' scenario

While some of the key drivers and local responses in the *Umnga* Everywhere scenario were considered likely by participants, in some instances there was generally shared disagreement (Table 4.1). For example, while everyone agreed that increasing climate variability and bush encroachment, declining agriculture and increased emphasis on small stock were likely, all disagreed that new varieties of corn would become widespread (Table 4.1). The different groups differed however in their views on the future role of home gardens, outward migration, small businesses and moral decay in the future.

In terms of agreement, for example, all workshop participants strongly agreed that increasing climate variability and an increase in bush encroachment (*Vachellia karoo*) were likely changes under the *Umnga* Everywhere scenario (Table 4.1). All groups strongly agreed that unresolved land tenure will not only contribute toward field abandonment and therefore further bush encroachment, but that it would also exacerbate food insecurity by 2050, with one workshop participant going further and identifying an action that needs to be taken today to avoid this scenario;

With unresolved land tenure, we foresee most households being food insecure …Therefore we need to lobby for land redistribution…

As a result of unresolved land tenure and declining cultivation, community leaders and elders agreed with the idea that home gardening would likely become a coping strategy. Most

elderly women suggested that the idea of home gardening would enable household food security; however, the youth suggested that under this scenario, home gardening is likely to decline due to the expansion of retail vegetable supermarkets. Although the youth cited this as a reason, further probing revealed that the youth were pessimistic with the notion of continued farming. This explains why the youth agreed with the proposed coping strategy of migrating to bigger cities within the Eastern Cape Province as a form of livelihood diversification with one youth participant stating that:

....Us as the youth we see ourselves migrating from Fairbairn because farming is a risky business... we will seek greener pastures in East London, Port Elizabeth and other areas within the Eastern Cape region or beyond....

When asked why all groups disagreed with the notion of increased yellow corn distribution as a response to counter household food insecurity (Table 4.1), workshop participants explained that white corn is presently their staple food and therefore the introduction of yellow corn would be against their food preference. In terms of drivers and responses around which there was some disagreement, the views provided by different groups shed light on the diversity of local views about the future. Both elders and community leaders disagreed with the idea that a key response to insecure tenure, bush encroachment and other drivers in this scenario would be outward migration, while the youth agreed. On the surface, the elders even linked this idea of outward migration to laziness. Furthermore, the youth suggested that they foresee an increase in entrepreneurism and small-scale business, although neither of the other groups agreed with this. With regards to moral decay, both the community leaders and elders expected to see an increase in moral decay with one of the community leaders stating that:

...we see alcohol abuse being rife in Fairbairn by 2050, the youth will lose their roots during the Umnga Everywhere scenario, and especially those that do not want to do physical or manual work....Ubuntu will be lost for sure!...

Table 4.1 Level of agreement on key drivers and responses as discussed in the **'Umnga** *Everywhere' narrative*

Key drivers and responses in the scenario	Youth	Elders	Community Leaders	Total level of agreement **(Column 2+3+4)**
Increase in climate variability	**+1**	**+1**	**+1**	**+3**
Increase in bush encroachment	**+1**	**+1**	**+1**	**+3**
Decrease in yield from arable agriculture	**+1**	**+1**	**+1**	**+3**
Increase in home gardens	**-1**	**+1**	**+1**	**+1**
Increase of small stocks	**+1**	**+1**	**+1**	**+3**
Increase in the distribution of yellow corn	**-1**	**-1**	**-1**	**-3**
Massive outward migration of people	**+1**	**-1**	**-1**	**-1**
Increase in developmental projects	**-1**	**-1**	**-1**	**-3**
Increase in entrepreneurism and small-scale business	**+1**	**-1**	**-1**	**-1**
Decrease in moral decay	**+1**	**-1**	**-1**	**-1**

Notes: +1 (Agree), -1 (disagree) and 0 (neutral)

The other side of the coin was however, that the youth agreed that it was possible that maladministration and corruption will increase as suggested by the *Umnga* Everywhere scenario (Table 4.1). When asked why they foresee an increase of corruption and maladministration, the youth explained, "most agricultural projects in the area have failed because of corruption and maladministration (for example HACOP, *refer to Chapter 3*) therefore we foresee this being the norm in the future and this might result in livelihood loss." In general, diversification of livelihood strategies appeared to be crucial to the youth whilst community leaders and elders disagreed that this would be a likely response and seemingly pinned their hopes on farming activities.

4.3.2 Community's perspective on the 'Urban Future' scenario

Out of seven key drivers and responses in this scenario, workshop participants strongly agreed on three, strongly disagreed on one and there were mixed feelings on the remaining three (Table 4.2). Overall, all workshop participants agreed that climate variability would increase, corruption was likely, food prices would increase and small stock numbers would increase under the *Urban Future* scenario (Table 4.2). The removal of social grants was included in this scenario as a key driver. While both elders and community leaders disagreed that this was ever likely to happen, the youth thought that it was possible. In particular, elderly women rigorously disagreed as compared to their elderly male counterparts. One of the reasons for this inability to foresee a future without social grants may stem from the fact that workshop participants explained that social grants were central to their wellbeing (*refer to Table 3.5, Chapter 3*). One elderly female participant mentioned that her income was completely dependent on social grants, and expressed the impossibility of imagining a future without social grants:

...it is very impossible for the removal of social grants; this is our only source of income...

When asked why the elders and the community leaders did not make any plans at all for a future without social grants, the ward councillor linked this to limited livelihood options and that the elderly generation has "so much faith" in the current ruling party. However, the younger generation suggested that social grants could be terminated in the future as government might fail to cater for the increasing population and basic service delivery. In order to avoid this future, the youth suggested they should embark on small businesses. The youth agreed that massive out-migration to urban centres, as envisioned in this scenario, was a possibility because of scarce livelihood opportunities in Fairbairn village.

Table 4.2 ***Level of agreement on key drivers and responses as discussed in the 'Urban Future' narrative***

Key drivers and responses in the scenario	Youth	Elders	Community Leaders	Total level of agreement **(Column 2+3+4)**
Increase in climate variability	+1	+1	+1	+3
Removal of social grants	+1	-1	-1	-1
Massive migration to urban centres	+1	-1	-1	-1
Increase in food prices	+1	+1	+1	+3
Increase in planting drought resistant crops	-1	-1	-1	-3
Decrease in small stocks production	+1	+1	+1	+3
Decrease in Home gardening	+1	-1	-1	-1

Note: +1 (Agree), -1 (disagree) and 0 (neutral)

The pursuit of better schools, health care, and business opportunities were the major concerns of the youth thus making the Urban Future possible from this perspective. This was contrary to the aspirations of the elders, who believed that the community leaders would bring development to the area. The elders did not see the urban future being possible by 2050.

All workshop participants strongly disagreed that the community would plant drought resistant crops under this scenario, arguing that this was unlikely because it did not meet their food preferences. Further probing revealed that not all workshop participants had adequate knowledge on which drought resistance crops to plant, thereby making the scenario unlikely. One of the areas covered in the scenario is related to water scarcity. With regards to water insecurity all groups suggested that they would likely embark on individually managed small-scale water technologies with one female participant stating that water harvesting techniques will enable households to cope with future anticipated water shortages.

In general, only the youth considered the Urban Future to be plausible, with the community leaders and elders disagreeing with the scenario. With regards to the removal of social grants, both elders and community leaders disagreed that this was likely to ever happen, while the youth thought that it was possible. Small-scale water harvesting techniques were suggested as a potential response to water insecurity; however, workshop participants did not have any knowledge on which drought resistant crops to plant.

