

The nexus of land-based livelihood adaptation and natural resource governance in a former homeland communal area of South Africa



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A thesis submitted to the Faculty of Science, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Doctor of Philosophy.

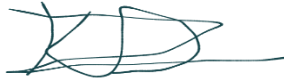
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DECLARATION

I declare that this thesis is my own work, unless the contribution of others is specifically mentioned and acknowledged in the text. It is being submitted for the Degree of Doctor of Philosophy at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any university. Each chapter's format is in consonance with the publication guidelines of the journal to which it is intended to submit it.

August 2019

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A handwritten signature in blue ink, appearing to be 'FKD' with a horizontal line extending to the right.

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ABSTRACT

Agriculture and the use of natural resources are important components of the rural economy in Africa. However, climate projections indicate worsening weather conditions, which come with negative impacts on the availability and access to critical environmental resources. This scenario introduces fresh demands on management approaches by way of innovation to adequately cope with these challenges. The process of developing and deploying effective solutions to challenging and often systemic socio-economic and environmental issues in support of societal progress is broadly termed social innovation. This study investigates the dynamics of social innovation in relation to climate change adaptation and land degradation in a former homeland area of South Africa. It involves innovation in natural resource governance and rural agriculture. The study site is Mpakeni village in the Mpumalanga Province of South Africa. It is the site of the Mthethomusha Game Reserve whose ownership is contested by the traditional (as well as other community members) and state authorities. This has affected collaboration between the two principal institutions in managing the reserve and the associated communal rangelands which support land-based livelihoods in the area. The first component of the study involved a case study on the changing roles of traditional institutions in the management of natural resources and the challenges to effective co-management with state institutions. A combination of focus groups, key informant interviews and interviews with 182 household heads was used between 2015 and 2016. The findings of the case study indicate that the effective management of common pool resources in the area is undermined because there is insufficient good governance and aggravated by an inadequate understanding of civic rights, resulting in their abuse. Given the increasing scale of environmental degradation in the area, the case for an effective co-management framework between the state and the traditional institution has become exigent. This study demonstrates the mode of an effective natural resource co-management by these principal institutions in the context of social innovation.

linnovation thrives in a conducive actioned policy environment. The introduction of social grants in the post-apartheid era is regarded as one of the important actioned policy interventions in the rural milieu that is backed with funding. These, non-contributory social grants benefit over a quarter of the South African populace, with consequences for their livelihoods. A mixed method approach (qualitative and quantitative) was used involving interviews with 182 household heads and 58 key informants to investigate the impact of social grant receipt on beneficiaries' engagement in agriculture-related activities. The findings of this component of the study support the argument that social grants serve as enabling resources for beneficiaries' participation in agriculture. Without the supplementary grant, some community members would be too financially compromised to invest in land-based livelihood activities. Thus, the social grant, which has been given to the poorest to help them survive, has equally empowered them to participate in land-based livelihood activities.

Hence, contrary to observations that only a third of the rural populace is able to engage in resource-intensive livestock production, over two thirds (70%) of grant beneficiaries engaged in livestock production. The study disputes the claim that there is a general decline in agriculture participation in the rural areas, as 95% of respondents were involved. This is exclusive of the level of intensity or the centrality of agriculture to rural livelihoods. As the majority of farming respondents rechannel their grants to enhance their agriculture, there is a need for improved extension support. Moreover, social grants have been described as having other livelihood enhancing effects. A cause-effect diagram is used in this study to highlight the context which makes an individual either gravitate towards their positive use or abuse.

The strategic location of a resource such as hosting vital agricultural assets (for example a pond or a communal cattle dip) can coincidentally facilitate smallholders' interactions. Such crucial interactions can inadvertently transform an area into an epicentre for cross-pollination of ideas and assist them (users or smallholders) to further morph into a dynamic community of practice that nourishes innovations. In the context of this study innovation refers to the uptake or use of an individual mitigation strategy in response to climate change and land degradation. Moreover, poor access to financial capital and requisite information were the main impediments to strategy uptake amongst respondents who exhibited low strategy uptake (as listed by farmers). Respondents' socio-demographic parameters such as educational levels, location of farming activity and age were positively associated with strategy uptake. In addition, the location of farming activity, had a significant impact on strategy uptake after controlling for variables in a binary logistic regression model. These factors can be collectively, regarded as pillars/scaffolds of innovation as they serve as catalysts that facilitate strategy uptake. These ingredients must hence be prioritised in innovation policies targeted at the rural environment to increase policy effectiveness and success of interventions. In addition, relatively higher numbers of specialist smallholders practiced increased usage of fertiliser in comparison to generalist smallholders. Ultimately, in mixed smallholder systems, when a farmer exhibited high innovation in plant cultivation, it did not simultaneously translate into animal productivity. However, in terms of agriculture, livestock production is considered as relatively more prone to climate impacts than crop production. This makes the case for capacity building in terms of knowledge and organisational and related skills to enable smallholder systems improve productivity in both crop and animal production imperative. This will also promote the successful entry of smallholder farmers into the mainstream economy in accordance with the objectives of government priority and policy.

Smallholder farmers can further maximise their livelihood resilience by exploiting micro-factors such as diversifying the use of mitigation strategies in support of their land-based livelihood activities. Thus, the deployment of a suite of mitigation strategies comes with positive returns on the optimum use of relative assets and coping with livelihood shocks. Age

had a significant influence on respondents' mitigation strategy diversification. Smallholders in the 35-54 year age cohort exhibited extensive strategy diversification compared to vulnerable groups such as the youth and the elderly. Moreover, there was a significant positive association between respondents' levels of diversification in strategies practiced, and their usage/ownership of land-based assets. Thus, a high level of strategy diversification is associated with a corresponding high level of use/ownership of land-based assets. Respondents with low diversification of strategies registered a low level of use/ownership of land-based assets because they have limited options for diversification, possibly being more invested in off-farm activities and thus relatively wealthier. Moreover, people with limited use/ownership of land-based assets had higher livestock numbers because they developed adequate organisational and financial capacity. Consequently, rural agro-environment policies and programmes that implement government policy need to factor the site and age dynamics into the use of common pool resources (e.g. grazing land) and climate change adaptation interventions whilst foregrounding education, given its positive returns on agricultural productivity.

Ultimately, effective resource governance is needed to safeguard the environment and related ecosystem services that sustain agriculture and related land-based livelihoods in the area. This necessitates integrating key indicators of good governance in co-governance frameworks for the successful governance of common pool resources and related ecosystem services by core actors. Moreover, the sustenance of land-based livelihood activities is enhanced by novel approaches such as the adoption of mitigation strategies. Consequently, the deployment of a suite of mitigation strategies helps optimise the harnessing of land-based livelihoods and related assets for sustainable rural development.

Key words: land-based livelihoods, co-governance frameworks, mitigation strategies, social innovation, common pool resources, livelihood stressors, agricultural activities.

To Jehovah El Elyon (Deut 32:8; Gen 12: 5-7) for shepherding me through all the changing scenes of life and my family for their encouragement and support which has culminated in me being the first in our family history to come this far.

ACKNOWLEDGEMENTS

—“*For promotion cometh neither from the east, nor from the west....but from the Lord*” (Psalm 75: 6-7).

I thank *Jehovah El Shaddai* for His grace and mercies which have brought me this far and choosing me from my family to come this far and set a precedent.

I also greatly appreciate the support and guidance that I received from my supervisors, Professors Kevin Balkwill and Wayne Twine. Aside the academic supervision I learnt a lot from their work ethic, integrity and values inter alia gratuit which has contributed to my personal development. Their constructive criticisms, kind words, ideas and guidance were instrumental catalysts to this project. Under their able supervision, the words of Alexander Pope “A little learning is a dangerous thing; *Drink deep, or taste not the Pierian spring*” became a personal mantra.

“*It takes a whole village to raise a child*” according to an African proverb. My baby steps on this journey were also nourished by interactions with others in this community of practice: Frances Duncan, Ed Witowski, Ellis Ayayee, Mary Scholes, Coleen Vogel, Francesca Parrini, Vivienne Williams, Danny Simatele and Marcus Byrne.

“*Wisdom is like a baobab tree; no one individual can embrace it*”. — Ewe proverb. My field assistants Collen Thabetha and Ellen Thabile were helpful with my field work in Mpakeni as well as Mr Ndlovu (the village headman), Chief Nkosi (Chief of Mpakeni), and Lucky Phiri (Manager of the Mthethomusha Game Reserve). My field trips were facilitated by the provision of a vehicle from the Pullen Nature Reserve (Wits facility), where I was also assisted by Elgin and Maleti (resident workers). Similarly, I was a regular visitor to the Wartenweiler Library of the University of Witwaterstrand (main campus), where I benefited from the immense support of Cynthia Smith, Mama Dudu, Nomasonto Mahlangu, Nelao Cokoto and Elsie Jansen Van Rensburg. I also say kudos to Lucille Mooragan and Hildegard Chapman of the Wits Research Office.

My work space was in the APES museum and I appreciate the esprit de corps that exists there, fostering a conducive working micro-climate thanks to Glynis Goodman, Di Poriazis, Renee Reddy, Donald McCallum, James Harrisson, Samelesu Mayonde Guelor, Rabelani Marikhele, Nomali Malindi, Portia Kgaboesele, Sylvi Fullard, Richard Oluchi, Kaylee van den Bosch, Jessica Minnaar, Mama Thabetha Lebakeng and Tamryn Hamilton.

I often sought counsel with my senior colleagues to gain concrete feedback and advice from their experience; Rehana Dada, Ruvimbo Mapaya, Candice Arendse, Nana Peprah, Ruth Allotey, Ntombifuthi Monedi-Noko, Selase Adjoa Ofori, Alisoun House, Tantoh Henry,

Eromose Ebhuoma, Tlou Raphela, Jeanne D'Arc Mukarugwiro, Peter Hloniphani Mthunzi, Ps. Martin Mutali, Oluseyemi and Esther Adeyemi, Rebecca Oyerinde, Monica Mbiba, Mulira Fiona, Fiona Paumgarten, Hadisu Abubakar, Kudakwashe Musengi, Noel Oettle, Penny Price, Kgagelo Chiloane, Elena Mariotti, Redae Teclai, Sukoluhle Khumalo and Norman Mathebula.

Statistics is not my forte, I relied on the statistical finesse of Mweza Gideon Shingini, Senyo Dzokoto, Pedzisai Ndagurwa, Sipho Mbonani, Solomon Narh Bana, Kwabena Asare, Emmanuel Ayifah, Selase Adjoa Ofori and Emmanuel Olamijuwon to undertake the necessary statistical analyses. Similarly, I doff my hat to Theresa Mazarire and Wendy Phillips of the School of Geography and Environmental Science for their assistance with my maps. Special thanks are in order to Prof. Kevin Mearns, Prof. Elizabeth Kempen, Prof. Tracey McKay and Estherlene Hart of the College of Agriculture and Environmental Sciences (CAES-UNISA).

I am grateful for the funding support from the National Research Foundation (NRF), the Postgraduate Merit Award (PMA - University of Witwaterstrand) and the Faculty of Science Thesis Paper Writing Grant (University of the Witwaterstrand).

My housemates at No. 23 Mountainview Avenue, Northcliff were a family that gave much morale support; Naomi Janse van Vuuren, Souchon, Dominique, Elizabeth Janse van Vuuren, Janaki, Simangele Mabena, Linden Edwards, Paul Jourdan, Mocke Jansen van Vuuren, Sizwe Moyo, Sam and Tumi Jourdan, Precious and Aunty Pumla.

“All work and no play, makes jack a dull boy”, so goes an axiom. My membership of a prison and hospital visitation ministry, which visits inmates and the sick at the Johannesburg Central Prison and the Charlotte Maxeke Hospital respectively, made me appreciate the liberties as well as blessings I often took for granted and renewed my zeal. I also say “Nkosi” to colleagues in the South African Adaptation Network, Inala Food Sovereignty and Climate Justice Forum as well as the Erasmus Mundus Students Alumni, as I gained practical experiences related to my research whilst serving these organisations.

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CHAPTER 1 – INTRODUCTION:

Background, study aim and objectives and study approach

1.1. STUDY CONTEXT

The dawn of the post-apartheid era has introduced a number of policy interventions that are affecting rural communities and livelihoods in South Africa's former homelands (Cousins & Walker, 2015). This includes plurality (due to policy) in the management of common pool resources such as woodland and water resources with implications for land-based livelihoods (Eberbach et al., 2015; Claassens, 2015). Furthermore, the palpable impact of climate change and pro-poor interventions such as social grants on vulnerable rural livelihoods necessitates further research to inform policy and management approaches (Hoffmann, 2015; Neves & Du Toit, 2013). This study provides new insights into and addresses how common pool resources and rural land-based livelihoods are being impacted by a confluence of policy interventions in the face of climate change in South Africa's post-apartheid era.

Climate change has been referred to as a "*super wicked problem*" as the longer it is left, the harder it becomes to address (Levin et al., 2012). The issue of climate change has thus become one of the most pressing challenges in modern times with Africa being the most affected (Fisher et al., 2010). Rural communities in Africa bear the brunt of climate fluctuations, because of their natural resource-dependence and climate-sensitive livelihoods. Woodlands are examples of such critical natural resources that support rural livelihoods. Moreover, the ecosystem services they supply are vital for climate adaptation and crucial to the livelihoods of rural communities that are highly dependent on land-based livelihood activities such as agriculture (Mukoto et al., 2015). Ecosystem services are often supplied in concert with natural resource productivity and are essential to sustaining the wellbeing of communities and humankind in general (Boisvenue & Running, 2013). Moreover, the challenge of loss of biological diversity and the poverty phenomenon are intricately linked, necessitating holistic and more comprehensive approaches to address them (UNESCO & UNEP, 2003). Thus, linking conservation to the livelihood and cultural context of local communities is a viable approach (UNEP, 2005) and can make woodland projects more effective. Furthermore, ecosystem-based adaptation to climate change could help avoid future food crises in Africa and build resilience to climate change in rural agricultural systems (University of the West of England). The "*Ecosystem-based Adaptation*" (EbA) approach denotes a way of managing the impacts of climate change and environmental degradation by using biodiversity and ecosystem services as components of a general adaptation strategy to enable people and communities to cope with the associated negative impacts from the micro to the macro scale (UNEP, 2012).

One approach to addressing the effects of climate change at the community level is to develop local adaptive capacity so that communities are capable of adjusting, moderating or taking advantage of climate-induced changes in their settings (D'Amato et al., 2011). Adaptive capacity thus comprises the livelihood resilience of individuals, households and communities coupled with the adaptive ability of the background natural systems which determine the capacity to implement planned adaptation (Lindner et al., 2010). However, some scholars

contest the assertion that adaptive capacity is premised chiefly on livelihood or economic development (Adger & Vincent, 2005) and use evidence from traditional societies to argue that adaptive capacity hinges on experience, knowledge and reliance on environment-sensitive resources (Walker et al., 2006). Nonetheless, a common thread in the debate is that adaptation is knowledge-intensive and requires enhanced access to relevant and usable knowledge to sustain new initiatives which are more effective and targeted. Hence, increased information boosts institutional capacity to generate proactive policies, laws and regulations to adequately address future challenges. The lack of such information hampers efforts at responding to climate change-induced threats and crises; hence the urgent need for accessing relevant knowledge and technical resources, coupled with the capacity to use these resources where they are needed.

The ecosystem approach indicates that due to the lack of comprehensive knowledge on the complexity and interconnectedness of ecosystems, management needs to be adaptive and integrate a way of learning about ecosystem dynamics (Dale et al., 2000; Folke & Olsson, 2004; Alweny et al., 2014). This is because ecosystems are complex adaptive systems that necessitate flexible governance with the capacity to address environmental feedback (Folke & Olsson, 2004). Thus, building capacity to cope and adjust to changing conditions has become imperative due to the undeniable impact of anthropogenic factors on biospheric processes at all levels (Folke et al., 2002). The division of management, power and responsibility may require multiple institutional connections within communities, government agencies and nongovernmental organizations. Adaptive co-management depends on the cooperation of a number of stakeholders functioning as networks at multiple-scales ranging from local users, to regional and national organizations, as well as international bodies (Mwakaje et al., 2013; Thondhlana et al., 2015). It has therefore become imperative to integrate ecosystems knowledge with management practice so that they develop with the institutional and organizational aspects of management (Walker et al., 2006) since sustainability cannot be a static goal (Rammel et al., 2007; MoEST, 2012).

These challenges suggest the need for more focus on opportunities for agency and leverage within socio-ecological systems. Nonetheless, the transitions narrative stresses that in addressing the scale and complexity of socio-ecological challenges, society needs major system-wide transformations that entail breakthrough technologies and probably elementary changes in social goals, institutions, industrial frameworks as well as demand (van den Bergh et al., 2011). However, “*system-wide changes*” are practically impossible to attain without recognizing points of leverage within such systems. Grassroots institutions and their related key actors represent such points of leverage.

Rural traditional institutions, with their associated actors, are an essential unit of analysis that is often under-represented in socio-ecological systems research (Berkes, 1999; Adger & Vincent, 2005). In traditional society, management of natural resources is premised on

taboos, customary laws and customary norms, which are largely unwritten and influenced by fear of incurring the wrath of the chief, deities/spirits and consequently incurring severe punishment (Mowo et al., 2011). Though effective in the past, the effectiveness of these approaches in the post-colonial period has been weakened and in other cases eroded by a number of factors such as migration, urbanisation, materialism, religion, education and general modernization (Fraser et al., 2015). Nonetheless, community-based natural resource management (CBNRM) projects are often underpinned by these traditional customs or are a product of such. Thus, traditional management practices need to adapt to modern environmental governance concepts that are more evidence-based. Hence, in reflecting or accommodating current concepts of climate and ecosystem management, such invaluable practices become enhanced and more relevant for the sustainable development of the community and posterity (Johann, 2007; Abernethy et al., 2014). Therefore, the application of local knowledge through community and social action can produce adaptive and flexible solutions that are suitable for solving environmental problems (Burgess et al., 2003) such as climate change and its impact on sustainable land-based livelihoods (e.g. agriculture) and natural resources (such as woodland resource) management.

1.2. STUDY BACKGROUND

1.2.1 Woodland Resources

Approximately 1.745 billion people globally are reliant on forest and woodland resources for their livelihoods, and about 200 million indigenous communities are almost totally dependent on them (Chao, 2012). Thus, a significant part of sub-Saharan Africa's population depends on forest and woodland products for their subsistence uses, cash income, or both (Ryan et al., 2016). Ecosystem health in the Agriculture, Forestry and Land Use (AFOLU) sector has far reaching implications for the local context and beyond (FAO, 2007; Rahlao et al., 2012). Globally, farm pastures and plantations have expanded, resulting in significant habitat and biodiversity loss (Tinker et al., 1996; Mantyka-Pringle et al., 2015). Such adverse land use modifications compromise the ability of ecosystems to support agriculture, to sustain water and forest resources, to enhance climate and air quality, or to control pests and diseases. Consequently, finding the balance in meeting immediate human needs without adversely compromising the long term biological integrity of ecosystems has become a global concern which is also echoed in the concept of sustainable development (World Bank, 2001; IISD, 2013). The scope of managing climate change impact has therefore broadened to embrace land-use based mitigation adaptation activities embracing agriculture and related activities as well as harvesting of common community resources.

The current FAO (Food and Agriculture Organisation) definition of a forest largely embraces South Africa's woodland, plantation, thicket, and indigenous forest vegetation forms. According to the definition, a forest is a form of vegetation having a *“single minimum tree crown cover value between 10 and 30 per cent; and a single minimum land area value between*

0.05 and 1 hectare; and a single minimum tree height value between 2 and 5 metres” (FAO, 2007). Nonetheless, South Africa’s woodland vegetation largely falls under the savanna biome which represents 32.8% of the total land area (Mucina & Rutherford, 2009). Some of the key characteristics of the savanna biome are its seasonality of precipitation and (sub) tropical thermal regime interspersed with low occurrence of frost (Mucina & Rutherford, 2009). It occurs at low altitudes stretching to about 1800 m, therefore recording higher temperatures in comparison to grassland at higher altitudes (Mucina & Rutherford, 2009). South Africa records a yearly precipitation variation coefficient between 20% in the eastern moist areas to over 40% in the arid west. The increased variance over time is partly attributed to the El Niño Southern Oscillation (ENSO), a cyclical fluctuation in global climate, which translates into sequential droughts and wet periods in southern Africa (Crétat et al., 2010). The associated climatic factors such as drought and rainfall variability, coupled with poor land use practices facilitate land degradation (Hoffman, 2015). Nonetheless, savannas represent the most widespread ecozone in southern Africa and also host the majority of the area’s wildlife, livestock and human populations (Eriksen & Watson, 2009). The savanna biome is therefore of immense importance to communities and associated economies (Chidumayo & Gumbo, 2010). Moreover, human interactions with savannas by way of land use coupled with climatic factors have profoundly influenced their present nature and status (Scholes & Walker, 1993; Eriksen & Watson, 2009).

A key feature of the savanna biome is the co-dominance of trees and grasses, both of which are markedly influenced by environmental conditions. Varying water and nutrient situations alternately enhance tree or grass growth over different temporal scales. In addition, grazer and browser stocking rates, damage due to big animals, fire and atmospheric CO₂ concentrations impact the grass-tree dynamics (Scholes & Archer, 1997; Eriksen & Watson, 2009) and hence its productivity and ecosystem function (Kgosikoma et al., 2013). Hence, the amount of resources such as water and nutrients coupled with the interaction of natural processes in savannas (such as fire) serve as management tools for directly influencing the woody plant constituents of the savanna biome. Consequently, fire is an important management tool that can impact the structure of savanna vegetation (Mucina & Rutherford, 2009; Scholes, 2004; Eriksen & Watson, 2009). Nonetheless, biomass burning is also regarded as a significant ecosystem process through the release of trace gases and aerosols which result in seasonal tropospheric ozone enhancement with impacts on the regional and global atmospheric chemistry and biogeochemical cycles (Scholes & Andreae, 2000; Mucina & Rutherford, 2009).

In addition to being carbon reservoirs, soundly managed indigenous woodlands and landscapes enhance biodiversity conservation and provide vital ecosystem services, which are important for agricultural productivity and livelihood resilience in the face of climate change, a challenge to local communities and downstream economies (Fishpool & Evans; 2001; Poggio et al., 2012).

In agriculture, climate adaptation measures revolve around interventions that harness related natural resources to develop resilience in rural livelihoods in the face of climate variability and disaster (Nelson et al., 2009). Thus, in places where natural resources are a source of sustenance and fodder, changes in the availability of such natural resources may require livelihood adaptations, including either partial or permanent migration (Hunter et al., 2013). Livestock farming in rural communal rangelands for example, is a livelihood strategy that helps to spread risk. Moreover, the monetary and non-monetary gains accrued from communal rangelands coupled with their secondary resources serve to diversify livelihoods and boost their resilience (Twine, 2013). Some of the valued products and services comprise provisioning ecosystem services like construction materials, fodder, fruits, fuel wood, bushmeat, gum, honey, insects, termites, medicinal plants, thatching material and wood for small artisanal crafts; social services such as cultural and spiritual benefits; aesthetic value; wilderness experience and recreation; employment; and ecological services such as carbon sequestration, grazing, shade, soil stabilization, water catchment, wildlife habitat and acting as windbreaks (Gandiwa, 2011; Langat et al., 2016). During periods of extreme weather events such as droughts and floods, woodlands represent some of the most accessible sources of products and incomes for many economically marginalised people (Mutenje et al., 2011). They are thus crucial to the livelihoods of local communities as they form the only easily accessible safety net for food and income aside from external support in the form of food-aid from the government or NGOs (Gandiwe, 2011). Ultimately, unfarmed rangelands in rural communities are argued to be vital sources of secondary resources which satisfy domestic needs such as fuelwood and income (Twine, 2013).

The risks to woodlands however, involve large-scale challenges, owing to poor harvesting and grazing practices, which work together with opportunistic pests and diseases (Gimona et al., 2012). Moreover, several woodland flora and fauna rely on ecosystem resources (such as of the woodland) to thrive. To safeguard populations of such species, management decisions should proactively consider and reflect long-term uncertainty (Gimona et al., 2012). Consequently, climate change impacts on rangelands span a longer time horizon and are less apparent compared to agriculture but may escalate woodland resource degradation and hence there is a need for livelihoods to be more resilient in anticipation of such effects (Kgosikoma et al., 2013).

1.2.2 Climate Change and Agriculture

Climate change, coupled with increased global population, heightens food insecurity in sub-Saharan Africa. This is because agriculture, unlike woodland resources, is highly sensitive to climate change because increased temperatures decrease yields of desirable crops while aiding the proliferation of weeds and pests, which has implications for animal production as well (Nelson et al., 2009). Consequently, climate change impacts all four dimensions of food security namely *availability, access, stability* and *utilisation* of food. The use of natural

resources however, buffers poor rural households from climate impacts on agriculture (Nelson et al., 2009). Dry land agriculture, such as that practiced across most of Africa, is more vulnerable to the fluctuations in rainfall than irrigated lands, which exacerbates the chances of crop failures in the short term and production losses in the long term (Nelson et al., 2009). The global shortfall in food production and surge in food prices between 2007–2008 (Nawrotzki et al., 2014), as well as South Africa's recent high shortfall in maize production due to drought (Reuters, 2015) emphasise this point. With 75 % of the world's poor living in rural areas, people in developing countries are already vulnerable and faced with the highest risk of food insecurity. In addition, escalating population growth and scarce land resources, coupled with unfavourable economic conditions, often exacerbated by adverse weather conditions such as droughts diminish rural incomes (Campbell et al., 2000; Mutenje et al., 2011). These factors cause people to explore natural woodlands for agricultural and pasture land (Chibisa & Rwizi, 2009). Moreover, rural dwellers actively source woodland products for sale as complementary income (Mutenje et al., 2011).

Similarly, circa 40% of South Africa's underprivileged population lives in rural communities and relies on land directly or indirectly for sustaining their livelihood through agriculture and related activities (Turpie & Visser, 2012). The kind of agriculture practiced by such rural folk is extremely vulnerable due to its high sensitivity to climate variables, as well as the country being largely semi-arid (Turpie & Visser, 2012). Consequently, climate change is projected to have direct impact on rural subsistence agriculture, as well as the rural economy as a whole. This may put undue strain on rural local governments which supply services and facilitate local development (Turpie & Visser, 2012). This scenario indicates that climate change further complicates the quest for sustainability in rural animal and crop production systems (Nelson et al., 2009).

Innovation is key to boosting such multiple livelihood strategies without compromising their resilience (Twine, 2013). The case for innovation is especially pressing as climate change will directly impact the sectors that sustain the poor viz: agriculture, water supplies, biodiversity and ecosystems (Turpie & Visser, 2012).

1.2.3 Social Innovation

Social innovation is one critical component for successful adaptation to climatic and related socio-economic challenges (Steward et al., 2009). The term *social innovation* encompasses two main aspects, namely *social* and *innovation*.

- a) *Social*: an innovation is deemed to be social when it produces a social value i.e. beneficial to the entire public or society instead of a privileged few.
- b) *Innovation* refers to the successful use of fresh ideas (Steward et al., 2009, p.7). This suggests that an innovation is not only an invention but a new idea that is more successful or more efficient than pre-existing alternatives.

Social innovation is therefore *“a novel solution to a social problem that is more effective, efficient, sustainable or just than present solutions and for which the value created accrues primarily to society as a whole rather than private individuals”* (Phills et al., 2008, p.36). Furthermore, *“social innovation is a potent tool in the environmental sphere as it involves social groups and communities producing, developing and sharing ideas and answers to tackle urgent social needs”* (University of the West of England, 2014, p.3).

Social innovation may manifest as a completely fresh idea that is disseminated throughout the local community, but it can also be a hybrid of existing and fresh ideas to create something new (Abernethy et al., 2014). This assumes that a myriad of ideas may be introduced but undergo phases of justification and refinement before they are embraced (University of the West of England, 2014). In the context of this study, social innovation entails the response measures adopted by rural resource users to cope with the impact of climate change and environmental degradation, as well as finding ways to make traditional management systems more sensitive to contemporary climate and environmental management concepts. It also points to establishing and redefining roles and responsibilities for key actors (Abernethy et al., 2014).

The natural ecosystem is subject to fluctuations, thus necessitating adaptive and dynamic approaches that are provided by social innovation (Reeves et al., 2013). Comparatively small social groups have the capacity to serve as a test-bed for innovation in environmental and sustainable living (Reeves et al., 2013). When successful in this seedbed stage, innovation can be tailored for the needs of other communities (University of the West of England, 2014). Nonetheless, such environmental interventions are ineffective in the absence of a requisite management and governance framework (Abernethy et al., 2014). Thus, natural resource management becomes problematic when managed by an institution whose span of authority is not commensurate with the geographical scale or particular spatial dynamics of the resource (Cash & Moser, 2000). The poor consideration given to scale and cross-scale interactions as per human-environment systems produces misguided public policies and resource management systems (Cash & Moss, 2000).

The local social dynamics and roles of responsibility affecting natural resources are often shaped by culture (UNESCO & UNEP, 2003). Culture influences human interpersonal and human environment interactions with implications for the present and future generations (UNESCO & UNEP, 2003). Hence, there is a common dependence between biological diversity and culture as numerous cultural practices rely on specific elements of biodiversity for their continued existence and expression (UNESCO & UNEP, 2003). Furthermore, some locally specific approaches to managing biological diversity tend to be produced and governed by cultural associations, with language and knowledge as a mode of maintenance (UNESCO & UNEP, 2003). Consequently, when languages and cultures are ignored, we directly limit the sum of our knowledge about the environment and the numerous benefits that humankind can derive from it (UNESCO & UNEP, 2003).

1.2.4 Considering Traditional/Indigenous Social Dynamics and Resource Management

Although adaptive co-management has developed from current resource management systems (Berkes, 2007; Chidumayo & Gumbo, 2010), the presence of some factors can further enhance its advancement. These factors mirror its cross-scale dynamics and emphasize the duties of core individuals and trust building coupled with the exchange of information and knowledge in the entire process (Berkes et al., 2000; Berkes, 2007; Chidumayo & Gumbo, 2010). Some of these core factors include:

- **Institutions**

Contemporary environmental management reflects the delicate balance of essentially satisfying the peculiar needs of different stakeholder or user groups and effective management of the ecosystem (Berkes, 2007; Ostrom, 2008; Chidumayo & Gumbo, 2010). Nonetheless, institutions in the broader sense mediate the roles of the various stakeholder groups. In the commons or governance literature, institutions also include other mediators between society and environment, such as customary laws, norms, taboos etc. Furthermore institutions (be they traditional or modern civic and governmental institutions) denote social frameworks and organisations which have achieved high levels of resilience (Scott, 2001). For example, local institutions influence equity and voice at the local level, which in turn mediate the degree to which individuals may benefit from natural resources (Chidumayo & Gumbo, 2010). However, it has been observed that the high involvement of a community does not necessarily translate into better management in comparison to private or governmental ownership (Meinzen-Dick, 2007; Nagendra, 2007). Moreover, others argue that community management of common-pool resources can result in benefits being shared unequally among community members (Oyono et al., 2005; Platteau, 2004), often skewed in favour of the elite to the exclusion of the poorest members (Claassens, 2015). Thus, simply handing over the reins of common-pool resource management to local users does not necessarily mean challenges such as poaching, overharvesting etc. will be solved (Ostrom, 2008; Claassens, 2015). Nevertheless, some communities perform better in the management of their common-pool resources than others (Acheson, 2003; Andersson, 2004). This can be attributed to

different factors like more robust institutions with effective rules that address the spatial and temporal scales of the resource in question; sound cooperation between the related national; regional and local institutions and the flexibility/adaptability of governance approaches to common pool resources (Ostrom et al., 1999; Gerber et al., 2008; Bluffstone et al., 2015). Furthermore, local communities have demonstrated their capacity to create robust local institutions for governing local resources effectively (Ostrom, 2005; Berkes, 2007; Muhumuza & Balkwill, 2013).

Institutions are premised on three key pillars that are mutually reinforcing (Scott, 2001). These are the cultural-cognitive, the normative and the regulative. The three pillars, when coupled with associated activities and resources, provide stability and meaning to social life (Scott, 2001). The *regulative pillar* of institutions pertains to preserving law and order in society (Scott, 2001). It is associated with establishing codes of conduct and introducing rules or conventions, ensuring conformity and exacting the commensurate incentives or penalties as the situation demands (Russo, 2001). This may manifest in a myriad of ways, ranging from humiliation to use of law enforcement agencies such as the police or the courts (Scott, 2001). Such disciplinary mechanisms ensure conformity and move actors toward uniformity within a defined space (Foucault, 1977).

Institutions have a key role in the successful observance of laws relating to the sustainable use and management of resources (Jepperson, 1991). The *normative pillar* reflects the society's *values* and *norms* (Scott, 2001). The values refer to notions of the ideal coupled with the setting of benchmarks or standards which serve as points of reference (Scott, 2001). Norms, however, dictate the manner of doing things and outline legitimate means to pursuing an endeavour (Scott, 2001). This suggests institutions can influence local practices or attitudes for the effective management of local resources or serve as impediments (Hughes, 1936; Cundill et al., 2013). Furthermore, in the domain of the *cultural-cognitive*, conformity arises because alternative behaviour is deemed as implausible; hence routines are accepted and observed as the usual way of doing things without hesitation or much question (Scott, 2001). This surmises that cultural norms can shape the practices and interventions in a locale to managing their natural resources (Cundill et al., 2013). These core features of institutions are necessary for proffering 'optimal' solutions for addressing the hydra-headed problems associated with common-pool resources (Ostrom, 2008). Furthermore, they are vital to providing the needed adaptive, multi-level governance that such complex, evolving resource systems require (Ostrom, 2008).

- **Local Actors**

Poor households often use biological products from the wild (including woodlands) such as wild spinaches, wood fuels, edible insects, wood for building, venison, wild honey and reeds for weaving amongst others (Mowo et al., 2011). Such products commonly referred to as *non-timber forest products (NTFPs)* are exploited for consumption and also as safety nets by the

rural populace in South Africa (Shackleton & Shackleton, 2004). Subsistence products are mainly harvested by children, women and elders, whilst the commercial extraction of resources is done principally by young men (Chidumayo & Gumbo, 2010) within the framework of local norms which are supervised by the leaders. The combined effect of the actions of these players has implications for the sustainable management of natural resources (Chidumayo & Gumbo, 2010). The advancement of adaptive co-management systems embraces robust institutions as well as proactive self-organizing processes for problem solving (Folke et al., 2003). Leadership is a key factor in the self-organizing process as leaders frequently initiate the essential measures needed in ecosystem management (Westley et al., 2002). Ecosystem management aspirations coupled with the ecosystem information and understanding at their disposal determines the path of action in reaction to change (Folke et al., 2003). Leadership may arise from communities and aid the self-organizing process. Thus, individuals act as key drivers and facilitators in organizational change as per ecosystem dynamics and its associated adaptive co-management process.

As key stewards, leaders are essential in nurturing inter and intra organizational functional links and therefore enhance the dissemination of information and knowledge from numerous sources to be used in the local context of ecosystem management (Imperial, 1999). Moreover, social networks develop for such goals (Scheffer et al., 2002). These social networks provide an avenue for local users to benefit from external sources of information and knowledge. Furthermore, the capability to cope with the dynamics of social and ecological systems depends on the entire network of interacting individuals and institutions at various scales that mobilise action around the right issues at the right time (Westley et al., 2002; Folke et al., 2003).

Trust is another vital feature in social self-organizing processes directed at ecosystem management as trust lubricates cooperation (Pretty & Ward, 2001). Hence, the absence of trust amongst people is an obstacle to the development of collaborative measures like adaptive co-management systems (Baland & Platteau, 1996). Notable cases of co-management that have thrived are attributed to extensive periods of trust building (Pretty & Ward, 2001).

Due to its fluid nature, several local actors can initiate social innovation in the environment sector with different degrees of formality and organization *'including community groups, NGOs, charities, governments, businesses, academics, philanthropists, combinations of these and more spontaneous gatherings of citizens recruited through social media to tackle environmental issues'* (University of the West of England, 2014, p. 5). The involvement of local actors, as a bottom-up strategy has more advantages for the community vis-à-vis more structured top-down processes such as increased public trust, enhanced decision making on local issues, adopting more environmentally friendly lifestyles, values and practices (Reeves et al., 2013). This has led to the phenomenon of citizen science. Citizen Science is a

burgeoning field which experiments with alternative channels of public knowledge production and democracy. Through partnership with scientists in structured investigative projects, citizens can supply valuable information that can shape policy, enhance understanding and answer a number of pressing social issues (ECSA, 2015). A social innovation project located in the Swedish wetlands of Kristianstads Vattenrike is lauded as a fine example of this approach as it elicits public support in monitoring local wildlife (University of the West of England, 2014). The gathered data then feed national and European monitoring projects (University of the West of England, 2014). It can be argued that such a model is transportable to Africa. However, in sub-Saharan Africa, it is noteworthy that poverty is a key cause and consequence of environmental degradation and depletion of natural resources (NEPAD, 2003). This makes people largely desperate for the scarce natural resources available and supports the argument to give greater emphasis to the human dimensions of ecological conservation in addition to the purely scientific assessments of species and habitats (Muhumuza & Balkwill, 2013). This suggests that the dynamics of such public knowledge production may differ and hence follow a different trajectory. This research sheds light on this theme as it involves the roles of local actors and resource users in the sustainable management of natural resources. Nonetheless, the cooperation and contribution of all individuals across the social strata in addressing pressing environmental challenges confronting society is laudable (Folke et al., 2003; Mowo et al., 2011). It also cuts across other background themes such as institutions, elitism and gender.

- **Policy**

Poverty and high human densities, coupled with insecure land tenure and weakening traditional institutions, have a profound effect on ecosystem integrity in savannas (Hoffmann, 2015). Moreover, the influence of institutional transformation, as well as modifications in technology and services on savanna processes indicates that policies are a determining factor in the success of such sustainability (Eriksen & Watson, 2009). Cultural geographies, political boundaries and natural boundaries influence the interest and ability of communities to partake in environmental management (Prager et al., 2015). Several policy formulations highlight the essence of endogenous, grassroots participation as an effective approach to sustainable management of the environment, citing the particular benefit of harnessing the creativity, development potential and cooperation of local people (UNESCO, 2008). Such policies indicate that the input of communities will engender social, economic and environmental benefits locally and farther afield. Moreover, effectual community engagement will produce more cost effective (less costs for control and enforcement) and more sustainable operation of policies because the policy objectives are understood, embraced and have the goodwill of the relevant stakeholders (Prager et al., 2015). Besides the notion of *community* being a complex setting, technical, socio-political and institutional challenges related to inadequate knowledge integration (scientific versus lay/local knowledge) and regular evaluations are some of the factors that complicate rural policies (Prager et al., 2015). However, often the poor fit of policies with diverse institutional

echelons, coupled with the policy relevance to the challenge it seeks to tackle, together with the fit between the social (institutional structure) and the biophysical system, are seen as hurdles to successful environmental governance (Berkes, 2009). Similarly, related policy modifications have implications at the grassroots including impacts on rural livelihoods, economic activities and changes in land use (Prager et al., 2015). Hence, there is often friction between traditional and statutory law including the rights to resources which affect effective management in the savanna.

The term “policy” broadly includes local principles and decision-making frameworks (Claassens, 2015). Moreover, actors, be they individual or communal, work together to discuss and make decisions; thus their conduct largely determines policy success (Claassens, 2015). Consequently, the conducts of individuals are equally as vital in shaping policy implementation and communal initiative similar to that of collective entities (Prager et al., 2015). Nonetheless, communities are often heterogeneous with individuals varying in their preferences, capacities, interests and levels of influence (Cousins & Walker, 2015). Communal members may be sympathetic or unsympathetic to the cause of the environment: they may be opposed to the views of the collective or they may simply show apathy (Eberbach et al., 2015). Measures are initiated by the individual but affect the neighbours, peers, and the entire community in the end (Eberbach et al., 2015). The nature of the communal organization coupled with the associated governance arrangement will stimulate individuals’ interest and proactiveness in the management of their natural environment or otherwise (Hoffmann, 2015). Their preferences and needs will decide how they see anticipated benefits and assess policy impacts (Prager et al., 2015).

Though the nature of policy may suggest that it considers community members across the board, it is argued that one vital role of policy intervention is to identify the key actors, choosing one group over another (Kovach, 2000; Rinkema, 2003). Local policy and action is thus an interplay of local and extra-local factors as environmental resources often overlap local and administrative boundaries (Eberbach et al., 2015). Hence, management of environmental resources involves a myriad of socio-economic factors, ranging from local to global scales, thus necessitating constant adaptation: the human systems that influence the utilisation, development and management of resources (Claassens, 2015). Such systems revolve around local policies.

- **Gender**

Globally, climate change disproportionately affects sections of the population that are most dependent on natural resources for their livelihoods and sustenance, as well as have the least capacity to address natural disasters, such as droughts (UNFCC, 2014). Local institutions have a critical role in addressing the needs of such vulnerable groups (UNFCC, 2014; UNDP, 2018). Moreover, institutions impose restrictions by defining legal, moral, and cultural boundaries distinguishing legitimate from illegitimate activities (Acemoglu et al., 2001; Cramb & Wills,

2010). Hence, institutions also provide guidelines and resources for acting as well as prohibitions and constraints on action (Savoia et al., 2010; Kain, 2011; Hill, 2011). This suggests that institutions also support as well as empower activities and actors (along gender lines) which has implications for sustainable resource management in the rural context (Kain, 2011; Hill, 2011).

The influence of institutions is also reflected in the nature of gender roles at the communal level and subsequently gender roles related to resource use (Johnson et al., 2004). Consequently, the differences between men and women in interacting with the environment is reflected in the 1992 United Nations Conference on Environment and Development (the Earth Summit) in Rio de Janeiro. These differences between men and women in environmental interactions are further accentuated by power relations, which are maintained by institutions (Ostman & Parker, 1987). Hence, the nature of power relations in the family and society influence women's use of resources. The effect of environmental shocks also differs across the genders due to variances in vulnerabilities owing to the varying responsibilities of men and women as per the cultural context in which they function (Chant, 2010; Resurreccion & Elmhirst, 2012). Moreover, women are faced with heightened risks and burdens from the adverse effects of climate change in conditions of poverty, and women form the predominant populace of the world's poor (UNDP, 2018). Furthermore, women's comparatively low involvement in decision-making structures and labour markets entrenches inequalities and hinders their proper contribution to climate-related planning, policy-making and implementation (Arora-Jonsson, 2011). However, women can make crucial contributions to climate change response by virtue of their local knowledge, deep connections to the environment and roles in natural resource management (UNFCCC, 2014). Such qualities make women potent agents of transformation with knowledge and expertise for building resilience to climate change and disaster at the household and community level (UNDP, 2018). Conversely, when policies or interventions are introduced without the meaningful involvement of women, it accentuates prevailing inequalities and compromises effectiveness (UNFCCC, 2014; UNDP, 2018). It is therefore imperative to involve women and men equally in the development and implementation of climate policies that are gender-responsive to help address the differentiated needs, experiences, priorities and capacities of women and men (McCright, 2010; UNFCCC, 2014). This will help bolster climate change and disaster resilience and empower women with equal accessibility to and control of the resources they need in adapting to and mitigating the impacts of environmental fluctuations (Arora-Jonsson, 2011; UNDP, 2018). Gender equality and women's empowerment programmes have thus been recognized as vital to successful environmental conservation and realizing sustainable development (Resurreccion & Elmhirst, 2012).

- **Age**

People's attitudes and perceptions affect their human-environment relations. Age is a significant variable in studying attitudes and perceptions as people of different age cohorts vary in their values (Kooij et al., 2011). It is thus argued, that people in diverse age categories have their unique perspectives and exhibit different environmental behaviours to varying degrees (Torgler et al., 2008). Others posit that the strength and direction of age-effects in terms of human-environment relations is largely inconsistent (Brenton et al., 2013). It is therefore imperative to understand variances across age groups in terms of their approach to the natural environment, their awareness of environmental issues, the factors that trigger their environmental actions, as well as their environmentally-friendly conduct (Aminrad et al., 2011). Consequently, investigating the connection amongst age-groups and environmental management can afford vital insights on tailoring environmental interventions.

Due to the impact of youth emigration as a livelihood strategy, village households in South Africa tend to be headed by older people relative to other places and hence there is the need to consider the implications for environmental initiatives (Hunter et al., 2013). Moreover, it has been observed that household structures in several African countries (South Africa inclusive) have been radically transformed by the HIV/AIDS epidemic (Pillay, 2016). This has led to families and communities becoming incapable of coping with the adverse effects of HIV and AIDS, with particular emphasis on the assistance needed by affected orphans and vulnerable children (Twine et al., 2010). Traditionally, such orphans were supported by the extended family. However, this safety net is compromised in modern times (Mogotlane et al., 2010). Consequently, these orphans are forced to fend for themselves resulting in the phenomenon of the child-headed household (CHH), as a new type of family (Mturi, 2012). Therefore, the dynamic relationship between age-groups and social innovation at the village level is also assessed in this study.

The strength and direction of age-effects vis-à-vis a number of psychological domains offer possible patterns of conduct as per human-environment relations (Aminrad et al., 2011). For example, the socio-emotional selectivity hypothesis argues that variance in individuals' perspective of time remaining in their lives causes them to seek a wide spectrum of information and follow particular social goals (Carstensen et al., 1999). Relatively young people are likely to regard their time remaining as long and hence prioritise and make preparations for distant-future objectives, like finding fresh information or opportunities. However, this is countered by the argument that this idea of time may be abused and young people may thus for example, not save for retirement because it seems far away. Moreover, in some communities old people are the ones who have time and interest in the environment unlike the youth who are busy with their lives. Nonetheless, comparatively young people may be presumed to be more environmentally aware and knowledgeable (Brenton et al., 2013). As innovation and adaptation are knowledge intensive, it can also be presumed that young

people will be more innovative in the face of environmental pressures. Their activities could also be concentrated on educational behaviours which may enhance their environmental awareness. Moreover, as future-oriented objectives may be more of a priority to young people, they would be presumed to be more alarmed about the negative impacts of their environmental activities on their future, given that they will bear the brunt of such consequences and have to live with them for a longer timeframe (Brenton et al., 2013). Conversely, they are also less likely to perceive severe environmental change (e.g. degradation or climate change) because they have a shorter period from present to “baseline” (earliest clear recollection) for comparison. Furthermore, young people are more flexible in their beliefs and more receptive to change.

On the contrary, older people might have a higher likelihood of considering a briefer timeframe and consequently, follow goals that result in emotional satisfaction and steer clear of any current emotional discomfort (Baltes, 1968; Bamberg & Moser, 2007). Hence, they may have a higher probability of exploiting the environment to attain emotional satisfaction (Brenton et al., 2013). This translates into older people conserving less, being less environmentally proactive, and taking less environmentally responsible choices with implications for environmental innovation and sustainable livelihoods (Brenton et al., 2013). This is countered by the notion that elderly people are concerned for the wellbeing of their grandchildren and thus, are concerned about environmental health for posterity. Nonetheless, other arguments point to age-effects causing young people to be more environmentally aware and proactive (Roberts et al., 2006; Honnold, 1984). Power differentials also cause young people to be less influenced by the dominant social paradigm, and as such cause young people to be more open-minded and receptive to new ideas (including those on sustainability) as well as exhibiting environmentally-friendly values (Dunlap & Van Liere, 1978). Furthermore, these factors may also be related to the context in which each generation grew up.

Although it has been observed that several personality characteristics change markedly as people grow and mature, young people are more open to novel experiences (Roberts et al., 2006). As innovation demands flexibility and open-mindedness to change, young individuals can be presumed to be more likely to embrace fresh ideas and change with respect to environmental sustainability (Baltes, 1968). Moreover, older individuals may be more resistant to change and be more careful or wary of new ideas (Roberts et al., 2006). Hence, they may tend to consider change when there is an obvious benefit or when faced with immense social pressure (Morris & Vankatesh, 2000; Brenton et al., 2013).

1.2.5 Study Themes

The key themes of this thesis are captured and integrated in Fig. 1.1, showing how climate change (through its effects such as higher temperatures, drought, fluctuations in seasons and rainfall patterns) has implications for the sustainable management of natural resources (e.g.

woodlands) (Fig. 1.1). When these resources are managed sustainably, it helps in managing the impacts of climate change. Similarly, environmental challenges, such as excessive deforestation, unsustainable harvesting of woodland resources and poor burning practices, tend to worsen the impact of climate change and affect the sustainable management of resources. The dynamic interaction between the various themes of the study is thus illustrated in Fig. 1.1.

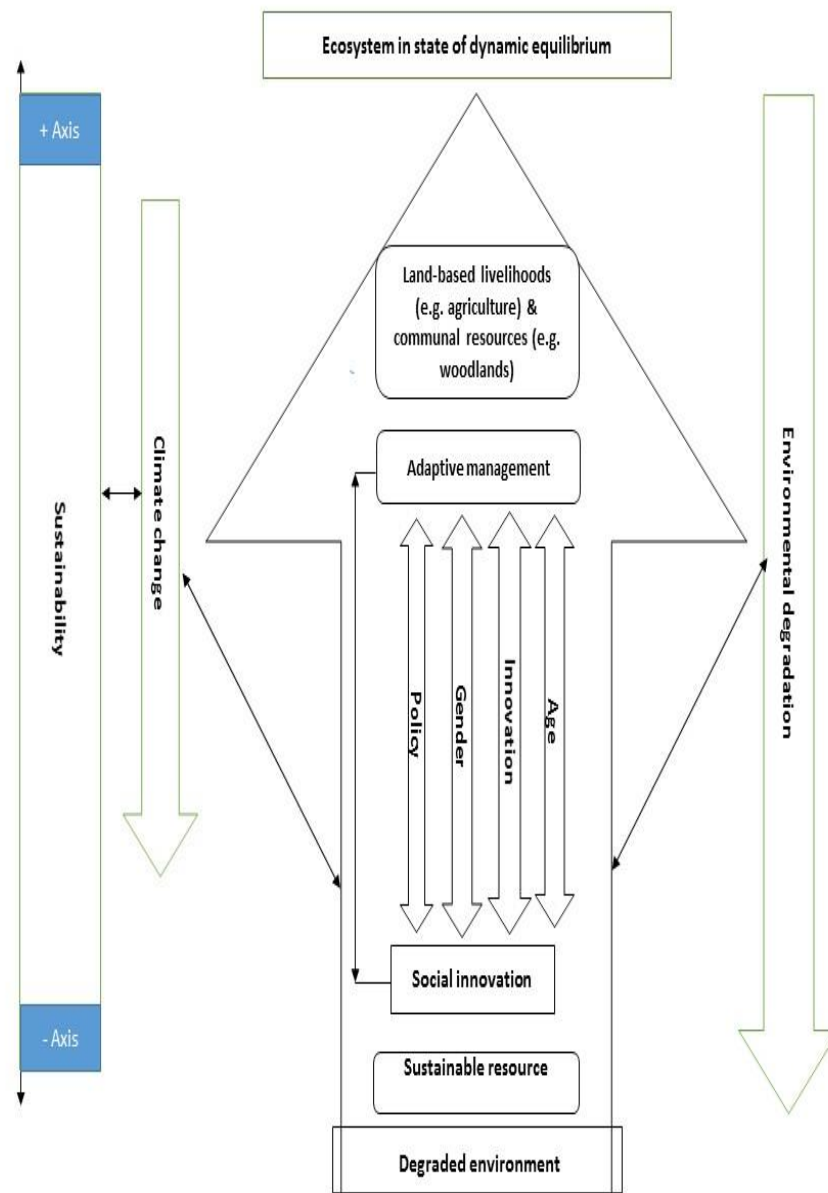


Figure 1.1. Flow diagram of thematic areas of this study.

In rural areas, livelihoods are intricately entwined with nature (Carr, 2008), and thus the twin impacts of climate change and degradation on environmental resources equally affect people's land-based livelihoods such as agriculture (Fig. 1.1). In response to such environmental pressures, societies formulate new ideas by way of innovation to safeguard

their livelihoods. These fresh reactionary ideas mediated by rural policy, gender and institutions (Fig. 1.1) may not necessarily be ideal, positive or effective in sustainably managing the targeted natural resource but may simply be trial and error.

With time, the environmental feedbacks from applying these ideas or techniques are assessed and society adapts the management technique (Fig. 1.1) accordingly in the light of fresh evidence and knowledge. The community then improves the technique tailored for their peculiar socio-economic and environmental condition.

1.3. AIM

The overarching aim of this study was to explore the key factors that separately or together with climate variability may be driving innovation in response to climate and land degradation for agricultural productivity and effective management of natural resources at the village level.

1.3.1 Objectives, Research Questions and Hypotheses

Objective 1: To explore the influence village level actors (per co-management frameworks) and nonagrarian policies on the management of common pool resources and land-based livelihoods (respectively) in the rural milieu

Research Questions 1

1a) How do village level nonagrarian policies influence engagement in land-based livelihood activities amongst vulnerable groups?

1b) What are some core background factors that cause an individual to either abuse or positively invest supplemental income with reference to their livelihoods?

1c) How do the changing roles of traditional leaders over time (during and post-apartheid eras) affect the management of communal natural resources at the local level?

Research Hypotheses 1

1a) Social grants beneficiaries are disincentivised to engage in productive labour such as agriculture unlike non-beneficiaries.

1b) The changing roles of traditional institutions in the management of communal resources negatively impacts the effectiveness of related natural resource co-management frameworks.

Objective 2: To explore the influence of key individual traits of respondents such as gender, age, education and location of farming activity on strategy uptake for sustainable agriculture and use of woodland resources for enhanced climate adaptation.

Research Questions 2

2a) How does the uptake of agricultural strategies differ across key traits such as gender, age, space and social capital for agricultural productivity and sustainable woodland resource management?

2b) What are the key implications for key traits in responding to climate fluctuations within the context of innovation at the community level?

Research Hypotheses 2:

2a) Key individual traits such as gender, educational level and age have a positive association with the uptake of agricultural strategies in response to environmental dynamics.

2b) The location of farming activity has a positive association with strategy uptake in rural smallholder systems.

Objective 3: To determine the impact of key individual traits of respondents on the number of land-based asset classes used/owned by smallholders and related numbers of agricultural strategies pursued.

Research Questions 3

3a) How does the number of land-based assets used/owned by smallholders differ across key traits (such as gender, age, space and social capital)?

3b) How do key individual traits influence the number of agricultural strategies pursued by smallholders to secure their livelihoods?

3c) What is the association between the number of land-based livelihood asset classes used/owned and the numbers of agricultural strategies pursued?

Research Hypotheses 3:

3a) There is no positive relationship between key parameters such as age, gender, location of farming and gender with the numbers of land-based assets used/owned by smallholders.

3b) Key parameters (such as age, location of farming and gender) have no positive association with the numbers of agricultural strategies pursued by smallholders to secure their livelihoods.

3c) There is no positive association between the numbers of land-based assets owned and the number of agricultural strategies pursued by smallholders.

1.4. THEORETICAL FRAMEWORK

The theoretical framework for the study stems from socio-ecological systems theory. Natural systems and social systems are individually complex in their own respect. In addition, many of our environmental and social challenges entail the further intricacy of interaction between social and natural systems (Berkes, 1999; Berkes, 2007). Evidence from a number of studies indicates that current resource and environmental challenges are not effectively responding to their prescribed solutions, thus highlighting the gulf between contemporary environmental challenges and available capacity (Berkes & Folke, 1998; van den Berg et al., 2011; Levin et al., 2012; Börzel & Hamann, 2013). This scenario comes in the face of mounting evidence of the profound impact of human-related factors as drivers of environmental change. Thus, there has been increased demand for creative forms of cross-disciplinary collaborative approaches to tackle social and environmental issues in-depth (Borrini-Feyerabend, 1996; Berkes et al., 2003). This has resulted in a number of concepts with such attributes including socio-ecological systems (Halliday & Glaser, 2011). These social ecological systems are intricate adaptive systems consisting of many diverse human and non-human elements that interact. They adapt to fluctuations in their environment and their environment changes as a result (Halliday & Glaser, 2011).

Socio-ecological systems (SES): SES are nested, cross-scale systems which supply some of the basic yet vital social services such as food, drinking water, energy and fibre (Berkes & Folke, 1998). They are synonymously referred to as “human-environment systems” (Scholz, 2011).

The following terms used in line with socio-ecological systems in the literature are defined as follows:

Adaptive management underscores the process of learning by practice and suggests that resource management policies can be regarded as test cases from which managers can learn (Grunderson, 1999; Berkes et al., 2003). It distinctively lays emphasis on the significance of environmental feedbacks in steering policy, accompanied by a cycle of tests to shape policy (Berkes et al., 2003).

Institutions are the formal and informal structures that shape human interactions with normative and cognitive attributes (Berkes et al., 2003).

The conceptual framework (Fig. 1.2) of this study—the bricolage of notions, assumptions and theories that buttress and inform this research—forms a core aspect of the research design. Hence, a visual representation of the key factors or variables and presumed relationships between them and the phenomena studied is graphically illustrated.

1.5. CONCEPTUAL FRAMEWORK

The global climate is being transformed with implications for our local weather, ecosystems and society (Fig. 1.2) amongst others (Parmesan & Yohe, 2003; Richard et al., 2010). This is because there is an intricate connection between the elements of the earth's ecosystem (Agrawal, 2011). Thus, when one core component is compromised, it comes with ripple effects on everything else (Boeing, 2016). This scenario has been referred to as the *butterfly effect* (Lorenz, 1963). An example of such a typology is the scenario of global warming unleashing diverse chain reaction effects (Fig. 1.2) on plants and animals as well as human communities (Sala et al., 2000; Duraiappah, 2006; Dadamouny & Schnittler, 2015).

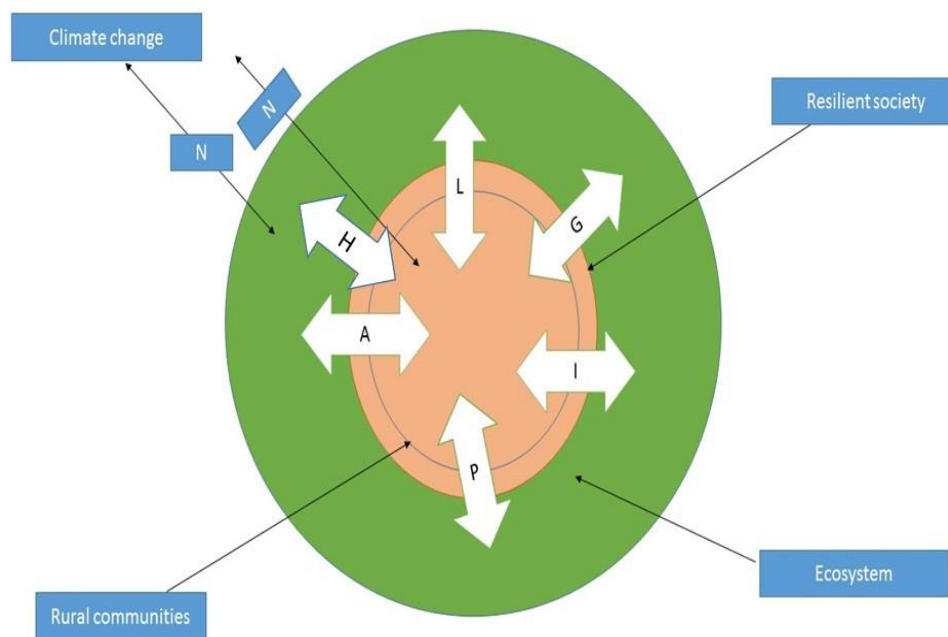


Figure 1.2. Conceptual framework.

