

The impact of agroecology training on the adaptability of smallholder communities to climate change in the Mopani district of Limpopo

by
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of Master of Philosophy in Sustainable Development in the Faculty of
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Declaration

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Abstract

Climate change is expected to increasingly affect global food security, food production, and smallholders as severe weather patterns become more frequent. Within this context, this study assessed the impact of agroecology training on smallholders' adaptability to climate change through a case study of smallholders in Limpopo. Four research questions were selected to explore this topic through two research designs. A literature review was used to answer the first research question (i), which centred on examining how agroecology could influence the adaptability of smallholders in the face of climate change. A case study design was chosen to answer the three remaining research questions, namely: (ii) whether the leadership component of an agroecology training course enabled trainers to transfer agroecology knowledge to smallholders, and (iii) identifying the adaptive strategies smallholders were using before and (iv) after agroecology training. The following elements were used to design the case study: the research questions, the research focus, the conceptual framework, methods for data collection (interviews, observation, analysis of documentary evidence), and a thematic data analysis approach.

To answer question i, I reviewed literature on adaptability and agroecology (as a science, movement, and practice). In doing so, I developed a conceptual framework to illustrate the link between adaptability and agroecology, which enabled me to argue that agroecology has the potential to increase smallholders' adaptability. The main finding for question ii was that the leadership component of the agroecology training course had enabled trainers to transfer their knowledge to smallholders by encouraging different types of learning. The key finding for question iii was that adaptive strategies enabled through certain networks were limited, as smallholders were still reliant on coping strategies through conventional extension networks. For question iv, I found that smallholder communities are closer to becoming adaptive communities since undergoing the agroecology training, due to a shift from coping to adaptive strategies.

A number of recommendations are proposed for 17 Shaft, the Southern Africa Food Lab, and the Department of Agriculture, Forestry and Fisheries. Recommendations for 17 Shaft include: placing more emphasis on certain leadership behaviours, self-esteem, and gender specific components of the course, and establishing a partnership with postgraduate programmes for continuous evaluation of training. It is recommended that the Southern Africa Food Lab uses its network to facilitate further conversations between smallholders, the Department of Agriculture, Forestry and Fisheries, and academia, specifically to develop a more detailed categorisation of smallholders. The following recommendations were identified for the Department of Agriculture, Forestry and Fisheries: improving extension support for smallholders by developing in-community trainers, and inspiring youth into agriculture through communities of practice.

Opsomming

Daar word verwag dat klimaatsverandering toenemend die wêreld se voedselsekuriteit, voedselproduksie, en kleinboere sal beïnvloed soos strawwe weerstoestande toeneem. Gegewe hierdie konteks, het hierdie studie deur middel van 'n gevallestudie op kleinboere in Limpopo bepaal hoe opleiding in agro-ekologie hul aanpasbaarheid kan beïnvloed. Vier navorsingsvrae is gekies om hierdie onderwerp deur middel van twee navorsingsontwerpe te ondersoek. 'n Literatuuroorsig is gebruik om die eerste navorsingsvraag te beantwoord, naamlik: (i) Hoe beïnvloed agro-ekologie die aanpasbaarheid van kleinboere met betrekking tot klimaatsverandering as 'n faktor?

'n Gevallestudieontwerp is gekies om die oorblywende navorsingsvrae te beantwoord, naamlik: (ii) Het die leierskapkomponent van 'n opleidingskursus in agro-ekologie die instruksors in staat gestel om kennis van agro-ekologie aan kleinboere oor te dra? (iii) Watter aanpassingstrategieë het kleinboere voor die agro-ekologie-opleiding gebruik? (iv) Watter aanpassingstrategieë het kleinboere ná die agro-ekologie-opleiding gebruik? Die volgende elemente is gebruik vir die ontwerp van die gevallestudie: die navorsingsvrae, die navorsingsfokus, die konseptuele raamwerk, dataversamelingmetodes (onderhoude, waarneming, ontleding van dokumentêre bewyse), en 'n tematiese benadering tot data-ontleding.

Ten einde navorsingsvraag (i) te kon beantwoord, het ek 'n aanpasbaarheid en agro-ekologie literatuurondersoek ingestel (as 'n wetenskap, beweging, en praktyk). Sodoende kon ek 'n konseptuele raamwerk ontwikkel om die verhouding tussen aanpasbaarheid en agro-ekologie te illustreer. Daardeur kon ek die argument ontwikkel dat agro-ekologie die potensiaal het om kleinboerdery se aanpasbaarheid te kan verhoog. Die hoofbevinding van navorsingsvraag (ii) was dat die leierskapkomponent van die agro-ekologie-opleidingskursus die instruksors in staat gestel het om hul kennis aan kleinboere oor te dra deur verskillende soorte leer aan te moedig. Die hoofbevinding van navorsingsvraag (iii) was dat aanpassingstrategieë wat deur sekere netwerke in werking gestel is, beperk was, aangesien kleinboere steeds staatgemaak het op hanteringstrategieë deur middel van konvensionele hulpnetwerke. Die hoofbevinding van navorsingsvraag (iv) was dat kleinboergemeenskappe nader daaraan beweeg om aanpasbare gemeenskappe te word ná hul agro-ekologie-opleiding ontvang het omdat hulle geskuif het van hanteringstrategieë na aanpassingstrategieë.

Aanbevelings word gemaak vir 17 Shaft, die Southern Africa Food Lab, en die Departement van Landbou, Bosbou en Visserye. Aanbevelings vir 17 Shaft sluit in: plaas meer klem op sekere leierskapedrag, selfagting, en geslagspesifieke komponente van die kursus, en bou 'n vennootskap met nagraadse programme vir aaneenlopende evaluering van opleiding. Dit word aanbeveel dat die Southern Africa Food Lab hul netwerk gebruik om verdere gesprekke tussen kleinboere, die Departement van Landbou, Bosbou en Visserye, en die akademiese wêreld te fasiliteer, spesifiek om 'n meer gedetailleerde kategorisering van kleinboere te ontwikkel. Die volgende aanbevelings word vir die Departement van Landbou, Bosbou en Visserye gemaak: verbeter landbou-ondersteuning vir kleinboere deur

instrukteurs binne gemeenskappe te ontwikkel, en inspireer die jeug om landbou na te volg deur middel van praktiserende gemeenskappe.

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List of acronyms and abbreviations

DAFF	Department of Agriculture, Forestry and Fisheries of South Africa
FAO	Food and Agriculture Organization of the United Nations
IAASTD	International Assessment of Agricultural Knowledge, Science and Technology for Development
IFAD-UNEP	The International Fund For Agricultural Development- the United Nations Environment Programme
MFA	Mopani Farmers' Association of Limpopo
NGO/s	Non-governmental organisation/s
PGS	Participatory guarantee system/s
PLAAS	Institute for Poverty, Land and Agrarian Studies
SAFL	Southern Africa Food Lab
SES	Social-ecological system/s
SSA	Supporting Smallholder Agriculture

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Chapter 1: Introduction

1.1 Background

2015/16 marked one of the hottest years on record as the “average global temperature” peaked (Food and Agriculture Organisation of the United Nations (FAO) 2016:66), coinciding with one of the strongest El Niño Southern Oscillation events in over 50 years (FAO 2016, 2017). These events refer to a weather phenomenon that occurs every few years when the sea surface waters of the tropical Pacific Ocean become warmer (Baudoin, Nortje, Naik & Vogel 2017:128). The phenomenon contributes to increases in flooding, drought, and other extreme weather events (FAO 2016). At the same time, climate change influences the frequency and intensity of El Niño events (Pearce 2016). Increasingly, scientists and international assessments identify human activity, specifically in altering ecosystems (e.g. land use, nitrogen cycle, resource use) over the past fifty years, as contributing toward climate change (Steffen, Crutzen & McNeill 2007; International Assessment of Agricultural Science and Technology for Development (IAASTD) 2009).

In fact, scholars argue we are moving into a new geological epoch – out of the Holocene (a relatively stable period allowing humanity and agriculture to flourish) and into the Anthropocene (an era dominated by human activity) (Steffen et al. 2007; Rockström, Steffen, Noone, Persson, Chapin, Lambin, Lenton et al. 2009; Steffen, Persson, Deutsch, Zalasiewicz, Williams, Richardson, Crumley et al. 2011). According to the Framework Convention on Climate Change (cited in Intergovernmental Panel on Climate Change 2013), climate change refers to a change of climate and global atmosphere due to human activity, both directly and indirectly. This definition differentiates between climate change due to human activities and climate variability driven by natural processes (Intergovernmental Panel on Climate Change 2013).

The global food system and its industrial agricultural model is one example of a human activity that has contributed to climate change. Excess waste from crop and livestock production (e.g. animal excrement and fertilisers) is identified as a key driver of methane and nitrous oxide emissions (IAASTD 2009; Rockström et al. 2009; FAO 2016), both of which are considered toxic greenhouse gases (FAO 2016).

Since the financial crisis and the peak in global food prices in 2007/2008, the unsustainable nature of the current food system has become more evident. The crisis revealed that while the amount of food produced has increased, the structure of the world's food system has had negative social (inequality, poverty, and hunger) and environmental (soil degradation, loss of biodiversity, etc.) implications (De Schutter 2009; IAASTD 2009; Patel 2013; Shiva 2013).

Nevertheless, climate change is identified as one of the many trends driving change in food and agricultural systems. It is expected to impact all areas of food production as extreme weather events become more frequent (IAASTD 2009; The International Fund for Agricultural Development (IFAD) – United Nations Environment Programme (UNEP) 2013; FAO 2017). This will have ramifications for agricultural production and global food security, as losses occur in livestock and crop production (FAO 2016, 2017). Smallholders are considered especially vulnerable to the effects of climate change due to their dependence on agriculture and unequal access to resources, information, and support (IAASTD 2009; Morris, Méndez, Van Zonneveld, Gerlicz & Caswell 2016; Altieri & Nicholls 2017). There is increasing support for the notion that smallholders need to strengthen their resilience through the adoption of more sustainable production methods (Altieri 2009; IFAD – UNEP 2013), with a number of groups promoting agroecology as the approach through which to increase their adaptability, and thus build their social and ecological resilience (IAASTD 2009; De Schutter 2011; Kremen, Iles & Bacon 2012; Altieri, Nicholls, Henao & Lana 2015; FAO 2017).

Resilience theory in social-ecological systems (SES) has gained relevance as a way to understand the complexity of the aforementioned challenges and specifically, the concept of adaptability (Walker, Holling, Carpenter & Kinzig 2004; Folke 2006; Milestad, Westberg, Geber & Björklund 2010). SES refer to the complex interactions between social systems and ecosystems for the survival of humans (Berkes, Colding & Folke 2003). The increasing frequency of extreme weather events means smallholders need to learn how to adapt to change in the ecological systems on which their survival depends (FAO 2017). Appropriate adaptive strategies are therefore required to fashion more sustainable and resilient SES (Berkes et al. 2003; Fabricius, Folke, Cundill & Schultz 2007; Nelson, Adger & Brown 2007; De Bruijn, Buurman,

Mens, Dahm & Klijn 2017). Sustainability is commonly understood as meeting the present generation's needs without undermining the ability of future generations to meet their own needs (Berkes et al. 2003). Berkes et al. (2003) understand sustainability within SES as a 'dynamic' rather than specific process requiring individuals to develop their abilities, or adaptive capacities, to deal with change. Essentially, the resilience of smallholder communities hinges on their adaptability to change.

My research aims to assess how agroecology training can influence the adaptability of smallholders to climate change through a case study in Limpopo Province, South Africa. Gaps in the literature on agroecology suggest a focus on the adaptability, or the social resilience, of smallholders may be valuable, particularly in the South African context. This chapter provides an overview of the content for this thesis and is structured in the following way: 1.2 highlights the motivation for this study; the case study background is provided in 1.3; 1.4 discusses the problem statement and 1.5 identifies the research questions; 1.6 clarifies the concepts used in this thesis; 1.7 considers the significance of the study; a brief overview of the research design and methodology is highlighted in 1.8; and an outline of the thesis is illustrated in 1.9.

1.2 Motivation for the study

I chose this research focus due to my growing interest in the global food system, smallholders, and the need for more sustainable models of agriculture (De Schutter 2009; IAASTD 2009; Patel 2013). This interest is informed by my postgraduate studies at the Sustainability Institute, which is linked to Stellenbosch University. During my participation in the sustainable food systems stream, I became aware of the social and environmental crises underpinning the food system as well as the importance of smallholders (De Schutter 2009; Patel 2013). Several of my modules exposed me to the principles of agroecology. In 2016, I participated in a module that took place in India; interacting with smallholders who had transitioned from conventional agriculture to more agroecological forms of farming made me more aware of the value of agroecology for smallholders, especially in the context of climate change.

My involvement in community development projects in rural areas as a university student cultivated a passion for education. During this time, I quickly realised the

need for training, education, and skills transfer in rural communities. In 2016, I came across an opportunity to apply for a National Research Foundation bursary via the Southern Africa Food Lab (SAFL). One of the options for individuals applying for the bursary was to focus their research on an evaluation of a three-month agroecology training programme. My interest in the global food system combined with my passion for education/training motivated me to apply for the bursary with the SAFL. In doing so, I aimed to centre my research on the influence of the agroecology training on smallholder communities in the Mopani district of Limpopo. The relevance of this study for the South African context is discussed in the following section.

1.3 Case study background

This section of the chapter provides background information on the case study as context for the following chapters.¹ I discuss the institutions involved in developing the programme, the training programme itself, the research participants, and the Mopani district where the smallholder farmers who should ultimately benefit from the programme are based.

1.3.1 A brief history of the Southern Africa Food Lab

The SAFL, established in 2009, falls under the Food Security Initiative as part of the Hope project² at Stellenbosch University (SAFL n.d.a). The SAFL's (n.d.a) vision is to cultivate an understanding of the systemic issues underpinning food security, and foster "innovations" that aid the transition to a more sustainable and just food system. To achieve its vision (Goldberg 2016), the SAFL (n.d.a) supports multi-stakeholder interaction through the use of "innovative collaborative learning and facilitation approaches".

The SAFL has focused significant attention on the smallholder sector in South Africa. These farmers are viewed as essential for transforming South Africa's food system to a more sustainable one for two reasons (Drimie 2016). Firstly, smallholders' play a

¹ The information used to inform this overview was collected over the course of the research. The processes involved in collecting this data will be explained in the case study design section in chapter 2.

² The Hope project was established in 2010 at Stellenbosch University to encourage research projects centred on diffusing expertise to the broader South African society. Five areas of expertise were identified, namely: "eradicating poverty and related conditions, promoting human dignity and health, promoting democracy and human rights, promoting peace and security, and promoting a sustainable and competitive industry" (Stellenbosch University n.d.).

pivotal role in supporting vulnerable groups through informal markets. Secondly, their agricultural practices are conducive to fashioning sustainable and local food systems (Drimie 2016).

The SAFL has engaged with smallholders over the years through their Supporting Smallholder Agriculture (SSA) programme, which was established in partnership with the Institute for Poverty, Land and Agrarian Studies (PLAAS). Initially, the programme was titled Supporting Smallholders into Commercial Agriculture, but was later changed to SSA as the focus shifted from only supporting farmers into commercial agriculture to promoting farmers' choice (Giliam 2016; SAFL n.d.c). The SSA programme comprises numerous projects that the SAFL refers to as "innovations: new ideas about how to address challenges faced by smallholder farmers through new partnerships and new commitment" (Drimie 2016:1). Each innovation has been an experiment centred on learning and adaptation, allowing the SAFL and its network to gain further insight into how to create a more sustainable food system (Drimie 2016). The innovations³ under the SSA programme include:

- Farmers' Voices
- Agroecology Awareness
- Social, Environmental and Ethical Standards
- Building Local Economies
- Farmer Support
- Supporting Smallholder Farmers to enter the Organics Sector in South Africa (SAFL n.d.c).

The SAFL received funding in 2015 from the World Wide Fund for Nature's Nedbank Green Trust to implement the Agroecology Awareness innovation in the Mopani district of Limpopo. The project aimed to increase the awareness of agroecology and develop a "more sustainable and resilient farming system" in the area. The SAFL collaborated with the Mopani Farmers' Association (MFA), created by smallholders in the district, to implement the Agroecology Awareness innovation (Manderson, Kubayi, & Drimie 2016; SAFL n.d.d). Initially, the MFA was an informal representative structure for farmers in the district. It aimed to become a

³ These innovations were developed through a combination of learning journeys, consultative dialogues with farmers and farmers' associations, as well as innovation labs (SAFL n.d.c).

tertiary cooperative, but was unable to do so as it failed to set up primary and secondary cooperative members in the area. As a result, the MFA registered as a non-governmental organisation (NGO) at the end of 2016. Its mandate is to further agroecology in the district (Manderson 2017).

At first, the SSA programme linked farmers in the MFA to ZZ2 to learn about their farming with nature philosophy, which ZZ2 calls *natuurboerdery*.⁴ ZZ2 is a large commercial enterprise that “produces tomatoes, avocados, apples and onions”, primarily in the northern part of the country (SAFL & PLAAS 2013:10). Although the partnership between the SAFL and ZZ2 did not work out, the MFA farmers also felt that the ZZ2 farming operation was incompatible with their realities (Mlondobozi 2017). This led the MFA, specifically Ms Mlondobozi (2017) as a member of the MFA, to request the SAFL to conduct agroecology training suited to their contexts (Manderson 2017).

Therefore the agroecology training under the SAFL’s Agroecology Awareness innovation was their response to a request from smallholders within the MFA for agroecology skills (Manderson 2017; Mlondobozi 2017). The SAFL contacted 17 Shaft Training Centre near Soweto, Johannesburg to help pilot the training programme (SAFL n.d.b; Drimie 2016; Manderson 2017). The following section provides a brief overview of 17 Shaft Training Centre and their agroecology training course.

1.3.2 17 Shaft Training Centre and their agroecology training course

The Leadership Skills and Agroecology training programme was first piloted between May and August 2016. The SAFL enlisted the services of 17 Shaft Training Centre in Soweto, Johannesburg to conduct training for seven individuals (SAFL n.d.b; Drimie 2016) – hereafter referred to as the agroecology trainers. Upon completion of the programme, the agroecology trainers returned to the Mopani district in Limpopo and began sharing their skills (SAFL n.d.b). In May 2017, the second round of training commenced with 15 individuals enrolled. All 15 trainees graduated from the programme in August 2017.

⁴ *Natuurboerdery* is an Afrikaans words that translates to nature farming (ZZ2 2016).

17 Shaft Training Centre was established in 1994 as a centre focused on skills training, accommodation, and conferences (17 Shaft n.d.a). Its vision is to address socio-economic issues in Gauteng through the development of an urban community centre rooted in agroecological principles (17 Shaft n.d.a). Cooperation and collaboration, or the ‘spirit of *Ubuntu*’⁵, amongst diverse groups is embedded in the philosophy of the centre (17 Shaft n.d.b).

17 Shaft (n.d.b:2) is the “first institution in South Africa to introduce programmes that combine leadership, agroecology, and artisan skills training”. The content covered by each of these training areas is depicted in figure 1. Importantly, a number of teaching philosophies underpin 17 Shaft’s approach to learning. For instance, the idea that “true education” trains the mind to think, as opposed to simply learning facts, serves as a guide for the course (17 Shaft n.d.b:2). This is evident in their philosophy: “Man Know Thyself”, which recognises that individuals learn more through self-reflection, and identification of the feelings/emotions driving their thoughts and actions than through conventional teaching approaches (17 Shaft n.d.a:5, n.d.b:4). In this sense, the leadership component of the course is unique because it empowers participants with leadership skills and develops their self-esteem. The hope is that the skills acquired through the training will inculcate within the participants a sense of responsibility for transferring their skills, knowledge, and lessons learnt to their communities when they return home (17 Shaft n.d.a; SAFL n.d.b.; Manderson 2016).

⁵ *Ubuntu* is a Zulu word that is difficult to translate into English, but generally refers to the ‘spirit of humanity’ (New World Encyclopedia 2016).

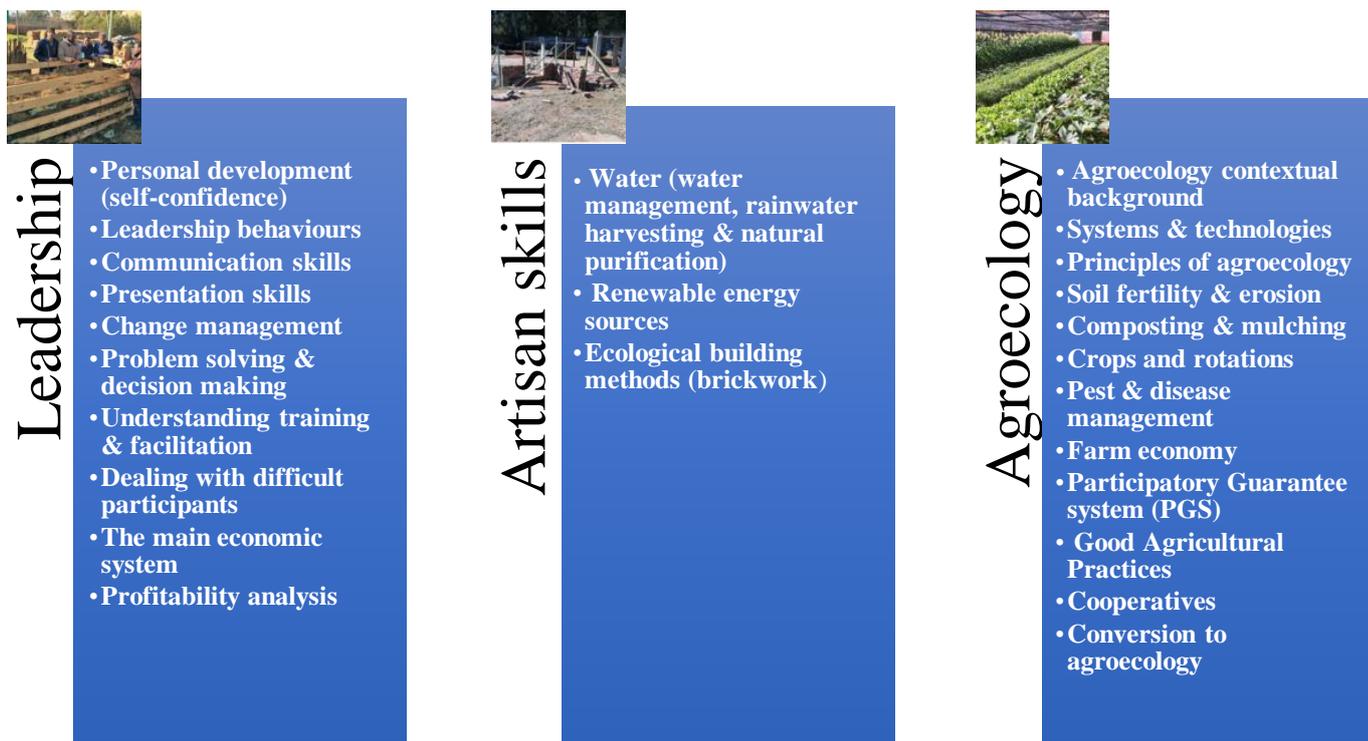


Figure 1: Content of the leadership and agroecology training programme (Source: 17 Shaft n.d.a; SAFL n.d.b)

The SAFL assisted 17 Shaft by project managing the first phase of the training, specifically the application process. Applications for the pilot training were initially open to all members of the MFA, but only three applications were received (Drimie 2016; Manderson 2017). To obtain seven trainees, the call for applications was opened to other smallholders in the Mopani district interested in more ecological forms of agriculture (Drimie 2016). According to the SAFL (n.d.b:1), “the selection of trainees was a careful process ... to identify individuals within the Mopani district that would benefit from a skills development programme and would then be able to transfer their learning from the course to teach others in their community without post-training support”. The selection process for the first phase of the training entailed an initial presentation to MFA farmers in Dzumeri village near Giyani, Limpopo Province, written applications, interviews, and a focus group discussion. Some of the criteria applicants had to meet included: they had to have matric, be able to read and write in English, and have some background in agriculture (Manderson 2017).

Given the success of the first phase, 17 Shaft applied for and received funding through World Wide Fund for Nature's Nedbank Green Trust to conduct a second phase of training in 2017 (Manderson 2017). This phase was primarily managed by 17 Shaft, though the SAFL was still involved. Based on the lessons learnt in the first phase, two new criteria informed the selection process. First, the training was once again extended to organisations⁶ and smallholders beyond the MFA but this time, each organisation had to explain their agroecology strategy and motivate why the individual they had nominated should be selected. Second, each organisation had to guarantee employment upon graduation and provide ongoing support to assist graduates of the programme to train other smallholders. The criteria from the first phase of having matric, being literate in English and having some background in agriculture were retained (Manderson 2017). The second phase took place between May and August 2017, resulting in another 15 graduates.

1.3.3 Participant information and the Mopani district

This section provides a brief overview of the research participants and the Mopani district. Eleven individuals were interviewed for this research (see 2.5.2 for further details). Seven were the agroecology trainers who graduated from the agroecology training programme in 2016, while three were smallholders from Nkomo village in the Mopani district of Limpopo. The three smallholders, Mr Kheto (2017), Ms Makhubela (2017), and Ms Baloyi (2017), were trained by Ms Mabunda and Ms Mbodi after they graduated from the agroecology training programme. The final interview was conducted with the operations manager of Bryanston Organic and Natural Market, Ms Wainwright (2017). Ms Wainwright was interviewed due to her connection with smallholders in Nkomo village through the Bryanston Market participatory guarantee system⁷ (PGS) and later the Giyani PGS, and her history with one of the trainers, Ms Mabunda. She is also connected to 17 Shaft as she facilitates the PGS training for trainees. Throughout 2016 and 2017, I also had informal conversations with Dr Manderson (2016, 2017) who has been the project manager for

⁶ These organisations included: Choice trust, MFA, Hoedspruit Hub, and the Giyani PGS (Manderson 2017).

⁷ PGS systems typically refer to local peer reviewed certification systems that disseminate knowledge and govern how food is produced (Dumont et al. 2016). PGS are elaborated on in chapter 4, part c of 4.5.2. Further details on the Bryanston Market PGS and Giyani PGS are given in chapter 5.

the SAFL's Agroecology Awareness innovation and the main supervisor for my thesis.

Aside from Ms Wainwright (2017), the individuals interviewed are based in the Mopani district, which occupies a fairly large part of Limpopo Province. As photo 1 illustrates, the Mopani district comprises five local municipalities, namely Greater Letaba, Greater Tzaneen, Greater Giyani, Maruleng, and Ba-Phalaborwa. It also includes the District Management Area, encompassing the Kruger National Park and the Greater Limpopo Transfrontier Park (Mopani District Municipality 2008-2009). Each municipality is divided into wards, "totalling 118 wards in the whole district area, with 15 urban areas (towns and townships) and 348 villages (rural settlements)" (Mopani District Municipality 2008-2009:4).

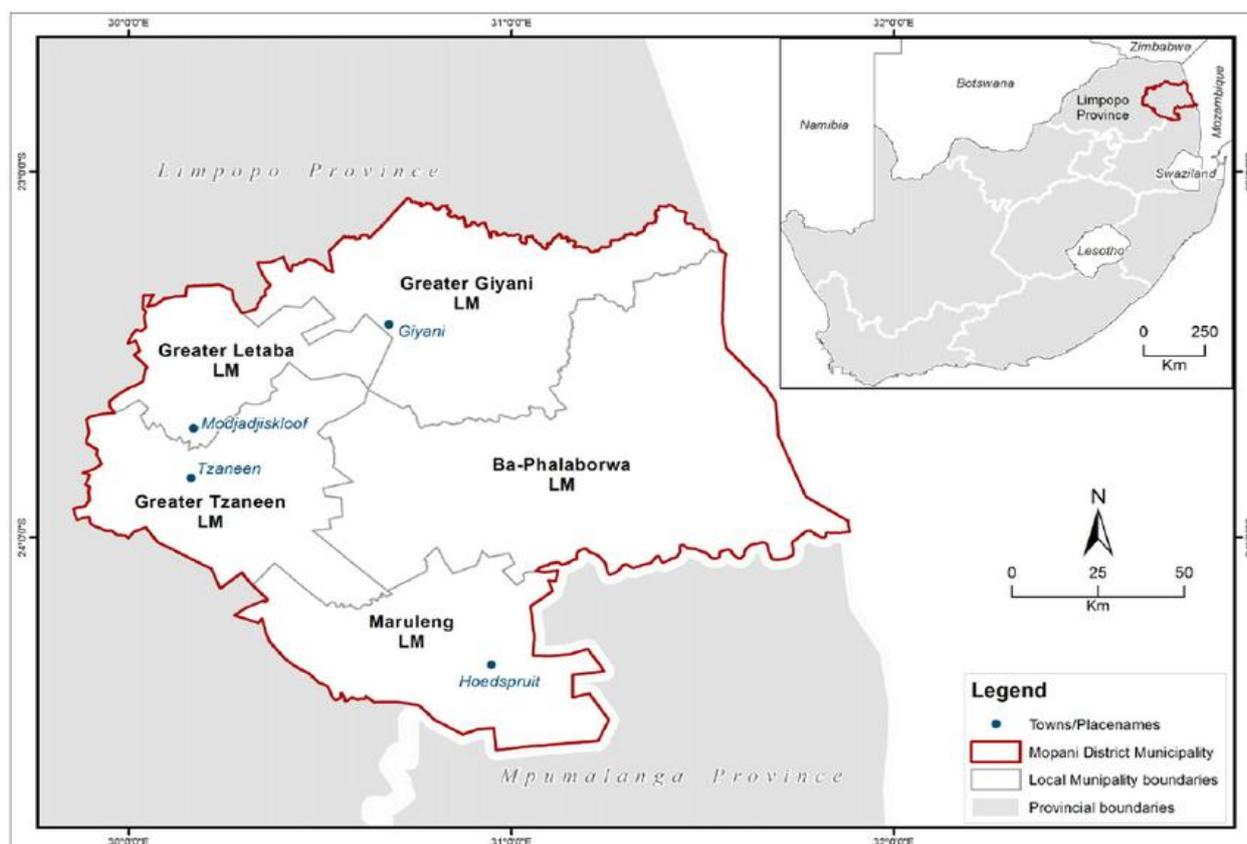


Photo 1: Map of the Mopani district, Limpopo within South Africa (Source: Baiyegunhi & Oppong 2016:143)

Limpopo Province is considered one of the poorest provinces in South Africa (Gbetibouo, Ringler & Hassan 2010; Maponya & Mpandeli 2012). Along with the Eastern Cape, Limpopo's high share of smallholders reliant on rain-fed agriculture,

along with low literacy rates, limited infrastructure and high unemployment rates, make it particularly susceptible to the effects of climate change (Gbetibouo et al. 2010). While droughts are a regular characteristic of Limpopo, dry seasons have become longer and have resulted in a later start to the wet seasons (October–November). Climate change effects in Limpopo have also become more noticeable through changes in rainfall and temperature (Thomas, Twyman, Osbahr & Hewitson 2007; Limpopo Department of Economic Development, Environment, and Tourism 2016). These challenges are evident in the Mopani district of Limpopo.

After mining, agriculture and forestry is the second major industry in the Mopani district contributing 50 per cent of the income in the province (Mopani District Municipality 2013-2014, 2014; Ubisi, Mafongoya, Kolanisi & Jiri 2017). There are numerous producers but “ZZ2 dominates in terms of output” (Mopani District Municipality 2013-2014:55). The main cash crops grown in the district include citrus, vegetables, subtropical fruit, and nuts (Mopani District Municipality 2014).

Additionally, the Mopani district faces a number of environmental challenges such as deforestation, soil erosion, irregular rainfall, regular drought conditions (see photo 2), and limited water resources (Mopani District Municipality 2013-2014; Ubisi et al. 2017). The Integrated Development Plan of the Mopani District Municipality (Mopani District Municipality 2013-2014) recognises the risks associated with climate change. Around 81 per cent of the district’s population live in rural areas and are therefore particularly susceptible to climate change and natural hazards, with few mechanisms in place to overcome these challenges (Mopani District Municipality 2013-2014). Recognising these challenges, the report advocates the adoption of organic agriculture, and suggests individuals and communities need to create awareness around the causes and effects of climate change (Mopani District Municipality 2013-2014).

As illustrated in photo 2, South Africa was experiencing a severe drought and a strong El Niño event between 2015 and 2016⁸ (Manderson et al. 2016; Baudoin et al. 2017). The implementation of the SAFL’s Agroecology Awareness innovation in July 2015 “coincided with the build-up of the El Niño-related drought in the country”

⁸ The effects of the drought and El Niño in South Africa will be elaborated on in the literature review in chapter 3.

(Manderson et al. 2016:1). For this reason, the SAFL conducted a drought impact assessment in the Mopani district of Limpopo in early 2016 as part of the innovation. A questionnaire was used to gather data from 19 smallholders in the district regarding their experiences with the social, environmental, and economic effects of the drought (Manderson et al. 2016). Smallholders’ response to drought conditions in the Mopani district during this period forms part of the data analysis and therefore will be elaborated on in section 5.4.3. in chapter 5.

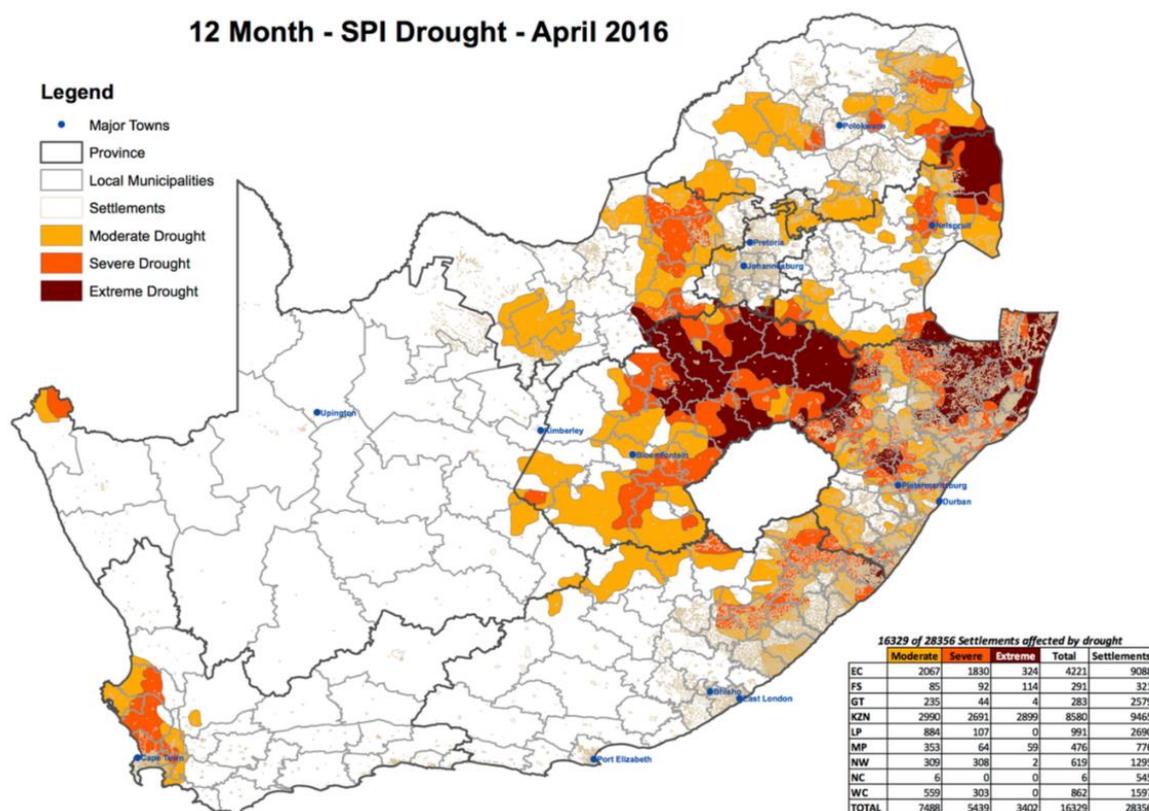


Photo 2: Areas affected by drought in South Africa between April 2015 and 2016 (Source: Department of Water Affairs cited in Manderson et al. 2016:8)

In terms of social characteristics, the Mopani district has very low literacy levels. According to the Integrated Development Plan (Mopani District Municipality 2013-2014:115), roughly 40 per cent of the adult population (above 20 years of age) can be classified as “functionally illiterate”, while only 27.1 per cent are considered literate. The report also highlights the loss of indigenous knowledge systems in Mopani as they do not form part of school curricula. This is seen as a challenge for the area, with

younger generations losing “their cultural values and roots” (Mopani District Municipality 2013-2014:121).

1.4 Problem statement

Based on the contexts outlined in 1.2 to 1.4, more research on how agroecology can enhance the social resilience, or adaptability, of smallholders in the face of climate change would be useful (identified in chapter 4) (Altieri et al. 2015; Altieri & Nicholls 2017). Related to this, the gaps in South African literature suggest the need for empirical research on smallholders and sustainable agriculture (identified in chapter 3) (Von Loeper, Musango, Brent & Drimie 2016).

1.5 Research questions

The research questions derived from the problem statement include:

- i. How could agroecology influence the adaptability of smallholders in the face of climate change?
- ii. Did the leadership component of the agroecology course enable trainers to transfer knowledge to Mopani smallholder farmers? If so, how? If not, why not?
- iii. Have smallholders in Mopani applied adaptive strategies prior to their exposure to agroecology?
- iv. What adaptive strategies are smallholders in Mopani using since their exposure to agroecology?

Mouton (2001) distinguishes between empirical and non-empirical questions. While the former address problems in the real world, the latter are concerned with identifying trends in scholarship (Mouton 2001). Question i will be addressed through a non-empirical literature review, while questions ii, iii, and iv will be answered through an empirical case study design.

1.6 Clarification of concepts

Some of the key concepts used in this thesis are defined below.

Adaptability is seen as part of resilience, but specifically refers to an intentional process individuals within a SES undertake to influence resilience (Walker et al. 2004; Smit & Wandel 2006; Hahn & Nykvist 2017). Influencing the resilience of a

SES depends on individuals' decision-making processes as well as their ability (adaptive capacity) to adapt to and shape change within social and ecological domains (Walker et al. 2004; Folke 2006; Smit & Wandel 2006; Walker, Gunderson, Kinzig, Folke, Carpenter & Schultz 2006). Adaptive capacity is therefore seen as an integral part of adaptability (Hahn & Nykvist 2017).

Adaptive strategies refer to “proactive adaptations” that promote long-term social and ecological sustainability (Fabricius et al. 2007:¶ 19). The strategies identified in this thesis include: social learning, diversity, increasing social capital, and cultivating collective action.

Agroecology is defined as “the integrative study of the ecology of the entire food system, encompassing ecological, economic and social dimensions” (Francis, Lieblein, Gliessman, Breland, Creamer, Harwood, Salomonsson et al. 2003:100).

Collective action is the voluntary involvement of groups of individuals and/or informal/formal institutions (whether spontaneous/emergent or intentional) in pursuit of a shared interest or goal. It may occur through coordination (top-down) or cooperation (bottom-up). Various factors facilitate (e.g. high levels of social capital) or constrain (e.g. low levels of social capital) collective action. In farming systems, indicators of collective action may include: farmers' markets, community organisations, gardens and advisory services (Cabell & Oelofse 2012), as well as PGS.

Communities of practice refers to “groups of people or community who have common concerns (domain area) and pursue knowledge through regular interaction based in practice (shared frameworks)” (Berkes 2009:1697). Communities of practice form part of social learning, but the concept also relates to collective action as both refer to groups of people with shared interests coming together.

Coping strategies are reactive short-term responses for survival with no social learning or institutional change taking place (Smit & Wandel 2006; Fabricius et al. 2007).

Diversity is understood in terms of the social and ecological domains of farming systems. Social diversity refers to a diverse range of opinions and actors in a system, with each actor performing a different function or role (Walker et al. 2006; Cabell & Oelofse 2012; Pereira 2012). Indicators may include diverse livelihoods, interaction

with diverse markets and diverse resources (knowledge, networks, buildings, tools) (Darnhofer, Bellon, Debieu & Milestad 2010). Ecological diversity in farming systems involves numerous components performing different roles/functions in the farm. Components performing the same function may respond differently to change. In other words, a heterogeneity of features provides evidence of diversity in farming systems. Indicators include: species diversity (biodiversity, animal and crop diversity), water harvesting, nutrients from multiple sources (compost, crop rotations, etc) and multiple production practices (Darnhofer, Bellon et al. 2010; Walker, Sayer, Andrew & Campbell 2010; Cabell & Oelofse 2012; Pereira 2012).

Learning is defined broadly as an ongoing process in which individuals' understanding, skills, knowledge, beliefs or behaviours may change through regular reflection, practice, experience or experiments, resulting in a new understanding of the world and their relation to it (Fazey, Fazey & Fazey 2005; Fazey, Fazey, Fischer, Sherren, Warren, Noss & Dovers 2007; Darnhofer, Bellon et al. 2010; Diduck 2010; Krasny, Lundholm & Plummer 2010; Milestad et al. 2010; Reed et al. 2010). Learning theories provide indicators of how learning may occur at the individual level.