4.3.3 Community's vision of a positive future

The three groups each developed their own visions of the future in response to the question: what does a positive future look like in Fairbairn? Interestingly, the groups found it much easier to explain strategies or adaptation practices than they did drivers of change. When the three visions were looked at collectively, four dimensions of desired livelihood activities that featured in some way in all three visions could be discerned, namely new ways of energy generation, new ways of farming, entrepreneurship development and better environmental management (Table 4.3). The youth mainly emphasised entrepreneurship and new ways of farming whilst the older generation focused almost entirely on new ways of farming. All workshop participants had positive visions of the future and envisioned a food secure village. In order to achieve this vision by 2050, all groups suggested the need for new and better ways of farming, although the elders and community leaders placed greater emphasis on this.

Table 4.3 Discussion on livelihood development strategies recommended in the Visioning discussions

Desired livelihood	Youth strategies	Elders' strategies	**Community leaders' strategies**
New ways of farming	• Livestock improvement programme • Land redistribution • Conservation agriculture • Training of youth farmers	• Land redistribution • Revival of HACOP • Small-scale irrigation • Home gardening projects	• Land redistribution • Marketing of small grains • Conservation agriculture
New ways of energy development	• Solar energy project	• Lobbying the government	• Lobbying the government
Entrepreneurship development	• Life orientation skills programme • Opening of small-scale business • Commercialisation of fuelwood	• *Not mentioned*	• Lobbying the government
Better environmental practice	• Education • Youth participation in the green economy	• Education	• Education

Conservation agriculture was seen by the community leaders and the youth as a key pathway to ensuring food security in the area under a changing climate (Table 4.3), while the elderly women suggested that there was a need for conservation agriculture to boost home garden produce. All groups mentioned that in order to achieve this, there was a need for land redistribution, as most households do not have security of tenure. All groups agreed that being open to new technologies is a proactive solution in ensuring a food secure village. The youth suggested the need for a livestock improvement programme (Table 4.3) that could benefit the youth through the commercialisation of small stocks (sheep and goats). Bringing multiple stakeholders together for this discussion proved useful, as the agricultural extension officers suggested that:

...the idea was brilliant in securing sustainable livelihoods in the area, and the Mpofu Agricultural centre is ready to help the community...

The revival of Hertzog Agricultural Co-operative HACOP (*refer to Section 1.2.3, Chapter 1*) was suggested as one of the key strategies that would enable the community to be food secure by 2050. One of the former HACOP leaders suggested that:

...the revival of HACOP will be beneficial to all community members, as it will empower members who are interested in agricultural activities; we need to revive our old agricultural culture to ensure that by 2050 all of us would be food secure...

All workshop participants' envisioned an energy secure village by 2050 (Table 4.3). The younger generation advocated solar energy. The youth were quite passionate about the investment in solar energy, seeing such an initiative as a means of empowering the youth through training and job creation, with three youth participants explaining that it would be wise for the community to invest in solar energy. Further probing revealed that some of the youth had acquired this idea from the media. Furthermore, the youth envisioned that by 2050, most of the youth would be formally and informally employed and the rates of unemployment would have declined. To achieve this vision youth suggested the need for life orientation skills training. The youth were mainly interested in off-farm activities. With regards to entrepreneurship development, the elders didn't mention any strategies, whilst the community leaders suggested that only the government would provide the jobs for the youth. All workshops envisioned a better educational system within the area (Table 4.3).

In general, workshop participants found it easy to envision a positive future. Workshop participants identified four big dimensions of livelihood contained in Table 4.3. With regards to new ways of farming, all groups mainly focused on village level initiatives as likely strategies. Although the youth did not appear to have a strong interest in systems of local production, the youth recommended the training of youth in farming, showing that there is a possibility for involving them in farming. In terms of entrepreneurship development, the youth suggested the need for livelihood diversification through the opening of small-scale businesses and commercialisation of fuelwood, whilst the elderly did not envision this. This might suggest that rural livelihoods are likely to be off-farm orientated by 2050. In terms of ensuring better environmental practices, all workshop participants suggested that education was a likely strategy. Lastly, the participatory scenario approach had the potential of helping the community members to become the custodians and drivers of future climate change adaptation interventions.

4.4 DISCUSSION

This chapter explores future scenarios in the community of Fairbairn for adaptation to current and future change including climate change. Through workshop dialogues and deliberations, participants navigated different potential future changes, from one dominated by bush encroachment (*Umnga* Everywhere), to one dominated by mass urbanisation (Urban Future), and three positive visions of the future developed by workshop participants themselves. The scenario process highlighted the differences between the views of the youth and the elders (including community leaders), both in terms of what they regarded as a plausible future, and in terms of their own visions for the future. Some distinct differences included the fact that the youth did not appear to have a strong interest in agriculture in the future while the elders did, and whilst the elderly could not conceive of a future without social grants, the youth considered this a possibility. With regards to the visioning scenarios, workshop participants recommended different strategies and likely responses for ensuring their desired future by 2050. Some of the strategies included better ways of farming, training of youth farmers and entrepreneurship. The youth mainly envisioned an off-farm orientated future whilst the elderly envisioned a future with continued agricultural activities. Lastly, workshop participants described the scenario planning approach as a method that enabled people to identify and avoid undesirable futures.

The youth were much more open to diversified and even very different forms of livelihood strategies in the future, whilst community leaders and elders remained firmly attached to farming activities. Reasons given behind livelihood diversification by the youth were a) participants viewed arable farming as a risk, due to climate variability and b) on-farming activities were said to be less profitable compared to off-farm activities. Given these reasons by the youth, the question now becomes, does the focus on agriculture alone as suggested by the elderly offer the potential for greater food security? Firstly, given the issue of unclear land tenure (*refer to Section 3.3.1.4, Chapter 3*) and anticipated climate variability (*refer to Figure 4.2, Chapter 4*), focus on agriculture alone might not offer greater food security because insecure land tenure might restrict households' access to both the land and credit that are required for improved land practices. Secondly, continued climate variability might result in crop failure thereby increasing vulnerabilities for households that solely focus on agriculture. Likewise, failure of short and long-term rains have the potential of affecting household food security. Therefore focusing on agriculture alone might be maladaptive in the long run, and diversification of rural livelihoods presents an opportunity to overcome short and long-term shocks (Shackleton and Luckert 2015).

Although the youth suggested new ways of farming, it appears as if the youth do not have a strong interest in systems of local production and prefer the idea of working in permanent and casual employment. This has also been observed by other authors in the Eastern Cape Province (Hebinck and Lent 2007, Shackleton and Luckert 2015). However, in digging deeper, the visioning scenarios revealed that agriculture could be made more appealing to the youth, with the right kinds of measures and support. Firstly, there might be a need to give the youth a chance to offer their opinions and experiences in village level agricultural initiatives. Secondly, there might be a need for the formulation of pro-youth policies that fit with the aspirations of the youth. For example, the [3]Agricultural Sector Education Training Authority (AgriSETA) of South Africa might expand its outreach programme to train the youth in Fairbairn village. This might be achieved by providing the right kinds of training at village level as suggested by the visioning scenarios. Although the youth preferred and envisioned off-farm orientated livelihoods, my research shows that there is a potential to attract young people to local agricultural production. Therefore, it is essential to note that the youth are an important key stakeholder group in successful adaptation, and how the youth understand and

[3] AgriSETA promotes opportunities for social, economic and employment growth for agri-enterprises through relevant, quality and accessible education, training and development in both primary and secondary agriculture, in conjunction with other stakeholders in agriculture

engage with both agriculture and climate change is a critical aspect of how the response to climate change will be determined and implemented in the future.