The arrows indicate the various factors in the figure are mutually reinforcing or in dynamic interaction with each other. N: natural factors P: policy A: age G: gender relations L: local actors H: human factors e.g. deforestation, poor harvest practices NB: Rural communities form an outer ring of Human society (Fig. 1.2) because most rural communities (or countryside) in the global south are located outside towns and cities in remote areas or hinterlands.

Natural events (N in Fig. 1.2) are not solely responsible for climate change, as anthropogenic factors (H in Fig. 1.2) related to significant volumes of carbon dioxide (CO₂) and other heat-trapping gases (greenhouse gases) into the atmosphere also play a significant role (Moss et

al., 2010). Climate change is projected to continue into the future with implications for our health, environment, natural resources and economy (USEPA, 2014; Dadamouny & Schnittler, 2015). But proactive measures can be taken by relevant actors to limit climate-induced impacts on our wellbeing rather than assume a fatalist stance (Costello et al., 2011; Anshelm & Hultman, 2016). Such proactive interventions guided by innovation will help in developing resilient communities (Fig. 1.2) as suggested in the Sustainable Development Goals (SDGs) (Callaghan & Colton, 2008; Horgan & Dimitrijević, 2018).

Rural dwellers are often most vulnerable to the impacts of climate change due to their climate sensitive lifestyles and lower diversity of sources of food resources (Kiem & Austin, 2013; Ajaero & Onokola, 2013). For example climate change causes:

- Changes in the patterns and volume of rainfall which has implications for streams and water bodies on which rural dwellers rely for pasture and agriculture related activities (Mugagga et al., 2010; Lenoir et al., 2010; Rouault, 2015).
- Changing ecosystems affect the geographic distribution of several flora and fauna and their related lifecycle events, such as migration and reproduction (Thomas et al, 2004; Grunderson & Holling, 2001). Because some of these species have their niches in the rural communities which depend on them, their survival is important for the rural ecosystem and wellbeing of the rural farming communities (Tinker et al, 1996; Nagendra, 2007; Warrick, 2016).

Given the high dependence of rural dwellers on environmental resources, there is a constant dynamic interaction between rural dwellers and the environment (Jump & Penuelas, 2005; Agrawal, 2011). This dynamic interaction responds to environmental feedback, and is mediated by important factors such as key local actors (Prager et al., 2015), gender relations (Resurreccion & Elmhirst, 2012) and policy (Prager et al., 2015): with implications for sustainable management of the environment.

Local actors (L) are influential and key to shaping attitudes. Thus, many typologies of innovation diffusion surmise an individual such as a change agent, informing a potential adopter of a novel idea (Correia et al., 2016). Furthermore, others involve a communication process involving mutual interaction and exchange of ideas by community members to enhance understanding. Knowledge about an innovation is often gained from near-peers especially their individual perceptions about the innovation in an interpersonal social network (Oosterlynck et al., 2015).

Gender (G) shapes human/environment relations as well as the use and management of environmental resources (Braidotti et al., 1994). Women are deemed to be key local agents who need active engagement for successful environmental resource management (Braidotti

et al., 1994). This is against the background that as key managers of households, communities and natural resources, women obtain peculiar knowledge about their local environment and its natural resources (Buckingham, 2010). Women are thus acknowledged as active agents of change and possess unique knowledge and skills that should be harnessed to develop resilience (Agarwal, 2010; Bradshaw, 2010). However, their poor representation in decision making processes and access to resources in comparison to men, compromises their much needed contribution (Dey et al., 2018; Swim et al., 2018). Gender responsive climate policies help address the differentiated capacities of women and men whilst empowering them with the requisite resources to cope with climate impacts (Araujo et al., 2008; Buckingham, 2010; Chant, 2010).

Key terms in the study and their mutual interaction include:

Local, indigenous and traditional knowledge indicate the unique environment insight accumulated not by scientific experts but by lay people who are in close proximity to a resource and who use and interact with such resource (Berkes et al., 2003).

A **livelihood** consists of the abilities, material and social assets and actions needed to sustain a living (Scoones et al., 1999).

Resilience is the capacity of a community to withstand, cope and recover from the impact of hazards effectively, without compromising its true nature or ability to function (Parry et al., 2007).

Vulnerability the degrees to which geophysical, biological and socio-economic systems are susceptible to, and unable to cope with, adverse impacts of climate change (Parry et al., 2007).

Adaptation refers to changes in the environmental and socio-economic systems in reaction to real or anticipated climate impacts. It denotes the change in method, approach and technique to limit possible negative impacts or maximise opportunities related to climate change (Parry et al., 2007).

1.6. METHODOLOGY

Methodologically, the mixed method research approach (Fig. 1.3) is used in this study. Both quantitative and qualitative research are valuable (Creswell & Clark, 2007; Bryman, 2012). The use of mixed methods (Fig. 1.3) does not compromise the importance of either of these approaches but rather enhances their combined usefulness in research (Creswell, 1994; Tashakkori & Teddlie, 2003). Furthermore, each of these has its own set of methods and practices (Johnson & Onwuegbuzie, 2004), thus several approaches to data collection were employed in a stepwise manner to prosecute the study objectives as illustrated (Fig. 1.3).

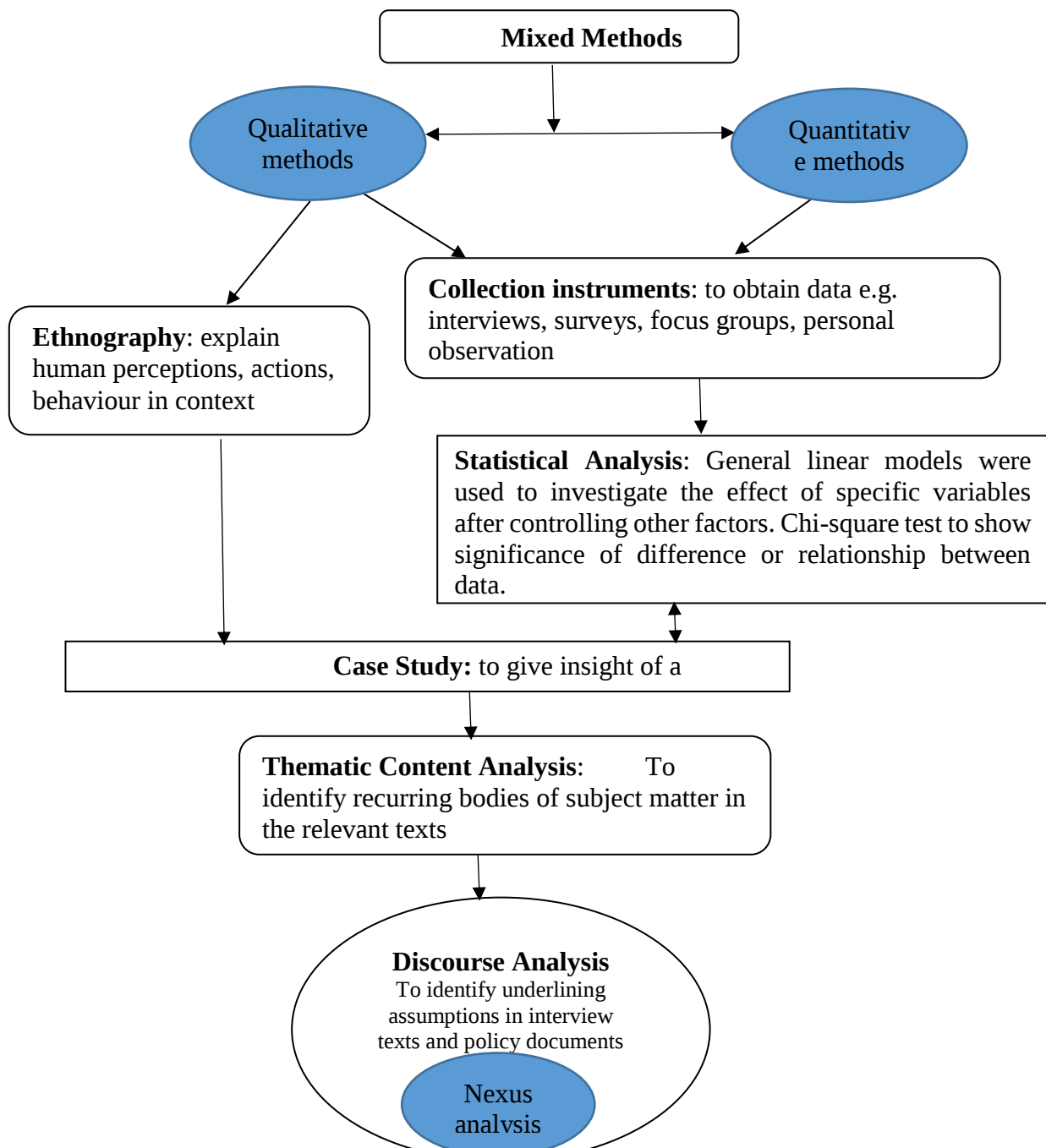


Figure 1.3. Research design.

The approach used largely falls under the *concurrent procedures* of mixed methodology whereby the researcher merges quantitative and qualitative data to gain a comprehensive analysis of the research problem. This design involves the researcher collecting both forms of data simultaneously in the course of the study and integrating the information in the interpretation of the global results (Creswell, 2013; Schoonenboom & Johnson, 2017).

1.6.1 Study Site: Mpakeni

The study site is a rural community in the Mpumalanga Province of South Africa. The village of Mpakeni (study site) falls under the Mpakeni Tribal Authority which is a cluster of four villages: Daantjie, Luphus, Zwelisha and Mpakeni. The Chief of the Mpakeni Tribal Authority does not live in Mpakeni but is represented by a headman. The Mpakeni area is found in the Nsikazi District to the south-west of the Kruger National Park in Mpumalanga Province, South Africa. It centres on geographical coordinates 25° 29' 08" South, 31° 16' 38" East and has an altitude of 821m–1,118m. It encompasses the Mthetomusha Game Reserve as well as the Bongani Lodge (Hampson et al., 2002).

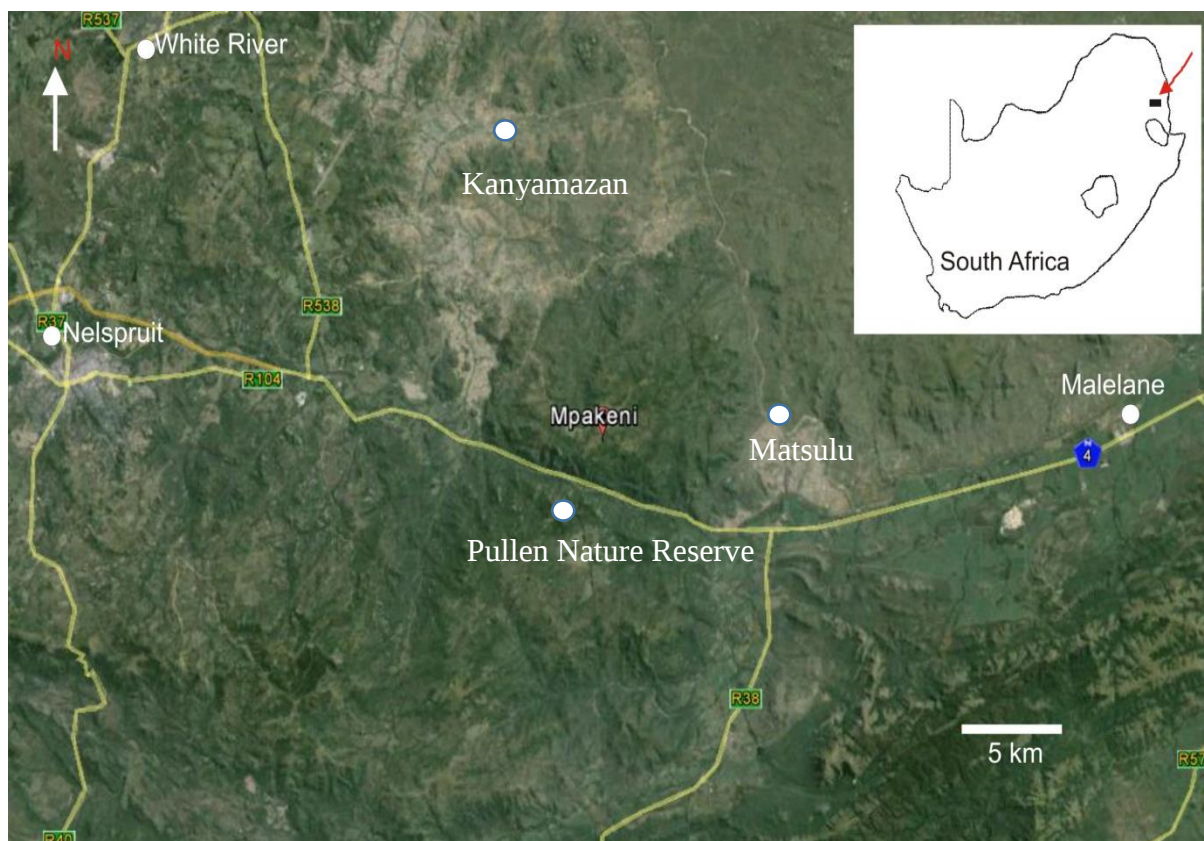


Figure 1.4. A satellite view of the study site (Mpakeni) and its relation to some fringe communities and major centres such as Nelspruit. The light areas indicate dense human settlements or intensive activity.

Source: Google Earth (2015)



Plate 1.A. Ground view of Mpakeni.

Mpakeni has a typical rural setting (Plate A). The buildings in the area are generally simple one-storey concrete buildings connected to the national electric grid and surrounded by sparse woody plants.

The area is predominantly populated by people of the siSwati (Swazi) and xiTsonga (Tsonga) language groups, which are originally traced to the southern region of the Kruger National Park (Van Riet et al., 1997). Rainfall is circa 700 mm per annum (Hampson et al., 2002), with an average low of 22°C and average high of 33°C in temperatures per day (Maplandia, 2015). The tributaries of the Makhomane, Luphusi and Nsikazi rivers drain the area and act as water sources (Hampson et al., 2002). The soils are characteristic of sandy loam soils interspersed with granite outcrops (Hampson et al., 2002). The prevalent flora is classified as sour Lowveld bushveld or Malelane mountain bushveld whilst part of the area is categorised as a vulnerable vegetation type -- *Croc Gorge Granite Mountainlands* (SANBI, 2007; Ferrar & Lötter, 2007). It also has an abundance of trees such as kiaat (*Pterocarpus angolensis*), corky-bark acacia (*Acacia davyi*), broad-leaved erythrina (*Erythrina latissima*), rock figs (*Ficus glumosa*), milkwood (*Mimusops zeyheri*), marula (*Sclerocarya birrea*), scented thorn (*Acacia nilotica*), spiny monkey orange (*Strychnos spinosa*) and Lowveld chestnut (*Sterculia murex*) (Low & Rebelo, 1996). The Mpakeni Dam is one of the key landmarks of the area. This 150 million cubic metre storage capacity dam, is located downstream on the confluence of the Ngwavuma and Mantambe Rivers (DWA, 2008). The main purpose of the dam is to store and distribute water to irrigated lands especially the lower reaches of the Ngwavuma River catchment (DWA, 2008).

1.6.2 Data Collection

1.6.2.1 Research design

This study was carried out using the *case study* approach. Literature and theoretical studies solely are not sufficient to gain significant insight into the thematic areas under investigation. Given the complex and yet pressing nature of the study topic, fieldwork was used to gain first-hand knowledge. This was necessary to appreciate the socio-cultural life of the subjects and affords an insight into what subjects articulate (Kvale & Brinkmann, 2009). Furthermore, the fieldwork helped understand vital ethicopolitical issues that needed further reflection at both the pre and post interview phases (Donkor, 2013). Moreover, visiting the target site permitted the researcher to pick situational cues which enhance the interview process and ultimately in prosecuting the research objectives (Kvale & Brinkmann, 2009).

1.6.2.2 Case study

The case study approach is a qualitative research technique utilized in this research. Case studies are used as empirical analyses of contemporary phenomena within real-life contexts; when the boundaries between phenomenon and context are unclear; and in which several sources of evidence are employed (Yin, 2014). Moreover, universals are the exception rather than the norm in the study of human affairs, because human actions largely originate in a local context of practice, thus context-dependent information is of much more worth than a pursuit for universal speculation (Flyvbjerg, 2001). Case studies can afford generalizations when rich contextual cases are deliberately selected to assess the validity of a hypothesis (Kvale & Brinkmann, 2009). In the light of the afore-mentioned views, the case study method was employed to afford deep insight of the subject of social innovation and agricultural/woodland resource management which is under investigation and permits the making of valid generalizations.

1.6.3 Methodological Approach

The choice of either a qualitative or quantitative approach must be dictated by the substantive issue under investigation (Karpatschhof, 2007). Consequently, quantitative approaches are ideal for studying serialized phenomena (Karpatschhof, 2007), whilst qualitative techniques are appropriate for studying contextualised phenomena, where individuals are regarded as belonging to social groups (Kvale & Brinkmann, 2009). Qualitative research interviews allow subjects to communicate their perspectives, desires, and concerns in their own words (Kvale & Brinkmann, 2009). Given that the views of the study subjects on measures and interventions they have adopted and fine-tuned in response to environmental stimuli over the years to safeguard their livelihoods are vital to the research, the qualitative approach was considered suitable.

1.6.3.1 Mixed methods

Quantitative methods have been used to help overcome the challenge of biases owing to the individual interpretations of the researcher and afford the making of valid generalisations. Hence the two approaches are mixed in this study.

The *mixed methods* approach falls under the domain of *multimethodology* or *multimethod* research which employs different methods of gathering data rather than relying solely on a single method to prosecute the objectives of a study (Mingers & Brocklesby, 1997). Mixed methods, however, chiefly comprise mixed qualitative and quantitative methods. Thus a hallmark of mixed method research is its methodological pluralism (or eclecticism) which translates into better-quality research in comparison to monomethod research. Although some researchers argue against the mixing of qualitative and quantitative methods as per the *incompatibility theory*, others counter that mixed methods enables the investigator to draw on the advantages of each method and limit their individual disadvantages (Howe, 1988; Johnson & Christensen, 2014). Thus, mixed methods are an ideal approach to bridge the schism between qualitative and quantitative methods as they complement each other (Onwuegbuzie & Leech, 2005). The combination of the different data sets in mixed methodology research can be achieved by merging or converging them, linking the dual datasets with one building on another, or embedding one dataset in another such that one of the datasets supports the other (Johnson et al., 2007; Collins & Onwuegbuzie, 2014).

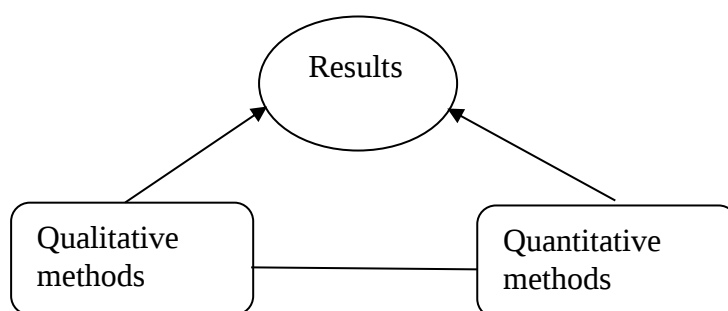


Figure 1.5. Linking the data sets in the research.

The qualitative and quantitative datasets were cross-referenced to complement one another (Fig. 1.5) and gain profound understanding of the information gathered. This was complemented with Rapid Rural Appraisal Techniques viz: personal observation, key informant interview, and group discussion to garner data. Rapid Rural Appraisal is a cross-disciplinary technique traced to the field of social anthropology and comprises a number of extractive techniques which are deemed as more efficient and cost-effective ways of learning by outsiders. It underscores the significance of local knowledge and use of dissimilar techniques to view the same information (Rennie & Singh, 1996). This is very helpful in areas where baseline data are unreliable and often scarce (FAO, 1997). Finding official published information on Mpakeni was not successful despite several attempts. This points to how scarce valid data on the study site are. Given the remoteness and paucity of information on Mpakeni, Rural Appraisal methods were found useful.

1.6.3.2 Information gathering

This refers to the various means of gathering data for the study as outlined below:

1.6.3.2.1 Literature reviews

A literature review affords a critical appraisal of the present state of scholarship on a topic of interest within a certain timeframe. Some key documents were perused to appreciate the status quo on the various thematic areas of the research. Hence, scientific articles and journals formed the main source of information in the literature review. Systematic searches on scientific databases such as Science Direct were employed to gather information on various themes. The searches were organised around specific keywords like: “*Social Innovation*”, “*Adaptive Management*”, “*Climate Change*”, “*Indigenous*”, “*Gender*”, “*Environment*” and “*Resilience*” which were paired with *Boolean operators* such as *AND* as well as *OR* . Examples of such searches include *Gender and Climate Change*, *Indigenous Systems and Resilience*, *Adaptive Management and Environment* amongst others.

1.6.3.2.2 Desktop study

This involved consulting news articles and other non-scholarly and scholarly literature which was equally relevant to the study.

1.6.3.3 Data collection

1.6.3.3.1 Field work

Secondary data were used to complement primary information that was gathered by visiting the field in the study. Thus, the case study site was visited to afford adequate interaction with some key informants and actors as a way of *participant observation*. Such interaction was necessary to appreciate the nature and extent of livelihood adaptation in the area over the years.

1.6.3.3.2 Interviews

Interviews are employed in case studies as they give special attention to a *person, situation, or institution* (Gee, 2010). Furthermore, interviews may also be used as an auxiliary method in conjunction with other methods (Kvale & Brinkmann, 2009). To guarantee data validity, several approaches to data collection were utilised; household/key informant interviews, and personal observation. Furthermore, to enhance triangulation, several households within the community were interviewed. In addition, the key informants were chosen from different stakeholder groups to afford a comprehensive overview of the subject matter. Finally, the questionnaires were prepared in such a manner that they were easily comprehensible to the respondents.

1.6.3.4 Sampling

In research, it is important that the sample size is adequate to ensure validity of the results (Kvale & Brinkmann, 2009). In light of this, a representative sample of circa 182 respondents was interviewed to ensure validity as per resource constraints of time and funds. The 182 respondents were household heads who were randomly interviewed from the various village sub-sections of Mpakeni village mostly due to availability and chance. The key informants included opinion leaders and government workers in the area who were dealing with themes related to this study.

1.6.3.5 Data interpretation

In the interview process, notes relevant to the aims of the research were made. Audio recordings of interviews were made and reflected upon later and permitted cross checking where necessary. Through a thematic content analysis, the significant themes arising from the interviews were stringed into statements à la *meaning condensation*. Meaning condensation denotes summarizing the expressions of interview subjects into brief formulations (Scollon & Scollon, 2004). Lengthy statements are condensed into brief accounts where the main idea articulated is rephrased more succinctly (Kvale & Brinkmann, 2009). The meaning condensation approach to analysis comprises five main steps: the whole interview is first assessed to gain a comprehensive overview; the *meaning units* as expressed by the interviewee in the transcript are identified by the researcher; the key thematic areas as per the meaning unit is rephrased succinctly; the meaning units are then cross-examined; finally the essential themes of the entire interview are joined to form a descriptive statement (Kvale & Brinkmann, 2009). In addition, quantitative analysis was carried out to give different perspectives of and further insights into the themes under investigation. These include the chi-square test which was used to examine significant differences between variables, regression models for assessing variables' interactions and conversion matrices for equalising values inter alia.

1.7. RESEARCH ETHICS

The genesis of ethics in research is traceable to The Belmont Report of 1979 which revolves around three basic principles (Department of Health, Education, and Welfare, 1979). These principles have been adopted across other disciplines of research and have become cardinal reference in terms of research best practices (Department of Health, Education, and Welfare, 1979). The codes of ethics as epitomised in The Belmont Report include: *Respect for person* this stipulates that the dignity of research subjects be valued. Hence respondents' informed consent was obtained prior to each interview, and the respondents were accorded due courtesy irrespective of gender or status. Moreover, they were not discriminated against in the conduct of the study. *Beneficence* demands that the researcher does not endanger the wellbeing of participants. Thus, interviews were conducted with respondents in a secure and serene atmosphere so as not to compromise their safety. The interview was done anonymously and responses were coded so that none of the respondents could be identified

and subjected to any form of harassment on the basis of the information they provided. *Justice* indicates a fair distribution of the threats and opportunities related with research. Thus, those partaking in research are entitled to also gain from it. The results of the study shall be shared with the community (including the Chief and the MTPA) and respondents accordingly. Furthermore, a *Participant Information Sheet* was addressed to potential participants detailing the research rationale as well as requirements of participants above 18 years. This was coupled with observing their right to full disclosure (telling them about the research) and non-coercion as per partaking in the study.

In contemporary times, *Respect for communities* has gained currency as a fourth principle pioneered by some bioethicists (Mack et al., 2012). This requires the researcher to respect the norms, values, customs and traditions of the subject population in research and, where plausible, shield them from harm's way as a form of social responsibility (Oates et al., 2010). Similarly, due process was followed as per community entry in accordance with local norms in the course of the study. Ultimately, this research falls under the ambit of the Human Research Ethics Committee (Non-Medical) of the University of Witwatersrand. Thus, the procedures adopted in the course of the study were in consonance with such guidelines/benchmarks, under the Wits human subjects research ethics certificate number H15/09/05.

1.8. STRUCTURE OF THE THESIS

The topography of the thesis is outlined as in Figs. 1.6 and 1.8 in order to facilitate its perusal. The structure of the thesis is outlined along the framework of a tree (Fig. 1.6). Beneath the tree are five arrows (roots) which represent the main aim and objectives as elaborated in the proceeding chapters that nourish the tree and hence provide its *raison d'être*/rationale. These aims and objectives then go through a discussion phase (chapter six) and produce the fruits (chapter findings) of the tree according to the chapter. The research chapters, addressing objectives 1–3 (Chapters 2–5), were written in the format of scientific papers ready for submission, to some selected internationally accredited scientific journals. Objective 1 is addressed in Chapters 2 and 5. Chapter 3 focuses on objective 2 whilst Chapter 4 gives insights on objective 3. The adopted approach of presenting and writing a thesis in a paper format (as per the University of Witwatersrand's requirements) has resulted in some inexorable repetition, especially vis-à-vis the introduction and methods sections. Chapter 2 was previously submitted for review at *Land Use Policy* but feedback from the journal indicated challenge with finding suitable reviewers resulting in undue delay. Hence it will be submitted to the *Journal of Peasant Studies* after some further revision. Chapters 3, 4 and 5 will also be submitted for publication. Following this introductory chapter, Chapters 2–5 each focus on specific research objectives (Figs. 1.6 & 1.7). The final chapter, Chapter 6, then integrates findings from the preceding chapters, to comprehensively expound the overall implications of the study.

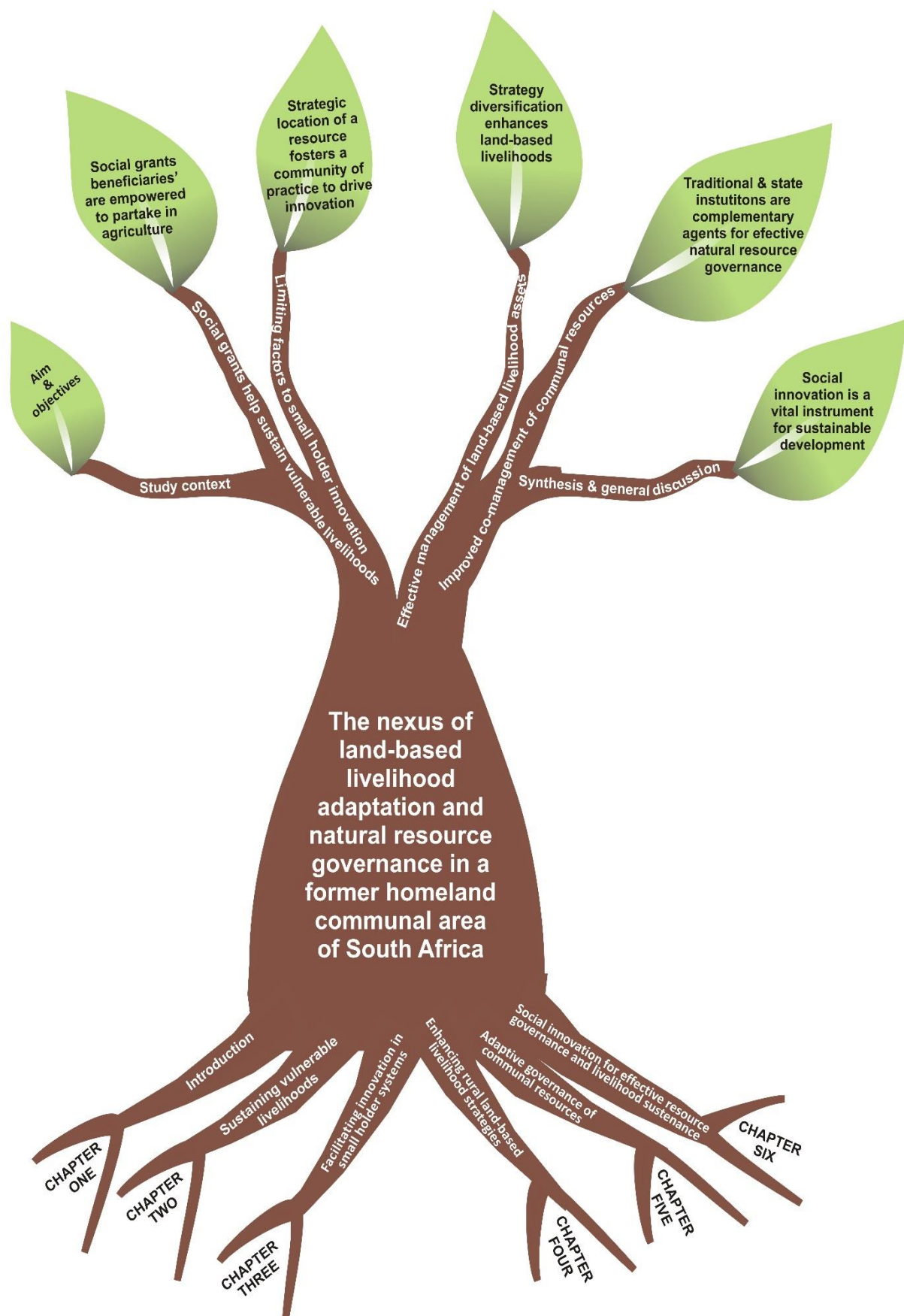


Figure 1.6. Problem tree analysis of thesis outline.

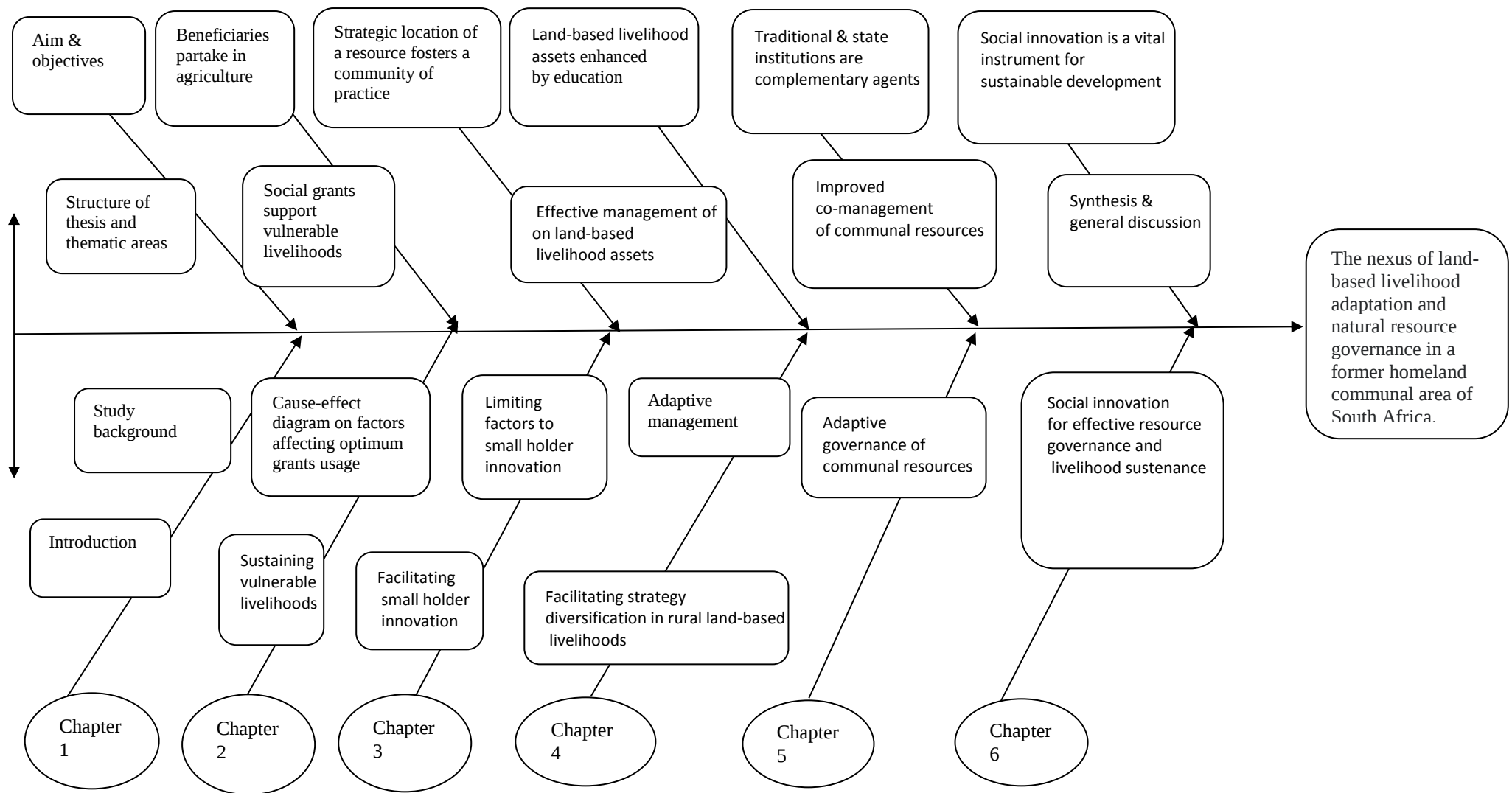


Figure 1.7. Fish bone diagram of thesis structure.

The cause-effect or fishbone diagram is used (Fig. 1.8) to hypothetically illustrate the thematic areas of the study and their culmination into the final thesis. The six bones above and beneath the axis represent the six chapters of the thesis. These chapters nourish or feed the backbone of the fish providing its structure and ultimately the thesis outcome.

1.9. REFERENCES

Abernethy, K. E., Bodin, O., Olsson, P., Hilly, Z., & Schwarz, A. (2014). Two steps forward, two steps back: The role of innovation in transforming towards community-based marine resource management in Solomon Islands. *Global Environmental Change*, 28, 309–321. <https://doi.org/10.1016/j.gloenvcha.2014.07.008>.

Acemoglu, D., Johnson, S., & Robinson, J. A. (2001). The colonial origins of comparative development: An empirical investigation. *American Economic Review*, 91 (5), 1369–1401.

Acheson, J. (2003). *Capturing the Commons: Devising Institutions to Manage the Maine Lobster Industry*. Hanover: University Press of New England.

Adger, W.N., & Vincent, K. (2005). Uncertainty in adaptive capacity. *Comptes Rendus Geoscience*, 337 (4), 399–410.

Agarwal, B. (2010). *Gender and Green Governance: The Political Economy of Women's Presence: Within and Beyond Community Forestry*. Oxford: Oxford University Press.

Agrawal, A. (2011). Effect of global warming on climate change, flora and fauna. *Journal of Ecophysiology and Occupational Health*, 11 (3–4), 161–174. <https://doi.org/10.18311/jeoh/2011/2261>.

Ajaero, C. K., & Onokala, P. C. (2013). The effects of rural-urban migration on rural communities of South-eastern Nigeria. *International Journal of Population Research*, 2013, 1–11. <https://doi.org/10.1155/2013/610193>.

Alweny, S., Nsengiyumva, P., & Gatarabirwa, W. (2014). *Africa Sustainable Mountain Development Technical Report No. 1*, ARCOS, October 2014. [http://www.fao.org/fileadmin/user_upload/mountain_partnership/docs/African%20Mountains%20Status%20Report 2014Final.pdf](http://www.fao.org/fileadmin/user_upload/mountain_partnership/docs/African%20Mountains%20Status%20Report%202014Final.pdf) accessed on 21.01.2018.

Aminrad, Z., Sayed-Zakaria, S. Z. B., & Hadi, A. S. (2011). Influence of age and level of education on environmental awareness and attitude: Case study on Iranian students in Malaysian Universities. *Social Sciences*, 6 (1), 15–19. <https://doi.org/10.3923/science.2011.15.19>.

Andersson, K. P. (2004). Who talks with whom? The role of repeated interactions in decentralized forest governance. *World Development*, 32 (2), 233–249. <http://dx.doi.org/10.1016/j>.

- Anshelm, J., & Hultman, M. (2016). *Discourses of Global Climate Change: Apocalyptic Framing and Political Antagonisms*. New York: Routledge.
- Araujo, A., Quesada-Aguilar, A., Aguilar, L., & Pearl, R. (2008). Gender equality and adaptation. *Gender*, 1–4. [https://www.gdnonline.org/resources/IUCN Factsheet Adaptation .pdf](https://www.gdnonline.org/resources/IUCN_Factsheet_Adaptation.pdf). Accessed on 12.06.2017.
- Arora-Jonsson, S. (2011). Virtue and vulnerability: Discourses on women, gender and climate change. *Global Environmental Change*, 21 (2), 744–751.
- Baland, J. M., & Platteau, J. P. (1996). *Halting degradation of natural resources: Is there a role for rural communities?* Oxford: Clarendon Press. <http://www.fao.org/docrep/x5316e/x5316e00.htm> accessed on 16.06.2015.
- Baltes, P. B. (1968). Longitudinal and cross-sectional sequences in the study of age and generation effects. *Human Development*, 11 (3), 145–171. <http://dx.doi.org/10.1159/000270604>.
- Bamberg, S. & Möser, G. (2007). Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour. *Journal of Environmental Psychology*, 27 (1), 14–25. <https://doi.org/10.1016/j.jenvp.2006.12.002>.
- Berkes, F. (1999). *Sacred Ecology: Traditional Ecological Knowledge and Resource Management*. Philadelphia: Taylor & Francis.
- Berkes, F. (2007). Community-based Conservation in a globalized world. *Proceedings of the National Academy of Sciences of the United States of America*, 104 (39), 15188–15193. <https://doi.org/10.1073/pnas.0702098104>.
- Berkes, F. (2009). Evolution of co-management: role of knowledge generation, bridging organizations and social learning. *Journal of Environmental Management*, 90, 1692–1702. <https://doi.org/10.1016/j.jenvman.2008.12.001>.
- Berkes, F., & Folke, C. (1998). *Linking Social and Ecological Systems. Management Practices and Social Mechanisms for Building Resilience*. Cambridge: Cambridge University Press.
- Berkes, F., Colding, J., & Folke, C. (2000). Rediscovery of traditional ecological knowledge as adaptive management. *Ecological Applications*, 10 (5), 1251–1262.

Berkes, F., Colding, J., & Folke, C. (2003). *Navigating Social-ecological Systems: Building Resilience for Complexity and Change*. Cambridge: Cambridge University Press.

Bluffstone, R., Dannenberg, A., Martinsson, P., Jha, P., & Bista, R. (2015). Cooperative Behavior and Common Pool Resources: Experimental Evidence from Community Forest User Groups in Nepal. Policy Research Working Paper No. 7323. <https://doi.org/10.1596/1813-9450-7323>.

Boeing, G. (2016). Visual analysis of nonlinear dynamical systems: Chaos, fractals, self-similarity and the limits of prediction. *Systems*, 4 (4), 37–54. <https://doi.org/10.3390/systems4040037>.

Boisvenue C., & Running, S. W. (2013). Controls on Provisioning Services and Forest Productivity: Responses and Risk under Changing Environmental Conditions. In: Timothy R.S., & Pielke, R. A. (Eds.). *Climate Vulnerability*, (pp. 129–149). Amsterdam: Elsevier Inc.

Borrini-Feyerabend, G. (1996). Collaborative Management of Protected Areas: Tailoring the Approach to the Context. Gland: IUCN.

Börzel, T. A., & Hamann, R. (2013). Business Contributions to Climate Change Governance: South Africa in Comparative Perspective. Houndsmill: Palgrave Macmillan, UK.

Bradshaw, S. (2010). Women, Poverty and Disasters: Exploring the Links through Hurricane Mitch in Nicaragua. In: Chant, S. (Ed.). *International Handbook of Gender and Poverty* (pp. 627–632). Cheltenham: Edward Elgar.

Braidotti, R., Charkiewicz, E., Hausler, S., & Wieringa, S. (1994). *Women, the Environment and Sustainable Development: Towards a Theoretical Synthesis*. London: Zed Books.

Brenton, M. W., Deniz, S. O., & Stephan, D. (2013). Age and environmental sustainability: a meta-analysis. *Journal of Managerial Psychology*, 28 (7/8), 826–856. <https://doi.org/10.1108/JMP-07-2013-0221>.

Bryman, A. (2012). *Social Research Methods*, Fourth Edition. Oxford: Oxford University Press.

Buckingham, S. (2010). Call in the women. *Nature*, 468 (7323), 502. <https://doi.org/10.1038/468502a>.

Burgess, J., Bedford, T., Hobson, K., Davies, G., & Harrison, C. (2003). (Un)sustainable Consumption. In: Berkhout, F., Leach, M., & Scoones, I. (Eds.). *Negotiating Environmental*

Change: New Perspectives from Social Science, (pp. 261–291). Cheltenham: Edward Elgar Publishing.

Callaghan, E. G., & Colton, J. (2008). Building sustainable & resilient communities: A balancing of community capital. *Environment, Development and Sustainability*, 10 (6), 931–942.

Campbell, B. M., Costanza, R., & van den Belt, M. (2000). Special section: Land use options in dry tropical woodland ecosystems in Zimbabwe: Introduction, overview and synthesis. *Ecological Economics*, 3 (3): 341– 351. <https://orcid.org/0000-0002-0123-4859>.

Carr, E. R. (2008). Between structure and agency: livelihoods and adaptation in Ghana's Central Region. *Global Environmental Change*, 18 (4), 689–699. <http://dx.doi.org/10.1016/j.gloenvcha.2008.06.004>.

Carstensen, L. L., Isaacowitz, D. M., & Charles, S. T. (1999). Taking time seriously: a theory of socioemotional selectivity. *American Psychologist*, 54 (3), 165–181.

Cash, D., & Moser, S. C. (2000). Linking global and local scales: Designing dynamic assessment and management processes. *Global Environmental Change*, 10 (2), 109–120. <http://dx.doi.org/10.1037/0003-066X.54.3.165>.

Chant, S. (2010). Gendered poverty across space and time: introduction and overview. Cheltenham: Edward Elgar.

Chao, S. (2012). Forest People: Numbers across the World. Moreton-in-Marsh: Forest Peoples Program. http://www.forestpeoples.org/sites/fpp/files/publication/2012/05/forest-peoples-numbers-across-world-final_0.pdf accessed on 03.04.2016.

Chibisa, P., & Rwizi, L. (2009). Traditional crafts and rural livelihoods in Manicaland's semi-arid areas: Implications for biodiversity and environmental sustainability. *Journal of Sustainable Development in Africa*, 11 (1), 16–40.

Chidumayo, E. N., & Gumbo, D. J. (2010). The Dry Forests and Woodlands of Africa: Managing for Products and Services. Washington: Earthscan.

Claassens, A. (2015). Law, land and custom, 1923-2014: What is at Stake Today? Ecosystem Based Adaptation. In: Cousins, B., & Walker, C. (Eds.). *Land Divided, Land Restored: Land Reform in South Africa for the 21st Century*, (pp. 68–84). Johannesburg: Jacana Media.

Collins, K. M. T., & Onwuegbuzie, A. J. (2014). *Toward a New Era for Conducting Mixed Analysis: the Role of Quantitative Dominant and Qualitative Dominant Crossover Mixed Analysis*. Thousand Oaks: Sage.

Correia, S. É. N., Macario De Oliveira, V., & Gomez, C. R. P. (2016). Dimensions of social innovation and the roles of organizational actors: the proposition of a framework. *Revista de Administração Mackenzie*, 17 (6), 102–133. <http://dx.doi.org/10.1590/1678-69712016/administracao.v17n6p102-133>.

Costello, A., Maslin, M., Montgomery, H., Johnson, A. M. & Ekins, P. (2011). Global health and climate change: moving from denial and catastrophic fatalism to positive Action. *Philosophical Transactions*, 369 (1942), 1866–1882. <https://doi.10.1098/rsta.2011.0007>.

Cousins, B., Walker, C. (2015). Introduction. In: Cousins, B., & Walker, C. (Eds.). *Land Divided, Land Restored: Land Reform in South Africa for the 21st Century*, (pp. 1–23). Johannesburg: Jacana Media.

Cramb, R. A., & Wills, I. R. (2010). The role of traditional institutions in rural development: Community-based land tenure and government land policy in Sarawak, Malaysia. *World Development*, 18 (3), 347–360.

Creswell, J. W. (1994). *Research design: Qualitative and quantitative approaches*. Thousand Oaks: Sage.

Creswell, J. W. (2013). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. London: SAGE Publications.

Creswell, J. W., & Clark, V.P. (2007). *Designing and Conducting Mixed Methods Research*. California: Sage Publications. <http://onlinelibrary.wiley.com/doi/10.1111/j.1753-6405.2007.00097.x/pdf>.

Crétat, J., Richard, Y., Pohl, B., Rouault, M., Reason, C., & Fauchereau, N. (2010). Recurrent daily rainfall patterns over South Africa and associated dynamics during the core of the austral summer. *International Journal of Climatology*, 32 (2), 261–273. <https://doi.org/10.1002/joc.2266>.

Cundill, G., Thondhlana, G., Sisitka, L., Shackleton, S., & Blore, M. (2013). Land claims and the pursuit of co-management on four protected areas in South Africa. *Land Use Policy*, 35, 171–178. <https://doi.org/10.1016/j.landusepol.2013.05.016>.

D'Amato, A. W, Bradford, J., Palik, B., & Fraver, S. (2011). Forest management for mitigation and adaptation to climate change mitigation: insights from long-term silviculture experiments. *Forest Ecology and Management*, 262, 803–816. <https://doi.org/10.1016/j.foreco.2011.05.014>.

Dadamouny, M. A., & Schnittler, M. (2015). Trends of climate with rapid change in Sinai, Egypt. *Journal of water and climate change*, 7 (2), 393–414. <https://doi.10.2166/wcc.2015.215>.

Dale, V. H., Brown, S., Haeuber, R. A., Hobbs, N. T., Huntly, N., Naiman, R. J., Riebsame, W. E., Turner, M.G. & Valone, T. J. (2000). Ecological principles and guidelines for managing the use of land. *Ecological Applications*, 10 (3), 639–670.

Department of Health, Education, and Welfare. (1979). The Belmont Report. https://www.hhs.gov/ohrp/sites/default/files/the-belmont-report-508c_FINAL.pdf accessed on 02.06.2015.

Dey, A., Singh, G., & Gupta, A. K. (2018). Women and climate stress: role reversal from beneficiaries to expert participants. *World Development*, 103, 336–359.

Donkor, F. K. (2013). *Viable Alternatives to Unsustainable Household Fuel Supply Sources; the Case of the West Gonja District in Ghana* (Unpublished MSc Thesis). Aalborg University Scholarly Works, Aalborg, Denmark. http://projekter.aau.dk/projekter/files/77302027/Felix_Kwabena_Donkor_SemIV_13_1_.pdf accessed on 01.06.2015.

Dunlap, R. E., & Van Liere, K. D. (1978). The 'New Environmental Paradigm': a proposed measuring instrument and preliminary results. *Journal of Environmental Education*, 9, 10–19.

Duraiappah, A. K. (2006). Millennium Ecosystem Assessment: Ecosystems and Human-wellbeing — Biodiversity Synthesis. Washington: World Resources Institute.

DWA. (2008). Joint Maputo River Basin Water Resources Study. <http://www.dwa.gov.za/maputobasinatlas/Reports/English/Report%208.2%20to%208.4%20-%20Current%20&%20Potential%20Dev%20-%20V2.0%20-%20May%20200.pdf> accessed on 03.04.2018.

Eberbach, K., Kubera, A., Okoth, L. N., & Watanabe, A. (2015). Contemporary traditional leaders a study on land and governance in South Africa. <http://www.institut-gouvernance.org/en/chapitrage/fiche-chapitrage-66.html> accessed on 09.11.2015.

ECSA. (2015). 10 Principles of Citizen Science. <https://ecsa.citizen-science.net/engage-us/10-principles-citizen-science> accessed on 04.04.2015.

Eriksen, S. E. H., & Watson, H. K. (2009). The dynamic context of southern African savannas: Investigating emerging threats and opportunities to sustainability. *Environmental Science & Policy*, 12 (1), 5–22. <https://doi.org/10.1016/j.envsci.2008.10.009>.

FAO. (1997). Rapid Rural Appraisal. In: Crawford, I. M. (Ed.). *Marketing Research and Information Systems*, (pp. 94–112). Rome: FAO. <https://betuco.be/marketing/Marketing%20research%20FAO.pdf> accessed on 06.06.2015.

FAO. (2007). Choosing a forest definition for the clean development mechanism. Forests and climate change working paper 4. <http://www.fao.org/forestry/11280-03f2112412b94f8ca5f9797c7558e9bc.pdf> accessed on 03.04.2015.

Ferrar, A. A. & Lötter, M. C. (2007). Mpumalanga Biodiversity Conservation Plan Handbook. Nelspruit: Mpumalanga Tourism & Parks Agency.

Fisher, M., Chaudhury, M., & McCusker, B. (2010). Do forests help rural households adapt to climate variability? Evidence from Southern Malawi. *World Development*, 38 (9), 1241–1250. <https://doi.org/10.1016/j.worlddev.2010.03.005>.

Fishpool, L. D. C., & Evans, M. I. (2001). Important Bird Areas in Africa and Associated Islands, Priority Sites for Conservation. Birdlife Conservation Series No.11. Cambridge: Pisces Publications.

Flyvbjerg, B. (2001). Making Social Science Matter — Why Social Inquiry Fails and How it Can Succeed Again. Cambridge: Cambridge University Press.

Folke, C., Carpenter, S., Elmqvist, T., Gunderson, L., Olsson, P., & Walker, B. (2002). Resilience and sustainable development: building adaptive capacity in a world of transformations. *Ambio*, 31 (5), 437–440. <https://doi.org/10.1579/0044-7447-31.5.437>.

Folke, C., Colding, J., & Berkes, F. (2003). Synthesis: Building Resilience and Adaptive Capacity in Social-ecological Systems. Cambridge: Cambridge University Press.

Folke, C., & Olsson, P. (2004). Adaptive comanagement for building resilience in social-ecological systems. *Environmental Management*, 34 (1), 75–90.

Foucault, M. (1977). Discipline and Punish: The Birth of the Prison. New York: Vintage Books.

Fraser, J. A., Frausin, V., Jarvis, A. (2015). An intergenerational transmission of sustainability? Ancestral habitus and food production in a traditional agro-ecosystem of the Upper Guinea Forest, West Africa. *Global Environmental Change*, 31, 226–238.

Gandiwa, E. (2011). Importance of savanna woodlands in rural livelihoods and wildlife conservation in south-eastern Zimbabwe. *Nature & Faune*, 26 (1), 60–66.

Gee, J. P. (2010). *An Introduction to Discourse Analysis: Theory and Method*, Third Edition. London: Routledge.

Gerber, J. D., Nahrath, S., Thomi, L., & Reynard, M. (2008). The role of common pool resource institutions in the implementation of Swiss natural resource management policy. *International Journal of the Commons*, 2 (2), 222–247. <http://doi.org/10.18352/ijc.44>.

Gimona, A., Poggio, L., Brown, I., & Castellazzi, M. (2012). Woodland networks in a changing climate: Threats from land use change. *Biological Conservation* 149 (1), 93–102. <https://doi.org/10.1016/j.biocon.2012.01.060>.

Google Earth. (2015). Mpakeni. <https://earth.google.com/web/@-25.48839935,31.2461489,976.402573a,5008.81207634d,35y,0h,45t,0r/data=ChYaFAoML2cvMWptY3p2Ym5mGAlgASgCKAI> accessed on 01.08.2015.

Grunderson, L. H. (2001). Managing surprising ecosystems in southern Florida. *Ecological Economics*, 37 (3), 371–378.

Grunderson, L. H., & Holling, C. S. (2001). *Understanding Transformations in Human and Natural Systems*. Washington: Island Press.

Halliday, A., & Glaser, M. (2011). A management perspective on social ecological systems: A generic system model and its application to a case study from Peru. *Human Ecology Review*, 18 (1), 1–18.

Hampson, J., Challis, W., Blundell, G., & De Rosner, C. (2002). The rock art of Bongani Mountain Lodge and its Environs, Mpumalanga province, South Africa: An Introduction to problems of Southern African rock-art regions. *The South African Archaeological Bulletin*, 57 (175), 15–30. <https://doi.org/10.2307/3889103>.

Hill, C. (2011). 'Enabling rural women's economic empowerment: institutions, opportunities and participation', *Expert group meeting on enabling rural women's economic empowerment: institutions, opportunities and participation*. University of Ghana, 20–23 September. Accra: Centre for Gender Studies and Advocacy.

- Hoffman, T. (2015). Environmental Change in Twentieth-Century South Africa and its Implications for Land Reform. In: Cousins, B., & Walker, C. (Eds.). *Land Divided, Land Restored: Land Reform in South Africa for the 21st Century*, (pp. 56–67). Johannesburg: Jacana Media.
- Honnold, J. A. (1984). Age and environmental concern some specification of effects. *The Journal of Environmental Education*, 16 (1), 4–10.
- Horgan, D., & Dimitrijević, B. (2018). Social innovation systems for building resilient communities. *Urban Science*, 2 (1), 13–29. <https://doi.org/10.3390/urbansci2010013>.
- Howe, K. R. (1988). Against the quantitative-qualitative incompatibility thesis, or, dogmas die hard. *Educational Researcher*, 17 (8), 10–16.
- Hughes, E. C. (1936). The ecological aspect of institutions. *American Sociological Review*, 1, 180–189.
- Hunter, L. M., Nawrotzki, R., Leyk, S., Maclaurin, G., Twine, W., Collinson, M., & Erasmus, B. (2013). Rural Outmigration, Natural Capital, and Livelihoods in South Africa. *Population, Space and Place*, 20 (5), 402–420.
- IISD. (2013). What is Sustainable Development? Environmental, economic and social well-being for today and tomorrow. <https://www.iisd.org/sd/> accessed on 29.07.2015.
- Imperial, M. (1999). Institutional analysis and ecosystem-based management: The institutional analysis and development framework. *Environmental Management*, 24 (4), 449–464. <https://doi.org/10.1007/s002679900246>.
- Jepperson, R. L. (1991). Institutions, Institutional Effects, and Institutionalism. In: Powell, W. W., & DiMaggio, P. J. (Eds.). *The New Institutionalism in Organizational Analysis*, (pp. 143–163). Chicago: University of Chicago Press.
- Johann, E. (2007). Traditional forest management under the influence of science and industry: The story of the alpine cultural landscapes. *Forest Ecology and Management*, 249 (1), 54–62.
- Johnson, C. Y., Bowker, J.M., & Cordell, H.K. (2004). Ethnic variation in environmental belief and behaviour: An examination of the new ecological paradigm in a social psychological context. *Environment and Behavior*, 36 (2), 157–186.

Johnson, R. B., & Christensen, L. (2014). *Educational Research: Quantitative, Qualitative and Mixed Approaches*, Fourth Edition. Thousand Oaks: SAGE.

Johnson, R. B. & Onwuegbuzie, A. J. (2004). Mixed Methods Research: A Research Paradigm Whose Time Has Come. *Educational Researcher*, 33 (7), 14–26.

Johnson, R. B., Onwuegbuzie, A. J., & Turner, L. A. (2007). Toward a definition of mixed methods research. *Journal of Mixed Methods Research*, 1 (2), 112–133.

Jump, A., & Penuelas, J. (2005). Running to stand still: Adaptation and the response of plants to rapid climate change. *Ecological Letters*, 8 (9), 1010–1020. <https://doi.org/10.1111/j.1461-0248.2005.00796.x>.

Kain, M. C. (2011). 'Role of Institutions in Rural Areas Addressing Women's Needs, With a Focus on Indigenous Women', *Expert Group Meeting on enabling rural women's economic empowerment: institutions, opportunities and participation*. University of Ghana, 20–23 September. Accra: Centre for Gender Studies and Advocacy.

Karpatschhof, B. (2007). Bringing quality and meaning to quantitative data, bringing quantitative evidence to qualitative observation. *Nordic Psychology*, 59, 191–209.

Kgosikoma, O. E., Mojeremane, W., & Harvie, B. A. (2013). Grazing management systems and their effects on savanna ecosystem dynamics: a Review. *Journal of Ecology and the Natural Environment*, 5 (6), 88–94. <https://doi.org/10.5897/JENE2013.0364>.

Kiem, S. A., & Austin, E. K. (2013.) Drought and the future of rural communities: Opportunities and challenges for climate change adaptation in regional Victoria, Australia. *Global Environmental Change*, 23 (5), 1307–1316.

Kooij, D. T. A. M., de Lange, A. H., Jansen, P. G. W., Kanfer, R., & Dijkers, J. S. E. (2011). Age and work-related motives: results of a meta-analysis. *Journal of Organizational Behavior*, 32, 197–225.

Kovach, I., (2000). LEADER, a New Social Order, and the Central- and East-European Countries. *Sociologia Ruralis*, 40 (2), 181–189. <https://doi.org/10.1111/1467-9523.00140>.

Kvale, S., & Brinkmann, S. (2009). *Interviews: Learning the Craft of Qualitative Research Interviewing*, Second Edition. London: Sage.

Langat, D. K., Maranga, E. K., Aboud, A. A., & Cheboiwo, J. K. (2016). Role of Forest Resources to Local Livelihoods: The Case of East Mau Forest Ecosystem, Kenya. *International*

Journal of Forestry Research, 2016, Article ID 4537354. <http://dx.doi.org/10.1155/2016/4537354>.

Lenoir, J., Gégout, J. C., Guisan, A., Vittoz, P., Wohlgemuth, T., Zimmermann, N. E., Dullinger, S., Pauli, H., Willner, W., & Svenning, J. C. (2010). Going against the flow: potential mechanisms for unexpected downslope range shifts in a warming climate. *Ecography*, 33 (2), 295–303. <https://doi.org/10.1111/j.1600-0587.2010.06279.x>.

Levin, K., Cashore, B., Bernstein, S. & Auld, G. (2012). Overcoming the tragedy of super wicked problems: constraining our future selves to ameliorate global climate change. *Policy Science*, 45,123–152.

Lindner, M., Maroschek, M., Netherer, S., Kremer, A., Barbati, A., Garcia-Gonzalo, J., Seidl, R., Delzon, S., Corona, P., Kolström, M., Lexer, J., & Marchetti, M. (2010). Climate change impacts, adaptive capacity, and vulnerability of European forest ecosystems. *Forest Ecology and Management*, 259, 698–709. <https://doi.org/10.1016/j.foreco.2009.09.023>.