Participatory guarantee systems (PGS) “are locally focused quality assurance systems. They certify producers based on active participation of stakeholders and are built on the foundation of trust, social networks, and knowledge exchange” (Katto-Andrighetto & Kirchner 2017:157). PGS reflect an alternative organic certification system, specifically suited to local markets as farmers and consumers play a participatory role in developing “their own standards and perform[ing] their own monitoring” (Kelly & Meterlerkamp 2015:9).

Resilience is understood in this thesis in the context of SES. Social-ecological resilience has three attributes:

- the amount of change a system can endure and still maintain a similar function and structure
- a system's capacity to self-organise
- a system's capability to learn and adapt (Carpenter, Walker, Anderies & Abel 2001; Folke 2006; Cabell & Oelofse 2012).

Smallholders refer to a heterogeneous group which differs along class, gender, and racial lines as well as marginalisation in terms of access to resources, information, technology, assets, capital, and land size (IFAD – UNEP 2013; Bernstein 2014; Jansen 2014). Due to the specific focus on smallholders in South Africa, this thesis uses Cousins’ definition and typology of farmers. According to Cousins (cited in SAFL & PLAAS 2013:3), “smallholders are small-scale farmers who use farm produce for home consumption to some degree, and use family labour within the farming operation to some degree, but for whom farming contributes a highly variable amount of cash income via marketing of farm produce. Levels of mechanisation, capital intensity and access to finance are also variable among such farmers”. Table 8 in chapter 3 provides a typology of smallholders in South Africa based on this definition.

Social-ecological systems (SES) are understood as the complex interactions between social systems and ecosystems for the survival of humans (Berkes et al. 2003:3). They are viewed as complex adaptive systems.

Social capital refers to attributes of the social domain – norms, trust, leadership, and networks – that shape people’s ability to act collectively and in turn, respond to change (Putnam 1995; Walker et al. 2006; Tamako & Thamaga-Chitja 2017). Key indicators of social capital in farming systems include: networks of families, friends, farmer associations, extension officers, as well as leadership, norms, and trust (Tamako & Thamaga-Chitja 2017).

Social learning is understood as a change in understanding at the societal level due to learning that occurs within social units/networks such as institutions or “communities of practice” (Wildemeersch 2007; Armitage et al. 2008; Berkes 2009; Armitage & Plummer 2010; Cabell & Oelofse 2012). Collaborative learning occurs through social networks, and may lead to the integration of diverse knowledge types (local/traditional to scientific), as well as transform power structures. Key indicators of social learning in farming systems comprise: extension support for farmers, partnerships/co-construction of knowledge between farmers, academics and universities, and knowledge sharing within farmer networks (Cabell & Oelofse 2012).

Sustainability is viewed as “a process, rather than an end product, a dynamic process that requires adaptive capacity for societies to deal with change... sustainability

implies maintaining the capacity of ecological systems to support social and economic systems” (Berkes et al. 2003:2). Hence, the adaptive capacity of communities is viewed as building the resilience of SES toward sustainability (Berkes et al. 2003).

1.7 Significance of the study

The research for this study is important as it should address several gaps in the literature on smallholders, agroecology, and the resilience of SES (identified in chapters 3 and 4), specifically farming systems. The study will build on existing knowledge by contributing to research on agroecology in a developing country context; this gap in the literature is discussed in 4.4.1.

Furthermore, the study contributes toward literature on SES and farming systems. It does so by obtaining empirical insight into the adaptability, or social resilience, of smallholders and their communities applying agroecological skills in the context of climate change. In doing so, the study highlights the social dimensions of the adaptability of the smallholders involved in managing these systems. Literature tends to focus on how agroecology enhances the resilience of ecological systems smallholders’ are embedded in, with less research on smallholders’ social resilience, or adaptability. This is highlighted in 4.5.

The research in this thesis is also pertinent to the South African context. By evaluating the impact of agroecology training on the adaptability of smallholder communities in Mopani, my thesis adds further knowledge to the limited research on sustainable agriculture (Blignaut, Knot, Smith, Nkambule, Crookes, Saki, Drimie et al. 2015; Midgley, Drimie, Von Loeper, Mudavanhu, Blignaut, Knot, Smith & De Wit 2015; Von Loeper et al. 2016) and smallholders in South Africa (Aliber & Hall 2012; Greenberg, 2013; Okunlola, Ngubane, Cousins & Du Toit 2016).

In line with political rhetoric on the importance of the smallholder sector, the study is also relevant due to its focus on in-community support for smallholders in South Africa. Scholars recognise diversity amongst smallholders in terms of income, relations to the market (subsistence to commercial), as well as divisions across class and racial lines (Cousins 2013; Greenberg 2013; Okunlola et al. 2016). Smallholders’ diverse needs means they require “targeted support by governmental (e.g. local municipalities) and non-governmental actors (e.g. NGOs or commodity associations)”

(Okunlola et al. 2016:53). Recently, the government recognised that different categories of smallholders exist, with each requiring their own support (Department of Agriculture Forestry and Fisheries (DAFF) 2016; Okunlola et al. 2016). In line with this, a new comprehensive extension policy⁹, approved in October 2016, intends to assist organisations better positioned to support smallholders that fall within some of the categories, especially those most suited to agroecological farming systems (DAFF 2016; Manderson 2016). This means there is a need for research that provides insight into the value of alternative extension models, specifically the organisations providing targeted support for smallholders. By assessing how agroecology training has developed in-community trainers and therefore influenced smallholders' adaptability to climate change in Mopani, the research findings could inform the implementation of the new extension policy (DAFF 2016).

Ultimately, the primary beneficiary of this research will be the SAFL and 17 Shaft given that the aim is to evaluate how and whether their agroecology training approach has influenced smallholders' adaptability. At the end of my research, I will present my findings to the research participants in an easily accessible format.

1.8 Overview of research design, methodology, and methods

The research approach is one of the most important aspects in designing the research. It is essentially the blueprint for how a study will be conducted and includes the philosophical assumptions of the researcher (Creswell 2014). A qualitative research approach, informed by an interpretivist-constructionist research paradigm, has been selected for this research (Yin 2011; Creswell 2014).

To answer the research questions identified in 1.5, two research designs have been selected. The first includes a non-empirical literature review to address question i, while questions ii, iii, and iv are addressed through an empirical case study design. A traditional literature review was selected for this research, as it enabled me to synthesise large volumes of the literature as well as identify gaps within existing literature (Petticrew & Roberts 2006; Cronin, Ryan & Coughlan 2008). The findings from the literature review were also used to develop a conceptual framework. The

⁹ Although the policy was approved in October 2016, the acting Chief Director of National Extension Support Services, Mr Lukhalo (2017), informed me that the policy is still in the process of being published by the Government's printers.

framework was used to gather and analyse the data on the case study, and is presented in 4.5.2.

A number of research methods were used to gather data for the case study, namely interviews, observation, and the analysis of documentary evidence (Mouton 2001; Yin 2009; Creswell 2014). Through the SAFL, I had access to the trainers who completed the agroecology training programme in 2016, farmers interacting with the trainers, the second round of training sessions, and documentary evidence. A thematic analysis approach was used to code and analyse the data (Braun & Clarke 2006).

1.9 Thesis outline

Figure 2 illustrates the outline of this thesis.

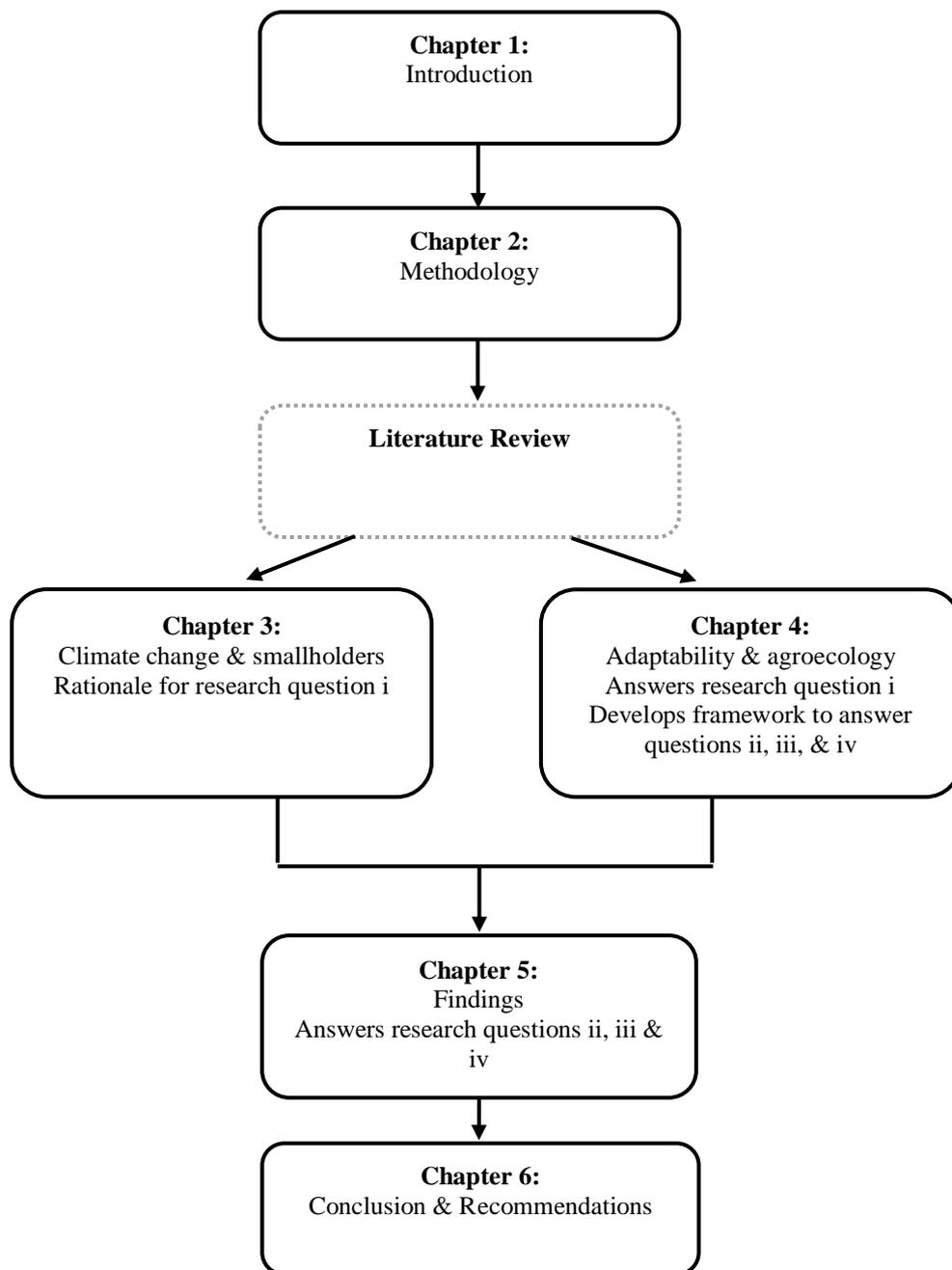


Figure 2: Outline of thesis

Chapter 2: Research design and methodology

2.1 Introduction

This chapter unpacks the research approach, questions, designs, and methods selected for the study, as well as the process of data analysis. As discussed in chapter 1, two research designs were chosen: a literature review and case study. Bryman, Bell, Hirschsohn, Dos Santos, Du Toit, Masenge, Van Aardt and Wagner (2014) distinguish between research designs and research methods. Research designs provide a framework to “guide the use of a research method” and data analysis, whereas different research methods (e.g. interviews, observation) are used “with different kinds of research designs” to collect data (Bryman et al. 2014:100). A literature review is used to answer research question i,¹⁰ while questions ii, iii and iv are addressed through a case study design.¹¹

This chapter discusses the research approach and both research designs through a number of sections: 2.2 explores the overarching research approach; the research focus and questions are identified in 2.3; the methods associated with the literature review design are unpacked in 2.4 and those associated with the case study design in 2.5; limitations not covered in 2.5 are included in 2.6; and ethical considerations are provided in 2.7.

2.2 Overarching research approach

A research approach refers to the plan for carrying out a study on a topic, and includes the researcher’s philosophical worldviews, research designs, and methods of data collection and analysis (Creswell 2014). A qualitative research approach has been selected for this research. Yin (2011) highlights the difficulty in providing a precise definition of qualitative research. Instead key features of this approach can be

¹⁰ Research question:

- i. How could agroecology influence the adaptability of smallholders in the face of climate change?

¹¹ Research questions:

- ii. Have smallholders in Mopani applied adaptive strategies prior to their exposure to agroecology?
- iii. What adaptive strategies are smallholders in Mopani using since their exposure to agroecology?
- iv. Did the leadership component of agroecology training enable individuals to transfer knowledge to Mopani smallholder farmers? If so, how? If not, why?

identified: exploring the perspectives of research participants, understanding the context in which research participants live, inductive or deductive analysis of data, a flexible research plan, and a researcher who gathers data and reflects on their positionality in the study throughout the process (Yin 2011; Creswell 2014). Describing their research paradigm is one way in which researchers can reflect on their positionality in the study.

Research paradigms refer to the worldviews that guide research studies, with each view shaped by its own philosophical assumption regarding the “nature of social reality (ontology), ways of knowing (epistemology), and ethics and value systems (axiology)” (Chilisa 2012:20). Three key paradigms can be identified: positivist-postpositivist, interpretivist-constructionist, and transformative (Chilisa 2012; Nieuwenhuis 2012; Bryman et al. 2014; Creswell 2014).

A postpositivist philosophy does not resonate with me, as I do not believe that researchers can attain the objectivity that this worldview claims is key (Crotty 1998; Creswell 2014). Although the transformative worldview’s goal of helping marginalised groups resonates with me, my research did not aim to take action to change the world (Creswell 2014), so this was not appropriate for my study either. Scholars who have an interpretivist-constructionist worldview believe reality is socially and individually constructed (ontology), knowledge is subjective due to its social construction (epistemology), and they acknowledge their positionality in the research process (axiology) (Chilisa 2012; Bryman et al. 2014; Creswell 2014). The constructionist worldview creates space for multiple realities from diverse cultures, acknowledging these cannot be generalised into a single, common reality (Chilisa 2012; Bryman et al. 2014). Given its emphasis on the subjective and socially constructed nature of knowledge, an interpretivist-constructionist worldview should thus theoretically value indigenous knowledge, belief systems, and community stories’ as authentic knowledge.

I feel I hold an interpretivist-constructionist worldview for the following reasons: it aligns with my understanding of the world from my background in International Relations and History; it aligned with my goal of gaining in-depth understanding of the changes in the thinking/behaviour of the individuals who have completed the training, and the farmers they have interacted with; and it values indigenous

knowledge, beliefs, and community experiences (which is also in line with agroecology principles).

Braun and Clarke (2006:85) seem to indicate that a wholesale devotion to a constructionist worldview would mean that I could not have relied on what the participants told me as being an accurate reflection of their “meaning and experience”, because constructionists cannot and do not “focus on motivation of individual psychologies”. In this sense, I am probably what Joffe (2012) refers to as a ‘weak’ constructionist, because I regard people’s engagement with issues as socially constructed, while still regarding the issues themselves as having some material basis. I also resonate strongly with Gibbs’ summation on the distinction (or lack thereof) between realists¹² and constructionists (which he regards as a form of ‘idealists’):

In practice, few qualitative analysts are purely realist or idealist. Most are concerned to portray, as accurately and faithfully as possible, what people actually said and to that extent they are realists. However, all would agree that qualitative research is a matter of interpretation, especially the researcher's interpretation of what respondents and participants say and do. A key commitment of qualitative research is to see things through the eyes of respondents and participants. This involves a commitment to viewing events, actions, norms, values, and so on from the perspective of those being studied. The researcher needs to be sensitive to the differing perspectives held by different groups and to the potential conflict between the perspective of those being studied and those doing the studying. Thus, there can be no simple, true and accurate reporting of respondents' views. Our analyses are themselves interpretations and thus constructions of the world.

(Gibbs 2012:7).

2.3 Research questions

In line with Creswell's (2014) description of qualitative research, certain research questions have emerged through a process of continuous engagement and reflection on the literature. As I became more familiar with the literature, the research questions were revised,¹³ and formulated as follows:

- i. How could agroecology influence the adaptability of smallholders in the face of climate change?

¹² Note: I must admit that I find the research epistemology literature to be a very confusing space, but I understand the concept of ‘realism’ to be most closely related to postpositivism as I referred to it earlier in this section.

¹³ The original research questions and why they changed can be found in Appendix A.

- ii. Did the leadership component of agroecology course enable trainers to transfer knowledge to Mopani smallholder farmers? If so, how? If not, why not?
- iii. Have smallholders in Mopani applied adaptive strategies prior to their exposure to agroecology?
- iv. What adaptive strategies are smallholders in Mopani using since their exposure to agroecology?

As discussed in 2.4, I have chosen a non-empirical literature review to address question i. A framework was developed as an output of the literature review, and then used to gather and analyse data to answer the other research questions. Questions ii, iii, and iv are addressed through an empirical case study design, discussed in 2.5.

2.4 Literature review design

A literature review refers to a comprehensive overview of scholarship on the topic under study (Mouton 2001; Cronin et al. 2008). According to Mouton (2001:180), scholars employ inductive reasoning when reviewing the literature, working through “a sample of texts ... in order to come to a proper understanding of a specific domain of scholarship”. There are a number of benefits and purposes in using a literature review as a research design to meet research objectives or answer questions. Some of these include providing context and background to the research topic under study, unpacking the major contentions within the literature consulted, clarifying concepts in terms of how they are used in the field, highlighting gaps in the literature as well as showcasing the importance of a study and how it intends to address this gap (Mouton 2001; Ridley 2012). Limitations of a literature review are discussed in 2.4.3.

The design of my literature review is discussed in the following sections: 2.4.1 identifies the type of literature reviews used in this thesis; 2.4.2 briefly illustrates the process and literature search; and 2.4.3 discusses the main limitations of a literature review.

2.4.1 Conceptualising literature reviews

There are various types of literature reviews. For example, Mouton (2001) identifies critical literature reviews, state-of-the-art reviews, and integrated literature reviews, but omits definitions for each. Other scholars discuss systematic reviews, which are

better suited to well-defined questions with numerical methodologies (see table 1) (Petticrew & Roberts 2006; Cronin et al. 2008; Jesson, Matheson & Lacey 2011; Ridley 2012). Some of the other types include narrative/traditional and conceptual reviews (Petticrew & Roberts 2006; Cronin et al. 2008; Jesson et al. 2011), defined in table 1.

Table 1: Key types of literature review

Type of literature review	Definition	Source
Systematic reviews	Uses a systematic approach for gathering, evaluating, and synthesising findings of a large number of studies on a specific topic or subject matter.	Petticrew & Roberts (2006) Cronin et al. (2008) Jesson et al. (2011) Ridley (2012)
Traditional/narrative review	Uses a critical approach to examine theories or hypotheses. Provides useful overviews of large volumes of literature, whilst identifying gaps in methods/results of studies.	Petticrew & Roberts (2006) Cronin et al. (2008) Jesson et al. (2011)
Conceptual review	Aims to develop a better understanding of issues by synthesising conceptual knowledge on the area	Petticrew & Roberts (2006) Cronin et al. (2008)

A traditional review was selected for this research as it can provide a useful synthesis of a large volume of literature, identify gaps in literature, and highlight the importance of new research (Petticrew & Roberts 2006; Cronin et al. 2008). Cronin et al. (2008:38) also suggest that these types of reviews can be “useful for both topic selection and topic refinement” as well as “developing conceptual or theoretical frameworks”. Both points are applicable to this study and as discussed in 2.5.3, conceptual frameworks are viewed as particularly important for designing a case study. The following section outlines the process involved in searching the literature.

2.4.2 Process and literature search

The processes involved in writing a literature review are ongoing and cyclical (Ridley 2012). Searching, reading, and writing about the literature are interconnected processes with no specific end point. Rather they continuously “feed into each other” (Ridley 2012:78). In turn, this cyclical process assists in shaping and revising the research focus, research problem, and questions. Ridley's (2012) assertions informed my literature review process.

Mouton (2001) highlights how a literature review can be structured according to themes. Using this logic, I divided my literature review into four key themes. Table 2 identifies the purpose of each theme and a few examples of the main search terms used. Once important sources were identified in each theme, an ancestry approach (using references in the bibliographies of key sources) was used to find further literature on the topic.

Table 2: Themes and purpose of literature review

Theme	Purpose	Search Terms
Climate change and agriculture	i. Provide a brief review of climate change effects on agriculture, specifically for smallholders, and in turn, the effects of agriculture/poor ecosystem management on smallholders' adaptability to climate change	<ul style="list-style-type: none"> • "Climate change" AND agriculture • "Climate change AND smallholders OR small farmers OR small scale"
Smallholders	i. Provide a brief overview of smallholders in global and South African literature	<ul style="list-style-type: none"> • smallholders OR small-scale farmers OR small farmers • smallholders OR small AND "South Africa"
Adaptability	i. Understand adaptability within resilience literature ii. Identify key adaptive strategies in the literature	<ul style="list-style-type: none"> • Adaptability AND resilience¹⁴ • Adaptability OR adaptive capacity OR adaptive strategies
Agroecology	i. Understand the concept of agroecology ii. Link agroecology and adaptability/social resilience	<ul style="list-style-type: none"> • Agroecology OR agro-ecology OR agroecological • Agroecology AND resilience

2.4.3 Limitations

While literature reviews can produce a thorough understanding of the trends, debates, and theories within a certain field, their limitation is that they "at best only summarise and organise existing scholarship" (Mouton 2001:180). Mouton (2001) adds that despite the insights obtained through literature reviews, there is still a need to test these insights through empirical research.

¹⁴ Note: The focus on adaptability also emerged through engagement with resilience literature. Initially, the research was focused on the influence of agroecology on the resilience of smallholders, but later it became more focused on adaptability due to the social focus.

A traditional literature review was selected in order to synthesise literature related to research question i¹⁵ and develop a conceptual framework. To overcome the limitation identified above, the conceptual framework was applied to an empirical case study, as discussed in 2.5.3 and 2.5.5, to gain insight into the impact of agroecology training on smallholders' adaptability.

2.5 Case study design for questions ii, iii, and iv

A case study design of inquiry was chosen to answer questions ii, iii and iv. According to Yin (2009, 2013), case studies are most suitable when: (a) the research aims to answer how and why questions, (b) the researcher is not intending to manipulate the behaviour of the research participant, but (c) is attempting to understand a contemporary phenomenon. The context in which the phenomenon is situated and the blurred lines between context and phenomenon are further reasons to consider this design (Baxter & Jack 2008). Points a, b, and c informed the selection of a case study design for this thesis. Point a is discussed in 2.5.1. In line with point b, the aim of the research was not to manipulate the behaviour of the research participants, but rather to understand their experiences with the agroecology training. At the same time, the need for more sustainable forms of agriculture in the face of climate change, specifically for smallholders, is a contemporary issue (c). A further reason for choosing this design centred on the need to bring forth the voices of marginalised groups (i.e. smallholders) in South Africa, and thereby cultivate a multi-perspective insight into the value of leadership and agroecology training programmes geared toward the need of these marginalised groups (Nieuwenhuis 2012).

Scholars identify a number of useful tools for designing a case study, including: research questions, a theoretical framework, determining the case/unit of analysis, preferred methods for data collection and data analysis (Baxter & Jack 2008; Yin 2013). As 2.5.1 to 2.5.5. elaborate, these tools were used to design the case study and inform the research process.

¹⁵ Research question i: How could agroecology influence the adaptability of smallholders in the face of climate change?

2.5.1 Research question/s

Research questions ii, iii and iv,¹⁶ identified in 2.3, may seem to contradict the fact that case study research is most commonly associated with “how” and “why” questions (Baxter & Jack 2008; Yin 2009, 2013). However, Yin (2013) acknowledges the exploratory nature of some “what” questions and recognises that these types of questions may use any research design. For instance, there are exploratory experiments, exploratory case studies, and exploratory surveys (Yin 2013). A case study was considered most relevant for exploring the impact of the SAFL and 17 Shafts’ agroecology training programme on smallholders’ adaptability to climate change in Limpopo. As the following sections demonstrate, the unit of analysis, the development of a conceptual framework, and the variety of data collection methods were further tools for designing the case study (Creswell 2014).

2.5.2 Unit of analysis

Yin (2013:29) emphasises the importance of “defining what the case is”. This means the unit of analysis needs to be made explicit. Clarification is needed on whether the focus is on a process, a programme or at the individual, small group, community or organisational level. Factors such as selection criteria and boundaries should also be included to limit the scope of the study (Baxter & Jack 2008; Yin 2013). According to Baxter and Jack (2008:546), identifying the “(a) time and place, (b) time and activity, and (c) definition and context” are useful ways to bind a case study and manage complex research.

I chose to focus my case study on the agroecology course at 17 Shaft due to my interest in agroecology training and the funding I received through the SAFL from the National Research Foundation. Using Baxter and Jack's (2008) logic, I then refined the case study focus to the experience and activities of trainers and smallholders who have been affected by the agroecology training programme. In this sense, the case study was bound by the individuals who completed the agroecology training, their contexts, and their interactions and activities with smallholders and their

¹⁶ Research question ii: Did the leadership component of the agroecology course enable individuals to transfer knowledge to Mopani smallholder farmers? If so, how? If not, why not?

Research question iii: Have smallholders in Mopani applied adaptive strategies prior to their exposure to agroecology?

Research question iv: What adaptive strategies are smallholders in Mopani using since their exposure to agroecology?

communities. Hence research participants were selected for the study based on two criteria. The first criteria was the inclusion of the individuals who had completed the agroecology training programme. Observations of individuals participating in the leadership part of the second round of training were also included as a way to reflect on the training experience for the first group.

The second criterion included smallholders or individuals who had engaged with or participated in activities of the trainers who had completed the agroecology training programme. Although the term ‘trainer’ refers to the individuals who graduated from the agroecology training programme, the distinction between trainer and smallholder is relatively blurred in this thesis. This is due to the fact that two of the trainers, Ms Mlondobozi (2017) and Mr Sekhula (2017), were farmers prior to their participation in the course. Prior to farming, Ms Mlondobozi (2017) was a teacher, but she turned to farming in response to her frustration with the food insecurity amongst her students. In 2004, Ms Mlondobozi (2017) started farming when her husband secured a three-hectare piece of land from a local chief in Phalaborwa. She subsequently resigned from teaching in 2005. Mr Sekhula (2017) started farming in 2007 and it was his main source of income.

Meanwhile, three of the other trainers, Ms Mabunda (2017), Ms Mbodi (2017), and Ms Risenga (2017), also described themselves as farmers. While Ms Mbodi (2017) informed me that she started farming in her backyard in 1996, Ms Risenga (2017) started farming on a small piece of land close to her house upon returning from the programme. Ms Mabunda (2017) added that she farms free range chickens to sell. Before the training, Ms Mabunda (2017) worked as a training manager responsible for capacity building for conventional agriculture in community projects, early childhood development centres, and farming communities. In late 2015, she became interested in agroecology and organic farming. During this time, she became an organic activist in her community, working with Ms Wainwright and the Bryanston PGS, until her enrolment in the leadership and agroecology training programme (Mabunda 2017; Wainwright 2017). The overlap between trainers and farmers means the views, activities, and experiences of both groups are used to inform and address the case study research questions.

Table 3 characterises the participants, highlighting their age, status as a farmer or trainer, how long they have been farming for, their background prior to agroecology training, and whether they were exposed to agroecology prior to either the training at 17 Shaft or becoming involved in the trainers' workshops/activities. Most of the farmers interviewed can be considered subsistence-oriented smallholders or market-oriented smallholders in loose value chains (Cousins & Chikazunga 2013 cited in SAFL & PLAAS 2013). A typology of smallholders, explaining this category of smallholders, is provided in 3.3.1 of chapter 3.

Table 3: Profiling the research participants

Participant name	Age (if given)	Location	Status (smallholder or trainer)	Smallholder category	Background/farming experience before the agroecology training	Prior exposure to agroecology
Mr James Kheto	63	Nkomo village, Mopani district, Limpopo	Smallholder	Subsistence- oriented smallholder/market-oriented smallholder in loose value chains	Started backyard farming in 2012	No
Ms Margareth Makhubela	-	Nkomo village, Mopani district, Limpopo	Smallholder	Market-oriented smallholder in loose value chains	Started farming in 1962	No
Ms Maria Baloyi	71	Nkomo village, Mopani district, Limpopo	Smallholder	Market-oriented smallholder in loose value chains	Started farming in 2000	No
Ms Butshabelo Mabunda	-	Giyani, Mopani district, Limpopo	Agroecology trainer	Market-oriented smallholder in loose value chains	<ul style="list-style-type: none"> • Commercial farming training manager from 2001-2015 • Activist from 2015-2016 • Farms free range chickens 	Yes
Ms Constance Mbodi	43	Giyani, Mopani district, Limpopo	Agroecology trainer, but also refers to herself as a backyard farmer	Subsistence-oriented smallholder	Farming since 1996	Yes

Ms Irene Risenga	-	Giyani, Mopani district, Limpopo	Agroecology trainer & smallholder	Subsistence-oriented smallholder	Since 2016, did not farm prior to 17 Shaft training	No
Mr Patrick Sekhula	35	Mbhedle village, Dzumeri, Mopani district, Limpopo	Agroecology trainer & smallholder	Market-oriented smallholder in loose value chains	Started farming in 2007	Yes
Ms Norah Mlondobozi	-	Tzaneen, Mopani district, Limpopo	Agroecology trainer & farmer	Market-oriented smallholder in loose value chains	<ul style="list-style-type: none"> Started farming in 2004 Resigned from teaching in 2005 	Yes
Mr Nelson Ngoveni	25	N'wamitwa, Tzaneen Municipality, Mopani district, Limpopo. Works in Hoedspruit, Mopani district, Limpopo	Agroecology trainer	Not applicable – refers to himself as a trainer	<ul style="list-style-type: none"> Studied public management at Tshwane University of Technology Helped on family farm 	No
Mr Eldred Maake	26	Greater Letaba Municipality, Mopani district, Limpopo Studies in Polokwane, Capricorn district, Limpopo	Agroecology trainer	Not applicable – refers to himself as a trainer	<ul style="list-style-type: none"> Attended Mandela Barwick Agricultural High School Completing a Masters degree in Agriculture at the University of Limpopo 	Yes
Ms Audrey Wainwright	-	Bryanston, Johannesburg, Gauteng	Operations Manager of Bryanston Organic & Natural Market	Not applicable	Facilitates Bryanston Market PGS	Yes
Dr Anri Manderson	-	Hoedspruit, Limpopo	<ul style="list-style-type: none"> Project Manager, SAFL Social Enterprise Manager, Hoedspruit Hub 	Not applicable	Facilitated the first phase of the leadership skills and agroecology training programme at 17 Shaft	Yes

A final issue to consider was that the trainers had only graduated from the programme in August 2016, which meant the research had to focus on potential effects during this short time span. I had one year to complete this research and was formally registered for the degree in February of 2017. These parameters helped shaped the research questions in conjunction with the literature.

2.5.3 Conceptual framework

Yin (2009, 2013) asserts that a good case study design depends on the development of a conceptual framework. According to Baxter and Jack (2008:553), “the conceptual framework serves as an anchor for the study and is referred to at the stage of data interpretation”, but it continues to develop as the research and data collection progresses. Using a framework has several uses such as using theory to describe relationships and categorising observations into “intellectual bins” (Baxter & Jack 2008:553).

The concepts from the framework informed the interviews and observations, as discussed in 2.5.4. The use of these concepts enabled me to place my observations and interview questions into “intellectual bins” (Baxter & Jack 2008:553), which was useful during data analysis (see 2.5.5). The conceptual framework was also influenced by my growing understanding of the case study, allowing me to focus on adaptive strategies that were not only central themes in literature on SES, but also relevant for my case study. By using the concepts within the framework, I was able to provide insight into the types of adaptive strategies present pre- and post-agroecology. Figure 3 illustrates the link between agroecology and the adaptive strategies identified in the literature. Section 4.5.2 provides a full description of my conceptual framework.

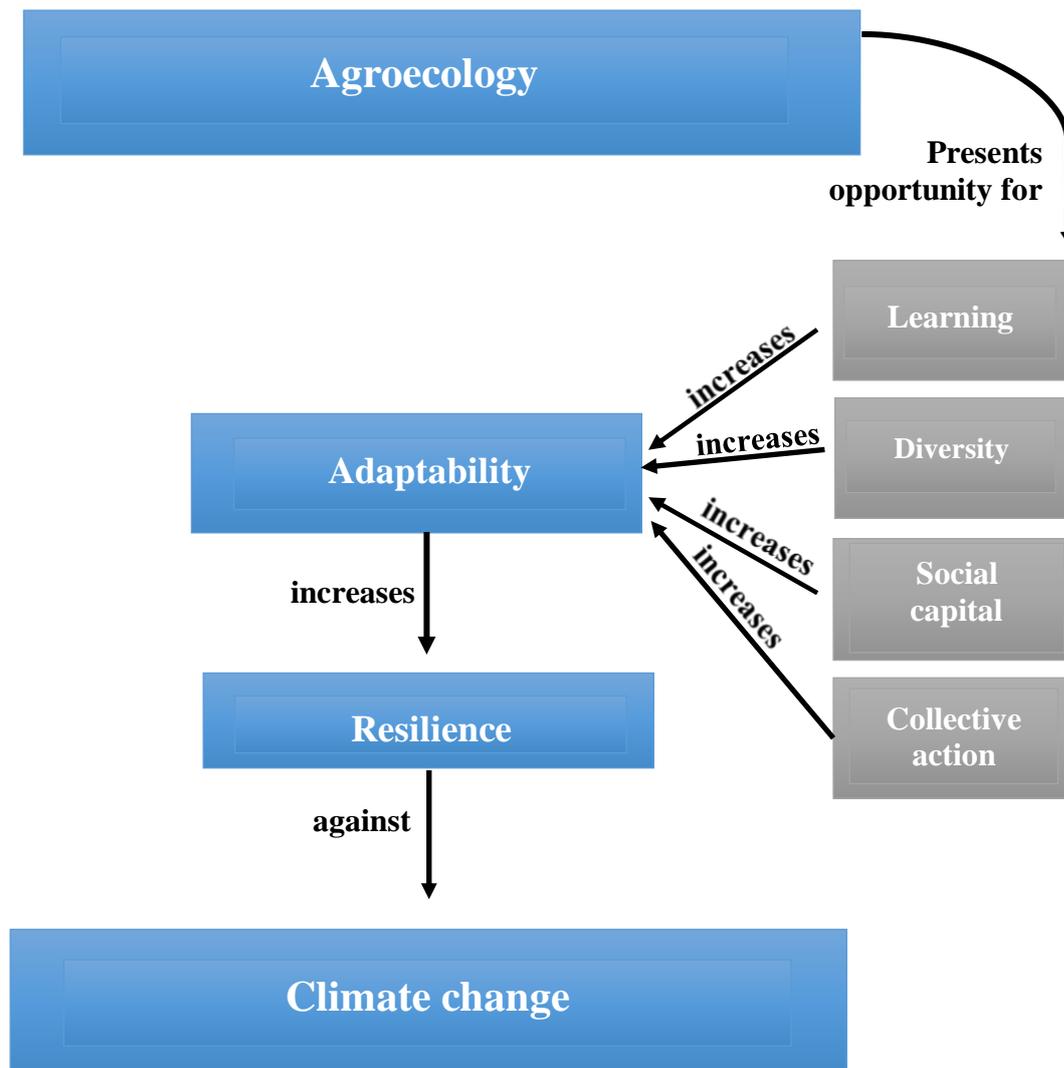


Figure 3: An illustration of the conceptual framework

2.5.4 Methods for data collection

A number of methods are commonly associated with case studies, including interviews, observation, and analysis of documentary evidence (Mouton 2001; Yin 2009; Bryman et al. 2014; Cresswell 2014). Research methods used for this study consisted of conducting interviews and observations, and analysing documentary evidence. Through the SAFL, I had access to the trainers, farmers, the 17 Shaft Training Centre, and documents from both the SAFL and 17 Shaft. The information gathered through these sources was used to inform the historical context of the case study in chapter 1.

a. Semi-structured interviews

Semi-structured interviews “require the participant to answer a set of predetermined questions”, but researchers also have the freedom to ask further questions (Nieuwenhuis 2012:87). These types of interviews rarely extend over long periods of time (Nieuwenhuis 2012). Semi-structured, rather than open-ended or structured interviews were considered most relevant for this research, because I had predetermined questions based on the literature that I wanted to ask. As a ‘weak’ constructionist, I also wanted to explore any new ideas or issues that emerged from the participants.

Semi-structured interviews were conducted with 11 individuals who had either completed the agroecology training, were connected to the training/trainers, or had been involved in the trainers’ activities in Limpopo. Seven of the interviews were conducted with trainers who completed the agroecology training. The other three interviews were conducted with smallholders who had been participating in weekly meetings organised by two of the trainers in Nkomo Village in Mopani district. The final interview was conducted with Ms Wainwright (2017) who had been working with one of the trainers, Ms Mabunda (2017), and smallholders in Nkomo village prior to the agroecology training. I had informal conversations with Dr Manderson throughout 2016 and 2017 to gain further understanding of the case study. Field notes were taken during each of these conversations, typed up, and then used for data analysis, as 2.5.6 discusses.

Interview schedules (see Appendix B, C, and D) were used to guide the interviews with the trainers and smallholders. In developing the schedules, I realised it was going to be difficult to convey the meaning of the concepts from the literature to individuals for whom English was not their first or even second language. To avoid using interview time to define concepts, the concepts were used implicitly through my understanding of them to elicit the views of the individuals who either completed the agroecology training or had been involved in the trainers’ activities. For instance, I asked smallholders whether there had been any changes in their thinking or behaviours toward farming since their participation in agroecology training with trainers, rather than asking them about the type of learning they had experienced.

Topics covered in the interviews with farmers included: eliciting their experience with weather patterns; identifying which, if any, strategies were used to cope with the effects of climate change prior to their exposure to agroecology; their experience with the agroecology training, and whether they felt anything had changed since their exposure to agroecology (see Appendix B). The interviews conducted with the trainers covered similar themes, especially as many of them also referred to themselves as farmers. However, further discussion points included their experience with the training programme and whether the leadership component enabled them to share their knowledge with smallholders (see Appendix C). Additional questions were asked when I needed to clarify a response.

The aim of the interview conducted with Ms Wainwright (2017) was to obtain information on some of the gaps in my research, specifically the background of the Giyani PGS launch. The main themes I discussed with her were: the history of the Giyani PGS, the launch of the Giyani PGS, and the role of agroecology in bringing the group of smallholders together to build social resilience in the face of climate change.

The difficulties experienced in conducting the interviews are discussed in 2.5.6 and 2.6. The ethical considerations in conducting the interviews are discussed in 2.7.

b. Observation

Observation is considered a valuable research method because it allows the researcher to develop insight into how power, communication, and language have been socially constructed (Nieuwenhuis 2012). There are four types of observation: “(1) being a participant only, (2) being a participant who also observes, (3) being an observer who also participates, and (4) being an observer only” (Yin 2011:122). The latter (4) was most suitable, as my direct involvement (e.g. asking questions in the leadership training) would have altered the dynamics or influenced the situation/activities I was aiming to observe (see table 4).

Table 4 details the activities I observed during the course of my research. The challenges experienced in observing these activities are discussed in 2.5.6 and 2.6. As table 4 indicates, I included notes on my participation in a learning journey to Mopani district in October 2016 with the SAFL as an observation. The SAFL uses learning

journeys¹⁷ to expose multiple stakeholders across the food system to various system realities in order to inspire collaborative and sustainable change (SAFL n.d.a). As indicated in 2.5.2, I was only formally enrolled for my MPhil in February 2017, which means my participation in the learning journey occurred before I had begun data collection. Nevertheless, I made preliminary field notes during the trip and typed these up for later use during data analysis, as discussed in 2.5.5. The aim of the SAFL's learning journey was to review the progress of their SSA programme, specifically the activities of the agroecology trainers since completing their training (Drimie 2016). Photos were taken during the learning journey and fieldwork to aid recall of the field notes.

Table 4: List of observation activities

Observation date	Area/place	Activity observed	Purpose of observation	Number of people observed	Time spent (hours)
01/11/2016-03/11/2016	Mopani district, Limpopo	Learning journey, the SAFL	Familiarise myself with the geographic location and meet future research participants in an informal setting	Prior to data collection	48
01/05/2017	Nkomo village, Limpopo	A weekly meeting amongst 19 smallholders in Nkomo village; Ms Mbodi was the only trainer present	<ul style="list-style-type: none"> • Observe trainers' transfer of knowledge to smallholders • Observe adaptive strategies used by smallholders 	19	4
16/05/2017	17 Shaft Training Centre, Johannesburg	Leadership training	<ul style="list-style-type: none"> • Gain insight into influence of leadership content on trainers 	14	6
17/05/2017	17 Shaft Training Centre, Johannesburg	Leadership training		14	5.5
22/05/2017	17 Shaft Training Centre, Johannesburg	Leadership training		16	3.5
23/05/2017	17 Shaft Training Centre, Johannesburg	Leadership training		16	5

¹⁷ The following link illustrates how learning journeys form an essential part of the SAFL's (n.d.e) theory of change: <http://www.southernafricafoodlab.org/our-approach/>.