Another important issue that emerged from the workshop discussion was that the community leaders and the elders could not conceive of a future without social grants. On the surface such a reliance on government social grants shows that, for rural communities to cope with a changing climate, government social grants are an important integral component for future rural livelihood systems (*refer to Section 2.3.1, Chapter 2*). One reason behind this might be a high dependency on government social grants; grants are crucial to allowing people to purchase food. As highlighted in Section 3.3.2, Chapter 3, arable farming has significantly declined in Fairbairn village since the 1960s, and social grants are crucial to ensuring household food security. The question now becomes: what might this high dependence on social grants mean about vulnerability in the future? Given the complex and multidimensional issues at play in Fairbairn, there is no straightforward answer. Firstly, heavy dependence on social grants could increase vulnerabilities to change in that it may supress household innovativeness to introduce new livelihood strategies. Secondly, it might further depress local agricultural production (Shackleton et al 2013) because households are likely to prefer purchasing food. Thirdly, it might narrow household livelihood portfolios because government social grants are a reliable monthly income, therefore this might result in households not expanding their livelihood strategies. Bank and Minkley (2005) suggest that government social grants alone are unable to change people's lives; therefore, government social grants would likely need to be merged with other responses such as better education and better business opportunities in order to avoid maladaptation.

Given a future under climate change and contextual issues such as tenure insecurity, workshop participants suggested that home gardens would likely become a coping strategy. Therefore it is not surprising that there has been a significant increase in home gardens since the 1960s (*refer to Section 3.3.2, Chapter 3*). Workshop participants, particularly the elderly, revealed that given trends of land tenure insecurity, home gardens appear to be a viable and sustainable option in the face of increasing climate variability and land tenure insecurity. Further deliberations revealed that home gardening has the potential of addressing future food insecurity, in that households can participate in home gardening in order to supplement their household food basket (Shackleton and Luckert 2015). More so, home gardening might be an important coping strategy in that it reduces household expenditure on retail food (Hebinck

and Lent 2007) and might be a viable option in reducing future vulnerability (Adekunle 2013).

4.4.1 Reflection on the use of a participatory approach

Workshop participants described the participatory scenario approach as a method that helped to identify and avoid undesirable futures. As one participant put it, "the process of participatory scenario planning has made me understand that we can create problems through poor planning and also we can solve those problems we created as a community." These findings are in agreement with several other studies (Enfors et al. 2008, Chirozva et al. 2013, Raford 2015) that used the participatory scenario approach. This reaffirms the suggestion that participatory scenario planning helps rural communities to see what can be done today to make a better future for themselves and this is important in climate change adaptation research (Wollenberg et al. 2000a).

In this study, youth participants observed that the participatory scenario planning was useful in solving some of the misconceptions they had on community leadership. The youth claimed that the community leaders did not have their interests at heart because a) most community jobs such as research assistance work were allocated to the elderly and b) most projects such as HACOP mainly benefited the elderly (*refer to Section 3.3.1.4, Chapter 3*). The raising of such concerns by the youth resulted in community leaders acknowledging their shortcomings, which led community leaders to ask the youth to select a representative to be part of the ward development committee. Such comments show that the scenario-planning workshop appeared to have helped 'mend bridges' between the youth and the rest of the community. This reaffirms that this approach gives voice to diverse perspectives and this is one of the major goals of scenario planning (Peterson et al. 2003).

Learning about change has become important in the fields of climate change adaptation and resources management (Folke et al. 2005, Cundill et al. 2014) and from my Fairbairn experience, the scenario approach offered a useful platform to learn more about complex problems, including climate change issues. Elderly participants found this approach to be a learning exercise with some mentioning that it was their first time to learn about climate change issues. Others suggested that having this climate information (*refer to Figure 4.1, Chapter 4*) at their disposal would help them adapt and plan for a changing climate. Furthermore, participants also discussed the need to adopt both short and long-term plans and visions for ensuring household food security. Such sentiments suggest that participatory

scenario planning may hold value in enhancing learning for adaptation (Butler et al. 2014). Furthermore, the participatory scenario approach provides a platform of bringing together traditional ecological knowledge and Western knowledge. Failure to recognise different sources of knowledge greatly affects learning (Keen et al. 2005). Given more time, the workshops might possibly have led to a shared vision, since giving different diverse perspectives of climate change adaptation is the main purpose of participatory scenario planning (Peterson et al. 2003). Therefore, scenario planning is pivotal to improving understanding and securing common ground for different groups within rural communities (Beach and Clark 2015). This may have contributed to why participants found it easy to recommend specific strategies (adaptation strategies) for ensuring a desired future in the visioning scenarios (*refer to Table 4.3, Chapter 4*).

Two key challenges experienced were a) a lack of precise terminology causing problems when discussing different scenarios and b) continuity of participants. In terms of defining key terms, the elderly had difficulties in fully conceptualising the term *scenario* in Xhosa (the local indigenous language) and interpretation of the word differed. Furthermore, the definition of *scenario* differed between different groups as a result of differing status and professions. More so, this resulted in the domination by community leaders as they presumed themselves to have a better understanding of the process. One of the community leaders interrupted one youth presenter as he was presumed to have failed to define and explain the *Umnga* Everywhere scenario. This is similar to the findings of Butler et al. (2015), who suggested that diversity of stakeholders and their inherent power dynamics could also present challenges. The second challenge, continuity of the workshop participants, was problematic especially with community leaders. The community leaders were busy preparing for the 2016 local municipality elections at the time of the participatory scenario workshop. Therefore, most of them had to leave shortly before the end of the workshop. It is important to note that participation was voluntary (*refer to Section 1.4.4, Chapter 1*). These processes linked challenges encountered in the Fairbairn experience and mirror the findings of Enfors et al. (2008) as well as Beach and Clark (2015).

Most participatory scenario studies (Enfors et al. 2008, Chirozva et al. 2013, Raford 2015) suggest that workshop participants frequently complain that the participatory scenario process is a bit lengthy. However, in Fairbairn village, workshop participants described the process as "interesting, worthwhile and short". This finding might be as a result of the fact that a) the community of Fairbairn might be motivated by research work as previous research work has

managed to bring about community development through the building of a bridge (*refer to Section 3.3.1.4, Chapter 3*) and b) the workshop was very short. Although workshop participants found the workshop to be short, this also has its own weakness. The institutional building, breaking down of barriers, relationship building and concrete planning parts of participatory scenario planning could not be adequately covered in such a short period.

4.5 CONCLUSION

This study highlights the importance of considering quite carefully whose voice is prioritised when planning for the future; different groups within this workshop had different perspectives concerning the future. One major issue highlighted from this study was that the youth mainly envisioned a future that is off-farm orientated, whilst the elderly mainly focused on new ways of farming. Although the youth mainly envisioned an off-farm orientated future, my study highlights that there is a potential to attract the youth into farming activities. Hence, my findings support the view that effective engagement of specific target groups within a community is an important aspect of climate change adaptation research and the youth are a key stakeholder in successful adaptation planning. This process revealed that the government has a major role to play in the adaption process, not only through farming inputs, or extension services, but also through land restitution. With regards to methodological reflection, the storylines did help the community to better understand local social-ecological systems and uncertainty. This demonstrates that the participatory scenario approach can be used in local climate change adaptation research and has the potential to increase understanding of challenges and opportunities faced. Future studies may consider planning for longer-term engagements than the one-day workshop conducted here in order to generate the potentially deeper impacts of the participatory process.