Lorenz, E. N. (1963). Deterministic nonperiodic flow. *Journal of the Atmospheric Sciences*, 20, 130–141.

Low, A. B., & Rebelo, G. (1996). Vegetation of South Africa, Lesotho and Swaziland. Pretoria: Department of Environmental Affairs and Tourism. https://archive.org/stream/vegetationofsouth19muci/Strelitzia_19_2006_djvu.txt accessed on 03.04.2015.

Mack, N., Woodsong, C., MacQueen, K. M., Guest, G., & Namey, E. (2012). Qualitative Research Methods: A Data Collector's Field Guide. Durham: FHI 360. <http://www.fhi360.org/sites/default/files/media/documents/Qualitative%20Research%20Methods%20-%20A%20Data%20Collector%27s%20Field%20Guide.pdf> accessed on 06.06.2015.

Mantyka-Pringle, S., Visconti, P., Di Marco, M., Martin, G., Carlo, R., & Rhodes, J. R. (2015). Climate change modifies risk of global biodiversity loss due to land-cover change. *Biological Conservation*, 187,103–111.

Maplandia. (2015). Mpakeni Map — Satellite Images of Mpakeni. <http://www.maplandia.com/south-africa/mpumalanga/nsikazi/mpakeni/> accessed on 23.03.2015.

McCright, A. M. (2010). The effects of gender on climate change knowledge and concern in the American public. *Population and Environment*, 32 (1), 66–87.

Meinzen-Dick, R. (2007). Beyond Panaceas in Water Institutions. *Proceedings of the National Academy of Sciences of the United States of America*, 104, 15200–15205.

Mingers, J., & Brocklesby, J. (1997). Multimethodology: Towards a framework for mixing methodologies. *Omega*, 25 (5), 489–509.

MoEST. (2012). Mainstreaming Climate Change into Mountain Development: Proceedings of the International Conference of Mountain Countries on Climate Change. April 5–6, 2012. Kathmandu, Ministry of Environment, Science and Technology. http://idsnepal.org/wp-content/uploads/2018/09/Mainstreaming_Climate_Change_in_Mountain_Development.pdf accessed on 05.06.2016.

Mogotlane, S. M, Chauke, M. E., van Rensburg, G. H., Human, S. P., & Kganakga, C. M. (2010). A situational analysis of child-headed households in South Africa. *Curationis*. 33 (3), 24–32. <http://dx.doi.org/10.4102/curationis.v33i3.4>.

Morris, M. G., & Vankatesh, V. (2000). Age differences in technology adoption decisions: Implications for a changing work force. *Personnel Psychology*, 53 (2), 375–403.

Moss, R. H., Edmonds, J. A., Hibbard, K. A., Manning, M. R., Rose, S. K., van Vuuren D. P., Carter, T. R., Emori, S., Kainuma, M., Kram, T., Meehl, G. A., Mitchell, J. F. B., Nakicenovic, N., Riahi, K., Smith, S. J., Stouffer, R. J., Thomson, M. A., Weyant, J. P., & Wilbanks, T. J. (2010). The next generation of scenarios for climate change research and assessment. *Nature*, 463 (7282), 747–756. <https://doi.org/10.1038/nature08823>.

Mowo, J., Adimassu, Z., Masuki, K., Lyamchai, C., Tanui, J., & Catacutan, D. (2011). The Importance of Local Traditional Institutions in the Management of Natural Resources in the Highlands of Eastern Africa. Nairobi: World Agroforestry Centre. <http://dx.doi.org/10.5716/WP11085.PDF>.

Mturi, J. A. (2012). Child-headed households in South Africa: What we know and what we don't. *Development Southern Africa*, 29 (3), 506–516.

Mucina, L., & Rutherford, M. C. (2009). The Vegetation of South Africa, Lesotho and Swaziland. Pretoria: South African National Biodiversity Institute.

Mugagga, F., Buyinza, M., & Kakembo, V. (2010). Livelihood diversification strategies and soil erosion on Mount Elgon, Eastern Uganda: A socio-economic perspective. *Environmental Research Journal*, 4 (4), 272–280.

Muhumuza, M., & Balkwill, K. (2013). Factors affecting the success of conserving biodiversity in national parks: A Review of case studies from Africa. *International Journal of Biodiversity*, 2013, 1–20. Article ID 798101. <http://dx.doi.org/10.1155/2013/798101>.

Mutenje, M. J., Ortmann, G. F., & Ferrer, S. R. D. (2011). Management of non-timber forestry products extraction: Local institutions, ecological knowledge and market structure in south-eastern Zimbabwe. *Ecological Economics*, 70 (3), 454– 461.

Mutoko, M. C., Hein, L., & Shisanya, C. (2015). Tropical forest conservation versus conversion trade-offs: Insights from analysis of ecosystem services provided by Kakamega rainforest in Kenya. *Ecosystem Services*, 14, 1–11.

Mwakaje, A. G., Manyasa, M., Wawire, N., Muchai, M., Ongare, D., Mugoya, C., Masiga, C. W., & Nikundiwe, A. (2013). Community-based conservation, income governance, and poverty alleviation in Tanzania: The case of Serengeti ecosystem. *The Journal of Environment & Development*, 22 (1), 51–73. <https://doi.org/10.1177/1070496512471949>.

Nagendra, H. (2007). Drivers of reforestation in human-dominated forests. *Proceedings of the National Academy of Sciences of the United States of America*, 104(39), 15218–15223. <https://doi.org/10.1073/pnas.0702319104>.

Nawrotzki, R. J., Robson, K., Gutilla, M. J., Hunter, L. M., Twine, W., & Norlund, P. (2014). Exploring the impact of the 2008 global food crisis on food security among vulnerable households in rural South Africa. *Food Security*, 6 (2), 283–297.

Nelson, G. C., Rosegrant, M. W., Koo, J., Robertson, R., Sulser, T., Zhu, T., Ringler, C., Msangi, S., Palazzo, A., Batka, M., Magalhaes, M., Valmonte-Santos, R., Ewing, M., & Lee, D. (2009). Climate Change: Impact on Agriculture and Costs of Adaptation. Washington: IFPR. http://www.fao.org/fileadmin/user_upload/rome2007/docs/Impact_on_Agriculture_and_Costs_of_Adaptation.pdf accessed on 16.06.2015.

NEPAD. (2003). Action Plan for the Environment Initiative. [http://www.nepad.org/system/files/Environment% 20Action% 20Plan.pdf](http://www.nepad.org/system/files/Environment%20Action%20Plan.pdf) accessed on 15.06.2015.

Neves, D., & Du Toit A. (2013). Rural livelihoods in South Africa: Complexity, vulnerability and differentiation. *Journal of Agrarian Change*, 13 (1), 93–115. [https://doi.org/ 10.1111/joac.12009](https://doi.org/10.1111/joac.12009).

Onwuegbuzie, A. J., & Leech, N. L. (2005). On becoming a pragmatic researcher: The importance of combining quantitative and qualitative research methodologies. *International Journal of Social Research Methodology*, 8 (5), 375–387. <https://doi.org/10.1080/13645570500402447>.

Oosterlynck, S., Kazepov Y., & Novy, A. (2015). Local social innovation and welfare state restructuring: analysing their relationship. ImPROvE Working Paper No. 15/15. Antwerp: Herman Deleeck Centre for Social Policy.

Ostman, R. E., & Parker, J. L. (1987). Impact of education, age, newspapers, and television on environmental knowledge, concerns, and behaviors. *Journal of Environmental Education*, 19 (1), 3–9. <https://doi.org/10.1080/00958964.1987.10801954>.

Ostrom, E. (2005). *Understanding Institutional Diversity*. Princeton: Princeton University Press.

Ostrom, E. (2008). Institutions and the environment. *Economic Affairs*, 28 (3), 24–31. <https://doi.org/10.1111/j.1468-0270.2008.00840.x>.

Ostrom, E., Burger, J., Field, C. B., Norgaard, R. B., & Policansky, D., (1999). Revisiting the commons: Local lessons, global challenges. *Science*, 284 (5412), 278–282.

Oyono, P. R., Kouna, C., & Mala, W. (2005). Benefits of forests in Cameroon. Global structure, issues involving access and decision-making hiccoughs. *Forest Policy and Economics*, 7, 357–368.

Parmesan, C., & Yohe, G. (2003). A globally coherent fingerprint of climate change impacts across natural systems. https://nctc.fws.gov/courses/alc/alc3193/resources/documents/Parmesan_Yohe_2003.pdf accessed on 01.02.2018.

Parry, M., Canziani, O., Palutikof, J., Van der Linden, P., & Hanson, C. (2007). *AR4 Climate Change 2007: Impacts, Adaptation and Vulnerability*. New York: Cambridge University Press.

Phills, J. A., Deiglmeier, K., & Miller, D. T. (2008). Rediscovering social innovation. *Stanford Social Innovation Review*, 6 (4), 34–43.

Pillay, J. (2016). Problematising child-headed households: The need for children's participation in early childhood interventions. *South African Journal of Childhood Education*, 6 (1), a359. <https://doi.org/10.4102/sajce.v6i1.359>.

Platteau, J. (2004). Monitoring elite capture in community-driven development. *Development and Change*, 35 (2), 223–246.

Poggio, L., Brown, I., Alessandro, G., & Castellazzi, M. (2012). Woodland networks in a changing climate: Threats from land use change. *Biological Conservation*, 149, 93–102.

Prager, K., Nienaber, B., Neumann, B., & Phillips, A. (2015). How should rural policy be evaluated if it aims to foster community involvement in environmental management? *Journal of Rural Studies*, 37, 120–131. <https://doi.org/10.1016/j.jrurstud.2014.12.006>.

Pretty, J., & Ward, H. (2001). Social capital and the environment. *World Development*, 29 (2), 209–227.

Rahlao, S., Mantlana, B., Winkler, H. & Knowles, T. (2012). South Africa's national REDD+ initiative: Assessing the potential of the forestry sector on climate change mitigation. *Environmental Science & Policy*, 17, 24–32. <https://doi.org/10.1016/j.envsci.2011.11.013>.

Rammel, C., Stagl, S., & Wilfing, H. (2007). Managing complex adaptive systems— A co-evolutionary perspective on natural resource management. *Ecological Economics*, 63 (1), 9–21. <https://doi.org/10.1016/j.ecolecon.2006.12.014>.

Reeves, A., Lemon, M., & Cook, D. (2013). Jump-starting transition? Catalyzing grassroots action on climate change. *Energy Efficiency*, 7 (1), 115–132.

Rennie, J. K., Singh, N. C. 1996. Participatory Research for Sustainable Livelihoods: A Guidebook for Field Projects. Winnipeg: International Institute for Sustainable Development (IISD). https://www.iisd.org/sites/default/files/publications/participatory_research.pdf accessed on 23.07.2019.

Resurreccion, B. P., & Elmhirst, R. (2012). Gender and Natural Resources Management: Livelihoods, Mobility and Interventions. London: Earthscan.

Reuters. (2015). Drought-hit Southern Africa at risk of food shortage – World Food Programme. <http://in.reuters.com/article/2015/05/11/africa-crops-idINKBN 0NW1TY 20150511> accessed on 26.06.2015.

Rinkema, R. A. (2003). Environmental agreements, non-state actors, and the Kyoto Protocol: A "Third Way" for international climate action? *University of Pennsylvania Journal of International Economic Law*, 24 (3), 729–757.

Roberts, B. W., Walton, K.E, & Viechtbauer, W. (2006). Patterns of mean-level change in personality traits across the life course: a meta-analysis of longitudinal studies. *Psychological Bulletin*, 132 (1), 1–25.

Rouault, M. (2015). El Niño threatens southern Africa with yet another drought. *The Conversation*. <https://theconversation.com/el-nino-threatens-southern-africa-with-yet-another-drought-50491> accessed on 01.02.2018.

- Russo, M. V. (2001). Institutions, exchange relations and the emergence of new fields: Regulatory policies and independent power production in America, 1978-1992. *Administrative Science Quarterly*, 46 (1), 57–86. <https://doi.org/10.2307/2667125>
- Ryan, C. M., Pritchard, R., McNicol, I., Owen, M., Fisher, J. A., & Lehmann, C. (2016). Ecosystem services from southern African woodlands and their future under global change. *Philosophical Transactions of the Royal Society*, 371 (1703), 1–16. <https://doi.org/10.1098/rstb.2015.0312>.
- Sala, O. E., Chapin, F. S., & Armesto, J. J. (2000). Global biodiversity scenarios for the year 2100. *Science*, 287 (5459), 1770–1774. <https://doi.org/10.1126/science.287.5459.1770>.
- SANBI. (2007). Threatened terrestrial ecosystems for South Africa (2011): Croc Gorge Granite Mountainlands (MP 14). http://bgis.sanbi.org/ecosystems/show_ecosystem.asp?CODE=MP%2014 accessed on 25.02.2016.
- Savoia, A., Easaw, J., & McKay, A. (2010). Inequality, democracy, and institutions: A critical review of recent research. *World Development*, 38 (2), 142–154.
- Scheffer, M., Westley, F., Brock, W. A., & Holmgren, M. (2002). Dynamic Interaction of Societies and Ecosystems — Linking Theories from Ecology, Economy, and Sociology. In: Gunderson, L. H., & Holling, C. S. (Eds.). *Panarchy: Understanding Transformations in Human and Natural Systems*, (pp. 195-239). Washington D.C.: Island Press.
- Scholes, M., & Andreaea, M. O. (2000). Biogenic and phyrogenic emissions from Africa and their impact on the global atmosphere. *Ambio*, 29, 23–29.
- Scholes, R. J. (2004). Woodlands of South Africa. In: Lawes, M. J., Eeley, H. A. C., Shackleton, C. M., & Geach, B. G. S. (Eds.). *Indigenous Forests and Woodlands in South Africa: Policy, People and Practice*, (pp. 3–29). Pietermaritzburg: University of KwaZulu-Natal Press.
- Scholes, R. J., & Archer, S. R. (1997). Tree-grass interactions in savannas. *Annual Review of Ecology and Systematics* 28, 517–544.
- Scholes, R. J., & Walker, B. H. (1993). An African Savanna: Synthesis of the Nylsvley Study. Cambridge: Cambridge University Press.
- Scholz, R. W. (2011.) Environmental Literacy in Science and Society: From Knowledge to Decisions. New York: Cambridge University Press.

Schoonenboom, J., & Johnson, R. B. (2017). How to construct a mixed methods research design. *Kölner Zeitschrift für Soziologie und Sozialpsychologie*, 69 (2), 107–131. <https://doi.org/10.1007/s11577-017-0454-1>.

Scollon, R., & Scollon, S. W. (2004). *Nexus analysis: A Practical Field Guide for Mediated Discourse Analysis*. London: Routledge.

Scoones, I., Mearns, R., & Leach, M. (1999). Environmental entitlements: Dynamics and institutions in community-based natural resource management. *World Development*, 27 (2), 225–247.

Scott, W. R. (2001). *Institutions and Organisations*, Second Edition. London: Sage Publications.

Shackleton, C., & Shackleton, S. (2004). The importance of non-timber forest products in rural livelihood security and as safety nets: a review of evidence from South Africa. *South African Journal of Science*, 100 (11–12), 658–664.

Steward, F., Liff, S., Dunkelman, M., Cox, J., & Giorgi, S. (2009). Mapping the Big Green Challenge: An analysis of 355 community proposals for low carbon innovation. Brooklynhurst: Appleby. https://www.nesta.org.uk/sites/default/files/mapping_the_big_green_challenge.pdf accessed on 04.02.2016.

Swim, J. K., Vescio, K.T., Dahl, J. L., & Zawadzki, S. J. (2018). Gendered discourse about climate change policies. *Global Environmental Change*, 48, 216–225.

Tashakkori, A., & Teddlie, C. (2003). *Handbook of mixed methods in social and behavioural research*. Thousand Oaks: Sage.

Thomas, C. D., Cameron, A., & Green, R. E. (2004). Extinction risk from climate change. *Nature*, 427 (6970), 145–148.

Thondhlana, G., Shackleton, S., & Blignaut, J. (2015). Local institutions, actors, and natural resource governance in Kgalagadi Transfrontier Park and surrounds, South Africa. *Land Use Policy*, 47, 121–129.

Tinker, P. B, Ingram, J. S. I., & Struwe, S. (1996). Effects of slash-and-burn agriculture and deforestation on climate change. *Agriculture, Ecosystems & Environment*, 58 (1), 13–22.

Torgler, B., Valiñas, M. A., & Macintyre, A. (2008). Differences in preferences towards the environment: The impact of a gender, age and parental Effect. *Climate change modelling and policy*, 18, 1–40.

Turpie, J., & Visser, M. (2013). The Impact of Climate Change on South Africa's Rural Areas. Midrand: Financial and Fiscal Commission.

Twine, R., Collinson, M. A., Polzer, T. J., & Kahn, K. (2010). Evaluating access to a child-oriented poverty alleviation intervention in rural South Africa. *Scandinavian Journal of Public Health*, 35 (69), 118–127.

Twine, W. (2013). Multiple strategies for resilient livelihoods in communal areas of South Africa. *African Journal of Range & Forage Science*, 30 (1–2), 39–43.

Twine, W., & Hunter, L. M. (2011). Adult mortality and household food security in rural South Africa: Does AIDS represent a unique mortality shock? *Development Southern Africa*, 28 (4), 431–444. <https://doi.org/10.1080/0376835X.2011.605559>.

UNDP. (2018). Gender, Climate and Disaster Resilience. [Http://Www.Undp.Org/Content/Undp/En/Home/Gender-Equality/Gender--Climate-And-Disaster-Resilience.Html](http://www.undp.org/content/undp/en/home/gender-equality/gender--climate-and-disaster-resilience.html) accessed on 23.02.2018.

UNEP. (2005). Millennium Ecosystem Assessment Report — Ecosystems and Human Wellbeing a Biodiversity Synthesis. <http://www.unep.org/maweb/documents/document.354.aspx.pdf> accessed on 06.05.2015.

UNEP. (2012). Ecosystem-Based Adaptation Guidance: Moving from Principles to Practice. Nairobi: UNEP.

UNESCO & UNEP. (2003). Cultural Diversity and Biodiversity for Sustainable Development. <http://unesdoc.unesco.org/images/0013/001322/132262e.pdf> accessed on 06.04.2015. UNFCCC. (2014).

University of the West of England. (2014). Science for Environment Policy In-depth Report: Social Innovation and the Environment. Report produced for the European Commission DG Environment, February 2014. http://ec.europa.eu/environment/integration/research/newsalert/pdf/IR10_en.pdf accessed on 01.05.2015.

USEPA. (2014). Overview of Climate Change Science. <https://19january2017snapshot.epa.gov/climate-change-science/overview-climate-change-science.html> accessed on 23.03.2015.

Van den Bergh, J. M., Truffer, B., & Kallis, G. (2011). Environmental innovation and societal transitions: Introduction and overview. *Environmental Innovation and Societal Transitions*. 1 (1), 1–23. <https://doi.org/10.1016/j.eist.2011.04>.

Van Riet, W., Claassens, P., Van Rensburg, J., Van Viegen, T., & Du Plessis, L. (1997). Environmental Potential Atlas for South Africa. Pretoria: Van Schaik.

Walker, B. H., Gunderson L. H., Kinzig, A. P., Folke, C., Carpenter, S. R., & Schultz, L. (2006). A handful of heuristics and some propositions for understanding resilience in social-ecological systems. *Ecology and Society*, 11 (1), 13–28. <https://doi.org/10.5751/ES-01530-110113>.

Warrick, B. (2016). *Examining Employee Motivation, Environmental Systems, and Corporate Social Responsibility in Proenvironmental Behaviour* (Unpublished doctoral dissertation). Walden University Scholarly Works, Minneapolis, USA. <http://scholarworks.waldenu.edu/cgi/viewcontent.cgi?article=4009&context=dissertations> accessed on 01.02.2018.

Westley, F., Carpenter, S. R., Brock, W. A., Holling, C. S., & Gunderson, L. H. (2002). Why Systems of People and Nature Are Not Just Social and Ecological Systems. In: Gunderson, L. H., & Holling, C. S. (Eds.). *Panarchy: Understanding Transformations in Human and Natural Systems*, (pp. 103–119). Washington: Island Press.

World Bank. (2001). What is Sustainable Development? <http://www.worldbank.org/depweb/english/sd.html> accessed on 29.07.2015.

Yin, K.R. (2014). Case Study Research Design and Methods, Fifth Edition. Thousand Oaks: Sage.

CHAPTER 2 – Harnessing the potential of social security interventions for enhanced land-based livelihoods of the poor and vulnerable:

Social grants facilitate participation of beneficiaries in rural agriculture

Journal of Peasant Studies (In preparation).

Social grants facilitate participation of beneficiaries in rural agriculture

ABSTRACT

Agriculture and other land-based livelihood activities are important components of the rural economies of the developing world. Nonetheless, the introduction of social grants in post-apartheid South Africa is argued to be one of the most significant interventions on the rural landscape with implications for recipients' engagement in labour. A multi-method approach involving 182 household heads and 58 key informant interviews was used to investigate the impact of social grant receipt on respondents' engagement in agriculture-related activities. Some community members would be too financially compromised to invest in land-based livelihood activities. However, social grants were found to serve as enabling resources for beneficiaries' participation in agriculture. The supplementary grant income empowers the poorer members of the population to be involved in land-based livelihood activities. The poorest have been given social grants to help them survive and they are now equally able to participate in land-based livelihood activities. Thus, contrary to observations that only a third of the rural populace is able to engage in resource-intensive livestock production, over two thirds (70%) of grant beneficiaries in the study community engaged in livestock production. As the majority of farming respondents rechannel their grants to enhance their agriculture, there is a need for improved extension support. Moreover, social grants have been described as having mixed results on livelihoods; from the commonly held perception that grants promote laziness and state-dependence to increased educational enrolment. The cause-effect diagram is used to provide further insight into this phenomenon, suggesting that an individual associated with some livelihood activity is more inclined to invest into livelihood enhancement unlike someone with no livelihood activity.

Keywords: social grants, land-based livelihoods, agricultural activities, natural resources

2.1. INTRODUCTION

2.1.1 Livelihoods, Social Support Services and Productive Labour

People generally adopt diverse strategies to secure the basic necessities of life and make a living (Shackleton and Shackleton 2015). The resources and capabilities that people employ to sustain their livelihoods are often subject to diverse stresses (FAO 2013). Hence, resilience is a livelihood trait, that is influenced by adaptive capacity of the household which is a function of access to livelihood capital and the strategies employed. This is vital for communities which are adversely affected by climate-related shocks to thrive (FAO 2013). Such vulnerable rural communities have a large proportion of households for whom environmental resources form a major part of livelihood sustenance (Tibesigwa et al. 2016).

One common approach being used by governments globally to support vulnerable households is providing social grants. Moreover, the grants have implications for the sustenance of beneficiaries' livelihoods (Neves and Du Toit 2013). This chapter considers the livelihood impacts specifically related to land-based livelihoods. *Social grants* refer to the purely state-funded gratis cash transfer system tailored for the basic needs of the poor or vulnerable (Grosh et al. 2008). The South African Social Security Agency (SASSA), an agency of the Department of Social Development, is charged with the administration of grants in that country (Zembe-Mkabile 2017). These monthly grants involve over 17 million beneficiaries forming more than a quarter of the South African populace (SASSA 2012). The major grant categories include child-support, disabled and old age pensioner grants (Neves and Du Toit 2013). In 2016, the monthly grant value amounted to R 350 (USD 26.0) for child-support, whilst the disabled and old age pensioners grant each amounted to R 1,500 or USD 113 (SASSA 2016). However, as at April 2018 the grants had been increased to cover tax hikes and help adjust the values above inflation (SASSA 2018). This translates monthly into R 400 (USD 34.0) for child-support, whilst the disabled and old age pensioners grant each amounts to R 1,690 or USD 145 (SASSA 2018).

Some attribute social grants as principally having a twin function; a '*safety net*' – as it supports vulnerable livelihoods and '*springboard*' – as it serves as a catalyst for livelihood enhancement (Holzmann and Jørgensen 2000). Others elaborate the functions of a social grant to portray their protective, preventative, promotive and transformative characteristics (Devereux 2001). Social grants can be *protective* by alleviating poverty and offering a safety net for the poor. In addition, the grants as a form of social protection are deemed *preventative* as they avoid impoverishment and possible collapse of a livelihood in the aftermath of a shock (Neves et al. 2009). Furthermore, social protection is inherently *promotive* because it helps boost available capacities and resources. Ultimately, social grants serve a *transformative* purpose as they help bridge the high inequalities amongst social groups (Neves et al. 2009). Thus, given the abject poverty in certain sections of the populace, social grants are a vehicle for effectively alleviating poverty in households in the lowest income bracket.

2.1.2 Social Grants and Impact on Labour

Literature on the influence of social grants on labour engagement provides mixed results (Neves and Du Toit 2013). Whilst some indicate that the old age pension disincentivises working-age adults from active employment in the beneficiaries' households (Bertrand et al. 2003), others point to empirical evidence that pension income stimulates labour market engagement (Kingdon and Knight 2000; Keswell 2004). Furthermore, social grants aside from their merits, are argued to cause several negative impacts such as creating avenues for patronage and corruption (Zembe-Mkabile 2017), destabilising local markets as well as distorting the flow of remittances, discouraging productive labour, supplanting individual savings and increasing fertility rates inter alia (Neves et al. 2009). In South America, social grants have been observed to stimulate investment in productive physical capital as well as smallholder agriculture, amounting to more than 150% of the grant value (Sadoulet et al. 2001). Similarly in South Africa, social grants are argued to boost investments in productive assets and related activities (Neves et al. 2009). However, the influence of social grants such as its '*safety net*' and '*springboard*' role (Holzmann and Jørgensen, 2000) in beneficiaries' land-based livelihood activities has received little research focus. Ultimately, there is a dearth of evidence to substantiate such claims (Ferguson 2015). A conceptual model is developed with the cause-effect or fishbone diagram (Fig. 2.1) to hypothetically illustrate the possible influences of social grants on rural agriculture and the effects.

The three bones (human capital, safety net and investments) above and beneath the axis represent key dimensions of rural livelihoods which are influenced by social grants and contribute to the dynamics of rural agriculture (Neves and Du Toit 2013; Ferguson 2015). The circles at the bottom refer to some interacting contexts that influence the manner of use of a social grant. The "+" and "-" signs indicate the positive and negative impacts attributed to the grants.

A market is generated (Plate 2.A) on the day of social grant disbursement (5th day of each month) in the study area, as people peddle their agricultural and non-agricultural items close to the disbursement site to attract customers. As a vehicle of social protection, social grants in addition to alleviating poverty, also serve as a form of safety net upon which people fall in dire circumstances such as crop failure. Social grants equally help to temper social vices (Neves and Du Toit 2013) as well as disincentivising the theft of farm produce inter alia. Nevertheless, in kinship-based societies and subcultures such as in many rural areas, there is a marked prevalence of a reciprocal socio-economic relationship based on a dynamic network of supportive kin (Tibesigwa et al. 2016). Such reciprocal social capital relationships serve as a form of informal insurance in most parts of sub-Saharan Africa which provide mutual farm labour or provide sustenance in times of food crisis or agriculture-related shocks (Ferguson 2015; Tibesigwa et al. 2016).

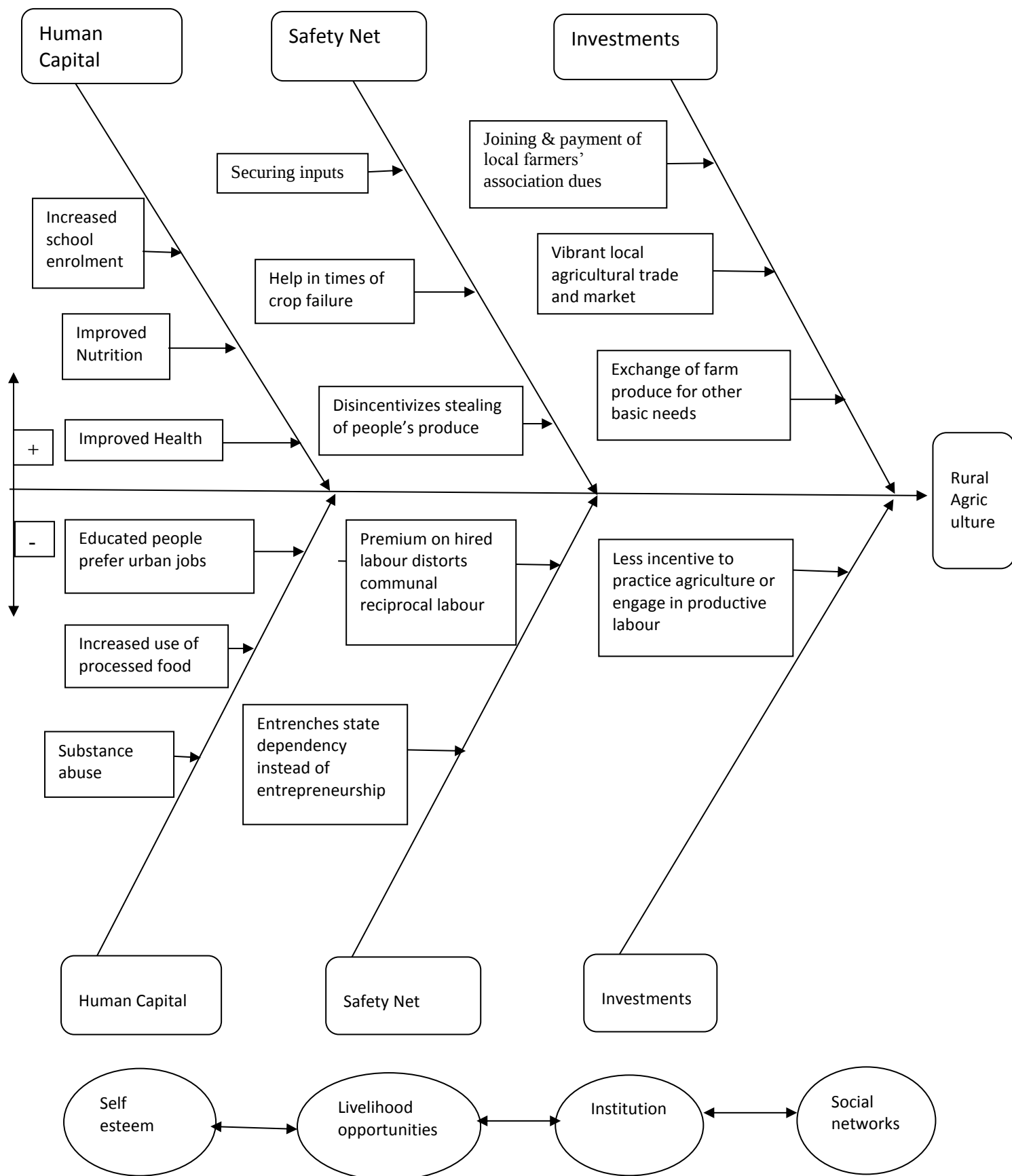


Figure 2.1. Cause-effect diagram of social grants on rural agriculture.

Social grants have also been argued to boost education in rural areas through enabling the payment of school fees and increased educational enrolment. Similar ripple effects have been observed in areas of nutrition and health, feeding into human capital development (Rosenberg et al. 2015). However, the abuse of social grants such as expenditure on substance abuse (Ferguson 2015) or misuse such as the shift to processed/refined foods instead of the locally produced foods is counterproductive due to the ensuing poor nutrition and health (Cock 2014a; Cock 2014b; Nawrotzki et al. 2014). Social grants engender potential economic benefits. This includes enabling savings and investment and stimulating the development of local markets (Neves and Du Toit 2013) such as for agriculture. On the other hand the non-contributory grants are argued to foster dependency and undermine the will to engage in productive labour (Ferguson 2015) like agriculture-related activities.



Plate 2.A. Social grant disbursement day serves as market day in the study area.

There are a number of interacting contexts that influence the positive use or abuse of a social grant. The ethnically defined Apartheid “homelands” created by the South African government in the 1950’s have been observed to bear the brunt of poverty (Noble and Wright 2013; Ferguson 2015). Moreover, the waning of unskilled job opportunities further aggravates the plight of rural dwellers due to their relatively low literacy levels (Neves and Du Toit 2013). Nevertheless, the presence of robust state and local institutions can help alleviate the plight of such people (IRR/CRA 2016) as intended by the Expanded Public Works Programme (EPWP) in the case of South Africa (Bhorat et al. 2016). Hence, the Human Development Index (HDI) highlights the critical role of institutions in harnessing the innate capacities of individuals and enhancing wellbeing (UNDP 2016). In the rural landscape for example, this includes mediating the access of individuals to critical environmental resources (Twine et al. 2003; Leach et al. 1997). Ultimately, individuals must be committed to enhancing their livelihoods (including land-based) to be able to maximize the opportunities available amidst other background factors (Scoones 2015) as demonstrated in Plate 2.A.

The Maslow's hierarchy of needs and the wider field of developmental psychology theory emphasize the importance of self-esteem for individuals' optimum career development and livelihood performance (Maslow 1943; Newman and Newman 2012). *Self-esteem* is the experience of an individual's personal self-worth and influences social functioning (Ersöğütçü and Karakaş 2016) including the use of available resources such as social grants to enhance farm productivity and provide for one's family. People with relatively low personal motivation require continuous admiration and validation from others and are less committed to a better life (Ersöğütçü and Karakaş 2016) such as enhancement in their land-based livelihoods. Such people would be more prone to abuse of a grant than reinvesting it in more productive activity (Ersöğütçü and Karakaş 2016). This is contrary to those with a better sense of self-worth who put such resources to productive uses (Scoones 2015) such as expanding their agriculture.

Social networks underpin life in kinship-based societies and subcultures (Ferguson 2015). Many members of such societies are recipients of social grants in South Africa due to the high proportions of endemic poverty in those areas (Neves and Du Toit 2013; Ferguson 2015). Individuals with strong networks who are adept at navigating and harnessing the inherent opportunities and support of such relationships are more likely to experience greater life satisfaction (Zhao et al. 2016) and less likely to fall into the negative axis due to the critical support they receive from their social capital base (Tibesigwa et al. 2016). For example such people fall on their social capital to assist with farm labour as well as support in times of livelihood shocks (Ferguson 2015). Moreover, people engaged in productive labour or who have access to supplementary *livelihood opportunities* are more likely to reinvest their resources to enhance such livelihoods than those who are not engaged in any productive labour or doing *piece jobs* (irregular employment) (Ferguson 2015). Given the positive attributes of social grants (Neves 2011; Neves and Du Toit 2013), a key rationale behind their introduction is to enhance rural livelihoods, redistribute wealth and stimulate the rural economy (Shackleton and Shackleton 2015). This includes 70% of the poorest households residing in the former homelands who rely on land directly or indirectly for sustaining their livelihood through agriculture and related activities (Turpie and Visser 2013). The influence of pro-poor interventions in reducing pressure on communal natural resources and helping to enhance livelihoods such as agriculture is demonstrated in Fig. 2.2.

Rural livelihoods are intricately entwined with environmental resources, which are impacted by climate change and degradation (Dold and Cocks 2012; Hoffman 2015). In addition, socio-economic influences (such as high unemployment and poverty) in the face of climate change have consequences for the sustainable management of natural resources (Fig. 2.2). This is more so in rural sub-Saharan Africa where resource conservation laws are often ignored so as to satisfy basic social needs (Kirkland et al. 2007). When these resources are effectively managed, it results in livelihood enhancement and wellbeing (Mowo et al. 2011). This, coupled with effective institutions and policies, helps build livelihood resilience. Pro-poor

interventions such as social grants help equalise participation for both recipients and non-recipients in agriculture (and other land-based livelihoods) and thus facilitate agricultural development. Moreover, the grants are seen as a tool for stimulating local markets and thus creating vibrant local economies (Neves and Du Toit 2013). Furthermore, they help reduce the desperation and abject poverty in targeted areas and hence the motivation to flout environmental laws to meet basic human needs. However, social grants on their own are neutral tools which when employed productively can help to further enhance a livelihood activity or disincentivise the beneficiary from his/her active labour engagement. Moreover, grants might buffer vulnerable households from irregular or declining food production resulting from climate change and environmental degradation. Similarly, in places where people exploit natural resources out of desperation, pro-poor interventions (e.g. social grants) indirectly help limit the pressure on such critical resources (Neves et al. 2009). This in addition to other policy interventions and functioning of institutions together play a role in the effective management of critical natural resource for sustainable development (Ostrom 1990; Mowo et al. 2011).

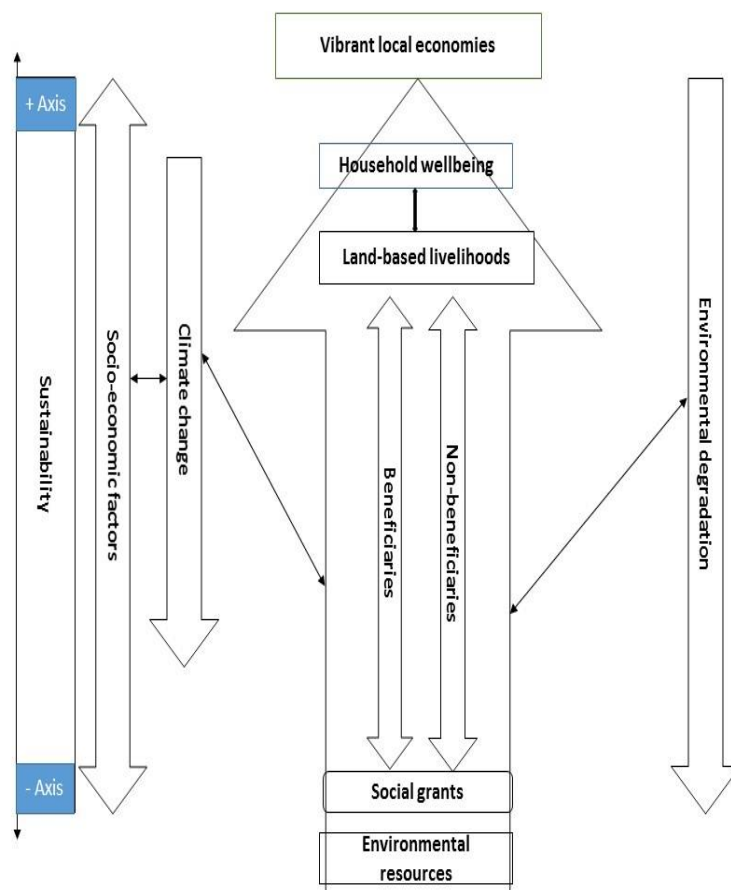


Figure 2.2. Flow diagram of thematic areas of the study.

The debate surrounding social grants, however, includes the claim that grant beneficiaries abuse the money and that social grants promote teenage pregnancies, a sense of entitlement and dependency on the state (Neves and Du Toit 2013). Consequently, there have been studies that have investigated the intended consequences of the social grant system on beneficiaries and rural livelihoods (Gutura and Tanga 2014; Rosenberg et al. 2015; Ferguson 2015). However, there is a dearth of research on the unintended consequences of social grants on land-based livelihoods, which this study addresses. Agriculture-related activities are important for the sustenance of rural livelihoods; hence understanding how factors such as social grants affect these livelihoods might help make them more secure (Sinyolo et al. 2016). Moreover, the social grants may serve as instruments of self-reliance. Therefore an appraisal of the potential unintended consequences of social grants on land-based livelihoods will provide further insight into the dynamics of rural agriculture and help authorities in tailoring measures to better address them. The study feeds into The National Development Plan (Vision 2030) which aims to eliminate poverty and reduce inequality by enhancing livelihoods to transform the rural economy. Ultimately, this chapter provides further insight on the impact of social grants on developing resilient rural livelihoods.

2.2. METHODS

2.2.1 Study Site: Mpakeni

Mpakeni village is in Mpumalanga Province in north-eastern South Africa (Fig. 2.3). The predominant populations in the area are of siSwati (Swazi) and xiTsonga (Tsonga) origin and located on the southern border of the Kruger National Park (Van Riet et al. 1997). The tributaries of the Makhomane, Luphusi and Nsikazi rivers drain the area and act as water sources (Hampson et al. 2002). The soils are characteristic of sandy loam interspersed with granite outcrops (Hampson et al. 2002). The prevalent flora has attributes of the sour lowveld bushveld or Malelane mountain bushveld whilst part of the area is categorised as a vulnerable vegetation type - *Croc Gorge Granite Mountainlands* (SANBI 2007). The area is argued to have been a hub for hunter-gatherers long ago (Hampson et al. 2002).

2.2.2 Population of Mpakeni

In the absence of reliable census data for Mpakeni, village population was determined by multiplying the number of homesteads (determined from Google Earth) by the mean number of permanent residents observed in comparable settings in the region. A homestead is the residence of a household, comprising one or more houses whilst a household is a social and economic unit of production and consumption typically exhibiting co-residency in the same homestead or compound, and having a common catering arrangement whilst mutually sharing resources (Ellis 2000). A household is also a basic unit of enumeration used by Statistical Services for Housing and Population Census. Approximately 270 homesteads were counted. A mean of six individuals per household was multiplied by the number of

homesteads counted from Google Earth to arrive at a population figure of 1,620 individuals (270×6) (Donkor et al. in preparation). A total of 182 homestead heads out of the 270 homesteads counted was interviewed to afford a representative sample.

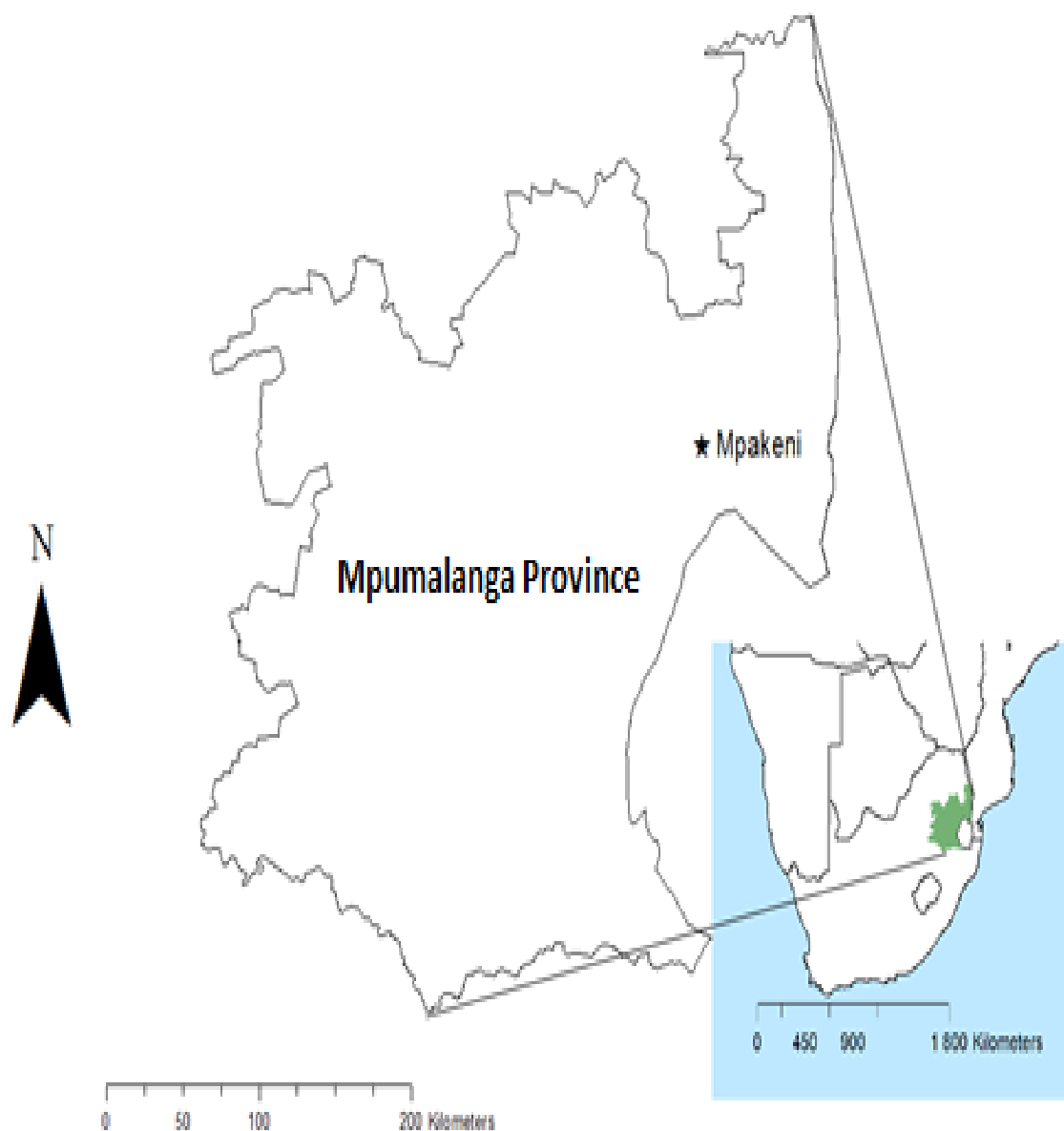


Figure 2.3. The location of the study site (Mpakeni) in the province (Mpumalanga) and South Africa.

2.2.3 Data Collection and Research Design

Ethics clearance was obtained from the University of the Witwatersrand non-medical human subjects research committee with certificate number H15/09/05. The informed consent of each interviewee was sought before they were interviewed. Data were collected during October 2015 and March/April 2016 using household interviews, Rapid Rural Appraisals (RRA), and key informant interviews. The data consisted of biographical information, perceptions on the influence of social grants on rural agriculture and livelihoods as well as trade in natural resource products. Household socio-economic data were gathered using a semi-structured questionnaire. Hence, 182 heads of households were randomly sampled from the four zones which constitute Mpakeni village in 2015 with an average of ten interviews per day depending on whether or not the household head was available. The questionnaire considered the relationship between a social grant beneficiary and involvement in productive labour particularly agriculture as well as other agricultural uses of grants, such as buying seed or fertilizer. The initial results from the questionnaires warranted further inquiry. Hence, an additional 56 semi-structured questionnaires were administered to *community members* and *key informants* in 2016 to probe further/more deeply on related issues. Key informants were people with first-hand knowledge about the themes of the study and were selected by recommendation. Community members were randomly selected without any prior criteria aside being resident in the area. The questions were informed from literature reviews and discussions. In general, qualitative techniques were predominantly employed such as the *case study* approach to investigate the study themes within their real life context (Yin 2014).

2.2.4 Data Analysis

The *mixed methods* approach falls under the domain of *multimethodology* or *multimethod* research that employs different methods of gathering data rather than relying entirely on a single method to prosecute the objectives of a study (Mingers and Brocklesby 1997; Johnson et al. 2007; Collins et al. 2012). Hence, the study is premised on a merger of qualitative and quantitative methods to enhance research quality ensuing from the different methods, perspectives and paradigms employed (Johnson and Onwuegbuzie 2004; Onwuegbuzie et al. 2011). Although some researchers argue against the mixing of qualitative and quantitative methods as per the *incompatibility theory*, others counter that mixed methods enable the investigator to draw on the advantages of each method and limit their individual disadvantages (Howe 1988; Johnson and Christensen 2014). Hence, mixed methods are an ideal approach to bridge the schism between qualitative and quantitative methods as they complement each other (Onwuegbuzie and Leech 2005; Onwuegbuzie et al. 2011). The qualitative and quantitative datasets were cross-referenced to complement one another and gain profound understanding of the information gathered. The ANOVA test was used to test if the mean number of grants differed significantly with number of household members employed.

This was complemented with data from RRA techniques such as: personal observation, and key informant interviews to garner data. Rapid Rural Appraisal is a cross-disciplinary technique traced to the field of social anthropology (USAID 1996; FAO 1997). It involves a number of exploratory techniques which are considered to be more efficient and cost-effective. Moreover, it underscores the significance of local knowledge and use of dissimilar techniques to view the same information (IISD 2015). This was very helpful in an area like Mpakeni where baseline data are not available (FAO 1997).

2.3. RESULTS

Key informants and community members answered questions pertaining to the influence of social grants on rural livelihoods (Table 2.1). These included questions on the grant value, its influence on nutrition, agriculture, and impacts on rural livelihoods in general. The responses were processed into count data to facilitate their input into the rubric of Table 2.1. Generally, key informants and community members were appreciative of the livelihood enhancing impact of social grants on their households and community.

The views of respondents (key informants and community members) was sought on the positive and negative impact of social grants on rural households (Table 2.1). In general respondents gave positive remarks on the impact of social grants on rural communities. A higher proportion of household heads and community members was on social grants compared to key informants (Table 2.2).

2.3.1 Social Grants and Rural Food Production

Amongst community members 52.9% were of the view that people are no longer growing vegetables, with the remainder opposing this view (47.1%) (Table 2.1). This is in contrast to the results of Table 2.4 as only 10 (5.5%) out of the sample 182 household heads were not involved in any form of land-based livelihood activities. The majority of community members (94%) felt that there would be mass starvation in rural areas in the absence of social grants (Table 2.1). Out of 182 household-heads, 94.5% were involved in some form of land-based livelihood activity (Table 2.3). Many respondents (39.4%) were involved in crop and livestock farming. Similar numbers of males and females were household heads whilst about 48.4% of respondents had not completed primary school (Table 2.4).

Table 2.1 Questionnaire for community members and key informants in April 2016 – Social grants and land-based livelihood activities

Frequency of answers out of 58 respondents (22 key informants and 36 community members).

Question	Key informants (n=22)		Community members (n=36)		Total (n=58)		
	Yes	No	Yes	No	Yes	No	
1. Are you on a social grant?	11	11	23	13	34	24	58
2. Some people say that without social grants there will be mass starvation in SA– do you agree?	18	2	34	1	52	3	55
3. Should the amount of money be increased?	19	2	36	0	55	2	57
4. Have people in rural areas stopped growing vegetables?	7	16	18	16	25	32	57
5. If yes, do you think it is because they get social grants?	2	5	11	5	13	10	23
6. Could there be other reasons such as no water, land dispossession by mining companies?	13	4	32	1	45	5	50
7. In your view what are the pros and cons of social grants in rural livelihoods (especially agriculture)?	21	2	35	4	56	6	56
8. In your assessment how have social grants impacted lives in Rural South Africa?	21		35		56		

NB: For questions 1–5, guardian receiving a child-support grant for a child qualifies as a “yes”. In question 7, of the key informants, 19 listed only pros, 2 listed both pros and cons and 1 person did not answer. Of the community members, 56 listed only pros and 6 listed both pros and cons. In question 8, the figure is the total number of people who gave positive answers.

Most respondents (35.6%) who partook in natural resource trade (e.g. reeds, edible herbs, wild fruits) did so to supplement income whilst most of those who do not partake in natural resource trade (26.9%) attribute not doing so to lack of information about the market in natural resource trade (Table 2.5). This result was highly significant ($p < 0.001$).

Table 2.2 Relative frequencies of respondents on social grants

Sample Category	Social grant recipient		Total	% of each group with a grant	P-value
	Yes	No			
Household head	131	51	182	72	<0.001
Community member	23	13	36	64	
Key informant	11	11	22	50	
Total	165	75	240	100	

NB: Community member refers to respondents who were not household heads at the study site at the time of the study. The results were tested with the chi-square, $\chi^2 = 17.4$. The p-value is the probability that the differences in frequency between the respondent categories is due to chance alone.

Table 2.3 Land-based livelihood activities of household heads

Agricultural activity	Receipt of social grants	
	Yes Percentage (Frequency)	No Percentage (Frequency)
Crop and livestock	39.4 (52)	36.0 (18)
Crop production	21.9 (29)	22.0 (11)
Livestock production	12.9 (17)	14.0 (7)
Crop, livestock and natural resource trade	10.6 (14)	8.0 (4)
Livestock and natural resource trade	6.8 (9)	6.0 (3)
None	5.3 (7)	6.0 (3)
Crop and natural resource trade	2.3 (3)	8.0 (4)
Natural resource trade	0.8 (1)	0.0 (0)
Total	100.0 (132)	100.0 (50)

Households with at least two persons permanently employed had the highest average number of social grants per household (Fig. 2.4). The results of the ANOVA test indicate that the mean number of grants differed significantly with number of household members employed [$F(3, 12) = 5.541$, $p\text{-value} = 0.019$].

Post hoc comparisons using the Tukey HSD test (Appendix 2.5), indicated that the mean score for the households with no one (0) employed ($M = 1.9$, $SD = 1.3$) was significantly less than those with 1 person employed ($M = 2.9$, $SD = 1.7$), $p < 0.001$. In addition, households with 2 people permanently employed ($M = 3.8$, $SD = 1.0$) had a relatively lower significant difference from those with 1 ($M = 2.9$, $SD = 1.3$), $p = 0.006$. Furthermore, households with no one (0) employed ($M = 1.9$, $SD = 1.3$), $p < 0.001$ also recorded a comparatively lower significant difference from those with 3 persons employed ($M = 2.7$, $SD = 1.5$) (Appendix 2.5). Hence, when there are few people employed in a household, the household is likely to be a social grant beneficiary.

Twenty-eight percent (28%) of households receive no grant, whilst circa 60% receive R 1, 500 or less in grants per month. In addition, the highest total grant value of R 4050 was received by 1% of the households (Table 2.6).

2.3.2 Investigating Other Factors Impacting Rural Agriculture

Community members were ambivalent as to whether social grants have caused a decline in rural agriculture such as production of vegetables (Table 2.1). Forty seven percent (47%) answered in the affirmative with 53% in the negative. Out of the community members who think people have stopped growing vegetables ($n=18$), the majority (61%) attribute this to the influence of social grants. On the other hand, most community members (89%) cited other important factors as adversely affecting rural agriculture such as soil fertility, land loss to mining or game reserves etc.

Table 2.4 Summary of socio-demographic characteristics of household heads

Gender type	Percent (Frequency)
Male	42.9 (78)
Female	52.2 (95)
Missing	4.9 (9)
Total	100.0 (182)
*Age range	
18–24	3.8 (7)
25–34	15.4 (28)
35–44	26.9 (49)
45–54	16.5 (30)
55–64	13.7 (25)
65–74	17.0 (31)
75–84	4.4 (8)
85+	1.7 (3)
Missing	0.6 (1)
Total	100.0 (182)
Educational level	
No formal education	14.3 (26)
Not completed primary school	34.1 (62)
Completed primary school	30.8 (56)
Matric	13.7 (25)
ABET (Adult basic education and training)	6.0 (11)
Missing	1.1 (2)
Total	100.0 (182)

NB. The * age range starts from 18 due to ethics requirement.

2.3.2.1 Views on the grant amount and impact on other aspects of rural livelihoods

All community members (100%) and the majority of key informants (91%) were of the view that the grant value must be increased (Table 2.1). However, amongst key informants, one person was against a blanket increase arguing for a smart way of tailoring the grants for those who need it most such as the disabled and the aged whilst curbing the child grant.

In terms of the use of social grants in agriculture, responses of grant recipients favoured labour related costs whilst the perception of non-grant recipients favours other farm services. Actual expenditure (by grant recipients) as opposed to perceived expenditure (non-recipients) was not statistically different (Table 2.7).

Table 2.5 Factors influencing participation in natural resource trade amongst household heads

Participation in natural resource trade			
Reasons	Yes (n=38) Percentage (Frequency)	Reasons	No (n=144) Percentage (Frequency)
Low household income	35.6 (21)	Lack of knowledge	26.9 (66)
Household needs	15.3 (9)	Lack of customers	21.6 (53)
Breadwinner deceased	13.6 (8)	Scarcity of natural resources	18.4 (45)
Personal needs	11.9 (7)	Lack of equipment	14.3 (35)
Pensioner died	10.2 (6)	Lack of labour	9.8 (24)
No employment in household	5.1 (3)	Enough income	9.0 (22)
Other	5.1 (3)		
Retrenchment	3.4 (2)		
Total	100.0 (59)		100.0 (245)

NB: Respondents were asked to choose options. Responses were mutually exclusive.

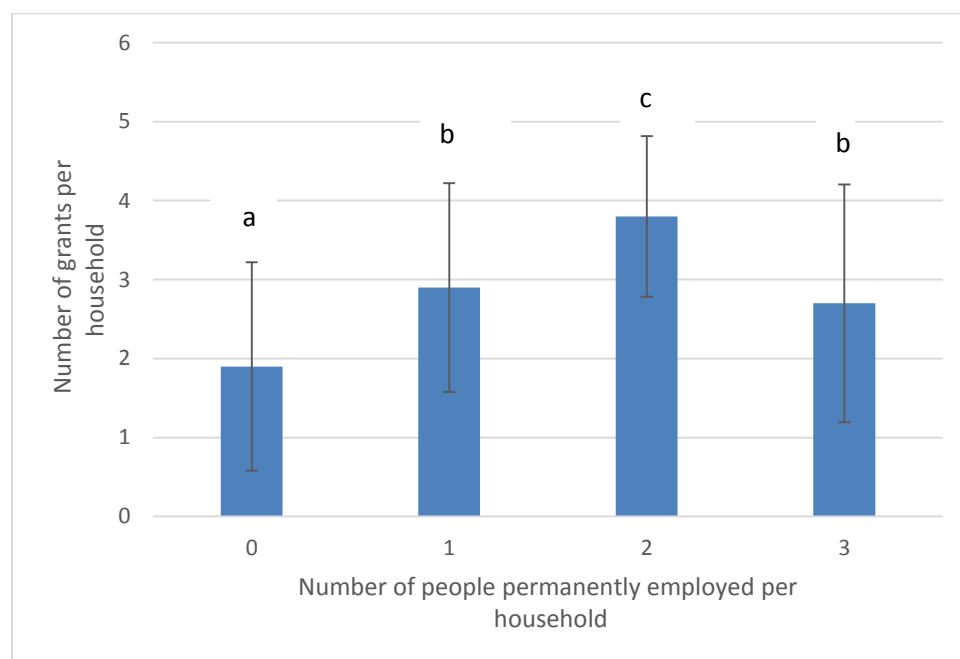


Figure 2.4. Grant receipt per household and household employment. The bars show the mean number of grants received by households and the error bars show the confidence interval at 95%. Different letters indicate a significant difference ($p < 0.05$) between the mean numbers of grants received per household (using the Tukeys post hoc test).

Table 2.6 Distribution of grant value amongst recipient households

Total value range of grant per household (ZAR)	Percent (Frequency)
0 (none)	28.0 (51)
1–500	20.9 (38)
501–1000	17.6 (32)
1001–1500	21.4 (39)
1501–2000	4.9 (9)
2001–2500	0.6 (1)
2501–3000	4.4 (8)
3001–3500	0.6 (1)
3501–4000	0.6 (1)
4001 and above	1.1 (2)
Total	100.1 (182)

Mean= 779.6703, Standard Deviation=862.765, Skewness=1.610028, Variance=744363.4

There was no statistically significant difference between what grant recipients say they spend their grant on (in terms of agriculture) and what non-grant recipients say the grant recipients spend their social grants on (Table 2.7).

Table 2.7 Relative perceptions of grant and non-grant recipients on the use of social grants in agriculture

Category	Grant recipients	Non-grant recipients	P-value
	Percentage (Frequency)		
Hiring tractor	31.3 (10)	23.5 (4)	0.86
Hiring labour	28.1 (9)	23.5 (4)	
Buying farm implements	25.0 (8)	29.4 (5)	
*Other	15.6 (5)	23.5 (4)	
Total	100.0 (32)	99.9 (17)	

The results were tested with a chi-square, $X^2 = 0.7791$. The p-value is the probability that the differences between the grant recipients and non-grant recipients in the usage of categories of agricultural services is due to chance alone. The **other* category refers to activities such as erecting fences to secure their farms, increasing their farm sizes, being in a position to exchange harvested produce for mealie meal etc. and being able to pay membership dues for agricultural/farmers association.