Total	35 ¹⁸	24
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The weekly meetings between smallholders in Nkomo village are usually facilitated by two of the trainers, Ms Mbodi and Ms Mabunda. The venues rotate each week, with the intention to share work and knowledge on agroecology on each smallholders' land. At the meeting I attended in May 2017, only the smallholders were present in the first hour of my observation. Ms Mbodi arrived later and facilitated the rest of the meeting. Ms Mabunda was unable to attend this meeting due to other commitments, so her sister translated for me until Ms Mbodi arrived.

Observations may be recorded through the use of anecdotal records ("short descriptions of basic actions"), running records (detailed and continuous accounts of the situation, the context and actions), or structured observations ("predetermined categories of behaviour") (Nieuwenhuis 2012:85). Although I had developed a structured observation schedule (see Appendix F), I experienced difficulties in completing the form while in the field. Instead, I made brief notes during the field work, with key concepts from the literature in mind (e.g. learning at the individual or social levels). Following each observation, I typed the field notes into running records (detailed, continuous accounts). As 2.5.5 will discuss, these notes were used for data analysis. The ethical considerations for the observation process are discussed in 2.7.

c. Documentary evidence

Analysis of documentary evidence is the final method used for this study. Documents are important for enhancing and confirming the evidence gathered through other methods (Yin 2009; Nieuwenhuis 2012). Additional advantages of documentary evidence include: verifying details mentioned during interviews, confirming participants' or organisations' details, as well as providing background and context (Yin 2009). Some of the limitations of documentary evidence include the difficulty in retrieving documents and the bias involved in selecting certain documents.

When using documentary evidence, it is necessary to distinguish between primary and secondary sources of data. Primary sources of data refer to documents, either published or unpublished, received directly from the participants or organisations (e.g.

¹⁸ This is not a sum of the numbers listed for each observation, as I observed some people more than once.

reports or meeting minutes). Secondary sources of data, on the other hand, refer to documents based on “previously published work” such as books or journal articles (Nieuwenhuis 2012:83). As I received a bursary through the SAFL to conduct this research, I experienced no difficulties in gaining access to requested documents. I received access to all documents primarily through the SAFL, 17 Shaft Training Centre, and Ms Wainwright (2017). Most of the documents used were primary sources while one was a secondary source based on primary data collected from 150 smallholders in Mopani and Vhembe districts of Limpopo (Ubisi et al. 2017). I used the Ubisi et al. (2017) study to see whether their findings regarding the 2015/2016 drought confirmed or differed from those identified in the other data sources. The documents consisted of the following:

- Smallholder farmer’s perceived effects of climate change on crop production and household livelihoods in rural Limpopo (Ubisi et al. 2017)
- Supporting smallholders into commercial agriculture: A social dialogue and learning project (SAFL & PLAAS 2013)
- Growing places: A visit to PGS farmer members in Giyani (Wainwright 2015)
- Funding proposal for agroecology and organic agriculture workshops, and the introduction of participatory guarantee systems in Giyani, Limpopo (Mabunda & Wainwright 2016a)
- Giyani on the ground: The Giyani workshops (Mabunda & Wainwright 2016b)
- Mopani learning journey – reflections (Drimie 2016)
- Food Lab system shift report (Goldberg 2016)
- The SAFL drought impact assessment (Manderson et al. 2016)
- Leadership skills and agroecology training (17 Shaft n.d.a)
- Leadership skills and agroecology training (17 Shaft n.d.b)
- Leadership Learner Guide (17 Shaft n.d.c)
- Concept note: 17 Shaft LACE training, phase II (SAFL n.d.b)

The documents consulted proved useful in two ways. First, they provided valuable background on the training, events, and activities that took place in relation to the agroecology training. These documents largely informed the historical context summarised in chapter 1. Second, the documents enhanced the data gathering and analysis process, by corroborating evidence from the other sources.

2.5.5 Data analysis

My data analysis strategy was to first provide a “detailed description of the setting or individuals” and then analyse “the data for themes” (Creswell 2014:196). Thematic analysis is a method that involves searching across data sources (interviews, observations, documentary evidence, etc.) to identify repeated patterns (Braun & Clarke 2006). I chose it as my data analysis strategy, because it can “provide a rich and detailed, yet complex, account of the data” (Braun & Clarke 2006:78). Although thematic analysis is commonly used in qualitative research, it is often not named explicitly nor were there clear guidelines on how to apply the method before Braun and Clarke’s 2006 article.

There are certain advantages and disadvantages to using this method. Two key advantages include: its flexibility as a tool across different research paradigms (e.g. realist versus constructionist paradigms) and its ability to convey complex findings simply. Thematic analysis can have limited explanatory power if used without a theoretical framework (Braun & Clarke 2006). Ultimately, Braun and Clarke (2006) suggest that the researcher needs to be explicit about the decisions made when applying thematic analysis, which I discuss in the sections below.

When using this approach, there are a number of useful steps to follow, including: (a) organising the data, (b) coding the data (by hand or computer), (c) developing themes, and (d) interpreting the findings and relating them to the literature. These steps were used to inform my data analysis strategy.

a. Organising the data

Before data collection, I created folders on my laptop for each data source used. As data was collected, I placed each document (e.g. transcribed interview) into the relevant folder. The audio files from the interviews were saved on my phone with the participant’s name (see 2.7 for the ethical process). In order to convert these sound files to text for analysis, I enlisted the services of a transcription company, The Typing Pool Transcription Services. I checked each transcription from The Typing Pool against the audio recordings to ensure the interview had been captured accurately. Before coding, I briefly read over the transcriptions and summaries of the interviews, the observation field notes, and the documentary evidence to gain a general understanding of the data.

b. Coding codes

I used a computer assisted qualitative data analysis programme, *atlas.ti*, to code and analyse data (Yin 2009). Using software like *atlas.ti* does not negate the analytic role of the researcher, as the programme merely helps to organise mass data in a structured way through assigning codes to selected quotations of texts (Yin 2009, 2011). Ultimately, researchers still need to analyse the data once it is coded. To use *atlas.ti*, I participated in an introductory course, which taught me how to use the programme to create codes and extract data for specific codes/code groups.

I used both a theory-driven and data-driven approach to coding (Braun & Clarke 2006; Gibbs 2012; Creswell 2014). It was theory-driven in the sense that I had reviewed the literature before I began my analysis, and so had developed a clear understanding of the kinds of concepts and issues that I was interested in identifying in the participants' interview data. But, it was data-driven too because, as a constructionist, I wanted to honour the participants' voices and views, and so developed codes based on what the interview data indicated. Gibbs (2012:46) acknowledges that most researchers move between these two approaches, and advises that one should not become "too tied to the initial codes" one has constructed from the literature. I consequently also coded for topics that seemed important to the participants and the overall research questions (Braun & Clarke 2006), even when these did not fit neatly into my pre-defined conceptual framework. The analysis of these additional codes also helped inform my recommendations to various stakeholders who could benefit from the research, and supported the identification of areas for future research.

Researchers also determine the depth of interpretation of their themes/codes. Analysis at the semantic level focuses on explicit meaning in the data and therefore does not seek further meaning behind what is said/written (Braun & Clarke 2006). On the other hand, latent analysis examines the assumptions underlying semantic content. The latter approach uses interpretation to develop themes, with the analysis already rooted in theory; it is therefore typically used in conjunction with a constructionist worldview (Braun & Clarke 2006). When coding, I mostly focused on interpreting the implicit meanings underpinning the quotations selected (latent level). I also used

semantic level analysis when I identified explicit statements that related to codes that had been generated.

The entire content of the data set was coded using the codes developed through the conceptual framework as well as codes that emerged in the data. Once the data corpus had been coded, I then reviewed the data within each code to ensure the quotations selected were relevant. To further refine the codes that had been generated, some codes were renamed and merged with other codes where there was significant overlap. Once this had been completed, the codes were then grouped together into relevant code groups/families. For instance, codes identifying types of individual learning (experiential, instrumental, communicative, emancipatory) were placed into the code group: ‘learning’. Codes identifying attributes or general aspects of social learning (networks, integration of knowledge, social learning) were placed into the code group: ‘social learning’, and so on. Emergent codes were also placed into relevant code groups. Appendix G defines the codes and coding groups that were developed.

c. Developing the themes

Developing the themes is the third step in the data analysis process. At this stage, researchers “define and refine” the essence of each theme and proceed to “analyse the data within them” (Braun & Clarke 2006:92). Braun and Clarke (2006) suggest researchers decide on “what counts as a theme” whether this is in terms of prevalence or its importance to the research question (Braun & Clarke 2006:82).

After placing the codes into code groups, I analysed the code groups to identify themes across the data. The main overarching themes that emerged included:

- The leadership training and leadership skills
- Adaptive strategies smallholders and trainers were using before and after their exposure to agroecology training
- Benefits and limitations of agroecology
- Observation of weather patterns
- Challenges

Within each of these themes, there were sub-themes that related to concepts in the literature (social learning before agroecology training, social learning after

agroecology training, etc.) and those that emerged from the data (resource challenges).

d. Interpreting the findings

Researchers may use numerous approaches to interpret the findings. This may entail discussing the lessons learnt, identifying further questions, or comparing findings to the literature (Creswell 2014). To help me interpret the findings, I manually organised the themes into three categories that would allow me to answer the three research questions, including ‘leadership’, ‘before the agroecology training’, and ‘after the agroecology training’. I then compared the data in the categories to the findings identified in the literature review. I also identified areas for future research (see 6.5).

2.5.6 Limitations of a case study design

While a case study design was useful for the focus of this research and for answering research questions ii, iii and iv, there are limitations to this design. A common criticism of case study research is the time-consuming nature of data collection and analysis (Mouton 2001; Yin 2009, 2013). One of my challenges was the time required to travel from where I live to the case study sites (17 Shaft and Giyani in the Mopani district), as photo 3 illustrates. Trips had to be planned in advance and even so I was not always able to meet my objectives. For instance, I had intended to conduct interviews with all of the trainers in my first trip to Limpopo, but this was not possible due to their schedules and also the distances between them in the district. Due to their busy schedules, some of the interviews were not as in-depth as I had initially hoped, because trainers either needed to leave or were too tired to continue. Still, I managed to ask all the questions I needed to, and follow-up conversations via phone calls were had with the trainers when further clarification was needed.

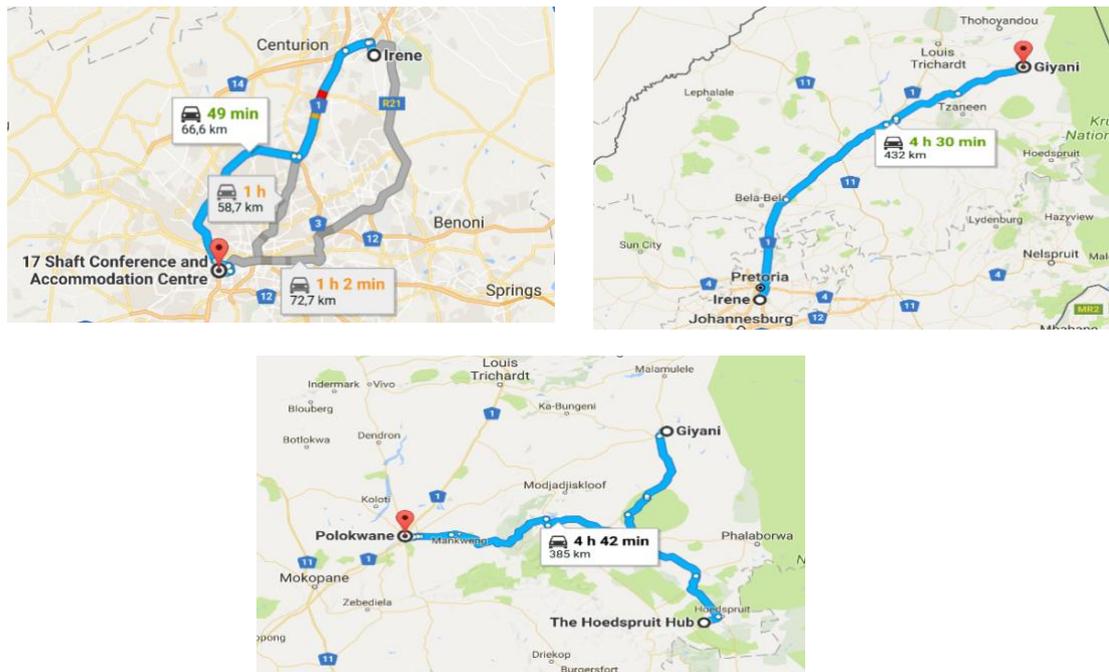


Photo 3: Distance to case study sites

Planning observations was also challenging as the schedule for the leadership and agroecology training at 17 Shaft was continuously revised. I ensured that I remained in close contact with the facilitators of the programme so I could adjust my schedule accordingly.

Data analysis was more time consuming than anticipated as it was my first time analysing large volumes of data. This required me to refine my analytical abilities; I did this by devising a clear data analysis strategy and continuously refining how I approached the data.

A second criticism relates to the context-bound nature of case studies. Critics argue case studies are limited due to the inability to provide generalisable recommendations (Mouton 2001; Yin 2009, 2013). However, this is not always the aim of case study research, particularly not for exploratory research like mine. Rather, case studies can provide insight into the dynamics within certain contexts, as opposed to offering conclusions that can be generalised (Yin 2009; Nieuwenhuis 2012). An additional weakness relates to the difficulties involved in designing a case study given the absence of a comprehensive manual (Yin 2013). As 2.5.1 to 2.5.5 demonstrate, a number of tools were used to overcome this limitation.

2.6 Other limitations

One of the major limitations in carrying out this research was the communication barrier between myself and research participants during interviews and observations. Most of the participants could speak English, but it is not their first or even second language; I am also unable to speak their first languages. During my observation in Nkomo village, one of the trainers was able to translate for me. Still, the communication barrier meant I had to have a thorough grasp of the concepts in order to conduct the interviews. Despite my grasp of the concepts, I had to prompt or use examples when asking certain questions, which may have influenced the interviewees' responses. Furthermore, I felt some of my questions and responses were 'lost in translation/communication'. In other words, I may have been able to elicit more detailed responses to some of the questions if I was fluent in the languages of the research participants, or if I was able to afford a professional translator.

2.7 Ethical considerations of study

The key ethical consideration within this research relates to the study of people and their behaviour. I tried to ensure all research participants were treated fairly and with respect to prevent any harm to those involved in the research. As a 'weak constructionist', I ensured I valued their lived experiences. I listened actively to their opinions and was also mindful of their time. To conduct interviews and the observation sessions, I requested each participant's permission through a consent form. While each section of the consent form¹⁹ was explained to most of the participants in English, one of the trainers helped me to translate the consent form to the smallholders in Nkomo village (see appendix E). The consent forms informed the participants of my research aims and their involvement, requested their permission to observe the activity or record the interview, enquired about their preferred degree of anonymity, and pledged to delete audio recordings and files once the research was complete. All research participants gave their permission to be interviewed and observed, for the interviews to be recorded, and indicated that anonymity was not required.

¹⁹ Given that a number of consent forms were used for the different groups and research methods, appendix E provides an example of the forms used to request permission to interview trainers.

Once consent had been granted, I conducted the interviews using an interview guide (see Appendix B, C, and D) and made recordings with my phone. I took measures to safeguard interviewees' privacy and their right to confidentiality by saving the recordings on my phone first and then later transferring them into a folder on my personal online Google Drive (cloud-based file sharing) that only I could access. In order to convert these sound files to text analysis, I enlisted the services of a transcription company, The Typing Pool Transcription Services. The Google Drive folder containing the audio files for each interview was only shared with The Typing Pool Transcription Services. Each transcribed interview was sent directly to me, and I saved the files on my laptop with each interviewee's name. Transcriptions and field notes will be kept as part of the *atlas.ti* data bundle for the foreseeable future, as more research findings could be drawn from the dataset, using different research questions, but the recordings were deleted, as explained to interviewees.

An additional ethical risk involved managing the expectations of the research participants. Some participants asked whether there would be future support for their resource challenges (e.g. irrigation). It was difficult to answer these questions, because I sympathised with the challenges they were facing. To overcome this challenge, I emphasised that my research would ultimately highlight their experiences and challenges with both agroecology and extension support through an academic thesis, but that I was not in a position to offer them financial support. I would, however, translate key research findings into an accessible format for these farmers as part of my National Research Foundation agreement with the SAFL.

Chapter 3: Climate change and smallholders – a literature review

3.1 Introduction

The growing number of environmental problems (drought, water scarcity, land degradation, etc.) globally (FAO 2016) mean communities have to learn to adapt to change to deal with future crises, but many lack the capacity to do so (Berkes et al. 2003; Fabricius et al. 2007; Nelson et al. 2007; De Bruijn et al. 2017). For instance, social (hunger), economic (rising food prices), and ecological (climate change, droughts, floods) crises are placing pressure on the global food system, and farmers in particular. These crises require farmers to continuously adapt how they farm (Darnhofer, Bellon et al. 2010; Cabell & Oelofse 2012; Pereira 2012). Yet farmers have been coping with and adapting to change for generations (Darnhofer, Bellon et al. 2010), so why is there a need to focus on their adaptability to climate change? As Cabell and Oelofse (2012) contend, the changes occurring today differ in speed, magnitude, and how or where they begin.

This chapter provides the rationale for chapter 4 on adaptability and agroecology, which addresses my first research question.²⁰ I discuss climate change and its implications for smallholders through the following sections: 3.2. discusses the effects of climate change on agriculture and smallholders in the global and South African contexts; 3.3 briefly reviews the definition and status of smallholders in global and South African literature; and 3.4 summarises the chapter.

3.2 Climate change in the global and South African contexts

Climate change is one of the key drivers of change in the 21st century (FAO 2017). It is expected to lead to more extreme weather events (droughts and floods), higher temperatures, water scarcity, and land degradation. The effects of climate change will vary across regions, countries, and ecological zones, but poorer countries are expected to be most affected (FAO 2016, 2017). As indicated in chapter 1, climate change, as defined in this thesis, is attributed to human activities, both directly and indirectly

²⁰ Research question i: How could agroecology influence the adaptability of smallholders in the face of climate change?

(Intergovernmental Panel on Climate Change 2013). Using this definition, climate change (driven by human activity) differs from climate variability (driven by natural processes) (Intergovernmental Panel on Climate Change 2013).

Between 2015 and 2016, “South Africa experienced the combined effects of a severe drought and a strong El Niño event”²¹ (Baudoin et al. 2017:128). South African authorities consider it the worst drought in the last 23 years (Baudoin et al. 2017). According to Baudoin et al. (2017), El Niño events can sometimes trigger extreme droughts. In addition to drought, climate change is also expected to affect the country’s temperatures and rainfall patterns, and lead to more frequent and extreme flood events. This is problematic in a country that is semi-arid and water-scarce (Gbetibouo et al. 2010). However, climate change is expected to have varied effects on different parts of the country. For instance, climate change projections for South Africa indicate that by 2050 the interior will become significantly warmer (5–8°C), the west and southern parts of the country will become drier, and the eastern area may face wetter conditions (Department of Environmental Affairs 2013; Montmasson-Clair & Zwane 2016). Some of the effects of climate change on Limpopo province were identified in 1.3.3. The following section discusses the effects of climate change on agriculture globally and in South Africa.

3.2.1 The effects of climate change on agriculture globally and in South Africa

Climate change is expected to impact food security and all areas of food production, despite the fact that agriculture is one of the major contributors (e.g. destruction of ecosystems, soil degradation, feedlots, etc.) to climate change (Joubert 2006; IAASTD 2009; FAO 2017). The increasing frequency of extreme weather events poses a risk to global and regional food security, and specifically to the ability of poor and marginal groups to feed themselves (IAASTD 2009; De Schutter 2011; FAO 2017).

In terms of agriculture, losses are expected to occur in livestock, fisheries, forestry, and crop productivity (FAO 2016, 2017). While the effect of climate change on crop productivity will vary between regions, developing countries are expected to be more

²¹ Section 1.1 in chapter 1 defines El Niño events

negatively affected than developed countries (Intergovernmental Panel on Climate Change 2013; FAO 2016, 2017; Altieri & Nicholls 2017). For instance, De Schutter (2011:5) points out how “yields from rain-fed agriculture could be reduced by up to 50 per cent between 2000 and 2020” in southern Africa. Further evidence is found in the fifth Intergovernmental Panel on Climate Change (2013) report, indicating a decline in crop yields in regions already experiencing food insecurity (cited in FAO 2016).

The effects of climate change in South Africa are concerning given the limited “agricultural potential of most land” in the country (Cousins 2013:125). Variable rainfall and frequent droughts make agriculture, specifically crop production, in South Africa risky and challenging (Cousins 2013). This was noticeable during the recent drought, which led to water restrictions in most parts of the country, a decline in crop yields, higher food prices, “reduced availability of basic foods”, and higher levels of debt amongst farmers (Baudoin et al. 2017:128).

With variable rainfall patterns and other extreme weather events becoming more common, farmers will find it challenging to maintain their productivity (Goldblatt n.d.). While the effects of climate change on farmers will vary, smallholders are considered more vulnerable. This issue is discussed in the following section.

3.2.2 The effects of climate change on smallholders globally and in South Africa

Smallholders are seen as more susceptible to the effects of climate change due to their “reliance on agriculture” for their livelihoods (Altieri & Nicholls 2017:34), their remote geographic locations, their unequal access to resources, their low income (IAASTD 2009; Morris et al. 2016; Altieri & Nicholls 2017), and their lack of access to relevant information (Ubisi et al. 2017). Furthermore, a recently published study (Carleton 2017) links the effects of climate change, specifically rising temperatures during growing seasons, to around 60,000 farmer and farm worker suicides in India. However, as Patel (2013) discusses, farmer suicides are also a product of the power imbalances within the food system (e.g. suicides are linked to farmer debt due to loans taken to pay for inputs). Nevertheless, the study claims a one degree increase in the temperature, when day temperatures are over 20 degrees during agricultural seasons, culminates in an additional 67 suicides across India (Carleton 2017). Carleton

(2017:8747) argues the heat damage to crops places additional “economic pressure on farming households”. These points suggest that the effects of climate change exacerbate smallholders’ vulnerability within the global food system.

On the other hand, Altieri and Nicholls (2017) argue that statistics often exaggerate the susceptibility of smallholders. For instance, biotechnology advocates use statistics to push “climate-smart genes (drought or flood resistant transgenic crops) as the only option for small farmers to adapt to climate change” (Altieri & Nicholls 2017:34). According to Altieri and Nicholls (2017), use of traditional methods such as raised beds, green manures, cover crops, and terraces make many small farms resilient to the effects of climate change (Altieri & Nicholls 2008; Altieri 2009; Van der Ploeg 2014). While this view assumes all smallholders use environmentally friendly practices, certain groups highlight how they have also undermined ecosystem services through their reliance on pesticides, fertilisers, and modern seed varieties (IAASTD 2009; Kremen et al. 2012; IFAD – UNEP 2013). For instance, Altieri and Toledo (2011:591) acknowledge that only 50 per cent of smallholders use “resource-conserving farming systems”. Although the points raised above depend entirely on context, smallholders’ contribution to ecosystem degradation is concerning given their dependence on natural resources (IFAD – UNEP 2013).

Nonetheless the literature recognises the need for more smallholders to adopt sustainable production practices to enhance their social and ecological resilience to the effects of climate change (Altieri & Nicholls 2008; Altieri 2009; IAASTD 2009; IFAD – UNEP 2013; FAO 2017). Some authors believe this can be done through smallholders’ adoption of agroecology, acknowledging its value as an approach smallholders can use to cope with environmental stress (Altieri & Nicholls 2008; Altieri 2009; IAASTD 2009; Altieri & Toledo 2011; De Schutter 2011; FAO 2016, 2017). Many of the points raised in the global literature are equally relevant to the South African context, with smallholders facing similar challenges in dealing with the effects of climate change (Ubisi et al. 2017).

Similar to global trends, the susceptibility of smallholders to climate change in South Africa depends on location, access to resources and technologies, but their vulnerability is also related to their historical marginalisation (Gbetibouo et al. 2010). Importantly, Gbetibouo et al. (2010) highlight how the adaptive capacity of South

Africa's provinces also determines smallholders' adaptability to climate change. For instance, Gauteng and Western Cape are considered less vulnerable given their higher literacy levels and better developed infrastructure, in comparison to other South African provinces. Meanwhile, Limpopo, Kwazulu-Natal, and Eastern Cape are seen as particularly vulnerable, because they are "characterised by densely populated areas, large numbers of small-scale farmers, high dependency on rain-fed agriculture, and high land degradation" (Gbetibouo et al. 2010:175). Studies in Limpopo have identified the following effects of climate change on smallholders: food insecurity due to crop losses, shortages of water, outbreak of pests and diseases, and loss of livestock due to water and food shortages (Maponya & Mpandeli 2012; Ubisi et al. 2017). Ubisi et al. (2017) argue that smallholders adapt better to climate change when they have appropriate extension support.

Within the context outlined above, it is concerning that research on sustainable agriculture (Blignaut et al. 2015; Midgley et al. 2015; Von Loeper et al. 2016) and smallholders in South Africa (Greenberg 2010; Aliber & Hall 2012; Okunlola et al. 2016) is limited. The lack of qualitative and quantitative evidence on sustainable agriculture in the country suggests the need for further empirical research in this area (Von Loeper et al. 2016).

3.3 Who are smallholders?

A brief understanding of smallholders and their status is needed before examining how agroecology may influence their adaptability in the face of climate change (chapter 4). 3.3.1 briefly reviews the definitions and characteristics of smallholders at the global and South African levels, while 3.3.2 identifies the estimated number of smallholders globally and in South Africa, as well as their contribution to food security.

3.3.1 Defining and categorising smallholders

A commonly agreed upon definition of smallholders remains elusive (Morton 2007; IFAD – UNEP 2013). The term itself is often used interchangeably with "peasant", "subsistence farmers", and "small-scale farmers" (Altieri & Nicholls 2008; Altieri, 2009; Altieri & Toledo 2011; Kremen et al. 2012; Van der Ploeg 2014), with little recognition of the fact that these farmers are not a homogenous group (Cousins 2013;

Bernstein 2014; Jansen 2014). Morton (2007) suggests smallholder agriculture generally refers to rural farmers who are largely based in developing countries, and who rely on family labour and farming as the primary source of income.

Certain scholars recognise smallholder differentiation in terms of class differences, gender inequalities, access to resources (information, technology, capital, and land size), and their diverse relations with the market (Wegner & Zwart 2011; Christen & Anderson 2013; IFAD – UNEP 2013; Bernstein 2014; Jansen 2014). The FAO (n.d.) of the United Nations classifies a small farm as less than 2 hectares (cited in IFAD – UNEP 2013), but Morton (2007) suggests this depends on national contexts. According to the IFAD – UNEP (2013) report, land size does not capture marginalisation, limited resources, or a sense of powerlessness.

Related to the aforementioned views, Christen and Anderson (2013) put forth a typology of smallholders in low and middle-income countries. Numerous factors (e.g. gender, land size, etc.) are used to distinguish three categories of smallholders: non-commercial smallholders, commercial smallholders in loose value chains, and commercial smallholders in tight value chains (see table 5) (Christen & Anderson 2013). Although Christen and Anderson (2013) typology is useful for understanding the nuances between different groups of smallholders (e.g. gender of farmers), the average age of smallholders and their model of farming (e.g. more conventional or more sustainable forms of farming) are absent.

Table 5: Smallholders in low and middle-income countries

	Non-commercial smallholders	Commercial smallholders in loose value chains	Commercial smallholders in tight value chains
Numbers	300 million smallholders	165 million smallholders	35 million smallholders
Gender of farmer	More women in subsistence farming	-	Less women
Land size	Less than 1 hectare	1 to 2 hectares	2 hectares or more
Crop mix	Staple crops	Staples and some cash crops	Cash crops, few staple crops

Engagement with markets	Little engagement with market. Most food is produced for home consumption.	Some food is consumed at home. Surplus of staple crops are sold through informal, local markets	Some food is consumed at home, with surplus of staple crops sold to informal, local markets. Cash crops sold to export or regional markets
Access to technology	Limited	Limited	Good
Access to finance	Limited or informal	Limited and informal	Informal and some formal

(Source: Christen & Anderson 2013)

In the South African literature consulted, a major strength is the emphasis placed on differentiating smallholders. This seems to be a response to the lack of clarity on the term in policy discussions (Cousins 2013; Greenberg 2013; Okunlola et al. 2016). South African scholars seem to agree with international scholars (Wegner & Zwart 2011; Christen & Anderson 2013; Bernstein 2014; Jansen 2014), noting that smallholders are not a homogenous group (Cousins 2013; Greenberg 2013; Okunlola et al. 2016). In line with Morton's (2007) views, Cousins offers the following definition for the South African context:

smallholders are small-scale farmers who use farm produce for home consumption to some degree, and use family labour within the farming operation to some degree, but for whom farming contributes a highly variable amount of cash income via marketing of farm produce. Levels of mechanisation, capital intensity and access to finance are also variable among such farmers.

(Cousins cited in SAFL & PLAAS 2013:3).

Broadly speaking, Cousins (2013) highlights how a common distinction is made in South African literature between a larger number of smallholders who can be categorised as subsistence or semi-subsistence on the one hand, and a smaller group that can be considered commercial, semi-commercial, or emerging commercial farmers on the other. These points are best reflected in Cousins and Chikazunga's (2013 cited in SAFL & PLAAS 2013) typology of smallholders in South Africa, seen in table 6.

Table 6: Typology of smallholders in South Africa

Subsistence-oriented smallholders	Market-oriented smallholders in loose value chains	Market-oriented smallholders in tight value chains	Small-scale capitalist farmers
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Objective of production	Household consumption	Household consumption + cash income	Cash income + some home consumption	Profit
Proportion of marketed output	None or insignificant	50% or >	75% or >	100%
Contribution to household income	Reduces expenditure on food	Variable – from small to insignificant	Significant	Very significant
Labour	Family	Family + some hired	Family + significant numbers hired	Hired
Mechanisation	Very low	Low	Medium to high	High
Capital intensity	Very low	Low	Medium to high	High
Access to finance	Absent	Some	Significant	Very Significant
Numbers in SA	2–2.5 million households	200–250 000 households	?	?

(Source: Cousins & Chikazunga 2013 cited in SAFL & PLAAS 2013)

Many of the variables in Cousins and Chikazunga's (2013 cited in SAFL & PLAAS 2013) classification are comparable to those identified in Christen and Anderson (2013). Similar to Christen and Anderson (2013), Cousins and Chikazunga's (2013 cited in SAFL & PLAAS 2013) typology does not characterise smallholder groups based on their average age or model of farming (conventional versus more sustainable forms of agriculture). While Christen and Anderson (2013) include the gender of farmers in their typology, the gender dimension is also missing from Cousins' and Chikazunga's typology.

Okunlola et al. (2016:53) highlight that each type of smallholder requires “targeted support by governmental (e.g. local municipalities) and non-governmental actors (e.g. NGOs or commodity associations)”. This means typologies of smallholders need to include gender dimensions, age, and the model of agriculture smallholders are generally engaged in. Further research is needed on each of these areas to build on Cousins and Chikazunga's typology. Adding these variables (gender, age, and model of farming) could assist in ensuring support services are more appropriate to the needs of smallholders in South Africa. This is important as scholars indicate that smallholders have so far received insufficient support through policy measures and the government's extension programme (Greenberg 2013; Hendriks 2014; Okunlola et al. 2016).

Despite the gaps in Cousins' and Chikazunga's (cited in SAFL & PLAAS 2013:3) definition and typology, they still provide a nuanced understanding and recognition of the heterogeneity amongst smallholders in the South African context. For this reason, Cousins' and Chikazunga's definition and typology informs the understanding of smallholders in this thesis.

3.3.2 The current status of smallholders globally and in South Africa

In the twenty-first century, there are 2.5 billion people who derive their livelihoods from food production systems (FAO n.d.). Out of the 2.5 billion individuals, smallholders comprise roughly 1.5 billion located on 350 million small farms (FAO n.d.; Altieri & Nicholls 2017). According to the IAASTD report (2009:9), small farms, less than two hectares, are mostly found in "Asia (87%), followed by Africa (8%), Europe (4%) and America (1%)". There has also been a gradual feminisation of smallholder farming, or increase in the number of female smallholders (IAASTD 2009). However, Morton (2007:19680) contends the absence of a universal definition means "there are few informed estimates of world or regional population of smallholder or subsistence farmers".

The paucity of reliable data is evident in the South African context too (Cousins 2013; Pienaar 2013; Kelly & Metelerkamp 2015), and is likely connected to the lack of conceptual clarity in policy discourse (Cousins 2013; Greenberg 2013). A study conducted by Aliber et al. (2009 cited in Cousins 2013) is considered to offer the most reliable national data on the number of smallholders in South Africa. This study, also cited in Kelly and Metelerkamp (2015), identifies roughly four million black individuals or 2.5 million black households involved in agriculture, most of which are female.

Smallholders are considered vital for ensuring food security at household level in South Africa, especially for the most vulnerable (Baiphethi & Jacobs 2009; Von Loeper 2016). Though South Africa is food secure at national level, food insecurity at household level still remains (Baiphethi & Jacobs 2009; Pereira & Drimie 2016). Hence there is a need to support the productivity of smallholders to improve food security at household level (Baiphethi & Jacobs 2009; Von Loeper 2016).

Due to their numbers, smallholders are viewed as contributing significantly to global and regional food security, especially for the most vulnerable people in rural and urban areas (Altieri & Nicholls 2008; Altieri 2009; Altieri, Funes-Monzote & Petersen 2012; IFAD – UNEP 2013; Van der Ploeg 2014). Certain scholars contend that small farms are more productive than large farms, if one considers total output rather than the yield per crop (Altieri & Nicholls 2008; Altieri 2009; Altieri & Toledo 2011; Altieri et al. 2012). Bernstein (2014), on the other hand, remains sceptical of estimates of smallholder populations and their contribution to the food supply, doubting whether increases in their productivity would really enhance global food supply. The debate on smallholders' productivity has become polarised (Van der Ploeg 2014) with smallholders regarded favourably amongst some scholars (Altieri & Nicholls 2008; Altieri & Toledo 2011; Holt-Giménez & Altieri 2013), and less favourably amongst others (Bernstein 2014; Jansen 2014).

While their contribution to food security and productivity remains contested (IAASTD 2009), smallholders and landless workers are often neglected (IFAD – UNEP 2013). These farmers continue to be some of the most vulnerable in our societies (De Schutter 2009). Many smallholders and landless labourers, who produce our food, are hungry and unable to buy food (De Schutter 2009). At the same time, countries and regions based on smallholder farming tend to be the most susceptible to “ecosystem degradation” (IAASTD 2009). As 3.2.2 briefly acknowledges, smallholders in these countries are usually reliant on natural resources and agriculture for their livelihoods, with only half of these farmers using methods that conserve rather than degrade ecosystems (IFAD – UNEP 2013). This suggests the need for smallholders to enhance their adaptability and resilience through the adoption of more sustainable practices.

3.4 Conclusion

This chapter provided the rationale for the following chapter. Climate change is expected to have significant implications for agriculture and food security over the coming decades, especially for smallholders. These farmers are considered more susceptible due to their limited access to resources, marginalisation, geographic locations, and food insecurity. Given the reliance of smallholders on agriculture and their contribution to the food security of the most vulnerable people, there is a need to

enhance their adaptability to climate change and in doing so, improve their SES resilience.

The literature consulted indicates how an accepted definition of smallholders cannot be found globally or in South Africa. However, it is evident that smallholders are not homogenous. Rather, they are a heterogeneous group comprising various degrees of marginalisation and access to resources, support services, capital, land, and varying relations to the market. As mentioned in the chapter, the differentiation amongst smallholders calls for diversified support efforts to increase their adaptability to climate change. Further research is needed on characterising smallholders in order to understand how gender, age, and models of agriculture determine their needs.

Chapter 4: Agroecology and smallholders' adaptability to climate change – a literature review

4.1 Introduction

Chapter 3 unpacked the rationale on which the arguments in this chapter are based. It discussed the impact of climate change on agriculture and smallholders, and also highlighted that smallholders are a heterogeneous group, requiring targeted support. By reviewing literature on adaptability and agroecology, this chapter answers research question i: how could agroecology influence the adaptability of smallholders in the face of climate change?

The question is addressed through the following sections: 4.2 situates the concept of adaptability within resilience thinking and then provides a thorough review of the concept; 4.3 identifies adaptive strategies; 4.4 unpacks the concept of agroecology as a science, a practice, and a movement; 4.5 discusses how agroecology influences smallholders' adaptability in the face of climate change; and 4.6 summarises the arguments put forth.

4.2 Framing adaptability

Given its significance for building SES resilience, this section reviews how adaptability is conceptualised in the literature through three main sections: 4.2.1 uses SES literature to examine the concept of adaptability; 4.2.2 defines adaptability; and 4.2.3 briefly distinguishes between coping and adaptive strategies in the literature.

4.2.1 Adaptability in social-ecological systems

Interest in resilience has grown over the years (Carpenter et al. 2001; Folke 2006; Krasny et al. 2010). The term first emerged in the field of ecology in the 1960s through the work of Holling (1973 in Folke 2006), but the concept has since spread to numerous fields (Folke 2006; Brown 2014). In this thesis, adaptability and resilience concepts are rooted in the research field of SES (Brown 2014). Despite the progress in extending the concept of resilience to SES, some scholars note the challenges involved in transferring ideas from natural sciences to social systems (Gallopín 2006; Hornborg 2009; Hatt 2013; Maclean et al. 2014), while others (Brown 2014; Hahn &

Nykvist 2017) acknowledge the progress in understanding the social dimension of resilience.

Adaptability along with resilience and transformability are identified as key properties of SES (see table 7) (Carpenter et al. 2001; Walker et al. 2004; Folke 2006; Folke, Carpenter, Walker, Scheffer, Chapin & Rockström 2010). Yet, there is some contestation in the literature over whether adaptability and transformability form part of (Folke 2006; Folke et al. 2010) or are separate to resilience (Gallopín 2006 in Brown 2014). Hahn and Nykvist (2017) relate these opposing views to the definitions provided in Walker et al. (2004), in which resilience and adaptability were defined separately. This has led to perceptions of resilience as backward looking, preventing innovation or change toward a new trajectory (Folke et al. 2010).

Table 7: Key attributes of SES

Attributes of SES	Definition
Resilience	Resilience in SES is understood as: (1) the amount of change a system can endure and still maintain a similar function and structure; (2) a system's capacity to self-organise; and (3) a system's capability to learn and adapt (Carpenter et al. 2001; Folke 2006; Cabell & Oelofse 2012).
Adaptability	Actors' ability to influence a system's resilience (Folke et al. 2010). It includes the concepts of adaptation and adaptive capacity (Hahn & Nykvist 2017). In this sense, adaptability is closely related to social resilience, and often used interchangeably (Maclean et al. 2014).
Transformability	The ability to transform away from a stable state into a new system when social, economic or ecological structures become unsustainable (Walker et al. 2004; Folke et al. 2010).

Brown (2014) highlights how recent literature on resilience has realigned resilience to adaptation and transformation. For instance, social change through adaptation and transformation is increasingly recognised as essential for SES resilience (Folke 2006; Folke et al. 2010; Brown 2014; Hahn & Nykvist 2017). As Brown (2014:112) contends, “social change – profound change – is required for persistence in the Holocene”.²² An intimate relationship clearly exists between the concepts of adaptability, resilience, and transformability. The degree of overlap is less clear, making it fairly difficult to decide which concept offers the best lens for analysing a

²² As highlighted in chapter 1, the Holocene refers to a stable geological period that allowed humanity and agriculture to flourish (Steffen et al. 2007).

particular SES. The research questions in this study have determined the focus on adaptability, which is recognised as building resilience.

4.2.2 Defining adaptability

Providing a singular definition of adaptability is challenging as the concept is defined in diverse ways (Smit & Wandel 2006; Nelson et al. 2007). Many authors define adaptability in terms of the ability, or adaptive capacity, of individuals in a SES to influence or build resilience (Walker et al. 2004; Folke 2006; Smit & Wandel 2006; Walker et al. 2006; Hahn & Nykvist 2017). For these authors, adaptability is an intentional process guided by individuals (Walker et al. 2004; Smit & Wandel 2006; Hahn & Nykvist 2017). Adaptability is also viewed as an “inclusive concept”, encompassing adaptive capacity, adaptiveness, and adaptations (Hahn & Nykvist 2017). Given that adaptive capacity forms part of adaptability (Hahn & Nykvist 2017), adaptability is also closely related to social resilience (Maclean et al. 2014), with both concepts focused on individuals’ ability to influence resilience. Darnhofer, Bellon et al. (2010) provide a pertinent example of how decision making on farms is under the influence of humans and thus there is a need to understand the adaptability of the farmer/social domain.