CHAPTER 5: CONCLUSION AND IMPLICATIONS OF FINDINGS

"The future belongs to us, because we have taken charge of it. We have the commitment, we have the resourcefulness, and we have the strength"- Ellen Johnson Sirleaf

5.1 INTRODUCTION

Given that much of the data have already been discussed in Chapters 2, 3 and 4, this chapter seeks to bring together and summarise the key findings in relation to the overarching objectives and propositions as outlined in Section 1.1.3, Chapter 1. I highlight the key implications of the findings and make recommendations for future livelihoods, policy, institutional capacity building, and rural development in Fairbairn Village and the Eastern Cape Province more generally. The last section presents concluding remarks.

An integrated conceptual framework was developed in order to help understand interactions and synergies between drivers of social-ecological change and their impacts on livelihood opportunities (*refer to Figure 1.5, Chapter 1*). In this, I highlighted that social-ecological systems are complex adaptive systems, for which there are no simple solutions to challenges. Furthermore, my study acknowledged that "having a memory" is one key dimension of complexity (*refer to Chapter 2, 3 and 4*) meaning that, understanding both past (*refer to Chapter 3*) and present experiences (refer to *Chapter 2*) is important in livelihood analysis. This therefore helped me in understanding how the community of Fairbairn make a living in their local settings. This study has therefore expanded on the work of other scholars who suggest that social-ecological thinking is important in understanding linked dynamics of environmental and societal change (Fischer et al. 2015).

5.2 THE ROLE OF NATURAL RESOURCE PRODUCTS IS DECLINING

In the introduction (*refer to Section 1.1.3, Chapter 1*) to this study, it was proposed that "the use of natural resource products and their role in rural livelihoods is declining as communities modernise".

The findings from Fairbairn village show that this proposition is largely not applicable. Instead they suggest that natural resource products continue to be key to people's livelihoods, demonstrated by the high levels of use, sale and diversity of products used by households *(refer to Section 2.3.3, Chapter 2*). Furthermore, this importance might continue in the near future as suggested by participatory scenario deliberations (*refer to Section 4.3.3, Chapter 4*). The proportion of households utilising natural resource products has remained fairly constant over the past fifteen years. However, there were some changes in use, with some products being disposed of while others were added to the livelihood portfolio. Other changes included

increases in the mean amounts collected for some of the products such as fuelwood and river sand. For example, the daily use of fuelwood has increased over the past fifteen years (*refer to Section 2.3.3.1, Chapter 2*) despite modernisation through rural electrification (*refer to Section 3.3.1.4, Chapter 3*). This highlights the continued importance of effectively free or low cost fuelwood in rural energy systems. Interestingly, changing life styles linked to modernisation were mentioned as some of the drivers related to the increased use of river sand over the past fifteen years, hence contrary to my proposition. Households in Fairbairn village have shifted from building traditional rondavels to modern cement brick houses, thus resulting in the increased use of river sand. Another change which suggest a diminishing role for some more traditional products, is the declining proportion of households collecting and using mushrooms, bush meat, wild herbs, prickly pear and *Imula*. This significant shift might be linked to, for example, changing diets, loss of local ecological knowledge (*refer to Section 2.3.2, Chapter 2*), high reliance on purchased food, a decline in field cultivation and availability of wild herbs, and the increasing importance of home gardens (*refer to Section 3.3.3, Chapter 3*). These findings support the expectation that both local and external drivers influence patterns of resource use and ecosystem dynamics as highlighted by the integrated social-ecological systems model that was used to frame this study (*refer to Figure 1.5, Chapter 1*)

Furthermore, the study demonstrated that despite modernisation over the past fifteen years, commercialisation trends for certain products have increased in the area (*refer to Table 2.4, Chapter 2*) in response to a lack of employment opportunities, the need to augment inadequate household income and the expansion of social grants markets (*refer to Section 3.3.3, Chapter 3*). There is further indication that this pathway is likely to continue in the near future (*refer to Section 4.3.3, Chapter 4*) as highlighted by the envisioned scenarios. This finding is similar to those of Shackleton and Shackleton (2004) who conclude that increasing commercialisation trends might be a response to limited alternative strategies. Natural resource product commercialisation can therefore be regarded as a form of livelihood diversification (Shackleton et al. 2002; 2015, Paumgarten and Shackleton 2011, Shackleton and Gumbo 2010, Shackleton et al 2015).

5.3 THE ROLE OF ARABLE AGRICULTURE IS DECLINING AND HOUSEHOLDS HAVE BECOME RELIANT ON OTHER LIVELIHOOD SOURCES

Evidence from this study supports the second proposition that was posed for this study, namely, "arable agriculture, as in other parts in the Eastern Cape, is declining and rural households have become reliant on other livelihood sources as proposed by Bryceson (2004) with her concept of "deagrarianisation". For example, arable agriculture has declined over the past forty-five years in Fairbairn village (*refer to Section 3.3.2, Chapter 3,*) and rural households have adopted multiple livelihood strategies (*refer to Section 3.3.3, Chapter 3),* as in other parts of the Eastern Cape (Shackleton and Luckert 2015). The results also demonstrate that although arable agriculture has declined, there has been a corresponding increase in the number of home gardens. The results suggest that this shift is the result of a combination of social-economic and environmental factors which have interacted in a complex manner (*refer to Section 3.3.1, Chapter 3)*, as reflected in the IPBES conceptual framework, which emphasises how historical, political and economic processes play a pivotal role in ecosystem and social dynamics at the local level. Insecure land tenure, lack of government support and climate variability were frequently pronounced as major catalysts pushing the decline of arable agriculture and the increase in home gardens over time (*refer to Figure 3.3, Chapter 3,*). Given the decline in extensive arable agriculture, the question now becomes "will this land use trajectory increase vulnerabilities and food insecurities in the future?". A combination of high reliance on purchased food and projected food price increases with the impacts of climate change worldwide (Timmernas 2004) might increase the vulnerability of households in the future.

Given the decline in extensive arable agriculture, this study suggests that rural livelihoods have diversified, and in that diversification there have been noticeable switches over the past twenty-five years (*refer to Section 3.3.3, Chapter 3*). For example, prior to 1994 (democratic elections), households in Fairbairn largely received their income from formal employment as farm workers, however post-1994, social grants formed the largest percentage share of livelihood income (*refer to Table 3.5, Chapter 3*). Again evidence from my study supports the widely held view by other studies that the contribution of social grants has become increasingly important as other income sources (e.g. sale of livestock, remittance from migrant workers and formal employment) have declined over time (Neves and du Toit 2013, Mjoli and Shackleton 2015) (*refer to Table 3.3, Chapter 3*). This mirrors Bryceson's (2004) work that rural households have become reliant on other livelihood activities with the decline in extensive arable agriculture, however the results do not fully support Bryceson's notion of deagrarianisation as households continue to keep livestock and food gardening has increased,

indicating continued links with the land. These findings also fit with the customised SLF framework provided in Chapter 1, which illustrates how rural livelihoods are built from multiple and diverse activities and sources of income.