In addition to the influence of grants on land-based livelihoods, other aspects of rural livelihoods are also impacted (Table 2.8). There was a highly significant relationship between the impact of social grants and the diverse livelihood (Table 2.8) aspects mentioned by respondents ($\chi^2 = 602$, $p < 0.001$).

Table 2.8 Number of community members indicating that social grants were used for particular aspects of rural livelihood (other than agriculture)

Aspect of rural livelihood	Examples of indicative comments	Percentage (Frequency)	P-value
Nutrition	<i>Vulnerable groups are able to feed themselves</i>	25.6 (22)	<0.001
Safety net	<i>Reliable income source for chronically unemployed</i>	20.9 (18)	
Dependency	<i>Fosters a culture of dependency and abuse of state funds</i>	15.1 (13)	
Human capital development	<i>Payment for nappies, clothes and school fees</i>	11.6 (10)	
Household wealth	<i>New buildings have sprung up financed with grant money</i>	9.3 (8)	
Reciprocal relationships	<i>People are able to pay membership dues e.g. burial societies and farmers association</i>	8.1 (7)	
Social profile	<i>Helps deal with the stigma of abject poverty in some households</i>	4.7 (4)	
Alleviating crime	<i>Tempers the desperation that leads to crime</i>	4.7 (4)	

The results were tested with the chi-square, $\chi^2 = 602$. NB: The expected value was the global mean across the categories of livelihoods.

2.4. DISCUSSION

2.4.1 Social Grants and Participation in Agriculture

To the best of our knowledge this is the first study that specifically deals with the impact of social grants on participation in rural land-based livelihoods, especially agriculture. Results of interviews with community members and key informants indicate that the grants help beneficiaries to enhance their land-based livelihood activities and meet associated costs such as labour and inputs. Hence, the financial capital in the form of grants serves as an enabling resource for beneficiaries' participation in agriculture with ripple effects on the local market (Plate 2.A) and general rural socio-economy (Fig. 2.2). The supplementary income from the grants (Table 2.6) is facilitating engagement in capital-intensive livestock production (Table 2.3). Thus, unlike crop production which cuts across the rural social strata, ownership of livestock production is often skewed towards the rural elite (traditional leaders, government officials, business people) as only a third of the rural population is able to keep livestock (Shackleton et al. 2000; Cousins 2013) such as cattle, sheep and goats (Shackleton et al. 2000). However, more than two thirds of grant beneficiaries (70%) in the study area engaged in livestock production (Table 2.3), which could indicate that people are now accruing enough capital to venture into capital-intensive livestock production (Plates 2.B and 2.C) which

hitherto was the preserve of the rural elite who could afford such investments (Cousins 2013). It is noteworthy that once a farmer has acquired animals to start a herd (which is an outlay) there are other input costs and challenges going forward for production. This includes inadequate pasture, diseases (e.g. rinderpest) and market distortions. The initial capital outlay therefore becomes a barrier to entry which the grants help to assuage (Meltzer 1995; Khapayi and Celliers 2016).

Respondents also report reinvesting their grant money to enhance their agriculture-related activities such as fencing their farms to keep thieves or stray animals out, purchasing farm inputs and implements, as well as hiring labour (Table 2.7, Plate 2.D). This makes the need for enhanced extension and allied services urgent as the grant money is being rechanneled to meet farm needs (Table 2.7). Ultimately, social grants are invested in beneficiary households' livelihood activities, with the aim of achieving higher returns from the value addition (Tables 2.7 and 2.8). Similar results have been observed in Bolivia where the per annum *Bonosol* social pension increased food production by 165 percent over the value of the grant with parallel results in Mexico (Sadoulet et al. 2001; Neves et al. 2009). Furthermore, social grants address basic social determinants of health (Table 2.8) including food insecurity, access to health services, income and early childhood development. Research also indicates that it enhances women's agency enabling them to alleviate financial crises and gain access to reciprocal exchange networks for informal credit and swapping of food (Zembe-Mkabile 2017).



Plate 2.B. Goat grazing by livestock farmers.



Plate 2.C. Cattle being led to graze on communal land.



Plate 2.D. Picture of one of the tractors hired for farm services in Mpakeni.

2.4.2 Social Grants and Natural Resource Harvesting

The harvesting of wild natural resources for trade (Tables 2.3 and 2.5) is equally important to many rural households (Shackleton and Shackleton 2015). However, this is often driven by poverty and desperation which translates into degradation of the environment as environmental regulations are often ignored in the drive to satisfy basic human needs (Kirkland et al. 2007). Furthermore, environmental degradation leads to loss of vital ecosystem services which enhance agricultural productivity and household food security (Tibesigwa et al. 2016). Given that the study site falls in an area with high incidence of poverty (Tables 2.1 and 2.2) and unemployment (IRR/CRA 2016), the lack of any significant difference

between beneficiaries and non-beneficiaries in harvesting communal natural resources (Appendix 2.3) may be attributed to the supplementary income (Table 2.6) alleviating the pressure to harvest such resources. Thus, it might be possible that the grants in helping satisfy some of the basic needs of beneficiaries help temper the desperation that results in over harvesting of wild natural resources and hence environmental degradation.

This scenario could be as a result of shift from gathering wild resources to people growing their produce; an effective mediation of natural resource use by the relevant institutions or purchase of the requisite resources from a different area. In the course of the study, it was also observed that the area is supplied with fodder for livestock (Plate 2.E) by the Department of Agriculture, although many complained that the supply is irregular and inadequate. This was complemented with some other items (e.g. salt lick, chicken feed, fertilizer) sourced from Venda (Limpopo province) by the local farmers association.



Plate 2.E. A bale of grass for feeding livestock supplied by the Department of Agriculture. Note the bale of grass in the background behind the farmer.

2.4.3 Grants and Social Vices

Although some respondents point to the negative influences of social grants (Section 2.3.2, Table 2.8) the provision of social grants is argued to discourage adolescents from '*risky behaviours*' with regards to the HIV prevalence rate (Ferguson 2015). Furthermore, the monetary assistance is deemed to make teenage girls especially less vulnerable and less prone to exchanging sexual favours for monetary gains (Ferguson 2015; Rosenberg et al. 2015). Although social grants are blamed for escalating levels of substance abuse in the former homelands it is argued that the largest item that consumes grant money is food (Table 2.8) and not alcohol or illicit substances (D. personal communication, 20 May, 2016). Moreover, the grants help temper the desperation amongst the unemployed youth that leads to stealing and other vices (Fig. 2.1, Table 2.8). The stealing of farm produce and livestock frustrates

farmers' efforts towards productivity and is a disincentive to invest further in land-based livelihoods (Tables 2.3 and 2.5) such as agriculture. Ultimately, the social cost of addressing the challenges of HIV and drug addiction inter alia would compete with agriculture for scarce state capital. Thus, social grants, through helping mitigate such social problems, indirectly make more resources available in the state coffers as it changes how the resources can be spent.

2.4.4 Increasing the Social Grants Value and Imposition of Conditionalities

The increase in grant value in April 2018 in comparison to April 2017 is a welcome development in light of calls by the majority of respondents for an increase (Section 2.3.2.1). Grant holders and key informants both indicated that an upward adjustment of the social grant values above the inflation rate will make a difference to household wellbeing (Section 2.3.2.1, Table 2.8). This is because people have said that the grant value is meagre (Unpublished data, D. Neves, personal communication, 20 May, 2016). Moreover, it is argued that the child-support grant, for example, is insufficient to satisfy the most basic needs of its recipients (like adequate nutrition), although there is a general consensus that it is indispensable to millions of households nationwide (Zembe-Mkabile 2017). An examination of the child-grant values between 2017 (R 350) and 2018 (R 400), indicates that the difference of R 50 translates into circa 7.1% which is the inflation rate for the period under review (Inflation.eu, 2018). Thus, although the grant increased in numerical value, the increase was minimal (Inflation.eu 2018). Moreover, given that the grants are being utilised appropriately such as being invested in nutrition and education (Table 2.8), calls for an increase in the grant value are justified. The expenditure on children's education feeds into the Department of Basic Education's vision of ensuring that all children have unhindered access to lifelong learning, education and training opportunities (Department of Basic Education 2018). In addition, education and nutrition all contribute to the attainment of key dimensions of human development as per the Human Development Index (HDI) and promote a decent standard of living for citizens as envisioned in the country's Vision 2030 to enhance quality of life and develop a peaceful, prosperous and democratic South Africa (National Planning Commission 2015; UNDP 2016). Furthermore, the social cost of malnutrition inter alia is incalculable in the context of sustainable development (National Planning Commission 2015; UNDP 2016). Ultimately, the importance of developing the country's critical human resources from the formative stages, as well as safeguarding the wellbeing of its vulnerable populace (Table 2.8) cannot be overemphasised (National Planning Commission 2015; DEA 2018).

Currently, social grants fall below four percent of South Africa's GDP, but within the bracket for a developing country and cannot be increased indefinitely as they have to be within what the country's economy can afford (Neves et al. 2009; Rossouw 2017). However, the social grant system is purely state-funded (Ferguson 2015). This is one of the reasons informing the argument against a blanket increase in grants and rather finding a smarter approach, where

the grants are tailored for those who need it most and adds value to the economy (Section 2.3.1, Table 2.8). Thus, even though over 91% of respondents want the grant value increased (Section 2.3.2), the investment in social grants is disproportionate to South Africa's relatively small tax base given the asymmetry of five million taxpayers and 15 million beneficiaries of grants (D. Neves, personal communication, 20 May, 2016). Moreover, it would be helpful if agricultural extension services for rural smallholders were improved so the grants are not used to acquire extension-related services in the quest for enhanced agricultural productivity. Furthermore, claims of institutional mismanagement of the grant system and exploitation of the beneficiaries, needs to be addressed to enhance its cost effectiveness given its profound effect on households and their livelihoods (Zembe-Mkabile 2017).

2.5. CONCLUSION

Social grants empower beneficiaries to partake in land-based livelihoods such as agriculture and have additional positive spin-off such as improved rural quality of life and stimulation of the rural economy. Social grants also serve as an enabling resource for beneficiaries' participation in agriculture. Some community members are too financially compromised to invest in land-based livelihood activities. The supplementary capital empowers more of the poorer members of the population to be involved in land-based livelihood activities. Hence, when grant recipients are associated with some form of livelihood activity, the impact of the grant is significantly enhanced. Consequently, contrary to observations that a minute third of the rural populace is able to engage in resource intensive livestock production, over two thirds (70%) of grant beneficiaries engaged in livestock production. Therefore, the poorest have been given social grants to help them survive and are now equally able to participate in land-based livelihood activities. Ultimately, social grants also help alleviate social vices as well as the stealing of farm produce which is counterproductive to the overall goal of agricultural productivity. Improving the provision of extension services will complement and enhance the impact of the grant in agricultural productivity. Social innovation is not limited to the welfare or non-profit sector but can be facilitated by market incentives and related dynamics. The social grants are helping develop the critical human resources of vulnerable communities through the meeting of nutritional needs and facilitating educational enrolment. This will help improve the literacy rate and skills base in such areas to drive the needed sustainable rural development.

2.6. REFERENCES

- Bertrand, M., D. Mullainathan., and S. Miller. 2003. Public policy and extended families: Evidence from pensions in South Africa. *The World Bank Economic Review* 17 (1): 27–50.
- Bhorat, H., K. Naidoo., and K. Pillay. 2016. South Africa’s civil servants are the country’s new labour elite. *The Conversation*. <https://theconversation.com/south-africas-civil-servants-are-the-countrys-new-labour-elite-54269> accessed on 03.06.2016.
- Cock, J. 2014a. The political economy of food in South Africa. *Amandla* 37 (38): 50–53.
- Cock, J. 2014b. Inequality, consumption and some damaging conceptions of the ‘modern’ in contemporary South Africa. *Rethinking Development and Inequality* 3: 111–122.
- Collins, K. M. T., A. J. Onwuegbuzie., and R. B. Johnson. 2012. Securing a place at the table: A review and extension of legitimization criteria for the conduct of mixed research. *American Behavioural Scientist* 56: 849–865. <https://doi.org/10.1177/0002764211433799>.
- Cousins, B. 2013. Smallholder irrigation schemes, agrarian reform and ‘accumulation from above and from below’ in South Africa. *Journal of Agrarian Change* 13 (1): 116–139.
- DEA. 2018. National Framework for Sustainable Development. <https://www.environment.gov.za/documents/strategicdocuments/nfsd> accessed on 23.04.2018.
- Department of Basic Education. 2018. About Basic Education. <https://www.education.gov.za/AboutUs/AboutDBE.aspx> accessed on 23.04.2018.
- Devereux, S. 2001. Livelihood insecurity and social protection: A re-emerging issue in rural development. *Development Policy Review* 19 (4): 507–519.
- Dold, T., and M. Cocks. 2012. *Voices from the Forest: Celebrating Nature and Culture in the Xhosaland*. Auckland Park: Jacana Media, pp. 236.
- Donkor, F. K., K. Balkwill., and W. Twine. (In preparation). Dynamics of effective natural resource governance in transitional social contexts: Evidence from traditional versus state institutions in a rural co-management framework.
- Ellis, F. 2000. *Rural Livelihoods and Diversity in Developing Countries*. Oxford: Oxford University Press, pp. 296.

Ersöğütçü, F., and S. A. Karakaş. 2016. Social functioning and self-esteem of substance abuse patients. *Archives of Psychiatric Nursing* 30 (5): 587–592. <https://doi.org/10.1016/j.apnu.2016.03.007>.

FAO. 1997. Rapid Rural Appraisal. In: *Marketing Research and Information Systems*. Rome: FAO, 94–112.

FAO. 2013. Resilient Livelihoods: Disaster Risk Reduction for Food and Nutrition Security. Rome: FAO, pp. 108. <http://www.fao.org/3/a-i3270e.pdf> accessed on 02.02.2017.

Ferguson, J. 2015. Give a Man a Fish: Reflections on the New Politics of Distribution. Durham: Duke University Press, pp. 280.

Grosh, M., C. Del Ninno., E. Tesliuc., and A. Ouerghi. 2008. For protection and promotion: The design and implementation of effective safety nets. Washington: The World Bank, pp. 612.

Gutura, P., and P. T. Tanga. 2014. The intended consequences of the social assistance grants in South Africa. *Mediterranean Journal of Social Sciences* 5 (2): 1–12. <https://doi.org/10.5901/mjss.2014.v5n2p659>.

Hampson, J., W. Challis., G. Blundell., and C. De Rosner. 2002. The rock art of Bongani Mountain Lodge and its environs, Mpumalanga province, South Africa: An introduction to problems of Southern African rock-art regions. *The South African Archaeological Bulletin* 57 (175): 15–30.

Hoffman, M. T. 2015. Environmental Change in Twentieth-Century South Africa and its Implications for Land Reform, in Cousins, B., Walker, C. (Eds.) *Land Divided, Land Restored: Land Reform in South Africa for the 21st Century*. Johannesburg, Jacana Media, pp. 56–67.

Holzmann, R., and S. Jørgensen. 2000. Social risk management: A new conceptual framework for social protection, and beyond. Social Protection Discussion Paper No. 0006. Washington: The World Bank, pp. 31.

Howe, K. R. 1988. Against the quantitative-qualitative incompatibility thesis or dogmas diehard. *Educational Researcher* 17 (8): 10–16.

IISD. 2015. Rapid Rural Appraisal. <https://www.iisd.org/casl/CASLGuide/RapidRuralAppraisal.htm> accessed on 16.06.2015.

- Inflation.eu. 2018. Inflation South Africa 2017. <http://www.inflation.eu/inflation-rates/south-africa/historic-inflation/cpi-inflation-south-africa-2017.aspx> accessed on 23.04.2018.
- IRR/CRA. 2016. Fast Check: All politics is local from Cape to Capricorn. No5/2016/May 2016/Issue 297. <https://irr.org.za/reports-and-publications/fast-facts/fast-facts-2016/all-politics-is-local-from-cape-to-capricorn-2013-may-2016/> lead Image /image view full screen accessed on 01.03.2016.
- Johnson, R. B., and A. J. Onwuegbuzie. 2004. Mixed methods research: A research paradigm whose time has come. *Educational Researcher* 33 (7): 14–26. <https://doi.org/10.3102/0013189X033007014>.
- Johnson, R. B., A. J. Onwuegbuzie., and L. A. Turner. 2007. Toward a definition mixed methods research. *Journal of Mixed Methods Research* 1 (2):112–133. <https://doi.org/10.1177/1558689806298224>.
- Johnson, R. B., and L. Christensen. 2014. Educational Research: Quantitative, Qualitative and Mixed Approaches (4th ed.). Thousand Oaks, SAGE, pp. 621.
- Keswell, M. 2004. Non-linear earning dynamics in post-apartheid South Africa. *South African Journal of Economics* 72 (5): 913–939.
- Khapayi, M., and P. R. Celliers. 2016. Factors limiting and preventing emerging farmers to progress to commercial agricultural farming in the King William's Town area of the Eastern Cape Province, South Africa. *South African Journal of Agricultural Extension* 44 (1): 1–17. <http://dx.doi.org/10.17159/2413-3221/2016/v44n1a374>.
- Kingdon, G. G., and J. Knight. 2000. Unemployment in South Africa: The nature of the beast. *World Development* 32 (3): 391–408.
- Kirkland, T., L. M. Hunter., and W. Twine. 2007. “The bush is no more”: Insights on institutional change and natural resource availability in rural South Africa. *Society and Natural Resources* 20 (4): 337–350. <https://doi.org/10.1080/08941920601161353>.
- Leach, M., R. Mearns., and I. Scoones. 1997. Environmental Entitlements a Framework for Understanding the Institutional Dynamics of Environmental Change. IDS Discussion Paper 359. Brighton, IDS, pp. 38.
- Maslow, A. H. 1943. A theory of human motivation. *Psychological Review* 50 (4): 370–396. <http://dx.doi.org/10.1037/h0054346>.

Meltzer, M. I. 1995. Livestock in Africa: The economics of ownership and production, and the potential for improvement. *Agriculture and Human Values* 12 (2): 4–18. <https://doi.org/10.1007/BF02217292>.

Mingers, J., and J. Brocklesby. 1997. Multimethodology: Towards a framework for mixing methodologies. *Omega* 25 (5): 489–509. [https://doi.org/10.1016/S0305-0483\(97\)00018-2](https://doi.org/10.1016/S0305-0483(97)00018-2).

Mowo, J., Z. Adimassu., K. Masuki., C. Lyamchai., J. Tanui., and D. Catacutan. 2011. The Importance of Local Traditional Institutions in the Management of Natural Resources in the Highlands of Eastern Africa. Working Paper No 134. Nairobi, World Agroforestry Centre, pp. 27. <http://dx.doi.org/10.5716/WP11085.PDF>.

Nawrotzki, R. J., K. Robson., M. J. Gutilla., L. M. Hunter., W. Twine., and P. Norlund. 2014. Exploring the impact of the 2008 global food crisis on food security among vulnerable households in rural South Africa. *Food Security* 6 (2): 283–297.

National Planning Commission. 2015. National Development Plan 2030. Our future — make it work. https://nationalplanningcommission.files.wordpress.com/2015/02/ndp-2030-our-future-make-it-work_0.pdf accessed on 23.04.2018.

Neves, D. 2011. Critics of SA's social grant system lack hard evidence. Independent Online. <https://www.iol.co.za/business-report/economy/critics-of-sas-social-grant-system-lack-hard-evidence-1107216> accessed 04.05.2016.

Neves, D., and A. Du Toit. 2013. Rural livelihoods in South Africa: Complexity, vulnerability and differentiation. *Journal of Agrarian Change* 13 (1): 93–115.

Neves, D., M. Sampson., I. van Niekerk., S. Hlatshwayo., and A. du Toit. 2009. The use and effectiveness of social grants in South Africa. Research Report to the FinMark Trust. Cape Town, Institute for Poverty, Land and Agrarian Studies (PLAAS) and Economic Policy Research Institute (EPRI). www.finmarktrust.org.za/.../getfile.aspx?...%20The%20use%20and%20effectiveness%20of%20social%20grants%20in accessed 04.05.2016.

Newman, B. M., and P. R. Newman. 2012. Development Through Life: A Psychosocial Approach (11th ed.). Belmont: Wadsworth/Cengage Learning, pp. 768.

Noble, M., and G. Wright. 2012. Using indicators of multiple deprivations to demonstrate the spatial legacy of apartheid in South Africa'. *Social Indicators Research* 112 (1): 187–201.

Onwuegbuzie, A. J., and N. L. Leech. 2005. On becoming a pragmatic researcher: The importance of combining quantitative and qualitative research methodologies. *International*

Journal of Social Research Methodology 8 (5): 375–387. <https://doi.org/10.1080/13645570500402447>.

Onwuegbuzie, A. J., L. N. Leech., and K. M. T. Collins. 2011. 'Toward a New Era for Conducting Mixed analysis: The Role of Quantitative Dominant and Qualitative Dominant Crossover Mixed Analysis', in Williams, M., W. P. Vogt (Eds.) *The SAGE Handbook of Innovation in Social Research Methods*. London, SAGE Publications, pp. 353–384.

Ostrom, E. 1990. *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge: Cambridge University Press, pp. 280.

Rosenberg, M., A. Pettifor., N. Nguyen., D. Westreich., J. Bor., T. Bärnighausen., P. Mee., R. Twine., S. Tollman., and K. Kahn. 2015. Relationship between receipt of a social protection grant for a child and second pregnancy rates among South African women: A cohort study. *PLoS ONE* 10 (9): e0137352. <https://doi.org/10.1371/journal.pone.0137352>.

Rossouw, J. 2017. Why social grants matter in South Africa: they support 33% of the nation. *The Conversation*. <https://theconversation.com/why-social-grants-matter-in-south-africa-they-support-33-of-the-nation-73087> accessed on 02.04.2017.

Sadoulet, E., A. de Janvry., and B. Davis. 2001. Cash transfer programs with income multipliers: PROCAMPO in Mexico. *World Development* 29 (6):1043–1056.

SANBI. 2007. Threatened terrestrial ecosystems for South Africa: Croc Gorge Granite Mountainlands (MP 14). <http://bgis.sanbi.org/ecosystems/showecosystem.asp?CODE=MP%2014> accessed on 25.02.2016.

SASSA. 2012. Fact Sheet: South African Social Security Agency. <http://www.sassa.gov.za/Portals/1/Documents/815477a6-9e37-4590-a785-7b934f045e52.pdf> accessed on 14.06.2012.

SASSA. 2016. You and Your Grants 2016/17. www.sassa.gov.za/index.php/knowledge-centre/grant-booklets?Download...grants... accessed on 04.09.2016.

SASSA. 2018. SASSA Statement on Social Grant Payments for April 2018 <http://www.sassa.gov.za/index.php?limitstart=0> accessed on 03.04.2018.

Scoones, I. 2015. *Sustainable Livelihoods and Rural Development*. Rugby-Warwickshire: Practical Action Publishing, pp. 168.

Shackleton, S. E., and C. M. Shackleton. 2015. 'Not Just Farming: Natural Resources and Livelihoods in Land and Agrarian Reform' in Cousins, B., Walker, C. (Eds.) *Land Divided, Land Restored: Land Reform in South Africa for the 21st Century*. Jacana Media, Johannesburg, pp. 191–205.

Shackleton, S. E., C. M. Shackleton., and B. Cousins. 2000. 'The Economic Value of Land and Natural Resources to Rural Livelihoods: Case Studies from South Africa' in Cousins, B. (Ed.) *At the Crossroads: Land and Agrarian Reform in South Africa into the 21st Century*. Programme for Land and Agrarian Studies, Cape Town, pp. 198–210.

Sinyolo, S., M. Mudhara., and E. Wale. 2016. To what extent does dependence on social grants affect smallholder farmers' incentives to farm? Evidence from KwaZulu-Natal, South Africa. *African Journal of Agricultural and Resource Economics* 11 (2): 154–165.

Tibesigwa, B., M. Visser., M. Collinson., and W. Twine. 2016. Investigating the sensitivity of household food security to agriculture-related shocks and the implications of informal social capital and natural resource capital. *Sustainability Science* 11 (2): 193–214.

Turpie, J., and M. Visser. 2013. 'The Impact of Climate Change on South Africa's Rural Areas' in *Technical Report Submission for the 2013/14 Division of Revenue — For an Equitable Sharing of National Revenue*. Midrand, Financial and Fiscal Commission, pp. 127–220.

Twine, W., D. Moshe., T. Netshiluvhi., and V. Siphugu. 2003. Consumption and direct-use values of savanna bio-resources used by rural households in Mametja, a semi-arid area of Limpopo province, South Africa. *South African Journal of Science* 99: 467–473.

UNDP. 2016. Human Development Index (HDI).

<http://hdr.undp.org/en/content/human-development-index-hdi> accessed on 04.05.2016.

USAID. 1996. Performance Monitoring and Evaluation Tips: Conducting a Key Informant Interview. https://pdf.usaid.gov/pdf_docs/PNABS541.pdf accessed on 20-12-2012.

Van Riet, W., P. Claassen., J. Van Rensburg., T. Van Viegen., and L. Du Plessis. 1997. Environmental Potential Atlas for South Africa. Pretoria: Van Schaik, pp. 60.

Yin, R. K. 2014. Case Study Research Design and Methods (5th ed.). Thousand Oaks, Sage Publications, pp. 282.

Zembe-Mkabile, W. 2017. South Africa's social grants system: There's more than just money at stake. The Conversation. <https://theconversation.com/south-africas-social-grants-system-theres-more-than-just-money-at-stake-74376> accessed on 02.04.2017.

Zhao, J., Y. Wang., and F. Kong. 2016. Exploring the mediation effect of social support and self-esteem on the relationship between humor style and life satisfaction in Chinese college students. *Personality and Individual Differences* 64: 126–130.

2.7. APPENDICES.

A. QUESTIONNAIRE

From the household survey in 2015

Section A. Biographical Data

1. Gender

1. Male

2. Female

2. Age Range

1. 18-24

2. 25-34

3. 35-44

4.

45-54

5. 55-64

6. 65-74

7. 75-84

8. 85 or over

3. What is your highest qualification?

1. No formal qualifications

2. Matric

3. Vocational

4. Degree or equivalent

5. Postgraduate

6. Other (*please write in:* _____)"

B) Social Grant type and household dynamics

4) How many people live in this household permanently?

.....

5) How many people in this household permanently employed?

.....

6) Are you on social grant?

1) Yes

2) No

7) Type of social grant (if yes) (NB: 1) Yes 2) No

a) Child b) Old age c) Pension d) Disability e) N/A

8) Total number of social grants per household

.....

9) Total value of social grant for the household?

.....

NB: (Grant for Older Persons R1, 500 per month, Disability Grant R1, 500 per month, Child-support Grant R350 per month).

Section C Social Grant and Crop Production

10) Did this household plant any crops in the last 12 months?

1) Yes 2) No

11) How many fields outside of the homestead yard are owned or used by the household?

.....

C) Social Grant Livestock farming/ Animal rearing

12. Are you involved in farming the following?

1) Yes 2) No

13. If yes which of these are you involved in?

	Livestock category	does household own any (yes, no)	Number
a	Cattle		
b	Donkey		
c	Sheep		
d	Goats		
e	Pigs		
f	Chicken		

Section D Social Grant and Natural Resource Use

14) Is this household involved in natural resource trade?

1) Yes 2) No

15) If yes why? NB: 1) Applicable 2) Not applicable

1. The household income is not enough
2. Nobody in the household is employed
3. A household member was retrenched
4. The breadwinner has passed away
5. A pensioner has passed away
6. The person selling the resource needed to pay for something for the household
7. The person selling the resource wanted to pay for something for themselves
8. Other...
9. Don't know

16) If no, why not? 1) Applicable 2) Not applicable

1. Did not need extra money
2. Nobody in the household knows how to make or sell natural products
3. There are not enough natural resources around this village
4. This household does not have the equipment or vehicle which is needed
5. There are not enough people in this household to help collect and sell natural products
6. Nobody wants to buy natural products around here
7. Other...
8. Don't know

CHAPTER 3 – Facilitating innovation in smallholder systems:

Strategic location of a resource coincidentally nurtures a community of practice to stimulate innovation

Global Environmental Change (In preparation).

Strategic location of a resource coincidentally nurtures a community of practice to stimulate innovation

ABSTRACT

Climate change forecasts indicate grave consequences for land-based livelihoods in sub-Saharan Africa. This scenario has foregrounded the case for enhanced innovation to improve resilience and productivity in food systems. This is even more exigent for the smallholder systems which comprise 90% of Africa's agriculture and are vital for alleviating food insecurity. This study uses a multi-method approach involving 150 farmers to investigate factors affecting mitigation strategy uptake in smallholder systems and the implications for food security. The strategic location of an area such as hosting vital agricultural assets (e.g. pond, communal cattle dip) can coincidentally transform it into an epicentre of crucial interactions, fostering a thriving community of practice which stimulates farm-level innovations. Moreover, according to respondent farmers, inadequate financial capital and access to information are the main impediments to the adoption of strategy mitigation for livelihood resilience. Factors such as educational levels, age and location of farming activity are positively associated with mitigation strategy adoption. Furthermore, the location of farming activity has a significant impact on the uptake of strategy mitigation after controlling for variables in a logistic regression model. These factors can be regarded as pillars/scaffolds of innovation as they serve as catalysts that facilitate strategy uptake. Hence, these ingredients must be prioritised in innovation policies aimed at the rural environment to increase policy effectiveness and success of interventions. Higher numbers of specialist smallholders engaged in increased fertiliser use compared to generalist smallholders. Ultimately, in mixed smallholder systems, high strategy uptake in plant cultivation does not simultaneously translate into animal productivity. There is therefore, a need for capacity building in terms of knowledge and organisational and allied skills to help smallholder farmers enhance productivity in both crop and animal production. This will also facilitate the successful entry of smallholder farmers into the mainstream economy as a government priority and policy aim.

Keywords: food security; climate change; land-based livelihoods; community of practice; innovation uptake

3.1. INTRODUCTION

Agriculture in South Africa is extremely vulnerable due to its high sensitivity to climate variables, as well as the country being largely semi-arid (Ziervogel & Ericksen 2010). The impact of climate change on agriculture has largely been negative for low-input farming systems and climate change impacts all four dimensions of food security namely *availability*, *access*, *stability* and *utilisation* (Ziervogel & Ericksen 2010). This makes it important to enhance innovation in adaptive measures to improve agricultural productivity. Furthermore, food systems are highly sensitive to climate change as increased temperatures decrease yields of desirable crops while aiding the proliferation of many weeds and pests (Nelson et al. 2009). Dry land agriculture, such as that practiced across most of Africa, is more vulnerable than irrigated lands to fluctuations in rainfall patterns, which increase the chances of production losses in the long term and crop failures in the short term (Nelson et al. 2009). With about 40% of South Africa's poor depending directly on land for sustenance; small scale farming such as homestead gardens are already vulnerable and faced with the highest risk of food insecurity (Turpie & Visser 2012). Thus, climate change introduces fresh requirements for crop and animal productivity (Nelson et al. 2009), which makes innovation imperative to sustain such livelihoods.

Innovation denotes harnessing fresh ideas which produce novel products, processes or management systems that add value or improve quality with important consequences on productivity and growth (Sayiner 2015). Although agriculture is highly climate sensitive, farmers who exploit the opportunities presented by climate change through innovation will sustain their livelihoods in the face of adverse and fluctuating environmental conditions. In the context of this study, innovation refers to the usage or uptake of individual farm-level mitigation strategies against the negative impacts of climate change and land degradation.

Extension services are critical agents of information that stimulate innovation (Christoplos 2010). This is in addition to the social capital of farmers which provides additional support to their livelihoods (DFID 2000). Such social resources in terms of the sustainable livelihood framework include networks and connectedness, membership of formalised groups and relationships of trust, reciprocity and exchanges (DFID 2000). However, in many rural areas of the Global South such as the former homelands of South Africa, there is a notable dearth of quality extension services (Cousins 2013; Hoffmann 2015). This results in farmers mainly resorting to their biocultural heritage and associated social capital to support their livelihoods such as agriculture.

Biocultural Heritage (BCH) refers to the knowledge, innovations and practices of indigenous peoples and their natural endowments including their cultural norms and values which have been developed over time to sustain their socio-economic needs (Ekblom et al. 2019). As indigenous peoples have adapted to the changing climate across generations, this bequeathed heritage is important for food security in the face of climate change (Ekblom et

al. 2019). Furthermore, it enhances development of sustainable and resilient local economies (Ekblom et al. 2019). The evolution of such elaborate traditional innovation systems which steer agriculture in remote areas is made more vivid in the context of *Bloom's Taxonomy of Educational Objectives* (Bloom 1956; Anderson & Krathwohl 2001). In Figure 3.1, the trajectory of farm management through innovation in the light of Bloom's Taxonomy at the rural community level and how the various stages complement each other is demonstrated. In addition, the Diffusion of Innovation (DOI) Theory explains how a novel idea or product incrementally spreads through a system. It postulates that for an innovation to thrive, it must exhibit five core characteristics (Rogers 2003; Tohidi & Jabbari 2012; Castle et al. 2016):

- *relative advantage* (the degree to which an innovation is considered to be more effective than what it supersedes);
- *compatibility* (how a new idea is regarded to be consistent with the existing norms, previous experiences and demands of potential adopters);
- *complexity* (the level to which an innovation is easy to use);
- *trialability* (the possibility of testing the innovation on a trial basis); and
- *observability* (the extent to which the outcomes are visible to the public).

Innovations that exhibit higher *relative advantage*, *compatibility*, *trialability*, and *observability*, as well as less *complexity*, are often adopted and vice versa (Rogers 2003; Wani & Ali 2015). How higher forms of thinking on human-environment relations progress at the local level in a series of dynamic phases is demonstrated in a model (Fig. 3.1). These phases can further be condensed and expressed in terms of the three cardinal domains of educational learning: cognitive (mental skills or knowledge), affective (attitude) and psychomotor (manual or physical skills). Furthermore, the standard colours behind the regulation of vehicular traffic are integrated in the model (Fig. 3.1) whereby *green* permits free movement of traffic; *yellow* (or *amber*) signals a preparatory phase; and *red* indicates a stationary phase.

The initial knowledge existing in the community (cognitive) shapes the attitude of people in the community (affective) in their perceptions and relations with the environment. The environmental feedback and socio-economic pressures such as increasing populations and less grazing land cause people to experiment with other technologies (psychomotor) in a bid to enhance their livelihoods (Fig. 3.2). These processes provide an opportunity for the individual and community (Fig. 3.4) to learn and acquire new insights about their immediate environment (Figs. 3.3 & 3.4). Consequently, respondents' perceptions of the changes in rainfall and temperature, impact of such changes on their agricultural productivity, and interventions adopted to address such changes to secure household livelihoods were appraised in sections of this study.

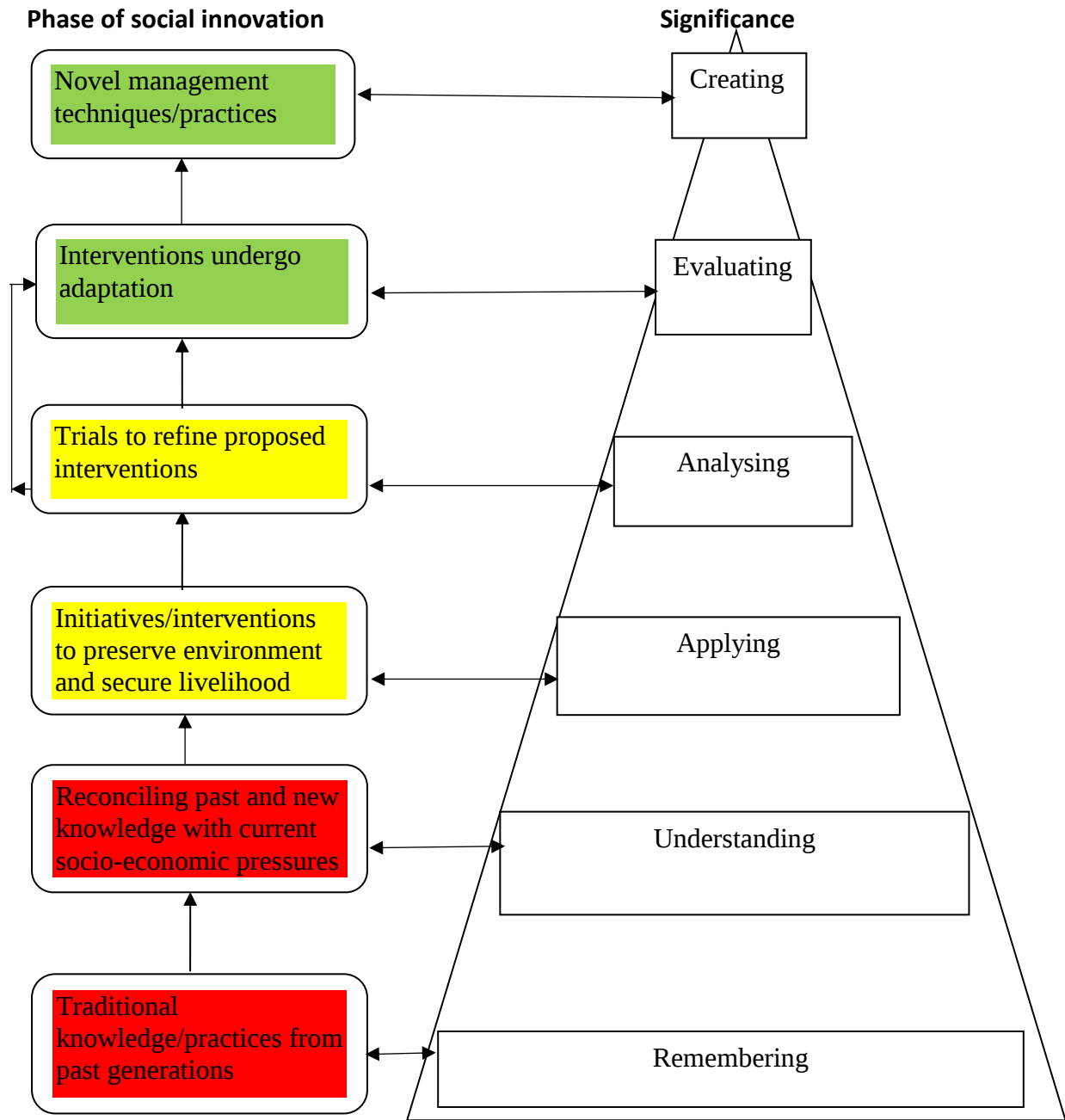


Figure 3.1. Environmental management through biocultural innovation à la Bloom's *Taxonomy of Educational Objectives* (1956).

The double-headed arrows translate as 'would be categorised as'.

The original Bloom's *Taxonomy of Educational Objectives* (1956) proposes a categorisation of scales or degrees of knowledge and a sequential progression in the process of teaching and learning. The model's subsequent modification by Anderson and Krathwohl (2001) enhances and gives profound insights into the dynamics of the learning process (Fig. 3.1).

In rural societies such as Mpakeni (the study site), knowledge about the management of communal natural resources is transmitted across generations via oral tradition (Dold & Cocks

2012). There exists therefore a plethora of knowledge typologies, which community folk *remember* (Fig. 3.1). However, society is dynamic and in continuous flux; hence such knowledge systems and techniques for managing natural resources are challenged by new pressures such as climate change and environmental degradation on scales not hitherto experienced. Consequently, these knowledge types though *remembered* need to be *understood* in the light of such pressures (Johann 2007; Abernethy et al. 2014). This is more so as memories are not constant but relative – what people tend to remember is influenced by what they experience (Schacter 1989; Cauchi-Santoro 2016). Ultimately, in the process of re-accessing past information or events, memories are subject to errors and distortions, hence memories are reconstructed rather than being accurately recalled or retrieved (Schacter 1989; Cauchi-Santoro 2016). Thus, memories of such traditional knowledge about the management of natural resources and agriculture passed between generations are ultimately reconstructed and compromised with distortions during the process of remembering. With reference to the traffic light (Fig. 3.1), the colour is *red* at this stage because there is no significant innovation to radically transform prevailing management methods.

In rural settings where livelihoods are highly sensitive to environmental fluctuations, people react to environmental stimuli to protect their livelihoods and survive (Hoffman 2015). Thus, a number of reactionary measures are undertaken (some out of desperation) to secure their livelihoods. Consequently, these reactionary measures/ideas may not be positive or beneficial for sustainable management as they are *applied* by way of trial and error to ascertain their effectiveness. With the passage of time, the results of these implemented ideas enables society to undergo a process of *analyzing* and *evaluating* to adapt and consequently *create* new techniques tailored for their peculiar conditions and needs. The stepwise progression of the phases demonstrates that learning at the more complex/higher echelons necessitates prior knowledge or skills at the preceding lower levels (Fig. 3.1). When interpreted in the context of a traffic light, the *analyzing* and *applying* stages are *yellow/amber* as innovation shows gradual/limited progress or movement. Ultimately, at the *evaluating* and *creating* phases the *innovation traffic light* indicates *green* because there is significant change or transformation from the innovation which results in novel management or interventions. This manifests as progress or as departure from past approaches. Such enhanced novel approaches are needed to boost global food security.

The global population is projected to reach 9 billion by 2050, creating unprecedented demand for food. In South Africa, there has been increased food insecurity with only 46% of the population being food secure and another 26% faced with full-blown hunger (Shisana et al. 2013). Agriculture provides an avenue for alleviating such high incidence of hunger. Moreover, climate projections indicate increased severity of drought conditions and significant climate impact on the livelihoods of small-scale subsistence farming households which comprise 70% of South Africa's poorest households (DEA 2017). In addition, there is

limited arable land available in the former homelands which are described as amongst the most degraded areas in the country (Hoffmann 2015). Such areas have been at the brunt of recent drought (2014-2016, linked to El Nino). Furthermore, there have been initiatives to develop an emerging black farming class in South Africa who have access to good quality arable land (as noted in the National Development Plan - 2013 which specifies the agricultural sector as a major job creator). However, such farms have generally become less productive than before (Hoffman 2015). This makes understanding the factors affecting the use of innovation and building resilience to enhance productivity as well as food security imperative. Ultimately, understanding the management strategies adopted by rural smallholder farmers to enhance productivity in response to changing ambient conditions will help to implement appropriate interventions. This paper contributes to knowledge on the micro/farm level factors affecting uptake of innovation amongst rural smallholder farmers and the implications for agricultural productivity and food security. This is done by investigating the relationship between a number of socio-demographic variables and different mitigation strategies adopted by smallholders to assess their influences individually.

This study is of relevance to the Sustainable Development Goals (SDGs) and the National Development Plan (Vision 2030) which seeks to alleviate poverty and inequality by enhancing livelihoods to transform the rural economy. The sustainable use of land is associated with national and local food security, jobs and wealth creation through the value-adding chain in agriculture, biodiversity protection on farmland, and the prevention of land degradation through sustainable land management.

The dynamic interaction between the core thematic areas of this chapter is illustrated in Figure 3.2. Innovation is critical to effective management of ecosystem services that support agriculture and the success of rural smallholder systems (Fig. 3.2). Moreover, innovation is an important factor in building resilience in agricultural systems given the impact of climate change on related livelihoods (Fig. 3.2).

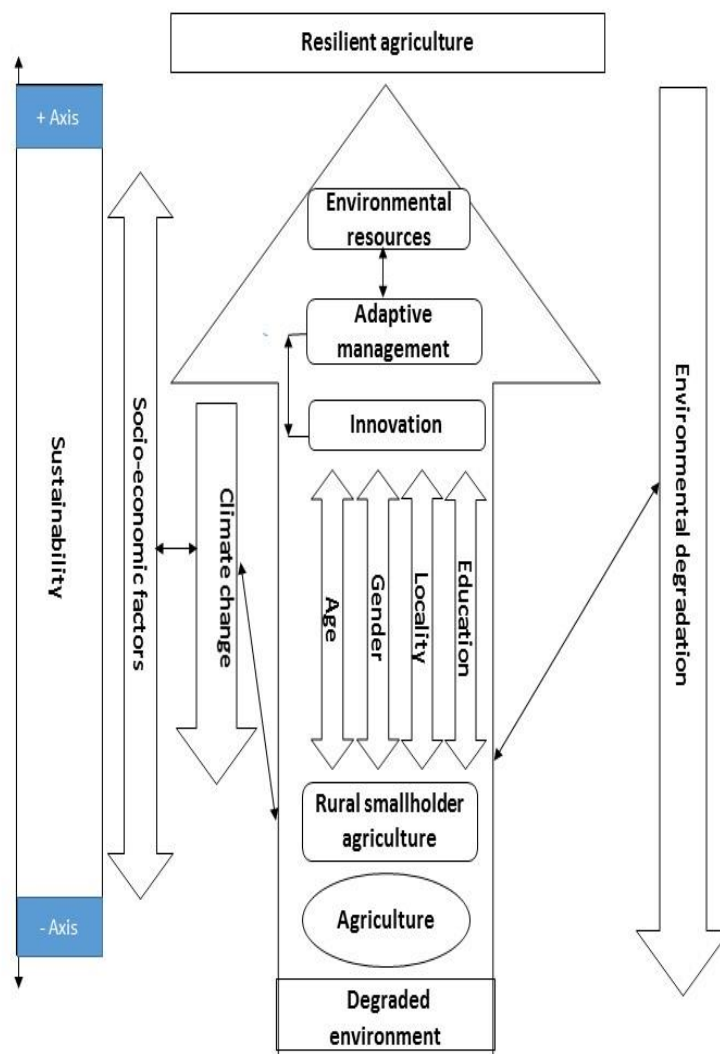


Figure 3.2. Flow diagram of thematic areas of the study.

Rural smallholder agriculture is dependent on environmental resources, whilst the associated ecosystem services are sensitive to climate change and degradation (Dold & Cocks 2012; Hoffman 2015). In addition, socio-economic influences (such as high unemployment and poverty) in the face of climate change, have consequences for the sustainable management of natural resources (Fig. 3.2). This is more so in rural sub-Saharan Africa where laws on conservation are often ignored so as to satisfy basic socio-economic needs due to dependence on such resources (Kirkland et al. 2007).

Effective state institutions and national agro-environment policies are macro factors that facilitate sound environmental governance with impact on livelihood resilience. The effectiveness of such macro interventions can be affected by other micro factors (Shisana et al. 2013) such as age, gender, space, educational level and information inter alia (Kolade & Harpham 2014). Furthermore, innovative management strategies enhance agricultural productivity and resilience (Twine 2013). Given the low level of adaptation in rural smallholder systems (Tibesigwa et al. 2016) coupled with the low extension services (Cousins

2013) the need for innovation is imperative. Ultimately, innovations in smallholder systems feed into the overall goal of a robust national and local agricultural sector that meets the food security needs of the populace. Hence, this chapter hence assesses some of the core parameters influencing the successful uptake of farm-level innovation amongst rural smallholders.

3.2. METHODOLOGY

3.2.1 Study Site: Mpakeni

The study was conducted in Mpakeni in Mpumalanga Province of the north-eastern part of South Africa. The major populations in the area are of siSwati (Swazi) and xiTsonga (Tsonga) descent and reside on the southern border of the Kruger National Park (Van Riet et al. 1997). The area has a population of 1394 (783.50 per km²) and is located by geographical coordinates 25° 29' 08" South, 31° 16' 38" East with an altitude of 821m (Census 2011). It hosts the Mthetomusha Game Reserve and Bongani Lodge (Hampson et al. 2002). The tributaries of the Makhomane, Luphusi and Nsikazi rivers form part of the area's drainage and serve as key water sources (Hampson et al. 2002). The soils of Mpakeni are typically sandy loam soils interspersed with granite outcrops (Hampson et al. 2002). The main flora is classified as sour Lowveld bushveld or Malelane mountain bushveld whilst sections of the area are described as belonging to the vulnerable vegetation type *Croc Gorge Granite Mountainlands* (SANBI 2007).



Figure 3.3 Aerial view from Google Earth of study site and neighbouring villages and towns.

3.2.2 Data Collection

Data were collected in March/April 2016 employing household interviews and rapid rural appraisal (RRA) techniques such as direct observation at the site/farm-level amongst others. The data consisted of biographical information and details of the interventions used by farmers to address climate impacts such as drought to enhance resilience as well as food security. The consent of each respondent was obtained on an individual basis before their interview.

For the interviews, 150 farmers were selected through targeted/snowball sampling from the four zones which comprise Mpakeni village (Fig. 3.4). Potential respondent farmers were initially identified during the community mapping (Fig. 3.4). These farmers were then contacted for interviews and they assisted in identifying other farmers in their locality who were interviewed depending on their consent and availability. This approach was necessary as this chapter deals with investigating land-based livelihood adaptation and thus only smallholders involved in the usage of land-based strategies were needed. The questions were generated following in-depth literature studies and discussions in a questionnaire format covering themes such as farmers' biographical information, types of mitigation strategies used and the sectors of agriculture they engaged in amongst others. The topography and agricultural conditions of the four village sub-sections (zones) of Mpakeni as well as important communal resources related to agriculture in the area are described (Fig. 3.4). The only two bore holes in the area as well as the natural ponds are found in the Magamzin and Gaganene zones (Fig. 3.4).

3.2.3 Data Analysis

Case studies, essentially investigate a contemporary real-life phenomenon and are invaluable where in-depth explanations of a social phenomenon is probed (Ridder 2017; Yin 2014). Moreover, it is regarded as a robust research method which affords detailed investigation and comprehension of complex socio-economic issues within a specific context (Grassel & Schirmer 2006; Johnson 2006). Furthermore, case studies are touted as helping overcome the demerits of quantitative methods in producing holistic and in-depth descriptions of social and behavioural themes under investigation (Zainal 2007). Thus, with the help of the case study approach, a researcher transcends the quantitative statistical outcomes and gains insights into the associated behavioural patterns from the participants' perspective (Crowe et al. 2011). Furthermore, the integration of quantitative and qualitative data facilitates the explanation of the process and outcome of a phenomenon through thorough observation and analysis inter alia of the cases in question (Zainal 2007; Crowe et al. 2011). Generally, a case study is premised on a particular geographical area or with a selected number of individuals as study subjects (Yin 2014). However, a core criticism of the case study approach is that the limited number of subjects compromises the ability to make generalisations. Furthermore, it provides laxity for biased opinions (Ridder 2017; Yin 2014). The marriage of different research approaches helps overcome such limitations (Crowe et al. 2011).

The mixed method approach is used in this study as it combines qualitative and quantitative approaches. One hundred and fifty smallholder farmers were interviewed on their adaptation strategies in response to climate impacts such as drought conditions. The chi-square test was used to examine significant variances in use of innovation along key traits such as *gender*, *age range*, *educational level*, *social capital* and *neighbourhood of respondent*. Furthermore, a logistic regression model was employed to provide a more robust assessment of the influence of the multiple variables on uptake of innovation, after simultaneously controlling for the impact of other factors which the chi-square does not. The strategies include interventions that help reduce surface evaporation by applying crop residues and plant mulches; encourage the proliferation of insects and worms (“pollinators and beneficial insects” and “vermiculture” respectively); enhance livestock nutrition; improve organic matter content and increase soil water-holding capacity given the semi-arid nature of the South African landscape inter alia. In addition, respondents chose between innovation strategies which were not mutually exclusive. Thus respondents chose as many strategies as they used from a list. However, the *Yes* and *No* options were mutually exclusive. The main sources of information which farmers rely on was investigated. These included *print* (newspaper), *electronic* (internet, television and radio) and *others* (church, friends, extension officers and traditional healer). Additionally, the effect of the social capital on uptake of innovation was examined. This included membership of a farm association, the existence of kinship or networks as well as reciprocal relationships of the smallholder whereby help is exchanged between the farmer smallholder and third parties.

A regression model was used to test for the raw number of mitigation strategies and its relation with the number of livestock and additional cultivated fields of a farmer. For livestock production, a conversion matrix was created whereby livestock numbers were converted to a common livestock unit. The standard relative body masses of the different types of livestock were obtained from the Food and Agriculture Organisation (FAO) as follows; cattle = 0.7, sheep = 0.1, goats = 0.1, pigs = 0.2 and chicken = 0.01 (FAO 2005; Maass et al. 2012; Mosites et al. 2015). The additional cultivated fields were put in categories (per the questionnaire) of 1–4, 5–10, 11–14, 15–20 and 20 plus because people were hesitant to divulge information on the exact number of fields they had.

3.3. RESULTS

About 30% of adults were over 65 years old whilst only 19% had matric or higher qualification (Table 3.1). The highest frequency of farmers was from Mambayin (46%) whilst the least numbers of farmers came from Magamzim (9%). The relative numbers of males and females were almost equal.

Table 3.1 Profile summary of respondent farmers.

Category	Percent (Frequency)
Respondent's gender	
Male	51 (76)
Female	49 (74)
Total	100 (150)
Respondent's neighbourhood	
Mambayin	46 (69)
Manjesa	24 (36)
Gaganene	21 (31)
Magamzim	9 (14)
Total	100 (150)
Respondent's age	
18–24*	1 (2)
25–34	15 (23)
35–44	18 (27)
45–54	19 (28)
55–64	17 (25)
65–74	17 (26)
75–84	10 (15)
85+	3 (4)
Total	100 (150)
Respondent's highest educational level	
No schooling	29 (43)
Primary school (Grade 1–7)	39 (58)
Secondary school (Grade 8–11)	14 (21)
Matric and above	19 (28)
Total	100 (150)

*NB. The age range starts from 18 in consonance with ethics requirements.

Respondents indicated their participation in different sectors of agricultural production (Table 3.2). Most respondents were engaged in both crop and livestock production (45%). Moreover, the “Crop only” production category registered the second highest number (41%) of farmers.

Table 3.2 Respondents’ participation in different sectors of agricultural production (n=150).

Gender	Both genders	Male	Female
	Percentage (Frequency)		
Sector of production		P-value	P-value
Crop & livestock	45 (68)	0.002	42 (32) 40 (30)
Crop only	41 (62)		39 (30) 51 (38)
Livestock only	12 (18)		16 (12) 11 (8)
*Other	1 (2)		3 (2) 0 (0)
Total	100 (150)		100 (76) 100 (74)

NB: * Other category refers to other agricultural activities such as natural resources trade. The results were tested with the chi-square test. The p-value is the probability that the differences from an even-split between all categories of agriculture and gender are due to chance alone. To facilitate the chi-square calculation the categories with expected values less than 5 were omitted.

There were more generalists (22%) engaged in the use of improved varieties as a farm level innovation strategy compared to specialists (15%). In addition, mixed farmers were more prevalent in the practice of “Growing own forage” (23%) and “Creating shade areas on your farm” (23%) in comparison to livestock specialists (Table 3.3).

Table 3.3 Proportions of farm level strategy uptake between specialists and generalist farmers.

	Percentage (Frequency)		
Sector of agricultural production	Crop only (n=62)	Crop & livestock (n=68)	P-value
Strategy adopted			
Crop production			
Use of manure or compost	94 (58)	94 (64)	0.99
Crop rotation	90 (56)	66 (45)	0.30
Cover crops usage	87 (54)	74 (50)	0.68
Plants & animal diversity	76 (47)	85 (58)	0.83
No till or minimum tillage	68 (42)	72 (49)	0.96
Pollinators or beneficial insects	63 (39)	34 (23)	0.06
Less use of chemical fertiliser	61 (38)	78 (53)	0.52
Vermiculture	57 (35)	52 (35)	0.93
Increased use of chemical fertiliser	19 (12)	10 (7)	0.41
Livestock production	Livestock only (n=18)	Crop & livestock (n=68)	
Early morning dew pasturing	89 (16)	87 (59)	0.99
Growing own forage	83 (15)	34 (23)	0.02
Use of improved varieties	83 (15)	32 (22)	0.01
Creating shade areas on farm	78 (14)	34 (23)	0.04

NB: Each row shows the frequencies of respondents’ participation per strategy in crops alone versus crop and livestock, as well as livestock alone versus crop and livestock. The p-value is the probability that the difference in strategy adoption between these two categories (generalists and specialists) is due to chance alone. Respondents chose between strategies which were not mutually exclusive. Thus respondents chose as many strategies as they used from a list. However, the Yes and No options were mutually exclusive. The results were tested with the chi-square test on a row by row basis. Improved varieties refers to the use of livestock species with enhanced reproductive and health performance. Vermiculture denotes efforts by farmers to encourage proliferation of earthworms in their soils to boost fertility at the study site.

Respondents were categorised in terms of their gender to test the relationship between gender and the usage of individual strategies across different domains of agricultural production. There was no statistically significant relationship between the adoption of strategies and farmers' gender (Table 3.4).

Table 3.4 Association between respondent farmers' gender and strategy adoption.

Percentage by row (Frequency) Percentage by sample				
Sector of production	Crops only and crops plus livestock (n= 130)		Total	P-value
Gender of respondent	Male (n=59)	Female (n=71)		
Strategy adopted				
Crop production				
Pollinators or beneficial insects	46 (31) 53	54 (37) 52	100 (68)	0.99
Crop rotation	48(48) 81	53 (53)75	100(101)	0.91
Plants & animal diversity	46 (12) 20	54 (14)20	100(26)	0.99
Growing leguminous crops	34 (13) 22	66 (25)35	100 (38)	0.39
Cover crops usage	50(13)22	50 (13)18	100 (26)	0.89
No till or minimum tillage	36 (14) 24	64 (25)35	100 (39)	0.43
Increased use of chemical fertiliser	54 (37)63	46 (32)45	100 (69)	0.10
Vermiculture	44 (49) 83	56 (61)86	100 (110)	0.98
Use of manure or compost	12 (1) 2	88 (7) 10	100(8)	0.18
Less use of chemical fertiliser	45 (17) 29	55 (21)30	100 (38)	0.99
Livestock production				
Sector of production	Livestock only and crops plus livestock (n=86)			
Gender of respondent	Male (n=40)	Female (n=46)		
Strategy adopted				
Early morning dew pasturing	45 (34)85	55 (41) 89	100 (75)	0.97
Use of improved varieties	56 (20) 50	44 (16)17	100 (36)	0.54
Growing own forage	55 (21)53	45 (17)37	100 (38)	0.14
Creating shade areas on your farm	57 (21)53	43 (16)35	100 (37)	0.42

NB: Each row shows the frequencies of respondents' participation by gender per strategy in the context of males versus females. For each row the p-value is the probability that the difference between males and females in the uptake of mitigation strategies is due to chance alone. Respondents chose between mitigation strategies which were not mutually exclusive. Thus respondents chose as many strategies as they used from a list. However, the Yes and No options were mutually exclusive. The results were tested with the chi-square test on a row by row basis. Improved varieties refers to the use of livestock species with enhanced reproductive and health performance. Vermiculture denotes efforts by farmers to encourage proliferation of earthworms in their soils to boost fertility at the study site.

Respondents were categorised in terms of their sector of agricultural production, and the relationship between the adoption of mitigation strategies and respondents' gender was investigated (Table 3.5). Generally, there was no statistically significant relationship between use of the mitigation strategies and the sectors of agricultural production across respondents' gender. However, a significantly higher proportion of men ($p=0.02$) who were specialist farmers (59%) used cover crops unlike their female specialist counterparts (23%). Conversely, a significantly higher proportion of female generalist farmers ($p=0.02$) practiced minimum tillage (Table 3.5). Hence, more generalist female farmers (29%) practiced "No or minimum tillage" relative to their generalist male (23%) counterparts.