On the other hand, critics (Nelson et al. 2007; Hornborg 2009; Hatt 2013) seem to hold a more impersonal view of the concept. They perceive adaptability as the ability of a SES to self-organise through an unintentional and harmonious process (cited in Hahn & Nykvist 2017). These authors (Nelson et al. 2007; Hornborg 2009; Hatt 2013) critique of adaptability is based on their contention that SES literature overlooks social conflict and power dynamics (Brown 2014; Hahn & Nykvist 2017; Maclean, Ross, Cuthill & Witt 2017). Hahn and Nykvist (2017) disagree with critics’ view of adaptability, noting that much of their critique is linked to the self-organisation property of complex adaptive systems²³ frameworks. In these frameworks, actors/components are observed from outside a system, and adaptations are typically seen as an autonomous property of a system. One example is assessing the adaptation of farming systems to climate change without including an analysis of

²³ Complex adaptive systems refer to dynamic systems with interactions between various components that adapt or self-organise in response to change. Some of their key characteristics include: heterogeneity (diverse actors/components), self-organisation (a system’s spontaneous arrangement of its parts), and non-linear interactions between components/actors (relationship between cause and effect is not a straight line) (Cilliers 2000; Berkes et al. 2003; Folke 2006; Wells 2013).

the farmer's role in enabling the adaptation. Hahn and Nykvist (2017) contend that SES research does not assume this process is “harmonious or autonomous”, as increasing focus is placed on social issues and agency (Brown 2014; Hahn & Nykvist 2017). For instance, one body of research centres on identifying the adaptive needs of a community and the practical strategies that may enhance their adaptive capacity (Smit & Wandel 2006). The view of adaptability as an intentional process individuals undertake is most relevant to this thesis given the focus on smallholders' adoption of agroecology to enhance their adaptability.

With these considerations in mind, adaptability is defined in this thesis as part of resilience, but specifically referring to an intentional process undertaken by individuals within a SES to influence resilience (Walker et al. 2004; Smit & Wandel 2006; Hahn & Nykvist 2017). Influencing the resilience of a SES depends on individuals' decision-making processes, and their ability (adaptive capacity) to adapt to and shape change within social and ecological domains (Walker et al. 2004, Folke 2006; Smit & Wandel 2006; Walker et al. 2006).

4.2.3 Adaptive versus coping strategies for adaptability

Along with its diverse definitions, individuals' adaptability can also be examined in a number of ways (Smit & Wandel 2006). Scholars use coping strategies and adaptive strategies to characterise communities' responses to change, as illustrated in table 8 (Smit & Wandel 2006; Fabricius et al. 2007). Coping strategies denote reactive short-term responses for survival with no social learning or institutional change taking place. On the other hand, adaptive strategies refer to “proactive adaptations” to ensure long-term social and ecological sustainability (Fabricius et al. 2007:¶ 19). Arguably coping strategies do not require system change, whereas adaptive strategies most likely require some form of social change. Fabricius et al. (2007) identify three types of communities based on their adaptive capacity: powerless spectators who lack the abilities to respond to change, coping actors who have the ability to adapt to change, but rely on coping strategies, and adaptive co-managers who adopt proactive and long-term views of challenges, and use adaptive strategies to respond to change (see table 8).

Table 8: Categorising communities' adaptability

Type of community	Characteristics
Powerless spectator	<ul style="list-style-type: none"> • Lack the capacity to govern • No options, financially or technologically, to adapt • Lack skills, natural resources, networks, and institutions • Lack awareness/knowledge of threats facing them • Weak/fragile adaptive capacity
Coping actor	<ul style="list-style-type: none"> • Lack of leadership, vision, and motivation • Short-term tactics
Adaptive co-managers	<ul style="list-style-type: none"> • Able to support adaptation in the long-term due to adaptive capacity • Social learning and institutional change is central • Aware of challenges and take the necessary action to ensure sustainability in the long-term • Typically supported by institutions at different spatial scales • Possible through six strategies: <ol style="list-style-type: none"> 1. Leadership & vision 2. Knowledge networks 3. Institutional networks 4. Culture & management 5. Enabling policies 6. High motivation

(Source: Fabricius et al. 2007)

Fabricius et al. (2007) emphasise the need for strategies that enable communities to become adaptive co-managers, and thus enhance their adaptive capacity. Their preferred six strategies are indicated in table 8. The identification of strategies to enhance adaptability is a common theme in the literature. For instance, learning (individual and social), diversity, and self-organisation are identified by many authors, as factors that generate adaptive capacity (Carpenter et al. 2001; Olsson et al. 2004; Armitage 2005; Armitage & Plummer 2010; Darnhofer, Bellon et al. 2010; Darnhofer, Fairweather & Moller 2010; Diduck 2010; Milestad et al. 2010; Cabell & Oelofse 2012). Further strategies in the literature comprise:

- increasing social capital (Adger 2003; Ostrom & Ahn 2003; Armitage 2005; Folke 2006; Walker et al. 2006)
- enhancing spatial and temporal heterogeneity (Cabell & Oelofse 2012)
- developing networks (Olsson et al. 2004; Armitage & Plummer 2010)

All of the above strategies are viewed as valuable ways for communities and individuals to respond to change.

According to Walker et al. (2006), three to five key factors, “i.e. the rule of hand”, can be used to understand changes in SES. Therefore, four strategies to become adaptive co-managers: learning, cultivating diversity (social and ecological), developing social capital, and inspiring self-organisation (referred to as collective action in this thesis), have been selected for investigation in the case study due to their expected relevance.

Learning receives the most attention in 4.3 because it is considered an essential strategy for farmers (Darnhofer, Bellon et al. 2010; Cabell & Oelofse 2012), and is also considered central to the definitions of resilience and adaptive capacity (Carpenter et al. 2001; Darnhofer, Fairweather et al. 2010; Diduck 2010). Networks are also briefly discussed, as the concept relates to all four strategies identified and therefore they are viewed as the central link between the strategies (as illustrated in figure 4). These strategies, as well as the network link, are discussed in the following section.

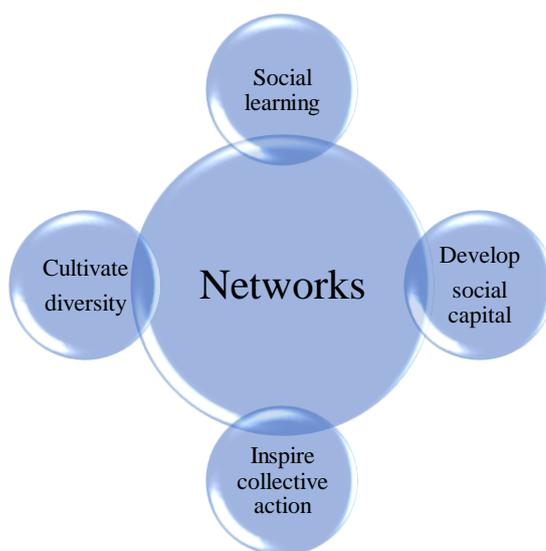


Figure 4: Links between adaptive strategies identified for the case study

4.3 Networks, and the strategies that enhance the adaptability of smallholders

This section contains a review of networks, and the four strategies identified above. Networks are discussed as the linking concept between the four strategies (4.3.1). Using literature on resilience and adaptability in farming systems, numerous indicators for each strategy are then identified (4.3.2 to 4.3.5) (Darnhofer, Bellon et al. 2010; Cabell & Oelofse 2012; Tamako & Thamaga-Chitja 2017). The main

argument in this section is that the four strategies identified may enhance smallholders' adaptability to climate change. Smallholders with strong adaptability represent adaptive co-managers (see table 8 in 4.2.2) who are able to influence SES resilience. These strategies link agroecology and smallholders' adaptability in the context of climate change, as discussed in 4.5.2.

4.3.1 Social networks as the central link between adaptive strategies

Social networks are a key component of learning (individual or social), diversity, social capital, and collective action strategies. In this way, social networks are the central link between these strategies. This section briefly identifies how social networks enable or constrain these strategies, which are defined in sections 4.3.2 to 4.3.5.

In SES, social networks encompass a multitude of actors (from individuals to organisations) across spatial scales who share norms, and typically rely on flows of information for ecosystem management or to address problems (Olsson et al. 2004; Armitage & Plummer 2010). Networks offer support, create hope, and develop communities' capacity to handle uncertainty and change (Maclean et al. 2014). For instance, social networks are a way for farmers to cooperate (collective action) and share knowledge/technologies (learning) (Tamako & Thamaga-Chitja 2017).

At the same time, when networks no longer serve individuals' needs or constrain their social capital, individuals may leave and form their own networks (Pelling & High 2005). As Walker et al. (2006) indicate, cooperation within networks is contingent on its structure, trust, and the flow of information. Disintegration of these three aspects may impede cooperation and thus reduce resilience (Walker et al. 2006).

Individual and social learning are embedded in social contexts such as networks that ultimately influence the learning process. Learning through social interaction also enables actors to transform social networks by debating norms, rules, and power structures (Reed et al. 2010). Further research is needed on how power dynamics inhibit or facilitate learning processes, specifically around questions such as "who learns what, when, to whose benefit and why" (Galaz 2005:567; Wildemeersch 2007; Diduck 2010; Lee & Krasny 2015). At the same time, networks allow adaptive co-managers at different spatial scales to share and integrate diverse knowledge types

(local/indigenous to scientific knowledge) to foster awareness of SES or address a problem (Fabricius et al. 2007; Darnhofer, Bellon et al. 2010; Cabell & Oelofse 2012).

Social networks also cultivate social diversity by increasing the range of actors, opinions, and access to markets and knowledge systems (Darnhofer, Bellon et al. 2010; Walker et al. 2010; Cabell & Oelofse 2012; Pereira 2012). Though it is not discussed in the literature consulted, social networks may also cultivate ecological diversity given the intrinsic link between social and ecological systems in SES. The development of social networks is viewed as a particularly important attribute of social capital (Ireland & Thomalia 2011), as they offer a vehicle through which trust, norms, and leadership can develop. Finally, social networks provide a platform for collective action to occur. At the same time, collective action amongst individuals may strengthen existing networks (Ostrom 2009; Ireland & Thomalia 2011; Vanni 2014).

4.3.2 Learning for change and uncertainty

Adapting unsustainable agricultural practices to more sustainable ones, such as agroecology, requires a shift in thinking and behaviour (Fazey et al. 2005; Wals & Van der Leij 2007; Darnhofer, Bellon et al. 2010; Milestad et al. 2010). A pertinent example is how learning may change smallholders' understanding of which farming methods (e.g. water harvesting to conserve water during a drought) are more suited to a changing climate and in turn, enhance their ability to adapt to change. Understanding how learning influences actors' ability to handle change requires an analysis of key definitions of learning in the literature.

A challenge in defining the concept is the lack of distinction made between individual and social learning within the literature (Diduck 2010; Reed et al. 2010). Diduck²⁴ (2010) stresses the importance of distinguishing between learning at different levels, because individuals and groups learn differently. Still, there seems to be an overlap between individual and social learning. While this thesis differentiates between the

²⁴ Diduck (2010) refrains from using the concept of social learning, as he believes the concept obscures the complexity of meanings attached to it. In place of social learning, Diduck (2010) discusses action group learning, organizational learning, network learning, and societal learning. A discussion of each of these concepts is beyond the scope of this thesis, but they all do relate to elements of social learning, and thus his views are included in this section.

two concepts, it also recognises the dynamic interplay between social and individual learning and that features of both may overlap (see figure 5). Individual learning is discussed in part a of this section, while literature on social learning is reviewed in part b.

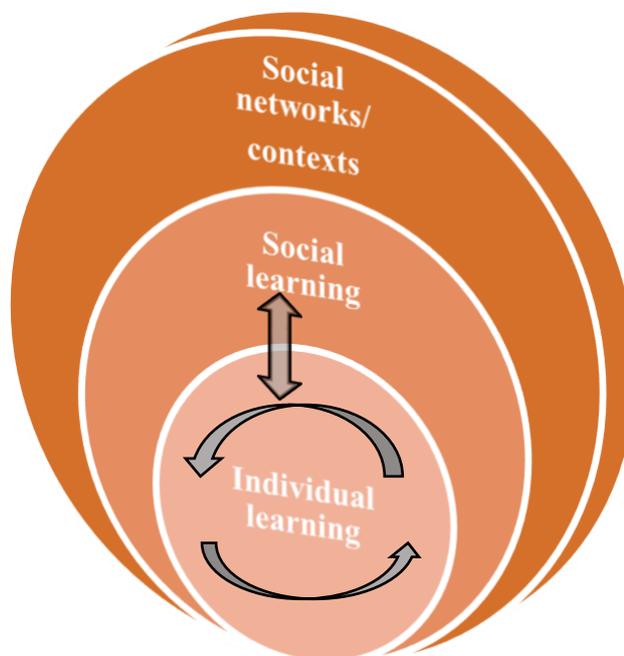


Figure 5: Interaction between individual and social learning

a. Individual learning

Conventionally, learning has been defined at the individual level (Berkes 2009) and therefore general definitions tend to focus on this scale. At this level, definitions centre on an ongoing process that leads to a change in individuals' beliefs, skills, knowledge, or behaviours (Fazey et al. 2007; Diduck 2010; Milestad et al. 2010; Reed et al. 2010). Differences in how scholars define learning are also evident, including:

- changes in individuals' understanding through regular practice (Fazey et al. 2005; Fazey et al. 2007; Diduck, 2010; Milestad et al. 2010) or experiments (Darnhofer, Bellon et al. 2010)
- how learning alters individuals' understanding of the world and their relation to it (Fazey et al. 2005; Krasny et al. 2010; Reed et al. 2010)
- how new understanding guides action in the future (Milestad et al. 2010)

Yet, Reed et al. (2010) argue learning may or may not result in changes to the thinking, attitudes, and behaviour of individuals.

Numerous theories in the literature explain how learning occurs. This is where the distinction between individual and social learning is blurred. Some scholars use learning theories to describe individual learning (Diduck 2010), whilst others use the same theories to describe social learning (Armitage et al. 2008; Berkes 2009). As Reed et al. (2010) point out, these theories do not describe social learning per se, but are used to provide insight into the foundation on which it occurs. The main learning theories referred to in the literature include:

- experiential learning (Armitage et al. 2008; Berkes 2009)
- organisational theory (single-, double-, and triple-loop learning) (Armitage et al. 2008; Berkes 2009; Diduck 2010; Reed et al. 2010)
- transformative theory (instrumental, communicative and emancipatory forms of learning) (Armitage et al. 2008; Berkes 2009; Diduck 2010; Reed et al. 2010)

Diduck (2010) and Reed et al. (2010) suggest organisational and transformative learning theories are comparable. For this reason, this thesis only discusses experiential learning and transformative learning theories, as figure 6 illustrates, and limits them to the individual level in the interest of clarity.

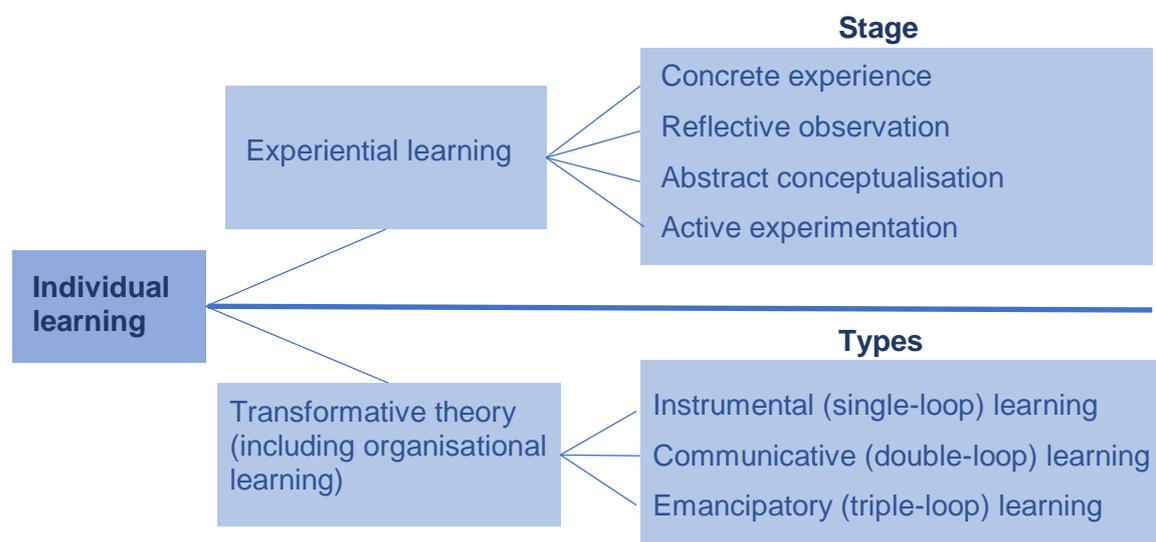


Figure 6: Mind map of various types of individual learning

Experiential learning, originally developed by Kolb (1984), refers to a continuous process in which knowledge is generated through learning by doing, reflection, and then experimentation (Armitage et al. 2008; Berkes 2009). Kolb (1984:30) identified

four stages within the experiential learning process, namely: “concrete experience”, “reflective observation”, “abstract conceptualisation”, and “active experimentation” (Armitage et al. 2008:88). An example of experiential learning is how farmers gain knowledge about agroecological practices by learning how to make and apply compost, and then observing the changes.

Transformative theory refers to learning processes that transform individuals’ worldviews (Armitage et al. 2008; Berkes 2009). It comprises three forms of learning: instrumental, communicative, and emancipatory (Armitage et al. 2008; Diduck 2010; Milestad et al. 2010). Definitions of instrumental learning tend to differ. For instance, some view instrumental learning as learning that influences or controls people and the environment (Diduck 2010; Milestad et al. 2010), whereas Reed et al. (2010) describe instrumental learning as the development of new knowledge or skills. Both definitions are considered valuable in this thesis. For instance, individuals may develop leadership skills and knowledge that enable them to influence (or control) change amongst people and the environment.

Authors seem to have similar understandings of communicative learning. It is seen as individuals’ ability to re-examine knowledge through communication with others (Armitage et al. 2008; Diduck 2010; Milestad et al. 2010; Reed et al. 2010). One example is how individuals’ may re-examine their perception of agroecology through conversation.

Finally, emancipatory learning refers to transformations in individuals’ assumptions (e.g. epistemic, physical or institutional structures, etc.) resulting in new attitudes, behaviours, or social norms (Berkes 2009; Diduck 2010; Milestad et al. 2010). A switch from conventional agriculture, or using chemical inputs, to agroecology may reflect some degree of emancipatory learning.

Self-reflection on one’s ability, skills, and knowledge is thus central to the definitions of both communicative and emancipatory learning (Milestad et al. 2010). Diduck (2010) also identifies learning conditions most conducive for emancipatory learning such as: freedom and equal opportunity to contribute, access to factual information, tolerance for multiple viewpoints, and objective evaluation of arguments.

Milestad et al. (2010) identify overlap between the transformative forms of learning. According to them, an intimate link exists between instrumental and communicative learning, as they stimulate each other. Emancipatory learning can also be an outcome of communicative learning, as individuals gain knowledge or understanding of themselves through communication. Additionally, instrumental learning may inform emancipatory processes when individuals receive feedback on their abilities (Milestad et al. 2010). Milestad et al. (2010) recognise that while distinctions between these types of learning are noticeable in theory, there is significant overlap between them in practice.

In addition, only focusing on individual learning overlooks the social nature of learning (Fazey et al. 2005; Fazey et al. 2007; Wals & Van der Leij 2007; Berkes 2009; Diduck 2010; Reed et al. 2010). As mentioned in 4.3.1 and illustrated in figure 6, individual learning is embedded in social contexts or networks, which ultimately inform the learning process. Therefore, learning may occur simultaneously at both individual and social levels. For instance, an individual may change their thinking and behaviour, but this may be shaped by a specific social context or occur through interaction with others.

Using the views above, this thesis defines learning broadly as an ongoing process in which individuals' beliefs, skills, knowledge, or behaviours may change through regular reflection, practice, or experiments in social contexts, resulting in a new understanding of the world and their relation to it (Fazey et al. 2005; Fazey et al. 2007; Darnhofer, Bellon et al. 2010; Diduck 2010; Krasny et al. 2010; Milestad et al. 2010; Reed et al. 2010). Learning theories (experiential, instrumental, communicative and emancipatory) identified in the literature provide indicators of how learning may occur at the individual level, but also highlight the social nature of learning.

b. Social learning

Social learning also has diverse definitions in the literature (Wals & Van der Leij 2007; Diduck 2010; Reed et al. 2010; Lee & Krasny 2015). At its core, social learning refers to collaborative learning embedded in social networks such as communities of practice (Wildemeersch 2007; Armitage et al. 2008; Berkes 2009; Reed et al. 2010). "Communities of practice" signifies groups of individuals who have similar interests and "pursue knowledge through regular interactions based in practice (shared

frameworks)” (Berkes 2009:1697). In comparison to the individual level, social learning requires a change in understanding at the broader societal level through social interaction (Diduck 2010; Reed et al. 2010). As mentioned in 4.3.1, social networks are identified as particularly important for integrating knowledge types and shaping people’s opinions (Olsson et al. 2004; Fabricius et al. 2007; Diduck 2010; Reed et al. 2010; Cabell & Oelofse 2012). Social learning in farming systems involves: extension support for farmers, partnerships/co-construction of knowledge between farmers, academics and universities, and knowledge sharing within farmer networks (Cabell & Oelofse 2012). The views identified in this section inform the understanding of social learning in this thesis, as defined in 1.6.

4.3.3 Cultivating diversity

Scholars seem to agree that promoting diversity in both social and ecological domains builds system resilience, protecting the system from uncertainty and collapse (Walker et al. 2006; Cabell & Oelofse 2012). Increasing diversity encourages diverse responses within a system, and thereby boosts its ability to respond to change (Pereira 2012). Two types of diversity are recognised in the literature: functional and response diversity (Folke 2006; Walker et al. 2006; Walker et al. 2010; Darnhofer, Bellon et al. 2010).

Functional diversity refers to the number of different groups within the social and ecological domains of a SES, and their influence on its performance. Each group performs a different functional role within the SES. Therefore, the number of functions performed directly correlates to the richness of species or the number of different groups present (Walker et al. 2006; Darnhofer, Bellon et al. 2010; Cabell & Oelofse 2012; Altieri et al. 2015). An example is the different role grasses, shrubs, and trees each play in cultivating productivity in savannahs (Walker et al. 2006). Obtaining nutrient supply for crops (function) from various sources, such as compost and crop rotations (different components), is an example of functional diversity in farming systems (Darnhofer, Bellon et al. 2010).

Response diversity, also known as functional redundancy, refers to the “diversity of responses to disturbance among species or actors contributing to the same function in the SES, i.e., the species within the same functional group” (Walker et al. 2006). An example is how crop diversity, due to genetic variability, may elicit diverse responses

that serve as a buffer to the effects of climate change such as drought or flooding (Cabell & Oelofse 2012). According to scholars, response diversity enhances SES resilience, because it builds redundancy into the system. Redundancy helps prevent system collapse by ensuring there is always a backup if one element/actor fails (Walker et al. 2006; Walker et al. 2010; Cabell & Oelofse 2012; Pereira 2012).

While Cabell and Oelofse (2012) suggest redundancy may reduce efficiency, others question the value of efficiency for resilient systems (Walker et al. 2010; Pereira 2012). Walker et al. (2010:14) argue that farms with diverse annual and perennial crops tend to be more resilient to drivers of change (weather, markets, policies, input supplies, etc.) than “a single, high-production commodity crop system”. Biodiversity is therefore seen as essential for resilience, because it improves a system’s ability to respond to climate change due to the larger number of responses available (Pereira 2012; Altieri et al. 2015). Similarly, Pereira (2012) believes the global food system needs to shift from a seemingly ‘efficient’, but corporate controlled system to one comprising a variety of actors (functional diversity) and opinions (response diversity).

A number of scholars consider diversity an important adaptive strategy for both the global food system and farmers (Darnhofer, Bellon et al. 2010; Walker et al. 2010; Cabell & Oelofse 2012; Pereira 2012). These scholars identify indicators associated with diversity relevant to both the ecological and social domains of farming systems (Darnhofer, Bellon, et al. 2010; Walker et al. 2010; Cabell & Oelofse 2012). Table 9 provides an overview of the main features identified in the literature.

Table 9: Attributes of diversity in farming systems

Farming system	Attributes of diversity	Sources
Ecological system	Crop diversity; crop rotations; multiple production practices (mulching, composting, etc.), obtaining nutrients from multiple sources (compost, crop rotations, etc.), water harvesting (collecting water from different sources) and biodiversity.	Darnhofer, Bellon et al. 2010; Walker et al. 2010; Cabell & Oelofse 2012; Pereira 2012
Social system	Diverse livelihoods/income sources, supplying diverse markets, diverse actors (farmers, cooperatives, farm labour, etc.) and diverse resources (knowledge, networks, buildings and tools).	Darnhofer, Bellon et al. 2010; Cabell & Oelofse 2012; Pereira 2012

Using the attributes identified in table 9, this thesis understands diversity in terms of the social and ecological domains of farming systems. In other words, diversity refers

to a heterogeneity of features in both the social (e.g. diverse actors and resources) and ecological (e.g. diverse production practices) domains of farming systems, as defined in 1.6. Importantly, diversity within social systems is seen as embedded in the diversity within ecological systems, as depicted in figure 7.

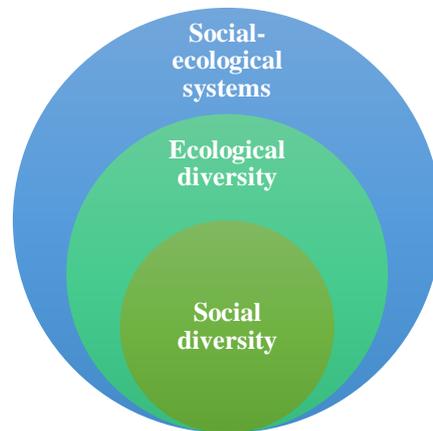


Figure 7: Social and ecological diversity in SES

4.3.4 Developing social capital

Social capital is well-recognised in the literature for developing communities' adaptive capacity (Armitage 2005; Walker et al. 2006; Armitage & Plummer 2010; Tamako & Thamaga-Chitja 2017). Similar to many concepts discussed in this thesis, social capital has diverse interpretations (Adger 2003; Pelling & High 2005), which are ultimately linked to distinctions between the original definitions provided by Bourdieu (1984 cited in Pelling & High 2005), Coleman (1990 cited in Pelling & High 2005), and Putnam (1993 cited in Pelling & High 2005).

For instance, Bourdieu (1984 cited in Pelling & High 2005:310) understood social capital as a 'good' individuals have to invest in to maintain, whereas Coleman (1990 cited in Pelling & High 2005:310) identified social capital as an 'outcome' of social structures and interaction. This contrasts with Putnam (1995:664–665) who defines social capital as the “features of social life – networks, norms and trust – that enable participants to act together more effectively to pursue shared objectives”. Putnam's (1995) definition has become the most commonly used and accepted interpretation (Pelling & High 2005), specifically in research on collective action (Vanni 2014). In comparison, Walker et al. (2006) view social capital in terms of adaptability, describing it as the ability to “respond to change”; they identify leadership as a further

attribute of social capital.

In this thesis, social capital refers to attributes of the social domain – norms, trust, leadership, and networks – that shape people’s ability to act collectively and in turn, respond to change (Putnam 1995; Walker et al. 2006; Tamako & Thamaga-Chitja 2017). Indicators of social capital in farming communities may include: trust and norms, as well as networks of families, friends, community gatherings, farmer associations, and/or extension officers (Tamako & Thamaga-Chitja 2017). While these are useful indicators, it is important to recognise the context-specific nature of social capital (Adger 2003). As networks were already discussed in 4.3.1, social capital is briefly discussed below in terms of only trust and norms (a) and leadership (b), and then summarised (c).

a. Trust and norms

According to Putnam (1995), the logic on which social capital is based assumes that the more individuals connect with one another, the more they will trust each other, and vice versa. In other words, trust and collective action are intimately connected. This may vary depending on age, race, gender, income, and potentially, the context. The difficulty lies in determining whether trust facilitates collective action or collective action generates trust (Putnam 1995). Ultimately, Putnam (1995:666) argues that "civic connections [or collective action] and social trust move together".

Fukuyama (1995 cited in Pelling & High 2005) offers a useful definition of trust and its relation to social norms. Trust is defined as “the expectation that arises within a community of regular, honest, and cooperative behaviour, based on commonly shared norms on the part of the other members of that community” (Fukuyama 1995 cited in Pelling & High 2005:311). Norms may centre on certain standards of behaviour or ethical questions (e.g. issues of justice or faith/religion) (Fukuyama 1995 cited in Pelling & High 2005). Central to this definition of trust is the idea that communities can develop norms that are “more or less conducive” to the cultivation of trust (Pelling & High 2005:311). In the case of SES, Ostrom (2009) refers to norms as standards (moral or ethical) that determine how resource users behave within groups.

b. Leadership

Unlike other scholars, Walker et al. (2006) and Tamako and Thamaga-Chitja (2017)

identify leadership as a major attribute of social capital. In the context of SES, the role of leaders is to create vision, build trust, cultivate motivation and communication, prevent exploitation of ecosystems, and resolve conflict (Olsson et al. 2004; Walker et al. 2006; Fabricius et al. 2007; Tamako & Thamaga-Chitja 2017). Essentially, leaders are viewed as “champions or visionaries” who cultivate trust between groups of people and facilitate collective action toward a common goal (Olsson et al. 2004; Fabricius et al. 2007). In this sense, leaders can be classified as adaptive co-managers. However they may also have a negative influence on situations or communities that creates conflict and tension (Fabricius et al. 2007). Walker et al. (2006) suggest leadership within SES is a “dynamic process”, requiring multiple leaders and leadership roles. The importance of leaders within SES provides justification for adapting Putnam’s definition to include leadership as a further feature of social capital that brings people together.

c. Summary of social capital

In sum, social capital is valued as an adaptive strategy. Trust, norms, leadership, and networks are considered enablers for cooperation and collective action. Tamako and Thamaga-Chitja (2017:18) emphasise how “high degree[s] of social capital” encourage collective action and learning amongst farmers, specifically in South Africa, and thus enhance their adaptability to climate change.

There are also shortcomings in the understanding of social capital. For instance, more research is needed on how social capital enables adaptive behaviour (Tamako & Thamaga-Chitja 2017). Adger (2003) cautions against assuming that social capital will lead to adaptation or enhance well-being, as it may undermine both. There is also a need to explore how social capital is shaped by power dynamics (Adger 2003; Pelling & High 2005).

4.3.5 Inspiring collective action

Collective action, often referred to as self-organisation in literature on SES, is the final adaptive strategy discussed in this thesis (Ostrom 2009; Ireland & Thomalia 2011; Vanni 2014). Definitions of collective action in the literature tend to centre on the voluntary, but intentional participation of numerous individuals and/or institutions (formal or informal) who act together in pursuit of certain goals or interests (Ireland & Thomalia 2011; Vanni 2014). With regard to farming systems, Vanni (2014:22)

identifies two types of collective action, namely: “cooperation (i): bottom-up, farmer-to-farmer collective action and (ii) coordination: top-down, agency-led collective action”. Research on bottom-up collective action amongst farmers is needed to understand the role it plays in farming systems. Authors suggest farmers who act collectively may address local needs and ultimately, develop their resilience (Cabell & Oelofse 2012; Vanni 2014). Farming networks that foster collective action include: farmers’ markets, cooperatives, community organisations, community vegetable gardens, advisory services (Cabell & Oelofse 2012), as well as PGS.

Ostrom (2009:420) believes collective action occurs spontaneously as self-organisation in a SES “when expected benefits of managing a resource exceed the perceived costs of investing in better rules and norms for most users and their leaders”. On a similar note, Hatt (2013) seems to view self-organisation and agency in SES as harmonious and spontaneous processes (cited in Hahn & Nykvist 2017). Ostrom (2009), however, identifies elements of social capital, specifically norms and leadership, as factors that may facilitate collective action amongst resource users, whilst the time and effort required to organise, combined with a lack of trust (social capital), may constrain the potential for collective action.

The value of collective action for adaptive capacity remains a contested issue within the literature due to the varied understandings of collective action as intentional versus spontaneous. Even so, Hahn and Nykvist (2017) argue that the analysis of adaptability has evolved from a focus on why it is needed to how individuals’ or actors’ organise adaptations. For instance, collective action has the potential to empower individuals, strengthen social networks, facilitate learning, and share knowledge (Ireland & Thomalia 2011; Vanni 2014), which ultimately all contribute to adaptability.

Based on the views above, collective action is defined as the voluntary involvement of groups of individuals and/or informal/formal institutions (whether spontaneous/emergent or intentional) in pursuit of a shared interest or goal. It may occur through coordination (top-down) or cooperation (bottom-up). Various factors may facilitate (e.g. high levels of social capital) or constrain (e.g. low levels of social capital) collective action. Figure 8 illustrates the relationship between social capital (high or low) and collective action.

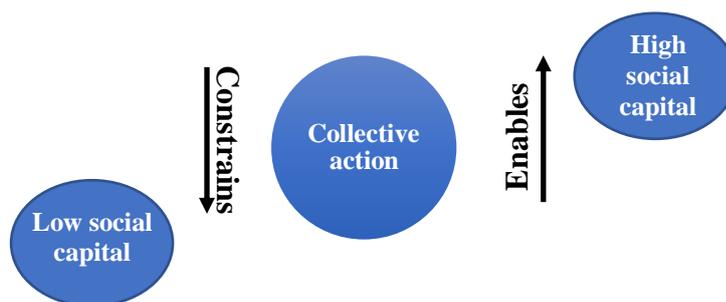


Figure 8: The interaction between social capital and collective action

4.4 Unpacking agroecology: An overview

One way smallholders could increase their adaptability to climate change is by adopting agroecology. Certain groups (Altieri & Nicholls 2008; IAASTD 2009; De Schutter 2011; Kremen et al. 2012; Holt-Giménez & Altieri 2013; Altieri et al. 2015; FAO 2017) favour agroecology as an approach comprising various forms of low external input sustainable agriculture, in contrast to the high external inputs associated with conventional agriculture. Some scholars also value agroecology for its transformative potential to create an alternative to the current food system (Holt-Giménez & Altieri 2013; Levidow, Pimbert & Vanloqueren 2014), specifically by shifting farmers' reliance on chemical inputs to a more holistic approach, grounded in ecosystem management (FAO 2017).

Agroecology is also increasingly recognised as a science, a set of practices, and a movement (Wezel & Soldat 2009; Silici 2014). This section briefly discusses agroecology in terms of its evolution.

4.4.1 Agroecology as a science

Agroecology emerged in the 1930s with its roots in the biological sciences such as ecology and agronomy (Francis et al. 2003; Wezel, Bellon, Dore, Francis, Vallod & David 2009; Silici 2014). These roots informed an understanding of agroecology as a science in many university courses and research projects (Francis et al. 2003). Some of these trends remain evident today in select areas of research on agroecology (Altieri et al. 2015; Altieri & Nicholls 2017), as 4.5.1 illustrates. Yet, in many ways, literature on agroecology has also grown, and in turn, the definition and focus of agroecology has evolved spatially from the field/farm to the food system scale (Altieri 1989; Francis et al. 2003; Wezel & Soldat 2009; Tomich, Brodt, Ferris, Galt,

Horwath, Kebreab, Leveau et al. 2011). To date, Francis et al. (2003:100) have provided the broadest interpretation of agroecology as “the integrative study of the ecology of the entire food system, encompassing ecological, economic and social dimensions”.

In their review of agroecology as a scientific field, Wezel and Soldat (2009) highlight how the United States and major scholars such as Altieri, Francis, and Gliessman continue to lead publication work on agroecology. However, these scholars (Wezel & Soldat 2009) do not question how knowledge produced on agroecology by a few countries and scholars reflects certain power tensions. It raises concerns over why knowledge produced on agroecology, aimed at smallholders, remains embedded largely within social and intellectual structures in the Global North. It also highlights the need for further research and publication on agroecology in developing countries, specifically in Africa.

On the other hand, Kremen et al. (2012) indicate how major scholars such as Gliessman (1989 cited in Kremen et al. 2012), Altieri (cited in Guzmán & Woodgate 2013) and Altieri and Toledo (2011) have attempted to establish links between agroecology as a science and local farmer knowledge. This is problematic for Jansen (2014) who interrogates the blurring of lines between farmer knowledge and agroecology as a science, highlighting the disappearance of its scientific roots in current food sovereignty literature.

Other scholars (Guzmán & Woodgate 2013; Levidow et al. 2014) view the integration of diverse knowledge systems (scientific to farmer/indigenous) more favourably. In fact, these scholars (Guzmán & Woodgate 2013; Levidow et al. 2014) argue the transformative potential of agroecology hinges on collaboration and participatory research between scientists, farmers, and citizens. Arguably, collaboration and the horizontal exchange of knowledge encourages social resilience in that it embodies diversification, and elements of social learning and social capital.

4.4.2 Agroecology as a set of practices

Agroecology has evolved from its basis in indigenous knowledge in peasant communities, specifically in South America, to a production approach that offers an alternative to industrial agriculture (Altieri & Toledo 2011; Silici 2014).

Agroecological practices are knowledge intensive, drawing on science and local farmer knowledge (Holt-Giménez & Altieri 2013). Its practices centre on three key principles, namely soil quality, water conservation, and functional diversity (Altieri & Toledo 2011; Silici 2014). Table 10 (Silici 2014:9) provides further details, but key practices include: water harvesting, crop rotation, mulching, composting, cover crops, and intercropping (Altieri & Toledo 2011). Based on its practices (see table 10), agroecology is regarded as more reliant on internal rather than external inputs, in contrast to the high-external input farming associated with industrial agriculture (Altieri & Toledo 2011; Silici 2014).

Table 10: Description of key agroecological practices

Practice	Description
Conservation tillage	Soil structure (aeration & water infiltration) is improved by little/no tillage and organic matter.
Mixing crops in a single plot (intercropping and polycultures)	Intercropping regulates pests, optimises the use of space, enhances nutrient and input efficiency, and therefore assists with stabilising crop yield.
Crop rotation and fallowing	Ensures nutrients remain in the soil over the seasons.
Cover crops and mulching	Delivers nutrients to the soil, enables biological approaches to pest regulation, conserves water, and prevents erosion.
Crop-livestock integration, including aquaculture	Optimises recycling of nutrients and supports the output of more biomass.
Integrated nutrient management	Chemical fertilisers can be reduced or eliminated when using nitrogen fixing crops, compost, and organic manure.
Biological management of pests, diseases and weeds	Reduces pests in the long-term and environmental and health challenges (due to chemicals) are reduced through push and pull methods, and integrated pest management.
Efficient water harvesting (especially in dryland areas)	Small-scale irrigation improves efficiency and therefore reduces the need for irrigation.
Manipulation of vegetation structure	Promotes biodiversity and water efficiency.
Agroforestry, especially multifunctional trees	Soil fertility and structure is enhanced through the fixation of nitrogen. It also helps adjust the microclimate.
Use of local resources and renewable energy sources, composting and waste recycling	Less external inputs are used and minimises stress on natural resources.
Holistic landscape management	Used: <ul style="list-style-type: none"> • along field perimeters (windbreaks, living fences, etc.) • across numerous fields (various crop types, etc.) • at different spatial scales (rivers, pastures, semi-natural areas)

(Source: Silici 2014:9)

As a set of practices, agroecology is considered a general term that comprises a number of alternative farming traditions, which can be categorised into two groups (Silici 2014). The first group (permaculture and biodynamic farming) shares most of the principles and practices of agroecology, whereas the second group (organic farming, conservation agriculture, and the system of rice intensification) share many of the agroecology principles, but only incorporate some of the practices (Silici 2014). Essentially, agroecology offers a flexible toolkit of practices for farmers to adopt based on what is best suited to their production system (see table 10), allowing farmers to move closer to sustainability. In this way, agroecology effectively blurs the boundaries between different farming traditions (Silici 2014).

On the other hand, more radical proponents (Altieri & Toledo 2011; Altieri & Nicholls 2012) maintain that there are differences between agroecology and alternative farming approaches, such as organic agriculture. For these scholars, organic farming systems that are managed as monocultures do not reflect agroecology or its principles. Their argument is that smallholders in these farming systems remain dependant on external inputs, expensive certification, and on exporting their produce (Altieri & Toledo 2011; Altieri & Nicholls 2012). However, these scholars' seem to have a fairly narrow view of organic agriculture.

According to the International Federation of Organic Agricultural Movements (cited in United Nations Environment Programme and United Nations Conference for Trade and Development 2008:7), organic agriculture refers to a “whole system approach based upon sustainable ecosystems, safe food, good nutrition, animal welfare, and social justice. Organic production therefore is more than a system of production that includes or excludes certain inputs”. Furthermore, “certified organic agriculture” is one aspect of organic agriculture (United Nations Environment Programme and United Nations Conference for Trade and Development 2008:7). For instance, many farms in developing and developed countries practice organic agriculture without being “certified organic” (Reganold & Wachter 2016:1). Still, as Altieri and Toledo (2011) as well as Altieri and Nicholls (2012) assert, the cost of becoming a certified organic producer are incompatible with smallholders' realities (United Nations Environment Programme and United Nations Conference for Trade and Development 2008). Therefore PGS (defined in 1.6), which emerged as a low-cost alternative to

traditional organic certification, is particularly suited to the needs of smallholders (Kelly & Meterlerkamp 2015; Reganold & Wachter 2016; Katto-Andrighetto & Kirchner 2017).