5.4 POTENTIAL FUTURE LIVELIHOOD PORTFOLIOS AND PATHWAYS ARE DIVERSE

The results from this study show that proposition III which argues that "future livelihood portfolios and pathways are viewed differently by different groups in the community and could take several directions and trajectories, adding to the uncertainty delivered by climate change" is largely true. Future livelihood portfolios are likely to be divorced from local production patterns (*refer to Section 4.3.3, Chapter* 4) in response to declining agriculture (*refer to Section 3.3.2, Chapter 3*), although natural resource product gathering and commercialisation will remain important in the foreseeable future (*refer to Section 2.3, Chapter 2*). One key highlight that emerged from this research concerning future livelihood portfolios and pathways is that it matters 'whose eyes we use' when considering how the future might unfold. The youth have different perspectives from the elderly. The youth highlighted that future livelihood portfolios and pathways are likely to become more off-farm oriented. This supports the widely held view that the youth are less enthusiastic about local production than the older generation (Shackleton et al. 2013b). Although the youth focused on off-farm oriented livelihoods and pathways, one encouraging view that emerged from the participatory scenario workshop with the youth was that agriculture could be made more appealing to the youth, with the right kinds of measures and support. Such initiatives might be critical in enhancing future household food security under a changing climate. Therefore planning for the future must engage a variety of age groups within the community.

Another important issue that emerged from the workshop discussion was that the community leaders and the elders could not conceive of a future without social grants (*refer to Section 4.3.3, Chapter 4*). Elderly participants stressed their dependence on grants as their only source of income. This heavy dependence shows that social grants will remain important in the near future and that they play a pivotal role in reducing vulnerabilities and food insecurity. On the other hand, such dependency on external support could increase vulnerabilities to change, by for example: a) depressing innovation (e.g. from my workshop discussions and deliberations the elderly did not have any other suggestions of livelihood diversification apart from state welfare; b) suppressing productive activity (e.g. most

households suggested that because of income from state welfare, it was easiest to buy retail food, thereby de-incentivising arable agriculture); and c) narrowing the livelihood portfolio (Shackleton and Luckert 2015). Therefore, this study supports, or at least acknowledges, the claim on page 10 of this thesis, which states that the complex interactions of different components of the social-ecological system may give rise to emergent properties. These emergent aspects cannot be explained or predicted by the properties of individual components of the system on their own.

5.5 POLICY IMPLICATIONS OF THE FINDINGS AND RECOMMENDATIONS FOR SUSTAINABLE RURAL LIVELIHOODS IN THE EASTERN CAPE REGION

5.5.1 Commercialisation of natural resource products and their sustainable use

This study suggests that the commercialisation of natural resource products will continue in the near future. Given the cash constraints facing most rural households, my results indicate that the sale of natural resource products can generate income to sustain households. For this to continue in the near future, new markets must be accessed and this also includes urban markets. However, the increased dependence on these products might result in the depletion of these resources. This therefore calls for policies that seek to promote sustainable trade of natural resource products (Shackleton and Gumbo 2010). This may be achieved by the strengthening of local institutions and capacity building for local communities to best manage their own resources. For example, capacity building through skills development training workshops that introduce the community to sustainable management of natural resource products, is needed (Shackleton 2009).

Evidence from my study shows that rural households in Fairbairn village continue to make use of different wild fruits and vegetables *(refer to Section 2.3, Chapter 2*). My study highlights that these wild foods and fruits are important for several reasons. First, some of the wild fruits and vegetables continue to add significantly to the diversity of the diet (e.g. wild vegetables and prickly pear). Second, others are regarded as traditional and cultural foods and juice (e.g. *Imula* and bush meat). Third, wild vegetables grow spontaneously without any input, care or costs. Considering the benefits mentioned, natural resource products have the potential to contribute to food security and better nutrition in Fairbairn village. Therefore there is a need to promote wild foods through information and education within school curriculums and clinics (Shackleton and Gumbo 2010, Vinceti et al. 2013); this could also be

promoted through popular and social media (Shackleton et al. 2015b). In addition, much remains to be understood in quantifying the role of natural resource products in food security, nutrition and dietary diversity, and this should be a focus of future research (Vira et al. 2015).

5.5.2 Land tenure, farming and food security

Unclear land tenure was one of the key drivers behind declining extensive agriculture (*refer to Section, 3.3.1.4, Chapter 3 and Section 4.3, Chapter 4*), therefore calling for the resolution and clarification of land rights. However, it is important to note that secure land tenure alone is unlikley to promote extensive arable agriculture in the area. Therefore, other multi-faceted strategies could be utilised, including revitalisation of HACOP and the irrigation scheme (*refer to Section 3.3.1.4, Chapter 3),* and linking smallholder farmers to local markets and cooperatives. These multi-faceted strategies are explained below. As highlighted by Nel and Hill (2000; *refer to Section 3.3.1.1, Chapter 3*), the Kat River is one of the most reliable rivers in South Africa, encouraging the revitalisation of the irrigation system, which is essential for the success of HACOP. Government and other relevant stakeholders should therefore revitalise the irrigation scheme in Fairbairn village, as it likely to play an important role in the resurgence of extensive arable farming. Such initiatives have the potential to increase the level of both household and community food security. Nevertheless, access to irrigation alone is not enough to significantly improve rural livelihoods, therefore the second multi-faceted strategy, as described above, of linking of smallholder farmers to local markets and cooperatives, should also be utilised. Given that most food is now purchased (Hebinck and Lent 2008, Shackleton and Luckert 2015) there might be an opportunity for local smallholder farmers to offer their produce to local customers as opposed to centralised markets such as retail markets. This requires market information systems that can be disseminated, by radio or by weekly pamphlets, by local leaders or Local Economic Development officials (Shackleton et al. 2015b). Furthermore, linking smallholder farmers to government procurement programmes (such as school feeding programmes) could have the potential of creating employment.

5.5.3 Support for home gardens

Given the decline in extensive arable farming, the growing trend towards home gardens also requires support. Drawing on the different benefits of home gardening, as mentioned in Chapter 3, the potential exists of improving future household food security and livelihoods. As highlighted by the study of Brooks (2016: *unpublished thesis*) in Fairbairn village, a well-

developed home garden contributes significantly to daily food needs, which has the potential of reducing reliance on purchased food. Therefore rural households need capacity building in methods that help maximise outputs from home gardens. This can be achieved through the promotion of conservation farming. Conservation farming promotes increased productivity, adaptability and resilience of food systems in the face of climate change (Mazvimavi and Twomlow 2009, Corbeels et al. 2015). Interventions such as vegetative contours, soil enriching crops and diversification of crops are needed to enhance home gardening in Fairbairn. However, for conservation farming to succeed in Fairbairn village, social transformative thinking by individual households is needed. As highlighted by Chapters 3 and 4, both the elders and the community leaders identify themselves as a farming or agrarian community, whilst much of the backyard land lies fallow; therefore there is a need to encourage households to use this available land. Farming for household consumption is not enough; a way of commercialisation of home garden products is needed to make it a viable livelihood option as highlighted by Maroyi (2013) in Zimbabwe. In addition, more research is required on home gardens in Fairbairn village so that their relevance to households can be constantly monitored and modified when necessary. My study is by no means a full assessment of home gardens as it was limited by time and resources.