Mitigation strategies in the context of specialists versus generalists								
	Percentage by row (Frequency)				Percentage by sample			
Sector of production	Specialists				Generalists			
	Crops only (n= 62)				Crops and livestock (n= 68)			
Gender of respondent	Male (n=32)	Female (n=30)	Total	P-value	Male (n=30)	Female (n=38)	Total	P-value
Strategies adopted								
<i>Crop production</i>								
Use of manure or compost	67 (14) 44	33 (7) 23	100 (21)	0.38	0 (0) 0	100 (4) 11	100 (4)	0.40
Crop rotation	52 (29) 91	48 (27) 90	100 (56)	0.99	42 (19) 63	58 (26) 68	100 (45)	0.97
Plants & animal diversity	66 (21) 66	34 (11) 37	100 (32)	0.31	36 (4) 13	64 (7) 18	100 (11)	0.89
Growing leguminous crops	62 (16) 50	39 (10) 33	100 (26)	0.66	33 (10) 33	67 (20) 53	100 (30)	0.50
Cover crops usage	73 (19) 59	27 (7) 23	100 (26)	0.02	26 (5) 17	74 (14) 37	100 (19)	0.29
No till or minimum tillage	60 (22) 69	41 (15) 50	100 (37)	0.63	39 (7) 23	61 (11) 29	100 (18)	0.02
Increased use of chemical fertiliser	66 (27) 84	34 (14) 47	100 (41)	0.14	21 (3) 10	79 (11) 29	100 (14)	0.37
Vermiculture	51 (30) 94	49 (29) 97	100 (59)	0.99	42 (25) 83	58 (35) 92	100 (60)	0.92
Pollinators or beneficial insects	63 (26) 81	37 (15) 50	100 (41)	0.32	40 (18) 60	60 (27) 71	100 (45)	0.85
Less use of chemical fertiliser	56 (20) 63	44 (16) 53	100 (36)	0.84	50 (17) 57	50 (17) 45	100 (34)	0.78
Strategies not adopted								
<i>Livestock production</i>								
Sector of production	Livestock only (n= 18)				Crops and livestock (n= 68)			
	(n=12)	(n=8)			(n=30)	(n=38)		
Early morning dew pasturing	65 (11) 92	35 (6) 75	100 (17)	0.63	40 (23) 77	60 (35) 92	100 (58)	0.78
Use of improved varieties	69 (11) 92	31 (5) 63	100 (16)	0.72	43 (9) 30	57 (12) 32	100 (21)	0.99
Growing own forage	69 (11) 92	31 (5) 63	100 (16)	0.72	44 (10) 33	57 (13) 34	100 (23)	0.99
Creating shade areas on your farm	69 (11) 92	31 (5) 63	100 (16)	0.72	44 (10) 33	57 (13) 34	100 (23)	0.99

There was a statistically significant relationship between some innovation strategies in the context of generalists and specialists (Table 3.6). This includes the usage of manure or compost ($p<0.001$), “No till or minimum tillage” ($p=0.02$), “Increased use of chemical fertilizer” ($p=0.01$), the “Use of resistant varieties” ($p<0.001$), the growing of forage ($p=0.02$) and creating shade areas on farms ($p=0.03$). Hence, in terms of crop production more specialists (60%) than generalists (6%) practiced manuring or composting. Moreover, in terms of livestock production more specialists were prevalent in the “Use of resistant varieties” (83%) compared to generalists (31%).

Table 3.6 Relationship between generalists and specialists in the adoption of mitigation strategies.

Strategies:				
Sector of production	Percentage by row (Frequency) Percentage by sample		Total	P-value
	Specialists Crops only (n=62)	Generalists Crops and livestock (n=68)		
Strategy adopted				
Crop production				
Use of manure or compost	90 (37) 60	10 (4) 6	100 (41)	< 0.001
Crop rotation	56 (56) 90	45 (45) 66	100 (101)	0.96
Plants & animal diversity	74 (32) 52	26 (11) 16	100 (43)	< 0.001
Growing leguminous crops	46 (26) 42	54 (30) 44	100 (56)	0.03
Cover crops usage	46 (26) 42	41 (18) 27	100 (44)	0.75
No till or minimum tillage	66 (37) 60	34 (19) 28	100 (56)	0.02
Increased use of chemical fertiliser	75 (41) 66	26 (14) 21	100 (55)	0.01
Vermiculture	50 (61) 98	50 (60) 88	100 (121)	0.97
Pollinators or beneficial insects	39 (41) 66	61 (65) 91	100 (106)	< 0.001
Less use of chemical fertiliser	45 (36) 58	55 (44) 65	100 (80)	0.27
Sector of production	Livestock only (n=18)	Crops and livestock (n=68)	Total	P-value
Livestock production				
Early morning dew pasturing	22 (16) 90	79 (58) 85	100 (74)	0.98
Use of resistant varieties	42 (15) 83	58 (21) 31	100 (36)	< 0.001
Growing own forage	40 (15) 83	61 (23) 34	100 (38)	0.02
Creating shade areas on your farm	38 (14) 78	62 (23) 34	100 (37)	0.03

NB: Each row shows the frequencies of respondents' participation by sector of production per strategy. For each row the p-value is the probability that the differences between specialists and generalist as per uptake of each mitigation strategy is due to chance alone. Respondents chose between mitigation strategies which were not mutually exclusive. Thus, respondents chose as many strategies as they used from a list. However, the Yes and No options were mutually exclusive. The results were tested with the chi-square test on a row by row basis. Improved varieties refers to the use of livestock species with enhanced reproductive and health performance. Vermiculture denotes efforts by farmers to encourage proliferation of earthworms in their soils to boost fertility at the study site.

Respondents were categorised in terms of the locality of their farming activities to investigate the relationship between agricultural sectors of production and respondents' locality. There was no statistically significant relationship between respondents' sectors of production and their localities (Table 3.7).

Table 3.7 Relationship between respondent farmers' location of farm activity and their engagement in sectors of agricultural production.

Localities	Percentage (Frequency)				Total	P-value
	Mambayin (n=69)	Manjesa (n=36)	Magamzin (n=14)	Gaganene (n=31)		
Farming sector						0.082
Crops only	36 (22)	23 (14)	16 (10)	26 (16)	42 (62)	
Livestock only	44 (8)	22 (4)	11 (2)	22 (4)	12 (18)	
Crops & livestock	56 (38)	27 (18)	3 (2)	15 (10)	46 (68)	

NB: The results were tested with the chi-square test, $\chi^2 = 11.2178$. The p-value is the probability that the differences in farming strategy between areas are due to chance alone.

Respondents were categorised in terms of their age cohorts to assess the relationship between agricultural sectors of production and farmers' age cohorts (Table 3.8). There was a statistically significant relationship between respondents' sectors of production and their age cohorts (Table 3.8). Similar numbers of respondents who majored as specialists in crop production ranged between the 55–64 (14%) and 65–74 (14%) age cohorts, whilst the majority of respondents in the 65–74 years age cohort specialised in livestock production. The highest frequency of generalists (29%) was in the 45–54 years age cohort.

Table 3.8 Association between respondent farmers' age cohorts and their corresponding sectors of agricultural production.

Respondents' age cohorts	Percentage (Frequency)								Total	P-value
	18–24 (n=2)	25–34 (n=23)	35–44 (n=27)	45–54 (n=28)	55–64 (n=25)	65–74 (n=26)	75–84 (n=15)	85+ (n=4)		
Farming sector										<0.001
Crops only	2 (1)	18 (11)	16 (10)	10 (6)	23 (14)	23 (14)	10 (6)	0 (0)	42 (62)	
Livestock only	0 (0)	17 (3)	0 (0)	0 (0)	17 (3)	39 (7)	22 (4)	7 (1)	12 (18)	
Crops and livestock	2 (1)	13 (9)	25 (17)	29 (20)	12 (8)	7 (5)	7 (5)	4 (3)	46 (68)	

NB: The results were tested with the chi-square test, $\chi^2 = 35.6$. The p-value is the probability that the differences in strategy between age groups are due to chance alone. To make the calculation of the chi-square possible, the 18–24 year age cohort was combined with the 25–34 age cohort whilst the 85+ age cohort was also combined with 75–84 age cohort because they had expected values less than 5.

Respondents were categorised in terms of the locality of their farming activities to investigate the relationship between the adoption of mitigation strategies and respondents' locality (Table 3.9). There was a statistically significant relationship between some mitigation strategies and the respondents' locality (Table 3.9). The "Less use of chemical fertiliser" was highest in Magamzin (75%) and lowest in Manjesa (9%) ($p < 0.001$) locality. Most respondents who practiced "No till or minimum tillage" were based in the Gaganene locality.

Table 3.9 Relationship between respondent farmers' locality of farm activity and the adoption of farm level mitigation strategies.

		Percentage by row (Frequency)				Percentage by sample	
Sector of production		Crops only and crops plus livestock (n= 130)					
Neighbourhood of respondent		Mambayin (n=60)	Manjesa (n=32)	Magamzin (n=12)	Gaganene (n=26)	Total	P-value
Crop production							
Strategy adopted							
Crop production							
Use of manure or compost		50 (4) 7	0 (0) 0	13 (1) 8	38 (3) 12	100 (8)	0.35
Less use of chemical fertiliser		21 (8) 13	8 (3) 9	24 (9) 75	48 (18) 69	100 (38)	<0.001
Cover crops usage		35 (9) 15	42 (11) 34	4 (1) 8	19 (5) 19	100 (26)	0.18
Plants & animal diversity		42 (11) 18	19 (5) 16	23 (6) 50	16 (4) 15	100 (26)	0.11
Crop rotation		47 (47) 78	19 (19) 59	11 (11) 92	24 (24) 92	100 (101)	0.49
Growing leguminous crops		42 (16) 27	40 (15) 47	3 (1) 8	16 (6) 23	100 (38)	0.13
No till or minimum tillage		46 (18) 30	5 (2) 6	8 (3) 25	41 (16) 62	100 (38)	0.002
Vermiculture		47 (52) 87	26 (29) 91	9 (9) 75	18 (20) 77	100 (110)	0.92
Pollinators or beneficial insects		43 (29) 48	22 (15) 47	12 (8) 67	24 (16) 62	100 (68)	0.74
Increased use of chemical fertiliser		45 (31) 52	23 (16) 50	13 (9) 75	19 (13) 50	100 (69)	0.75
Livestock production							
Livestock production							
Sector of production		Livestock only and crops plus livestock (n=86)					
Livestock production		(n=46)	(n=22)	(n=4)	(n=14)		
Early morning dew pasturing		57 (43) 94	28 (21) 96	5 (4) 100	9 (7) 50	100 (75)	0.44
Growing own forage		55 (21) 46	18 (7) 32	11 (4) 100	16 (6) 43	100 (38)	0.30
Creating shade areas on your farm		57 (21) 46	16 (6) 27	11 (4) 100	16 (6) 43	100 (37)	0.22
Use of resistant varieties		50 (18) 39	19 (7) 32	11 (4) 100	19 (7) 50	100 (36)	0.25

NB: Significant values are in bold. For each row the p-value is the probability that the differences between the localities as per uptake of each mitigation strategy is due to chance alone. Respondents chose between mitigation strategies which were not mutually exclusive. Thus respondents chose as many strategies as they used from a list. However, the Yes and No options were mutually exclusive. The results were tested with the chi-square test on a row by row basis. Improved varieties refers to the use of livestock species with enhanced reproductive and health performance. Vermiculture denotes efforts by farmers to encourage proliferation of earthworms in their soils to boost fertility at the study site.

Concerning associations between age categories and strategy adoption, “Cover crops usage” was most commonly observed (28%) in the 35–54 years age cohort whilst its lowest practice (0%) was recorded in the 75+ years age cohort (Table 3.10). Furthermore, the prevalence of “Creating shade areas on your farm” (85%) and “Growing own forage” (84%) was most widespread amongst farmers in the 75+ years age cohort (Table 3.10).

Table 3.10 Association between respondent farmers’ age cohorts and the adoption of farm level mitigation strategies.

		Percentage by row (Frequency)				Percentage by sample	
Sector of production		Crops only and crops plus livestock (n= 130)				Total	P-value
Age range of respondent		18–34 (n=22)	35–54 (n=53)	55–74 (n=41)	75+ (n=14)		
Strategy adopted							
Crop production							
Less use of chemical fertiliser		18 (7) 32	34 (13) 25	32 (12) 29	16 (6) 43	100 (38)	0.71
Cover crops usage		23 (6) 27	58 (15) 28	19 (5) 12	0 (0) 0	100 (26)	0.04
Plants & animal diversity		19 (5) 23	31 (8) 15	39 (10) 24	12 (3) 21	100 (26)	0.77
No till or minimum tillage		18 (7) 32	44 (17) 32	28 (11) 27	11 (4) 29	100 (39)	0.95
Use of manure or compost		38 (3) 14	25 (2) 4	25 (2) 5	13 (1) 7	100 (8)	0.45
Vermiculture		16 (18) 82	42 (46) 87	33 (36) 88	9 (10) 71	100 (110)	0.94
Growing leguminous crops		26 (10) 46	58 (22) 42	8 (3) 7	8 (3) 21	100 (38)	0.01
Crop rotation		16 (16) 73	35 (35) 66	36 (36) 88	14 (14) 34	100 (101)	0.49
Pollinators or beneficial insects		22 (15) 68	49 (33) 62	22 (15) 37	8 (5) 36	100 (68)	0.19
Increased use of chemical fertiliser		13 (9) 41	41 (28) 53	36 (25) 61	10 (7) 50	100 (69)	0.77
Livestock production							
Sector of production		Livestock only and crops plus livestock (n=86)					
Livestock production		(n=13)	(n=37)	(n=23)	(n=13)		
Early morning dew pasturing		12 (9) 69	45 (34) 92	28 (21) 91	15 (11) 85	100 (75)	0.88
Creating shade areas on your farm		5 (2) 15	19 (7) 19	46 (17) 74	30 (11) 85	100 (37)	<0.001
Growing own forage		8 (3) 23	18 (7) 19	45 (17) 74	29 (11) 85	100 (38)	0.001
Use of improved varieties		11 (4) 31	11 (4) 11	50 (18) 78	28 (10) 77	100 (36)	<0.001

NB: Significant values are in bold. For each row the p-value is the probability that the differences between age groups as per uptake of each mitigation strategy is due to chance alone. Respondents chose between mitigation strategies which were not mutually exclusive. Thus respondents chose as many strategies as they used from a list. However, the Yes and No options were mutually exclusive. The results were tested with the chi-square test on a row by row basis. Improved varieties refer to the use of livestock species with enhanced reproductive and health performance. Vermiculture denotes efforts by farmers to encourage proliferation of earthworms in their soils to boost fertility at the study site.

The prevalence of innovation varied significantly by education levels in only two cases (Table 3.11). The provision of shade ($p=0.001$) and cultivating own forage ($p=0.002$) were highest in the “Matric+” category but least in the “No Schooling” category respectively. Moreover, most farmers who engaged in the “Use of improved varieties” ($p=0.001$) had secondary education whilst the least usage was observed amongst respondents in the “Grade 1–7” category.

Table 3.11 Association between respondent farmers’ educational levels and their adoption of mitigation strategies.

Adoption of mitigation strategies						
	Percentage by row (Frequency)				Percentage by sample	
Production sector	Crops only plus crops and livestock (n=130)					
Educational level	No schooling (n=33)	Grade 1–7 (n=51)	Grade 8–11 (n=20)	Matric + (n=26)		
Strategy adopted						
Crop production					Total	P-value
Vermiculture	26 (28) 85	37 (41) 80	16 (18) 90	21 (23) 89	100 (110)	0.97
Less use of chemical fertiliser	23 (16) 49	42 (29) 57	23 (16) 80	12 (8) 31	100 (69)	0.14
Plants & animal diversity	31 (8) 24	46 (12) 24	15 (4) 20	8 (2) 8	100 (26)	0.46
No till or minimum tillage	15 (6) 18	44 (17) 33	13 (5) 25	28 (11) 42	100 (39)	0.36
Crop rotation	28 (28) 85	36 (36) 71	17 (17) 85	20 (20) 77	100 (101)	0.88
Use of manure	50 (4) 12	13 (1) 2	13 (1) 5	25 (2) 8	100 (8)	0.32
Cover crops usage	15 (4) 12	46 (12) 24	15 (4) 20	23 (6) 23	100 (26)	0.68
Increased use of chemical fertiliser	21 (8) 24	42 (16) 31	21 (8) 40	16 (6) 23	100 (38)	0.55
Pollinators or beneficial insects	13 (9) 27	50 (34) 67	16 (11) 55	21 (14) 54	100 (68)	0.11
Leguminous crop usage	18 (7) 21	45 (17) 33	13 (5) 25	24 (9) 35	100 (38)	0.71
Production sector	Livestock only plus crop and livestock (n=86)					
Livestock production	(n=22)	(n=38)	(n= 10)	(n=16)		
Creating shade areas	19 (2) 9	27 (7) 18	23 (6) 60	30 (11) 67	100 (26)	0.001
Growing own forage	8 (3) 14	18 (7) 18	22 (6) 60	29 (11) 67	100 (27)	0.002
Use of improved varieties	11 (4) 18	11 (4) 11	28 (7) 70	28 (10) 63	100 (25)	0.001
Early morning dew pasturing	12 (9) 41	54 (34) 90	14 (9) 90	15 (11) 67	100 (63)	0.18

NB: Significant values are in bold. For each row the p-value is the probability that the differences between educational levels as per uptake of each mitigation strategy is due to chance alone. Respondents chose between mitigation strategies which were not mutually exclusive. Thus respondents chose as many strategies as they used from a list. However, the Yes and No options were mutually exclusive. The results were tested with the chi-square test on a row by row basis. Improved varieties refers to the use of livestock species with enhanced reproductive and health performance. Vermiculture denotes efforts by farmers to encourage proliferation of earthworms in their soils to boost fertility at the study site.

Respondents were categorised in terms of specialists and generalists, to investigate the relationship between the strategies adopted and respondents' educational levels between generalists and specialists (Table 3.12). Most specialist farmers with secondary education engaged in "Increased use of chemical fertiliser" ($p=0.01$). Furthermore, the majority of generalist farmers with "Matric+" practiced the "Use of manure" ($p=0.002$). The practice of "Growing own forage" ($p=0.01$), the use of "Improved varieties" ($p=0.01$) and "Creating shade areas" ($p=0.002$) was most prevalent amongst specialists with secondary education and above (Table 3.12).

Table 3.12 Relationship between respondent farmers' educational levels and the adoption of farm level strategies in the context of specialists and generalists.

		Percentage by row (Frequency)											Percentage by sample										
Production sector		Specialists (n=80)					Generalists (n=68)																
Educational level		Crops only					Crops plus livestock																
		No schooling (n=29)	Primary school (n=27)	Secondary school (n=10)	Matric + (n=14)	Total	P-value	No schooling (n=13)	Primary school (n=31)	Secondary school (n=10)	Matric + (n=14)	Total	P-value										
Crop production																							
Use of manure	50 (2) 7	25 (1) 4	0 (0) 0	25 (1) 7	100 (4)	0.82	52 (11) 41	29 (6) 19	5 (1) 10	14 (3) 21	100 (21)	0.002											
Less use of chemical fertiliser	36 (5) 17	43 (6) 22	7 (1) 10	14 (2) 14	100 (14)	0.86	29 (12) 44	39 (16) 52	17 (7) 70	15 (6) 43	100 (41)	0.62											
Plants & animal diversity	27 (3) 10	46 (5) 19	18 (2) 20	9 (1) 7	100 (11)	0.70	42 (13) 52	42(13) 42	7 (2) 20	10 (3) 21	100 (31)	0.41											
Vermiculture	22 (13) 45	43 (26) 96	15 (9) 90	20 (12) 86	100 (60)	0.13	33 (22) 89	33 (22) 71	14 (9) 90	20 (13) 93	100 (66)	0.94											
No till or minimum tillage	21 (4) 14	47 (9) 33	5 (1) 10	26 (5) 36	100 (19)	0.27	30 (11) 41	38 (14) 45	11 (4) 40	22 (8) 57	100 (37)	0.79											
Crop rotation	20 (9) 31	40 (18) 67	18 (8) 80	22(10) 71	100 (45)	0.15	25 (12) 70	37 (18) 58	18 (9) 90	18 (10) 71	100 (49)	0.30											
Cover crops usage	17 (3) 10	50 (9) 33	17 (3) 30	17 (3) 21	100 (18)	0.31	39 (10) 37	39 (10) 32	4 (1) 10	19 (5) 36	100 (26)	0.61											
Increased use of chemical fertiliser	15 (5) 17	50 (17) 63	24 (8) 80	12 (4) 29	100 (34)	0.01	31 (11) 41	36 (13) 42	22 (8) 80	11 (4) 29	100 (36)	0.27											
Pollinators or beneficial insects	13 (6) 21	56 (25) 93	13 (6) 60	18 (8) 57	100 (45)	0.005	29 (12) 44	39(16) 52	12(5) 50	20 (8) 57	100 (41)	0.80											
Leguminous crop usage	13 (4) 14	53 (16) 59	13 (4) 40	20 (6) 43	100 (30)	0.05	46 (12) 44	30(8) 26	4 (1) 10	19 (5) 35	100 (26)	0.50											
Production sector		Livestock only					Crops plus livestock																
Livestock production	(n=10)	(n=14)	(n=12)	(n=13)			(n=29)	(n=27)	(n=10)	(n=14)													
Creating shade areas	0 (0) 0	0 (0) 0	40 (6) 50	60 (9) 69	100 (15)	0.002	30 (7) 24	44 (10) 37	9 (2) 20	17 (4) 29	100 (23)	0.77											
Growing own forage	0 (0) 0	6 (1) 7	38 (6) 50	56 (9) 69	100 (16)	0.01	30 (7) 24	44 (10) 37	9 (2) 20	17 (4) 29	100 (23)	0.12											
Use of improved varieties	0 (0) 0	6 (1) 7	38 (6) 50	56 (9) 69	100 (16)	0.01	33 (7) 24	33 (7) 26	14 (3) 30	19 (4) 29	100 (21)	0.55											
Early morning dew pasturing	83 (10) 100	8 (1) 7	8 (1) 8	0 (0) 0	100 (12)	< 0.001	20 (9) 31	33 (15) 56	20 (9) 90	27 (12) 86	100 (45)	0.53											

NB: Each row shows the frequencies of respondents' participation by educational levels per strategy in the context of specialists versus generalists. For each row the p-values are the probabilities that the differences between the educational levels as per uptake of each mitigation strategy is due to chance alone in the context of specialists and generalists respectively. Respondents chose between mitigation strategies which were not mutually exclusive. Thus respondents chose as many strategies as they used from a list. However, the Yes and No options were mutually exclusive. The results were tested with the chi-square test on a row by row basis. Improved varieties refer to the use of livestock species with enhanced reproductive and health performance. Vermiculture denotes efforts by farmers to encourage proliferation of earthworms in their soils to boost fertility at the study site.

Mixed farmers who recorded low strategy uptake in plant production had the highest numbers of livestock (Table 3.13). The lowest numbers of livestock were, however, observed amongst farmers with “moderate use” of strategies (Table 3.13).

Table 3.13 Relationship between livestock productivity or ownership and the uptake of crop innovation strategies amongst mixed farmers (n=68).

Level of strategy uptake	Percentage (Frequency)	Mean livestock numbers per farmer	Standard deviation	Min	Max	P-value
Low use (n=21)	16 (11)	60	50	10	184	0.01
Moderate use (n=44)	34 (23)	27	33	10	68	
High use (n=85)	50 (34)	41	15	9	62	

The results were tested with a t-test. The p-value is the probability that the differences in mean livestock numbers between the categories of strategy uptake are due to chance alone. Null hypothesis, H_0 : Mixed farmers with high innovation uptake will have highest livestock numbers. Alternate hypothesis, H_A : Mixed farmers with low innovation uptake will have highest livestock numbers.

Lack of access to financial capital was the principal constraint to strategy adoption amongst the high innovation category according to farmers (Table 3.14). Moreover, farmers who are not innovating regard lack of access to information as their main challenge whilst farmers who are innovating consider lack of access to financial capital as the main challenge to innovation uptake.

Table 3.14 Core limiting factors to the uptake of strategies at the study site as listed by farmers.

Constraints to innovation uptake	Percentage (Frequency)			Total	P-value
	Level of innovation uptake				
	Low (n=21)	Moderate (n=44)	High (n=85)		
Lack of access to financial capital	0	45 (19)	49 (42)	41 (61)	<0.001
*Other	9 (2)	31 (13)	24 (20)	23 (35)	
Labour	0	7 (3)	16 (14)	11 (17)	
Lack of access to information	91 (20)	17 (7)	12 (10)	25 (37)	

NB: The results were tested with the chi-square test, $X^2=69.34$. The p-value is the probability that the response differences per limiting factor in the context of strategy uptake is due to chance alone. * Other refers to other factors like accessibility to land, adequate extension services, availability of improved varieties etc.

When the simultaneous effects of multiple variables such as gender, age, location and educational level on strategy uptake were examined by a standard binary logistic regression model (Table 3.15), it was found that place of farming activity (zone) was a significant catalyst for respondents' use of innovation in terms of strategy uptake (i.e. if at least one innovation was used). Strategy uptake was categorical and compared with the reference category. The use of farm-level strategies was significant in Magamzin and Gaganene neighbourhoods in comparison to the reference category. The odds ratio for the Magamzin locality indicates farmers from that area are thrice more likely than their counterparts from Mambayin to adopt farm-level

innovations. Furthermore, respondents from Gaganene are almost twice more likely than those from Mambayin to adopt farm-level innovations. Thus, farming in the Magamzin or Gaganene localities has positive returns on innovation uptake (Table 3.15).

Table 3.15 Analysis of factors influencing respondent farmers' strategy uptake.

Variable	Category	Odds Ratio	Standard error	[95% CI]	P-value
Age	18–34	Ref	Ref	Ref	Ref
	35–54	2.03	2.08	0.27- 15	0.49
	55–74	1.29	1.54	0.13-13	0.83
	75+	4.14	6	0.24-71	0.33
Gender	Male	Ref	Ref	Ref	Ref
	Female	0.56	0.38	0.15-2.2	0.41
Educational level	No schooling	Ref	Ref	Ref	Ref
	Primary school (Grade 1–7)	0.33	0.34	0.43-2.57	0.29
	Secondary school (Grade 8–11)	1.17	0.23	0.13- 13	0.2
	Matric and above	2.77	0.99	0.06-9.6	0.84
Zone	Mambayin	Ref	Ref	Ref	Ref
	Manjesa	1.22	1.22	0.14-10	0.18
	Magamzin	3.1	0.1	0.02-0.63	0.01
	Gaganene	2.13	0.13	0.02-0.71	0.02
Social capital					
Household member's membership of farm association	No	Ref	Ref	Ref	Ref
	Yes	0.44	0.14	0.00-1.54	0.32
Active network					
Close friend in village	No	Ref	Ref	Ref	Ref
	Yes	1.18	0.26	0.01-5.06	0.23
Relative in same village	No	Ref	Ref	Ref	Ref
	Yes	8.42	14	0.26-274	0.23
Relative in another village	No	Ref	Ref	Ref	Ref
	Yes	14.9	28	0.34-651	0.16
Reciprocal relationships					
Close friend's assistance	No	Ref	Ref	Ref	Ref
	Yes	1.85	1.8	0.25-13	0.55
Assistance from relative Relative in another village assistance	No	Ref	Ref	Ref	Ref
	Yes	0.63	0.51	0.12-3.1	0.16
Information source					
Print	No	Ref	Ref	Ref	Ref
	Yes	0.56	0.43	1.7-0.4	0.34
Others	No	Ref	Ref	Ref	Ref
	Yes	1.78	2.2	0.36-3.2	0.79
Electronic	No	Ref	Ref	Ref	Ref
	Yes	2.46	0.41	1.2-2.2	0.6
Cultivated farm fields					
1–4	No	Ref	Ref	Ref	Ref
	Yes	1.01	0.2	0.12-2.4	0.3
5–10	No	Ref	Ref	Ref	Ref
	Yes	0.3	0.22	0.07-1.3	0.11
11+	No	Ref	Ref	Ref	Ref
	Yes	1.81	2.5	0.12-27	0.67

NB: Significant values are in bold. "Ref" refers to "reference category". Results were tested with a binary logistic regression. The p-value is the probability that the response differences for each variable per strategy uptake are due to chance alone. The logistic regression model was not significant ($X^2 = 0.2547$, $p = 0.0833$).

An agroecology map (Fig. 3.4) was created after surveying the area, holding discussions with farmers on their farms and homesteads as well as consulting literature. It highlights the natural resource and land-based livelihood assets of the area.

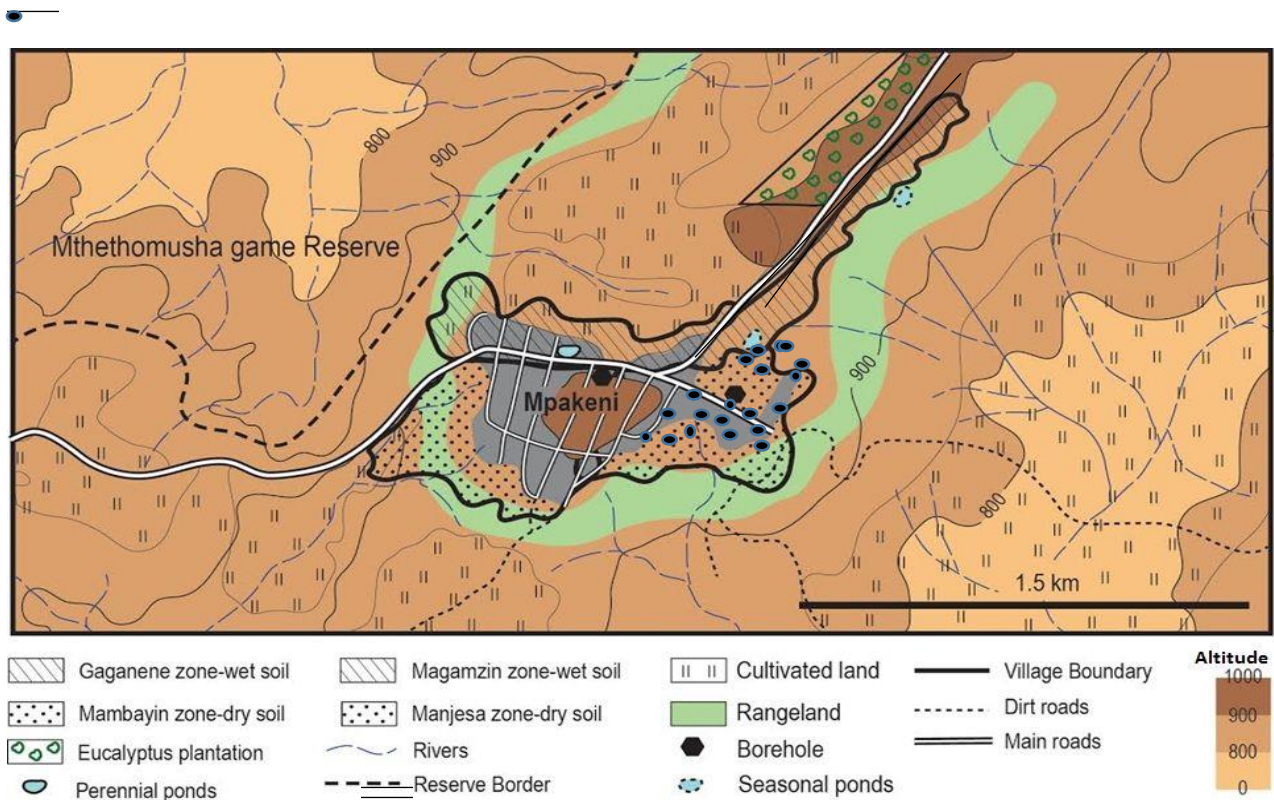


Figure 3.4. Agroecology map of Mpakeni.

3.4. DISCUSSION

3.4.1 Innovation Uptake in Response to Climate Effects and Enhancing Food Security

Smallholder farmers working on up to 10 hectares manage an estimated 80% of the farmland in sub-Saharan Africa and Asia (FAO 2012). Thus, smallholders play a critical role in fighting food insecurity and need to continually adapt their management systems to enhance their competitiveness and business viability (FAO 2012; Anastasova–Chopeva et al. 2015). The world's smallholders are increasingly faced with challenges that affect their productivity and sustainability (Anastasova–Chopeva et al. 2015; AGRA 2017). A crucial prerequisite for enhancing their competitiveness and agricultural sustainability is the scale or degree of deployment of farm-level innovation. Thus, the use of innovation by way of mitigation strategy uptake helps to safeguard smallholders' preferred areas of agricultural engagement in the face of climate impacts and land degradation (Table 3.2). Moreover, the uptake of these innovations does not follow a

linear process, but is a rather complicated, dynamic and random process (FAO 2012). This necessitates interrogating a plethora of possible causal factors impinging on mitigation strategy uptake. To our knowledge this is the first study to investigate the effect of a wide range of social capital (as per the sustainable livelihood framework) on mitigation strategy uptake in rural smallholder systems. Furthermore, this study gives unique insights on the nexus of strategy uptake amongst generalist and specialist smallholder systems.

3.4.2 Gender and Strategy Uptake

Women featured in all sectors of agricultural production at the study site (Table 3.2). Moreover, women form a significant segment of the smallholder populace that supply circa 80% of the food in sub-Saharan Africa and Asia (FAO 2012). However, they have increasingly become susceptible to the competitive pressures from globalization and market factors further exacerbating their vulnerability (Fan et al. 2013; AGRA 2017). One of the key levers for facilitating the development of smallholder systems is promoting gender parity in agricultural productivity, which is also posited to have positive returns on the entire value chain and rural economy (Doss 2011; Doss et al. 2015). However, there is a remarkable dichotomy in agricultural participation along gender lines across sub-Saharan Africa (Kilic et al. 2015). In the context of strategy uptake and gender (Tables 3.4 & 3.5) with only two out of the fourteen strategies (*cover crops usage* and *no till or minimum tillage*), recording significant differences ($p=0.02$) in use across gender (Table 3.5). Hence, in terms of specialists in crop production, more males (59%) compared to females (23%) practiced cover cropping. On the reverse, more female generalists farmers (29%) than their male counterparts (23%) practiced “No till or minimum tillage”. Thus, *cover crops usage* and *no till or minimum tillage* were the only mitigation strategies (14%) that recorded a significant association with gender in the context of specialists and generalists respectively (Table 3.5).

In the context of innovation, gender equity harnesses the creative innovations (Fig. 3.1) of both sexes in building resilience and enhancing productivity. Moreover, projections of gender disparities in agriculture largely revolve around 20% to 30% in sub-Saharan Africa (Kilic et al. 2015). This phenomenon has been attributed to factors such as gender disparity in (i) access to agricultural inputs, (ii) security of tenure and associated investments in land and advanced technologies, (iii) accessibility to market and credit, (iv) requisite human and physical capital, and (v) institutional and cultural challenges mediating intra-household duties of farm management and marketing tasks (Doss 2011; Villamor 2017; AGRA 2017). A common denominator in the narrative of a gendered dichotomy in agriculture, is that gender inequality is effectively alleviated when these factors are addressed (Bryceson 2002; Sishuba 2016; FAO 2019). It has also been observed that access to factors of agricultural production in South Africa is skewed in favour of men, leaving women disadvantaged (Claassens 2015). Moreover, the local agricultural sector has recorded persistent gender inequalities in access to and control over resources particularly in

rural areas, compromising the goal of sustainable and inclusive development of the sector (Thagwana 2009; Raidimi 2014). Results from Table 3.5 indicate that the adoption of “Cover crops” was highest in male specialist farmers (59%) relative to female specialist farmers (23%). Moreover, in the context of generalist farmers there was a significant association in the manner of strategy adoption as more females (29%) practiced “No till or minimum tillage” relative to males (23%). The practice of “No till or minimum tillage” involves preparing the land for farming without mechanically disturbing it as high levels of crop residue is left behind (Jat et al. 2012). This helps to improve soil moisture, soil fertility and weed control. On the reverse, tillage is labour intensive, and often a plot of land needs to be tilled several times before planting commences (Jat et al. 2012). It might be possible that due to their several culturally-assigned household duties females find minimum tillage to be cost-effective in terms of time and/or may not have the resources to afford labour unlike their male counterparts.

In the South African context, the preponderance of male migration to urban areas in search of off-farm jobs, creates a vacuum (in terms of human resources) which is often filled by the female resident populace (Ntshangase et al. 2018). In addition, claims of entrenched gender inequalities in access to factors of agricultural production particularly in rural areas persist (Thagwana 2009; Raidimi 2014). However, the scenario in South Africa is argued to be comparatively better than in other sub-Sahara African countries (Sishuba 2016; FAO 2019). Thus, unlike studies in other places in Africa such as rural Benin which point to men and women adopting different strategies to address extreme weather conditions (Villamor 2017), in this study there were generally no significant differences in strategy uptake across gender (Tables 3.2 & 3.4).

In addition, women are considered as important players in global food security (in particular) and the agricultural spectrum (in general), as an estimated 70% of women reside in rural areas tasked with 60–80% of the sector’s activities in the developing world (Sishuba 2016; Villamor 2017). However, it is argued that equal access to resources (in the context of gender), does not necessarily translate into equal returns for female farmers (World Bank 2017). Therefore, women, require specialized agricultural training, child care and customized support to assuage their double work load as farmers and caregivers (World Bank 2017). Study results (Chapter 2) indicate that more female (52.2%) compared to male (42.9%) respondents were social grant beneficiaries. Moreover, alleviating the child care needs and empowering vulnerable households to attain some minimum standard of living inter alia, are key rationales behind the introduction of social grants (Durieux 2012). It can therefore be said that social grants are empowering female farmers to overcome their double work load as farmers and caregivers. In addition, this scenario of equitable gender participation in sectors of agriculture (Table 3.2) at the study site posits that the dominant narrative of significant gender disparity in access to key resources essential for success in agriculture (Sishuba, 2016; FAO 2019) may be marginal in the local context. This augurs

well for agricultural development as no gender is disadvantaged in managing climate impacts with consequences for household food security. Moreover, women are usually more vulnerable to climate effects in comparison to men due to their culturally assigned household duties, poor access to natural resources and limited influence in decision making (Villamor 2017). Hence, bridging this gender gap in agriculture aside from boosting farm yields and therefore food and nutrition security globally, empowers women (across locations) to participate in other economically viable activities that contribute to the economy (FAO 2019; Sishuba 2016).

3.4.3 To Specialise or Not to Specialise

Agricultural systems do not exist in a vacuum but are situated within social and political environments (Fig. 3.2) that have tremendous influence on how they operate (Archer et al. 2008; Bettencourt et al. 2015). Thus, a farmer's *modus operandi* (Tables 3.2, 3.3, 3.5, 3.6 & 3.13) is mediated by mutually interacting internal social factors, external social factors and political factors (Archer et al. 2008; Swanepoel et al. 2010). The decision to specialise or generalise (Tables 3.6, 3.7 & 3.8, Plates 3.B, 3.D & 3.F) is often informed by the farmer's assessment of their capabilities (Archer et al. 2008; Swanepoel et al. 2010). Such capabilities can be mediated by age (Tables 3.8 & 3.10), farm site (Tables 3.7 & 3.9) conditions (Fig. 3.4), education (Tables 3.11 & 3.12), gender (Tables 3.4 & 3.5) and potential for optimised livelihood outcomes (Fig. 3.2, Plate 3.E) as per their livelihood portfolio (Swanepoel et al. 2010; Bettencourt et al. 2015). Moreover, this can also be affected by the interplay of factors such as the farmer's experience, household requirements, climate, market factors, soils and supportive governmental policy *inter alia* (Swanepoel et al. 2010; Bettencourt et al. 2015).

Mixed farming was one of the core sectors of agriculture practiced by respondent farmers as per their smallholder systems. The combination of crop and livestock in smallholder systems (Tables 3.2 & 3.7) is argued to reinforce resilience to the impact of climate change (Rojas-Downing et al. 2017). Moreover, it is surmised that agriculture can be a core contributor to climate change but is strongly affected by it. The livestock sector is responsible for 14.5% of global GHG emissions (Gerber et al. 2013; Rojas-Downing et al. 2017). The effect of climate change is such that it accentuates the vulnerability of agricultural systems and reinforces prevailing factors that are undermining productivity (Rust & Rust 2013; Tibesigwa 2014). Thus, subsistence farmers (such as the respondent farmers of this study) are principally vulnerable to climate change (Tibesigwa 2014; Sejian et al. 2016). This opines that in addition to diversifying their crop types, farmers and their households need to embrace mixed farming (Table 3.2) in light of the palpable effects of climate change (Rojas-Downing et al. 2017). Consequently, there is a policy shift towards encouraging smallholder farmers to combine crops and animals in South Africa. This is in contrast to the previous approach towards farmers simply diversifying their crops (Tibesigwa 2014). Thus,

the scenario of 68% of respondent farmers involved in mixed farming (Table 3.2) is beneficial for smallholder farm resilience and wellbeing.

Study results indicate that higher numbers (66%) of specialist smallholders are engaged in increased use of chemical fertiliser (Table 3.6) compared to generalist smallholders (21%). Moreover, given that 62 (78%) farmers out of the 80 smallholder specialist population were crop farmers, the phenomenon of a significant difference as per *increased fertiliser use* (Table 3.6) could be attributed to the crop farmers' fertiliser usage. Thus, it can be opined that specialist smallholders (Table 3.6) engaged in crop production (66%) are just more invested in crop production, and are therefore more likely to spend on inputs like fertilizer. In addition, they may be faced with relatively poor soil conditions compared to their generalist counterparts (21%). This could be because monoculture systems tend to deplete soil fertility more than polyculture systems (Yahaya et al. 2017). Conversely, it can be argued that generalist smallholders benefit from livestock manure to improve their soils hence alleviating fertiliser use (Table 3.6). In addition, animals are exposed to the weather elements, and rely on pasture coupled with allied natural forage for nutrition (Rust & Rust 2013). Moreover, climate change affects the quality and quantity of forage crops undermining farmers' efforts to meet the nutritional requirements of livestock (Tibesigwa 2014; Sejian et al. 2016). This comes with appreciable effects on livestock productivity, the carrying capacity of rangelands, the buffering capacity and sustainability of ecosystems, as well as the assortment of livestock diseases and parasites (Rust & Rust 2013). Animal husbandry is therefore argued to be more susceptible to climate fluctuations and a highly risk prone enterprise (Nkonde et al. 2015; Kedebe 2016).

The practice of mixed farming helps spread the risk of farm failure and reduces smallholders' already vulnerable conditions (Tibesigwa 2014; Sejian et al. 2016). Additionally, ownership of livestock in rural South Africa is skewed towards the elite as less than a third of the populace is able to engage in any form of livestock farming (Chapter 2). Social grants empower the poorest at the study site to participate in capital-intensive livestock production (Chapter 2). Furthermore, livestock ownership correlates with augmented income from nonrural sources, and is consequently regarded as a key indicator of social differentiation especially in rural South Africa (Cousins 1996). In addition, animal husbandry (Plates 3.D & 3.F) is a crucial economic and socio-cultural activity for the wellbeing of rural households (Rust & Rust 2013; Gaughan & Cawdell-Smith 2015). It comes with positive trade-offs of food security, income generation, capital accumulation, job creation, soil fertility, livelihoods, transport, agricultural traction, agricultural diversification and sustainable agricultural production (Archer et al. 2008; Cousins 1996; Swanepoel et al. 2010; Bettencourt et al. 2015).

The practice of mixed farming amongst respondent smallholders at the study site is not an isolated case in several rural milieux (Rust & Rust 2013; Gaughan & Cawdell-Smith 2015). Furthermore, in many rural communities across the globe, livestock can be the singular asset of the poor and vulnerable, despite its vulnerability to climate variability and extremes (Rust & Rust 2013; Gaughan & Cawdell-Smith 2015). In addition, circa 1.3 billion people of the poorest populace worldwide have livelihoods based on the livestock (including poultry) sector which employs circa 1.1 billion individuals (Rojas-Downing et al. 2017). This includes over 600 million smallholders in the southern hemisphere who depend on livestock for food and financial security (Rust & Rust 2013; Gaughan & Cawdell-Smith 2015). Consequently, the situation whereby circa 57% of respondent farmers are engaged in livestock production (Tables 3.2 & 3.6) is important for asset accumulation of the poor and vulnerable, as well as efforts to alleviate social inequality in South Africa which is regarded as one of the most unequal societies in the world (Noble & Wright, 2013; Bhorat 2015). This is more so as the study site falls in a region with high numbers of indigent people and endemic poverty is rife (ARC 2015). Ultimately, ownership of livestock comes with positive trade-offs for vulnerable groups per the global agenda of Leaving No One Behind as per the Sustainable Development Goals.

3.4.4 Locality and Strategy Uptake

The stimulus for innovation can be the immediate micro-environment or location (Tables 3.7, 3.9 & 3.15). The terrain (Figs. 3.3 & 3.4), for example, might be unsuitable for agriculture hence challenging the organisational skill of the farmer to introduce appropriate technology (Sayiner 2015). This stimulates the taking of risks and pursuit of new ideas causing further creativity and innovation (Figs. 3.1 & 3.2). An environment that demands creativity heightens innovative output as people are forced to respond to such needs (Puccio & Acar 2015; Sayiner 2015). Conversely, an unfriendly agricultural terrain can discourage farming in the absence of much needed extension support (Sayiner 2015). This might be the case for areas such as Mambayin and Manjesa (Fig. 3.4) which farmers described as relatively less fertile and dry. Study results (Table 3.9) indicate that respondents from Magamzin (75%) and Gaganene (69%) are associated with relatively less use of chemical fertiliser in comparison to those from Mambayin (13%) and Manjesa (9%). Given that chemical fertilisers are used to improve soil nutrient content and enhance crop production (Chaney 2012), it can be inferred that the need for enhancing soil fertility is greatest in the Mambayin and Manjesa localities (Table 3.9). It can also be posited that farmers from those localities are relatively wealthier or it might be possible they have learnt that it is effective and worth the expense.

“No till or minimum tillage” registered highest uptake in Gaganene locality (62%) and lowest in the Manjesa (6%) locality (Table 3.9). This mitigation strategy helps limit soil erosion, improves water infiltration into the soil, and enhances soil biological fertility and the soil retention capacity

of organic matter (Zikeli & Gruber 2017; Carr et al. 2013). It might be possible that farmers from Gaganene are more informed or experienced with this mitigation strategy relative to Manjesa.

Much of Gaganene and Magamzin are contiguous with the Mthethomusha Game Reserve. Farmers described game reserve land as very fertile for agricultural production and an erstwhile hub of agricultural activity prior to the creation of the game reserve. However, these claims were not scientifically substantiated during the study. Other accounts describe the reserve area as *low potential agricultural land* which was demarcated for optimal and sustainable development by the management of the then KaNgwane Parks Corporation (SA-Venues.com, 1999). Furthermore, the only two water boreholes in Mpakeni village (Fig. 3.4) are located in Gaganene and Magamzin neighbourhoods (also referred to as *zones* by the locals). Such water sources are critical as the area is generally described as semi-arid. The areas Gaganene and Magamzin also host the only two natural water ponds (Fig. 3.4, Plate 3.A) in Mpakeni village which serve as additional sources of water. However, the former is perennial whilst the latter is seasonal. Thus, Gaganene has the advantage of a year round water supply which is crucial to farmers.



Plate 3.A. Perennial water source in Gaganene zone.

Nevertheless, smallholder farmers are disproportionately susceptible to climate change due to their dependence on dryland agriculture and limited options in coping with climate fluctuations (Tibesigwa 2014; Rust & Rust 2013). It was observed that most crop farmers at the study site grew annual crops (such as maize) which complete their life cycle before the dry winter seasons. Thus, crop producers can afford to grow only summer crops to limit crop failure in the winter season. However, livestock farmers do not have such latitude as livestock requires constant water supply and has to survive beyond the annual cycle of most crops grown at the study site.

Furthermore, livestock in tropical regions are generally subjected to multiple stressors simultaneously (Rust & Rust 2013; Sejian et al. 2016). The combined effect of several stressors significantly impacts animal production, reproduction and immune status (Sejian et al. 2016; Rojas-Downing et al. 2017). Thus, there is a dichotomy in the relative vulnerabilities of sectors of agricultural production (Gaughan & Cawdell-Smith 2015). It is therefore argued that livestock production is more sensitive to climate vagaries vis-à-vis crop production (Fereja 2016; Sejian et al. 2016; Rojas-Downing et al. 2017). The recent drought linked to the 2015–2016 El Nino, manifested the incontestable impact of extreme climatic conditions on South Africa's livestock (Kriel 2017). This resulted in a spike in incidences of all types of livestock infections. Furthermore, the dearth of sufficient grazing translated into several animals experiencing nutrient deficiencies, poor conception rates, slowed growth and compromised immune systems inter alia (Kriel 2017). The narrative from the respondent farmers of this study reflected these challenges and the consequences for their livelihoods and household welfare. Conversely, it is argued that extreme temperatures will also create more favourable production conditions for high-lying areas in the Free State, Eastern Cape and Kwazulu-Natal, given the preponderance of frost in winter (Kriel 2017). The heightened temperatures will also assist farmers in such areas to become more productive. This necessitates organised agriculture and agribusinesses enhancing knowledge about sustainable agriculture and addressing misconceptions in the sector (Rust & Rust 2013; Fereja 2016; Kriel 2017).

In addition, it was observed during the field work that the weekly Thursday communal cattle dipping (Plate 3.B), supervised by agricultural extension workers (Plate 3.C), occurs only in the Gaganene zone. This may have made Gaganene a default area for quality/effective interaction between farmers (Plate 3.D) and other relevant actors (Plate 3.C) with consequences for strategy uptake (Kolade & Harpham 2014).



Plate 3.B. Weekly communal cattle dipping in Gaganene Zone.

It is exigent to stress the level of interaction as Magamzin is the site of the Community Town Hall (see Mpakeni Community Map in Chapter 5) where all major community meetings regarding salient socio-economic issues (agriculture included) of the village are held. In addition, the disbursement of monthly social grants which creates a market for diverse agricultural and non-agricultural produce (Plate 3.E) also happens in Magamzin.



Plate 3.C. Agricultural extension officer visits Mpakeni to supervise communal cattle dipping in Gaganene zone.



Plate 3.D. Farmers await their turn to herd their cattle for dipping.

Such meetings, however, are infrequent and not necessarily agriculture-related compared to the regular informal farmer interaction afforded by the cattle dipping in Gaganene and associated visits of the agriculture department officers. In addition, most livestock herders who wish to graze near the Mthethomusha Game Reserve, lead their livestock through the Gaganene and Magamzin zones. The intercourse of the two (frequent meaningful interaction and a critical resource) serves as a seedbed conducive for innovation to thrive and be successfully adopted (Dolinska & d'Aquino 2016).



Plate 3.E. Social grant disbursement day serves as market day where farmers and others trade their goods.

It might be possible that even if such Town Hall meetings are frequent, power dynamics between different groups such as farmers, teachers, rural elite etc. might compromise the effectiveness of any intended meaningful interaction as participation is on unequal terms (Goulet 2013).



Plate 3.F. Farmers pass through Gaganene to graze on land bordering the Mthethomusha Game Reserve.

Given the significance of strategy uptake in Magamzin relative to the reference category (Table 3.15), it can be argued that the regular agricultural market that occurs only in the Magamzin zone (Plate 3.E) has fortuitously become a unique platform for cross-fertilization of farming ideas and hence adoption (Table 3.15) of innovation. It is noteworthy that the agricultural market also attracts people from the other zones, neighbouring villages and other parts of Mpumalanga province, which may facilitate exposure to novel strategies (Rogers 2003; Sayiner 2015; Castle et al. 2016). Moreover, in light of the diffusion of innovation theory, it can be surmised that the agricultural market and weekly cattle dipping afford *observability* and *trialability* as farmers see the tangible results from their peers before committing to adopt (Rogers 2003; Tohidi & Jabbari 2012; Castle et al. 2016).

Therefore, the Gaganene and Magamzin zones may have provided a conducive environment for an effective community of practice to evolve. Such a community of practice serves as an avenue for learning and for the creation of discourses and norms which could facilitate or impede innovation in terms of strategy uptake (Goulet 2013). These gatherings, in the Gaganene and Magamzin zones may have created a platform for collective learning as farmers interact and share experiences on the sidelines. The incidental outcome is more cross-pollination of ideas and

dissemination of novel farming interventions on addressing recurrent agricultural problems with consequences for strategy uptake. Ultimately, given that strategy uptake is significant in Gaganene and Magamzin (Table 3.15) relative to other areas, it can be argued that such a community of practice empowers farmers to be more innovative in their farming (Dolinska & d'Aquino 2016).

Agricultural productivity is commonly understood in terms of output per unit of input (Kolade & Harpham 2014). This can be due to (1) enhanced quantity and quality of inputs coupled with labour and (2) enhanced production processes (Kolade & Harpham 2014). Hence, results from the study site (Figs. 3.3 & 3.4) indicate that enhanced training/education improves quality of inputs and enhances productivity (Kolade & Harpham 2014). Moreover, improvement in technology can be due to access to novel knowledge (Fig. 3.1) that enhances the production process and social capital (Sayiner 2015). In mixed smallholder systems at the study site, extensive strategy uptake in plant cultivation does not simultaneously translate into livestock productivity (Table 3.13). Hence, amongst smallholder systems, the ample strategy uptake in plant cultivation is not a proxy predictor of animal productivity (Table 3.13). This highlights the low skills base or adaptive capacity of smallholder systems (Tibesigwa et al. 2016) including the study area. This is because, although agriculture is highly affected by climate change, within the agricultural sectors livestock production is argued to be highly climate sensitive (Parry et al. 2007; Panthi et al. 2016). Furthermore, this scenario indicates that building the capacity of smallholder farmers will enable them to be productive in both spheres of production similar to commercial farmers. On the other hand, it can be inferred that smallholders prefer to specialise in their agricultural production given their low skills base and resources. Enhanced agricultural productivity will benefit all farmers across their age cohorts and hence the entire community (Tibesigwa 2014; Rust & Rust 2013).

3.4.5 Age-cohort and Strategy Uptake

Age had a significant association with farmers' sector of agricultural production (Table 3.8). Furthermore, a community's age distribution can affect its productivity as capacity to adapt and innovate is associated with the performance of some activities which may vary over the life cycle (Börsch-Supan & Weiss 2016; Watcharaanantapong et al. 2014). Moreover, experience, work skills, health status or fitness amongst other background factors can also affect productivity (Börsch-Supan & Weiss 2016). It appears that farmers in the age cohorts of 35–54 and 75+ years exhibit relatively higher propensity for strategy adoption in comparison to the reference category (Table 3.15). In addition, power differentials cause young people to be marginally involved with the dominant social paradigm (as expatiated in Chapter 5), and as such cause young people to be more open-minded and receptive to sustainable concepts as well as exhibiting environmentally-friendly values (Dunlap & Van Liere 1978; Watcharaanantapong et al. 2014). They are hence more predisposed to experiment with new ideas resulting in 'micro-inventions', which refers to changes or modifications to equipment and practices (Van der Veen 2010; Sezgin et al. 2011).

Moreover, as innovation demands flexibility and open-mindedness to change, young individuals can be presumed to be more likely to embrace fresh ideas and change with respect to environmental sustainability (Van der Veen 2010). These characteristics of the youth are largely universal. However, for a society to successfully harness the potential of its youth resources for sustainable development, the requisite conducive atmosphere needs to be created (Anastasova–Chopeva et al. 2015). Results from Table 3.10, indicate that the majority of respondents engaged in cover cropping (28%) were in the 35–54 years age cohort and the lowest (0%) amongst the 74+ years age cohort. In addition, the farmers in the 18–34 years age cohort were most prevalent (46%) in the practice of “Growing leguminous crops” ($p=0.01$) whilst the 55–74 years age cohort were least engaged in this practice (Table 3.10). Both strategies are cost effective methods for enhancing soil bio-physical conditions such as soil fertility, soil moisture and limiting soil erosion amongst others (Carlson 2013; Bettencourt et al. 2015). It might be possible that the youth due to lack of capital are unable to afford costly alternatives such as the use of fertiliser and thus predominate in the usage of these strategies.

In terms of livestock production the 55–74 and 75+ years age cohorts were the core users of “Creating shade areas”, “Growing own forage” and “Use of improved varieties” as opposed to the 18–34 and 35–54 years age cohorts (Table 3.10). Similarly, Table 3.8 results also suggest that the youth were not a majority in any sector of agricultural production. The youth in rural sub-Saharan Africa are faced with wider systemic and socio-economic hurdles that disincentive their participation in agriculture (Kolade & Harpham 2014; AGRA 2017). This includes access to arable land, access to credit (Table 3.14) and several other productive resources vital to agriculture (Vos et al. 2014). This may account for the low numbers of youth involved in agriculture at the study site. However, the youth represent the future of food security and need to be incentivised to engage in agriculture (Chapters 2 & 5), helping feed the escalating global population whilst conserving the environment (Vos et al. 2014).

This is necessary to help reverse the scenario of a majority of the global food production being undertaken by (ageing) smallholder farmers especially in the southern hemisphere (Carr et al. 2013). Moreover, given that most of Africa’s populace is below the age of 25, and 72% of these youth are classified as either unemployed or vulnerable, it has become imperative to promote agriculture as a lucrative and specialised entrepreneurial business venture (AGRA 2017). It is also argued that agriculture can only be feasibly lucrative for a very few farmers. Competition and structural constraints such as shortage of land, insecure tenure, lack of access to markets, and lack of access to affordable credit are major obstacles to transitioning from subsistence to lucrative farming. Thus, programmes such as the Land Care project (by the Department of Agriculture, Forestry and Fisheries) which is aimed at developing awareness and capacity of the youth (learners, matriculants and graduates) particularly in rural areas to become agricultural

entrepreneurs needs to be encouraged (DAFF 2018). Additionally, as climate fluctuations are increasingly undermining the development of agricultural production systems, the creativity of the youth is essential to effectively address such challenges (Watcharaanantapong et al. 2014). Conversely, the elderly accrue a wealth of knowledge and experience which are critical to their livelihoods (Watcharaanantapong et al. 2014). In addition, they often have the requisite means such as capital to employ the needed labour (which may be the youth) for their agricultural activities (Dunlap & Van Liere 1978; Watcharaanantapong et al. 2014). Furthermore, older individuals may be more resistant to change and be more careful or wary of new ideas (Roberts et al. 2006; Schubert & Andersson 2014). Thus, it can be inferred that the two age cohorts (35–54 and 75+) are more successful in harnessing their relative advantages to enhance their agricultural livelihoods. This has translated into them exhibiting comparatively higher propensities for strategy uptake (Table 3.15). Moreover, these age attributed factors may also be related to the context in which each generation grew up. Ultimately, the absence of any significant impact of age on strategy uptake en bloc, posits that the underlying challenges are encountered on similar scale across age groups (Table 3.15). Education can serve as an instrument for facilitating farm-level innovation and mitigation strategy adoption.