The latter views of organic agriculture suggest there is significant overlap between agroecology and organic farming systems. As Silici (2014) suggests, the value of agroecology lies in its potential to help farmers move closer to sustainability.

4.4.3 Agroecology as a movement

Agroecology is connected to the food movements, such as food sovereignty and food justice. Centred around issues of justice, equality (e.g. gender empowerment), and environmental sustainability, these food movements embody alternative visions for transitioning to a more sustainable food system (De Schutter 2009; Holt-Giménez 2009; Altieri & Toledo 2011; Holt-Giménez & Shattuck 2011; Patel 2013; Silici 2014).

Essentially, agroecological practices have been adopted as “the practical basis” for food and farmer movements (Silici 2014:10). This has occurred in both developed and developing countries. While in the former this has largely been in the form of farmers groups, agroecology in developing countries has become increasingly connected with food sovereignty. This has been bolstered with the adoption of agroecological practices into the agenda of peasant movements, such as *La Via Campesina* and Brazil’s Landless Workers Movement (*Movimento dos Trabalhadores Rurais Sem Terra*), whose focus centres on food sovereignty and challenging the current food system (Holt-Giménez 2009; Altieri et al. 2012; Guzmán & Woodgate 2013). A group of trainers assist *La Via Campesina* in spreading knowledge on agroecology across the Americas, Asia, and Africa (Guzmán & Woodgate 2013).

There are also smallholders working with NGOs and academics, such as Gliessman and Altieri (cited in Guzmán & Woodgate 2013), to implement agroecological practices by exchanging knowledge between farmers and within farmer field schools (Warner 2006; Holt-Giménez 2009; De Schutter 2011; Morris et al. 2016). One example is the *Campesino-a-Campesino* (farmer-to-farmer) movement, which centres on knowledge sharing between farmers (Holt-Giménez 2009).

With its focus on resource poor farmers, social equity forms an integral part of agroecology (Wezel et al. 2009; Dumont, Vanloqueren, Stassart & Baret 2016). Gender and social justice concerns also form part of agroecology as a movement, specifically through its link to the food sovereignty movement (Holt-Giménez & Shattuck 2011). While the implementation of agroecology does not guarantee social justice in “current [socioeconomic] context[s]”, social equity remains an important attribute of the movement (Dumont et al. 2016:29).

4.5 Agroecology and adapting to climate change

To address research question i, this section examines how agroecology influences smallholders’ adaptability in the face of climate change. Section 4.5.1 discusses how literature tends to focus on the contribution of agroecology toward ecological, rather than social, resilience (Altieri et al. 2015). To address this gap in the research, a conceptual framework is provided 4.5.2, linking attributes of agroecology as identified in 4.4. to adaptability (social resilience), specifically the adaptive strategies identified in 4.3.

4.5.1 Agroecology and the resilience of farming systems

Droughts, floods, and extreme weather conditions are expected to become more frequent. In this context, agroecology is increasingly supported as a production model that is more resilient to shocks (IAASTD 2009; De Schutter 2011). As mentioned in 4.4.1 and 4.4.2, agroecological practices and knowledge remains linked to indigenous knowledge in peasant communities (Altieri 2009; IAASTD 2009; Van der Ploeg 2014; Altieri & Nicholls 2017). Certain groups acknowledge that these farmers’ knowledge, accumulated over generations, has enabled them to adapt their practices and develop agricultural systems that tend to be more resilient to climate change (Altieri & Nicholls 2008; Altieri 2009; Altieri et al. 2012; Van der Ploeg 2014). This is largely linked to their reliance on ecologically friendly methods in the form of raised fields, terraces, polycultures, high biodiversity, and farming systems based on traditional knowledge (Altieri & Nicholls 2008; Van der Ploeg 2014; Altieri et al. 2015). Section 4.4.2. indicated how agroecology draws on many of these practices.

Quantitative empirical research (Holt-Giménez 2002; Rosset, Sosa, Jaime & Lozano 2011) has emerged over the years providing evidence that adopting agroecology,

specifically its practices, enables smallholders to adapt to climate change conditions (IAASTD 2009; De Schutter 2011; Altieri et al. 2012, 2015; Altieri & Nicholls 2017). Studies on the impact of Hurricane Mitch in 1998 (Holt-Giménez 2002), Hurricane Stan in 2005 (Philpott et al. 2011 cited in Altieri & Nicholls 2017), and Hurricane Ike in 2008 (Rosset et al. 2011), and scholars who have reviewed their evidence (De Schutter 2011; Altieri et al. 2015; Altieri & Nicholls 2017), identify a number of salient points on this issue.

A first point raised is that smallholders using agroecological practices tend to be less affected by extreme weather events, in comparison to farmers reliant on conventional methods (see table 11) (Holt-Giménez 2002; De Schutter 2011; Rosset et al. 2011; Nicholls & Altieri 2012). For instance, Rosset et al. (2011) conducted fieldwork in Holguín and Las Tunas, two Cuban provinces, 40 days after Hurricane Ike struck. The findings from their study demonstrated that farms using agroecology recovered much faster (80–90% recovery after 60 days) in comparison to “least integrated farms” (80–90% recovery after 120 days) (Rosset et al. 2011:183).

Secondly, diversity in farming systems (e.g. plants, crops, species, genetic, etc.) through diversification strategies (agroforestry, intercropping, polycultures, etc.) and soil management practices (water harvesting, soil cover, organic matter, etc.) are identified as fundamental strategies for resilience against climate change (De Schutter 2011; Altieri et al. 2012; Nicholls & Altieri 2012; Altieri et al. 2015; Altieri & Nicholls 2017). Table 11 offers a summary of the main findings from the study (Holt-Giménez 2002) conducted after Hurricane Mitch, specifically highlighting some of the main agroecological practices discussed.

Table 11: Summary of findings in study on Hurricane Mitch

Event/region	Key findings	Some of the agroecological practices identified	Sources
Hurricane Mitch in Nicaragua, 1998	180 smallholder communities studied; Found that after the hurricane, plots using agroecology methods had less damage than conventional farmers: <ul style="list-style-type: none"> • 40 % more topsoil • 69% less gully erosion • 49% lower incidence of landslides • Less impact on profits 	<ul style="list-style-type: none"> • Crop rotation • Green manures • Agroforestry/trees • Zero-tillage • Intercropping • Terraces • Ditches • Mulch • Legumes • Rock bunds • No-burn 	Main source: Holt-Gimenez 2002 Also discussed in: <ul style="list-style-type: none"> • De Schutter 2011 • Nicholls & Altieri 2012 • Altieri et al. 2015 • Altieri & Nicholls 2017

The fact that these scholars' (Holt-Giménez 2002; Rosset et al. 2011), and those who review their studies (Altieri et al. 2012; Nicholls & Altieri 2012; Altieri et al. 2015; Altieri & Nicholls 2017), are associated with agroecology and food sovereignty literature/movements may raise questions on the objectivity of their findings. However, Holt-Giménez's (2002) study was also cited in two international assessments, namely the IAASTD (2009) and the report of the UN Special Rapporteur on the Right to Food (De Schutter 2011).

Furthermore, there are other case studies which demonstrate similar findings (De Schutter 2011). For instance, a study highlighted how Malawian farmers involved in an agroforestry programme “protected farmers from crop failure after droughts” (cited in De Schutter 2011:13). Experiments on farms in the Netherlands, India, and Ethiopia provide further testimony on how soil management practices enhance crops' resistance to drought (cited in De Schutter 2011).

Evidence seems to suggest smallholders' adoption of agroecological practices influences their ability to adapt to climate change (Holt-Giménez 2002; Rosset et al. 2011). Still, much of the literature concentrates on how agroecological practices contribute toward ecological resilience, neglecting social resilience (Altieri et al. 2015; Altieri & Nicholls 2017). As previously discussed, social resilience is closely related to adaptability, and often used interchangeably (Maclean et al. 2014).

A major gap then is the lack of empirical research on the adaptability of communities and farmers who manage agricultural systems, and their ability to influence the system's resilience (Altieri et al. 2015; Altieri & Nicholls 2017). Further empirical research is needed on how agroecology may impact smallholders' adaptability (social resilience) in SES. To overcome this gap, the following section provides a framework linking major attributes of agroecology (identified in 4.5.2) to the adaptive strategies found in social resilience literature (identified in 4.3).

4.5.2 Linking agroecology to adaptive strategies: A framework

To address the gap on the social resilience of agroecology, it is necessary to identify whether agroecology (as a science, a practice and a movement) can enhance smallholders' adaptability. This section demonstrates how attributes associated with agroecology can be linked to the adaptive strategies identified in 4.3. A conceptual framework is provided (see table 12), which identifies similarities between indicators found in resilience literature for each adaptive strategy and those found in agroecology literature. The framework forms the basis for analysing the data in chapter 5. It demonstrates that agroecology has the potential to increase smallholders' adaptability by equipping them with adaptive strategies, and in turn increasing their social resilience in the face of climate change.

Table 12: Agroecology and adaptive strategies: A framework

Adaptive strategy	Key features identified in resilience literature	Key features identified in agroecology literature
Learning	<ul style="list-style-type: none"> • Experiential (learning by doing) • Instrumental • Communicative • Transformative 	<ul style="list-style-type: none"> • Type of learning is not evident, but arguably all learning types discussed in this thesis are applicable (experiential, instrumental, communicative, & emancipatory forms of learning) • Learning occurs through social networks farmers are embedded in (farmer field schools; extension services, etc.)
Social learning	<p>Learning through social networks:</p> <ul style="list-style-type: none"> • Extension & advisory services • Cooperation & knowledge sharing between farmers 	<p>Learning through social networks:</p> <ul style="list-style-type: none"> • Farmer field schools; farmer-to-farmer knowledge sharing • Extension services, farmer cooperatives & organisations

	<p>Integration of knowledge sources:</p> <ul style="list-style-type: none"> • Collaboration between universities, research centres & farmers • Record keeping by farmers 	<p>Integration of knowledge sources:</p> <ul style="list-style-type: none"> • Collaboration & participatory research between scientists, farmers & citizens • PGS • Practices are based on science & local farmer knowledge
Cultivating diversity	<p>Social indicators:</p> <ul style="list-style-type: none"> • Diverse actors & opinions, livelihoods, markets, networks, & resources (knowledge, buildings, tools) 	<p>Social indicators:</p> <ul style="list-style-type: none"> • Diverse actors (individuals, farmers, cooperatives/farmer organisations, scientists/researchers, citizens, NGOs/knowledge networks) • Links to diverse networks & movements (peasant movements, Brazil's Landless Workers Movement, food sovereignty, food justice movements) • Diverse knowledge systems (indigenous/traditional, empirical & scientific)
	<p>Ecological indicators:</p> <ul style="list-style-type: none"> • Diversity (biodiversity, animal & crop diversity) • Water harvesting, nutrients from multiple sources (compost, crop rotations, etc.) • Multiple production practices 	<p>Ecological indicators</p> <ul style="list-style-type: none"> • Agroecological practices²⁵ encourage ecological diversity
Increasing social capital	<ul style="list-style-type: none"> • Networks of families, friends, farmer associations, extension officers, etc. • Leadership • Trust • Norms/rules 	<ul style="list-style-type: none"> • Expansive networks (food movements, PGS, <i>Campesino-a-Campesino</i>) • Trust, norms & leadership are essential (as in PGS) • Norms: social equity & gender empowerment
Inspiring collective action	<ul style="list-style-type: none"> • Farmer's markets • Advisory networks • Co-operatives • Farmers' associations • Community gardens 	<ul style="list-style-type: none"> • Farmer cooperatives & organisations (<i>La Via Campesina</i>, <i>Campesino-a-Campesino</i>, Brazil's Landless Workers Movement, PGS, etc.) • Field schools • Empowerment of marginalised/indigenous groups & gender equality

a. Individual and social learning through agroecology

Central elements of adaptive capacity discussed in 4.3.1 relate to individuals' or groups' ability to handle change through individual or social learning, as well as the integration of diverse knowledge systems (Armitage & Plummer 2010; Milestad et al. 2010; Reed et al. 2010). The argument put forth here is that agroecology is an approach that encourages learning at both the individual and social levels.

The link between agroecology and social learning is particularly evident in the literature consulted. Although somewhat contested (Jansen 2014), agroecology is valued for integrating knowledge and participation of academics, farmers, and citizens

²⁵ See table 10 on agroecological practices

in the research process and in the field (Warner 2006; De Schutter 2011; Guzmán & Woodgate 2013; Levidow et al. 2014). Essentially, there is a collaborative construction of research, exchange of knowledge, and shared management of resources involving numerous actors (NGOs, academics, farmers and citizens) (Warner 2006; De Schutter 2011; Dumont et al. 2016; Morris et al. 2016).

Furthermore, agroecology promotes the involvement of farmers in farmer organisations/cooperatives, farmer field schools, and extension services. Learning through these networks is seen as a valuable way to transfer knowledge about agroecology amongst smallholders (De Schutter 2011; Rosset et al. 2011; Rosset 2015). According to De Schutter (2011), farmer field schools, farmer movements (e.g. *La Via Campesina* and AgriCultures Network²⁶), and extension officers have assisted in disseminating agroecology amongst farmers. The most explicit example is the *Campesino-a-Campesino* (farmer-to-farmer) movement (Rosset 2015), illustrated in figure 9 (Rosset et al. 2011). Its methodology depends on farmer “promoters” or extension officers who share their knowledge or their rediscovery of traditional practices (Rosset 2015:301). The movement centres on the idea that farmers are “more likely to believe and emulate a fellow farmer” through a participatory and horizontal exchange of knowledge (Rosset 2015:301). All these examples are indicative of the link between agroecology and social learning (Reed et al. 2010).

²⁶ AgriCultures was formerly known as the Low External Input Sustainable Agriculture Network (De Schutter 2011)

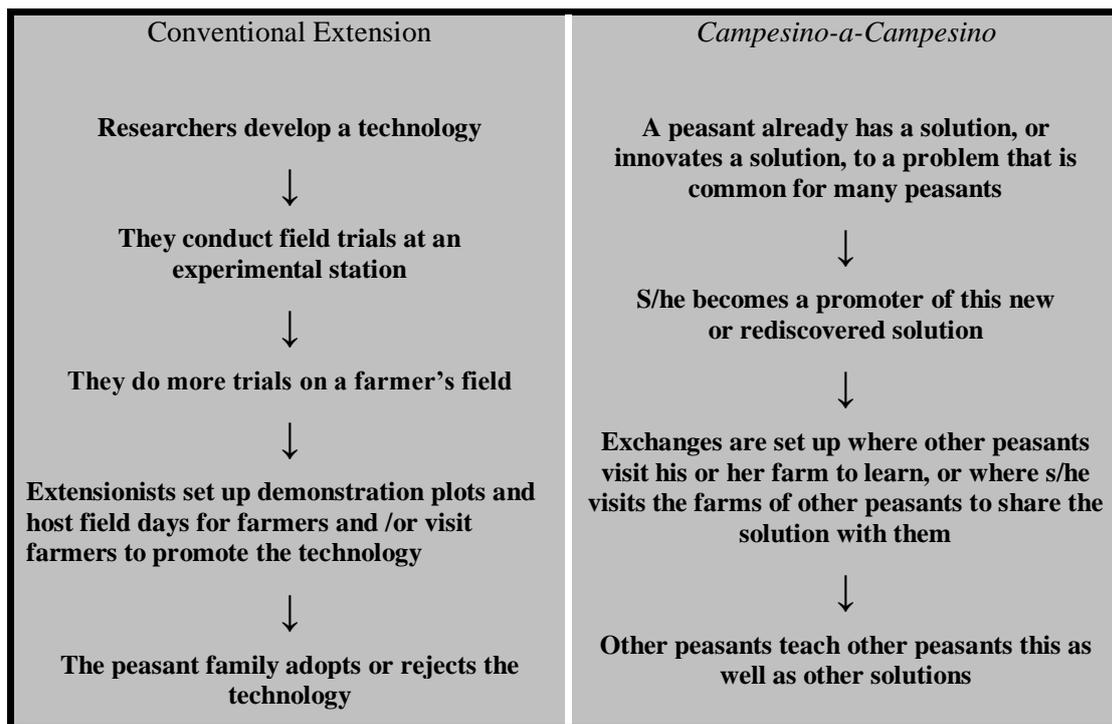


Figure 9: Conventional agricultural extension versus Campesino-a-Campesino (Source: Machin Sosa et al. 2010 cited in Rosset et al. 2011:169)

On the other hand, the link between agroecology and learning at the individual level seems to be a more implicit theme within the literature consulted. For instance, De Schutter (2011) discusses how farmer field schools encourage continuous learning. He also seems to suggest that farmers participation in field schools leads to the adoption of new practices or behaviours (De Schutter 2011). An example provided is the reduction in pesticide use due to the knowledge gained through farmers involvement in farmer field schools (De Schutter 2011). This example suggests participation in farmer field schools or networks may change smallholders' knowledge, skills, and behaviour toward farming through regular reflection, experience, or practice (Fazey et al. 2005; Fazey et al. 2007; Darnhofer, Bellon et al. 2010). It also implicitly illustrates that agroecology may encourage experiential (learning by doing), instrumental (new skills or knowledge), and emancipatory (changing in thinking and behaviour) forms of learning.

Understanding how agroecology contributes toward learning and social learning as an adaptive strategy, requires some recognition that the learning processes and outcomes will not be value free (Hahn & Nykvist 2017). Drawing on questions raised in the SES literature, it is then necessary to be critical in conducting empirical research in

order to understand whether there are any power dynamics or social conflicts inhibiting or facilitating learning processes (Galaz 2005; Wildemeersch 2007; Lee & Krasny 2015). More specifically, scholars should reflect on “who learns what, when, to whose benefit and why” (Galaz 2005:567). On the other hand, Silici (2014:17) points out how poorer smallholders may not adopt agroecological practices “if the additional time required for learning and experimentation diverts labour from other income-generating activities”. While SES literature identifies power and politics as a barrier to learning, livelihood challenges seem to be a further barrier to learning through agroecology.

b. Enhancing diversity through agroecology

A further way in which agroecology influences smallholders’ adaptability is its focus on diversity in both social and ecological systems. As discussed, a vast array of social actors are involved in agroecology, including individuals/farmers, cooperatives/farmer organisations, researchers, NGOs/knowledge networks, and civil society (Altieri & Nicholls 2008; Levidow et al. 2014; Dumont et al. 2016). Furthermore, 4.5.1 demonstrated how diversity is also fundamental to agroecological practices. The extensive range of agroecological practices (see table 10) means these farms not only perform multiple functions, but evidence also suggests they tend to be more resilient to the impact of climate change (De Schutter 2011; Altieri et al. 2012; Nicholls & Altieri 2012; Silici 2014; Altieri et al. 2015; Altieri & Nicholls 2017). A lack of social and ecological diversity may undermine smallholders’ ability to adapt to extreme weather conditions and in turn, this may affect SES resilience. Diversity is then essential as it enhances SES resilience and protects systems from collapse (Walker et al. 2006; Darnhofer, Bellon et al. 2010; Cabell & Oelofse 2012).

c. Cultivating social capital through agroecology

Social capital is also a central attribute of agroecology, although perhaps more implicitly (Dumont et al. 2016). The most evident link is how agroecology embodies the idea of social capital through its expansive networks in which the network itself, trust and norms, and leadership are essential (Altieri & Toledo 2011; De Schutter 2011; Morris et al. 2016).

Farmers using agroecology and involved in PGS is a pertinent example (Dumont et al. 2016). PGS, as defined in chapter one, may encourage farmer-to-farmer learning and

diversity through various activities such as “field checks”, “mixed certification”, and “inspection committees” (Dumont et al. 2016:33). NGOs and agroecology movements have helped spread PGS across continents and countries. Hence PGS cultivates social capital, specifically trust and norms, and networks, amongst farmers (Dumont et al. 2016).

An important norm within agroecology is its emphasis on empowering marginalised groups, specifically poor farmers and female farmers (Holt-Giménez & Shattuck 2011; Dumont et al. 2016). In the context of the feminisation of agriculture, there is a need to focus on empowering female farmers in order to facilitate further learning, develop social capital, and inspire collective action (De Schutter 2011; Morris et al. 2016). Pretty (2008:451) affirms the importance of this link between social capital as an adaptive strategy and agroecology, arguing “agricultural systems with high levels of social and human assets are more able to innovate in the face of uncertainty”.

d. Inspiring collective action through agroecology

Collective action is also evident in agroecology. Peasant movements and farmer organisations (Brazil's Landless Workers Movement, *La Via Campesina*, *Campesino-a-Campesino*, etc.), and field schools are representations of some degree of collective action (De Schutter 2011; Morris et al. 2016). Furthermore, PGS, described under social capital, are also valued for encouraging collective action and sharing of knowledge amongst the network's members (Dumont et al. 2016). This reinforces the idea that social capital facilitates collective action (Adger 2003). A further element present in agroecology is the power dynamics and politics. Arguably, agroecology is inherently political given its intimate connection to food and peasant movements, which have been framed as alternatives to the current food system (Guzmán & Woodgate 2013; Holt-Giménez & Altieri 2013; Levidow et al. 2014).

4.6 Summary

The aim of this chapter's literature review was to address research question i, namely how could agroecology influence the adaptability of smallholders in the face of climate change? A conceptual framework was developed to address this question. This framework, and the sections linking the adaptive strategies to agroecology, illustrate agroecology's potential as an approach which smallholders can use to adapt to climate change. Therefore, in theory, agroecology enables smallholders to

strengthen their adaptability by equipping them with adaptive strategies such as learning (individual and social), diversity (social and ecological), social capital, and collective action, and in turn, increases their social resilience to climate change.

This argument is developed through a review of the literature in a number of key sections. First, the concept of adaptability was situated in the research field of SES, and then the concept itself was reviewed (4.2). The concept is understood in terms of actors' ability to influence systems' resilience, and is therefore intimately connected to social resilience.

Adaptive strategies are identified and discussed in 4.2.3 and 4.3. These include: learning (individual and social), diversity, social capital, and collective action. The strategies identified are analytical tools that can be used to gain insight into how farmers respond to uncertainty and change through agroecology, and the decision-making processes involved. As indicated in 4.3.1, social networks are identified as the central link between learning, social diversity, social capital, and collective action strategies. Social networks can either enable or constrain the development of these strategies. Central to learning and collective action, including social capital, is the need to better understand how power, culture and social conflict may inhibit or facilitate these processes.

Certain groups believe smallholders' adoption of agroecology will enhance their farms' and their communities' resilience in the context of climate change. In the context of these claims and to address question i, 4.5 discussed how agroecology can influence smallholders' adaptability in the face of climate change. 4.5.1 illustrated how the literature consulted focuses on the contribution of agroecological practices toward ecological resilience, with less written on the social systems. To overcome this gap, 4.5.2 proposes a framework in which attributes of agroecology (discussed in 4.4) are linked to the adaptive strategies in SES literature (identified in 4.3).

Chapter 5: Agroecology training and smallholders in the Mopani district of Limpopo – analysis and findings

5.1 Introduction

Chapter 1 set the context for this chapter with an overview of the case study background in terms of the SAFL, 17 Shaft, and the training programme. Chapter 2 detailed the methodology involved in collecting and analysing the case study data. Chapters 3 and 4 provided the literary rationale for arguments put forth in this chapter. Chapter 3 outlined the effects of climate change on agriculture, and smallholders' susceptibility to climate change globally and in South Africa. Chapter 4 argued that agroecology offers a valuable adaptive approach for smallholders, as it encourages learning at the individual and social levels, and increases diversity, social capital, and collective action. A conceptual framework was also developed in chapter 4 to support this argument and is used here to explore the empirical findings on the influence of agroecology on the adaptability of smallholders to the effects of climate change in the Mopani district. Therefore, this chapter comprises the findings and analysis of the data collected from agroecology trainers and smallholders.

Using the conceptual framework, the findings within each theme, identified in 2.5.5 of chapter 2, were arranged into three categories that allowed me to answer the remaining research questions: (ii) did the leadership component of the agroecology course enable trainers to transfer knowledge to Mopani smallholder farmers? If so, how? If not, why not? (iii) have smallholders in Mopani applied adaptive strategies prior to their exposure to agroecology? and (iv) what adaptive strategies are smallholders in Mopani using since their exposure?

The chapter is structured in the following way: 5.2 provides a brief recap of the case study and elaborates on the trainers' activities since their return to Mopani district; 5.3 addresses research question ii primarily through the individual learning concept; 5.4 discusses the findings for research question iii and 5.5 assesses the findings for research question iv, using all the concepts in the framework; and 5.6 offers concluding thoughts.

5.2 Case study context: A review of the institutions and agroecology trainers

To provide context for sections 5.3 to 5.5, 5.2.1 briefly revisits the key institutions involved in launching both phases of the leadership and agroecology training programme. Background information on the trainers' activities since their return to Mopani is elaborated on in 5.2.2. The information provided is based on the data collected during the research process and informs the findings identified in 5.3 to 5.5.

5.2.1 Key institutions involved in launching the leadership and agroecology training programme

As mentioned in chapter 1, smallholders have been a priority for the SAFL through their SSA programme, which prioritises farmers' voices. The Agroecology Awareness innovation emerged through the SSA, and ultimately led to the launch of the Leadership Skills and Agroecology training at 17 Shaft (SAFL n.d.c, n.d.d). The first phase of the training programme took place between May and August 2016.

The SAFL contacted 17 Shaft Training Centre in Soweto, Johannesburg to conduct the training. Seven individuals completed the training in August 2016 and returned to their communities in the Mopani district of Limpopo (Drimie 2016; SAFL n.d.b). A second phase of training was conducted between May and August 2017. The World Wide Fund for Nature's Nedbank Green Trust funded both phases. Through their training course, 17 Shaft Training Centre has established itself as the first South African institution to combine leadership, agroecology, and artisan skills (17 Shaft n.d.b).

5.2.2 Overview of trainers' activities since their return to Mopani

All seven trainers have (see table 1 in 2.5.2), in varying ways, shared the knowledge they gained during the three-month agroecology course. The trainers returned home after the training and conducted workshops with smallholders without further financial support from the SAFL or 17 Shaft (Drimie 2016). A summary of the trainers and their role in the research, as well as their activities, is provided in Appendix H.

Upon completing their training, all seven trainers facilitated a workshop on agroecology in Giyani in August 2016 for smallholders in the MFA. According to Mr Ngoveni (2017), each trainer was responsible for presenting a certain component of the workshop that the group as a whole designed. The workshop was attended by members of the various area associations within the MFA, representatives of 17 Shaft and the SAFL, as well as representatives from two local NGOs: CHoiCE Trust and Lima Rural Development Foundation. The workshop consisted of one theoretical and one practical training day, and according to trainers and the SAFL, was well received.

Although four of the trainers, Mr Maake (2017), Ms Mbodi (2017), Ms Mlondobozi (2017), and Mr Sekhula (2017), were members of the MFA prior to the training, some issues arose between some of them and the MFA during and after the course. After a learning journey to the Mopani district in November 2016, the SAFL provided a useful summary of the situation, and why Ms Mlondobozi and Mr Sekhula were expelled when they returned as graduates:

The MFA executive committee ... made it clear during the training that the three month process should be considered as a personal gain and not a duty for the MFA, and, as such, they would not support the four MFA trainees with stipends for the three months of training It was originally intended that the MFA would be the institutional structure through which the trainees would transfer their skills, but when the MFA failed to offer the necessary institutional support for trainers to transfer their skills, two of the trainees who are also full-time farmers [Ms Mlondobozi and Mr Sekhula], decided to go in another direction. They began the process of registering an alternative structure and formed a secondary cooperative, an agroecology training and processing centre to train smallholder farmers in the Mopani district. Their intention [was] to ... start another PGS and buy these farmers' agro-ecologically endorsed produce for processing. After returning to Mopani, the MFA became uncomfortable with the new secondary cooperative working alongside it rather than beneath it. This subsequently led to a conflict of interest being declared by the MFA executive and the two trainers being asked to leave the Association. A number of important points are raised in this story. The training led to new structures being created with ramifications for the old. It also led to new leadership that was prepared to challenge the old. All of this led to some upheaval in the lives of the two trainers, as well as the leadership of the MFA.

(Drimie 2016:4).

While Ms Mlondobozi (2017) and Mr Sekhula (2017) have left the MFA and formed a secondary cooperative to train smallholders in Mopani, they have been unable to start the training, because they have not managed to secure a piece of land, nor a

training centre. As trainers who were farming before 17 Shaft, both have found other ways to transfer knowledge to their communities. For instance, Mr Sekhula (2017) has shared his knowledge with dryland smallholders in the Dzumeri area. As a farmer herself, Ms Mlondobozi (2017) has transferred the leadership skills she acquired to her workers. She also conducted a presentation for smallholders and extension workers at the Limpopo Department of Agriculture and Rural Development, which was also attended by Mr Ngoveni (Mlondobozi 2017).

Ms Mbodi (2017) remains part of the MFA and continues to receive a monthly stipend, albeit a limited one, to facilitate agroecology training for smallholders in Mopani. Ms Mbodi (2017) works closely with Ms Mabunda, who has been working with a network of smallholder communities in the district, including Nkomo, Dzingidzingi, Vleifontein, Thomo, Louis Trichardt, Bongani, and Malamulele (Mabunda 2017). Ms Mabunda is not working with the MFA, but independently. As chapter 2 indicated, Ms Mabunda previously worked as a training manager for conventional agriculture in community projects. Although she depends on her daughter's income to support her transportation between communities, Ms Mabunda (2017) said she feels responsible for helping the communities she was previously working with to adopt more agroecological practices. Ms Wainwright (2017a) felt the agroecology course further stimulated Ms Mabunda's passion for supporting farmers, motivating her to work with smallholder communities. While Ms Risenga (2017) was initially working with Ms Mabunda and Ms Mbodi, she was unable to continue, because she was not receiving an income through this work and could not afford the transportation costs. As a result, she has mostly transferred her knowledge to her family, and neighbours passing by (Risenga 2017).

With some funding and logistical help from the Bryanston Organic and Natural Market,²⁷ Ms Mabunda and Ms Mbodi also launched the Giyani PGS in Nkomo village in March 2017 (Wainwright 2017a). According to a flyer Ms Mabunda gave me on the PGS (see appendix I), over 30 workshops have been conducted on agroecology and PGS in three villages since Ms Mabunda's graduation in August

²⁷ Ms Mabunda and Ms Wainwright applied to the World Wide Fund for Nature for funding for the launch of the Giyani PGS, but this was unsuccessful as their budget had already been allocated. Ms Mabunda and Ms Wainwright then decided to launch the PGS without funding, but the Bryanston Organic and Natural Market helped with some of the costs and logistics (Wainwright 2017a).

2016, which led to the launch of the PGS. Nkomo and Dzingidzingi villages are located in the Mopani district, while Vleifontein village is situated in the neighbouring Vhembe district of Limpopo. Ms Mbodi and Ms Mabunda have facilitated these workshops independently without financial assistance from the SAFL, 17 Shaft, or the Bryanston Organic and Natural Market. The latter do provide financial assistance for the Giyani PGS assessments. Workshops in these villages have centred on compost making and use, agroecology and organic agriculture, the negative effects of conventional agriculture, soil preparation, garden designs, mulching, water conservation, and an introduction to PGS for market access (Mabunda & Wainwright 2016a; Mabunda 2017; Mbodi 2017).

These workshops have been possible through the weekly meetings model Ms Mabunda (2017) has developed where 18 to 25 smallholders per village come together and work in a different smallholder's backyard each week. As a result, many of the backyards in these villages have compost heaps (Wainwright 2017a). Although I was unable to observe Ms Mbodi's and Ms Mabunda's transfer of knowledge to the other smallholder communities, my observations of Ms Mbodi in Nkomo village and Ms Mabunda's workshop with a smallholder in 2016 suggest there has been a successful sharing of knowledge with smallholders in the communities previously identified.

Mr Maake (2017) and Mr Ngoveni (2017) discussed how they have been involved in activities through which they were able to transfer knowledge about agroecology and leadership to smallholders. Mr Maake (2017) remains part of the MFA network, but has mostly independently shared the knowledge he acquired about agroecology and leadership through his community project, Mamone Poultry Projects and Vegetables, in Letaba community. On the other hand, Mr Ngoveni (2017) informed me that through Dr Manderson, he was hired by Hoedspruit Hub²⁸ to train local smallholders in agroecology. In his role at Hoedspruit Hub, Mr Ngoveni (2017) also trains supervisors from three commercial farms, namely Bavaria Fruit Estate, Blydevallei

²⁸ The Hoedspruit Hub is a social enterprise based in Hoedspruit, Maruleng Municipality, Limpopo. It sells accredited skills and compliance training to commercial citrus farmers in the area, and invests profits into the development of surrounding impoverished communities. A strong focus is placed on drawing youth into agriculture through learnerships, internships, and an entrepreneurial agroecology course (Manderson 2017).

Boerdery, and Landman Vars Produkte. The training is focused on developing the leadership qualities of the supervisors (Ngoveni 2017).

5.3 The impact of the leadership component of the agroecology training

To answer research question ii,²⁹ this section assesses whether the leadership component of the agroecology course enabled the trainers to transfer their knowledge to Mopani smallholders. The trainers were asked to reflect on the leadership component of the training, as well as indicate the kinds of training or knowledge transfer activities they had engaged in since the training. The findings for question ii are explored through five sections: 5.3.1 uses instrumental learning theory to identify the skills trainers acquired through the leadership training; 5.3.2 explores how the leadership training enabled trainers to develop their leadership abilities through communicative, experiential, and emancipatory learning theories; 5.3.3 briefly acknowledges the social nature of the trainers' learning; 5.3.4 identifies the barriers some of the trainers' faced in sharing their knowledge, and 5.3.5 offers concluding remarks.

5.3.1 Instrumental learning in relation to the leadership training

Instrumental learning was a dominant category under the leadership training and leadership skills theme (of themes listed in 5.1). This type of learning refers to the formation of new skills/knowledge (Reed et al. 2010), or learning to influence (or control) people and the environment (Diduck 2010; Milestad et al. 2010). Both elements of the definition were evident. The trainers spoke about how they acquired skills and knowledge about leadership that they previously lacked. These skills enabled them to influence, rather than control, change amongst smallholders in Mopani through the transfer of knowledge (Maake 2017; Mabunda 2017; Mbodi 2017; Mlondobozi 2017; Ngoveni 2017; Risenga 2017; Sekhula 2017). This section focuses on the development of new skills through the leadership training that enabled the trainers to influence change amongst smallholders, as explored in 5.5.

A key example of instrumental learning was how most of the trainers felt their ability to communicate in front of others improved through the training (Maake 2017;

²⁹ Research question ii: Did the leadership component of the agroecology course enable trainers to transfer knowledge to Mopani smallholder farmers? If so, how? If not, why not?

Mabunda 2017; Mbodi 2017; Ngoveni 2017; Risenga 2017). Ms Risenga (2017) highlighted this by saying, “Before I went there [17 Shaft training], I was a shy lady really. It [was] too difficult for me to stand in front of other people to say something, but now I am bold enough to ... communicate [with] everyone”. Ms Mbodi (2017) had a similar experience, stating “it [the training] helped me a lot because I can [now] stand before multitudes and talk without fear. I can explain clearly so people understand what I am trying to tell them”. Importantly, some of the trainers’ expressed that the improvement in their ability to communicate was related to the improvement in their self-esteem (emancipatory learning), as discussed in 5.3.2 (Mabunda 2017; Ngoveni 2017; Risenga 2017).

Leadership behaviours that received little or no attention in the interviews, but were interesting components of the course include: change management, developing resilience, listening, drive, and self-motivation (17 Shaft n.d.c). The leadership manual that formed part of the 17 Shaft training specifically identifies tools for facilitating change, including: communication, education, training, and involving the affected individuals in the change process (17 Shaft n.d.c). Meanwhile, steps for becoming more resilient include cultivating a more positive worldview and sense of self, long-term goals, an organised approach to deal with change (e.g. to-do lists or track plans), and experimentation with new ideas, etc. (17 Shaft n.d.c).

Some of the change management and resilience behaviours identified above were implied in the interviews (Maake 2017; Mabunda 2017; Mbodi 2017; Mlondobozi 2017; Ngoveni 2017; Risenga 2017; Sekhula 2017). For instance, Ms Mabunda (2017) spoke about how she has become more organised with her budgeting and planning since the training. Meanwhile, some of the other behaviours have either been discussed here (e.g. communication), or are referred to in part b (positive sense of self) or section 5.5 (education/training). This suggests the trainers have adopted some of these tools/behaviours to facilitate a change to agroecology.

Still, one may question the extent to which the trainers’ leadership qualities are attributed to the training programme or to characteristics they had prior to the training. For instance, Ms Mabunda’s ability to transfer knowledge is also likely to result from her experience working as a training manager before the agroecology training, while Ms Mlondobozi’s teaching experience has probably also played a role in her ability to

transfer knowledge. Both, however, emphasised the value of the training (Mabunda 2017; Mlondobozi 2017); Ms Mabunda (2017) specifically stated, “I will say the reason today we have the Giyani PGS officially launched, it’s through the leadership qualities, which I’ve received from 17 Shaft agroecology and leadership training”.

Ultimately, the skills identified above seem to have helped trainers transfer their knowledge about agroecology to smallholders upon completing the training, as indicated in 5.2.2 and discussed in detail in 5.5. The transfer of knowledge between the trainers and smallholders, or their communities, can be seen as influencing, rather than controlling, change. The formation of the trainers’ leadership skills (instrumental learning) is also intimately linked to the experiential, communicative, and emancipatory learning aspects of the leadership training.

5.3.2 Experiential, communicative, and emancipatory forms of learning

All seven trainers felt the leadership training transformed them as individuals and, in turn, equipped them with skills that enabled them to share their knowledge with smallholders (Maake 2017; Mabunda 2017; Mbodi 2017; Mlondobozi 2017; Ngoveni 2017; Risenga 2017; Sekhula 2017). The changes trainers experienced seem to be an outcome of experiential (cyclical process involving learning-by-doing), communicative (re-examining knowledge through communication with others), and emancipatory (changes in worldviews leading to new views or behaviours) learning processes (Armitage et al. 2008; Diduck 2010; Milestad et al. 2010).

Evidence of experiential, communicative, and emancipatory learning emerged as important elements of the learning sub-theme during my observation of the second phase of the training (Giliam 2017b). For instance, experiential learning occurred through trainees’ participation in regular group activities that were designed to test their leadership abilities, though this was often unstated. The facilitator of the training, Mr Mofikeng, observed these activities and then provided feedback to the trainees (communicative learning). In one instance, the trainees’ completed a self-evaluation of their leadership behaviours (communication, time allocation, etc.) and then participated in an activity that tested these behaviours (experiential learning). An important element of the activity was self-reflection and evaluation of their behaviours (emancipatory learning). After the activity, Mr Mofikeng said they

evaluated themselves very highly, because they had not ‘applied’ any of the leadership behaviours (task structuring, time allocation, and communication) they had learnt (Giliam 2017b).

During an activity a week later on leadership in the work environment, trainees had to work together to come up with questions to ask a hypothetical employee why they had arrived late. There was a noticeable difference in how trainees interacted from the previous week, as they made a concerted effort to apply leadership behaviours such as communication, time allocation, and task structuring (Giliam 2017b). This example arguably illustrates the four stages of experiential learning: “concrete experience”, “reflective observation”, “abstract conceptualisation”, and “active experimentation” (Kolb 1984:30; Armitage et al. 2008:88). Communicative and emancipatory learning were an important part of these experiential learning processes (Giliam 2017b). Through feedback with each other and Mr Mofikeng (communicative learning), trainees were forced to re-examine their knowledge about leadership, and ultimately, change their behaviours (emancipatory learning) (Diduck 2010; Milestad et al. 2010; Reed et al. 2010). Similar to the views held in the literature (Milestad et al. 2010), this finding suggests that emancipatory learning is connected to or an outcome of experiential and communicative forms of learning. In this way, the change in trainees’ thinking and behaviour is shaped by the interaction with each other and Mr Mofikeng, reflecting the social nature of learning.

Improved self-esteem emerged as one of the most important aspects in relation to emancipatory learning for trainers who graduated in 2016 and those who graduated in 2017 (Giliam 2017b; Mabunda 2017; Mbodi 2017; Ngoveni 2017; Risenga 2017). Mr Ngoveni (2017) emphasised how his communication skills improved as his self-esteem grew, stating, “I think [the training] built my self-confidence ... it made me ... understand myself more and ... know what I am capable of So that [helped] me ... get out there and be myself and be able to teach as I do here at [the Hoedspruit] Hub”. Mr Ngoveni (2017) added that farmers who are being trained in agroecology also need to believe in themselves so that “they have the courage to go out there and start ... agroecology”. When asked if assertion and self-esteem were not qualities she had before, Ms Mabunda (2017) felt the training had improved her self-confidence and allowed “the inner person [to come] out”. Additionally, two of the trainees in the

second phase of training informed me that the course was already changing how they think about themselves and their leadership style (Giliam 2017b).