5.5.4 Social grant system and livelihood diversification

Two interesting highlights that emerged from this study are that the elderly could not conceive of a future without social grants (*refer to Section 4.3.3, Chapter 4*) and that social grants form the largest percentage share of livelihood income (*refer to Section 3.3.3, Chapter 3*). Some commentators suggest that the grant system alone is unable to change rural people's lives (Maris 2011). Shackleton and Luckert (2015:1073) suggested, "social grants are neither permanent nor secure and are lost when the pensioner passes away or the child grows up". Such sentiments reflect that social grants will likely need to co-exist with other livelihood strategies i.e. sustainable commercialisation of natural resource products, small-scale business entrepreneurship and better education. As highlighted in section 1.2.3, Chapter 1, less than ten percent of the people in Fairbairn village had completed matric (equivalent to General Certificate of Secondary Education) and no one was recorded as having a tertiary qualification. Such low levels of education might increase people's vulnerabilities, depress innovative thinking and reduce people's chances of obtaining formal employment. As suggested by the youth, it is difficult for the uneducated youth to get into the many lucrative niches available within the Eastern Cape Province. There is therefore a need to redouble

efforts in education, especially in the spheres of life orientation lessons for the unemployed youth and self-employment opportunities. As suggested by Ndlovu et al. (2012), the promotion of education is one key strategy that has the potential of reversing the negative impacts of social grants. In addition, training of the youth in entrepreneurship is needed.

5.5.5 Methodological contribution: participatory scenario approach

My study found that a participatory scenario approach could be used in local climate change adaptation research and has the potential to increase understanding of challenges and opportunities faced by rural communities (*refer to Section 4.3, Chapter 4*). However, the approach I developed faced some shortcomings. Here, I will highlight three recommendations that I consider most significant for a refined approach in other studies. Firstly, my workshop was a stand-alone, once-off event and this had its limitations (*refer to Section 4.2.3, Chapter* 4). Spending more time with workshop participants would have generated a more nuanced understanding of the resilience of future livelihood pathways. Therefore, I recommend that future researchers increase time spent on conducting the participatory scenario planning exercise (Wollenberg et al. 2000b). Secondly, important terms such as *scenario* and *uncertainty* must be clearly defined and understood by both researcher and workshop participants, before pursuing a participatory scenario approach. In addition, a one-day workshop should be conducted in order to explain the key processes and terms involved in the participatory scenario approach, before the start of the actual participatory scenario planning exercise. Furthermore, the creation of a glossary by the Environmental Science Department, Rhodes University, that explains key social-ecological terms in the local indigenous language (Xhosa), would be of great use. Lastly, one of the research goals of this study was to understand how drivers acting of different levels influence livelihood choices and pathways. During the workshop, the groups did not manage to address this goal as anticipated, even when directed by the workshop facilitator. This therefore calls for further research that assesses and refines the participatory scenario planning processes. One of the key questions that needs to be answered by future research is: "*can existing participatory scenario methods help both the facilitators and workshop participants understand the interaction of key drivers on different levels in a single scenario*"?

5.6 CONCLUSION

The themes of knowledge, scale, politics and dynamics offer an exciting and challenging agenda for research and practice to enrich livelihood perspectives for rural development into the future. This study has provided evidence that long-term processes of political, social and economic changes have shaped contemporary livelihoods and will continue to influence livelihood trajectories in the near future. Furthermore, livelihood and landscape changes in Fairbairn village are embedded within a history of direct state intervention and more recent improvements in basic service delivery. Therefore rural livelihoods and landscapes are as complex, fluid and dynamic as ever. Although rural livelihood and landscape strategies are continuously changing, the following question comes to mind; is everyone benefiting from these changes? Who does and why needs to be the focus for further research. As a closing note, it is important to remember that a "…social–ecological frame of analysis improves our understanding of the resilience of human–environment systems, and of complex multi-scale, multi-temporal environmental phenomena in multiple ways…in this type of inquiry, human–environment transactions are construed not as static notions of fit nor describable by structural (and determinate) governing equations, but as complex and dynamic processes of adaptation and counter adaptation…" (Stokols et al. 2013: *no pg. nos.*). This is a challenge that I hope I have unveiled in this study.

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Appendix 1: Consumer Price Index numbers