3.4.6 Education and Strategy Uptake

Farmers' educational levels were significantly associated with the adoption of some mitigation strategies in general and in the context of generalists and specialists (Tables 3.11 & 3.12). Furthermore, education is argued to make people more open-minded and receptive to new ideas which facilitate strategy adoption (Dolinska & d'Aquino 2016). The accrued information and knowledge due to education also tends to build human resource capacity (Sayiner 2015). Moreover, it is noteworthy that farmers with comparatively higher educational levels recorded relatively higher propensity for strategy uptake compared to those with less education, as probability for adopting an innovation increased with rise in education in comparison to the reference category (Table 3.15). The main drivers of degradation in the homelands are the high densities of people and their livestock, linked with communal tenure and weak institutions (Cousins 1996; Cousins & Walker 2015; Hoffmann 2015). In addition, poor land use practices are also a contributing factor to degradation (Hart & Aliber 2012; DWA 2018).

In the context of specialists in livestock production, respondents with secondary education and above were most prevalent (69%) in the use of "Creating shade areas", "Growing own forage" and "Use of improved varieties" (Table 3.11). These strategies are associated with the on-farm investment and innovation (Godfray et al. 2010). For example the "Creating of shade areas" often involves the erection or construction of structures for livestock which comes with cost implications (Koelle et al. 2016). Moreover, the "Growing of own forage" has become complicated in the face of adverse climatic conditions requiring the farmer to be more innovative

in the selection/combination of forage species and timing of planting that translates into high quality, nutritious forages that come with ecosystem benefits (ARC 2016; Stagnari et al. 2017). The “Use of improved varieties” of livestock involves capital complemented with training for improved animal husbandry (World Bank 2016). Ultimately, all three strategies necessitate technical knowledge, skills and finances to be sustainable and maximize productivity in animal husbandry (Godfray et al. 2010; Nardone et al. 2010; Ribeiro et al. 2018). It can be inferred that education by its significant association with these strategies, empowers farmers with the requisite resources to be able to engage in their use. In addition, given that education also empowers people to access and use information, it can be opined that farmers with enhanced formal education are more successful in finding useful information to support their agricultural activities (Dolinska & d’Aquino 2016). It is thus important to enhance education (Tables 3.1, 3.11 & 3.12) in farming communities (Fig. 3.4) as it comes with positive impacts in the agricultural value chain (Villamor 2017). However, a common narrative during interviews with farmers was that agricultural education is not foregrounded in the post-apartheid school curricula unlike previously. This has contributed to apathy towards agriculture which has been compounded by poor access to requisite resources such as extension services. Additionally, Table 3.12 indicates that formal education generally has chequered results on strategy uptake at the study site. Thus, in Table 3.12, most specialist farmers who practiced “Increased use of chemical fertiliser” had secondary school (Grade 8–11) education (80%), whilst the second highest usage was recorded amongst respondents with “Primary school” education (63%). Moreover, the practice of this strategy falls to 29% amongst “Matric+” respondents and decreases marginally to 17% amongst respondents with “No schooling”. The scenario of mixed results on the association between education and individual strategy uptake is repeated in the context of specialists and generalist smallholders (Table 3.12). This is reflected in results pattern for the “Use of pollinators or beneficial insects”, “Creating shade areas”, “Growing own forage”, “Use of improved varieties” and “Early morning dew pasturing” in the context of specialists and the “Use of manure” context of generalist smallholders.

This situation indicates that formal education has mixed results or simply a marginal influence on strategy uptake at the study site. Therefore, the non-significant effect of formal education on strategy uptake (Table 3.15) can be attributed to the dearth of agricultural education in the school curricula inter alia (Stoecker 2014; Raidimi & Kabiti 2017). Moreover, the generally low levels of education (Tables 3.1, 3.11 & 3.12) at the study site also indicate that agricultural education through the school curricula will have limited impact without a commensurate improvement in enrolment rates. Furthermore, a common thread in the narrative of innovation adoption opines that an innovation diffuses successfully through a specific segment of a populace or social system (i.e. the critical mass) who serve as its catalysts (Rogers 2003; Tohidi & Jabbari 2012; Castle et al. 2016). Thus, it can be argued that the presence of a critical mass (Rogers 2003;

Tohidi & Jabbari 2012; Castle et al. 2016) is sufficient to significantly diffuse agricultural innovation at the study site. Moreover, people of different levels of education can still interact and constitute a critical mass. Therefore, it can be surmised that such a critical mass is lacking in the area's formal educational context given the non-significant impact of education on strategy adoption (Table 3.15). In addition, it can be inferred that agricultural education at the study site is more prevalent or effective at alternative fora other than formal education such as the weekly gatherings in Gaganene (Plates 3.B, 3.C & 3.D) which afford extension education and related services. Nevertheless, there is the need to improve the visibility of agriculture in the formal school sector as well as interactions between agriculture education institutions and local communities (Stoecker 2014; Raidimi & Kabiti 2017). Additionally, as the palpable effect of climate change on rural economies of the Southern Hemisphere worsens, school curricula need to also reflect themes of sustainability to help address deteriorating productivity and environmental degradation (Stoecker 2014; Raidimi & Kabiti 2017). Moreover, farmers are capable of producing novel ideas and farm interventions which are unique from that of agronomists and extension workers (Goulet, 2013). Ultimately, the low education levels (Table 3.1) of the farmers make a case for more education as well as tailored extension services (Ngubane 2018). These will serve as catalysts for cultivating and facilitating such peer networks across the farming areas/zones to improve rural agriculture (Dolinska & d'Aquino 2016). Conversely, it can be argued that farming may be the most viable livelihood strategy for those with less education. Moreover, people are less likely to farm if they have higher education, and thus access to other employment/career options. There is therefore no guarantee that better education will make people better farmers – they may simply abandon farming for more profitable livelihoods that open up to them with better education, such as working in the cities. Social capital is another important factor in the dynamics of farm-level of innovation.

3.4.7 Social Capital and Strategy Uptake

Study results indicate that social capital did not impact individual strategy uptake (Table 3.15) at the study site. Informal social capital and communal natural resources serve as coping strategies in times of agriculture-related shocks (Tibesigwa et al. 2016). Moreover, social capital (such as membership of a *farmers' association*) can facilitate uptake of innovation and is also a vital source of support for rural smallholders coupled with having relations and other connections (Kolade & Harpham 2014; Tibesigwa et al. 2016). This indicates that joining a farmer's association can enhance the spread and uptake of novel farming techniques in response to increasingly unfavourable climatic conditions (Klerkx & Proctor 2013). However, the membership of a social group by a household member did not significantly affect strategy uptake at the study site (Table 3.15). This could be attributed to the level of influence in decision making which the household member wields in the household, which is often outweighed by that of a household head. This can compromise the effectiveness of the household member as an agent for facilitating strategy

uptake. During the field work, the chairman of the local farmers association lamented the poor commitment of local farmers to its ideals. This has led to a situation where members do not attend meetings, effectively participate in activities nor pay their membership dues. Moreover, this has translated into a weak and dysfunctional farmer's organisation which is failing to perform its core functions. This scenario may have also contributed to the membership of farmers organisation not having a significant effect on strategy uptake (Table 3.15) at the study site (Fig. 3.3), despite arguments to the contrary (FAO 2012; Anastasova–Chopeva et al. 2015).

Social networks are argued to enhance life in kinship-based societies and subcultures (Ferguson 2015). However, their effectiveness depends on individuals' abilities to maximize/capitalize on such an asset to enhance their livelihood (Zhao et al. 2016). It can hence be argued that farmers are equally not effectively exploiting their social capital in the domains of *kinship* and *connectedness* (Table 3.15). In the course of the field work, it was observed that farmers occasionally volunteered their services en bloc to assist each other as the situation demanded. Farmers also explained that this was a way of attracting the blessings and goodwill of their ancestors which comes with good fortune and other invaluable benefits. Moreover, such practices are argued to be compromised due to the influence of modernization (Mensah & Amissah 2016). In addition, it can be inferred that the harnessing of these social networks is so ingrained amongst respondents such that any possible differences could simply be marginal rather than significant (Table 3.15). Furthermore, people normally depend on these aspects of their social capital for support when in need of assistance for farm labour or when faced with livelihood shocks (Ferguson 2015; Tibesigwa et al. 2016). Thus, the non-significant outcome in all aspects of social capital viz membership of more formalized social groups, kinship and connectedness (Table 3.15) could mean there is less meaningful cross pollination of farm related ideas through these media at such fora. This scenario suggests that the flow of information is important for the dissemination of innovation and hence uptake of related strategies.

3.4.8 Influence of Access to Information and Capital on Strategy Uptake

Poor access to information and financial support inter alia was cited by farmers as core hindrances to their innovation uptake (Table 3.14). Access to capital affects a farmer's willingness to adopt an innovation (Kolade & Harpham 2014). Thus, farm strategies that are accompanied with financial strains on the farmer are rejected in favour of less costly alternatives (Toma et al. 2018). It can therefore be inferred that the practice of a strategy such as composting (Table 3.6) does not involve any significant financial burden and the associated relevant information is also easily accessible irrespective of respondents' gender (Table 3.14).

Farmers posited that the lack of access to capital was a key factor in their usage of farm inputs (seeds, fertilizer, labour, and finance) (Chapter 2). Furthermore, it has been observed that

women generally own relatively fewer assets and lack adequate access to inputs as well as services (training, insurance) unlike men (Hart & Aliber 2012; World Bank 2017). Thus, the scenario of similar proportions of specialist males and females as well as generalist males and females using individual strategies may be attributed to the interplay of limiting factors to strategy uptake (Table 3.14) being experienced similarly across gender. Additionally, a number of studies indicates that throughout the world, women farmers make far less use of improved technologies and inputs (Sishuba 2016; FAO 2019). They also tend to have poor accessibility to extension services, which are important sources of information on new technologies in the developing world (FAO 2019). Moreover, institutional biases reinforce gender inequality in access to factors of agricultural production such as land, access to capital and inputs inter alia especially in the rural areas of South Africa (Hart & Aliber 2012). This further marginalises women as partners or actors of rural development (Hart & Aliber 2012; FAO 2019; Sishuba 2016). However, these study results indicate that this dominant narrative is also less prevalent at the study site (Fig. 3.3), as there is generally an absence of gender disparity in agricultural participation (Tables 3.1, 3.2 & 3.15) and access to such critical resources. Furthermore, it has been observed that globally, female farmers receive only 5% of all agricultural extension services, and constitute only 15% of the world's extension agents (Sishuba 2016). In the light of this argument, it can be posited that female farmers (at the study site) are actively engaged in the related communities of agricultural practice (Tables 3.2& 3.6) such that they benefit from the information exchange afforded by such a platform.

The dissemination of information to farmers through agents such as extension agencies improves knowledge on farming methods and introduces novel approaches (Tables 3.3 & 3.6) that enhance productivity (Kolade & Harpham 2014). The information source is associated with the relevance and effectiveness of the appropriate technology needed for farm productivity (Table 3.13) and resilience (Goulet 2013). The delivery of relevant information amongst farmers' networks of practice enhances their receptivity and propensity to adopt targeted innovation (Oreszczyn et al. 2010), as it deepens insight on a novel idea (Figs. 3.1 & 3.2). It is therefore advisable to disseminate extension information via communities of practice etc. to reinforce communication and provide diverse perspectives (Sayiner 2015). The poor dissemination and access to farm related information translates into low exposure to relevant ideas that can trigger innovation (Klerkx & Proctor 2013). Moreover, farmers also gain knowledge through their engagement in heterogeneous networks and agents of information (Klerkx & Proctor 2013). In the rural landscape such as the study site (Figs. 3.3 & 3.4) this includes religious bodies (like churches), friends and traditional healers. Moreover, although insignificant as per strategy uptake, the electronic media are very common sources of information in many rural areas (Kolade & Harpham 2014), compared to other agents of information (Table 3.15) and enhance the probability of strategy uptake. Similarly, print medium was not significant (Table 3.15) which may

be due to people being uninterested in perusing printed agricultural information or they being difficult to access. Moreover, indigenous cultures have oral traditions and therefore would be more open to the use of audio materials. Consequently, the presentation and dissemination of agricultural information via radio and television is congenial for strategy uptake (Kolade & Harpham 2014).

In addition, some mitigation strategies recorded significant differences in use across diverse variables relative to others (Tables 3.3, 3.4, 3.6, 3.9, 3.10, 3.11 & 3.12). It might be possible that these strategies (e.g. compost) exhibit peculiar relative advantages that cause farmers to opt for their usage in comparison to others. Furthermore, the factors limiting strategy uptake as cited by farmers (Table 3.14) may be less pronounced or encountered in the usage of such strategies. Specialists in crop production (Table 3.6), are predisposed to a high use of chemical fertiliser (60%) compared to generalists (21%). In addition, specialists are more inclined to adopt no till (60%) unlike generalists (28%). Given that such strategies are soil fertility enhancing (Ekblom et al. 2019), it can be surmised that crop production in specialist systems requires relatively high fertiliser usage (Sishuba 2016; FAO 2019). Conversely, it can be argued that soil conditions are relatively more fertile in generalist systems compared to specialists (due to manure availability), thus requiring less use of fertiliser (Table 3.6). This also posits that the phenomenon of some specific strategies and sectors of production (Tables 3.8 & 3.12) recording significant statistical values can be due to adequate access to resources such as information (in the communities of practice) for such strategies. They also provide peculiar relative advantages and are compatible with the values, experiences, and needs of their user groups as per the DOI theory (Rogers 2003; Tohidi & Jabbari 2012; Castle et al. 2016). Moreover, farmers may have developed confidence in such methods over time and become comparatively more receptive to their adoption unlike the rest. For example the higher significance values registered for “Use of manure or compost” ($p < 0.001$) and “Plant and animal diversity” ($p < 0.001$), as opposed to the “Increased use of chemical fertilizer” ($p = 0.01$) (Table 3.6), may be due to respondent farmers preference for the use of such alternative soil fertility enhancing measures. Moreover, it can be surmised that farmers from the study area have a penchant for the usage of ecosystem friendly strategies in general such as crop rotation, cover cropping and composting inter alia (Table 3.6). It might also be possible that these strategies probably also require low levels of input, and may also be traditional practices or more analogous with such.

Additionally, some farmers at the study site often pointed to social grants helping them cover the costs of agricultural inputs especially fertiliser (Chapter 2). Thus, the usage of nature-based soil enhancing strategies might also indicate farmers are more predisposed to utilise natural options such as compost (Table 3.6) which are cheaper and also benefit the soil (Ekblom et al. 2019). In addition, the significant values recorded (in terms of generalists/specialists) for

strategies such as “No till or minimum tillage”, “Use of resistant varieties”, “Growing own forage” and “Creating shade areas” (Table 3.6) can be attributed to readily available information and extension support inter alia (Sishuba 2016; Ngubane 2018; FAO 2019).

3.5. CONCLUSION

Low strategy uptake amongst rural smallholder farmers is linked to factors like low adaptive capacity and allied resources. Study results illustrate a pattern indicating that the location and agricultural-related activities in an area can help overcome these challenges and facilitates strategy adoption. Hence, the location of farming activity coincidentally serves as an effective catalyst which promotes strategy uptake at the study site. In addition, variables like age and education play a complementary role or enhance the prospect of strategy uptake. These factors collectively need to be foregrounded in agro-environmental interventions so as to enhance policy effectiveness and success. Understanding and integrating the gender dimension in adaptation strategies in response to climate impacts helps enhance the social impact and relevance of the resultant agricultural knowledge, technology or innovation. Moreover, there was generally no gender bias in the adoption of mitigation strategies based on gender at the study site unlike other places in Africa. Smallholder specialist farmers used relatively high levels of fertiliser compared to their generalist counterparts. This could be attributed to specialists being relatively more invested in their domain of production and/or being confronted with less fertile soil conditions juxtaposed with generalist systems. Furthermore, in mixed smallholder systems, high strategy uptake in plant cultivation does not necessarily result in high livestock productivity. This underscores the low skills base or capacity of smallholder systems in the study area as they are unable to be productive in both sectors simultaneously. This scenario indicates that building the capacity of smallholder farmers will enable them to be productive in both spheres of production. Conversely, it can be inferred that smallholders prefer to engage in crop production due to their limited options or lower startup costs. Interventions that build the adaptive capacity of smallholders need to employ diverse media to disseminate and facilitate uptake and impact of information. Improving extension services and support for smallholders in less fertile areas may help incentivise their participation in agriculture as well as nurture vibrant communities of practice.

3.6. REFERENCES

Abernethy, K. E., Bodin, Ö., Olsson, P., Hilly, Z., and Schwarz, A. 2014. Two steps forward, two steps back: The role of innovation in transforming towards community-based marine resource management in Solomon Islands. *Global Environmental Change*. Vol. 28, pp. 309–321. <https://doi.org/10.1016/j.gloenvcha.2014.07.008>.

AGRA. 2017. Africa Agriculture Status Report 2017: The Business of Smallholder Agriculture in Sub-Saharan Africa (Issue 5). Nairobi: Alliance for a Green Revolution in Africa (AGRA), 180 pp.

Anastasova–Chopeva, M., Nikolov, D., and Yovchevska, P. 2015. Farmers’ adaptation: What factors affecting agricultural innovations? Paper Presented at the 147th EAAE Seminar ‘CAP Impact on Economic Growth and Sustainability of Agriculture and Rural Areas’. Institute of Agricultural Economics, 7–8 October. Sofia: IAE, 13 pp.

Anderson, L. W., and Krathwohl, D. R. 2001. A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives. New York: Longman, 336 pp.

ARC. 2015. Annual Report for 2015/16. Pretoria: Agricultural Research Council (ARC), 39 pp. <http://pmg-assets.s3-website-eu-west-1.amazonaws.com/161020ARC.pdf> accessed on 23.05.2015.

ARC. 2016. Understanding crop rotation. Farmers Weekly. <https://www.farmersweekly.co.za/farm-basics/how-to-crop/understanding-crop-rotation/>.accessed on 26.12.2018.

Archer, D. W., Dawson, J., Kreuter, U. P., Hendrickson, M., and Halloran, J. M. 2008. Social and political influences on agricultural systems. *Renewable Agriculture and Food Systems*. Vol. 23, No. 4, pp. 272–284. <https://doi.org/10.1017/S174217050700169X>.

Bettencourt, E. M. V., Tilman, M., Narciso, V., Carvalho, M. L. S., and Henriques, P. D. S. 2015. The livestock roles in the wellbeing of rural communities of Timor-Leste. *Revista de Economia e Sociologia Rural*. Vol. 53, No. 1, pp. S063–S080. <http://dx.doi.org/10.1590/1234-56781806-94790053s01005>.

Bhorat, H. 2015. Fact check: Is South Africa the most unequal society in the world? The Conversation. <https://theconversation.com/factcheck-is-south-africa-the-most-unequal-society-in-the-world-48334> accessed on 01.07.2018.

Blackhurst, R., 2008. Joint Maputo River Basin Water Resources Study. <http://www.dwa.gov.za/maputobasinatlas/Reports/English/Report%208.2%20to%208.4%20-%20Current%20&%20Potential%20Dev%20-%20V2.0%20-%20May%20200.pdf> accessed on 02.04.2016.

Bloom, B. S. 1956. Taxonomy of Educational Objectives: The Classification of Educational Goals. Boston: Addison-Wesley Longman Ltd, 207 pp.

Börsch-Supan , A., and Weiss, M. 2016. Productivity and age: Evidence from work teams at the assembly line. *The Journal of the Economics of Ageing*. Vol. 7, No. C, pp. 30–42.

Bryceson, D. F. 2002. The scramble in Africa: Reorienting rural livelihoods. *World Development*. Vol. 30, No. 5, pp. 725–739. [https://doi.org/10.1016/S0305-750X\(02\)00006-2](https://doi.org/10.1016/S0305-750X(02)00006-2).

Carlson, S. 2013. Research priorities for advancing adoption of cover crops in agriculture-intensive regions. *Journal of Agriculture, Food Systems, and Community Development*. Vol. 3, No. 4, pp. 125–129. <https://doi.org/10.5304/jafscd.2013.034.017>.

Carr, P. M., Gramig, G. G., Liebig, and M. A. 2013. Impacts of organic zero tillage systems on crops, weeds, and soil quality. *Sustainability*. Vol. 5, pp. 3172–3201. <http://dx.doi.org/10.3390/su5073172>.

Castle, M. H., Lubben, B. D., and Luck, J. D. 2016. Factors Influencing the Adoption of Precision Agriculture Technologies by Nebraska Producers. University of Nebraska-Lincoln (UNL) Digital Commons, 2016. <http://digitalcommons.unl.edu/ageconworkpap/49> accessed on 08.05.2017.

Cauchi-Santoro, R. 2016. Mapping community identity: Safeguarding the memories of a city's downtown core. *City, Culture and Society*. Vol. 7, No. 1, pp. 43–54. <https://doi.org/10.1016/j.ccs.2015.12.003>.

Census. 2011. Mpakeni. <https://census2011.adrianfrith.com/place/874067> accessed on 08.05.2017.

Chaney, R. L. 2012. Food safety issues for mineral and organic fertilizers. *Advances in Agronomy*. Vol. 117, pp. 51–99.

Christoplos, I. 2010. Mobilising the Potential of Rural and Agricultural Extension. Rome: FAO, 34 pp. www.fao.org/docrep/012/i1444e/i1444e00.pdf accessed on 04.07.2017.

Claassens, A. 2015. Law, Land and Custom, 1923-2014: What is at Stake Today? Ecosystem Based Adaptation. In: Cousins, B., and Walker, C. (Eds.). *Land Divided, Land Restored: Land Reform in South Africa for the 21st Century*, 68–84. Johannesburg: Jacana Media.

Cousins, B. 1996. Livestock production and common property struggles in South Africa's agrarian reform. *The Journal of Peasant Studies*. Vol. 23, Nos. 2–3, pp. 166–208. <https://doi.org/10.1080/03066159608438612>.

Cousins, B. 2013. Smallholder irrigation schemes, agrarian reform and 'Accumulation from Above and from Below' in South Africa. *Journal of Agrarian Change*. Vol. 13, No. 1, pp. 116–139.

Cousins, B., and Walker, C. 2015. Introduction. In: Cousins, B., and Walker, C. (Eds.). *Land Divided, Land Restored: Land Reform in South Africa for the 21st Century*, 1–23. Johannesburg: Jacana Media.

Crowe, S., Cresswell, K., Robertson, A., Hubby, G., Avery, A., and Sheikh, A. 2011. The case study approach. *BMC Medical Research Methodology*. Vol. 11, pp. 100. <https://doi.org/10.1186/1471-2288-11-100>.

DAFF. 2018. DAFF Youth: What is Junior Land Care? <http://www.daff.gov.za/daffweb3/DAFF-Youth> accessed on 29.06.2018.

DEA. 2017. South Africa's Second National Communication under the United Nations Framework Convention on Climate Change. Pretoria: Department of Environmental Affairs, 752 pp. https://www.environment.gov.za/sites/default/files/reports/draftsouthafricas3rdnationalcommunication_unfccc2017.pdf accessed on 04.07.2017.

DFID. 2000. Sustainable Livelihoods Guidance Sheets. London: Department for International Development (DFID), 150 pp. <http://www.livelihoodscentre.org/documents/20720/100145/Sustainable+livelihoods+guidance+sheets/8f35b59f-8207-43fc-8b99-df75d3000e86> accessed on 16.06.2016.

Dold, T., and Cocks, M. 2012. Voices from the Forest: Celebrating Nature and Culture in the Xhosaland. Johannesburg: Jacana Media, 236 pp.

Dolinska, A., and d'Aquino, P. 2016. Farmers as agents in innovation systems. Empowering farmers for innovation through communities of practice. *Agricultural Systems*. Vol. 142, pp. 122–130.

Doss, C. 2011. If women hold up half the sky, how much of the world's food do they produce? ESA Working Paper No. 11–02. <http://www.fao.org/3/a-am309e.pdf> accessed on 29.06.2018.

Doss, C., Kovarik, C., Peterman, A., Quisumbing, A., and Van den Bold, M. 2015. Gender inequalities in ownership and control of land in Africa: Myth and reality. *Agricultural Economists*. Vol. 46, No. 3, pp. 403–434.

Dunlap, R. E., and Van Liere, K. D. 1978. The 'New Environmental Paradigm'. *Journal of Environmental Education*. Vol. 9, pp. 10–19.

Durieux, M. 2012. The Role of Social Grants in Supporting Local Economic Development (LED). Johannesburg: Studies in Poverty and Inequality Institute (SPII), 12 pp. <http://spii.org.za/wp-content/uploads/2013/12/The-role-of-social-grants-in-supporting-local-economic-development-LED-Policy-Brief-January-2012.pdf> accessed on 05.06.2016.

DWA. 2018. Biological control. <http://www.dwa.gov.za/wfw/Control/BioText.aspx> accessed on 17.07.2018.

Ekblom, A., Shoemaker, A., Gillson, L., Lane, P., and Lindholm, K. 2019. Conservation through biocultural heritage—examples from Sub-Saharan Africa. *Land*. Vol. 8, No. 5. <https://doi.org/10.3390/land8010005>.

Fan, S., Brzeska, J., Keyzer, M., and Halsema, A. 2013. From Subsistence to Profit: Transforming Smallholder Farms. Food Policy Reports 26. Washington: IFPRI, 30 pp.

FAO. 2005. Livestock Sector Brief: Ghana. Rome: FAO, 18 pp. http://www.fao.org/ag/againfo/resources/en/publications/sector_briefs/lb_GHA.pdf accessed on 03.11.2017.

FAO. 2012. Smallholders and Family Farmers. Rome: FAO, 4 pp. http://www.fao.org/fileadmin/templates/nr/sustainability_pathways/docs/Factsheet_SMALLHOLDERS.pdf accessed on 24.06.2018.

FAO. 2019. Why is gender equality and rural women's empowerment central to the work of FAO? <http://www.fao.org/gender/background/en/> accessed on 02.01.2019.

Fereja, G. B. 2016. The impacts of climate change on livestock production and productivities in developing countries: A review. *International Journal of Research–GRANTHAALAYAH*. Vol. 4, No. 8, pp. 181–187. <https://doi.org/10.5281/zenodo.61302>.

Ferguson, J. 2015. Give a Man a Fish: Reflections on the New Politics of Distribution. Durham: Duke University Press, 280 pp.

Gaughan, J.B, and Cawdell-Smith, A. J. 2015. Impact of Climate Change on Livestock Production and Reproduction. In: Sejian, V., Gaughan, J., Baumgard, L., Prasad, C. (Eds.). *Climate Change Impact on Livestock: Adaptation and Mitigation*, 51–60. New Delhi: Springer.

Gerber, P. J., Steinfeld, H., Henderson, B., Mottet, A., Opio, C., Dijkman, J., Falcucci, A., and Tempio, G. 2013. Tackling Climate Change through Livestock – A Global Assessment of Emissions and Mitigation Opportunities. Rome: Food and Agriculture Organization of the United Nations (FAO), 139 pp.

Godfray, H. C. J., Beddington, J. R., Crute, I. R., Haddad, L., Lawrence, D., Muir, J. F., Pretty, J., Robinson, S., Thomas, S. M., and Toulmin, C. 2010. Food security: The challenge of feeding 9 billion people. *Science*. Vol. 327, No. 5967, pp. 812–818. <https://doi.org/10.1126/science.1185383>.

Goulet, F. 2013. Narratives of experience and production of knowledge within farmers' groups. *Journal of Rural Studies*. Vol. 32, pp. 439–447.

Grassel, E., and Schirmer, B., (2006). The use of volunteers to support family carers of dementia patients: results of a prospective longitudinal study investigating expectations towards and experience with training and professional support. *Zeitschrift Fur Gerontologie Und Geriatrie*. Vol. 39, No. 3, pp. 217–226. <http://dx.doi.org/10.1007/s00391-006-0313-6>.

Hampson, J., Challis, W., Blundell, G., and De Rosner, C. 2002. The rock art of Bongani Mountain Lodge and its environs, Mpumalanga province, South Africa: An introduction to problems of Southern African rock-art regions. *The South African Archaeological Bulletin*. Vol. 57, No. 175, pp. 15–30.

- Hart, T., and Aliber, B. 2012. Inequalities in agricultural support for women in South Africa. Policy Brief November 2012. Human Sciences Research Council (HSRC), Pretoria, pp. 8. <http://www.hsrc.ac.za/uploads/pageContent/5325/InequalitiesLR.pdf> accessed on 29.06.2018.
- Hoffman, M.T. 2015. Environmental change in twentieth-century South Africa and its implications for land reform. In: Cousins, B., and Walker, C. (Eds.). *Land Divided, Land Restored: Land Reform in South Africa for the 21st Century*, 56–67. Johannesburg: Jacana Media.
- Jat, R. A., Wani, S. P., and Sahrawat, K. L. 2012. Conservation agriculture in the semi-arid tropics: Prospects and problems. *Advances in Agronomy*. Vol. 117, pp. 191–273.
- Johann, E. 2007. Traditional forest management under the influence of science and industry: The story of the alpine cultural landscapes. *Forest Ecology and Management*. Vol. 249, pp. 54–62.
- Johnson, M. P. 2006. Decision models for the location of community corrections centers. *Environment and Planning B: Planning and Design*. Vol. 33, No. 3, pp. 393–412. <https://doi.org/10.1068/b3125>.
- Kebede, D. 2016. Impact of climate change on livestock productive and reproductive performance. *Livestock Research for Rural Development*. Vol. 28, No. 227. <http://www.lrrd.org/lrrd28/12/kebe28227.htm>.
- Kilic, T., Winters, P., and Carletto, C. 2015. Gender and agriculture in sub-Saharan Africa: Introduction to the special issue. *Agricultural Economics*. Vol. 46, pp. 281–284.
- Kirkland, T., Hunter, L. M., and Twine, W. 2007. “The bush is no more”: Insights on institutional change and natural resource availability in rural South Africa. *Society and Natural Resources*. Vol. 20, No. 4, pp. 337–350. <http://dx.doi.org/10.1080/08941920601161353>.
- Klerkx, L., and Proctor, A. 2013. Beyond fragmentation and disconnect: Networks for knowledge exchange in the English land management advisory system. *Land Use Policy*. Vol. 30, No. 1, pp. 13–24. <https://doi.org/10.1016/j.landusepol.2012.02.003>.
- Koelle, B. R. I., Slabbert, E., Koopman, A., Oettlé, N. M., Kotze, D., and Archer, E. 2016. Livestock Farming Under Climate Change Conditions. Nieuwoudtville: Indigo Development and Change, 54 pp. <https://www.indigo-dc.org/documents/Livestockfarming.pdf> accessed on 17.07.2018.

Kolade, O., and Harpham, T. 2014. Impact of cooperative membership on farmers' uptake of technological innovations in Southwest Nigeria. *Development Studies Research*. Vol. 1, No. 1, pp. 340–353. <https://doi.org/10.1080/21665095.2014.978981>.

Kriel, G. 2017. Why climate change is a threat to livestock production. Farmers Weekly. <https://www.farmersweekly.co.za/animals/sheep-goats/climate-change-threat-livestock-production/> accessed on 27.06.2018.

Maass, B. L., Musale, D. K., Chiuri, W. L., Gassner, A., and Peters, M. 2012. Challenges and opportunities for smallholder livestock production in post-conflict South Kivu, eastern DR Congo. *Tropical Animal Health and Production*. Vol. 44, No.6, pp. 1221–1232. <http://dx.doi.org/10.1007/s11250-011-0061-5>.

Mensah, J. V., and Amissah, A. A. 2016. Effects of modernisation on the socio-cultural aspects of families in Ajumako-Enyan-Essiam district in Ghana. *International Journal of Economics, Commerce and Management*. Vol. 4, No. 4, pp. 820–841.

Mosites, E. M., Rabinowitz, P. M., Thumbi, S. M., Montgomery, J. M., Palmer, G. H., May, S., Rowhani-Rahbar, A., Neuhouser, M. L., and Walson, J. L. 2015. The Relationship between livestock ownership and child stunting in three countries in Eastern Africa using national survey data. Public Library of Science (PLOS) *ONE*. Vol. 10, No. 9, e0136686. <http://dx.doi.org/10.1371/journal.pone.0136686>.

Nardone, A., Ronchi, B., Lacetera, N., Ranieri, M. S., and Bernabucci, U. 2010. Effects of climate changes on animal production and sustainability of livestock systems. *Livestock Science*. Vol. 130, Nos. 1–3, pp. 57–69. <https://doi.org/10.1016/j.livsci.2010.02.011>.

Ndagurwa, P. 2013. *The Impact of Family Structure on Schooling Outcomes for Children in South Africa* (Unpublished masters thesis). Durban: University of Kwazulu Natal Scholarly Works, 147 pp. https://researchspace.ukzn.ac.za/bitstream/handle/10413/11325/NdagurwaPedzisai_2013.pdf?Sequence=1&isAllowed=y accessed on 05.11.2018.

Nelson, G. C., Rosegrant, M. W., Koo, J., Robertson, R., Sulser, T., Zhu, T., Ringler, C., Msangi, S., Palazzo, A., Batka, M., Magalhaes, M., Valmonte-Santos, R., Ewing, M., and Lee, D. 2009. Climate Change Impact on Agriculture and Costs of Adaptation. Washington: International Food Policy Research Institute, 30 pp. http://www.fao.org/fileadmin/user_upload/rome2007/docs/Impact_on_Agriculture_and_Costs_of_Adaptation.pdf accessed on 16.06.2015.

Ngubane, M. 2018. Obstacles facing a young black farmer in South Africa: A personal story. The Conversation. <https://theconversation.com/obstacles-facing-a-young-black-farmer-in-south-africa-a-personal-story-94037> accessed on 04.07.2017.

Nkonde, C., Jayne, T. S., Richardson, R. B., and Place, F. 2015. Testing the Farm Size- Productivity Relationship Over a Wide Range of Farm Sizes: Should the Relationship be a Decisive Factor in Guiding Agricultural Development and Land Policies in Zambia. In: *Linking Land Tenure and Use for Shared Prosperity*. Proceedings of the World Bank Conference on Land and Poverty. March 23–27, 2015. Washington DC: World Bank.

Noble, M., and Wright, G. 2013. Using indicators of multiple deprivation to demonstrate the spatial legacy of apartheid in South Africa. *Social Indicators Research: An International and Interdisciplinary Journal for Quality-of-Life Measurement*. Vol. 112, No. 1, pp. 187–201. <https://doi.org/10.1007/s11205-012-0047-3>.

Ntshangase, N. L., Muroyiwa, B., and Sibanda, M. 2018. Farmers' perceptions and factors influencing the adoption of no-till conservation agriculture by small-scale farmers in Zashuke, KwaZulu-Natal province. *Sustainability*. Vol. 10, No. 2, pp. 555–571. <https://doi.org/10.3390/su10020555>.

Oreszczyn, S., Lane, A., and Carr, S. 2010. The role of networks of practice and webs of influencers on farmers' engagement with and learning about agricultural innovations. *Journal of Rural Studies*. Vol. 26, No. 4, pp. 404–417.

Panthi, J., Aryal, S., Dahal, P., Bhandari, P., Krakauer, P., Pandey, N.Y., and Prasad, V. 2016. Livelihood vulnerability approach to assessing climate change impacts on mixed agro-livestock smallholders around the Gandaki river basin in Nepal. *Regional Environmental Change*. Vol. 16, No. 4, pp. 1121–1132. <https://doi.org/10.1007/s10113-015-0833-y>.

Parry, M., Canziani, O., Palutikof, J., Van der Linden, P., and Hanson, C. (Eds.). 2007. AR4 Climate Change 2007: Impacts, Adaptation and Vulnerability. New York: Cambridge University Press, 987 pp.

Puccio, G. J., and Acar, S. 2015. Creativity will stop you from being promoted, right? Wrong! A comparison of creative thinking preferences across organizational levels. *Business creativity and the creative economy*. Vol. 1, No. 1, pp. 4–12. <http://dx.doi.org/10.18536/bcce.2015.07.1.1.02>.

Raidimi, E. N. 2014. The roles and activities of women in the six selected agricultural projects in Thulamela local municipality of Vhembe district municipality in the Limpopo Province. *South African Journal of Agricultural Extension*. Vol. 42, No. 2, pp 10–23.

Raidimi, E. N., and Kabiti, H. M. 2017. Agricultural extension, research, and development for increased food security: The need for public-private sector partnerships in South Africa. *South African Journal of Agricultural Extension*. Vol. 45, No. 1, pp. 49–63. <http://dx.doi.org/10.17159/2413-3221/2017/v45n1a414>.

Ribeiro, M. N., Ribeiro, N. L., Bozzi, R., and Costa, R. G. 2018. Physiological and biochemical blood variables of goats subjected to heat stress – A review. *Journal of Applied Animal Research*. Vol. 46, No. 1, pp. 1036–1041. <https://doi.org/10.1080/09712119.2018.1456439>.

Ridder, H. 2017. The theory contribution of case study research designs. *Business Research*. Vol. 10. No.2, pp. 281–305. <https://doi.org/10.1007/s40685-017-0045-z>.

Roberts, B. W., Walton, K. E., and Viechtbauer, W. 2006. Patterns of mean-level change in personality traits across the life course: A meta-analysis of longitudinal studies. *Psychological Bulletin*. Vol. 132, pp. 1–25.

Rogers, E. M. 2003. *Diffusion of Innovations*. New York: The Free Press 576 pp.

Rojas-Downing, M. M., Nejadhashemi, A. P., Harrigan, T., and Woznicki, S. A. 2017. Climate change and livestock: Impacts, adaptation, and mitigation. *Climate Risk Management*. Vol. 16, pp. 145–163. <https://doi.org/10.1016/j.crm.2017.02.001>.

Rust, J. M., and Rust, T. 2013. Climate change and livestock production: A review with emphasis on Africa. *South African Journal of Animal Science*. Vol. 43. No. 3, pp. 256–267.

SANBI. 2007. Threatened terrestrial ecosystems for South Africa (2011): Croc Gorge Granite Mountainlands (MP 14). http://bgis.sanbi.org/ecosystems/show_ecosystem.asp?CODE=MP%2014 accessed on 25.02.2016.

SA-Venues.com. 1999. The Mthethomusha Game Reserve. https://www.sa-venues.com/game-reserves/mpl_mthethomusha.htm accessed on 12.04.2018. https://www.sa-venues.com/game-reserves/mpl_mthethomusha.htm accessed on 12.04.2018.

Sayiner, S. 2015. Physical space drives innovation: How the environment can increase an organization's productivity, creativity and innovation. *Intersect: The Stanford Journal of Science, Technology and Society*. Vol. 8, No. 2, pp. 1–18.

Schacter, D. L. 1989. Memory. In Posner, M. I. (Ed.) *Foundations of Cognitive Science*, pp. 683–725. Cambridge: MIT Press.

Schubert, T., and Andersson, M. 2014. Old is gold? The effects of employee age on innovation and the moderating effects of employment turnover. *Economics of Innovation and New Technology*. Vol. 24, Nos. 1–2, pp. 95–113. <https://doi.org/10.1080/10438599.2014.897858>.

Sejian, V., Gaughan, J. B., Raghavendra, B., and Naqvi, S. M. K. 2016. Impact of climate change on livestock productivity. https://www.feedipedia.org/sites/default/files/public/BH_026_climate_change_livestock.pdf accessed on 25.02.2016.

Sezgin, A., Kaya, T. E., külekçi, M., and kumbasaroğlu, H. 2011. Factors affecting the adoption of agricultural innovations in Erzurum province, Turkey. *African Journal of Business Management*. Vol. 5, No. 3, pp. 777–782. <https://doi.org/10.5897/AJBM10.885>.

Shisana, O., Labadarios, D., Rehle, T., Simbayi, L., Zuma, K., Dhansay, A., Dhansay, A., Reddy, P., Parker, W., Hoosain, E., Naidoo, P., Hongoro, C., Mchiza, Z., Steyn, N.P., Dwane, N., Makoe, M., Maluleke, T., Ramlagan, S., Zungu, N., Evans, M.G., Jacobs, L., Faber, M., and SANHANES-1 Team. 2013. South African National Health and Nutrition Examination Survey (SANHANES-1). Cape Town: HSRC Press, 423 pp.

Sishuba, S. 2016. The crucial role of women in African agriculture. *Farmers Weekly*. <https://www.farmersweekly.co.za/opinion/by-invitation/the-crucial-role-of-women-in-african-agriculture/> accessed on 26.04.2018.

Stagnari, F., Maggio, A., Galieni, A., and Pisante, M. 2017. Multiple benefits of legumes for agriculture sustainability: An overview. *Chemical and Biological Technologies in Agriculture*. Vol. 4, No. 2.

Stoecker, R. 2014. Extension and higher education service learning: Toward a community development service-learning model. *Journal of Higher Education Outreach and Engagement*. Vol. 18, No. 1, pp. 15–43.

Swanepoel, F., Stroebel, A., and Moyo, S. 2010. The role of livestock in developing communities: Enhancing multifunctionality. Cape Town: University of the Free State and Technical Centre for Agricultural and Rural Cooperation (CTA), 226 pp.

Thagwana, M. S. 2009. *Trends in Women's Participation in Agriculture at Tshiombo Irrigation Scheme, Limpopo Province* (Unpublished masters thesis). Bellville: University of the Western Cape Scholarly Works, 72 pp. http://etd.uwc.ac.za/xmlui/bitstream/handle/11394/3517/Thagwana_MPhil_2010.pdf?sequence=1&isAllowed=y accessed on 11.09.2017.

Tibesigwa, B. 2014. Mixed strategy farming helps beat climate change. *Farmers Weekly*. <https://www.farmersweekly.co.za/agri-technology/farming-for-tomorrow/mixed-strategy-farming-helps-beat-climate-change/> accessed on 29.06.2018.

Tibesigwa, B., Visser, M., Collinson, M., and Twine, W. 2016. Investigating the sensitivity of household food security to agriculture-related shocks and the implications of informal social capital and natural resource capital. *Sustainability Science*. Vol. 11, No. 2, pp. 193–214.

Tohidi, H., and Jabbari, M. M. 2012. Innovation as a success key for organizations. *Procedia Technology*. Vol. 1, pp. 560–564.

Toma, L., Barnes, A.P., Sutherland, L. A., Thomson, S., Burnett, F., and Mathews, K. 2018. Impact of information transfer on farmers' uptake of innovative crop technologies: A structural equation model applied to survey data. *The Journal of Technology Transfer*. Vol. 43, No.4, pp. 864–881. <https://doi.org/10.1007/s10961-016-9520-5>.

Turpie, J., and Visser, M. 2012. The Impact of climate change on South Africa's rural areas. Chapter 4 of Financial and Fiscal Commission: Submission for the 2013/14 Division of Revenue. Midrand: Financial and Fiscal Commission, 320 pp.

Twine, W. C. 2013. Multiple strategies for resilient livelihoods in communal areas of South Africa. *African Journal of Range and Forage Science*. Vol. 30, Nos.1–2, pp. 39–43. <https://doi.org/10.2989/10220119.2013.768703>.

- Van der Veen, M. 2010. Agricultural innovation: Invention and adoption or change and adaptation? *World Archaeology*. Vol. 42, No. 1, pp. 1–12. <https://doi.org/10.1080/00438240903429649>.
- Van-Riet, W., Claassen, P., Van-Rensburg, J., Viljoen, T., and Du Plessis, L. 1997. Environmental potential atlas for South Africa. Pretoria: J. L. van Schaik, 61 pp.
- Villamor, G. 2017. Men and women farmers in Benin are responding differently to climate-change. The Conversation. <https://theconversation.com/men-and-women-farmers-in-benin-are-responding-differently-to-climate-change-72110> accessed on 09.05.2017.
- Vos, R., Yao, X., Villarreal, M., Brizzi, A., and Rutten, L. 2014. Youth and Agriculture: Key Challenges and Concrete Solutions. Rome: FAO, 128 pp.
- Wani, T. A., and Ali, S. W. 2015. Innovation diffusion theory: Review and scope in the study of adoption of smartphones in India. *Journal of General Management Research*. Vol. 3, No. 2, pp. 101–118.
- Watcharaanantapong, P., Roberts, R. K., Lambert, D. M., Larson, J. A., Velandia, M., English, B.C., Rejesus, R. M., and Wang C. 2014. Timing of precision agriculture technology adoption in US Cotton production. *Precision Agriculture*. Vol. 15, pp. 427–446.
- Weisberg, S. 2013. Simple linear regression. In: Weisberg, S. (Ed.). *Applied linear regression*, 49–66. New Jersey: John Wiley and Sons Inc.
- World Bank. 2016. Better Livestock and Crop Varieties Bring New Opportunities for Samoa Farmers. <http://www.worldbank.org/en/results/2016/04/15/better-livestock-and-crop-varieties-bring-new-opportunities-for-samoa-farmers> accessed on 29.06.2018.
- World Bank. 2017. Help women farmers 'Get to Equal'. <https://www.worldbank.org/en/topic/agriculture/brief/women-farmers-getting-to-equal> accessed on 11.08.2018.
- Yahaya, M. S., Syafiq, M., Ashton-Butt, A., Ghazali, A., Asmah, S., and Azhar, B. 2017. Switching from monoculture to polyculture farming benefits birds in oil palm production landscapes: Evidence from mist netting data. *Ecology and Evolution*. Vol. 7, No. 16, pp. 6314–6325. <http://dx.doi.org/10.1002/ece3.3205>.

- Yin, R. K. 2014. *Case Study Research Design and Methods*. California: Sage, 282 pp.
- Zainal, Z. 2007. Case study as a research method. *Jurnal Kemanusiaan*. Vol. 5, No. 1, pp. 1–6.
- Zhao, J., Wang, Y., and Kong, F. 2016. Exploring the mediation effect of social support and self-esteem on the relationship between humour style and life satisfaction in Chinese college students. *Personality and Individual Differences*. Vol. 64, pp. 126–130. <https://doi.org/10.1016/j.paid.2014.02.026>.
- Ziervogel, G., and Ericksen, P. J. 2010. Adapting to climate change to sustain food security. *Wiley Interdisciplinary Reviews (WIREs) Climate Change*. Vol. 1, pp. 525–540. <https://doi.org/10.1002/wcc.56>.
- Zikeli, S., and Gruber, S. 2017. Reduced tillage and no-till in organic farming systems, Germany — status quo, potentials and challenges. *Agriculture*. Vol. 7. No. 4, pp. 35. <https://doi.org/10.3390/agriculture7040035>.

3.7. APPENDICES.

Appendix 3.7.1

Standard logistic regression model for mitigation strategy uptake amongst respondent farmers

Logistic regression model, also called logit regression, was used on strategy uptake across diverse key individual traits. It was performed in the form of log of odds where the odds were a function of probability of strategy uptake in relation to specific individual traits. The specific model was binary logistic model due to the fact that the dependent variable was coded 1 to denote strategy uptake and 0 to represent non-uptake. Letting X represent independent variables (sex, age, village-subsection or zone, education level etc.), the logistic model can be represented by;

$$\log \frac{\pi_i}{1 - \pi_i} = \log O_i = \alpha + \beta_1 (X_1) + \beta_2 (X_2) + \beta_3 (X_3) + \beta_4 (X_4)$$

Source: adapted from (Weisberg 2013; Ndagurwa 2013)

Where $1 - \pi_i$ represents the conditional probability of non-uptake of mitigation strategy; π_i is the conditional probability of strategy uptake; and is the conditional odds of strategy uptake. In order for interpretation of logistic regression using odds, antilogs were applied to the equation to have the model as;

$$\frac{\pi}{1-\pi} = e^{\alpha+\beta} = (e^{\beta})^x$$

Source: adapted from (Weisberg 2013; Ndagurwa 2013)

Where the two constants multiplied by each other raised to the power “x” imply that an additional explanatory variable added on to the regression has a multiplicative effect on the odds of strategy uptake. This helped test the impact of key individual parameters on strategy uptake whilst controlling for other factors.

QUESTIONNAIRE

Area/Zone

1) Mambayin	2) Manjesa	3) Magamzin	4) Gaganene
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Section A. Biographical Data

2. Gender 1. Male 2. Female

3. Age Range

1) 18-24	2) 25-34	3) 35-44	4) 45-54
5) 55-64	6) 65-74	7) 75-84	8) 85 or over

4. What is your highest qualification?

1) No formal qualifications	2) Grade 1-4	3) Matric
4) Degree or equivalent	5) Grade 5-10	6) Vocational
7) Post graduate		

Section B Agricultural Activities and Adaptation

Crop Production

5. Did you plant any crops in the last 12 months?

1) Yes 2) No

6. Type of crops.....

a) Vegetables (moroho, cabbage etc)	b) Crops (e.g. maize, sorghum)
c) Fruits trees (avocados, mangoes, bananas, citrus)	d) other

Comment.....

7. Reasons for growing these particular crops?

1) for family subsistence	2) for selling	3) raw materials	4) ornamentals	5) other
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Comment.....

8) Do you have additional fields outside of the homestead yard?

1) Yes 2) No

9). How many fields outside of the homestead yard do you own? (if yes)

a) 1-4 b) 5-10 c) 11- 14 d) 15-20 e) 20 plus

10) Have you adopted any of these measures in your crop farming?

a) Increasing the diversity of plants and animals	1)Yes	2)No
b) Maintaining populations of pollinators or beneficial insects (NjeniyaSebentisa maInsect kuti Nisite Kukulisa tihlahla?)	1) Yes	2)No
c) Low mechanical soil disturbance, no till or minimum tillage	1)Yes	2)No

(NjeniyawaSebentisa maTraktel?)

(Njeniyayekela lomhlabati kuti ampumule?)

d) use of manure or compost

1)Yes 2) No

e) less use of chemical fertiliser

1) Yes 2) No

reason.....

f) Increased use of chemical fertiliser

1)Yes 2) No

reason.....

g) vermiculture

1)Yes 2)No

(Njeniyakulisa tibungu for Mtsuba)

h) use of cover crops

1) Yes 2) No

i) crop rotation

1) Yes 2)No

j) growing of leguminous crops

1) Yes 2) No

k) others?

11. What were the main constraints/difficulties in changing your farming approaches?

Key for Reasons: 1: lack of money, 2: lack of information, 3: shortage of labor, 5: high cost of labour 6) Other

.....

12. Did you use livestock manure (dung) as fertiliser or fuel in the last growing season?

1)Yes 2) No

ii) Section C **Livestock farming**

13. Are you involved in livestock farming?

1) Yes 2) No

Are you involved in farming the following

	Livestock category	does household own any (yes, no)	Number	Main use	Second use	tertiary use	How many have you slaughtered in the last 12 months?
a	Cattle						
b	Sheep						
c	Goats						
d	Pigs						
e	Chickens						

Key : Livestock use

M = Meat **N** = Manure **I** = Investment/asset **L** = Milk **P** = Ploughing **C** = Cultural/religious **E** = Eggs **T** = Transport

14) In the last 3 years did you experience any shortages of food for your livestock?

1) Yes 2) No

15. Have you adopted any of these measures in your livestock production?

a) Early morning dew pasturing 1) Yes 2) No
(taking livestock to feed and take advantage of dew due to scarcity of water?)
b) any other odd timing?

Comment.....

c) Growing areas of shade on your farm 1) Yes 2) No
D) Growing own forage 1) Yes 2) No
e) Use of resistant varieties 1) Yes 2) No

(Njeniyahlanyela tihlahla letilwa maPests, nema disease?)

OTHER

Comment.....

Section D Social capital

16. Do you belong to a social group, committee or association?

1) Yes 2) No

17. Does the household head belong to a social group, committee or association (If different from farmer)?

1) Yes 2) No

18. Do you have a close friend living in this village?

1) Yes 2) No

19. Did you get any money, food or other type of assistance from the close friend in the last 12 months?

1) Yes 2) No

20. What type of assistance do you get from the close friend? Key

a) = Food b = other household groceries c = assistance with cultivation d = tools e =
assistance with herding f= fuel e.g. wood, petrol, paraffin g= money **h = Clothes**
i= child care j = care of the elderly or sick k = cell phone airtime **l = transport**
m= Sharing of information

21. Do you have any relatives living in this village?

1) Yes 2) No

22. Did your household get any money, food or other type of assistance from these relatives in the last 12 months?

1) Yes 2) No

23. What type of assistance do you get?

a) = Food b = other household groceries c = assistance with cultivation d = tools e =
assistance with herding f= fuel e.g. wood, petrol, paraffin g= money **h = Clothes**
i= child care j = care of the elderly or sick k = cell phone airtime **l = transport**
m= Sharing of information

24. Do you have relatives living in the other village or in the city (migrant labour?)

Yes No

25. Did you get any money, food or other type of assistance from any relatives living in OTHER villages in the last 12 months?

Yes No Don't know

26. What type of assistance do you get?

a) = Food **b** = other household groceries **c** = assistance with cultivation **d =tools** **e** =
assistance with herding **f**= fuel e.g. wood, petrol, paraffin **g**= money **h** = Clothes
i= child care **j** = care of the elderly or sick **k** = cell phone airtime **l** = transport
m= Sharing of information 12= Sharing of information 13=Other (specify)

27. Did you get any money, food or other type of assistance from your neighbours who are NOT close friends or relatives of the head and his/her spouse in the last 12 months?

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

28. What type of assistance do you get?

a) = Food **b** = other household groceries **c** = assistance with cultivation **d =tools** **e** =
assistance with herding **f**= fuel e.g. wood, petrol, paraffin **g**= money **h** = Clothes
i= child care **j** = care of the elderly or sick **k** = cell phone airtime **l** = transport
m= Sharing of information

29. Did you GIVE any money, food or other type of assistance to ANOTHER household in the last 12 months?

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

30. What is the relationship to this household?

Key 11: Relationship of assisted households/individual with this household

1 = Relatives living in this village **3** = Friends living in this village **5** = Neighbours **7** = Other (specify)

2 = Relatives living in another village **4** = Friends living in another village **6** = Members of your church congregation

Disputes related to natural resources

31. Have you had any dispute related to agriculture and natural resources

1) Yes 2) No

32. Have you approached the chief or induna for assistance (e.g. mediating a dispute) in the last 12 months?

1) Yes 2). No

33. Have you approached the village C.D.F. for assistance (e.g. mediating a dispute) in the last 12 months?

Yes No

Section E. Information Sources on agricultural activities

34. What is your most regular and important source of information on your agricultural activities?

1) Newspaper 2) Radio 3) Television 4) Friends 5) Church 6)
CSIR/Agricultural extension 7) Internet 8) Traditional healer

CHAPTER 4 – Factors affecting the number of land-based asset classes owned/used and numbers of agricultural strategies pursued in a rural economy:

Smallholders' strategy diversification is affected by their access to land-based assets

Land Use Policy (In preparation)

Smallholders' strategy diversification is affected by their access to land-based assets.

ABSTRACT

Agriculture represents a critical component of households' diversified livelihood portfolios in rural South African socio-ecological systems. The vast majority of the world's poor and vulnerable, residing in the rural South, depend on related livelihood sources. Hence, addressing factors that affect these livelihoods such as agriculture have implications for household wellbeing and thriving rural economies. However, a confluence of factors such as climate change, global economic trends and poor skills as well as a compromised asset base of rural smallholders has precipitated the degradation of land-based livelihoods across the globe. Macro factors like climate change and globalisation are largely beyond the control of rural smallholders. However, they can maximise their livelihood resilience by exploiting micro factors such as diversifying the use of strategies in support of their land-based livelihood activities with positive returns on the optimum use of related assets and coping with livelihood shocks. This study uses a mixed-method approach involving 150 smallholders to investigate factors affecting the number of land-based assets used/owned as well as the suite of agricultural strategies pursued, and the implications for related livelihoods. The study was conducted in the rural community of Mpakeni in Mpumalanga Province, South Africa. Age had a significant influence on respondents' mitigation strategy diversification. Smallholders in the 35-54 years age cohort exhibited extensive diversification compared to vulnerable groups such as the youth and the elderly. Moreover, respondents from areas with favourable agricultural conditions recorded low strategy diversification compared to those from less fertile areas. Furthermore, the lowest use/ownership of land-based assets was observed amongst respondents with no formal education. In addition, there was a significant positive association between respondents' use/ownership of land-based assets and corresponding levels of diversification in strategies practiced. Thus, the higher the level of use/ownership of land-based assets the higher the level of strategy diversification. Furthermore, respondents with low diversification of strategies registered a low level of use/ownership of land-based assets because they have limited options for diversification or are more invested in off-farm activities or are relatively wealthier. Ultimately, people with limited use/ownership of land-based asset classes have higher livestock numbers because they developed adequate organisational and financial capacity. Consequently, rural agro-environment policies need to factor the site and age dynamics into the use of common pool resources (e.g. grazing land) and climate change adaptation interventions whilst foregrounding education, given its positive returns on agricultural productivity.

Keywords: innovation, smallholder systems, food security, climate impacts

4.1. INTRODUCTION

The majority of South Africa's rural population resides in the former *Apartheid* homelands or Bantustans (Hoffmann 2015). These were racially and spatially designated areas where the majority of the Black population was confined so as to prevent them from living in the urban areas of South Africa (Butler et al. 1977; Ferguson 2015). Although the homelands no longer exist as political entities and have been integrated into provinces, these largely rural areas are still classified as some of the poorest in the country, with low employment opportunities, high population densities, poor infrastructure, and land shortages (Butler et al. 1977; Ferguson 2015) (and also expatiated in Chapter 5). Nevertheless, households in these areas employ diverse livelihoods for sustenance. Generally, a livelihood is composed of the capabilities, assets and activities necessary for generating a form of living (DFID 1999; DFID 2006). Moreover, for a livelihood to be sustainable it must be able to cope with and recover from stresses and shocks (DFID 2006; Pica-Ciamarra et al. 2007). Additionally, the rural household economy comprises land-based livelihoods which are sustained by environmental resources (Fisher 2004), as well as key off-farm livelihood sources such as social grants and remittances from migrant workers (Shackleton & Shackleton 2015). These are complemented by environmental income which hinges on the monetary and non-monetary benefits obtained from ecosystem goods and services harvested from wild or uncultivated natural systems (Cavendish 2000; Angelsen et al. 2014; Ragie 2016). Furthermore, in many rural communities, activities such as crop production, livestock farming and use of natural resources are important in financial, social and ecological terms (Shackleton et al. 2001; Mwiturubani & Van Wyk 2010; Muigua, 2015). A combination of allied strategies is employed to support these land-based livelihood activities such as composting and crop rotation amongst others (Ganiyu & Omotayo 2016).

Although livelihood strategies and activities are often used interchangeably in livelihoods literature (Babulo et al. 2008), in this study strategies refer to the actions employed by farmers to sustain their livelihood activity. Furthermore, livelihood diversification usually considers diversification across economic activities, but in this study, the focus is on diversification of strategies within economic activities (agricultural in this case), which has received less attention in the literature. The effective combination of these agricultural strategies, coupled with the *savoir faire* of farmers, is argued to enhance the capabilities and productivity of related land-based livelihood systems (Lakner et al. 2018). The enhanced capabilities are crucial in times of shock as they reinforce livelihood resilience (Waha et al. 2018). Moreover, farmers employ their social capital to cope with such livelihood shocks (Ellis 2000; Scoones 1998). These shocks include crop failure due to drought and damage to crops due to grazing animals (which may lead to disputes) inter alia.