The development of the trainers' self-esteem is an important strength of the training. As discussed in chapter 4, certain learning conditions facilitate emancipatory learning. Some of these include: opportunities for everyone to participate, freedom to think critically, and tolerance for alternative perspectives (Diduck 2010). Based on the changes the trainers feel they have undergone, 17 Shaft has arguably created a learning environment that encourages emancipatory learning.

Indeed, some trainers' improved self-esteem (Mabunda 2017; Mbodi 2017; Mlondobozi 2017; Ngoveni 2017; Sekhula 2017) was more evident than others (Maake 2017; Risenga 2017). By changing how they viewed themselves and their abilities, trainers seemed to form new leadership skills (instrumental learning) or improve existing ones such as their ability to communicate (Mabunda 2017; Ngoveni 2017; Risenga 2017). Once again, this point reinforces the idea in the literature that learning theories are not mutually exclusive in practice, but rather tend to overlap and reinforce each other (Milestad et al. 2010). The interrelation between the concepts is illustrated in figure 10.

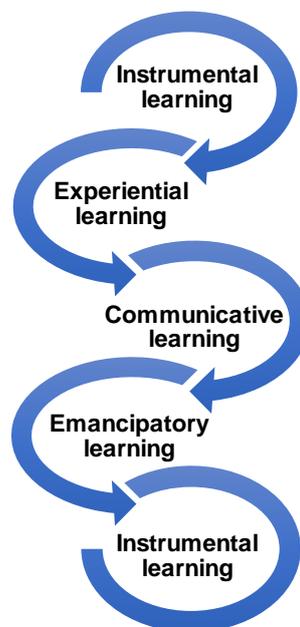


Figure 10: Leadership training learning process

5.3.3 The social nature of learning

The inherently social nature of individual learning is a further sub-theme within the ‘leadership training and leadership skills theme’. As 5.3.2 suggested, the change trainees and trainers experienced through the leadership training was shaped by their interaction with each other and Mr Mofikeng. This was best demonstrated through the trainers’ views of Mr Mofikeng’s facilitation of the leadership training. Most of the trainers expressed how Mr Mofikeng had inspired them and transformed their understanding of leadership (Maake 2017; Mabunda 2017; Mlondobozi 2017; Ngoveni 2017). Ms Mabunda (2017) emphasised this point by saying, “in terms of leadership, I learned more from [Mr Mofikeng] ... the guy is skilled in leadership I have a diploma in business management ... leadership management was part of my course, but what I have learned in that three months surpassed what I [learnt] for three years”. The trainers’ experiences show how their changes in thinking and approach to leadership was ultimately shaped by the social interactions and feedback during the leadership course (5.3.2). In line with the literature (Fazey et al. 2005; Fazey et al. 2007), this finding indicates that learning is ultimately a social process that can occur simultaneously at individual and social levels.

5.3.4 Barriers in transferring knowledge to smallholders

Despite the value of the course, some of the trainers experienced barriers in transferring their knowledge to smallholders in their communities or networks. The barriers were part of the major theme, ‘challenges’, and those relevant to question ii are discussed here. Interestingly, most of the barriers the trainers encountered were not due to any shortcomings they identified in the training content, but were rather a result of external factors. Power tensions, linked clearly to leadership, have been a major factor inhibiting the promotion of agroecology to encourage learning, and cultivate social capital, social diversity, and collective action.

The most evident barrier has been the politics or power dynamics between some of the trainers (who were MFA members prior to their participation in the training programme) and the MFA (Drimie 2016). As indicated in 5.2.2, Ms Mlondobozi (2017) and Mr Sekhula (2017) were asked to leave the MFA. Both feel this has restricted their ability to transfer knowledge through the Association’s large network of farmers, comprising roughly 1 600 smallholders (Sekhula 2017), and thereby

establish a large community of practice. According to Ms Mlondobozi (2017), “when they chase[d] us out of the MFA, they deprived us from sharing this knowledge with [the farmers] and now it is not easy for us to go to these farmers, because they belong to the association and we are no longer part of it”.

Mr Sekhula’s and Ms Mlondobozi’s involvement in the training programme exposed the unequal power underlying the MFA’s leadership structure, which led to a breakdown in trust (social capital) (Walker et al. 2006). Ultimately, the politics between the network and the two trainers have hindered their potential to use agroecology as an adaptive strategy to generate individual and social learning, diversity, social capital, and collective action in the MFA’s expansive network.

As highlighted in 5.2.2, Ms Mlondobozi (2017) and Mr Sekhula (2017) have overcome these tensions by leaving the network to form their own secondary cooperative (network), and will be sharing their knowledge with other farmers once they have secured land and a training facility. Ms Mbodi (2017) also seems to be exploring the possibility of leaving the MFA; she spoke about the MFA restricting her from being hired and paid as a consultant to train smallholders for other organisations, as they claim her as their own, yet have no formal agreement with her.

The lessons learnt from the tensions that arose between the trainers and the MFA guided 17 Shaft’s selection process for the second round of training. As mentioned in chapter 1, the training was extended to organisations beyond the MFA to nominate individuals, but each organisation had to guarantee employment and support for the graduates within their own agroecology development strategies (Manderson 2017).

Another barrier identified is the implicit power tensions between different knowledge systems (e.g. agroecology/traditional knowledge versus conventional agriculture). For instance, trainers spoke about the scepticism they have faced in trying to transfer their knowledge about agroecology (Mlondobozi 2017; Ngoveni 2017; Risenga 2017). There seems to be disbelief in the feasibility of agroecology in comparison to conventional agriculture, and a lack of interest in a production practice that is reminiscent of the traditional methods of farming (Mlondobozi 2017; Ngoveni 2017). These implicit power tensions between agroecology/traditional knowledge and conventional agriculture can be seen as a clash of knowledge systems, with one

valued more than the other. This is illustrated in the following excerpt from an interview:

Small-scale farmers in South Africa look at the ... big commercial farmers ... and think it is only when you are conventional that you can make it in farming ... it is very, very difficult to convince them to change to agroecology The farmers trust ... extension officers [more] than us, because ... the extension officers [have] been to school [tertiary institutions], they are trained for agriculture, they know it. So, when you come as an agroecology trainer and try to convince them, it is very difficult until they see it When the department promised to give seeds and fertilisers ... all farmers open their hands, because they want to receive. [When] you get those seeds ... those fertilisers ... you are no longer going to apply your traditional knowledge, but you are going to apply what the extension officer is saying. So that is the challenge we are facing ... it's how to save the traditional [way of farming]. People are no longer interested in wanting to practice the skill, we depend ... on buying [seeds] every time People are no longer [saving] seeds and then it's the traditional seeds [that are lost].

(Mlondobozi 2017).

While Ms Mlondobozi's (2017) statement suggests that smallholders attach more value to conventional agriculture than traditional knowledge systems, DAFF's extension support for smallholders has not been sufficient nor has it met the needs of these farmers (Greenberg 2013; Okunlola et al. 2016). The lack of extension support for smallholders in Mopani during the drought is discussed in 5.4. Ultimately, the trainers' and smallholders' experiences suggest the value attached to conventional agriculture, and related extension, is a barrier to social learning.

A third barrier relates to the resource capabilities of the trainers. Four of the trainers indicated that their lack of personal transportation hinders their ability to transfer knowledge to smallholders in Mopani (Maake 2017; Mabunda 2017; Mbodi 2017; Risenga 2017). Meanwhile, Ms Mlondobozi (2017) and Mr Sekhula (2017) have been unable to train farmers through their secondary cooperative as they are still in the process of securing land and a training centre. As highlighted in 5.3.1, most of the trainers have found ways to overcome these tensions by sharing their knowledge with other farmers in close proximity to them or with their farm workers.

5.3.5 Conclusion

In answering research question ii, the focus has been on understanding whether the leadership course enabled trainers to transfer their knowledge to smallholders. The

trainers' experiences were examined through the learning theories as these emerged as important examples of the learning sub-theme in the data. Instrumental learning, discussed in 5.3.1, was particularly prominent in terms of the formation of new skills or knowledge that enabled them to transfer their knowledge. Some of the major skills identified include communication and leadership behaviours.

Experiential, communicative, and emancipatory learning were more implicit aspects of the learning process at 17 Shaft. These were discussed in 5.3.2. Observation of the leadership training provided insight into how the trainers acquired new leadership skills and knowledge through regular practice/experience, conversation, and reflection over the three months. Emancipatory learning was most evident in terms of the changes the trainers experienced in their thinking, attitudes, and behaviours regarding themselves, ultimately improving their self-esteem. In turn, as figure 10 illustrates, emancipatory learning enabled trainers to further develop their leadership abilities. In analysing the trainers' experiences, it became evident that the overlap between learning theories is even more noticeable in practice than in theory. 5.3.3 discussed how the trainers felt Mr Mofikeng was instrumental in shaping their leadership abilities, highlighting that learning at the individual level is fundamentally a social process.

Though the training programme seems to have equipped trainers with the skills and confidence to transfer knowledge to smallholders, they also face a number of constraints in doing so. These were discussed in 5.3.4. These barriers involve politics between some of the trainers and the MFA, implicit power tensions between knowledge systems, and resource constraints. Diffusing agroecology to a broader social scale requires a recognition of these issues, and identifying ways to overcome them.

To conclude and answer question ii, Mr Mofikeng's leadership training has equipped the trainers with the necessary leadership skills (instrumental learning) to share their knowledge through experiential, communicative, and emancipatory processes. In this way, the training programme has developed proactive leaders who have the capabilities (in self-esteem, skills, and knowledge) to share their knowledge and inspire change amongst smallholders. According to the 17 Shaft training manual (17 Shaft n.d.c:1), "leadership is getting people to want to do what needs to be done.

Management is getting people to do what needs to be done. Leaders pull. Managers push. Leaders communicate. Managers command”. In this sense, the trainers can be characterised as adaptive co-leaders, rather than “adaptive co-managers” (Fabricius et al. 2007).

5.4 Adaptive strategies before the agroecology training

To answer research question iii,³⁰ this section reviews one of the major themes from the data, around whether (and how) smallholders in Mopani district have applied adaptive strategies to deal with climate change prior to their exposure to agroecology training. In the interest of clarity, ‘before agroecology’ (as used from hereon) specifically refers to the period before the 17 Shaft agroecology training course commenced and smallholders in Mopani district were exposed to agroecology training by the trainers. While emphasis is placed on smallholders in this question, evidence from other sources such as the trainers or documentary evidence is also used to validate the farmers’ experiences. The type of strategies smallholders used before agroecology are examined through the adaptive strategies identified in chapter 4, specifically the prevalence of diversity, and the presence of social networks that can foster learning, enable collective action, and build social capital. These concepts shed light on whether smallholders were using coping or adaptive strategies³¹ to deal with the effects of climate change prior to agroecology.

Research question iii is explored through the following sections: 5.4.1 examines smallholders’ and trainers’ awareness of weather patterns before the agroecology course; 5.4.2 provides a narrative discussion of the social networks that were present before the agroecology course;³² 5.4.3 elaborates on the absence of ecological and social diversity before the agroecology training; and 5.4.4 offers concluding thoughts.

³⁰ Research question iii: Have smallholders in Mopani applied adaptive strategies prior to their exposure to agroecology?

³¹As defined in 4.2.2, coping strategies are short-term and reactive responses to change based on survival, whereas adaptive strategies are usually long-term and proactive approaches to ensure social and ecological sustainability (Smit & Wandel 2006; Fabricius et al. 2007).

³² All data sources were used to inform the narrative overview of the networks present before the agroecology training at 17 Shaft

5.4.1 Awareness of weather patterns before the agroecology training

Before discussing the types of measures used in the face of climate change, smallholders were asked about their observations of weather patterns. The aim was to gauge their awareness about the region's susceptibility to drought, low rainfall, and arguably climate change (Mopani District Municipality 2013-2014). Although they did not go into significant detail, most of the smallholders seemed aware of changes in weather patterns and the challenges associated with drought, especially in terms of farming. However, the degree of awareness was less clear due to communication barriers, which required prompting or the use of examples (e.g. drought, rain, etc.) when asking about their experience with weather patterns.

The three smallholders from Nkomo village did not make an explicit reference to drought or climate change per se (Baloyi 2017; Kheto 2017; Makhubela 2017). Instead, all three cited how they have noticed a change in rainfall patterns in the area. According to Ms Baloyi (2017), "back then, the rain used to fall often and not at once, unlike now where the rain comes at once and it is finished". Similar to the smallholders in Nkomo village, Mr Sekhula (2017), one of the trainers, has noted how rainfall has become more intense, but infrequent. The experiences of the trainers and smallholders are in line with findings in the literature; 1.3.3 of chapter 1 discussed how the effects of climate change in Limpopo have become more noticeable through shifts in temperature, rainfall patterns, and longer dry seasons (Thomas et al. 2007; Limpopo Department of Economic Development Environment and Tourism 2016). Despite their awareness, smallholders indicated that they were reliant on coping, rather than adaptive strategies. This is discussed in 5.4.2 and 5.4.3.

5.4.2 Learning, social diversity, social capital, and collective action enabled by the social networks present before the agroecology training

Learning (individual and social), social diversity, social capital, and collective action were sub-themes within the main coding theme on 'adaptive strategies', and are specifically reviewed here in terms of the period 'before the agroecology training'. As mentioned in 4.3, social networks are the central link between these strategies, as they are either enabled or constrained through networks (Fabricius et al. 2007; Darnhofer, Bellon et al. 2010; Ireland & Thomalia 2011). In this section, networks are thus used

as an entry point to discuss the types of strategies smallholders were using before the agroecology training.

Based on the interviews, there were a number of social networks present before smallholders began participating in agroecology training with the trainers during 2016 and 2017. The most obvious networks engaging with smallholders were the SAFL, the MFA and indirectly, the World Wide Fund for Nature through their funding of the SAFL's Agroecology Awareness innovation. After receiving funding in 2015, the SAFL began working with the MFA to support smallholders in the area (SAFL n.d.d) and during this time, the El Niño-related drought began to intensify in the country (Manderson et al. 2016). Initially, the SAFL linked MFA farmers to ZZ2 so they could learn about their farming with nature philosophy (SAFL & PLAAS 2013). While the partnership did not work out, MFA smallholders felt the training was in any case not suited to their needs. MFA farmers, specifically Ms Mlondobozi (2017), requested the SAFL to continue to pursue opportunities for agroecology training in line with their realities as smallholders.

As a network, it seems the SAFL began cultivating elements of social learning amongst smallholders prior to the agroecology training course. This is most evident in the SAFL's creation of a community of practice involving diverse actors (e.g. smallholders, academics, NGOs, etc.), especially smallholders from the Mopani district, in the food system prior to the agroecology training course. Learning forms an integral part of the SAFL's theory of change, "with farmer voices inspiring and catalysing action throughout the process" (SAFL n.d.e). The learning that this theory encourages has likely informed the SAFL's growth/adaptation of their Agroecology Awareness innovation. For instance, in response to requests from farmers in the MFA, the SAFL decided to pilot a leadership and agroecology training programme (Drimie 2016). The SAFL's decision to place farmers' needs at the centre of their work suggests diverse experiences and knowledge systems were valued; it also reflects the SAFL's attempt to move from enabling top-down to bottom-up collective action amongst smallholders. Essentially, these points illustrate that key elements of social learning, namely the co-construction of research and exchange of/integration of diverse knowledge systems, were central to the SAFL's work with smallholders before the agroecology course. This finding affirms the views in the literature

concerning the role networks play in facilitating social learning, specifically knowledge sharing and integration (Fabricus et al. 2007; Darnhofer, Bellon et al. 2010).

The MFA is perhaps the best example of a bottom-up cooperative network of collective action amongst smallholders prior to the agroecology training (Manderson et al. 2016; Mabunda 2017; Mlondobozi 2017). As mentioned in chapter 1, the MFA is an association that smallholders created to represent themselves in the Mopani district (Manderson 2017). The presence of the MFA suggests that some form of collective action and learning, at the individual and social levels, existed amongst smallholders before the agroecology training. In fact, it was through the MFA that some of the trainers, specifically Mr Maake (2017), Ms Mbodi (2017), Ms Mlondobozi (2017), and Mr Sekhula (2017), were first exposed to the concept of agroecology. As members of the MFA, the trainers attended numerous workshops on agroecology, and then had to use the knowledge gained to advise local farmers on how to implement its practices. However, these trainers highlighted that their knowledge of agroecology at the time was based on theoretical, rather than practical knowledge. Without experiential learning, the trainers felt they were unable to implement or sufficiently share agroecological practices (Maake 2017; Mbodi 2017; Mlondobozi 2017; Sekhula 2017). One of the trainers, who was farming before 17 Shaft, described her exposure to agroecology before the training course in the following way:

The workshops ... I attended before I went to 17 Shaft ... did not work, because it was only theory ... but because we did not see it, it was very difficult to understand and then when we go back to practice, it did not work.

(Mlondobozi 2017).

While the MFA embodies a form of collective action before the agroecology training course, learning about agroecology through the network occurred, but it was limited. The trainers' experiences highlight that prior to the training at 17 Shaft, smallholders gained knowledge about agroecology (instrumental learning), but lacked the skills or experience to apply this knowledge.

Another network present was the Bryanston Organic and Natural Market and the Bryanston Market PGS. Members within the Bryanston Market PGS serve as the link

between this network and the SAFL and 17 Shaft. Five smallholders in Nkomo village were farming organically prior to the agroecology training. These farmers were already supplying the Bryanston Organic and Natural Market through another member of the community, who was part of the Bryanston Market PGS. This community member introduced these farmers to the Bryanston Market PGS committee and through annual farm assessments, they received certificates and became members of the Bryanston Market PGS (Wainwright 2017a). Yet these smallholders were only a small group out of the larger group of smallholders in Nkomo village (Mabunda 2017; Mbodi 2017; Wainwright 2017a). Smallholders' interactions with the Bryanston Organic and Natural Market through the Bryanston Market PGS indicates that some degree of social diversity and social capital were present before the agroecology course. By becoming members of the Bryanston Market PGS, smallholders essentially agreed to certain norms within this PGS.

However, due to the traveling distance, the five smallholders from Nkomo village were unable to fully participate in the Gauteng-based farm visits and bi-annual meetings for the Bryanston Market PGS. These meetings tend to involve seed exchanges, committee elections, and the adoption of documents (Wainwright 2017a). During this time, Ms Wainwright (2017a) recognised that a local PGS had to be established so smallholders in Nkomo village could play a more active role in developing their own PGS rules through meetings and benefit from the knowledge exchange (learning) on farm visits; a critical aspect of PGS. At the same time, Ms Mabunda (2017) felt they could not say these smallholders were “truly organic”, because “if they didn't know how to handle the challenge[s organic farmers face], they would go back to chemicals”. While this network may have facilitated aspects of social capital (in terms of norms), social diversity, and learning, Ms Mabunda's (2017) and Ms Wainwright's (2017a) experiences suggest there was a need to develop local networks and leadership in Nkomo village to further enable each of these strategies.

Prior to the agroecology training, Ms Mabunda (2017) was already interacting with smallholders in the Mopani district as an organic activist through the Bryanston Market PGS. Through an informal mentorship programme with the Bryanston Market PGS and their support of her application to attend the International Federation of Organic Agriculture Movements' Organic Leadership Course, and later the 17 Shaft

Agroecology and Leadership Training, Ms Mabunda received extensive PGS training (Mabunda 2017; Wainwright 2017a). This example illustrates that the Bryanston Market PGS enabled Ms Mabunda to begin developing her leadership abilities.

Extension and advisory services was the most obvious form of social learning, or lack thereof, through networks that smallholders themselves spoke about (Mabunda & Wainwright 2016a; Baloyi 2017; Kheto 2017; Maake 2017). An important finding was how social learning through these networks has not been collaborative or conducive to the integration of diverse knowledge systems (e.g. scientific and traditional knowledge). Instead, it was highlighted that extension officers advise smallholders to use chemicals to control environmental challenges. According to Ms Baloyi (2017), they were told to “go and buy chemicals to control pests and everything”. Smallholders and trainers felt this advice was not suited to their realities, because chemical inputs are too expensive for them and because it has led to a loss of their traditional knowledge systems. In their view, current extension support has created perceptions that conventional agriculture is the only or best way to farm (Baloyi 2017; Kheto 2017; Maake 2017; Mabunda 2017; Makhubela 2017; Mbodi 2017; Mlondobozi 2017; Ngoveni 2017; Risenga 2017; Sekhula 2017). This is illustrated in one of the smallholder’s statement (as translated by Ms Mbodi):

There were extension officers who taught them to go and buy chemicals in order to [build] their soils. Those who had money ... went and [bought], but for those who didn’t have money, it meant ... you don’t have.

(Kheto 2017).

One of the trainers made a similar observation, stating:

Our ancestors used to farm and they were not using industrial agriculture. They used to farm their own way, but it reached a stage where the way they used to produce food was regarded as inferior and then they dropped it and then adopted this type of farming, which is not good.

(Mlondobozi 2017).

At the same time, there was also a lack of extension support for farmers during the 2015/2016 drought (Manderson et al. 2016; Ubisi et al. 2017). Extension support during a drought is vital as it can improve smallholders’ adaptability by educating and training farmers on how to diversify their practices (Ubisi et al. 2017). These points reinforce the importance of social learning through extension support as a way to enhance smallholders’ adaptability. Yet smallholders’ experiences indicate that

conventional extension networks have undermined their self-reliance by only promoting a particular knowledge system, divorced from their realities. This raises an important question about the types of knowledge systems underpinning individual and social learning, and which of these facilitate or inhibit adaptability. This is a neglected area in the literature consulted.

Given, the limited support smallholders received from extension services during the drought, many farmers relied on coping, rather than adaptive strategies (Manderson et al. 2016; Baloyi 2017; Kheto 2017; Makhubela 2017; Mlondobozi 2017; Sekhula 2017; Ubisi et al. 2017). This had implications for their ecological and social diversity, as elaborated on in 5.4.3. The aforementioned views suggest extension support through DAFF is often limited when it is needed most but when it is present, it is disconnected from the needs or wishes of smallholders. These experiences reinforce the views held in the literature (Okunlola et al. 2016) regarding the need for targeted extension support, aligned with the diverse realities of smallholders.

Although some of these farmers (Mr Sekhula and Ms Mlondobozi) were part of the other networks discussed above (e.g. the MFA, the SAFL), they did not implement adaptive strategies prior to or during the drought (see a of 5.4.3). This finding indicates that the social networks such as the MFA and the SAFL were only beginning to encourage agroecological principles amongst farmers when the drought began. It may also be an indication that in isolation, even with limited learning, diversity, collective action, and social capital, networks do not guarantee adaptability.

This section has highlighted that a number of networks were present before the agroecology course. These networks influenced how smallholders used various types of strategies. For instance, elements of social learning, social diversity, social capital, and collective action were enabled through the SAFL, the MFA, and the Bryanston Market PGS, albeit in different ways and to varied degrees. The promotion of agroecology seems to have been the factor binding these networks, as they all encourage adaptive strategies amongst smallholder farmers.

While these networks may have promoted the adoption of adaptive, rather than coping strategies, the findings suggest that before the 17 Shaft training, smallholders were mostly reliant on coping strategies to deal with the drought. This was most evident

through conventional extension support networks, which did not enable learning or learning that was suited to smallholders' needs. The promotion of conventional agriculture through extension networks distributing free inputs seems to create a dependency on coping strategies, preventing smallholders from exploring alternatives or implementing adaptive strategies (Smit & Wandel 2006; Fabricius et al. 2007). The findings ultimately suggest there was a need for local in-community networks to stimulate further learning, social diversity, social capital, and collective action.

5.4.3 Diversity before the agroecology training

Prior to the agroecology course, the lack of diversity emerged as a strong sub-theme in the data. As 5.4.2 identified, smallholders relied on coping strategies due to the lack of support from extension networks, but also because the other networks only began to promote agroecology when the drought first started. The implications for smallholders' ecological and social diversity are discussed in a and b below.

a. Limited ecological diversity before the agroecology training

Ecological diversity, or the lack thereof, was particularly prominent across the data before agroecology (Manderson et al. 2016; Baloyi 2017; Kheto 2017; Maake 2017; Makhubela 2017; Mlondobozi 2017; Sekhula 2017). As discussed in 4.3.2, ecological diversity in farming systems refers to water harvesting (collecting water from different sources), species diversity (biodiversity, animal, and crop diversity), multiple production practices (intercropping/polycultures, crop rotations, composting, mulching, etc.), and obtaining nutrients from multiple sources (compost, crop rotations, etc.) (Darnhofer, Bellon et al. 2010; Walker et al. 2010; Cabell & Oelofse 2012). Very few of these were evident in the interviews and the SAFL's drought impact assessment (Manderson et al. 2016).

An important finding was smallholders' reliance on rain, rivers, and boreholes to irrigate their crops in the Mopani district (Kheto 2017; Mlondobozi 2017; Sekhula 2017). However, during the recent drought, few strategies were implemented to manage these stressed water resources efficiently. Only one of the smallholders, Ms Makhubela (2017), commented on how the shortage of water led her to drill a borehole. On the other hand, Ms Baloyi (2017) acknowledged that during the drought, "the crops used to die, because we didn't have this knowledge [agroecology] of adding organic matter to the soil". Ms Baloyi's statement implies she did not apply

adaptive strategies in response to the drought, as she lacked the knowledge to increase the water-holding capacity of the soil (e.g. by adding compost or mulching); a key element of ecological diversity. Two of the trainers, who were farming prior to the agroecology course, acknowledged that they had no strategies in place when the rivers and boreholes ran dry, despite their exposure to agroecological principles before their training at 17 Shaft (Mlondobozi 2017; Sekhula 2017). These examples illustrate how smallholders were not proactive in their responses to weather patterns before participating in agroecology workshops with trainers.

Similar findings were identified in the SAFL's drought impact assessment (Manderson et al. 2016). The assessment found that "four boreholes and three streams dried up completely during the drought" (Manderson et al. 2016:12), suggesting that water sources were not sufficiently diversified, nor well managed during the drought. Smallholders who had the financial resources only invested in one strategy to cope with the drought. This primarily involved transporting water to their farms, but also included increased electricity bills to pump more water (Manderson et al. 2016). Both measures centred on water supply rather than reducing water usage or adopting more efficient water-use strategies (Manderson et al. 2016). Even though half of the smallholders were aware of an impending drought, "many of them did not consciously [intentionally] prepare for it" (Manderson et al. 2016:23). Those who did prepare used "drought resistant seeds (one of whom claimed the seeds were indigenous), followed by better soil management [practices] to retain water (including additional manure), reduced irrigation, and reduced water use" (Manderson et al. 2016:21). However, some farmers did not prepare due to insufficient information and support for the drought (Manderson et al. 2016).

In their study of 150 smallholders in Mopani and Vhembe districts of Limpopo, Ubisi et al. (2017) drew similar conclusions. They found that the lack of education had a significant effect on farmers adaptive capacity. In particular, female smallholders were unable to adapt to the effects of climate change, as many lacked the knowledge (Ubisi et al. 2017). Manderson et al. (2016) and Ubisi et al. (2017) argue that extension support for smallholders needs to be strengthened, specifically indicating the need to train extension officers in more sustainable adaptive strategies. Based on

their findings, learning in the form of training seems to play a crucial role in building smallholders' adaptability.

On the other hand, companion planting and crop rotations were practices many smallholders were using before the agroecology training (Ubisi et al. 2017; Wainwright 2017a). As Mr Ngoveni (2017) stated, "with indigenous farming ... they plant a lot of stuff together, that's how they have been doing it I'm not sure if they were necessarily conscious of climate change and adapting to [it] or it was just something that they do traditionally". This reinforces the finding in the SAFL's assessment that some smallholders may be using drought resistant strategies without realising it (Manderson et al. 2016).

Based on the interviews and the SAFL's assessment, there was not significant ecological diversity in terms of farming practices (e.g. composting, mulching, water harvesting, etc.) during the drought or before agroecology to support smallholders' adaptability (Manderson et al. 2016; Baloyi 2017; Kheto 2017; Mabunda 2017; Mlondobozi 2017; Ngoveni 2017; Sekhula 2017). The findings presented here seem to corroborate the SAFL's (Manderson et al. 2016:18) view that most strategies "were short-term to deal with immediate drought impacts, and not to increase resilience", or in the context of this thesis, coping rather than adaptive attempts at dealing with the dry weather.

b. Social diversity before the agroecology training

In addition to diverse networks and actors (discussed in 5.4.2), social diversity in the literature also refers to individuals' resources, markets, and livelihoods (Darnhofer, Bellon et al. 2010; Cabell & Oelofse 2012; Pereira 2012). 5.4.2 identified that there was a diverse group of networks interacting with smallholders before the agroecology training, but these networks' promotion of agroecology at the start of the drought meant smallholders were still reliant on coping strategies (discussed in part a of 5.4.3). These strategies undermined smallholders' social diversity.

Social implications of the drought included less household/financial resources, a halt in savings as farmers invested in emergency measures, "doubts and fears about the future" as well as "less socialising" (Manderson et al. 2016:18). Smallholders also lost opportunities to sell to markets due to lower crop production (Manderson et al. 2016;

Baloyi 2017). Meanwhile, Ubisi et al. (2017) reported that the effects of the drought compromised the food security of smallholders. As a result, some farmers had to leave farming, with several farmers re-entering the job market (Manderson et al. 2016; Mbodi 2017; Mlondobozi 2017).

Although these findings are most likely a limited account of the social diversity during the drought, they do suggest smallholder communities had “weak adaptive capacity” (Fabricius et al. 2007). Smallholders seemed to lack financial and technological options, as well as the necessary skills, networks, and support systems to ensure their social resilience (Fabricius et al. 2007).

5.4.4 Mopani smallholder communities: powerless spectators or coping actors?

In relation to research question iii, this section has discussed the degree of adaptive strategies smallholders in Mopani were using prior to the agroecology course, which was one of the main coding themes identified. Learning (individual and social), diversity (social and ecological), social capital, and collective action were sub-themes that gave insight into the presence or absence of adaptive strategies.

5.4.2 identified the networks smallholders in Mopani interacted with prior to the agroecology course. Agroecology was identified as the factor that linked these various networks, as they were all promoting adaptive strategies to climate change through the adoption of agroecology. Social networks such as the SAFL, the MFA, and the Bryanston Market PGS were already playing a role in enabling some degree of learning, and a role in facilitating social diversity, social capital, and collective action amongst smallholders. Nevertheless, the implementation of agroecology and the adaptability of smallholders were limited. It might have been that these social networks were only starting the promotion of agroecology during the start of the drought, but strategies were also mostly enabled from the top-down through networks such as the SAFL and Bryanston Market PGS, rather than driven by trainers or smallholders in their own communities from the bottom-up.

Another constraint to adaptability was the conventional government extension services smallholders received during the drought. Extension support during the drought was lacking, but when support was accessible, it was not seen as conducive to

collaboration or integration of diverse knowledge systems. It promoted methods that reduced ecological diversity through an approach that did not encourage social learning or social diversity.

5.4.3 elaborated on how smallholders' diversity (social and ecological) had been reduced by their reliance on coping strategies before agroecology. The findings suggest that smallholders were possibly caught in a cycle in which the lack of diversity (social and ecological) meant they were reliant on coping rather than adaptive strategies and in turn, their use of these strategies seemed to further reduce diversity. Although smallholders were mostly aware of the challenges associated with drought and climate change (5.4.1), many smallholders implemented short-term emergency measures, rather than investing in long-term strategies to improve their resilience (part a of 5.4.3). This was particularly evident in the measures smallholders took to increase their water supply instead of adjusting their water usage. Smallholders, and trainers, reported that they lacked the appropriate knowledge and skills to adopt alternatives before agroecology training. The social effects of smallholders' reliance on coping strategies were discussed in part b of 5.4.3. This section indicated that the drought had negative social implications, specifically for smallholders' livelihoods and food security.

To conclude and answer question iii, this section of the chapter has arguably illustrated that many of the strategies smallholders applied prior to agroecology were short-term and reactive to the effects of the drought, in other words: coping strategies. Some degree of learning, social diversity, social capital, and collective action was present through certain networks, but were limited as smallholders remained reliant on coping strategies, promoted through conventional extension networks, during the drought. In this sense, many of these smallholders and their communities could be characterised as coping actors before the agroecology course.

5.5 Adaptive strategies post-agroecology training

This section also examines one of the major themes from the data, specifically the adaptive strategies smallholders have been using in the period since trainers returned to their communities and began transferring their knowledge. To clarify, post-agroecology training refers to smallholders' experiences with the trainers' agroecology training in their communities. However, as smallholders' experiences are

ultimately embedded in the trainers' networks, evidence from other sources is also used to contextualise the changes in smallholders' strategies since their exposure to agroecology training. As in 5.4, the strategies smallholders have used since their exposure to agroecology training are discussed in terms of the adaptive strategies from the conceptual framework, specifically the key coding sub-themes relating to post-agroecology training. They shed light on whether or not smallholders have become proactive in their approach to farming and to the effects of climate change.

Research question iv³³ is examined in the following way: 5.5.1 gives a narrative review of the networks present post-agroecology training;³⁴ 5.5.2 elaborates on some of the types of learning agroecology training is encouraging; 5.5.3 discusses how the training is enhancing ecological diversity on smallholders' farms; 5.5.4 identifies challenges, a main coding theme, in relation to smallholders' adoption of agroecology; and section 5.5.5 summarises the findings and offers concluding remarks.

5.5.1 Learning, social diversity, social capital, and collective action enabled by social networks present post-agroecology training

Similar to 5.4.2, learning, social diversity, social capital, and collective action were key sub-themes within the main coding theme on 'adaptive strategies', but are examined here in relation to the social networks present, or that formed after the agroecology training at 17 Shaft. Based on the data, the same networks were still present, but some new ones had formed through the trainers' engagement with smallholders in Mopani.

As 5.4.2 mentioned, smallholders in Mopani district were already engaging with the SAFL, the MFA, and the Bryanston Organic and Natural Market, through the Bryanston Market PGS, before the agroecology training. 5.4.2 identified the MFA as a network that represents a bottom-up collaborative network amongst farmers. During and after the training, the unequal power relations that emerged between two of the trainers and the MFA, as described in 5.2.2, essentially impeded Ms Mlondobozi's

³³ Research question iv: What adaptive strategies are smallholders in Mopani using since their exposure to agroecology?

³⁴ All data sources were used to inform the narrative overview of the networks present after the agroecology training at 17 Shaft.

(2017) and Mr Sekhula's (2017) ability to enable learning, social diversity, social capital, and collective action through the network. This finding suggests the MFA's impact on smallholders has possibly not been as far reaching as it could have been.

On the other hand, the MFA remains a valuable network through which smallholders in Mopani can access support and generate various degrees of learning amongst themselves. For instance, Ms Mbodi (2017) remains part of this network and facilitates agroecology training for smallholders through the network. Through her training, the MFA continues to encourage learning at the individual and social levels, but as 5.4.2. discussed, she is unsure how long she will remain part of the network. While the MFA has not featured as prominently after the agroecology training in my data, this is likely due to the fact that most of the trainers and smallholders interviewed in this research are embedded within their own networks, outside of the MFA.

The World Wide Fund for Nature, the SAFL, 17 Shaft, and the Bryanston Organic and Natural Market continue to enable the adoption of adaptive, rather than coping strategies amongst smallholders in Mopani, through their promotion of agroecology. 5.4.2 suggested that adaptive strategies were still limited prior to the training, because these networks only began promoting agroecology at the start of the drought and mostly from the outside (top-down), as opposed to driving it from within the community (bottom-up). The difference since the agroecology training is that the trainers have become the vehicle through which these networks enable learning, social diversity, social capital, and collective action amongst smallholders. The World Wide Fund for Nature has indirectly contributed to each of these by providing the funding for phase I and II of the training. By linking both the MFA and other smallholders to the 17 Shaft training course, the SAFL directly contributed to individual and social learning, and continues to do so through its ongoing connection to trainers and smallholder networks in Mopani (e.g. the MFA). The Bryanston Market PGS remains connected to smallholders in Nkomo village, but now also enables adaptive strategies through the trainers and the Giyani PGS (17 Shaft n.d.b; SAFL n.d.b; Drimie 2016; Wainwright 2017a).

Meanwhile, 17 Shaft's course has been instrumental in cultivating a network of in-community trainers, equipped with the necessary leadership and agroecology skills,

who are linked by their mutual interest in transferring agroecology to smallholders as a “proactive adaptation” to the effects of climate change (Fabricus et al. 2017:¶ 19). In this way, 17 Shaft training has directly cultivated social capital in Mopani. The training also encouraged various degrees of learning (as discussed in 5.3.) and collective action amongst the trainers. For example, Ms Mabunda, Ms Mbodi, and Ms Risenga working together with smallholders reflects a form of collective action amongst the trainers. Based on these findings, 17 Shaft’s course can be considered a proactive or adaptive strategy in itself (17 Shaft n.d.c; SAFL n.d.b; Drimie 2016; Manderson 2017).

With the leadership and agroecology skills the trainers acquired through the training, they have been able to transfer their knowledge, in varying degrees, to smallholders in their communities (discussed in 5.2.2). As a network and through agroecology training, the trainers have helped increase social and ecological diversity in their communities (the latter is elaborated on in 5.5.2), while also cultivating a bottom-up form of social capital and collective action amongst smallholders. This is most noticeable in trainers’ involvement in or creation of their own communities of practice amongst smallholders since the agroecology training (Maake 2017; Mabunda 2017; Mbodi 2017; Ngoveni 2017).

For instance, Mr Maake (2017) seems to have cultivated some degree of social learning and collective action amongst smallholders in his community, Letaba village. After holding a meeting about agroecology through his community project, Mr Maake (2017) said farmers began collaborating with each other, sharing knowledge, and asking for advice when faced with challenges. Mr Maake (2017) believes there is less interaction and cooperation when farmers are using chemicals. This is perhaps, as the findings in 5.4.2 suggest, because these practices do not encourage the same collaboration. Hoedspruit Hub, where Mr Ngoveni (2017) is employed as an agroecology trainer, reflects another example of a community of practice. Through its agroecology training, the Hoedspruit Hub seems to be cultivating further learning, individual and social, amongst smallholders (Ngoveni 2017).

The launch of the Giyani PGS is the best example of a community of practice formed after smallholders in Mopani were introduced to agroecology. Prior to the launch of the Giyani PGS in March 2017, smallholders in Nkomo village and surrounding

communities learnt about agroecology and PGS through numerous workshops with Ms Mabunda (2017) and Ms Mbodi (2017), as highlighted in 5.2.2. During the weekly meetings, the trainers share their knowledge about agroecology (as a science, practice, and movement) and PGS by facilitating conversations (communicative learning) and practical demonstrations (experiential learning) amongst the group. In this way, the trainers have empowered smallholders with the skills and knowledge (instrumental learning) necessary to shift away from using chemicals to implementing agroecological practices (emancipatory learning) (Giliam 2017a; Baloyi 2017; Maake 2017; Mabunda 2017; Mbodi 2017; Risenga 2017; Sekhula 2017). According to Ms Baloyi (2017), she changed her approach to farming by using compost, rather than “buying anything [referring to inputs]”. By changing her approach, Ms Baloyi (2017) seems to have gained a sense of independence: “... it [the use of compost] brings yield and [I have] used no cent [referring to money] in doing all that”. It became apparent that these types of learning, especially communicative learning, were only possible amongst smallholders in Nkomo village, because the trainers are able to speak the local language/s. Instances of experiential learning, encouraged through this network, are elaborated on in 5.5.2.

In addition to learning, the two trainers have cultivated many aspects of social capital, specifically trust and social norms (e.g. support and collaboration), and collective action through the weekly meetings. For instance, the smallholders interviewed in Nkomo village highlighted how the group has become an important part of their lives and has revitalised collaboration and knowledge sharing in the village (Baloyi 2017; Kheto 2017; Makhubela 2017). While Mr Kheto (2017) spoke about how the group has re-connected him to how things were done in their community in the past, Ms Baloyi claims:

... in our associations, when you come across a problem, it is not your problem alone [it's] the group's problem and when it is ... they will come help you with hands If [smallholders] can come together like us, it can help them a lot ... the best way to learn about agroecology [is to] start by coming together. That is the best way, because you cannot do it alone, we need each other ... and then we will grow as we go forward.

(Baloyi 2017).

These examples illustrate the value of in-community extension support with trainers who are equipped with the skills to enable social capital, collective action, and various

types of learning (experiential, communicative, instrumental, and emancipatory). As figure 11 depicts, the trainers' in-community training of smallholders is very similar to the *Campesino-a-Campesino* methodology discussed in the literature, which rests on participatory and horizontal exchanges of knowledge (Rosset 2015). Based on the above-mentioned, the formation of in-community learning networks arguably reflects an alternative extension model to conventional extension. These networks seem to provide a more conducive and regular form of support and learning for smallholders to enhance their adaptability compared to conventional extension networks, as highlighted in 5.4.2 (SAFL n.d.b).