Table B – CPI headline

Table B1 - CPI headline index numbers[1] (Dec 2012 = 100)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1960	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5
1961	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5
1962	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5
1963	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5	1,5
1964	1,5	1,5	1,5	1,6	1,6	1,6	1,6	1,6	1,6	1,6	1,6	1,6	1,6
1965	1,6	1,6	1,6	1,6	1,6	1,6	1,6	1,6	1,6	1,6	1,6	1,6	1,6
1966	1,6	1,6	1,7	1,7	1,7	1,7	1,7	1,7	1,7	1,7	1,7	1,7	1,7
1967	1,7	1,7	1,7	1,7	1,7	1,7	1,7	1,7	1,7	1,7	1,7	1,7	1,7
1968	1,7	1,7	1,7	1,7	1,7	1,7	1,8	1,8	1,8	1,8	1,8	1,8	1,8
1969	1,8	1,8	1,8	1,8	1,8	1,8	1,8	1,8	1,8	1,9	1,9	1,9	1,8
1970	1,9	1,9	1,9	1,9	1,9	1,9	1,9	2,0	2,0	2,0	2,0	2,0	1,9
1971	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,1	2,1	2,1	2,1	2,1	2,0
1972	2,1	2,1	2,1	2,1	2,1	2,1	2,2	2,2	2,2	2,3	2,3	2,3	2,2
1973	2,3	2,3	2,3	2,4	2,4	2,4	2,4	2,4	2,4	2,5	2,5	2,5	2,4
1974	2,5	2,5	2,6	2,6	2,6	2,7	2,7	2,7	2,8	2,8	2,8	2,8	2,7
1975	2,9	2,9	2,9	3,0	3,0	3,0	3,1	3,1	3,1	3,1	3,2	3,2	3,0
1976	3,2	3,2	3,3	3,3	3,3	3,4	3,4	3,5	3,5	3,5	3,5	3,5	3,4
1977	3,6	3,6	3,6	3,7	3,7	3,7	3,7	3,8	3,8	3,8	3,8	3,9	3,7
1978	3,9	3,9	3,9	4,0	4,0	4,0	4,2	4,2	4,3	4,3	4,3	4,3	4,1
1979	4,4	4,4	4,5	4,5	4,5	4,6	4,8	4,8	4,9	4,9	4,9	5,0	4,7
1980	5,0	5,1	5,1	5,1	5,2	5,3	5,4	5,4	5,5	5,7	5,7	5,8	5,4
1981	5,8	5,9	5,9	5,9	6,0	6,1	6,2	6,3	6,5	6,5	6,6	6,6	6,2
1982	6,6	6,7	6,9	6,9	7,0	7,0	7,1	7,2	7,3	7,4	7,5	7,5	7,1
1983	7,5	7,7	7,7	7,8	7,9	7,9	8,0	8,1	8,1	8,2	8,3	8,3	8,0
1984	8,4	8,4	8,5	8,7	8,8	8,8	8,9	9,0	9,1	9,2	9,3	9,4	8,9
1985	9,5	9,8	9,6	10,1	10,2	10,3	10,3	10,5	10,6	10,7	10,9	11,1	10,3
1986	11,4	11,5	11,7	11,9	11,9	12,1	12,3	12,5	12,7	12,9	13,0	13,1	12,3
1987	13,3	13,5	13,7	13,9	14,0	14,1	14,2	14,4	14,7	14,8	15,0	15,1	14,2
1988	15,2	15,2	15,5	15,6	15,8	15,9	16,1	16,3	16,5	16,7	16,8	17,0	16,1
1989	17,2	17,4	17,7	17,9	18,2	18,3	18,5	18,8	18,9	19,1	19,3	19,6	18,4
1990	19,8	20,0	20,3	20,4	20,7	20,8	21,0	21,3	21,6	21,8	22,3	22,4	21,0
1991	22,7	23,0	23,1	23,5	23,8	24,0	24,3	24,6	25,0	25,4	25,7	26,0	24,3
1992	26,4	26,6	26,8	27,2	27,3	27,6	27,9	28,2	28,3	28,4	28,6	28,6	27,7
1993	28,9	29,0	29,4	30,1	30,2	30,4	30,6	30,8	30,9	31,1	31,2	31,3	30,3
1994	31,7	31,8	32,0	32,2	32,4	32,6	33,1	33,6	34,0	34,2	34,3	34,3	33,0
1995	34,8	35,0	35,4	35,8	35,9	35,9	36,1	36,2	36,2	36,3	36,5	36,7	35,9
1996	37,2	37,3	37,5	37,8	38,0	38,4	38,7	38,8	39,2	39,6	39,8	40,2	38,5
1997	40,6	40,9	41,1	41,5	41,7	41,8	42,2	42,2	42,5	42,6	42,5	42,6	41,9
1998	43,0	43,1	43,4	43,6	43,8	44,0	45,0	45,5	46,3	46,5	46,5	46,5	44,8
1999	46,8	46,8	46,8	46,9	46,9	47,1	47,1	47,0	47,1	47,3	47,4	47,5	47,1
2000	48,1	47,9	48,4	49,0	49,3	49,6	50,0	50,2	50,4	50,6	50,7	50,8	49,6
2001	51,5	51,6	51,9	52,2	52,4	52,6	52,6	52,5	52,6	52,6	52,9	53,1	52,4
2002	54,1	54,6	55,2	56,0	56,4	56,8	57,7	57,9	58,6	59,4	59,7	59,7	57,2
2003	60,3	60,2	60,9	61,0	60,9	60,7	60,7	60,9	60,7	60,3	59,9	59,9	60,5
2004	60,4	60,7	61,1	61,2	61,2	61,4	61,6	61,6	61,6	61,8	62,1	62,0	61,4
2005	62,2	62,3	62,9	63,2	63,2	63,1	63,7	63,9	64,2	64,2	64,2	64,2	63,4
2006	64,6	64,7	65,0	65,4	65,7	66,2	66,9	67,4	67,6	67,7	67,6	68,0	66,4
2007	68,5	68,4	69,0	69,9	70,3	70,9	71,6	71,9	72,5	73,1	73,4	74,0	71,1
2008	74,8	75,1	76,3	77,7	78,5	79,6	81,2	81,8	81,9	81,9	82,0	81,1	79,3
2009[2]	81,4	82,3	83,4	83,8	84,1	84,5	85,4	85,6	86,0	86,0	86,0	86,2	84,6
2010	86,4	87,0	87,7	87,8	88,0	88,0	88,5	88,6	88,7	88,9	89,0	89,2	88,2
2011	89,6	90,2	91,3	91,6	92,0	92,4	93,2	93,4	93,8	94,2	94,5	94,6	92,6
2012	95,2	96,7	96,8	97,2	97,2	97,5	97,8	98,0	98,9	99,5	99,8	100,0	97,8
2013	100,3	101,3	102,5	102,9	102,6	102,9	104,0	104,3	104,8	105,0	105,1	105,4	103,4
2014	106,1	107,3	108,7	109,2	109,4	109,7	110,6	111,0	111,0	111,2	111,2	111,0	109,7
2015	110,8	111,5	113,1	114,1	114,4	114,9	116,1	116,1	116,1	116,4	116,5	116,8	114,7
2016	117,7	119,3	120,2	121,2	121,4	122,1	123,1	123,0	123,2				

[1] Primary urban areas up to and including December 2008. All urban areas from January 2009. The series were linked so as to provide a continuous index.

Appendix 2: Participatory Learning and Action Techniques

This appendix provides detailed descriptions of the various techniques used throughout this research, in addition to the information provided in Chapter 1, and Chapters 3 and 4.

Exercise 1 – Buzz groups

Purpose: Identification of current livelihood activities

Materials: Flip chart, voice recorder, markers and colourful pens

Buzz group method: Organise the participants, composed of elders, males, female and young elders, into 2-3 per group

Prompt Questions

What are the current livelihood activities?

Exercise 2 – Ranking

Purpose: Ranking of livelihood activities

Materials: Flip chart, colourful markers, voice recorder and camera

Ranking method: All participants rank the current livelihood activities

Prompt Questions:

Livelihood	Reason
1	
2	
3	

Exercise 3 – Pie charts

Materials: Flip chart, coloured markers, voice recorder and camera

Pie chart method: All participants draw their own Pie charts

Prompt Questions

Imagine you have a cake shared among family members. The father gets the biggest slice followed by the mother and then the children. Portray in that manner, whether remittances are more important than social grants.

NB: First draw and show them what you mean. Then let them draw and they must explain what they mean.

Exercise 4 – Trend line

Purpose: For a particular important variable

Materials: Rectangular cards, colourful markers, stones, voice recorder and camera

Trend line method: Everyone participates

Prompt Questions:

How has the value of remittances changed over time?

How has the **availability** of **fuelwood, Acacia karoo, and grass** changed over time?

How has the number of fields harvested changed over time?

How has the **reliance** on **fuelwood** changed over time?

NB: Not more than 6 dates
Equal proportion of stones on all of the dates agreed by the participants
Do not forget to count the number of stones

PAST LIVELIHOOD ACTIVITIES - 20 YEARS AGO OR ANY AGREED TIMEFRAME

Exercise 1 – Buzz groups

Purpose: Identification of past livelihood activities

Materials: Flip chart, voice recorder, markers and colourful pens

Buzz group method: Organise the participants, composed of elders, males, female and young elders, into 2-3 per group

Prompt Questions

What is the current situation regarding livelihood activities?

Exercise 2 – Ranking

Purpose: Ranking of livelihood activities

Materials: Flip chart, colourful markers, voice recorder and camera

Ranking method: All participants rank the past livelihood activities

Exercise 3 – Pie charts

DIAGRAMMATIC REPRESENTATION OF LIVELIHOOD STRATEGIES IN TIME PERIODS AGREED BY THE PARTICIPANTS

Materials: Flip chart, coloured markers, voice recorder and camera

Pie chart method: All participants will draw their own Pie charts

Prompt Questions

Imagine you have a cake shared among family members. The father gets the biggest slice followed by the mother and then the children. Portray in that manner, whether remittances are more important than social grants.

NB: First draw and show them what you mean. Then let them draw and they must explain what they mean.

Exercise 6 - Timeline (This will be constructed during all activities)

Purpose: For better understanding what is causing change (drivers)

Materials: Flip Charts, colourful markers, camera, voice recorder

Timeline method: It will be constructed by the researcher and also with the community

Prompt Questions

Is there any event that has been skipped by the researcher?

Appendix 3: Participatory Scenario approach

Materials: Flip charts, voice recorder, markers and colourful pens

Exercise 1 – Introduction

Menelisi will explain what scenario planning is

Menelisi will read the sketched scenarios *(the sketched scenarios will be translated into Xhosa)*

Exercise 2 – Buzz groups (*Umnga* everywhere)

Purpose: Discussion about the sketched scenarios (by Menelisi)

Discuss how future would really look like with the *Umnga* everywhere future.