In addition, rural producers exhibit minimal livelihood specialisation but rather engage in a myriad of subsistence and income generating land and non-related activities to sustain their livelihoods (Bryceson 1996; Thondhlana & Muchapondwa 2014). This has led to rural producers being referred to as 'Jacks-and-Jills-of-many-trades', regarding their practising of land-based livelihood strategies (Cousins 2013). This foregrounds the argument that rural producers are largely engaged in diversified livelihood income portfolios which is necessary for sustainable livelihoods (Shackleton & Shackleton, 2004; Angelsen et al. 2014; Ragie 2016). Therefore, the sustainable livelihoods framework considers the linkages between the local or micro situation and actors, institutions and processes at play in the wider world. Farmers' capacities to generate and maintain their land-based livelihood activities, and enhance their well-being and that of future generations, are influenced by their ability to effectively harness a bricolage of strategies. Moreover, the capacity to employ these strategies is contingent upon the availability and accessibility of options (DFID 2006; Lakner et al. 2018). Furthermore, land-based livelihoods provide a safety net in times of crisis and also help alleviate household poverty particularly amongst low-income households, with spin-offs for income-equality and conservation (Cavendish 2000; Fisher 2004; Muhumuza & Balkwill 2013; Serrat 2017). The poor are disproportionately more dependent on land-based resources than wealthier households in rural communities, which makes them susceptible to the consequences of resource degradation and climate impacts (Cavendish 2000; Campbell & Luckert 2002; Bavinck et al. 2014). Thus, it is argued that the poorest people across the world are predominantly involved and locked into environmental resource use which further perpetuates poverty (Bhorat & Van Der Westhuisen 2012; Etongo et al. 2016). Additionally, climate change is adversely affecting these land-based livelihoods as they are climate sensitive (Nhemachena et al. 2014). Diversity in land-based livelihood strategies in support of related activities is crucial for developing livelihood resilience while building pathways for households to escape poverty with positive returns on rural development (Obi & Tafa 2016).

The Fourth Assessment Report by the Intergovernmental Panel on Climate Change (IPCC) estimates that by 2020, adverse weather conditions in Africa could affect land-based activities like agriculture by halving crop yields (Parry et al. 2007). In the same vein, other IPCC projections point to sub-Saharan Africa suffering losses of up to 7% of its gross domestic product (Sango & Nhamo 2015). This comes with severe livelihood impacts on the continent's vulnerable and poor communities that rely on climate-sensitive, often land-based activities, for sustenance (Nhemachena et al. 2014). Climate-related impacts on land-based livelihoods have therefore become a policy concern in Africa as a significant number of the rural populace reside in ecologically vulnerable areas (Shackleton et al. 2011; OXFAM 2016). It is therefore posited that farmers need to diversify their land-based livelihood strategies (within each land-based activity) to better adapt related activities to climatic and livelihood risks (Waha et al. 2018). Furthermore,

more diverse use of strategies has positive returns on household food security as well as livelihood sustainability (Lakner et al. 2018). In addition, farmers' capacities to diversify mitigation strategies is mediated by factors such as the market orientation of a household, livestock ownership, off-farm employment opportunities, and available land resources. An interplay of these factors impinges on the vulnerability of land-based livelihoods (Poole et al. 2013; Waha et al. 2018).

One viable approach to reducing the vulnerability of such livelihoods is to enhance their resilience and capitalise on their assets (DFID 2000; Slater & Twyman 2003). The notion of resilience has thus gained currency in socio-ecological systems. Resilience in livelihood systems denotes the capacity of the system to retain its core functions during and after shocks (Nyamwanza 2012; Tibesigwa et al. 2016). Furthermore, such livelihood disturbances or challenges present inherent opportunities for introducing novel interventions (Folke 2006). This includes diversifying mitigation strategies in support of land-based livelihood activities (Twine 2013). In addition, livelihood assets refer to the capital endowments which people exploit to support their livelihoods (Ellis 2000; Scoones 1998). These include human capital (e.g. skills and education); physical capital (e.g. farm equipment); social capital (e.g. social networks); financial capital and its substitutes (e.g. savings, cattle etc); and natural capital (e.g. land). Innovation is needed to harness the potential of these assets (Ellis 2000). This involves employing diverse aggregates of novel strategies/interventions to support and enhance livelihoods (Scoones 1998). The multiple use of strategies in a livelihood activity helps boost the livelihood and maximise value from its associated assets (DFID 2000; Twine 2013).

Economic challenges (e.g. escalating cost of food) diminish real income, compel the poor to trade their assets, reduce food consumption, and limit their dietary diversity as well as accessibility to quality nutrition (FAO 2013). This comes with negative consequences for achieving the Sustainable Development Goals (SDGs). Hazards ultimately engender poverty traps that exacerbate food insecurity and malnutrition (FAO 2013). Therefore, insight into the nexus of factors influencing agricultural diversification, both in terms of diversity of asset types owned/used, and in diversity of types of strategies is critical to securing such rural household livelihoods (Fig. 4.1).

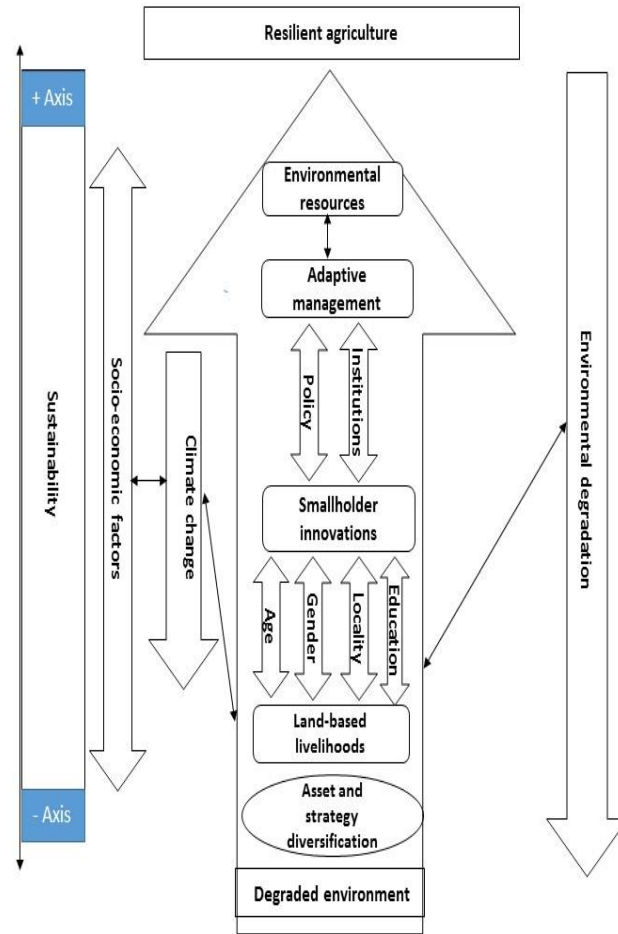


Figure 4.1. Flow diagram of thematic areas of the chapter.

Factors such as social status, experience and education are assets which can help an individual better employ technology to maximise their physical assets like land or space (DFID 2000; Obi & Tafa 2016). Although off-farm income has assumed importance in rural landscapes, land-based livelihoods remain significant in meeting household subsistence needs (Shackleton & Shackleton, 2004; Angelsen et al. 2014). Moreover, given that the rural society is dynamic, there is a continuous need for research on the connection between environmental resource use, particularly land-based livelihood assets, and poverty dynamics, especially among indigenous communities (Ragie 2016; Angelsen et al. 2014; Obi & Tafa 2016). Factors such as education, innovation and assets are considered critical to achieving the goals of decent work and sustainable communities as per the SDGs 8 and 11 respectively which relate to secure livelihoods and sustainable communities respectively (UNDP 2018). Furthermore, although Africa (in general) and South Africa (in particular) recorded progress towards related goals under the erstwhile Millennium Development Goals (MDGs), these gains are considered low in comparison to other regions (STATSSA 2015; UNECA et al. 2015). This calls for interrogating the underlining

causal factors to help improve performance vis-à-vis the current SDGs. Moreover, the limited job opportunities in rural areas are accentuated by the degradation of land-based livelihoods and further escalate the phenomenon of rural-urban migration (STATSSA 2015; NEPAD 2016). This is projected to result in 6.5 billion people - two thirds of all humanity living in urban areas by 2050 (UNDP 2018). Thus, as potential economically active persons migrate to urban areas in search of increasingly non-existent opportunities, it has become necessary to create the conducive environment for their thriving in the rural milieu to help stem this tide (Foster 2012; STATSSA 2015; UNDP 2018). This includes enhancing the land-based livelihoods and related assets which support rural households but which are equally susceptible to shocks that reverse developmental gains (UNECA et al. 2015; NEPAD 2016). Moreover, such measures will help reverse the growing trend of South Africa's rural areas, increasingly becoming migrant-sending areas in stark contrast to the robust rural economy and development agenda of Vision 2030 (STATSSA 2015). Ultimately, the concept of "Leave No One Behind (LNOB)" is a cardinal theme in the SDGs as a way of making the SDGs genuinely transformational by fast-tracking actions for the poorest and most marginalised people (Stuart & Samman 2017). This research, therefore contributes knowledge by investigating how the employment of diverse land-based livelihood supporting activities and associated assets is influenced by a number of individual factors. It contributes insights on how these suites of influencing factors and socio-economic characteristics affect the diversified livelihood portfolios of rural smallholders and their ensuing engagement in such livelihood strategies. This study situates such global objectives in the light of local realities, by addressing an important lever in the bricolage of rural-livelihoods which has the potential to transform households and communities. This is done by investigating how land-based livelihood assets can be optimised by employing a suite of strategies for productivity and resilience in the context of sustainable livelihoods.

4.2. RESEARCH METHODOLOGY

4.2.1 Study Site: Mpakeni

Mpakeni village (Fig. 4.2) is in Mpumalanga Province in north-eastern South Africa. The predominant populations in the area are of siSwati (Swazi) and xiTsonga (Tsonga) origins and are located on the southern border of the Kruger National Park (Van Riet et al. 1997). The tributaries of the Makhomane, Luphusi and Nsikazi rivers drain the area and serve as water sources (Hampson et al. 2002). The soils are sandy loams interspersed with granite outcrops (Hampson et al. 2002). The prevalent flora is classified as the sour lowveld bushveld or Malelane mountain bushveld whilst part of the area is categorised as a vulnerable vegetation type - *Croc Gorge Granite Mountainlands* (SANBI 2007). The area is argued to have been a hub for hunter-gatherers (Hampson et al. 2002).

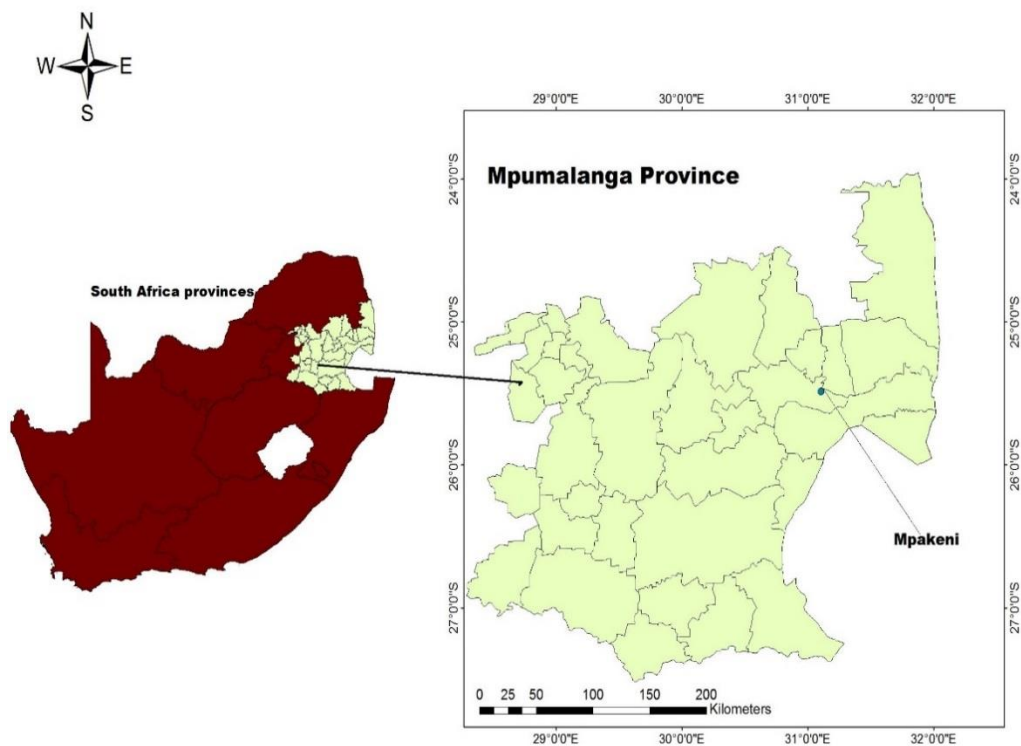


Figure 4.2. The location of the study site (Mpakeni) in the province (Mpumalanga) and South Africa.

4.2.2 Data Collection

A case study affords the investigation of contemporary real-life phenomena and is often premised on a particular geographical area or with a selected number of individuals as study subjects (Ridder 2017; Yin 2014). The intercourse of quantitative and qualitative data in the context of a case study provides unique insights and facilitates the explanation of the process and outcome of a phenomenon (Crowe et al. 2011). Consequently, the mixed method approach was used in this study as it combines qualitative and quantitative approaches. A total of 150 farmers were interviewed from across Mpakeni.

Data were gathered involving individual farmer interviews. The data comprised biographical information about engagement in agricultural livelihood activities. The selected smallholder farmers were interviewed on their involvement in agricultural livelihood activities and ownership of related resources. To help understand the dynamics of strategy diversification in the area, interviewees were asked about their use of several mitigation strategies.

Respondents were interviewed on their practice of diversifying mitigation strategies in response to climate impacts (such as drought conditions) as well as in support of their land-based livelihood activities. The strategies included interventions that helped reduce surface evaporation by applying crop residues and plant mulches; improve organic matter content and improve livestock nutrition inter alia.

Farmers equally shared information about their social capital resources across three dimensions in the sustainable livelihood framework. In the context of sustainable livelihoods, an individual's social capital denotes the social resources which they harness to realise core livelihood objectives. These revolve around networks and connections, participation in more formal groups, and relationships of trust, reciprocity and exchanges that promote co-operation inter alia (UNDP 2018). The core aspects of social capital investigated were group membership and reciprocity. Reciprocity is a core component of social capital that represents the presence of relatives or friendship connections and the incidence exchanging assistance from these connections (Mbiba et al. 2019). Group membership denotes affiliations or association by a farmer to an institutions or organizations such as farmers' association. Reciprocity is bifurcated and involves the receipt (reciprocity-receive) or the giving (reciprocity-give) of assistance by farmers from their kinship or neighbourhood connections. Smallholders therefore indicated whether they had benefited from any form farm-related assistance (reciprocity-receive) or offered such assistance (reciprocity-give) over the past year.

For the interviews, farmers were selected through targeted/snow ball sampling from across the four neighbourhoods/village sub-sections (Mambayin, Manjesa, Magamzin and Gaganene) which comprise Mpakeni village. Potential farmers were initially identified with the help of a local research assistant. These farmers then directed us to other farmers in a chain-referral fashion. This approach was used as the study dealt with land-based livelihood activities about which the farmers were best placed to provide informed answers. The questions were generated following an in-depth literature review and discussions with farmers (Appendix 4.7.2). Each interviewee was assigned a code rather than a name to safeguard the anonymity of the respondents.

4.2.3 Data Analysis

Respondents were interviewed on their practice of diversifying mitigation strategies in response to climate impacts (such as drought conditions) as well as in support of their land-based livelihood activities. The level of strategy diversification was put into 3 categories *low* (1-3 strategies), *medium* (4-6 strategies) and *high* (7+). The relationship between various factors and the level of strategy diversification was then assessed. The strategies include interventions that help reduce surface evaporation by applying crop residues and plant mulches; improve organic matter

content and improve livestock nutrition inter alia. The diversification of strategies was categorical and compared with the reference category (Mambayin).

To facilitate analysis, continuous variables such as age were converted into categorical variables by assigning classes. The chi-square test was then used to examine significant differences in the levels of diversification, as per land-based livelihood strategies adopted, along key traits such as *gender, age category, educational level* and *neighbourhood of respondent*. The chi-square test was used for pairwise comparisons. A multivariate logistic regression model was used to afford a more robust assessment of how the use/ownership of land-based livelihood asset classes, were influenced by the suite of independent variables after simultaneously controlling for the impact of other factors which the chi-square test does not.

Farmers' land-based assets including cultivated fields (in addition to their homestead gardens), at least one fruit tree (e.g. avocado pear) in the household's yard, as well as livestock were put into 3 categories: *low* (1 asset), *medium* (2 assets), and *high* use/ownership (3 assets). The scale and intensity of use/ownership of the land-based livelihood asset classes were not tested save the number of associated assets. The ownership/use of land-based asset classes was categorical and compared with the reference category.

An ordinal logistic regression model was used to assess the relationship between respondents' classes of ownership/use per land-based livelihood assets and their livestock numbers. This assessed how closely livestock farming and productivity correlates with other land-based strategies. For livestock production, standard livestock/animal units were obtained from the Food Agricultural Organisation (FAO). A conversion matrix was thereafter used to transform the values to a common livestock/animal unit: cattle = 0.7, sheep = 0.1, goats = 0.1, pigs = 0.2, chickens = 0.01 (FAO 2005; Maass et al. 2012; Mosites et al. 2015). The numbers of additional cultivated fields to homestead were put in categories of 1–4, 5–10, 11–14, 15–20 and 20 plus because people were hesitant to divulge information on the exact number of fields they had. To help understand the dynamics of strategy diversification in the area, interviewees were quizzed about their use of several mitigation strategies.

4.3. RESULTS

Respondents indicated their individual usage of different mitigation strategies (Table 4.1). In terms of crop production, the “Use of manure or compost” ($p < 0.001$) recorded the highest proportion of usage as a climate mitigation strategy (93.8%) amongst respondents, whilst “Vermiculture” ($p < 0.001$) recorded the lowest (15.4%). For livestock farming, “Early morning dew pasturing” ($p < 0.001$) registered the highest proportion of usage as a mitigation strategy (87.2%).

Table 4.1 Proportions of mitigation strategy usage amongst respondent farmers

		Percentage (Frequency)	
Land-based livelihood strategy			
Sector of production			P-value
Strategies adopted			
<i>Crop production (n=130)</i>			
Use of manure or compost	93.8 (122)		<0.001
Plant & animal diversity	80.8 (105)		0.04
Cover crops usage	80.0 (104)		0.06
Crop rotation	77.7 (101)		0.12
Less use of chemical fertiliser	70.8 (92)		0.56
Growing leguminous crops	70.8 (92)		0.56
No till or minimum tillage	70.0 (91)		0.64
Increased use of chemical fertiliser	60.0 (78)		0.35
Attracting pollinators or beneficial insects	47.7 (62)		0.01
Vermiculture	15.4 (20)		<0.001
Strategies adopted			
<i>Livestock production (n=86)</i>			
Early morning dew pasturing	87.2 (75)		<0.001
Growing own forage	44.2 (38)		0.19
Creating shade areas	43.0 (37)		0.15
Use of improved varieties	43.0 (37)		0.15

NB: Respondents chose between strategies which were not mutually exclusive. Thus respondents chose as many strategies as they used from a list. However, the Yes and No options were mutually exclusive. The expected value for each strategy was calculated as the total scored frequency divided by the number of categories. The results were tested with the chi-square test on a row by row basis. The p-value is the probability that the selection of a particular strategy is due to chance alone. Improved varieties refer to the use of livestock species or varieties with enhanced reproductive and health performance. Vermiculture denotes efforts by farmers to encourage proliferation of earthworms in their soils to boost fertility at the study site.

In terms of crop production, there was only a significant difference between mixed farmers and crop producers in the usage of “Attracting pollinators or beneficial insects” ($p < 0.001$) in support of respondents’ land-based livelihood activities. In addition, strategies such as “Growing own forage” ($p = 0.01$), “Creating shade areas” ($p = 0.02$) and “Use of improved varieties” ($p = 0.01$) recorded significant differences in usage in terms of livestock production (Table 4.2).

Table 4.2 Proportions of mitigation strategies adopted by farmers for their land-based livelihood activities.

Sector of production Strategies adopted	Percentage (Frequency)			Total	P- value
	Crop and livestock (n=68)	Crop only (n=62)	Livestock only (n=18)		
Crop production					
Less use of chemical fertiliser	58.7 (54)	41.3 (38)		100.0 (92)	0.49
Plant & animal diversity	54.3 (57)	44.8 (47)	0.9 (1)	100.0 (105)	0.86
No till or minimum tillage	53.9 (49)	46.2 (42)		100.0 (91)	0.96
Use of manure or compost	52.5(64)	47.5 (58)		100.0 (122)	0.99
Cover crops usage	48.1 (50)	51.9 (54)		100.0 (104)	0.69
Crop rotation	44.6 (45)	55.5(56)		100.0(101)	0.37
Increased use of chemical fertiliser	55.7 (34)	44.3 (27)		100.0 (61)	0.72
Growing leguminous crops	41.3 (38)	58.7 (54)		100.0 (92)	0.09
Vermiculture	40.0 (8)	60.0 (12)		100.0 (20)	0.74
Attracting pollinators or beneficial insects	37.1(23)	62.9 (39)		100.0 (62)	<0.001
Strategies adopted					
Livestock production					
Early morning dew pasturing	78.7 (59)		21.3 (16)	100.0 (75)	0.99
Growing own forage	60.5 (23)		39.5 (15)	100.0 (38)	0.01
Creating shade areas	62.2 (23)		37.8 (14)	100.0 (37)	0.02
Use of improved varieties	56.8 (21)	2.7 (1)	40.5 (15)	100.0 (37)	0.01

NB: Each row shows the frequencies of respondents' adoption per mitigation strategy in crops and livestock, crops alone as well as versus livestock alone. The results were tested with the chi-square test on a row by row basis. The p-value is the probability that the differences in adoption of the mitigation strategy between the categories is due to chance alone. Some strategies had expected values less than five, and were combined with the appropriate category to facilitate the calculation of the chi-square. Hence, in terms of "Plants and animal diversity" the "Livestock only" category was combined with the "Crop and livestock". In terms of "Use of improved varieties", the "Crop only" category was combined with "Crop and livestock" category. Respondents chose between strategies which were not mutually exclusive. Thus, respondents chose as many strategies as they used from a list. However, the *Yes* and *No* options were mutually exclusive. The results were tested with the chi-square test on a row by row basis. *Improved varieties* refer to the use of livestock species or varieties with enhanced reproductive and health performance. Vermiculture denotes efforts by farmers to encourage proliferation of earthworms in their soils to boost fertility at the study site.

The majority of respondents used a high diversity of mitigation strategies (Table 4.3). Few respondents (14.0%) combined a maximum of 3 mitigation strategies (“Low”) in terms of diversifying their land-based livelihood strategy portfolio.

Table 4.3 Relative levels of diversification amongst respondents in the adoption of land-based livelihood mitigation strategies

Level of diversification	Percent (Frequency)	P-value
High (7+)	56.7 (85)	<0.001
Moderate (4–6)	29.3 (44)	
Low (Up to 3)	14.0 (21)	
Total	100.0 (150)	

NB: Significant value is in bold. The p-value is the probability that the differences in frequencies amongst the suites of mitigation strategies usage are due to chance alone. A goodness of fit test was conducted for the Table ($p=0.0017$), thus the differences in the observed frequencies are significant.

Respondents were categorised in terms of their gender to investigate its relationship with the number of mitigation strategies they individually adopted (Table 4.4). However, the difference was not statistically significant ($p=0.301$).

Table 4.4 Relationship between respondents’ gender and their levels of diversification in terms of land-based livelihood mitigation strategies (n=150).

Level of diversification	Female	Male	P-value
	Percent (Frequency)	Percent (Frequency)	
High (7+)	52.7 (39)	60.5 (46)	0.301
Moderate (4–6)	28.4 (21)	30.3 (23)	
Low (Up to 3)	18.9 (14)	9.2 (7)	
Total	100.0 (74)	100.0 (76)	

The results were tested with the chi-square test, $X^2= 2.40$. The p-value is the probability that the differences in diversification of mitigation strategies per gender is due to chance alone.

There was a statistically significant relationship ($p=0.024$) between respondents’ age cohorts and their levels of strategy diversification (Table 4.5). A very low proportion of respondents in the 35–54 year age cohort exhibited low levels of strategy diversification (1.8%) compared to the other age groups (Table 4.5). Furthermore, respondents in the 18–34 years age cohort registered lower levels (48.0%) of strategy diversification than the older age groups.

Table 4.5 Association between respondents' age cohorts and their levels of diversification in terms of land-based livelihood mitigation strategies (n=150).

Level of diversification	Respondents' age range				P-value
	18–34	35–54	55–74	75+	
	Percent (Frequency)				
High (7+)	48.0 (12)	60.0 (33)	56.7 (29)	57.9 (11)	0.024
Moderate (4–6)	36.0 (9)	38.2 (21)	21.6 (11)	15.8 (3)	
Low (Up to 3)	16.0(4)	1.8 (1)	21.6 (11)	26.3 (5)	
Total	100.0 (25)	100.0 (55)	100.0 (51)	100.0 (19)	

The results were tested with the chi-square test, $X^2= 14.57$. The p-value is the probability that the differences in diversification of mitigation strategies per age range is due to chance alone.

The differences in levels of diversification were statistically significant ($p<0.001$). Respondents with no formal education recorded high proportions of “Low” strategy diversification (57.1%), and also the second highest of “High” diversification in their mitigation strategies (Table 4.6).

Table 4.6 Association between respondents' educational levels and corresponding degrees of diversification in terms of land-based livelihood mitigation strategies

Level of diversification	Respondents' educational levels				P-value
	No Education	Grade 1–7	Grade 8–11	Matric+	
	Percent (Frequency)				
High (7+)	31.8 (27)	36.5 (31)	9.4 (8)	22.4 (19)	<0.001
Moderate (4–6)	9.1 (4)	47.7 (21)	29.6 (13)	13.6 (6)	
Low (Up to 3)	57.1 (12)	28.6 (6)	0.0 (0)	14.3 (3)	
Total	100.0 (43)	100.0 (58)	100.0 (21)	100.0 (28)	

The results were tested with the chi-square test, $X^2= 26.95$. The p-value is the probability that the differences in diversification of mitigation strategies per respondents' educational level is due to chance alone.

There was no statistically significant relationship ($p=0.064$) between respondents' localities and the number of mitigation strategies adopted (Table 4.7).

Table 4.7 Association between respondents' localities and their levels of diversification in terms of land-based livelihood mitigation strategies.

Level of diversification	Respondents' village sub-section				P-value
	Mambayin	Gaganene	Manjesa	Magamzin	
	Percent (Frequency)				
High (7+)	63.8 (44)	38.7 (12)	66.7 (24)	35.7 (5)	0.064
Moderate (4–6)	20.3 (14)	45.2 (14)	25.0 (9)	50.0 (7)	
Low (Up to 3)	15.9 (11)	16.1 (5)	8.3 (3)	14.3 (2)	
Total	100.0 (69)	100.0 (31)	100.0 (36)	100.0 (14)	

The results were tested with the chi-square test, $X^2= 11.90$. The p-value is the probability that the differences in diversification of mitigation strategies per respondents' village sub-section are due to chance alone.

Respondents were categorised in terms of their social capital assets to investigate whether there was a relationship with the number of mitigation strategies they adopted (Table 4.8). However, there was no statistically significant relationship ($p=0.99$) between these two variables (Table 4.8).

Table 4.8 Association between respondents' level of mitigation strategies diversification and related social capital assets

Level of strategy diversification	Percentage (Frequency) Social capital category			P-value
	Membership of social group	Kinship/networks	Reciprocal relationships	
High (7+)	57.2 (83)	58.9 (79)	57.1 (84)	0.99
Medium (4–6)	28.3 (41)	26.9 (36)	29.3 (43)	
Low (Up to 3)	14.5 (21)	14.2 (19)	13.6 (20)	
Total	100.0 (145)	100.0 (134)	100.0 (147)	

The results were tested with the chi-square test $X^2=0.20$. The p-value is the probability that the differences between respondents' social capital and the related categories of diversification per mitigation strategies adopted are due to chance alone.

There was a statistically significant relationship ($p<0.001$) between respondents' level of diversification in the adoption of mitigation strategies, and their corresponding land-based assets owned/used (Table 4.9). Respondents with the lowest numbers of land-based assets (47.5%) simultaneously recorded the lowest levels of strategy diversification, and conversely, the greatest proportion of households with high diversification was among those with high asset ownership/use.

Table 4.9 Association between respondents' level of mitigation strategies diversification and corresponding land-based assets owned/used

Level of diversification	Respondents' level of land-based assets ownership/use			P-value
	Low (1 asset)	Moderate (2 assets)	High (3 assets)	
	Percent (Frequency)			
High (7+)	30.0 (12)	60.0 (33)	72.7 (40)	<0.001
Moderate (4–6)	22.5 (9)	38.2 (21)	25.5 (14)	
Low (Up to 3)	47.5 (19)	1.8 (1)	1.8 (1)	
Total	100.0 (40)	100.0 (55)	100.0 (55)	

The results were tested with the chi-square test, $X^2=53.74$. The p-value is the probability that the differences between respondents' ownership/use of land-based asset classes and the categories of diversification per mitigation strategies adopted are due to chance alone.

The relationship between respondents' levels of educational attainment and the land-based assets used/owned was statistically significant ($p=0.048$) (Table 4.10). The majority of respondents in the "Low" (43.2%) category had no formal education. However, respondents from the "Grade 1–7" category were most prevalent in the "High" (50.0%) diversification category.

Table 4.10 Relationship between respondents' educational levels and the land-based asset classes used/owned

Level of use/ownership	Respondents' educational levels				P-value
	No Education	Grade 1–7	Grade 8–11	Matric+	
	Percent (Frequency)				
High (3)	24.3 (9)	50.0 (26)	38.1 (8)	42.9 (12)	0.048
Moderate (2)	32.4 (12)	38.5 (20)	38.1 (8)	32.1 (9)	
Low (1)	43.2 (16)	11.5 (6)	23.8 (5)	25.0 (7)	
Total	100.00 (37)	100.00 (52)	100.00 (21)	100.00 (28)	

The results were tested with the chi-square test, $X^2=12.70$. The p-value is the probability that the differences in diversification of mitigation strategies between the educational levels are due to chance alone.

Respondents were classified according to their level of use or ownership of land-based assets to test the relationship between the "High", "Medium" and "Low" categories (of land-based livelihood assets use/ownership) and their related social capital. However, there was no statistically significant relationship ($p=0.98$) between respondents' level of use/ownership of land-based assets and three dimensions of social capital (Table 4.11).

Table 4.11 Association between respondents' level of use/ownership of land-based assets and their related social capital

Level of use/ownership of assets	Percentage (Frequency) Social capital category			P-value
	Membership of farmer's association	Reciprocity (Give)	Reciprocity (Receive)	
High (7+)	58.2 (85)	60.6 (77)	60.6 (63)	0.98
Medium (4–6)	28.8 (42)	26.8 (34)	26.9 (28)	
Low (Up to 3)	13.0 (19)	12.6 (16)	12.5 (13)	
Total	100.0 (146)	100.0 (127)	100.0 (104)	

The results were tested with the chi-square test, $X^2=0.32$. The p-value is the probability that the differences between respondents' social capital and the categories of diversification per mitigation strategies adopted are due to chance alone.

The association between respondents' locality of farming activity and their ownership/use of land-based assets was tested (Table 4.12). The difference was statistically significant ($p=0.01$). High ownership/use of land-based assets was much more prevalent in Mambayin (46.4%) and Manjesa (44.4%) than in the other two neighbourhoods (Table 4.12).

Table 4.12 Association between respondents' location of farming activity and the land-based assets used/owned

	Respondents' village sub-section				P-value
	Mambayin	Gaganene	Manjesa	Magamzin	
Level of use/ownership	Percent (Frequency)				
High (7+)	46.4 (32)	19.4 (6)	44.4 (16)	7.1 (1)	0.01
Moderate (4–6)	30.4 (21)	41.9 (13)	30.6 (11)	71.4 (10)	
Low (Up to 3)	23.2 (16)	38.7 (12)	25.0 (9)	21.4 (3)	
Total	100.0 (69)	100.0 (31)	100.0 (36)	99.9 (14)	

The results were tested with the chi-square test, $\chi^2=16.36$. The p-value is the probability that the differences in diversification of mitigation strategies between the localities are due to chance alone.

Respondents who were associated with a limited number of land-based livelihood assets recorded relatively high mean livestock numbers ($p<0.001$) (Table 4.13). Moreover, respondents with low land-based asset classes had more than twice the livestock numbers of their counterparts in the *medium* and *high* categories.

Table 4.13 Impact of respondents' level of land-based assets use/ownership and their corresponding livestock numbers

Level of use/ownership	Percentage (Frequency)	Mean livestock numbers per farmer	Standard deviation	Min	Max	P-value
High (7+)	64.0 (55)	22.5	13.1	9	62	<0.001
Medium (4–6)	15.1 (13)	23.7	17.2	11	68	
Low (Up to 3)	20.9 (18)	67.2	49.9	16	184	
Total	100.0 (86)					

NB: Significant value is in bold. The results were tested with the ANOVA test. The p-value is the probability that the differences in mean livestock numbers between the categories of land-based asset classes use/ownership are due to chance alone. Null hypothesis, H_0 : Respondents in the high land-based asset use/ownership class have the highest livestock numbers. Alternate hypothesis, H_A : Respondents in the high land-based asset use/ownership class have the lowest livestock numbers. This analysis was done amongst mixed smallholders to investigate the relationship between use/ownership of land-based assets and the numbers of livestock.

When the simultaneous effects of multiple variables such as gender, age and neighbourhood of respondent on respondents' classes of land-based asset use/ownership were examined by an ordinal logistic regression model (Table 4.14), the age, locality (zone) and social capital of respondents recorded significant impact on their ownership/use of land-based assets. The ownership/use of land-based assets was significant amongst the 75+ year age cohort in comparison to the reference category (18–34 age cohort). The odds ratio for the 75+ age cohort indicates they were 1.51 times more likely than the youth to own multiple land-based livelihood assets. Moreover, respondents from Magamzim were less likely to own/use multiple land-based assets compared to those from Mambayin (reference category).

Furthermore, when the simultaneous effects of multiple variables such as respondents' gender, age and neighbourhood on their level of strategy diversification were examined by an ordinal logistic regression model (Table 4.15), the neighbourhood (zone) recorded significant impact on the diversification of mitigation strategies. Individuals from the Magamzim locality were more likely to diversify their mitigation strategies relative to their neighbours Mambayin (reference category). The citing of farmers' agricultural activities in the Magamzim locality is therefore congenial for farmers' diversification of mitigation strategies (by circa 1.1 times).

A land-based asset map (Fig. 4.3) was created after surveying the area, holding discussions with farmers on their farms and homesteads as well as consulting literature. It portrays the topography of land-based asset classes used/owned across the study area's landscape. In addition, the map shows some key land marks of the community together with some important communal resources such as boreholes, ponds and rangelands.

Table 4.14 Impact of respondents' socio-demographic variables on their use/ownership of land-based asset classes (n=150)

Variable	Category	Odds Ratio	Standard error	[95% CI]	P-value
Age	18–34	Ref	Ref	Ref	Ref
	35–54	1.15	0.89	0.25- 5.2	0.85
	55–74	0.32	0.24	1.06-1.4	0.14
	75+	1.51	1.49	1.22-22.3	0.02
Gender	Male	Ref	Ref	Ref	Ref
	Female	1.72	0.85	0.65-4.5	0.27
Zone	Mambayin	Ref	Ref	Ref	Ref
	Manjesa	1.3	0.87	0.38-4.8	0.63
	Magamzin	0.1	0.09	0.01-0.6	0.01
	Gaganene	0.39	0.26	0.10-1.4	0.16
Social capital					
Membership of farmer's association	No	Ref	Ref	Ref	Ref
	Yes	0.2	0.32	0.23-4.5	0.01
Reciprocity (Give)	No	Ref	Ref	Ref	Ref
	Yes	1.07	1.05	0.15-7.4	0.94
Reciprocity (Receive)	No	Ref	Ref	Ref	Ref
	Yes	0.06	0.08	0.05-8.3	0.03

NB: *Ref* refers to *reference category*. Significant values are in bold. The results were tested with the ordinal logistic regression analysis. The p-value is the probability that the response differences in each variable as per respondents' ownership/use of land-based asset classes are due to chance alone. The logistic regression model was significant ($\chi^2= 0.1745$, $p = 0.0107$).

Table 4.15 Impact of respondents' socio-demographic factors on their mitigation strategy diversification within agriculture (n=150)

Variable	Category	Odds Ratio	Standard error	[95% CI]	P-value
Age	18–34	Ref	Ref	Ref	Ref
	35–54	1.15	0.89	0.25- 2.66	0.85
	55–74	0.32	1.47	0.07-30.0	0.14
	75+	1.52	1.49	0.22- 10.5	0.67
Gender	Male	Ref	Ref	Ref	Ref
	Female	1.72	0.85	0.65-4.56	0.27
Zone	Mambayin	Ref	Ref	Ref	Ref
	Manjesa	1.35	0.87	0.38-4.81	0.63
	Magamzin	1.11	0.09	0.01-0.61	0.01
	Gaganene	0.39	0.26	0.10-1.45	0.16
Social capital					
Membership of farmer's association	No	Ref	Ref	Ref	Ref
	Yes	4.7	2.4	0.31-4.20	0.19
Reciprocity (Give)	No	Ref	Ref	Ref	Ref
	Yes	1.07	0.1	0.15-7.43	0.19
Reciprocity (Receive)	No	Ref	Ref	Ref	Ref
	Yes	0.06	0.08	0.01-0.83	0.03

NB: *Ref* refers to *reference category*. Significant values are in bold. The results were tested with the ordinal logistic regression analysis. The p-value is the probability that the response differences for each variable as per mitigation strategies diversification are due to chance alone. The logistic regression model was significant ($\chi^2= 24.51$, $p = 0.0107$).

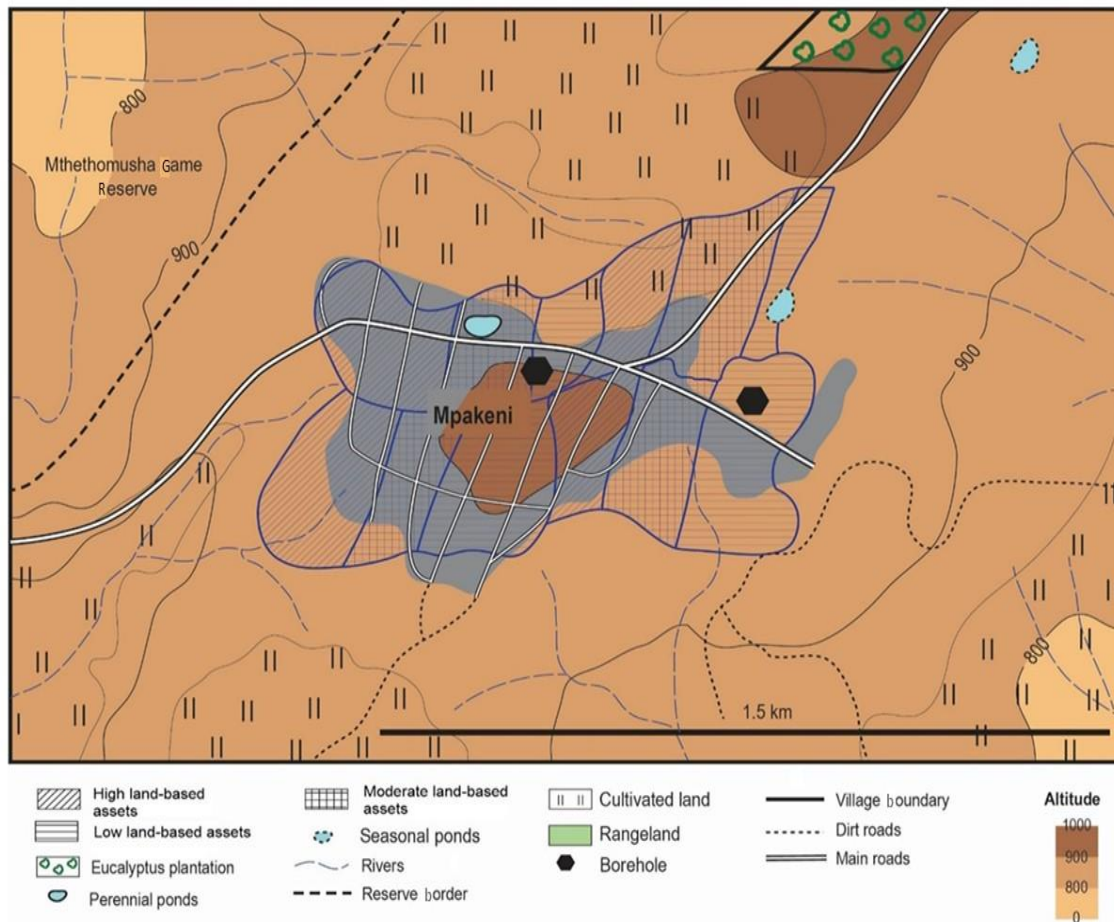


Figure. 4.3. Land-based asset map of Mpakeni.

4.4. DISCUSSION

4.4.1 The Interaction Between the Number of Land-Based Assets Used/Owned and Factors Affecting the Suite of Agricultural Strategies Deployed by Smallholders

This study explored factors affecting the number of land-based assets used/owned as well as factors affecting the suite of agricultural strategies pursued and the implications for related livelihoods. Study results indicate that age and location of farming activity are influenced the number of land-based assets used/owned by smallholders as well the suite of agricultural strategies they are able to deploy. Post-apartheid policies have sought to redress the legacy of multifaceted poverty and social inequalities created by apartheid politics especially in rural South Africa (Rootman et al. 2015; Cousins & Walker 2015). Land-based livelihoods and related assets are a common source of sustenance for poor and vulnerable groups. However, the multiple and competing interests on common pool resources and related land-based livelihood assets in these areas, coupled with climate change exacerbates their degradation (Hoffmann 2015; Shackleton

& Shackleton 2015). Consequently, the SDGs promote livelihood resilience which is also given emphasis in South Africa's Vision 2030 (National Planning Commission 2018; UNDP 2018). However, these can be affected by a number of socio-demographic factors (Petersen & Pedersen 2010). In the case of South Africa, the lingering impact of antecedent historical events such as apartheid on the rural milieu makes the case for harnessing all possible factors contingent on accelerated rural development such as sustainable land-based livelihoods urgent (Rootman et al. 2015; Cousins & Walker 2015). To the best of our knowledge this is the first study to assess the impact of three categories of social capital (as per the sustainable livelihood framework) coupled with a number of individual factors, on diversification of agricultural mitigation strategies as well as the ownership/use of land-based asset classes in smallholder systems.

4.4.2 The Nexus of Socio-Demographic Factors and Diversification of Agricultural Strategies

4.4.2.1 Age and strategy diversification

In general, respondent farmers adopted a diverse range of land-based livelihood mitigation strategies (Tables 4.1 & 4.3) to sustain their agricultural activities (Table 4.2). The age of respondents was a significant factor in their diversification of land-based mitigation strategies at the study site (Table 4.5). The concept of adult development as per human sciences posits that an individual's life course can be fragmented into age levels or segments from infancy to old age (Levinson 1986; Aktu & Ilhan 2017). The meaning of each stage is by virtue of its role in the entire life cycle (Levinson et al. 1978; Aktu & Ilhan 2017). Moreover, the life and career development stages concept, argues that an individual's occupational preferences and competencies are mediated by time and experiences (Super 1990). The vocational maturity of individuals, does not strictly correspond with chronological age, but develops through phases of career transitions (Super 1990; Aktu & Ilhan 2017); stage 1: growth (age 0–14), stage 2: exploration (age 15–24): stage 3: establishment (age 25–44): stage 4: maintenance (age 45–64), stage 5: decline (age 65+). The 35–54 years age cohort is generally characterised by skills development and career advancement through work experience. Hence, the predominance (60.0%) of respondents from the 35–54 years age cohort in the “High” diversification category suggests their requisite capacities are comparatively advanced unlike the other age cohorts. This scenario possibly explains the less prevalence of respondents in the 35–54 year age cohort in the “Low” levels of strategy diversification (1.82%) compared to the other age groups (Table 4.5). In addition, respondents in the 18–34 years age cohort exhibited lower levels (48.0% compared to 56.7% or more) of strategy diversification than the older age groups in the “High” diversification category (Table 4.5). This phenomenon could be due to their *savoir faire* being in a fledgling phase compared to the more experienced age cohorts.

In developing countries, such as South Africa, land-based livelihoods are a key component of rural livelihoods but highly sensitive to climate impacts. The employment of diverse strategies is crucial

for safeguarding land-based livelihood activities (UNDP 2018; Lakner et al. 2018). However, the capacity to harness various strategies is mediated by core factors such as the individual's *savoir faire*, market orientation of a household, livestock ownership, off-farm employment opportunities, and available land resources inter alia (Ogunkoya 2014; Waha et al. 2018). This may account for the relative distributions of the age groups in the different categories of diversification (Table 4.5) as mediated by the interplay of these background factors. Furthermore, it is posited that the age of an individual or their stage in life can affect their vulnerability within their social context (FAO 2000; Bavinck et al. 2014). The elderly (Plate 4.C) and the youth (Plates 4.A & 4.B) are classified as vulnerable groups which require social support due to their relative dearth of resources (Zaidi 2014). Furthermore, it has been observed that such vulnerable groups rely on land-based resources disproportionately, which further compromises their resilience in the face of resource degradation (Bavinck et al. 2014). The predominance of these two age cohorts (especially the elderly) in the "Low" diversification of mitigation strategies (Table 4.5) indicates that these groups at the study site require further assistance in enhancing their land-based livelihood activities (Nasa'i et al. 2010; Bavinck et al. 2014). Given that such land-based livelihood activities (Table 4.2) are core to the sustenance of vulnerable groups, it is necessary to introduce targeted policies that will address the peculiar livelihood needs of these vulnerable groups. This is critical to government efforts to transform rural areas into thriving centres with vibrant economies (Vision 2030) instead of their present reputation as migrant-sending areas (STATSSA 2015). It is noteworthy, that the significant influence of age on respondents' level of diversification (Table 4.5) is analogous with similar observations in other parts of Sub-Saharan Africa, which argue that age is a core socio-demographic parameter influencing the capacity of individuals to diversify their livelihood strategies in support of related activities (Nasa'i et al. 2010). However, unlike other parts of sub-Saharan Africa such as rural Nigeria where the majority of respondents was observed in the "Low" diversification category, most respondents from the study site (56.7%) were in the category of "High" diversification of strategies (Table 4.3). This is beneficial to the goal of optimising the capabilities and productivity of land-based livelihoods and safeguarding household wellbeing (UNDP 2018; Lakner et al. 2018). This has positive implications for respondents across the four localities of the study site.



Plates 4.A. & 4.B. Youth herding livestock at study site.

Note young herder in the background behind the herd of goats in Plate 4.B.



Plate 4.C. An elderly herdsman leading livestock for grazing at the study site.

4.4.2.2 Education and strategy diversification

Education had a positive influence on respondents' level of diversification with regards to land-based livelihood strategies at the study site (Table 4.6). Education is a vital ingredient in

reinforcing land-based livelihoods (Barrantes & Yagüe 2015). Education also comes with the advantage of increasing interest, flexibility to adapt and proactivity towards new technologies (Barrantes & Yagüe 2015). Education can also reinforce the availability and viability of knowledge between core actors in realising the objective of agriculture as a key contributor to food security, environmental sustainability and economic opportunity (Sørensen & Torfing 2011). Respondents with relatively lower educational levels demonstrated relatively lower levels (57.1%) of diversification (Table 4.6). Respondents with “No education” recorded the lowest levels of diversification relative to the other education categories. Conversely, it is noteworthy that as education levels rise from “No education” to “Matric+”, the number of respondents in the low diversification category generally reduces. Therefore, education comes with positive influence on agricultural innovation adoption such as the diversification of strategies for improved land-based livelihood activities (Schut et al. 2015). Furthermore, it is argued that building synergy between indigenous and external knowledge (particularly scientific knowledge) is key to developing locally-adapted options that address fresh livelihood challenges (Barrantes & Yagüe 2015). This is more so for indigenous communities where education levels largely tend to be low. Education can also reinforce the availability and viability of knowledge between core actors in realising the objective of agriculture as a key contributor to food security, environmental sustainability and economic opportunity (Sørensen & Torfing 2011). Nevertheless, the impact of education is often marginal in the absence of adequate socio-economic conditions (IFAD 2011). This can be attributed to the scenario of formal education having a marginally significant association with respondents’ level of ownership/use of land-based assets in comparison to the reference category (Table 4.10), as the study site falls in the category of areas classified with high poverty levels (ARC 2015). Social capital is an essential element in the socio-economic dynamics of such rural areas.

4.4.2.3 Locality and strategy diversification

A locality’s bio-physical conditions can also affect the success of land-based livelihood activities (Obi & Tafa 2016). Thus, the overriding influence of assets such as land on the success of land-based livelihoods cannot be overemphasized (Nasa’i et al. 2010). In conditions of high-risk agriculture and poverty, smallholders, due to their lack of requisite resources, are forced to find alternative income sources by adopting non-farm activities (UNDP 2018). Conversely, smallholders in unfavourable or resource poor conditions are incentivised to secure their livelihoods by adopting several strategies to protect their land-based livelihood activities (Asare 2018). The latter scenario seems to be at play at the study site as the areas regarded as unfavourable for agriculture (as expatiated in chapter 3) record relatively higher levels in the “High” diversification category (Table 4.7). Hence, respondents from Mambayin and Manjesa recorded relatively high levels of diversification (63.8% and 66.7% respectively) in comparison to Magamzim and Gaganene (35.7% and 38.7% respectively). Therefore, in terms of the study site,

respondents from the areas with favourable agricultural conditions (Table 4.7) are less motivated to diversify their livelihood mitigation strategies to secure their land-based livelihood activities. Moreover, diversification in land-based strategies is mediated by livelihood survival and distress under deteriorating conditions, as well as with livelihood enhancement under improving economic conditions (Kassie et al. 2017). When this outcome (of an insignificant association) was investigated further by controlling for other factors in a regression model, the results were significant (Table 4.15). Thus, individuals from the Magamzim locality were more likely to diversify their mitigation strategies relative to Mambayin (reference category). Therefore, the siting of farmers' agricultural activities in the Magamzim locality is conducive for farmers' diversification of mitigation strategies.

It is argued that areas with favourable agricultural conditions often record higher diversification in livelihood strategies due to a marked desire to increase income or accumulate wealth (Kassie et al. 2017; Mkuhlani et al. 2018). However, results from the study site indicate the contrary. Areas described as comparatively more favourable for land-based livelihood activities (by local farmers) exhibited less diversification in strategies (compared to the "High" category) unlike those with unfavourable conditions. Furthermore, rural people predominantly construct their livelihoods through three core avenues including agricultural intensification; livelihood diversification and migration (Nasa'i et al. 2010; Asare 2018). Results from Table 4.7 suggest respondents from Manjesa and Mambayin are more involved in intensifying their agriculture-related strategies to secure their land-based livelihood activities compared to Magamzim and Gaganene. However, given the statistically insignificant association recorded for this variable per Table 4.7, it can be surmised that the differences observed are largely marginal because it did not translate into causality. Ultimately, land use/land cover is largely dynamic in nature and affords an understanding of the association between anthropogenic activities and the environment. Moreover, fluctuations in land conditions affect land use/land cover and related livelihoods of people (Kassie et al. 2017).

4.4.3 The Nexus of Socio-Economic Parameters and the Use/Ownership of Land-Based Assets

4.4.3.1 Social capital and strategy diversification

Social capital was an important factor in respondents' use/ownership of land-based assets in comparison to the reference category (Table 4.14). This indicates that social capital is an important component of land-based livelihoods at the study site which is harnessed for farm related work inter alia. Moreover, social capital is sometimes the most important resource at the disposal of communities of poor smallholder farmers characterised by low incomes, limited education and few physical assets (Fairley-Grenot & Carberry 2014; Gómez-Limón et al. 2014). It

can therefore be opined that respondents' social capital facilitates access to labour and helps alleviate associated high transaction costs.

The reciprocity (receive) dimension of social capital had a negative association on smallholders' use/ownership of land-based assets at the study site compared to the reference category (Table 4.14). It is argued that reciprocity is high amongst poor individuals and communities as households depend on each other for subsistence. Consequently, the impact of social capital as a safety net in such communities is amplified (Zhang et al. 2017). Smallholders who exhibit significant levels of reciprocity dependence, are less likely to be wealthy and hence own multiple land-based assets (Table 4.14). Labour was one of the key challenges to farmers' agricultural productivity at the study site (as expatiated in Chapter 3). Furthermore, during the field work it was observed that farmers relied on their social networks for collective action as 'peer farmers' assisted on each other's farms en bloc as the situation demanded.

The social capital dimension of membership of farmer's association also had a negative association with smallholders' use/ownership of land-based assets at the study site (Table 4.14). The intangible value fostered through networks and trust developed within groups à la social capital promote safety nets that empower resource poor individuals and communities to cope with shocks, particularly in lieu of formal risk management options like credit or insurance (Scoones 2009; Saint-Ville et al. 2016). In addition, the availability of common pool resources and associated land-based assets can create an avenue for nurturing social capital, whilst their scarcity/paucity can translate into diminished social capital stocks (Barnes-Mauthe et al. 2015). During the field work, the chairman of the farmers association explained that although many smallholders in the village joined the association, their lack of commitment by not attending meetings and paying dues had largely compromised the effectiveness of the association. Therefore, it might be possible that the non-payment of dues is indicative of a dearth of financial capital and hence the means to own several land-based assets. Furthermore, although many smallholders may claim to be members of the farmers association in principle, their lack of resources might prevent them from being active members in practice.

4.4.3.2 Use/ownership of land-based assets and strategy diversification

Additionally, there was a highly significant association between respondents' level of strategy diversification and the level of ownership per land-based livelihood assets (Table 4.9). Respondents with the lowest numbers of land-based assets (47.5%) simultaneously recorded the lowest levels of strategy diversification. Conversely, respondents with the highest numbers of land-based assets (72.7%) also recorded the highest numbers of strategy diversification (Table 4.9). This outcome indicates that there is a positive correlation between the numbers of land-based assets used/owned and the levels of strategy diversification by respondents. It has been

observed that generally, rural communities in South Africa utilise a wide variety of natural resources to support their livelihoods (Andrew et al. 2003; Jacobs & Makaudze 2012). However, the nature of dependence on land and natural resource assets for employment and survival by the rural populace has become more nuanced within the past 50 years in South Africa (Jacobs & Makaudze 2012). Moreover, rural households engaged in agricultural and non-farm activities depend on a bricolage of livelihood sources including wage employment, agricultural activities and social grants (Jacobs & Makaudze 2012; Neves & Du Toit 2013). In addition, less well-off farmers and those with smaller herds, tend to make more use of various goods and services such as provided by livestock and tend to depend more on land-based livelihood assets unlike wealthier farmers (Etongo et al. 2016; Duval-Diop, 2016). It can therefore be surmised that respondents in the lower levels of ownership/use of land-based livelihood assets simultaneously registered lower diversifications (Table 4.9) because they have limited options for diversification. In addition, they could be comparatively more invested in off-farm activities or relatively wealthier. Conversely, respondents who recorded “High” diversification in their strategies but reported “Low” ownership/use of land-based assets could represent the youth or people who are contracted to manage such assets by proxy or perform farm labour activities on behalf of the bona fide owners (Jacobs & Makaudze 2012; Poole et al. 2013).

The allocation of land in rural areas is controlled by traditional leaders who have voiced their opposition to independent ownership of land within their tribal boundaries (Cousins 2013; Claassens 2015). One of the criticisms of land ownership in the former homelands (such as the study site) is that allocation is subject to the rural elite’s whims and caprices (Claassens 2015). This can come with implications for equitable access (Cousins 2013; Claassens 2015) to areas regarded as “choice areas” such as Magamzim and Gaganene which abut the Mthethomusha Nature Reserve and are described as more fertile areas by locals (Chapter 3). Thus, it might be possible that wealthier households or individuals with closer links to the rural elite could be more concentrated in such choice areas. However, this was not investigated for this study site during the study. Moreover, it might be possible that the phenomenon of respondents with *low* land-based assets having more livestock than those in the medium and high categories could be attributed to them being more successful due to their specialisation (Table 3.13).

Ultimately, the diverse use of land-based livelihood strategies is an innovative approach to securing related livelihood activities and assets (Bretthauer 2014; Farmer’s Weekly 2014; Lakner et al. 2018). This enhances farm production and is one viable approach to limiting competition over scarce resources and environmental degradation with implications for sustainable livelihoods (FAO 2000; Duval-Diop 2016; Dean 2018).

4.5. CONCLUSION

Land-based livelihoods are considered as important modes for transforming the rural economy and facilitating sustainable rural development in the context of the Sustainable Development Goals and the National Development Plan (Vision 2030). However, a convergence of factors has compromised land-based livelihoods with consequences on the global goals of equitable decent work and sustainable communities (SDGs 8 & 11). This has become more urgent as job prospects for the unskilled continue to dwindle and alternative livelihood sources are being explored. Understanding how other livelihood stressors combine with climate change to affect land-based livelihoods is imperative. Age, education and locality of activity have significant influences on the capacity of smallholders to diversify their livelihood strategies in support of their land-based livelihood activities. This comes with consequences for their ability to optimise their land-based livelihood assets. Furthermore, age, locality and social capital influenced respondents' use/ownership of land-based asset classes. Consequently, rural agro-environment policies need to reinforce smallholders' climate adaptation education and related interventions for enhanced climate adaptation and improved productivity. This also feeds into the post-apartheid government policy of facilitating smallholders into the mainstream economy. Ultimately, land-based livelihoods and associated assets are an essential element in the bricolage of rural livelihoods. Hence, they are an important lever through which the goals of decent work and sustainable communities (SDGs 8 & 11), as well as the ideals of "Leave No One Behind (LNOB)" can be effectively addressed. Furthermore, the sustainable use of land is linked to national and local food security, jobs and wealth creation through the value-adding chain in agriculture, biodiversity protection on farm land, and the prevention of land degradation through sustainable land management. Land-based livelihoods (in which *Jacks-and-Jills-of-many-trades* predominate) are particularly seen as an avenue to enhance employment amongst the rural communities in South Africa as part of a National Development Plan to spread wealth in one of the most unequal societies in the world. Interventions to safeguard vulnerable rural livelihoods and promote sustainability need to also give focus to related assets for long-term success. This study is of policy relevance to the National Development Plan (Vision 2030) which aims to safeguard the socio-economic rights of the rural populace inter alia, by eliminating poverty and reducing inequality through enhanced livelihoods to transform the rural economy.