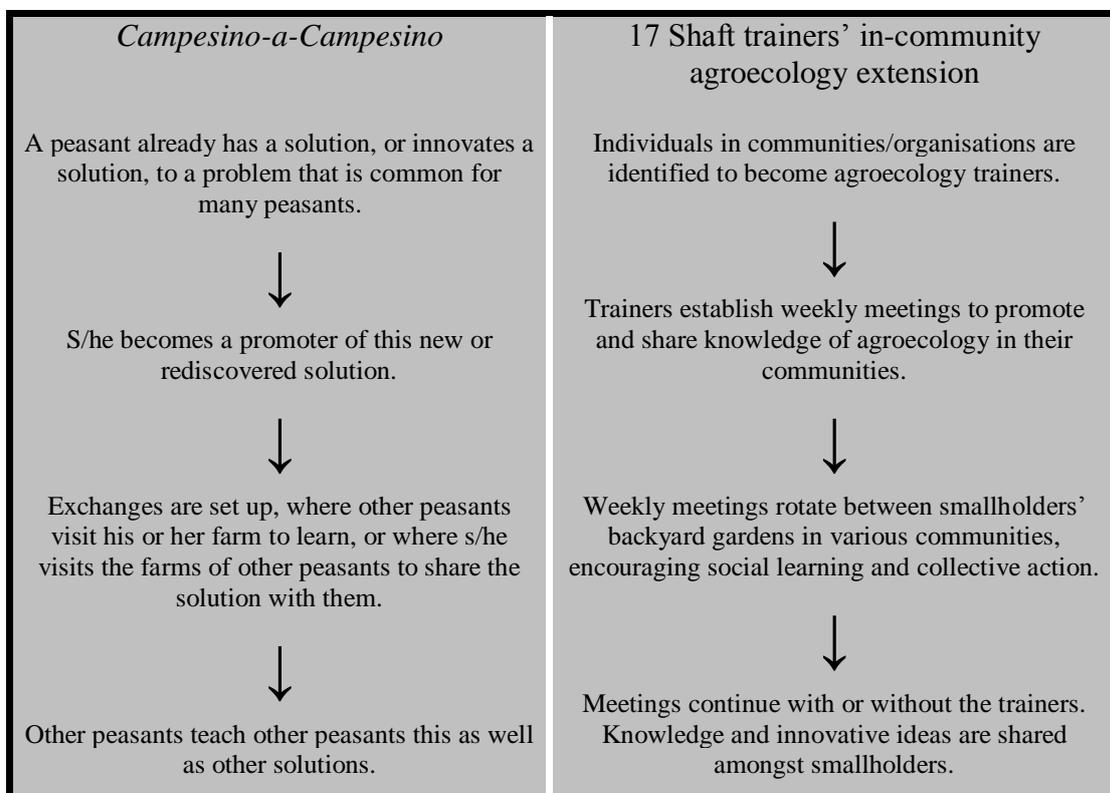


Figure 11: Similarity between *Campesino-a-Campesino* extension to 17 Shaft extension (Source: Adapted from Machin Sosa et al. 2010 cited in Rosset et al. 2011:169)³⁵

Although the trainers have been instrumental in facilitating change, the launch of the Giyani PGS in March 2017 has arguably generated further interest amongst smallholders. Before its launch, the idea of the Giyani PGS was already being used “as a vehicle to enable both ongoing community training and accessing different

³⁵ This figure is linked to figure 9 (Machin Sosa et al. 2010 cited in Rosset et al. 2011:169) in part a of 4.5.2.

markets especially the Bryanston Organic and Natural Market” (Drimie 2016:3). This was confirmed in the interviews, as smallholders stated they are being “linked to markets” (Baloyi 2017; Kheto 2017) “where [they] will sell [their produce]” (Kheto 2017). In this sense, smallholders’ interest in the formation of a farmer-to-farmer certification network seems to have stimulated their learning, by motivating them to become involved in the weekly meetings. The Giyani PGS is also already encouraging diversity, and the development of social capital and collective action from the bottom-up. This contrasts to before the agroecology training, when adaptive strategies were mostly enabled from outside (top-down) the community by more formal networks (e.g. the SAFL, Bryanston Organic and Natural Market, etc.).

In terms of social diversity, only the five smallholders who were originally part of the Bryanston PGS have become certified members of the Giyani PGS. However, a larger group of smallholders have become interested in accessing the Bryanston Organic and Natural Market through the Giyani PGS. During my observation in Nkomo village, there were roughly 19 smallholders present, with differentiation amongst them in terms of gender and the value chains they fall into (Baloyi 2017; Giliam 2017a; Kheto 2017; Makhubela 2017). The interview with Ms Wainwright (2017a) indicated that the number of smallholders interested in becoming members of the Giyani PGS is far greater, as more than 18 smallholders are involved in the weekly meetings in Nkomo, Vleifontein, and Dzingidzingi villages. This suggests the launch of the Giyani PGS, as a network, has encouraged social diversity in Nkomo village. Furthermore, the Giyani PGS, rather than the Bryanston Market PGS, has become the central link between smallholders in Nkomo village and the Bryanston Organic and Natural Market (Drimie 2016; Wainwright 2017a). Again this represents a move away from external top-down structures promoting agroecology and adaptability to emerging bottom-up networks building resilience. The increase in ecological diversity amongst smallholders in Nkomo village through their adoption of agroecological practices is elaborated on in 5.5.3.

In terms of social capital, PGS reflect the norms of the community in which they are based (Mabunda & Wainwright 2016a). In this way, these structures empower local communities with self-determination and social power, by allowing them to determine the rules that govern their involvement (Wainwright 2017a). For example,

respondents highlighted that when the Giyani PGS was launched, some discrepancies amongst old Bryanston PGS members were identified³⁶. These members were then expelled from the PGS and a new process (norm) was established whereby “only produce from farms approved by the Giyani PGS would in future be permitted to be sold in Johannesburg under Giyani PGS certificates” (Wainwright 2017b). The Giyani PGS certificates reflect how trust and specific social norms such as accountability form an essential part of the PGS processes. By checking the certificates, consumers know what practices farmers are using and whether they are considered organic.

As more smallholders become certified members of the Giyani PGS, they will be able to regularly participate in creating trust and norms (social capital) through bi-annual meetings and farm visits. This contrasts to before the agroecology training (see 5.4.2) when the five smallholders, who were members of the Bryanston Market PGS, were unable to participate in the Gauteng-based bi-annual meetings and farm visits. With the launch of the Giyani PGS, smallholders in Nkomo village and surrounding communities now have ownership over the system. There is also the possibility that nearby communities will establish their own PGS and merely coordinate with the Giyani PGS. Still, the development of norms and trust for a PGS takes time and needs to be “grown internally and organically within the community” (Wainwright 2017a). This will require ongoing support and effort, but according to Ms Wainwright (2017a), this is how PGS are established and strengthened.

While the Giyani PGS network has promoted the development of adaptive strategies, the smallholders in Nkomo village claim they were attracted to the group because of agroecology. According to these farmers, agroecology reminded them of their traditional knowledge (Baloyi 2017; Kheto 2017; Makhubela 2017). Ms Wainwright (2017a) reinforced their views, attributing the energy and interest in the launch of the Giyani PGS in March 2017 to the agroecology workshops that have been taking place since August 2016, with the support of Ms Mabunda. She felt the smallholders’ exposure to agroecology gave the PGS launch more substance.

Although the introduction of PGS has many societal benefits within communities, it is essentially a mechanism to access the organic market. If there are no farmers farming organically, then there is no need to implement

³⁶ The interviews for this thesis took place during a delicate period in the Giyani PGS. Respondents asked me to handle this information sensitively so I have deliberately refrained from mentioning names and providing further detail.

PGS. The agroecology and PGS workshops should go hand-in-hand – they are complimentary. This is evident in the model Ms Mabunda has implemented in her community, rotating workshops located at different backyard gardens and fields, starting with agroecology and introducing PGS as farmers see the possibility of selling their surplus.

(Wainwright 2017c).

This suggests the agroecology training and PGS are intrinsically linked and smallholders' adoption of agroecology is essentially reinforced through the farmer-to-farmer certification network. In other words, Ms Mbodi and Ms Mabunda seem to have strengthened the positive social and ecological impact agroecology could have on adaptability through the Giyani PGS network.

At the same time, the two trainers' in-community agroecology training in Nkomo village and the launch of the Giyani PGS has been successful because of the networks in which they are embedded. For instance, Ms Mabunda is likely having the biggest impact of all the trainers, due to her links with a number of supporting networks. Her understanding and implementation of PGS and agroecology amongst the groups she trains was made possible through the connection she had with the Bryanston Organic and Natural Market and the Bryanston Market PGS before the agroecology training at 17 Shaft, highlighted in 5.4.2. This network supported her application to go overseas for extensive PGS training with the International Federation of Organic Agriculture Movements, and also supported her application for the agroecology training at 17 Shaft (Wainwright 2017a). In this way, the Bryanston Organic and Natural Market, and the South African Organic Sector Organisation, have played an instrumental role in the development of the Giyani PGS. As this section highlighted earlier, the training was made possible by the SAFL and the funding received from the World Wide Fund for Nature's Nedbank Green Trust.

By concentrating their efforts into the agroecology training at 17 Shaft, these networks seem to have had a greater impact on smallholders' adoption of adaptive strategies after the training. For instance, the networks have encouraged more social learning amongst smallholders, specifically in terms of creating more diversity in the knowledge systems they have access to. This is best reflected by the integration of agroecology as a science (taught by 17 Shaft), a practice (taught by 17 Shaft and trainers, and implemented by 17 Shaft and farmers), and a movement (allowing farmers to reclaim their local and indigenous food system). This contrasts to before

the agroecology training when smallholders suggested their social learning (e.g. the diversity of knowledge systems) was limited through conventional extension networks, as discussed in 5.4.2. Smallholders' experiences indicate that social networks have encouraged various degrees of learning, social capital, diversity, and collective action. Experiential learning and the increase in ecological diversity are elaborated on in 5.5.2 and 5.5.3.

5.5.2 Agroecology training encourages experiential learning

Smallholders' experiences remain the focus of this section, but trainers' experiences with the agroecology training at 17 Shaft are also used to reinforce their views. This section identifies cases of experiential learning in the data, as it emerged as particularly important amongst smallholders in Nkomo village and the trainers. Importantly, experiential learning is also linked to the other types of learning, identified in 5.5.1.

Experiential learning was most evident in Nkomo village through the training activities in the weekly meetings with Ms Mbodi and Ms Mabunda. During my observation in Nkomo village, some of the smallholders demonstrated how to make compost before the trainer, Ms Mbodi, had arrived (see photo 4) (Giliam 2017a). I asked whether they knew how to make compost before meeting Ms Mbodi and Ms Mabunda and two of them (Mr Kheto and one other lady) said they had heard about it, but did not know how to make it. Before learning how, they simply spread cow manure on the ground or crops (Giliam 2017a). The observation of the meeting illustrated that through experiential learning, smallholders have acquired, with relative ease, the necessary skills to make compost. This was also implied in the interviews with the three smallholders (Baloyi 2017; Kheto 2017; Makhubela 2017).



Photo 4: Smallholders demonstrate how to make compost heaps before the trainers arrive

The trainers seemed to reinforce these views, as they implied that agroecology is valuable, because it encourages experiential learning. Trainers feel learning about agroecology through practice and experience is more accessible for the elderly farmers they work with as many of them are illiterate (Maake 2017; Mabunda 2017; Mbodi 2017; Mlondobozi 2017; Ngoveni 2017). Through experiential learning, farmers in Nkomo village seem to have been empowered with knowledge and skills (instrumental learning) that they are able to transfer to other smallholders. However, as Mr Ngoveni (2017) asserts, agroecology requires patience and being open to an ongoing process of experiential learning.

I think they [smallholders] need to see it working continuously ... then they will be able to change, because they already know that commercial farming works, that [conventional farming] produces cabbages that they can eat, but you've never brought them a cabbage and ... said ... this was grown agroecological[ly] and even then they will be sceptical If they can see ... the entire process throughout and it working continuously, I think that would change their minds But again that ... means [they will need] to have patience It's not necessarily a quick fix thing ... like in commercial farming. So the biggest challenge was explaining to people that you need to be patient ... because you can buy a synthetic fertiliser ... and spray it today. [But] it's going to take at least three to six months for compost to be ready.

(Ngoveni 2017).

Furthermore, the trainers emphasised how experiential learning at 17 Shaft equipped them with the skills (instrumental learning) to implement agroecology on their own farms (Mlondobozi 2017; Sekhula 2017), or share these skills with smallholder communities (Maake 2017; Mabunda 2017; Ngoveni 2017). After a few weeks at 17 Shaft, Ms Mlondobozi (2017) returned home for a long weekend and decided to make a compost heap on her farm. Four or five days later, Ms Mlondobozi's (2017) husband called and let her know the compost heap was 'smoking'; she said this meant it was cooking, which she knew, because she had seen and experienced the same process with the compost heaps at 17 Shaft. This contrasts to Ms Mlondobozi's (2017) experience with agroecology prior to 17 Shaft, as indicated in 5.4.2, which was mostly theoretical.

Based on the smallholders' and trainers' experiences, agroecology training that involves experiential learning seems to be most valuable, especially for illiterate smallholders.

5.5.3 Enhancing ecological diversity with agroecological practices

The increase in ecological diversity since the agroecology training in Nkomo village was one of the more prominent sub-themes that emerged from the data. This section identifies how smallholders' have enhanced ecological diversity on their farms since the agroecology training.

Based on the data, smallholders who have participated in the trainers' agroecology training have created, for the most part, more diversity in their farming systems (e.g. plants, crops, species, etc.). This has been achieved through the adoption of a number of agroecology practices or diversification strategies, which are indicated in table 13 (Giliam 2016, 2017a; Baloyi 2017; Kheto 2017; Maake 2017; Mabunda 2017; Makhubela 2017; Mbodi 2017; Mlondobozi 2017). The most prominent agroecological practices mentioned in the ecological diversity sub-theme include: intercropping, integrated nutrient management (e.g. composting to improve soil fertility), and more efficient water practices (e.g. water harvesting and mulching).

Table 13: Awareness/implementation of key agroecology practices in the Mopani district

Practices	Nkomo village	Trainers who	Trainers	17 Shaft
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	smallholders	are smallholders		training
Little or no tillage	Discussed	Yes	Yes	Yes
Intercropping and polycultures	Yes	Yes	Yes	Yes
“Crop rotation and fallowing”	Yes	Yes	Yes	Yes
“Cover crops and mulching”	Yes	Yes	Yes	Yes
“Crop-livestock integration”	Yes (some of the farmers)	Some	Yes	Yes
“Integrated nutrient management” (e.g. compost, etc.)	Yes	Yes	Yes	Yes
“Biological management of pests, diseases and weeds”	Yes	Yes	Yes	Yes
“Efficient Water Harvesting”	Yes	Yes	Yes	Yes
“Manipulation of vegetation structure and plant associations”	Yes	Yes	Yes	Yes
“Agro-forestry, especially the use of multifunctional trees”	Some of the farmers	Yes	Yes	Yes
“Use of local resources and renewable energy sources, composting and recycling”	Yes	Yes	Yes	Yes
“Holistic landscape management around fields perimeters, across multiple fields and at the landscape-to-regional scale”	Not seen/discussed	Not seen/discussed	Not seen/discussed	Yes

(Source: Adapted from Silici 2014:9).

In terms of intercropping, the following crops were identified in the data: spinach, okra, cabbage, amaranth, onions, cowpeas, beetroot, carrots, and tomatoes (Giliam 2016, 2017a; Baloyi 2017; Kheto 2017; Maake 2017; Mabunda 2017; Makhubela 2017; Mbodi 2017; Mlondobozi 2017). As part a of 5.4.4 indicated, many of the smallholders were already mixing crops and using companion planting (Giliam 2017a; Mabunda 2017; Ngoveni 2017), but the agroecology training seems to have increased the range of polycultures on smallholders’ farms in Nkomo village. This example indicates the connection between agroecological practices and indigenous knowledge systems (Altieri 2009; IAASTD 2009; Van der Ploeg 2014; Altieri & Nicholls 2017).

Another important element was the emphasis placed on water harvesting, or conserving water through better water and soil management practices (e.g. mulching and composting). Since the agroecology training, there seems to be more recognition of the water shortages in the region or more specifically, the need to conserve water

(Baloyi 2017; Kheto 2017; Maake 2017; Mabunda 2017; Mbodi 2017). Ms Mabunda (2017) spoke about how they (herself and Ms Mbodi) tell smallholder communities to conserve water by collecting and reusing rain and grey water.

Before the agroecology training in Nkomo village, smallholders indicated that they did not know how to make compost (Baloyi 2017), discussed in part a of 5.4.3. Since the training, integrated nutrient management practices were more apparent. Composting, liquid manure, and mulching practices have been adopted as ways to improve soil fertility (Baloyi 2017; Giliam 2017a; Sekhula 2017; Kheto 2017; Maake 2017; Mabunda 2017; Makhubela 2017; Mbodi 2017; Mlondobozi 2017; Ngoveni 2017; Risenga 2017). Ms Mabunda (2017) said the most important activity they do with smallholders is “compost making”. She recognised that the soil is not fertile enough and “building the soil” is the “foundation of ... production” (Mabunda 2017). As discussed in 4.5.1, studies conducted in Ethiopia, India, and the Netherlands provide evidence of how soil management practices enhance a farm’s resilience during droughts (cited in De Schutter 2011).

Smallholders felt the adoption of agroecological practices has made them more resilient to the effects of drought conditions (Kheto 2017; Makhubela 2017; Risenga 2017). Ms Makhubela (2017) stated how through agroecology “she manages to farm ... even though the drought is there” and “even if she is poor, she can farm using agroecology. Even if she [does not] have water, she can farm using agroecology”. They also feel that there has been an improvement in their yield and the ways crops grow since adopting agroecology, specifically the introduction of compost (Baloyi 2017; Kheto 2017; Mlondobozi 2017; Risenga 2017).

5.5.4 Challenges in adopting agroecology

‘Challenges’ was one of the main themes identified in the data and is discussed here in terms of the adoption of agroecology. The challenges are seen as barriers that may hinder further adoption of agroecology amongst smallholders. Main barriers identified include: (a) limited resource availability; (b) a lack of access to markets in Limpopo; (c) the patience and time required for agroecology; (d) the need for ongoing in-community extension support; (e) youth and gender dynamics, and (f) power imbalances. These are briefly discussed below.

a. Limited resource availability

One of the major barriers to the implementation of agroecology is smallholders' limited resources (Makhubela 2017; Mbodi 2017; Ngoveni 2017; Risenga 2017). For instance, two of the smallholders and one trainer felt drip irrigation would be more beneficial for their crops (Kheto 2017; Makhubela 2017; Risenga 2017). Another example is the challenges Mr Ngoveni (2017) has faced in growing seedlings from heirloom seeds, as there was not a designated area (infrastructure) for growing the seedlings. Further resource issues smallholders faced include: difficulties in accessing manure for compost and materials for mulching, transportation of materials and manure to farms, and the labour intensity of agroecology (Risenga 2017; Sekhula 2017).

On the other hand, smallholders in Nkomo village have shown that some resource challenges can also be overcome. Many of the smallholders did not have access to a measuring tape to design the layout of their gardens until one of the smallholders, Mr Kheto, used a measuring tape to create 19 measuring sticks for the community (Wainwright 2017a).

b. Access to markets remains a challenge

Despite conversion to agroecology, access to markets remains a challenge for the smallholders (Mbodi 2017; Sekhula 2017). Ms Mbodi (2017) spoke about the lack of markets in Limpopo, which requires smallholders to send their produce to Johannesburg. As a smallholder, Mr Sekhula (2017) expressed his frustration with sending produce to the national market in Johannesburg due to the transportation costs and the inequalities in the system, with farmers receiving little return on their produce.

c. Agroecology and PGS requires patience and time

A third obstacle for smallholders adopting agroecology is that it requires work, experience and practice, observation of the environment and therefore, a lot of patience (Maake 2017; Ngoveni 2017; Risenga 2017). Mr Ngoveni (2017) claims many smallholders lack the patience required for adopting agroecology; they are sceptical of its viability and therefore need to experience agroecology working first-hand. Mr Ngoveni's (2017) concerns relate to points raised in the literature regarding the barriers that may prevent smallholders from adopting agroecology. For instance,

Silici (2014) points out that the time needed for experimentation and learning may prevent poorer smallholders from adopting agroecology. Ms Wainwright (2017a) expressed similar sentiments about the development of PGS in communities, specifically indicating that it takes time and requires ongoing support.

d. The need for ongoing in-community extension support

Due to the challenges identified in c, ongoing support in the form of extension and knowledge networks is considered vital (Ngoveni 2017). While interactions between smallholders and other actors in the SAFL network are certainly important, only a few smallholders from the Mopani district (specifically the agroecology trainers and the MFA) are involved and therefore heard in these processes (Drimie 2016). Given the differentiation amongst smallholders (Okunlola et al. 2016), this raises the question of “who learns what, when, to whose benefit and why” (Galaz 2005). Mr Ngoveni feels particularly strongly about the need for an ongoing knowledge network and support system for smallholders, stating:

They can come together as farmers, but they will still need ... an external body of knowledge and support. I think ... maybe help from government and NGOs, but as long as there's something in place ... support in terms of agroecology knowledge, to markets and such things, such aspects that would really help them sustain their farms.

(Ngoveni 2017).

The continued involvement of trainers in this knowledge network provides a way for them to share their challenges and access information, which they can share with their communities.

e. Power dynamics

The unequal power relations between some of the trainers and the MFA and between different knowledge systems (agroecology versus conventional agriculture) were discussed in 5.3.4. As argued in that section, power tensions have been a major factor hindering the promotion of agroecology.

Unequal gender roles were a further power dynamic identified in the research. What was unclear during my observation and interviews was whether agroecology has had any effect on these dynamics within smallholder communities (Giliam 2017a). The weekly meetings seem to offer a form of support for the smallholders, which is important given that the majority are female (Giliam 2017a). However, based on one

of the interviews (Baloyi 2017) and my observation (Giliam 2017a), women seem to still shoulder most of the work. During her interview, Ms Baloyi (2017) stated that “[her] husband is hungry”, implying the need to finish the interview. This example reveals the gender roles that remain within communities, and how these may hinder female smallholders from adopting agroecology due to the time and effort involved, as point c discussed. Although two of the trainers (Mabunda 2017; Mlondobozi 2017) expressed a specific interest in supporting female smallholders, they informed me that they did not learn about support for female farmers during the training at 17 Shaft. In line with the gap identified in the literature in 3.3.1, the points made here reinforce the need for a typology that identifies the gender differentiation amongst smallholders, and the types of support these farmers need.

f. Youth’s involvement in agriculture

There is also a concern that the youth’s lack of interest in farming will lead to a loss of farming knowledge (Mbodi 2017). This was evident in Nkomo village where the weekly meeting between smallholders primarily consisted of elderly people (Giliam 2017a). However, Ms Mbodi (2017) stated that they are trying to recruit the youth and have managed to get two or three involved. Ms Mbodi (2017) believes “the youth are the ones who [can] take agroecology forward. They are the ones that must save our planet”. However, the challenge, as the SAFL (Drimie 2016) recognises, is that youth may believe in creating a more sustainable food system, but their concerns mostly centre on whether they can earn income and make a livelihood by farming.

5.5.5. Mopani smallholder communities: From powerless spectators/coping actors to adaptive communities

To answer research question iv, this section assessed the adaptive strategies smallholders in the Mopani district of Limpopo have applied since they were trained in agroecology. Similar to 5.4, the strategies identified in chapter 4, namely learning, diversity, social capital, and collective action, were coding sub-themes that provided insight into the types of strategies smallholders are using.

5.5.2 identified the networks smallholders in Mopani district have interacted with since the agroecology course. While networks such as the SAFL, the MFA, and the Bryanston Market PGS were playing a role in enabling some degree of adaptive

strategies amongst smallholders in Mopani before agroecology, this has arguably increased since the trainers returned home to their communities. Many of the trainers have enabled various degrees of adaptive strategies (learning, diversity, social capital, and collective action) through their involvement in or creation of communities of practice. In-community training by two of the trainers is perhaps the best example of how networks formed after the agroecology training at 17 Shaft and in Nkomo village, such as the Giyani PGS, have enabled various degrees of adaptive strategies. The smallholders' experiences with the in-community training and the Giyani PGS highlight the value of an in-community extension model compared to conventional extension models. At the same time, the trainers' success was ultimately linked back to the networks they are embedded in and in contact with prior to the agroecology training. Ultimately, it was suggested that by coming together around the agroecology training, the various networks have enhanced smallholders' adoption of adaptive, rather than coping, strategies.

5.5.2 identified cases of experiential learning and in doing so, indicated the value of experiential learning processes for illiterate smallholders. 5.5.3 elaborated on the increase in the ecological diversity on smallholders' farms since the agroecology training in their communities. The main practices identified include intercropping, integrated nutrient management (mulching, composting, etc.) to boost soil fertility, and more efficient water practices (water harvesting, use of greywater, mulching, etc.).

Ultimately, the findings identified in 5.5.1 to 5.5.3 suggest that the trainers can be considered adaptive co-leaders. Since their training, many of the trainers have adopted a proactive approach to change in the food system by encouraging smallholders to change their approach to farming through the adoption of agroecology. This contrasts to pre-agroecology where smallholders were mostly reliant on coping strategies; as adaptive strategies were present, but still limited.

While smallholders have become more proactive in their approach to farming, 5.5.4 identified a number of challenges to the further adoption of agroecology amongst smallholders. These included: limited resource availability (a); lack of access to markets (b); the time and patience agroecology requires (c); the need for ongoing in-

community extension support (d); power tensions (e); and youth's involvement in agriculture (f).

Finally, in answering question iv, Mopani smallholder communities implementing agroecology appear to be on the path to becoming adaptive communities, rather than coping actors, due to their adoption of adaptive rather than coping strategies. Social networks inside and outside of smallholder communities have played vital roles in strengthening smallholders' adaptability to climate change. At the same time, there is a need for ongoing and further in-community extension support to enable the adoption of agroecology at the broader social level in Limpopo, and South Africa.

5.6 Conclusion

The case study has been the focus of this chapter, providing insight into the value of the 17 Shaft leadership and agroecology training programme, in-community extension support, and the influence of agroecology training on smallholders' adaptability. This topic was explored through three of the four research questions. The findings for each question are briefly summarised below, while the areas for future research, identified during the research process, are discussed in chapter 6.

In answering research question ii, I argue in 5.3 that the leadership training has enabled trainers to transfer their knowledge to smallholders by equipping them with the necessary leadership skills and knowledge. The trainers developed their abilities (instrumental learning) through experiential, communicative, and emancipatory learning processes. Although barriers to trainers' transfer of knowledge were identified, most of the trainers have managed to overcome these. In sum, I contend that the training programme has developed adaptive co-leaders.

In terms of research question iii, I assert in 5.4 that smallholders were mostly reliant on coping strategies prior to the agroecology training. Certain networks were encouraging adaptive strategies amongst smallholders' through their promotion of agroecology. Yet, I argued this was limited, because adaptive strategies were mostly encouraged from networks outside (top-down) smallholder communities, rather than driven by the communities themselves (bottom-up). I also suggested that these networks' promotion of agroecology may have only begun when the drought started so smallholders were not sufficiently equipped to implement the practices advocated.

This meant smallholders continued to rely on coping strategies promoted through conventional extension networks. When their support was available, these networks seemed to reduce social and ecological diversity and hinder social learning by undervaluing smallholders' traditional knowledge systems. Finally, I concluded that smallholder communities could be classified as coping actors before the agroecology course.

In answering question iv, I assert in 5.5 that the networks have increased smallholders' use of adaptive strategies by concentrating their efforts into supporting the agroecology training at 17 Shaft and subsequently, the trainers. Smallholders' experiences suggest that networks, formed pre- and post-agroecology, have strengthened smallholders' adaptability to climate change. In conclusion, I argued that smallholders are on the path to becoming adaptive communities, but require ongoing in-community support.

Chapter 6: Conclusion

6.1 Introduction

This thesis focused on understanding the impact of agroecology training on the adaptability of smallholder communities to climate change in the Mopani district of Limpopo. This final chapter gives an overview of the research and is structured in the following way: 6.2 reviews my research process; 6.3 summarises my findings for the four research questions; 6.4 gives recommendations based on my findings; 6.5 identifies areas for further research; and 6.6 provides a conclusion.

6.2 Research process

This section of the chapter briefly reviews the process used to conduct the research for this thesis. Four research questions³⁷ were selected to guide the research on this topic. To address these questions, two research designs were selected: a literature review and a case study.

A traditional literature review was chosen to address the first research question. The literature review comprised two chapters. Chapter 3 centred on climate change and smallholders at the global and South African levels. The aim of the chapter was to provide the rationale for the arguments put forth in chapter 4. Literature on adaptability and agroecology were reviewed in chapter 4 in order to answer research question i. An outcome of this chapter was the development of a conceptual framework, which was then used to analyse the case study to answer questions ii-iv.

A case study design was chosen to answer research questions ii-iv. A number of elements were used to design the case study, including: the research questions, the research unit, the conceptual framework, methods for data collection (interviews, observations, and documentary analysis), and a thematic data analysis approach. The thematic data analysis approach allowed me to identify five overarching themes:

³⁷ Research question i: How could agroecology influence the adaptability of smallholders in the face of climate change?

Research question ii: Did the leadership component of the agroecology training enable individuals to transfer knowledge to Mopani smallholder farmers? If so, how? If not, why?

Research question iii: Have smallholders in Mopani applied adaptive strategies prior to their exposure to agroecology?

Research question iv: What adaptive strategies are smallholders in Mopani using since their exposure to agroecology?

- The leadership training and leadership skills
- Adaptive strategies smallholders and trainers were using before and after their exposure to agroecology training
- Benefits and limitations of agroecology
- Observation of weather patterns
- Challenges

Within each theme, there were sub-themes that related to concepts from the literature. To interpret the findings, I organised themes into three categories to help me answer the research questions: ‘leadership’, ‘before the agroecology training’, and ‘after the agroecology training’.

6.3 Research results

My research results are discussed in four sections: 6.3.1 summarises the arguments put forth to answer research question i, and 6.3.2 to 6.3.4 present the case study findings for research questions ii, iii, and iv.

6.3.1 How could agroecology influence the adaptability of smallholders in the face of climate change?

Based on the concepts of adaptability and agroecology, I examined how agroecology may influence smallholders’ adaptability in the face of climate change. A review of literature on climate change (3.2) and smallholders (3.3) in chapter 3 provided the rationale for answering this question. 3.2 highlighted how climate change is expected to affect all areas of food production, but the effects will vary between regions, countries, and farmers. Smallholders are identified as particularly susceptible to climate change due to their limited resources and a lack of support/access to support (3.2.2). Though some smallholders may be using more climate resilient farming methods, this is not the case for all smallholders. A more sustainable approach to agriculture, specifically agroecology, is viewed as a way to enhance the adaptability of smallholders to climate change, and is considered more conducive to meeting their livelihood needs. In reviewing literature on smallholders (3.3), I also argued that supporting smallholders’ adaptability requires recognition of the differentiation amongst them.

The context established in chapter 3 enabled me to focus the next part of my literature review (chapter 4) on answering research question i. More specifically, I investigated how agroecology can influence the adaptability of smallholders in the face of climate change. First, the concept of adaptability was situated in literature on the resilience of SES (4.2). In doing so, I indicated that adaptability specifically refers to individuals' ability to influence resilience, and is therefore connected to social resilience. Using the literature, I identified a number of adaptive strategies that are considered important ways for communities to enhance their adaptability (4.3). Networks were discussed first (4.3.1) as the linking concept between the four strategies that were identified.³⁸ These include: individual and social learning (4.3.2), cultivating social and ecological diversity (4.3.3), developing social capital (4.3.4), and inspiring collective action (4.3.5).

After exploring the concept of agroecology (4.4), I linked the adaptive strategies identified in 4.3 to agroecology (4.5.2). A conceptual framework was developed in 4.5.2 to illustrate the connection between the adaptive strategies and agroecology. Based on the links established between the two bodies of literature, I argued that agroecology has the potential to enhance smallholders' adaptability to climate change, because it encourages learning (individual and social), diversity (social and ecological), social capital, and collective action. In sum, I argued that by improving smallholders' adaptability, agroecology may enhance their social resilience and ultimately, SES resilience.

The framework and arguments developed in chapter 4 were used to analyse the data for research questions ii, iii, and iv. The findings for each of these questions are discussed below.

6.3.2 Did the leadership component of the agroecology course enable trainers to transfer knowledge to Mopani smallholder farmers? If so, how? If not, why not?

To answer question ii, trainers were asked to reflect on how the leadership training enabled them to share their knowledge (discussed in 5.3), and the types of knowledge

³⁸ Figure 4 in 4.2.3 illustrated the link between networks and the adaptive strategies used in this thesis.

transfer activities they have been involved in since the training (5.2.2). The latter formed part of the background information for chapter 5.

When examining the trainers' experiences, instrumental learning was identified as the most pronounced example of learning (5.3.1). Instrumental learning was discussed primarily in terms of how trainers formed new skills or knowledge about leadership, as 5.5 examined their influence on smallholders and their environment. The main skills identified were communication and leadership behaviours. I argued that trainers seem to have adopted a number of change management and resilience behaviours such as communication, training, and organisation.

Experiential, communicative, and emancipatory learning were more implicit elements of the learning process at 17 Shaft (5.3.2). My observations at 17 Shaft revealed that these learning processes form an essential part of the leadership training conducted by Mr Mofikeng. For instance, I linked my observation of trainees' participation in leadership activities to the four stages of experiential learning (experience, observation, conceptualisation, and experimentation), identified in the literature (Armitage et al. 2008). I argued that communicative and emancipatory learning were central to the experiential learning process, with trainers refining their participation in activities after feedback (communicative learning) and reflection (emancipatory learning).

Furthermore, the development of trainers' self-esteem emerged as the key example of emancipatory learning amongst those who graduated in 2016. The fact that this was a prominent topic amongst trainers suggests 17 Shaft has created learning conditions (e.g. equal opportunity to participate) that encourage emancipatory learning, as indicated in the literature (Diduck 2010). While acknowledging that the self-esteem of some trainers was more noticeable than others, I still argue that the trainers' views suggest the change in their self-perception enabled them to develop new leadership skills or improve existing ones (e.g. communication). My findings reinforce the view in the literature (Milestad et al. 2010) that learning theories tend to overlap and reinforce each other, as depicted in figure 10.

Finally, the change in trainers thinking and approach to leadership was also attributed to the social nature of learning (5.3.3). The trainers felt their interaction with Mr

Mofikeng ultimately shaped their understanding of leadership. Their experiences validated the perception in the literature (Fazey et al. 2005; Fazey et al. 2007) that learning at the individual level remains a social process.

While the leadership component of the course may have equipped trainers with the skills to transfer knowledge to smallholders, certain barriers (not associated with the 17 Shaft training) prevented some of them from doing so (5.3.4). These included power dynamics between a few of the trainers and the MFA, power tensions between different knowledge systems (e.g. agroecology versus conventional agriculture), and resource constraints. In conclusion, I assert that the leadership course has developed adaptive co-leaders, who have acquired the capabilities to diffuse agroecology amongst smallholders in Mopani and thereby strengthen their adaptability to climate change.

6.3.3 Have smallholders in Mopani applied adaptive strategies prior to their exposure to agroecology?

To answer question iii, I identified whether smallholders were using adaptive strategies before their exposure to agroecology training; one of the main themes from the data (5.4). Learning, diversity, social capital, and collective action were sub-themes under the ‘adaptive strategies’ theme, but were discussed specifically in terms of the period before the agroecology training. First, I discussed trainers’ and smallholders’ experience and observations of weather patterns before their introduction to agroecology (5.4.1). My intention was to determine their awareness of the region’s vulnerability to drought, low rainfall, and arguably climate change. Most of the interviewees had noticed changes in weather patterns over the years such as drier conditions and shifting rainfall patterns.

Secondly, I identified the networks smallholders in Mopani were engaging with prior to the agroecology course (5.4.2). It was recognised that a number of networks were present before the agroecology course, with some enabling adaptive strategies and others reinforcing coping strategies.

The SAFL, the MFA, and the Bryanston Market PGS networks encouraged adaptive strategies (e.g. social learning) through their promotion of agroecology amongst smallholders. Despite their efforts, I argued that smallholders’ limited implementation

of agroecology and therefore their adaptability to climate change was restricted before the training. One possible reason was that the networks engaging smallholders began their promotion of agroecology around the start of the drought, which did not allow sufficient time for thorough implementation. A second reason was that strategies were mostly enabled from networks outside the communities (e.g. the SAFL), rather than driven from the bottom-up by networks within the communities.

A further constraint was the support, or lack thereof, from conventional government extension networks. When support was accessible, I argued that the type of support was not collaborative or conducive to smallholders' needs or their preferred knowledge system. Instead, these networks seemed to promote strategies that reduced smallholders' social and ecological diversity, and therefore adaptability to climate change. The findings in this section (5.4.2) indicate there was a need for local in-community networks to further enable adaptive strategies and thereby improve smallholders' adaptability.

Despite their awareness of shifting weather patterns (5.4.1), I contend that there was little evidence of smallholders using ecological diversity, in terms of farming practices, as a way to prepare for potential droughts (part a of 5.4.4). Interviews and documentary evidence suggested that most of the strategies applied in the 2015/16 drought were short-term responses, or coping strategies. Smallholders' reliance on these strategies had negative implications for their livelihoods, and market relations; in other words, their social diversity (part b of 5.4.4). Drawing on the findings, I argued that before their exposure to agroecology training, smallholders in Mopani were reliant on coping rather than adaptive strategies. In line with this point, I characterised smallholder communities as coping actors prior to the agroecology course (5.4.5).

6.3.4 What adaptive strategies are smallholders in Mopani using since their exposure to agroecology, or are they using them, and if so which ones?

In 5.5, and to answer question iv, I analysed whether smallholders used more adaptive strategies in the period after the 17 Shaft training when trainers began transferring their knowledge to smallholder communities. Learning, diversity, social capital, and

collective action were coding sub-themes under the ‘adaptive strategies’ theme, but were examined specifically in relation to post 17 Shaft agroecology training for this question.

Similar to 5.4.2, I identified the networks interacting with smallholders in Mopani after the agroecology training in 5.5.1. I argued that while many of the networks remained the same, their mutual support for the agroecology training and trainers had arguably intensified learning, diversity, social capital, and collective action amongst smallholders. I pointed out that the difference since the agroecology training was that the trainers had become the vehicle through which these networks enabled adaptive strategies amongst smallholders in Mopani. The trainers’ involvement in or creation of communities of practice elicited many elements of these strategies.

The launch of the Giyani PGS was identified as the best example of a community of practice established after smallholders were introduced to agroecology training. I highlighted how components of learning (individual and social), diversity (social and ecological), social capital, and collective action became more pronounced after smallholders in Nkomo village were exposed to agroecology training by two of the agroecology trainers. The smallholders’ experiences with the trainers (network) and the Giyani PGS (network) demonstrated the value of in-community training as an alternative extension model to conventional government extension. At the same time, the trainers’ success in these communities was linked back to the networks in which they were embedded, and which cultivated their learning, social capital (leadership), and collective action.

Further elaboration of experiential learning through these networks was provided in 5.5.2. Experiential learning was identified as the best way to acquire practical agroecological skills, especially for illiterate smallholders. It is therefore suited to the realities of many smallholders in South Africa. 5.5.3 discussed the increase in ecological diversity on smallholders’ farms through their adoption of agroecological practices. Ecological diversity was evident through more varied farming practices such as intercropping, integrated nutrient management to improve soil fertility (compost, mulch, etc.), and more water efficient practices (part a of 5.5.3).

The challenges, as a key coding theme, were discussed in 5.5.4 in terms of barriers preventing further adoption of agroecology amongst smallholders. The barriers identified included a lack of resources (a), limited access to markets (b), the time and patience agroecology requires (c), the need for ongoing in-community extension support (d), power tensions (e), and the lack of youth's involvement in agriculture (f).

Based on these findings, I was able to conclude that since the agroecology training, smallholders are using adaptive, rather than coping strategies. In this way, Mopani smallholder communities who have been trained by 17 Shaft graduates are closer to becoming adaptive communities, away from their status as coping actors before the agroecology training. Although a number of challenges had to be overcome, smallholders felt empowered through their adoption of agroecology and the positive effect it had on their communities. Ultimately, the findings in this section demonstrate the value of networks, specifically networks of in-community trainers, for enhancing smallholders' adaptability to climate change.

6.4 Recommendations

My recommendations are based on the evaluation of the case study in chapter 5. The points raised specifically relate to supporting smallholders' adaptability with recommendations identified for 17 Shaft, the SAFL, and DAFF. These are presented below.

6.4.1 Strengthening the resilience and change management components of the 17 Shaft training programme

5.3.1 suggested that trainers have demonstrated aspects of change management (e.g. communication, training, etc.) and resilience (e.g. positive sense of self and organisation) leadership behaviours. As I argue in 4.2.1, adaptability is essentially an intentional process that individuals undertake to influence SES resilience. This means there is potential for trainers to use these behaviours, and their tools, in a more intentional way when training smallholders. For instance, trainers could share these behaviours with smallholders, as tools they can use to influence their adaptability to climate change, and thereby increase their resilience. To facilitate this process, 17 Shaft could place more emphasis in their leadership training on trainers intentionally sharing the importance of communication, farmer-to-farmer training/knowledge

sharing, experimentation, and long-term goals (or change management and resilience behaviours) with smallholders. If 17 Shaft would like to further enhance smallholders' resilience to climate change, they could also use the adaptive strategies identified in this thesis (4.3) to strengthen their content.