How will the community respond to better transport, markets for small stock?

Exercise 3 – Buzz groups (Urban Future)

Purpose: Discussion about the "Urban Future"

Discuss how future would really look like in an Urban Future scenario

How will the community respond to high crime rate, and cultural delusion?

Exercise 4 – Buzz groups (Visioning)

Purpose: Discussion about the future they want in Fairbairn, and what needs to happen today to achieve that future

Identify key adaptation areas

Ranking of the most suitable **VISIONING** scenario from the buzz groups

Scenario 1, 2050: Umnga Everywhere

Trends that began more than 50 years ago, in the early 2000s, have continued to this day. *Umnga* has taken over old fields and now forms woodland that surrounds the village of Fairbairn. Only a handful of people continue to cultivate their land, while others have moved on to other activities. Food security is a concern for everyone in the village.

The biggest worry today, in 2050, is the unpredictability of the rainfall. For example, this year although the Department of Agriculture predicted normal to above normal harvests for the province of the Eastern Cape, in Fairbairn extreme heat and very little rainfall have affected the harvest badly. This kind of thing has become common over the past 20 years, where rainfall predictions do not mean much to local farmers – they no longer pay any attention to official predictions, and have come to rely more on their own local knowledge. This year, harsh climatic conditions have created cracked earth and the maize (corn) is drying from the bottom up. Local farmers believe that the drought will continue into next year.

Since 2020, the government has been implementing their Rural Modernisation Programme (RMP). Over the past 30 years, there has been massive investment in rural development by the government. Importantly for Fairbairn, the government committed funds to open a tarred road that links Fairbairn with the R63, which leads to the town of Fort Beaufort. The R63 has also been upgraded, and an abattoir that services the whole province has been built in Fort Beaufort. There are now regular livestock collection trucks that take Fairbairn stock to the market in Fort Beafort This has left small stockholder farmers smiling as it has made the market more accessible.

Mr Phakadhe, a fifth generation crop farmer from the clan of Mgwazi, has never seen a drought like this one before. This has resulted in him failing to pay back the agricultural loan he took from the bank, thus pushing him into deep poverty and hunger. Offering agricultural loans is part of the Rural Modernisation Program, but the changing climate has meant that for some farmers, like Mr Phakadhe, this has backfired.

Mrs Nyathi, an extension officer, explains that the effects of drought are already being felt in the food markets, as 10 kg of mealie meal costs ZAR 250. As a result, most households are quickly becoming food insecure. As a result, the Mpofu local municipality has increased its efforts of distributing yellow maize (corn) which is not the preferred maize of the community; although nobody likes it very much, they find that they have no choice but to eat it. However, some households are still food secure because of their hand irrigated home gardens. Home gardens have become a vital source for supplementary food for the drought stricken households.

Whilst corn farmers have struggled, small-stock farmers are smiling because of the booming small stock population and the ready market. Small stock are still a pivotal source of income for the village of Fairbairn. With a combination of abandoned fields and a dry climate, *Umnga* provides perfect forage for thriving small-stock businesses. Mr Bongco, a prominent smallholder farmer explains that he earns around R5 000 per month because he has taken advantage of the opportunities provided by the government. In addition, the vast encroaching *Umnga* has enabled massive production of honey. Young entrepreneurs have taken advantage of the mass production of honey to brew large quantities of traditional beer. Tourists visiting the Katberg Mountains are attracted to the traditional beer, and buy the honey, which is marketed as 'organic' as no pesticides are used on the *Umnga* trees. Both beer and honey have been pivotal to enhancing rural youth livelihoods and encouraging the youth to stay in Fairbairn, despite the failure of agriculture.

Umnga also makes perfect fuelwood and charcoal, and most unemployed youth have ventured into the selling of fuelwood, thus lowering the unemployment rate of Fairbairn. This has further resulted in reduced poverty amongst the youth. Bongisa Mpama, a youth advocate, postulated that the youth are much better off in 2050 than 2010 through the opportunities being presented by *Umnga*.

Scenario 2, 2050: Urban Future

Over 2.1 million people in the Eastern Cape Province are in need of emergency food aid. This figure might rise to 5 million in 2051 unless the international community steps up with donations. Like other parts of the province, over the past 20 years, the Fairbairn community has suffered from severe weather conditions, but the drought of 2050 is likely to be one of the worst in recent memory. Frequent heat weaves, low temperatures in winter, and loss of surface water have increased food insecurity. To add to these difficulties and uncertainties affecting the rural poor, pro capitalist policies that began way back in 2030 resulted in the cancellation of social grants by government. The current tragedy has been exacerbated by maladministration within government, a lack of skills and low levels of primary education within the community, mainly as a result of a failing school system. However, through these

seemingly dark times, non-governmental organizations (NGOs) have played a major role in developing household resilience and their ability to cope with the uncertainty that they face.

Extreme weather conditions have been the norm for the past two decades, making livelihood diversification mandatory for Fairbairn community members. An NGO called the "Safety Net Programme: Failed Rain doesn't mean Failed Life" run adaptation programmes that help farmers adapt to the changing climate. Mrs Nsthundu is one of the last remaining farmers in Fairbairn who took advantage of the opportunities being offered by the NGO. She and her family now grow small grain crops (sorghum and millet) that can withstand dry spells and secure a harvest. Although it was sad to stop cultivating maize as her forefathers did, she is a pragmatic woman and believes in changing with the times. New water conservation techniques such as drip irrigation and fallowing help to return soil moisture and minimize run-off thus proving to be beneficial for Ms Nsthundu. However, Mr Phakadhe was sceptical about adopting the water conservation techniques and climate change has become a phenomenon he cannot control. He now survives on food aid.

As a response to declining on-farm livelihoods, ecotourism has become one of the off-farm livelihoods. Jongaphambile Ecotourism is part of a community initiative to adapt to the changing climate. Mr Cele believes the unique nature, culture and landscape present an opportunity to attract tourists, climbers and trackers. Tourists wanting to stay overnight in Fairbairn Mountains pay entrance and camping fees. This cash inflow is vital in supporting households involved in the project. The deteriorating R63 road, which has been ignored by government for decades, is an obstacle preventing more tourists from visiting the area.

Although a handful of people are being innovative and making things work for them in Fairbairn, the extreme climatic conditions have resulted in the mass movement of able-bodied people to urban areas in search of employment. Better job opportunities, education and health facilities are the key drawcards for Ms Bulelwa to migrate to Port Elizabeth. According to Ms Bulelwa, migrating to the urban centre has given her new hope to venture into entrepreneurship whilst her children get the best education. Life seems better for Ms Bulelwa as her fast booming crocheting project results in her buying a house, a dream she has had for her entire life. On a sad note, her rural roots are eroding and her son Bongisa will miss the traditional circumcision ceremony again this year, as his parents do not see the need for this old-fashioned activity. Bongisa's grandparents, who still live in Fairbairn, are desperate for Bongisa to come home for the ceremony, as they feel it is essential in maintaining *Xhosa* culture. However, they do not have the money or resources to do this, as they rely on money from their daughter every month. As with many families nowadays, it is the younger people living in the cities who get to decide what happens and what does not happen, as they have the money needed for most aspects of life. It was not always like this: her parents remember when they were young, way back in 2015, and it was the elderly who brought in the pensions and supported the family. While the elderly think life was better in the past, the youth say that social grants are an old-fashioned policy.