6.4.2 Develop a self-esteem module as part of the leadership training

5.3.2 pointed out that trainers felt their improved self-esteem helped them to form new or develop existing leadership abilities (e.g. communication). The emphasis 2016-graduates trainers placed on the improvement in their self-esteem through the leadership course was interesting and surprising. The value the trainers seemed to derive from working on their confidence suggests there was a need to develop their self-esteem. Therefore, it may be beneficial for 17 Shaft to include a module, as part of the leadership training, that specifically focuses on developing future trainees' self-esteem. Self-esteem itself is multi-faceted so the module could use activities to improve various areas of trainers' self-esteem.

6.4.3 Linking 17 Shaft to postgraduate degrees for continuous evaluation of the effects of the agroecology training

A further recommendation relates to the difficulty I experienced in fully evaluating the impact of the agroecology training on smallholder communities in Mopani district. Although my study was fairly broad, I believe I have only identified some of the effects of the agroecology training on smallholders in Mopani. With the second phase of training completed, I believe further research is needed on the ripple effects of the trainers' activities and ultimately, the training programme.

To ensure ongoing evaluation of the training, a formal partnership could be established between 17 Shaft and postgraduate programmes at universities. Ultimately, this would enable the facilitators of the training to continuously re-assess and align their content with the experiences of trainers and the needs of smallholders. Recommended research areas for postgraduate students who may decide to build on my findings are identified in 6.5.1.

6.4.4 Using the 17 Shaft training to strengthen support for female smallholders, and inform DAFF's extension policy

Female smallholders are seen as particularly vulnerable to the effects of climate change given that they have limited access to resources and support. In part e of 5.5.4, I highlighted that the training did not necessarily change the gender roles in the community. Although gender empowerment was a goal for some of the female trainers, they highlighted how this is not necessarily something they learnt during the agroecology training programme. There is an opportunity for 17 Shaft to include a gender specific focus into their training content. The training could sensitise trainers to gender dynamics, the needs of female smallholders in South Africa, and identifying ways to support them. Female trainers who graduated in 2016 and 2017 could offer valuable insight into how female smallholders could be better supported. If 17 Shaft is able to develop course content that enables trainers to better support female smallholders, this could be used to inform DAFF's new comprehensive extension policy. This requires DAFF to engage and interact with NGOS (e.g. 17 Shaft), trainers, and smallholders to identify more appropriate support for female smallholders. 6.4.6 elaborates on how DAFF could improve extension support.

6.4.5 Using the SAFL network to facilitate further conversations between smallholders, DAFF, and academia

As highlighted in 3.3.1 and 5.5, there is a need to gain further insight into smallholder differentiation in terms of age, gender, and model of agriculture. 5.4 and 5.5 have shown that the SAFL has played a valuable role in creating a platform that brings multiple stakeholders in the food system together. The recommendation is for the SAFL to bring smallholders, DAFF, and academia together to develop a more detailed categorisation of smallholders, building on Cousins and Chikazunga's (2013) current typology. This is elaborated on as an area for further research in 6.5.3.

In 5.3.4 and 5.5.4, I identified a number of barriers (power tensions, resource constraints, the need for ongoing in-community extension support, etc.) that may prevent the diffusion of agroecology to the broader social scale. The SAFL could use its platform to facilitate conversations on each of these barriers between actors in the food system (DAFF, smallholders, academia, etc.) in

order to identify ways to overcome them. The SAFL could also place more emphasis on ensuring a diverse group of smallholders are represented and heard during these processes, as part d of 5.5.4 indicated.

6.4.6 Improving DAFF's extension support smallholders in South Africa by developing in-community trainers

This thesis highlighted that smallholders have received insufficient support through government's extension programme (3.2.2, 3.3.1, 5.4.2). In line with political rhetoric on the importance of smallholders (1.7), there is a need to improve DAFF's support systems for smallholders. In their new comprehensive extension policy, DAFF recognises the need to assist NGOs who are better positioned to support smallholders that fall within different categories (e.g. subsistence oriented smallholders).

This thesis provided insight into the value of weekly meetings and in-community extension support that enables smallholders' adoption of sustainable adaptive strategies, which are more in line with their needs. Part c of 5.5.4 indicated that the time and patience required may prevent smallholders' from adopting agroecology. For this reason, an in-community extension model is particularly important, as trainers seem to play a pivotal role in supporting smallholders during their adoption of agroecology. Furthermore, in-community extension is also valuable, because trainers are able to speak the local language/s and conduct demonstrations for smallholders who are illiterate.

There is an opportunity for DAFF to develop more targeted extension support for smallholders by establishing an in-community extension model in South Africa. This could be achieved by supporting/funding training programmes run by NGOs, that specifically focus on developing in-community trainers who have been trained in sustainable adaptive strategies. As this thesis has shown (5.4, 5.5), networks (e.g. NGOs, actors in the food system, etc.) are equally important for developing in-community extension and therefore require ongoing support from DAFF. Furthermore, DAFF could support training programmes in sustainable agriculture to become fully accredited so there is more recognition of their value.

6.4.7 Inspiring youth into agriculture by establishing communities of practice in schools

Youth were noticeably absent amongst many of the smallholder groups I engaged with in Nkomo village. Importantly, the second phase of training seemed to consist of a largely younger group than the first phase. While it is important to have a mixed age group, it is also necessary to train youth in agroecology to prevent the loss of valuable knowledge in the sector. One way to do this is to begin introducing agroecology or sustainable agriculture principles into schools and school curricula. There are already NGOs in South Africa who are using agriculture and food gardens to teach school curricula, such as Earthchild Project, Plant the Seed Education, and Food and Trees for Africa. This may be a way to inspire a passion amongst youth for agriculture if more organisations, especially in rural areas, are involved. This will likely require time, dedication, and financial resources. This is an area for DAFF to explore by supporting these types of organisations with funding so they can facilitate learning in food gardens for schools or training staff members in agroecological principles, who are then able to relate agroecology to school curricula. As 6.4.4 mentions, there is a need to accredit training courses in sustainable agriculture. These courses could be offered to youth once they leave school if they are unable to or do not wish to go to University. Youth in agriculture is also identified as an area for future research in 6.5.3.

6.5 Further research

Some of the areas identified for further research are related to gaps or limitations in the framework used. These areas are discussed below.

6.5.1 Exploring this thesis' adaptive strategies in further detail

Due to the number of concepts used in my framework, I was not able to examine each adaptive strategy in detail. There is room for further exploration of each strategy in relation to the effects of the agroecology training on the trainers and smallholder communities. Some opportunities for future research are presented below.

Firstly, I was unable to fully evaluate the training programme itself. This means individual and social learning concepts could be used to assess the leadership, agroecology, and artisan skill components of 17 Shaft's training. This could prove

useful to 17 Shaft, allowing them to develop a better understanding of what type of learning is best suited to each component of the course.

Secondly, it was not possible to examine the effects of the trainers' activities on agroecology in some of the other communities they are working with. Therefore, further exploration is needed on how agroecology is contributing toward learning, diversity, social capital, and collective action in some of the other smallholder communities that trainers are engaged with.

Thirdly, I identified in 4.3.4 that there is a need for more research on how social capital enables adaptive behaviour. In 4.3.5, I also established the need for more research on bottom-up collective action amongst farmers and its role in farming systems. Both of these gaps in the literature could inform future research on 17 Shaft's agroecology training programme and the value of in-community trainers.

Finally, as my study was fairly broad, I was only able to identify some of the barriers to implementing agroecology amongst smallholders. The barriers to agroecology in the Mopani district therefore require further investigation and analysis. It is necessary to understand these barriers and tensions in depth in order to a) overcome them and b) adjust the course/training activities to address and resolve them. Future research could explore how power dynamics inhibit or enable smallholders' learning.

6.5.2 Investigating knowledge systems most suited for enabling smallholders' adaptability

Social and individual learning are identified as adaptive strategies in the literature. Yet, as 5.4.2 identified, there is a lack of distinction in the literature consulted between knowledge systems that enable learning that is conducive for adaptability (e.g. agroecology) versus those that reinforce coping strategies (e.g. conventional agriculture). At present, normative decisions or researcher bias will determine which knowledge systems are considered "more" conducive for adaptability than others. For instance, this study argued in favour of agroecology as the knowledge system that encourages individual and social learning as adaptive strategies. This means further research is needed to identify or categorise the type of knowledge systems that enable smallholders' adaptability.

6.5.3 Similarities across traditional knowledge systems

In 5.5.3, I highlighted how agroecology remains connected to indigenous knowledge systems. This was evident in the similarity between agroecological practices and traditional farming methods (e.g. companion planting) still used amongst South African smallholders. What is intriguing about this finding is the similarities in farming practices across traditional knowledge systems in different regions. Future research could classify or map the similarities and differences between indigenous knowledge systems across various regions, specifically in terms of those that build farmers' resilience to climate change.

6.5.4 Revision of smallholder categorisation to include youth, gender, and type of farming

Smallholder categorisation in South Africa needs to be updated through further profiling of smallholders. There is a need to understand differentiation of smallholders in the country in terms of gender, age, and type of farming used (conventional or sustainable). Though these categories will still require some degree of broad generalisation, further insight into these dynamics may assist in developing extension support for smallholders that is targeted to their needs and realities. It could also provide insight into how to scale up agroecology amongst smallholders in South Africa

6.5.5 Further exploration of the effect of agroecology on supporting youth and female smallholders in agriculture

Gender and youth dynamics were only referred to in part e and f of 5.5.4, as I was unable to fully explore either. It was pointed out that women still seem to shoulder most of the work, but this was implicit in my observation and two interviews. Further investigation is needed into the effects of agroecology on gender dynamics, and whether the in-community extension model offers an important form of support for female smallholders.

The absence or lack of youth involved in the trainers' agroecology activities was another issue that was not adequately examined. Similar to gender dynamics, it was not possible to include further examination of these dynamics. A potential aspect to examine is whether agroecology is appealing to youth and if so, why? If not, why not?

6.6 Conclusion

Across the globe, individuals and communities are already starting to experience the effects of climate change. Extreme weather patterns in terms of drought, floods, and irregular rainfall have become more commonplace. For instance, the hottest year on record occurred in 2015/2016, along with one of the strongest El Niño events in decades. Scientists identify human activity as playing a significant role in contributing toward climate change. Agriculture, in particular, is viewed as one of the key drivers, mostly in terms of land use and waste from crop and livestock production. The fact that climate change is expected to impact all areas of food production emphasises the need to switch to more sustainable methods of farming that can withstand or adapt to its effects.

Smallholders are considered particularly susceptible to the effects of climate change due to their remote locations, limited resource capabilities, and limited access to support. These farmers' inability to adapt is a cause for concern given their critical role in securing global and regional food security. In South Africa, smallholders are vital for ensuring food security at the household level, especially for vulnerable groups. Still, this thesis has highlighted how climate change is expected to have varying effects on different regions, countries, and smallholders. The diversity amongst smallholders means support efforts need to be in line with their needs. Agroecology is considered a useful approach to enhance the adaptability and in turn, the social resilience of smallholder communities.

In this study, adaptability specifically referred to increasing individuals' ability to influence resilience, and is considered intimately connected to social resilience. Learning (individual and social), diversity (social and ecological), social capital, and collective action were identified as useful strategies to improve smallholders' adaptability. While most studies tend to focus on agroecology's contribution to ecological rather than social resilience, the emphasis placed on agroecology's contribution to social resilience in this thesis is significant. The study has showcased that agroecology training has had some important effects on smallholder communities in Mopani, encouraging various degrees of learning, social capital, diversity, and collective action. At the same time, social networks present in Mopani, before and after the training, have arguably played the most important role in enabling adaptive

strategies amongst smallholders. This means that the development of smallholders' adaptability to climate change is not only dependent on agroecology training, but also on the networks and social systems in which they are embedded. In-community extension and local community networks seem to be an effective way of diffusing agroecology and encouraging learning, diversity, social capital, and collective action. Going forward, further in-community extension that is targeted toward the diverse needs of smallholders needs to be a priority.

In conclusion, this study provides insight into the importance of social systems as a form of support for smallholders in the face of climate change. The insights gleaned from this research suggest that strengthening social networks, developing in-community extension support, and disseminating agroecology through in-community training can assist smallholders to improve their adaptability to climate change. Moreover, adopting more sustainable farming practices such as agroecology offers some hope for the future of farming, but remains one of the greatest challenges of the 21st century.

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Appendices

Appendix A: Original research questions

1. What impact has the agro-ecology training approach of 17 Shaft and SAFL had on the resilience of the smallholder communities in the Mopani district of Limpopo?
 - a. What impact has the agro-ecology training curriculum had on trainers' thinking and activities toward farming and their communities?
 - b. Has the leadership component of the agro-ecology training enabled trainers to transfer knowledge to smallholder farmers in the Mopani District of Limpopo, and if so, how?
 - c. Has the transfer of agroecology knowledge from agroecology trainers to Mopani smallholder farmers changed their farming practices, and if so, how?
 - d. How have or could these changes in farming practices in Mopani influence the resilience of local smallholder communities in the face of current and future climatic changes?

After doing more research on resilience of social-ecological systems, I decided to focus on how agroecology could improve smallholders' adaptability. Adaptability enabled me to centre my research on how to improve smallholders' ability to influence resilience. Adaptive strategies as a way to influence individuals' adaptability was a key theme in many of the articles I read, and so I became interested in understanding whether there was a link between these strategies and agroecology. Identifying adaptive strategies also enabled me to develop a lens for understanding how agroecology could influence adaptability.

Appendix B: Interview schedule – farmers



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Interview Schedule: farmers

The impact of agroecology training on the adaptability of smallholder communities in Limpopo.

In requesting this interview, I would like to reiterate that you have been selected as a participant in this study because you have interacted with the individuals who have completed the agroecology training programme with the Southern Africa Food Lab and 17 Shaft Training Centre. The aim of this interview is to obtain your ideas and opinions regarding your experience/interaction with the individuals who have completed the agroecology training, and whether this has caused a change in your thinking and practices around farming. It is also aimed at understanding your thoughts and feelings on whether the agroecological practices the trainers' have shared will help you to manage and influence your farm's capacity to withstand and adapt to environmental pressures such as droughts. Do you have any questions before we start the interview?

1. Please tell me about yourself. [Ques: How old are you? What is your background?]
2. How do you know [name of trainer/s]?
3. Tell me about your experience with farming and weather conditions.
4. Why did you decide to start working with [name of trainer/s]?
5. Were you familiar with agroecology prior to your interaction with [name of trainer/s]? If yes, where did you hear about it? [Ques: Did your understanding of agroecology change?]
6. What was your experience with [name of trainer/s] workshop/activities? [Ques: If responder doesn't answer, ask if it was useful? did you enjoy it?]
7. What methods did you use to deal with changes in the weather such as the drought before the workshop/s?
8. Did you find the workshop/s or activities useful? Why? What did you learn during the workshop/s or activities?
9. Have the workshop/s or activities changed your thinking and approach toward the environment? [Ques: how did it change? Can you give me some examples?]
10. Have the workshop/s or activities influenced your thinking and approach to farming? If so, how?
11. Has the workshop/s or activities influenced what methods you will use in the future when you are facing a drought or changes in the weather?
12. If the workshops have led to a change in your approach, have you noticed any changes since introducing these practices? [Ques: what changes have you noticed?]
13. Are there any challenges in adopting these practices? [Ques: what are some of these challenges? Try to understand context/ask about their context].
14. Do you think a change in farming practices to agroecology will help farmers and farming communities during a drought/changes in the weather? Why do think so? Have you experienced anything?
15. Are there others in your community that are also farming this way? If so, are you working together? In what way?
16. Have you harvested any of your agroecological produce? If so, how many times have you harvested it and can you compare it to previous yields? Who do you sell your produce to?

Appendix C: Interview schedule – trainers



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Interview Schedule: trainers

The impact of agroecology training on the social-ecological adaptability of smallholder communities in Limpopo.

In requesting this interview, I would like to reiterate that you have been selected as a participant in this study because you have completed the agroecology training programme with the Southern Africa Food Lab and 17 Shaft Training Centre. The aim of this interview is to obtain your ideas and opinions regarding your experience with the agroecology training, whether there has been a change in your thinking and practices around farming and whether the leadership component has helped you to share your knowledge with farmers in the area. Do you have any questions before we start the interview?

1. Please tell me about yourself. [Ques: How old are you? What is your background?]
2. Why did you want to participate in the training?
3. What was your experience with farming/farmers and weather conditions before you started the agroecology training?
4. Were you familiar with agroecology prior to the training? If so, tell me what you knew about it?
5. What was your experience with the training programme?
6. Do you think the content of the training programme was useful? If so, how is the content useful?
7. Do you think the training programme has changed your thinking and activities toward farming? Tell me about it.
8. Have you been involved in any activities around farming since the training? If so, what kind and why? If not, have you been involved in anything since the training?
9. Did you pick up in the training with 17 Shaft that they were working with you from a leadership angle? What was your experience with that? [Ques: Who did it more often? Do you feel it empowered you? Has it helped you to empower others?]
10. Have you been sharing your knowledge with other people? If yes, can you tell me who you have shared it with and what you have been doing?
11. Do you think the leadership aspect of the training has helped you to share your knowledge with smallholder farmers in the area? If yes/no, please describe how and why.
12. Have you experienced any difficulties in sharing the knowledge you gained during the training since you returned to the community? [Queue: ask what the top three difficulties or challenges are?]
13. What strategies or methods have farmers used to deal with changes in weather such as the drought? [If they are working with farmers, ask if this has changed since introducing them to agroecology? What methods are they using now?]
14. Do you think a change in farming practices to agroecology will help farmers and farming communities during a drought/changes in the weather? If yes, in what way? Have you experienced anything in practice?
15. What do you think some of the challenges farmers face in adopting agroecology? Have you noticed anything specific?

Appendix D: Interview schedule – Ms Wainwright



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STELLENBOSCH UNIVERSITY Interview Schedule: Audrey Wainwright

The impact of agroecology training on the social-ecological adaptability of smallholder communities in Limpopo.

The aim of this interview is to obtain background on the Bryanston Organic and Natural Market and the launch of the Giyani PGS. I would also like to understand your views on whether agroecology or the Giyani PGS has facilitated changes in farmers approach toward farming. Do you have any questions before we start the interview?

Personal history

1. Could you tell me about yourself and your role at the Bryanston Organic and Natural Market?

History of Giyani PGS

2. How did Bryanston Organic & Natural Market become involved with smallholders in Giyani?
3. In addition to Nkomo village, were there other villages/areas in Giyani that Bryanston Organic and Natural Market worked with during this period?
4. For clarification, the five smallholders from Nkomo village were selling to Bryanston Organic and Natural Market through Lucy Mabundza but were not part of the PGS themselves?
5. What was your experience with smallholders in Giyani or Nkomo village approach to farming before the Giyani PGS and before they were exposed to agroecology?

Launch of Giyani PGS

6. How did the idea of the Giyani PGS emerge?
7. How many smallholders are part of the Giyani PGS and from what villages?
8. In a flyer I received from Butshabelo on the Giyani PGS, it said 30 workshops have been conducted with smallholders in three villages. Could you tell me what these workshops entail?
9. Do you know which villages the workshops were conducted in?
10. Do you think the agroecology training course played any role in helping the trainers (Butshabelo & Connie) to launch the Giyani PGS?

Role of agroecology

11. Do you think the introduction of agroecology to smallholders in Giyani played any role in the launch of the Giyani PGS?
12. Have you noticed a change in the smallholders' produce/approach to farming since their exposure to agroecology? If so, what changes?

Appendix E: Example of consent form



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STELLENBOSCH UNIVERSITY
CONSENT TO PARTICIPATE IN RESEARCH
Trainers

The impact of agroecology training on the adaptability of smallholder communities in Limpopo.

I would like to invite you to participate in my research study toward my MPhil in Sustainable Development in the School of Public Leadership at Stellenbosch University. My name is Amy Giliam [PGD: Sustainable Development; BA Hon International Relations; BPolSci: International Studies]. The results will contribute toward my MPhil dissertation. You were selected as a possible participant in this study because you have trained individuals in leadership as part of the Southern African Food Lab and 17 Shaft Training Centre's agroecology training programme.

PURPOSE OF THE STUDY

The research is designed to assess how the Southern African Food Lab and 17 Shaft Training Centre's agroecology training programme has affected individual's own ideas and practices around farming, smallholders in the area, and how these changes may affect the adaptability of the Mopani smallholder communities. In this instance, adaptability refers to the communities', specifically the trainers and farmers, ability to influence the capacity of farms to withstand environmental pressure and adapt during times of change to maintain productivity.

PROCEDURES

If you volunteer to participate in this study, I will ask you to partake in a 60-minute semi-structured interview on themes relating to the study and to answer any clarifying questions. In some instances, the research will also involve informal conversations and observation of any workshop/s or activities you organise. If information is shared that should be considered "off the record", interviewees should inform me. The aim of the interview is to understand whether there has been a change in individual's thinking and practices following the agroecology training, and whether you feel the training has enabled individuals who have completed the training to transfer this knowledge to farmers in their communities. The interview will take place at 17 Shaft Training Centre

Please indicate below that you have understood your involvement in the research and give your consent to be involved. Should you decide not to be involved, please inform me and I will adhere to your preference.

- I understand and give permission to be interviewed
 Other: _____

POTENTIAL RISKS AND DISCOMFORTS

This research has been approved by the Research Ethics Committee (REC) at Stellenbosch University. There are no known dangers or risks associated with you participating in this study. However, some discomfort may arise if I decide to ask questions on whether there have been any tensions that have arisen during your leadership training. Should you feel uncomfortable answering these questions, you may indicate this to me and we can move to questions you are more comfortable answering.

POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY

Your participation in this study will allow me to understand how the leadership skills and agroecology training has influenced the individuals who have completed the training and their communities. At the end of my research, I will present my findings to yourself and the other research participants in a format that is preferable to all of you. In line with the South African government's new comprehensive extension policy, a further aim of this research is to give insight into whether organisations working with smallholders are better placed to support them.

PAYMENT FOR PARTICIPATION

There will be no payment for participating in this research study.

CONFIDENTIALITY

Any information that is obtained in this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Please indicate your level of anonymity below. Should you change your preferred level of anonymity before or after the interview, please inform me and I will adhere to your preference.

- Anonymity not required
- Anonymity of participant's name required
- Anonymity of participant's title required
- Anonymity of the participant's current profession
- Other: _____

Recording the interview will assist in ensuring the data analysis is accurate. Should you be uncomfortable with the interview being recorded, please indicate this below. You may change your decision during or after the interview or request that certain parts of the discussion not be recorded. Confidentiality will be maintained by ensuring that the recording is kept safely on my laptop. Only myself, my supervisors, and possibly a transcriber, will have access to the audio recording. Once the recording has been transcribed, it will be deleted. The transcribed notes of the focus group will contain no information that would allow individual subjects to be linked to specific statements. The notes will also be kept on my laptop and may be shared with the Southern Africa Food Lab, if necessary, as the research is based on their training programme and is likely to be used to improve or reflect on the programme. Once the research has been completed, the transcripts will be deleted off my laptop. Should the research be published at any point after the study is completed, you will remain confidential and will be disclosed only if you have given your permission or as required by law.

- Permission to record granted
- Permission to record NOT granted
- Other: _____

PARTICIPATION AND WITHDRAWAL

You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may also refuse to answer any questions you do not want to answer and remain in the study. The investigator may withdraw you from this research if circumstances arise which warrant doing so.

IDENTIFICATION OF INVESTIGATORS

If you have any questions or concerns about the research, please feel free to contact:

Amy Giliam, 0826804081, a.giliam@yahoo.com

Dr Anri Manderson, Supervisor, 0845068665, anriland@gmail.com

RIGHTS OF RESEARCH SUBJECTS

You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have questions regarding your rights as a research subject, contact Ms Maléne Fouché [mfouche@sun.ac.za; 021 808 4622] at the Division for Research Development.

SIGNATURE OF RESEARCH SUBJECT OR LEGAL REPRESENTATIVE

The information above was described to [me/the subject/the participant] by [name of relevant person] in [Afrikaans/English/Xhosa/other] and [I am/the subject is/the participant is] in command of this language or it was satisfactorily translated to [me/him/her]. [I/the participant/the subject] was given the opportunity to ask questions and these questions were answered to [my/his/her] satisfaction.

[I hereby consent voluntarily to participate in this study/I hereby consent that the subject/participant may participate in this study.] I have been given a copy of this form.

Name of Subject/Participant

Name of Legal Representative (if applicable)

Signature of Subject/Participant or Legal Representative

Date

SIGNATURE OF INVESTIGATOR

I declare that I explained the information given in this document to _____ [name of the subject/participant] and/or [his/her] representative _____ [name of the representative]. [He/she] was encouraged and given ample time to ask me any questions. This conversation was conducted in [Afrikaans/*English/*Xhosa/*Other] and [no translator was used/this conversation was translated into _____ by _____].

Signature of Investigator

Date

Appendix F: Example of observation schedule



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Observation Schedule

Adaptive behaviour/categories to look out for	Date and Time	Observation event	Participants observed	Actions observed	Reflection
Individual learning (experiential, communicative, instrumental, experiential)					
Social learning/education					
Social capital (leadership, vision, trust, networks)					
Collective action/self-organisation					
Knowledge of agroecology and its principles					
Knowledge or implementation of agroecological practices aimed at improving soil quality					
Knowledge or implementation of agroecological practices geared toward water conservation or harvesting					
Knowledge or implementation of agroecological practices aimed at improving functional and response diversity					

Appendix G: Codebook

ATLAS.ti Report

Field research

Code groups (selection)

Report created by Amy Giliam on 14 Sep 2017



Adaptive communities

3 Members:

- Adaptive co-managers

Comment:

Refers to communities who have low adaptive capacity. These communities lack the capacity to govern due to limited knowledge or awareness of challenges. Indicators include: no financial, natural, technological resources as well as no apparent skills, institutions and networks.

- Coping actor

Comment:

Refers to communities who have the options, the knowledge and capacity to adapt (in urban and rural settings) but are not managing SES. They lack governance capacity due to limited/shortage of leadership, vision and motivation (Fabricius et al. 2007). Indicators: They lack institutions for social learning, lack leadership, vision and motivation

- Powerless spectators

Comment:

Refers to communities who have the capacity to adapt, invest in and govern SES over a long period of time. These communities are aware of the challenges and take appropriate action (Fabricius et al. 2007). Indicators include: long-term view, invest in their capabilities, employ some or all of the strategies: social capital, social learning, learning, collective action, diversity



Agroecology

7 Members:

- After agroecology

Comment:

Refers to the transformations that may have occurred after the agroecology.

- Agroecology as a movement

Comment:

This refers to anything related to agroecology as a movement in terms of involvement with food or farmer movements.

- Agroecology as a practice

Comment:

This refers to agroecology as a practice in terms of the production practices. Three key principles to look out for include: soil quality, water conservation and functional diversity. Key practices include: water harvesting, crop rotation, mulching, composting, cover crops and intercropping.

- Agroecology as a science

Comment:

This refers to the scientific field of agroecology. It is important to see whether there is an understanding/linking of farmer knowledge and the science of agroecology

- **Benefits of agroecology**

Comment:

This refers to comments in the data that reflect the benefits of agroecology, and the agroecology training

- **Benefits.health**

Comment:

This is an emergent (surprising) code from the data. It reflects the focus/emphasis placed on the health benefits of agroecology

- **Empowerment**

Comment:

This refers to references in the data to a sense of empowerment either explicitly or implicitly. In the literature, it is associated with collective action but it may be an outcome of any or all of the strategies

 **Before agroecology**

3 Members:

- **Conventional farming**

Comment:

This refers to the effects of conventional farming, or why the participants have shifted away from conventional farming

- **Strategies before agroecology/training**

Comment:

This refers to the strategies the farmers or trainers used prior to exposure to agroecology

- **Weather patterns**

Comment:

Refers to observations in data regarding weather patterns in Limpopo and in SA

 **Case study info**

3 Members:

- **Case study background**

Comment:

Refers to background or contextual information on the case study, the training, and the areas visited

- **Participant info**

Comment:

This refers to background information on the participants

- **The training programme**

Comment:

This refers to comments and statements made with regard to the training programme.

They made be positive or negative but should reflect the impact of the training programme

Challenges

13 Members:

- **C.agroecology practices**

Comment:

Emergent code. Refers to challenges in accessing/selling to markets post-agroecology

- **C.markets**

Comment:

Emergent code. Refers to challenges in accessing/selling to markets post-agroecology

- **C.resources**

Comment:

Emergent code. Refers to challenges post-agroecology in terms of resources

- **C.social/gender equity**

Comment:

Emergent code. Refers to social/gender issues post-agroecology

- **C.support**

Comment:

Emergent code. Refers to support challenges post-agroecology

- **C.training programme**

Comment:

Emergent code. Refers to challenges/limitations trainers identified in training programme

- **C.weather**

Comment:

Emergent code. Refers to challenges encountered with weather post-agroecology

- **C.youth**

Comment:

Emergent code. Refers to challenges encountered with youth.

- **Challenges**

Comment:

Refers to the challenges identified in the interviews and other data collection. This may be in terms of agroecology, the training, etc

- **Literacy levels**

Comment:

This refers to the challenges around the literacy levels in Limpopo but also some of the research participants

- **P.clash of knowledge systems**

Comment:

This refers to the politics and power dynamics around learning and certain knowledge systems. It is usually used as a barrier to learning/integration of knowledge systems

- **P.loss of traditional knowledge**

Comment:

This refers to the loss of traditional knowledge over generations. Reasons may vary, depending on the source

- **Power**

Comment:

Refers to power dynamics or structures that may inhibit or facilitate any of the four strategies, or elements of the strategies

◊ **Collective Action**

7 Members:

- **CA.unity**

Comment:

This is also an emergent code from the data. It refers to individuals discussing the sense of unity they have felt in coming together, sharing knowledge, and learning from each other

- **CA:cooperation**

Comment:

Refers to bottom-up, farmer-to-farmer collective action

- **CA:coordination**

Comment:

Refers to top-down, agency led collective action

- **Collective Action**

Comment:

Collective action is defined as the voluntary involvement of groups of individuals and/or informal/formal institutions in pursuit of a shared interest or goal. It may occur through coordination (top-down) or cooperation (bottom-up). Various factors may facilitate (e.g. high levels of social capital) or constrain (e.g. low levels of social capital) collective action. Indicators include: farmers markets, advisory networks, co-operatives, farmers associations, community gardens, PGS

- **Social equity/gender**

Comment:

This refers to social equity or gender issues that arise in the data

◊ **Diversity**

3 Members:

- **Ecological diversity**

Comment:

Ecological diversity in farming systems involves numerous components performing different roles/functions in the farm. Components performing the same function may respond differently to change and disturbance. In other words, a heterogeneity of features provides evidence of diversity in farming systems. Indicators include: species

diversity (biodiversity, animal and crop diversity), water harvesting, nutrients from multiple sources (compost, crop rotations, etc) and multiple production practices

- **Markets**

Comment:

This refers to the different markets farmers/research participants are selling to. It is also linked to social diversity - as diverse markets is one of the key indicators.

- **Social diversity**

Comment:

Refers to a diverse range of opinions and actors in a farming system, with each actor performing different functions or roles. Indicators: diverse livelihoods, interaction with diverse markets, diverse resources (knowledge, networks, buildings, tools).

 **Emergent codes**

15 Members:

- **Benefits of agroecology**

Comment:

This refers to comments in the data that reflect the benefits of agroecology, and the agroecology training

- **Benefits.health**

Comment:

This is an emergent (surprising) code from the data. It reflects the focus/emphasis placed on the health benefits of agroecology

- **Conventional farming**

Comment:

This refers to the effects of conventional farming, or why the participants have shifted away from conventional farming

- **Empowerment**

Comment:

This refers to references in the data to a sense of empowerment either explicitly or implicitly. In the literature, it is associated with collective action but it may be an outcome of any or all of the strategies

- **Farmer/traditional knowledge**

Comment:

This refers to the emphasis placed on participants indigenous/traditional knowledge and the re-connection to this knowledge through agroecology

- **Food security/home consumption**

Comment:

This is also an emergent code from the data. It refers to statements made regarding hunger, food grown for home consumption or food security issues faced in the participants' communities

- **L.communication**

Comment:

An emergent code in the data. This specifically refers to the use of communication as a tool for effective leadership

- **L.conflict management**

Comment:

An emergent code in the data. This also refers to conflict management as a tool for effective leadership

- **L.decision making**

Comment:

An emergent code in the data. This refers to the decision-making processes involved in effective leadership.

- **L.initiative**

Comment:

An emergent code in the data. This refers to initiative taken by participants, demonstrating leadership implicitly. This is also based on the leadership training.

- **L.listening**

Comment:

A further emergent code in the data with regard to leadership. This refers to the value of listening for effective leadership

- **L.sharing responsibility/knowledge**

Comment:

An emergent code in the data. This refers to participants learning how to share responsibility and knowledge through the leadership training.

- **L.vision**

Comment:

An emergent code in the data. This refers to the creation of visions or reference to the importance of having vision as a leader

- **Literacy levels**

Comment:

This refers to the challenges around the literacy levels in Limpopo but also some of the research participants

- **P.clash of knowledge systems**

Comment:

This refers to the politics and powder dynamics around learning and certain knowledge systems. It is usually used as a barrier to learning/integration of knowledge systems

Leadership

12 Members:

- **L.budgeting & recording**

Comment:

An emergent code in the data. This refers to leadership skills in terms of budgeting and recording

- **L.change**

Comment:

Refers to using leadership as a way to handle or respond to change

- **L.communication**

Comment:

An emergent code in the data. This specifically refers to the use of communication as a tool for effective leadership

- **L.conflict management**

Comment:

An emergent code in the data. This also refers to conflict management as a tool for effective leadership

- **L.decision making**

Comment:

An emergent code in the data. This refers to the decision-making processes involved in effective leadership.

- **L.flexibility**

Comment:

An emergent code in the data. This refers to the need for flexibility as a leader.

- **L.initiative**

Comment:

An emergent code in the data. This refers to initiative taken by participants, demonstrating leadership implicitly. This is also based on the leadership training.

- **L.listening**

Comment:

A further emergent code in the data with regard to leadership. This refers to the value of listening for effective leadership

- **L.self-esteem/self-confidence**

Comment:

An emergent code in the data. This refers to the value of the leadership training in terms of developing self-esteem and self-confidence.

- **L.sharing responsibility/knowledge**

Comment:

An emergent code in the data. This refers to participants learning how to share responsibility and knowledge through the leadership training.

- **L.vision**

Comment:

An emergent code in the data. This refers to the creation of visions or reference to the importance of having vision as a leader

- **Leadership**

Comment:

Refers to a dynamic process, with multiple leaders and leadership roles. Leaders are viewed as playing central roles in creating visions, building trust, cultivating motivation, preventing exploitation of ecosystems as well as conflict resolution. Indicators include: creating visions, build trust, cultivate motivation, resolve conflict, prevent exploitation of ecosystems

 **Learning**
5 Members:

- **communicative learning**

Comment:

Re-examining one's own knowledge, intentions or meanings through communication with others

- **Emancipatory learning**

Comment:

Transformations in individuals' assumptions or worldviews (e.g. epistemic, physical or institutional structures) resulting in new attitudes, behaviours or social norms

- **Experiential learning**

Comment:

Used to describe a cyclical process in which knowledge is generated through experience, or learning by doing, reflection and then experimentation

- **instrumental learning**

Comment:

The development of new skills/knowledge or learning to control people and the environment

- **Learning**

Comment:

Learning is defined broadly as an ongoing process in which individuals' understanding, skills, knowledge, beliefs or behaviours may change through regular reflection, practice, experience or experiments, resulting in a new understanding of the world and their relation to it (Fazey et al. 2005; Fazey et al. 2007; Darnhofer et al. 2010; Diduck 2010; Krasny et al. 2010; Milestad et al. 2010; Reed et al. 2010). Learning theories, identified in table 4, provide indicators of how learning may occur at the individual level

 **Social capital**
6 Members:

- **Networks**

Comment:

In SES, social networks encompass a multitude of actors (individuals to organisations) across spatial scales who share values or norms, and typically rely on flows of information for ecosystem management or to address problems/knowledge gaps (Olsson et al. 2004; Armitage & Plummer 2010) [AM1] .

- **SC.trust & norms**

Comment:

This refers to trust and norms in terms of social capital, it is either implicit or explicit.

- **Social capital**

Comment:

Refers to attributes of the social domain that shape people's ability to act collectively and respond to change. Indicators include: networks of families, friends, farmer associations, extension officers, as well as leadership, norms/rules, trust

 **Social learning**

4 Members:

- **Farmer/traditional knowledge**

Comment:

This refers to the emphasis placed on participants indigenous/traditional knowledge and the re-connection to this knowledge through agroecology

- **Integration of knowledge systems**

Comment:

Integration or exchange of different knowledge systems/sources. Presence of traditional to scientific knowledge; co-construction of research or programmes and shared management of resources amongst diverse actors. Indicators include: collaboration between universities, research centres/institutions and farmers; cooperation and knowledge sharing; record keeping about the state of the farming system by farmers

- **Social learning**

Comment:

Refers to learning embedded in social units and requires a shift in understanding at the broader social level. Indicators include: learning through social networks, diverse knowledge systems

- **Social networks**

Comment:

Social networks may influence or change people's perceptions through information transmission and deliberation. Indicators include: extension and advisory services for farmers, cooperation and knowledge sharing between farmers

Appendix H: Summary of research participants

Name of Individual	Role in research	Activities involved in
Mr Rikhotso James Kheto	Smallholder farmer	<ul style="list-style-type: none"> Giyani PGS and weekly meetings in Nkomo village
Ms Margreth Makhubela	Smallholder farmer	<ul style="list-style-type: none"> Giyani PGS and weekly meetings in Nkomo village
Ms Maria Baloyi	Smallholder farmer	<ul style="list-style-type: none"> Giyani PGS and weekly meetings in Nkomo village
Ms Butshabelo Mabunda	Agroecology trainer	<ul style="list-style-type: none"> Facilitates weekly meetings in numerous smallholder communities Facilitated the launch of Giyani PGS with the help of the Bryanston Market PGS
Ms Constance Mbodi	Agroecology trainer	<ul style="list-style-type: none"> Remains part of the MFA but has mostly focused on facilitating weekly meetings in numerous smallholder communities with Ms Mabunda Facilitated the launch of Giyani PGS with the help of the Bryanston Market PGS
Ms Irene Risenga	Agroecology trainer and smallholder	<ul style="list-style-type: none"> Initially, Ms Risenga helped Ms Mabunda and Ms Mbodi with weekly meetings in communities. Had to stop due to transportation costs Mostly shared knowledge with family and neighbours
Mr Patrick Sekhula	Agroecology trainer and smallholder	<ul style="list-style-type: none"> Previously part of the MFA but was asked to leave after forming a secondary cooperative with Ms Mlondobozi Only been able to share knowledge with dryland smallholders in Dzumeri area
Ms Norah Mlondobozi	Agroecology trainer and smallholder	<ul style="list-style-type: none"> Previously part of the MFA but was asked to leave after forming a secondary cooperative with Mr Sekhula Shared knowledge with smallholders and extensions workers through Limpopo Department of Agriculture and Rural Development Mostly transferred knowledge and leadership skills to individuals working on her farm
Mr Nelson Ngoveni	Agroecology trainer	<ul style="list-style-type: none"> Works as an agroecology trainer at the Hoedspruit Hub
Mr Eldred Maake	Agroecology trainer	<ul style="list-style-type: none"> Remains part of the MFA but mostly shared knowledge about agroecology and leadership in his community project, Mamone Poultry Projects and Vegetables, in Letaba
Mr Mosa Mofikeng	Facilitator of the leadership training	<ul style="list-style-type: none"> Facilitated the leadership training component of 17 Shaft's Leadership and Agroecology Skills training course

Appendix I: Flyer on Giyani PGS

Participatory Guarantee Systems

... supporting local market access for smallholder organic farmers.



PGS Natural Assurance means a farmer's production practices and records have been assessed by the PGS group and found to be compliant with organic agriculture principles.

Annual appraisal visits are made by the PGS group to the supplying farms and production sites. Customers are invited and welcomed as key participants on these visits



PGS is a reliable organic farming assurance system that shapes relationships of collaboration, trust and transparency between customers and producers

Elements of PGS:

- Shared Vision of organic agriculture
- Participatory and collective energy
- Transparency and openness
- Trust and integrity
- Learning and shared knowledge exchange
- Managed horizontally and not "top" down

since August 2016, over 30 agroecology workshops have been conducted in three villages in the district of Giyani. PGS workshops have also been held in preparation for the launch of the Giyani PGS in March 2017.

As the farmers increase their yields from this climate smart agriculture, their surplus produce will find markets beyond the communities they currently serve, not only in Limpopo Province but also in the cities of South Africa where the demand for organic produce is high.



shared vision • participation • trust • transparency
• learning process • horizontality



Member of:





For more information on Giyani PGS please contact Butshabelo Mabunda on 072 481 6364 or email mabundabutshabelo@gmail.com