4.6. REFERENCES

- Aktu, Y., & İlhan, T. (2017). Individuals' life structures in the early adulthood period based on Levinson's theory. *Educational Sciences: Theory and Practice*, 17 (4), 1383–1403. <http://dx.doi.org/10.12738/estp.2017.4.0001>.
- Andrew, M., Ainslie, A., & Shackleton, C. M. (2003). Evaluating land and agrarian reform in South Africa land use and livelihoods. *PLAAS Occasional Paper Series*, 8, 1–36.
- Angelsen, A., Jagger, P., Babigumira, R., Belcher, B., Hogarth, N. J., Bauch, S., Börner, J., Smith-Hall, C., & Wunder, S. (2014). Environmental income and rural livelihoods: A global-comparative analysis. *World Development*, 64 (1), S12–S28. <https://doi.org/10.1016/j.worlddev.2014.03.006>.
- ARC. (2015). Annual Report for 2015/16. <http://pmg-assets.s3-website-eu-west-1.amazonaws.com/161020ARC.pdf> accessed on 23.05.2015.
- Asare, K. Y. (2018). *Non-farm Livelihood Diversification in Selected Rural and Peri-Urban Communities in the Sunyani West District*. Unpublished masters thesis, University of Cape Coast, Cape Coast, Ghana. <https://erl.ucc.edu.gh/jspui/bitstream/123456789/3407/1/ASARE%202018.pdf>.accessedon18.08.2018.
- Babulo, B., Muys, B., Nega, F., Tollens, E., Nyssen, J., Deckers, J., & Mathijs, E. (2008). Household livelihood strategies and forest dependence in the highlands of Tigray, Northern Ethiopia. *Agricultural Systems*, 98 (2), 147–155.
- Barnes-Mauthe, M., Oleson, K. L. L., Brander, L. M., Zafindrasilivonona, B., Oliver, T. A., & Van Beukering, P. J. H. (2015). Social capital as an ecosystem service: Evidence from a locally managed marine area. *Ecosystem Services*, 16, 283–293. <https://doi.org/10.1016/j.ecoser.2014.10.009>.
- Barrantes, C., & Yagüe, J. L. (2015). Adults' education and agricultural innovation: A social learning approach. *Procedia - Social and Behavioral Sciences*, 191, 163–168. <https://doi.org/10.1016/j.sbspro.2015.04.387>.
- Bavinck, M., Pellegrini, L., & Mostert, E. (2014). *Conflicts Over Natural Resources in the Global South: Conceptual Approaches*. Balkema: CRC Press, pp. 224.
- Bhorat, H., & Van Der Westhuisen, C. (2012). *Poverty, Inequality and the Nature of Economic Growth in South Africa*. DPRU Working Paper 12151. Cape Town: University of Cape Town, Development Policy Research Unit.
- Bretthauer, J. M. (2014). Conditions for peace and conflict: Applying a fuzzy-set qualitative comparative analysis to cases of resource scarcity. *Journal of Conflict Resolution*, 59 (4), 593–616.

Bryceson, D. F. (1996). Deagrarianization and rural employment in sub-Saharan Africa. *World Development*, 24 (1), 97–111. [https://doi.org/10.1016/0305-750X\(95\)00119-W](https://doi.org/10.1016/0305-750X(95)00119-W).

Butler, J., Rotberg, R. I., & Adams, J. (1977). *The Black Homelands of South Africa: The Political and Economic Development of Bophuthatswana and Kwa-Zulu*. Berkeley: University of California Press, pp. 250.

Campbell, B. M., & Luckert, M. K. (2002). *Uncovering the Hidden Harvest: Valuation Methods for Woodland and Forest Resources*. London: Earthscan, pp. 262.

Cavendish, W. (2000). Empirical regularities in the poverty-environment relationship in rural households: Evidence from Zimbabwe. *World Development*, 28 (11), 1979–2003.

Claassens, A. (2015). Law, Land and Custom, 1923-2014: What is at Stake Today? Ecosystem Based Adaptation. In: Cousins, B., and Walker, C. (Eds.). *Land Divided, Land Restored: Land Reform in South Africa for the 21st Century*, 68–84. Johannesburg: Jacana Media.

Cousins, B. (2013). Land redistribution, populism and elite capture: New land reform policy proposals under the microscope. *The Journal of the Helen Suzman Foundation*, 70, 11–19. <https://hsf.org.za/publications/focus/focus-70-on-focus/focus-70-oct-b-cousins.pdf> accessed on 16.06.2016.

Cousins, B., & Walker, C. (2015). Introduction. In: Cousins, B., and Walker, C. (Eds.). *Land Divided, Land Restored: Land Reform in South Africa for the 21st Century*, 1–23. Johannesburg: Jacana Media.

Crowe, S., Cresswell, K., Robertson, A., Huby, G., Avery, A., & Sheikh, A. (2011). The case study approach. *BMC Medical Research Methodology*, 11 (100), 1–9. <https://doi.org/10.1186/1471-2288-11-100>.

Dean, S. (2018). Drought declared a national disaster. *Farmer's Weekly*, March 14. <https://www.farmersweekly.co.za/agri-news/south-africa/drought-declared-national-disaster/> accessed on 05.06.2018.

DFID. (1999). Sustainable Livelihoods Guidance Sheets. <http://www.livelihoodscentre.org/documents/20720/100145/Sustainable+livelihoods+guidance+sheets/8f35b59f-8207-43fc-8b99-df75d3000e86> accessed on 16.06.2016.

DFID. (2006). *Reducing the Risk of Disasters — Helping to Achieve Sustainable Poverty Reduction in a Vulnerable World: A DFID Policy paper*. London: Department for International Development, pp. 36.

Duval-Diop, D. (2016). Navigating Age, Gender, and Cultural Crashes and Clashes in a Youth-Led PAR Project in West Africa. In: Drame, E. R., and Irby, D. J. (Eds.). *Black Participatory Research*, 125–140. New York: Palgrave Macmillan.

Ellis, F. (2000). *Rural Livelihoods and Diversity in Developing Countries*. Oxford: Oxford University Press, pp. 296.

Etongo, D., Djenontin, I. N. S., & Kanninen, M. (2016). Poverty and environmental degradation in Southern Burkina Faso: An assessment based on participatory methods. *Land*, 5 (3), 20–43. <https://doi.org/10.3390/land5030020>.

Fairley-Grenot, K., & Carberry, P. S. (2014). Social capital and investment in agriculture: Three global networks converge with implications for research assimilation. *Organization and Management*, 16 (3), 343–353. <https://doi.org/10.1080/14479338.2014.11081992>.

FAO. (2000). *Conflict and Natural Resource Management*. Rome: Food and Agriculture Organisation, pp. 22. <http://www.fao.org/forestry/21572-0d9d4b43a56ac49880557f4ebaa3534e3.pdf> accessed on 16.06.2016.

FAO. (2005). *Livestock Sector Brief*. Rome: Food and Agriculture Organisation, pp. 18. http://www.fao.org/ag/againfo/resources/en/publications/sector_briefs/lb_JPN.pdf accessed 11.10.2018.

FAO. (2013). *Resilient Livelihoods: Disaster Risk Reduction for Food and Nutrition Security*. Rome: Food and Agriculture Organisation, pp. 108. <http://www.fao.org/3/a-i3270e.pdf> accessed on 16.06.2016.

Farmer's Weekly. (2014). Strategy focuses on job creation in the rural areas. March 11. <https://www.farmersweekly.co.za/agri-news/south-africa/strategy-focuses-on-job-creation-in-the-rural-areas/> accessed on 05.06.2018.

Ferguson, J. (2015). *Give a Man a Fish: Reflections on the New Politics of Distribution*. Durham: Duke University Press, pp. 280.

Fisher, M. (2004). Household welfare and forest dependence in Southern Malawi. *Environment and Development Economics*, 9 (2), 135–154. <https://doi.org/10.1017/S1355770X03001219>.

Folke, C. (2006). Resilience: The emergence of a perspective for social-ecological systems analyses. *Global Environment Change*, 16, 253–267. <http://dx.doi.org/10.1016/j.gloenvcha.2006.04.002>.

Foster, A. (2012). Creating Good Employment Opportunities for the Rural Sector. *Asian Development Review*, 29 (1), 1–28.

Ganiyu, M. O., & Omotayo, A. O. (2016). Effects of livelihood activities on the households' food security in the Ogbomoso South local government area of Oyo state, Nigeria. *Journal of Human Ecology*, 56 (1–2), 107–113. <https://doi.org/10.1080/09709274.2016.11907044>.

Gómez-Limón, J. A., Vera-Toscano, E., & Garrido-Fernández, F. E. (2014). Farmers' contribution to agricultural social capital: Evidence from southern Spain. *Rural Sociology*, 79 (3), 380–410. <https://doi.org/10.1111/ruso.12034>.

Hampson, J., Challis, W., Blundell, G., & De Rosner, C. (2002). The rock art of Bongani Mountain Lodge and its environs, Mpumalanga Province, South Africa: An introduction to problems of Southern African rock-art regions. *The South African Archaeological Bulletin*, 57 (175), 15–30.

Hoffman, M. T. (2015). Environmental Change in Twentieth-Century South Africa and its Implications for Land Reform. In: Cousins, B., and Walker, C. (Eds.). *Land Divided, Land Restored: Land Reform in South Africa for the 21st Century*, 56–67. Johannesburg: Jacana Media.

IFAD. (2011). *Climate Change: Building the Resilience of Poor Rural Communities*. Rome: IFAD, pp. 8.

Jacobs, P., & Makaudze, E. (2012). Understanding rural livelihoods in the West Coast District, South Africa. *Development Southern Africa*, 29 (4), 574–587. <https://doi.org/10.1080/0376835X.2012.715443>.

Kassie, G. W., Kim, S., & Fellizar, F. P. (2017). Determinant factors of livelihood diversification: Evidence from Ethiopia. *Cogent Social Sciences*, 3 (1369490), 1–16. <https://doi.org/10.1080/23311886.2017.1369490>.

Lakner, S., Kirchweger, S., Hoop, D., Brümmer, B., & Kantelhardt, J. (2018). The effects of diversification activities on the technical efficiency of organic farms in Switzerland, Austria, and Southern Germany. *Sustainability*, 10 (4), 1304–1322. <https://doi.org/10.3390/su10041304>.

Levinson, D. J. (1986). A conception of adult development. *American Psychologist*, 41 (1), 3–13. <http://dx.doi.org/10.1037/0003-066X.41.1.3>.

Levinson, D. J., Darrow, C. N., Klein, E. B., Levinson, M. H., & McKee, B. (1978). *The Seasons of a Man's Life*. New York: Ballantine Books, pp. 384.

Maass, B. L., Musale, D. K., Chiuri, W. L., Gassner, A., & Peters, M. (2012). Challenges and opportunities for smallholder livestock production in post-conflict South Kivu, Eastern DR Congo. *Tropical Animal Health Prod*, 44 (6), 1221–1232. <https://doi.org/10.1007/s11250-011-0061-5>.

Mbiba, M., Collinson, M., Hunter, L., & Twine, W. (2019). Social capital is subordinate to natural capital in buffering rural livelihoods from negative shocks: Insights from rural South Africa. *Journal of Rural Studies*, 65 (2), 12–21. <https://doi.org/10.1016/j.jrurstud.2018.12.012>.

Mkuhlani, S., Mupangwa, W., MacLeod, N., Gwiriri, L., Nyagumbo, I., Manyawu, G., & Chigede, N. (2018). Crop–livestock integration in smallholder farming systems of Goromonzi and Murehwa, Zimbabwe. *Renewable Agriculture and Food Systems*, 1–12. <https://doi.org/10.1017/S1742170518000558>.

Mosites, E. M., Rabinowitz, P. M., Thumbi, S. M., Montgomery, J. M., Palmer, G. H., May, S., Rowhani-Rahbar, A., Neuhouser, M. L., & Walson, J. L. (2015). The Relationship between livestock ownership and child stunting in three countries in Eastern Africa using national survey data. *PLoS ONE*, 10 (9), e0136686. <https://doi.org/10.1371/journal.pone0136686>.

Muhumuza, M., & Balkwill, K. (2013). Factors affecting the success of conserving biodiversity in national parks: A Review of case studies from Africa. *International Journal of Biodiversity*, 798101, 1–21. <http://dx.doi.org/10.1155/2013/798101>.

Muigua, K. (2015). Managing natural resource conflicts in Kenya through negotiation and mediation. *Alternative Dispute Resolution*, 4 (2), 1–63.

Mwiturubani, D. A., & Van Wyk, J. (2010). *Climate Change and Natural Resources Conflicts in Africa*. Pretoria: Institute for Security Studies, pp. 277.

Nasa'i, D. H., Atala, T. K., Akpoko, J. G., Kudi, T. M., & Sani, H. (2010). Factors influencing livelihood diversification among rural farmers in Giwa local government area of Kaduna State, Nigeria. *International Journal of Science and Nature*, 1 (2), 161–165.

Ndagurwa, P. (2013). *The impact of family structure on schooling outcomes for children in South Africa*. Unpublished masters thesis, UKZN, Durban, South Africa. https://researchspace.ukzn.ac.za/bitstream/handle/10413/11325/Ndagurwa_Pedzisai_2013.pdf?sequence=1&isAllowed=y accessed on 05.11.2018.

National Planning Commission. (2018). The National Development Plan 2030. <https://nationalplanningcommission.wordpress.com/the-national-development-plan/> accessed on 05.06.2018.

NEPAD. (2016). Yaounde Declaration and Plan of Action – 2nd Africa Rural Development Forum. <https://www.nepad.org/publication/yaounde-declaration-and-plan-action-2nd-africa-rural-development-forum> accessed on 05.06.2018.

Neves, D., & Du Toit, A. (2013). Rural livelihoods in South Africa: Complexity, vulnerability and differentiation. *Journal of Agrarian Change*, 13 (1), 93–115.

Nhemachena, C., Mano, R., Mudombi, S., & Muwanigwa, V. (2014). Perceptions on climate change and its impact on livelihoods in Hwange district, Zimbabwe. *Jàmbá: Journal of Disaster Risk Studies*, 6 (1), 1–6. <http://dx.doi.org/10.4102/jamba.v6i1.123>.

Nyamwanza, A. M. (2012). Livelihood resilience and adaptive capacity: A critical conceptual Review. *Jàmbá: Journal of Disaster Risk Studies*, 4 (1), 55–62. <http://dx.doi.org/10.4102/jamba.v4i1.55>.

Obi, A., & Tafa, S. (2016). The determinants of household poverty in South Africa. *Africa's Public Service Delivery and Performance Review*, 4 (4), a137.

Ogunkoya, F. T. (2014). *Socio-Economic Factors That Affect Livestock Numbers: A Case Study of Smallholder Cattle and Sheep Farmers in the Free State Province of South Africa*. Unpublished masters dissertation, University of South Africa, Pretoria, South Africa. http://uir.unisa.ac.za/bitstream/handle/10500/18251/dissertation_ogunkoya_ft.pdf?sequence=1&isAllowed=y accessed on 17.07.2018.

OXFAM. (2016). A harvest of dysfunction: Rethinking the approach to drought, its causes and impacts in South Africa. <http://www.oxfam.org.za/wp-content/uploads/2017/03/Final-Final-OZA-Oxfam-Drought-Report.pdf> accessed on 05.06.2018.

Parry, M., Canziani, O., Palutikof, J., Van der Linden, P., & Hanson, C. (2007). AR4 Climate Change 2007: Impacts, Adaptation and Vulnerability. New York: Cambridge University Press, pp. 987. <https://www.ipcc-wg2.gov/AR4/website/intro.pdf> accessed on 16.06.2015.

Petersen, E. K., & Pedersen, M. L. (2010). The Sustainable Livelihoods Approach: From a Psychological Perspective. http://ps.au.dk/fileadmin/Statskundskab/Dokumenter/subsites/Uland/TheSustainableLivelihoodsApproach_Psych.pdf accessed on 06.12.2017.

Pica-Ciamarra, U., Otte, J., & Chilonda, P. (2007). Livestock Policies, Land and Rural Conflicts in Sub-Saharan Africa. PPLPI Research Report No. 07-04. <http://www.fao.org/3/a-bp290e.pdf> accessed on 17.07.2018.

Poole, N., Álvarez, F., Penagos, N., & Vázquez, R. (2013). Education for all and for what? Life-skills and livelihoods in rural communities. *Journal of Agribusiness in Developing and Emerging Economies*, 3 (1), 64–78. <https://doi.org/10.1108/20440831311321656>.

Ragie, F. H. (2016). *Relationships between household resource dependence, socio-economic factors, and livelihood strategies: A case study from Bushbuckridge, South Africa*. Unpublished

masters dissertation, University of the Witwatersrand, Johannesburg, South Africa.
[http://wiredspace.wits.ac.za/jspui/bitstream/10539/21725/2 /FH%20Ragie, %20M Sc%20dissertation,%20Wits,%202016-08-04,%20Final%20Submission.pdf](http://wiredspace.wits.ac.za/jspui/bitstream/10539/21725/2/FH%20Ragie,%20M%20Sc%20dissertation,%20Wits,%202016-08-04,%20Final%20Submission.pdf) accessed on 06.12.2017.

Ridder, H. (2017). The theory contribution of case study research designs.
Business Research, 10 (2), 281–305. <https://doi.org/10.1007/s40685-017-0045-z>.

Rootman, G. T., Stevens, J. B., & Mollel, N. M. (2015). Policy opportunities to enhance the role of smallholder livestock systems in Limpopo province of South Africa. *South African Journal of Agricultural Extension*, 43 (2), 91–104. <http://dx.doi.org/10.17159/2413-3221/2015/v43n2a360>.

Saint-Ville, A. S., Hickey, G. M., Locher, U., & Phillip, L. E. (2016). Exploring the role of social capital in influencing knowledge flows and innovation in smallholder farming communities in the Caribbean. *Food Security*, 8 (3), 535–549. <https://doi.org/10.1007/s12571-016-0581-y>.

SANBI. (2007). Threatened terrestrial ecosystems for South Africa (2011): Croc Gorge Granite Mountainlands (MP 14). https://www.gov.za/sites/default/files/gcis_document/201409/34809gon1002.pdf accessed on 25.02.2016.

Sango, I., & Nhamo, G. (2015). Climate change trends and environmental impacts in the Makonde communal lands, Zimbabwe. *South African Journal of Science*, 111 (7), 1–6. <https://doi.org/10.1080/09709274.2015.11906936>.

Schut, M., Klerkx, L., Rodenburg, J., Kayeke, J., Hinnou, L. C., Raboanarielina, C. M., Adegbola, P. Y., Van Ast, A., & Bastiaans, L. (2015). RAAIS: Rapid Appraisal of Agricultural Innovation Systems (Part I): A diagnostic tool for integrated analysis of complex problems and innovation capacity. *Agricultural Systems*, 132, 1–11. <https://dx.doi.org/10.1016/j.agsy.2014.08.009>.

Scoones, I. (1998). Sustainable Rural Livelihoods: A Framework for Analysis. IDS Working Paper 72. <https://www.staff.ncl.ac.uk/david.harvey/AEF806/Scoones1998.pdf> accessed on 1.09.2017.

Scoones, I. (2009). Livelihoods perspectives and rural development. *The Journal of Peasant Studies*, 36 (1), 171–196. <https://doi.org/10.1080/03066150902820503>.

Serrat, O. (2017). The Sustainable Livelihoods Approach. In: Serrat, O. (Ed.). *Knowledge Solutions*, 21–26. Berlin: Springer.

Shackleton, C. M., Shackleton, S. E., & Cousins, B. (2001). The role of land-based strategies in rural livelihoods: The contribution of arable production, animal husbandry and natural resource harvesting in communal areas in South Africa. *Development Southern Africa*, 18 (5), 581–604. <https://doi.org/10.1080/03768350120097441>.

Shackleton, C. M., & Shackleton, S. E. (2004). The importance of non-timber forest products in rural livelihood security and as safety nets: A review of evidence from South Africa. *South African Journal of Science*, 100, 658–664.

Shackleton, S. E., & Shackleton, C. M. (2015). Not Just Farming: Natural Resources and Livelihoods in Land and Agrarian Reform. In: Cousins, B., and Walker, C. (Eds.). *Land Divided, Land Restored: Land Reform in South Africa for the 21st Century*, 191–205. Johannesburg: Jacana Media.

Shackleton, S., Delang, C. O., Angelsen, A. (2011). From Subsistence to Safety Nets and Cash Income: Exploring the Diverse Values of Non-Timber Forest Products for Livelihoods and Poverty Alleviation. In: Shackleton, S., Shackleton, C. M., and Shanley, P. (Eds.). *Non-Timber Forest Products in the Global Context*, 55–81. Tropical Forestry No. 7. Heidelberg: Springer-Verlag.

Slater, R., & Twyman, C. (2003). Hidden Livelihoods? Natural Resource-Dependent Livelihoods and Urban Development Policy. ODI Working Paper 225. <https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/2462.pdf> accessed on 1.09.2017.

Sørensen, E., & Torfing, J. (2011). Enhancing collaborative innovation in the public sector. *Administration and Society*, 43 (8), 842–868. <https://doi.org/10.1177/0095399711418768>.

STATSSA. (2015). *Millennium Development Goals: Country Report 2015*. Pretoria: Statistics South Africa, pp. 157.

Staurt, E., & Samman, E. (2017). Defining ‘Leave No One Behind’. ODI Briefing Papers. <https://www.odi.org/publications/10956-defining-leave-no-one-behind> accessed on 05.06.2018.

Super, D. E. (1990). A life Span, Life-Space Approach to Career Development. In: Brown, D., and Brooks, L. (Eds.). *The Jossey-Bass Management Series and the Jossey-Bass Social and Behavioral Science Series. Career Choice and Development: Applying Contemporary Theories to Practice*, 197–261. San Francisco: Jossey–Bass.

Tibesigwa, B., Visser, M., Collinson, M., & Twine, W. (2016). Investigating the sensitivity of household food security to agriculture-related shocks and the implications of informal social capital and natural resource capital. *Sustainability Science*, 11 (2), 193–214.

Thondhlana, G., & Muchapondwa, E. (2014). Dependence on environmental resources and implications for household welfare: Evidence from the Kalahari Drylands, South Africa. *Ecological Economics*, 108, 59–67.

Twine, W. C. (2013). Multiple strategies for resilient livelihoods in communal areas of South Africa. *African Journal of Range and Forage Science*, 30 (1–2), 39–43.

UNDP. (2018). What are the Sustainable Development Goals? <http://www.undp.org/content/undp/en/home/sustainable-development-goals.html> accessed on 05.06.2018.

UNECA., African Union., African Development Bank Group., & UNDP. (2015). MDG Report 2015: Lessons Learned in Implementing the SGDs. Assessing Progress in Africa toward the Millennium Development Goals. https://www.uneca.org/sites/default/files/PublicationFiles/mdg-2015_eng_16sep_rev2.pdf accessed on 05.06.2018.

Van Riet, W., Claassen, P., Van Rensburg, J., Viljoen, T., & Du Plessis, L. (1997). *Environmental Potential Atlas for South Africa*. Pretoria: J. L. Van Schaik, pp. 61.

Waha, K., Van Wijk, M. T., Fritz, S., See, L., Thornton, P. K., Wichern, J., & Herrero, M. (2018). Agricultural diversification as an important strategy for achieving food security in Africa. *Global Change Biology*, 24 (8), 3390–3400. <https://doi.org/10.1111/gcb.14158>.

Weisberg, S. (2013). Simple linear regression. In: Weisberg, S. (Ed.). *Applied linear regression*, 49–66. New Jersey: John Wiley & Sons Inc.

Yin, R. K. (2014). *Case Study Research Design and Methods*. California: Thousand Oaks, pp. 282.

Zaidi, A. (2014). Changing the Way We Age: Reducing Vulnerability and Promoting Resilience in Old Age. United Nations Development Programme. <http://hdr.undp.org/en/content/changing-way-we-age-reducing-vulnerability-and-promoting-resilience-old-age> accessed on 03.10.2018.

Zhang, Y., Zhou, X., & Lei, W. (2017). Social capital and its contingent value in poverty reduction: Evidence from Western China. *World Development*, 93, 350–361. <https://doi.org/10.1016/j.worlddev.2016.12.034>.

4.7. APPENDICES

4.7.1 An ordinal logistic regression model for levels of strategy diversification and ownership/usage of land-based assets amongst respondent farmers.

Logistic regression model, also called logit regression, was used on the levels of strategy diversification and ownership/usage of land-based assets across diverse key individual traits. It was performed in the form of log of odds where the odds were a function of probability of strategy diversification category or level of ownership/usage of land-based assets in relation to key individual traits. The specific model was binary logistic model due to the fact that the dependent variable was coded 1 to denote positive (Yes) and 0 to represent negative (No). Letting X represent independent variables (sex, age, village sub-section or zone, education level etc.), the logistic model can be represented by;

$$\frac{\pi_i}{1 - \pi_i} = \log O_i = \alpha + \beta_1 (X_1) + \beta_2 (X_2) + \beta_3 (X_3) + \beta_4 (X_4)$$

Source: adapted from (Weisberg 2013; Ndagurwa 2013)

Where $1 - \pi_i$ represents the conditional probability of a negative response per a level of strategy diversification or ownership/usage of land-based assets;

π_i is the conditional probability of strategy diversification or ownership/usage of land-based asset; and is the conditional odds of strategy diversification or ownership/usage of land-based assets. In order for interpretation of logistic regression using odds, antilogs were applied to the equation to have the model as;

$$\frac{\pi}{1-\pi} = e^{\alpha+\beta} = (e^{\beta})^x$$

Source: adapted from (Weisberg 2013; Ndagurwa 2013)

Where the two constants multiplied by each other raised to the power “x” imply that an additional explanatory variable added on to the regression has a multiplicative effect on the odds of respondents’ level of strategy diversification or ownership/usage of land-based assets. This helped test the impact of key individual parameters on the levels of strategy diversification and ownership/usage of land-based asset whilst controlling for other factors.

Appendix 4.7.2

QUESTIONNAIRE

Area/Zone

- 1) Mambayin 2) Manjesa 3) Magamzin 4) Gaganene

Section A. Biographical Data

2. Gender 1. Male 2. Female

3. Age Range 1) 18-24 2) 25-34 3) 35-44 4) 45-54
 5) 55-64 6) 65-74 7) 75-84 8) 85 or over

4. What is your highest qualification?

- 1) No formal qualifications 2) Grade 1-4 3) Matric
4) Degree or equivalent 5) Grade 5-10 6) Vocational
7) Post graduate

Section B Agricultural Activities and Adaptation

Crop Production

5. Did you plant any crops in the last 12 months?

- 1) Yes 2) No

6... Type of crops.....

- a) Vegetables (moroho, cabbage etc) b) Crops (e.g. maize, sorghum)
c) Fruits trees (avocados, mangoes, bananas, citrus) d) other

Comment.....

7. Reasons for growing these particular crops?

- 1) for family subsistence 2) for selling 3) raw materials 4) ornamentals
5) other

Comment.....

8) Do you have additional fields outside of the homestead yard?

- 1) Yes 2) No

9). How many fields outside of the homestead yard do you own? (if yes)

- a) 1-4 b) 5-10 c) 11- 14 d) 15-20 e) 20 plus

10) Have you adopted any of these measures in your crop farming?

- | | | |
|--|--------|-------|
| a) Increasing the diversity of plants and animals | 1)Yes | 2)No |
| b) Maintaining populations of pollinators or beneficial insects
(NjeniyaSebentisa maInsect kuti Nisite Kukulisa tihlahla?) | 1) Yes | 2)No |
| c) Low mechanical soil disturbance, no till or minimum tillage
(NjeniyawaSebentisa maTraktel?)
(Njeniyayekela lomhlabati kuti ampumule?) | 1)Yes | 2)No |
| d) use of manure or compost | 1)Yes | 2) No |
| e) less use of chemical fertiliser
reason..... | 1) Yes | 2) No |
| f) Increased use of chemical fertiliser
reason..... | 1)Yes | 2) No |
| g) vermiculture
(Njeniyakulisa tibungu for Mtsuba) | 1)Yes | 2)No |
| h) use of cover crops | 1) Yes | 2) No |
| i) crop rotation | 1) Yes | 2)No |
| j) growing of leguminous crops | 1) Yes | 2) No |
| k) others? | | |

11. What were the main constraints/difficulties in changing your farming approaches?

Key for Reasons: 1: lack of money, 2: lack of information, 3: shortage of labor, 5: high cost of labour 6) Other

.....

12. Did you use livestock manure (dung) as fertiliser or fuel in the last growing season?

1)Yes 2) No

ii) Section C **Livestock farming**

13. Are you involved in livestock farming?

2) Yes 2) No

Are you involved in farming the following

	Livestock category	does household own any (yes, no)	Number	Main use	Second use	tertiary use	How many have you slaughtered in the last 12 months?
a	Cattle						
b	Sheep						
c	Goats						
d	Pigs						
e	Chickens						

M = Meat **N** = Manure **I** = Investment/asset **L** = Milk **P** = Ploughing **C** = Cultural/religious **E** = Eggs **T** = Transport

1) Yes 2) No

a) Early morning dew pasturing 1) Yes 2) No
(taking livestock to feed and take advantage of dew due to scarcity of water?)
b) any other odd timing?
Comment.....

c) Growing areas of shade on your farm 1) Yes 2) No
D) Growing own forage 1) Yes 2) No
e) Use of resistant varieties 1) Yes 2) No
(Njeniyahlanyela tihlahla letilwa maPests, nema disease?)
OTHER.....Comment.....

16. Do you belong to a social group, committee or association?

1) Yes 2) No

17. Does the household head belong to a social group, committee or association (If different from farmer)?

1) Yes 2) No

18. Do you have a close friend living in this village?

1) Yes 2) No

19. Did you get any money, food or other type of assistance from the close friend in the last 12 months?

1) Yes 2) No

20. What type of assistance do you get from the close friend? Key

a) = Food **b** = other household groceries **c** = assistance with cultivation **d** = tools
e = assistance with herding **f** = fuel e.g. wood, petrol, paraffin **g** = money **h** =
Clothes **i** = child care **j** = care of the elderly or sick **k** = cell phone airtime
l = transport

m= Sharing of information

21. Do you have any relatives living in this village?

1) Yes 2) No

22) Did you household get any money, food or other type of assistance from these relatives in the last 12 months?

1) Yes 2) No

23. What type of assistance do you get?

Disputes related to natural resources

31. Have you had any dispute related to agriculture and natural resources

- 1) Yes 2) No

32. Have you approached the chief or induna for assistance (e.g. mediating a dispute) in the last 12 months?

- 1) Yes 2). No

33. Have you approached the village C.D.F. for assistance (e.g. mediating a dispute) in the last 12 months?

- Yes No

Section E. Information Sources on agricultural activities

34. What is your most regular and important source of information on your agricultural activities?

- | | | | | |
|--------------------------------|-------------|-----------------------|------------|-----------|
| 1) Newspaper | 2) Radio | 3) Television | 4) Friends | 5) Church |
| 6) CSIR/Agricultural extension | 7) Internet | 8) Traditional healer | | |

CHAPTER 5 – Adaptive governance and co-management of common pool resources:

Dynamics of effective natural resource governance in transitional social contexts: evidence from traditional versus state institutions in a rural co-management framework

Environmental Innovation and Societal Transitions (in preparation)

Dynamics of effective natural resource governance in transitional social contexts: evidence from traditional versus state institutions in a rural co-management framework.

ABSTRACT

Traditional institutions exercised control over communal resources in South Africa's apartheid era. This role has now been diluted and in some cases usurped by democratic institutions. This paper assesses the changing roles of traditional institutions in the management of natural resources and the challenges to effective co-management with state institutions. This case study involves interviews with ten key informants and 180 household heads from Mpakeni in the former KaNgwane homeland (Mpumalanga province) of South Africa. Effective resource governance in the area is being compromised by the insufficiency of governance and exacerbated by an inadequate understanding of civic rights, resulting in their abuse. Compared to other areas in the same province, traditional natural resource governance in the study site is perceived as functioning relatively better, but it is inadequate to address the scale of burgeoning environmental degradation, making co-management urgent. This necessitates novel approaches to the successful governance of common pool resources and related ecosystem services by core actors. Ultimately, the paper outlines how effective natural resource co-management by these principal institutions can be facilitated given the acceptability of both institutions.

Keywords: socio-ecological systems, adaptive co-management, traditional institutions, natural resource governance, democratic transition.

5.1. INTRODUCTION

5.1.1 Institutions and Sustainable Development

The ecosystem services provided by the earth's biological resources sustain life and human livelihoods (Shackleton & Shackleton, 2015). Consequently, the recent Sustainable Development Goals (SDGs) seek to protect the environment by combating climate change, and protecting oceans and forests within the larger framework of sustainable development (UN, 2015). This goal of protecting nature resonates with the Millennium Ecosystem Assessment and the erstwhile Millennium Development Goals (MDGs). Institutions generally have a crucial role in mediating such human-environment interactions. Hence, in recognition of the transformative power of institutions, Goal 16 of the SDGs is dedicated to building effective, accountable institutions at all levels (UN, 2015). Nonetheless, institutions operate at different scales and in different contexts, which influences their capacity to operate effectively for the socio-economic wellbeing of society. This process involves continuous innovation. Social innovation empowers actors to address societal challenges and stimulate social change (Avelino et al., 2017). This paper thus contributes to an understanding of natural resource governance at the local level and its impacts on rural livelihoods in a communal land tenure setting.

5.1.2 Impact of Socio-Economic Transitions on the Rural Landscape

A confluence of events has transformed the dynamics of rural livelihoods (De Brauw et al., 2014) and similarly the management of communal resources in rural areas of South Africa (Claassens, 2015). For example, there has been an increased rural-urban migration amongst South Africans, with many deserting the former homeland areas to towns and cities (Cousins & Walker, 2015). Nevertheless, many still maintain some connection with their rural origins for personal and cultural reasons. Furthermore, there is the argument that it is those who are disinclined to migrate or are risk-averse who remain (De Brauw et al., 2014) as some go to urban areas to earn with the intention of returning in the future (e.g. for retirement).

Notwithstanding their changing socio-economic contexts, the environmentally dependent livelihoods of rural communities makes them repositories of knowledge about their unique environments (Dold & Cocks, 2012) and they have evolved associated customary laws to mediate their relations with the environment *inter alia* (Hoffman, 2015). Thus, social innovation involves the transformation of social relations, the replication of place-bound and spatially exchanged cultural norms and establishment of requisite governance frameworks (Turker & Vural, 2017). Moreover, such customs and norms are embodied in traditional institutions which, due to their historical and cultural influence, tend to exercise oversight responsibility in the governance of common property resources (Mowo et al., 2011).

5.1.3 Traditional Institutions and Management of Communal Resources

Traditional institutions predate South Africa's colonial and apartheid eras. Moreover, before the advent of democratic rule in South Africa in 1994, traditional institutions under the influence of colonial and apartheid governments became instruments of "indirect rule", allegedly having greater powers and authority over the land and its resources than was historically the case (King 2005; Twine 2005). Traditional authority consequently became vital to the management of communal resources and has been lauded as largely effective in the past despite its shortcomings (Twine et al., 2003a; Kirkland et al., 2007). However, with the introduction of multi-party democracy, its unique influence has waned as it shares overlapping and sometimes conflicting responsibilities with government institutions (Table 5.1) (Claassens, 2015). This has been a source of confusion and has made management of natural resources at the local level less effective and failed to address increasing pressure on scarce natural resources and resultant degradation (Twine et al., 2003a; Kirkland et al., 2007). However, innovation thrives best in an atmosphere of effective alliances between core actors. This makes the case for effective collaboration amongst the key stakeholders, which is imperative for impactful social innovation (Mulgan et al., 2007). Moreover, in a country-wide assessment of land degradation, communal areas were classified as the most degraded in South Africa (Hoffman, 2015). This has been attributed to the triad of 1) high population densities, 2) high levels of poverty, and 3) communal tenure with ineffective institutions in these areas. Such complex, multi-faceted issues are a core focus of social innovation in facilitating real empowerment and equitable rural social change (DST, 2012; Hart et al., 2014).

The constitution of South Africa embraces the significant authority of non-elected traditional leaders, including heritable positions like chiefs and headmen (Eberbach et al., 2015). It also acknowledges the institution, status and roles of traditional leadership, in consonance with customary law (Table 5.1) and recognizes the invaluable function of traditional leadership institutions vis-à-vis constitutional democracy and rural-development (South African Government, 2015). Although traditional leadership was given principal authority in managing communal resources in the Apartheid era, the current democratic dispensation presents a new context within which it operates in exercising this role (Eberbach et al., 2015).

5.1.4 Good Governance as a Premise for Common Property Resources Management

Common property resources are bound to be over-exploited as demand increases in the absence of effective management mechanisms leading to the phenomenon of the *tragedy of the commons* (Hardin, 1968). Generally, biological resources including common-pool resources are finite and come with subtractive benefits because the more they are exploited by one party the less there is for other parties (Wade, 1987). Consequently, the common pool resources are highly prone to congestion, depletion or degradation (Blomquist & Ostrom, 1985; Hoffman, 2015).

Although there have been counter arguments which point to people as being rational norm-adopting individuals who eventually learn and adapt (Janssen, 2013), there is a general acknowledgement of the need for some form of effective management to guarantee the perpetuity of common pool resources (Millennium Ecosystem Assessment, 2005; Andersson & Ostrom, 2008). These include natural resources such as forests, rangelands and water resources which enhance rural livelihoods (Shackleton & Shackleton, 2015) and thus require collective action for sustainable rural development (Mwakaje et al., 2013). Effective governance represents one such avenue for collective action. Nonetheless, the prevailing significance of traditional leadership in the rural landscape is not unique to South Africa but also evident in other places in Africa and the globe (Rim-Rukeh et al., 2013; Prakash & Joshi, 2015).

The term “*good governance*” is of universal currency, although there is neither a single comprehensive definition nor delimitation of its scope (OHCHR, 2016). This permits its use with flexibility but equally presents difficulty at the operational level as it functions at different echelons and contexts (e.g. international, national, local, corporate etc.). Moreover, good governance also denotes the best possible processes employed in making and implementing decisions. Such good quality decision-making processes and consequently good governance have similar attributes (Puddington, 2015; OHCHR, 2016). Hence, contingent on the context and the overarching agenda, good governance principally encompasses accountability and transparency of processes and institutions, respect for the rule of law, responsiveness, multi-actor partnerships, equitability and inclusiveness, effectiveness and efficiency of the public sector, participatory processes, legitimacy, accessibility to knowledge, political empowerment of people, sustainability, and attitudes that foster responsibility (OHCHR, 2016). The greatest challenges to good governance stem from corruption, violence and poverty, which together compromise transparency, security, participation and fundamental freedoms (Puddington, 2015; Banerji, 2016). Nonetheless the core attributes of good governance can be condensed into (OHCHR, 2016): transparency, responsibility, accountability, participation and responsiveness (to the needs of the people).

Table 5.1 Some characteristics of state and traditional institutions and impacts on common property resource management in South Africa

Indicator	State Institutions (national, provincial and local government departments responsible for conservation and natural resource management)	Traditional Institutions
Institutional structure	The Provincial Executive Council (PEC) comprises the chairperson, three deputy chairpersons and 6 extra members who manage daily provincial matters. The 6 additional members include government department levels like agriculture (SALGA, 2018). There is not yet a formal structure to coordinate intergovernmental relations between the national and provincial executive (Parliamentary Monitoring Group, 2018). Municipalities fall under provinces and govern the local affairs of its community (SALGA, 2018). The study site is under the Mbombela Municipality in the Mpumalanga Province of South Africa.	Chieftaincies with traditional council comprising the chief, village headmen and additional councillors (Claassens, 2015). The chieftaincy is hereditary but the village headmen are appointed.
Tenure	Elected representatives have a five year tenure and are seldom concerned about issues with long term/future effects but rather focused on issues with immediate returns. Moreover, because they have a definite tenure and are answerable to the electorate, they tend to be concerned about polls and public opinion. Hence elected representatives often initiate measures that will please electorate and not necessarily promote sustainable environmental management (Westley et al., 2002).	Traditional authorities have an indefinite tenure (Eberbach et al., 2015), and so they do not take public opinion into account in most cases. Thus, a traditional leader who is naturally concerned and informed about the environment can implement measures that promote sustainable environmental management (Chidumayo & Gumbo, 2010) without necessarily being concerned about public opinion. Conversely, a traditional leader whose actions or decisions do not demonstrate sound environmental stewardship, will seldom yield to public concerns.
Guidance Framework	Elected representatives are guided by the Constitution which explicitly states their roles and responsibilities (Eberbach et al., 2015). The operation of the associated departments is also guided by the constitution, legislative framework, and policies. This helps to limit abuse of power as well as help the public to hold voted representatives accountable for their actions whether directly or indirectly relating to the environment (Westley et al., 2002; Folke et al., 2003). This helps to enhance transparency and trust in the operations of the elected representatives (Pretty & Ward, 2001).	Traditional institutions are mainly guided by customary laws which are fluid and subject to various individual interpretations (Claassens, 2015). This makes the abuse of power common (Shackleton & Shackleton, 2015) and limits accountability, transparency and trust in the functions of traditional institutions.
Arbitration of conflict	Elected representatives can be challenged in the Constitutional Court for measures taken that are detrimental to the sustainable management of the environment by affected individuals (Westley et al., 2002; Folke et al., 2003). This enhances inclusiveness (Reeves et al., 2013) but comes with significant resource costs for the judicial process (Weeks, 2015).	Traditional leadership can largely be unchallenged in the context of the customary law (Claassens, 2015; Eberbach et al., 2015). Hence, when the traditional court makes rulings which may be detrimental to the sustainable management of the environment it is very difficult to have them reversed by an affected party in the context of customary law. This limits inclusiveness.

Central government represents only one actor in the multi-faceted nature of governance. Hence, in rural areas there exist other players such as chiefs, headmen, influential peasant farmer associations, community associations and religious leaders who also play a role (Mowo et al., 2011). Social innovation in governance is a viable solution for policymakers to stimulate

sustainable development, alleviate inequality, and increase societal welfare (Turker & Vural, 2017).

In this study, this multi-faceted nature of governance is conceptualised and modelled around the operation of a lever and a conventional traffic light along a co-management continuum (Fig. 5.1). In the operation of a lever there is a *pivot* point as in a seesaw so that as one end descends due to excess weight, the other end ascends and vice versa. Similarly, the model integrates the standard colours behind the regulation of vehicular traffic whereby *green* permits free flow of traffic; *yellow* (or *amber*) signals a *warning*; and *red* stops traffic. Arrows indicate dynamic interaction.

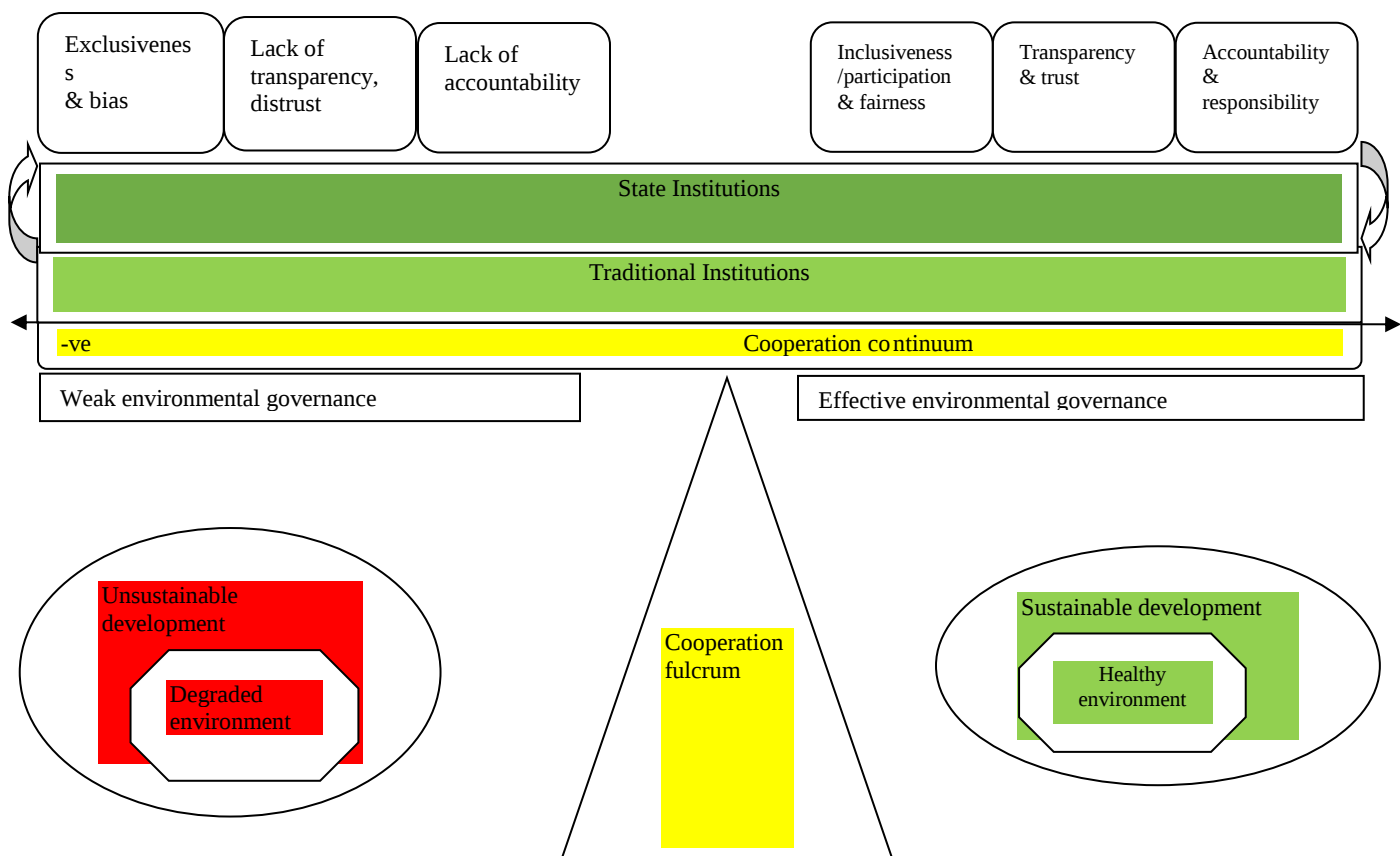


Figure 5.1. Co-management cooperation continuum lever.

The direction and side of the arrows indicate a reciprocal relationship. Above the fulcrum in Figure 5.1, *yellow* shows the boundaries of such cooperation. In the South African context, there are different state institutions (top-down) tasked with similar natural resource management responsibilities necessitating an enhanced *intra* state cooperation.

Traditional institutions have been tasked with roles similar to state institutions which demands an enhanced *inter* cooperation between these institutions. The effectiveness of such cooperation is enhanced by the presence of vital elements such as inclusiveness, fairness, transparency, trust and accountability (Pretty & Ward, 2001; Lockwood et al., 2010; OHCHR, 2016) on the top right of the fulcrum:

(a) *Inclusiveness & participation*—equal chance of involvement and contribution to decision-making for all parties; *fairness*—the contributions of interested parties are valued or respected without prejudice;

(b) *Accountability & responsibility*—where duty bearers are answerable to all actors and justify their actions.

(c) *Transparency & trust* —where the decision-making process is clear and open to scrutiny with governance information and performance accessible to all actors.

These factors are considered critical for building a thriving social innovation ecosystem (Davies & Simon, 2013). Moreover, these positive elements are not limited to traditional versus elected government institutions but embrace their engagement with the community as well (Mwakaje et al., 2013). The absence of these factors breeds negative elements which are the exact opposites such as exclusiveness, bias, lack of transparency, distrust and lack of accountability. An enhanced presence of the positive factors helps tilt institutional cooperation towards effective environmental governance, resulting in a healthy environment with benefits for sustainable development. Nevertheless, these positive elements in Figure 5.1 should ideally be coupled with capacity building in management and governance (Cundill et al., 2013; Thondhlana et al., 2015), amongst people in governance structures to be effective. The colour *green* is used to indicate a healthy ecosystem facilitating the *advancement* of sustainable development (Fig. 5.1). Conversely, the absence of such elements causes a fracture in cooperation leading to poor environmental governance which gravitates the scale of cooperation in a negative direction (Fig. 5.1) and compromises the goal of sustainable development (Figs. 5.1 & 5.2). Red is used to indicate that the biological integrity of the ecosystem services needed for sustainable development (Shackleton & Shackleton, 2015) has been compromised and hence is not in a healthy state to be able to function at maximum capacity. The fulcrum is *yellow* because it is the transformative phase around which the negative and positive sides revolve. Similarly, the state institutions are *deep green* and the traditional institution *pale green* because although both have a legislated mandate, the state institution has more leverage (Eberbach et al., 2015).

In acknowledgement of the capacity of local institutions to promote sustainable development at grassroots level, the recent SDGs (Sustainable Development Goals) aim to strengthen local structures (Goal 15) to promote sustainable management of natural resources (UNDP, 2015). The

management of communal resources in the post-Apartheid era introduces new demands in co-governance by traditional and state institutions which necessitate further studies to bring fresh insights on the dynamics of such cooperation. This paper addresses this gap with a case study of how erstwhile powerful traditional institutions, which are now largely relegated to ceremonial functions (Claassens, 2015), can effectively collaborate with state institutions in managing human-environment interactions. The paper thus contributes to the body of knowledge, including theory on effective mechanisms for co-management of communal natural resources between various stakeholders. The Mpakeni area which forms part of the former homelands in rural South Africa is a critical case as it epitomises the challenges faced by local institutions in fulfilling the SDG goal 15. The scale and scope of current environmental challenges in Mpakeni, has been described as alarming by both the traditional and state institution in comparison to the apartheid era. This comes with consequences for in situ and ex situ environmental management, warranting such a study. Social innovation as a vehicle for effective multi-actor governance frameworks, facilitates the building of mutual trust, social capital and social cohesion, and lends great legitimacy to public decision making processes (Davies & Simon, 2013).

The importance of robust institutions backed by effective policy inter alia in the sustainable governance of common property resources is demonstrated in Figure 5.2. Socio-economic factors (such as high levels of unemployment and poverty, increased population, and migration) in the face of climate change, have implications for the sustainable management of natural resources (Fig. 5.2). And when these resources are managed sustainably it helps to enhance rural livelihoods and quality of life (Mowo et al., 2011). Similarly, environmental degradation, such as excessive deforestation, unsustainable harvesting of woodland resources, excessive poaching of wildlife and poor land use practices, tend to negatively affect the sustainable management of resources (Shackleton & Shackleton, 2015). Furthermore, in places where there are multiple institutions tasked with managing the same resource, co-management is one such innovative approach to manage critical resources (Thondhlana et al., 2015). In response to such socio-economic and environmental pressures, societies formulate new ideas and adopt measures by way of innovation to safeguard their livelihoods.

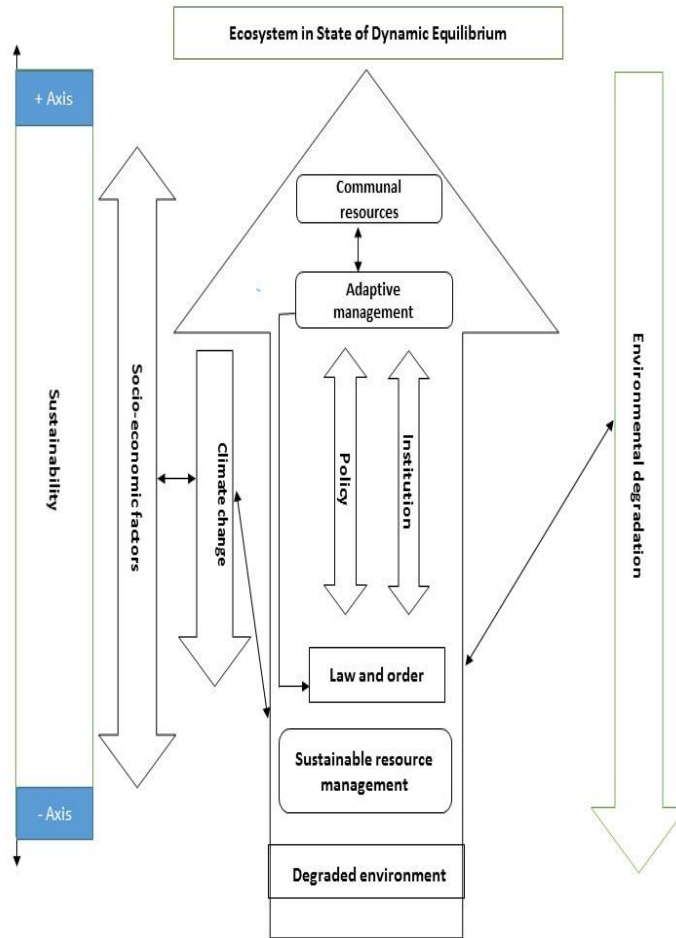


Figure 5.2. Flow diagram of thematic areas of the study.

This paper contributes to the discussion on effective co-management of common pool resources between traditional and state institutions in South Africa's new dispensation, and the consequences for rural livelihoods. It investigates how the changing roles of traditional institutions in the management of natural resources after democratic transition, is affecting effective co-management between traditional and state institutions and how they can be overcome in the context of social innovation. It also assesses the nature of participation or power in decision making at the institutional level (traditional versus state institution) which is novel vis-à-vis participation and power in CPR governance.

5.1.5 Theoretical Framework

The theoretical framework for the study stems from socio-ecological systems theory. Many environmental and social challenges involve the complex interaction of social and natural systems (Berkes et al., 2003). A number of studies indicate that current environmental challenges are not effectively addressed by their prescribed solutions, thus highlighting the gulf between contemporary environmental challenges and available capacity (Van den Berg et al., 2011; Levin et al., 2012). Complex societal problems, such as climate change, food insecurity, and environmental degradation, are intricately entangled in value conflicts amongst stakeholders, and cannot be solved with once-off solutions (Levin et al., 2012). Such convoluted yet pressing challenges defy simplistic or straightforward planning responses and hence demand constant social innovation to produce the requisite novel approaches for wider systemic transformations (DST, 2012; Hart et al., 2014). These embrace complementary innovations (such as technological change within organizational and institutional change), coordinated (amongst various levels and sectors) and collaborative frameworks (such as joint partnership by diverse societal stakeholders) (Levin et al., 2012).

This scenario comes in the face of mounting evidence of the profound impact of human-related factors as drivers of environmental change. Thus, there has been increased demand for creative forms of cross-disciplinary collaborative approaches to tackle social and environmental issues in-depth (Berkes et al., 2003). This has resulted in a number of concepts with such attributes, including socio-ecological systems (Halliday & Glaser, 2011).

Some of the terms used in the study are explained as follows:

Socio-ecological systems (SES) refer to the intricate interaction between human and ecological elements of a complex system with multi-scale feedbacks and dependencies. They are synonymously referred to as “human-environment systems” (Scholz, 2011).

Adaptive management underscores the process of learning by practice and suggests that resource management policies can be regarded as test cases from which managers can learn (Berkes et al., 2003). It distinctively lays emphasis on the significance of environmental feedbacks in steering policy, accompanied by a cycle of tests to shape policy (Berkes et al., 2003).

Institutions are the formal and informal structures which shape human interactions with normative and cognitive attributes (Berkes et al., 2003).

Local, indigenous and traditional knowledge indicate the unique environmental insight accumulated not by scientific experts but by lay people who are in close proximity to a resource and who use and interact with such a resource (Berkes et al., 2003; Magni, 2017).

A **livelihood** consists of the abilities, material and social assets and actions needed to sustain a living (Scoones, 1998).

Social innovation is an enhanced remedy to a social problem that is relatively more useful and successful than prevailing options and for which the value created principally benefits the society instead of private individuals (Phills et al., 2008, p. 36).

5.1.6 Study Area

5.1.6.1 Mpakeni village

The village of Mpakeni falls under the Mpakeni Tribal Authority which is a cluster of four villages: Daantjie (where the chief resides), Luphusi, Zwelisha and Mpakeni. It is located in the Mpumalanga Province (north-eastern South Africa), flanking the neighbouring countries of Swaziland and Mozambique. The Chief of the Mpakeni Tribal Authority is represented by a headman in Mpakeni village. The Mpakeni area is found in the Nsikazi District on the south-west of the Kruger National Park in Mpumalanga Province, South Africa. It centres on geographical coordinates 25° 29' 08" South, 31° 16' 38" East and has an altitudinal range of 821m–1,118m. It encompasses the Mthetomusha Game Reserve as well as Bongani Lodge (Hampson et al., 2002).

The area is predominantly populated by people of the siSwati (Swazi) and xiTsonga (Tsonga) language groups, which are originally traced to the southern region of the Kruger National Park (Van Riet et al., 1997). Rainfall is circa 700 mm per annum (Hampson et al., 2002), with an average low of 22°C and average high of 33°C in temperatures per day (Maplandia, 2015). The tributaries of the Makhomane, Luphusi and Nsikazi rivers drain the area and act as water sources (Hampson et al., 2002). The soils are characteristic of sandy loam soils interspersed with granite outcrops (Hampson et al., 2002). The prevalent flora is classified as sour Lowveld bushveld or Malelane mountain bushveld whilst part of the area is categorised as a vulnerable vegetation type -- *Croc Gorge Granite Mountainlands* (Ferrar & Lötter, 2007). It also has an abundance of trees such as *kiaat* (*Pterocarpus angolensis*), corky-bark acacia (*Acacia davyi*), broad-leaved erythrina (*Erythrina latissima*), rock figs (*Ficus glumosa*), milkwood (*Mimusops zeyheri*), marula (*Sclerocarya birrea*), scented thorn (*Acacia nilotica*), spiny monkey orange (*Strychnos spinosa*) and Lowveld chestnut (*Sterculia murex*) (Low & Rebelo, 1996). The Mpakeni Dam is one of the key landmarks of the area. This 150 million cubic metre live storage capacity dam, is located downstream on the confluence of the Ngwavuma and Mantambe Rivers (Blackhurst, 2008). The main purpose of the dam is to store and distribute water to irrigated lands especially the lower reaches of the Ngwavuma River catchment (Blackhurst, 2008). It has a perimeter of 132 square km and area of 36 square km.

5.1.6.2 Population of Mpakeni

At the time of the research, no official census data on the population were available (M, personal communication, July 3, 2015; T, personal communication, July 5, 2015; F, personal communication, October 5, 2015; Mukuka, 2006). To help estimate the population at Mpakeni, government officials working in the study community were consulted (P, personal communication, July 30, 2015). Researchers who have conducted research in the Mpumalanga province were also consulted, coupled with perusing published research in a comparable area (Twine et al., 2003b) to arrive at an average of six individuals per household. A household is a basic unit of enumeration used by Statistical Services for Housing and Population Census.

This household average was also confirmed during the community mapping process where 180 households were visited (see Table 2.4). Google Earth was then used to count the homesteads in Mpakeni. A homestead denotes the residence of a household, consisting of one or more houses and a household is a social and economic unit of production and consumption — typically exhibiting co-residency in the same homestead or compound, and having a common catering arrangement whilst mutually sharing resources (Ellis, 2000). First, a search was made on Google Earth with Mpakeni in Mpumalanga Province of South Africa as the target which was zoomed at different levels (1km, 500m) to make the homesteads visible and easily countable. A printed version was then compared and contrasted with the digital version. Approximately 270 homesteads were counted. A mean of six individuals per homestead was multiplied by the number of homesteads counted from Google Earth to arrive at a population figure of 1,620 individuals ($270 * 6$).

5.1.6.3 The Mthethomusha Game Reserve

Mthethomusha Game Reserve is 8000ha of previous communal land nestled between the southwestern boundary of the Kruger National Park and the Malelane Mountains in South Africa. The rugged terrain and diverse ecosystems of the reserve provide refuge for Lowveld antelope species like zebra, sable, kudu, nyala and a number of smaller mammals (Sa-venues.com, 2019). The presence of *damage causing animals* (DCA) such as buffalo, rhinoceros and elephant coupled with predators like lion and leopard which collectively form the big five, tend to deter people from trespassing into the park. At the time of the study, the pride of lions was about 4–5 in number (J, personal communication 18th March, 2015). In addition, there is a wide diversity of bird species with over 300 recorded (Sa-venues.com, 2019). Inside the reserve, there are about 67 rock art sites as well as ancient Bushmen (San) paintings, with cultural and spiritual significance. The reserve contains Iron Age settlements (Hampson et al., 2002; Sa-venues.com, 2019) and graveyards where the local tribes perform burial services, consult with their ancestors and obtain resources like firewood, thatch, *muthi* (medicinal plants) and marula fruits in summer annually (P, personal communication 18th March, 2015).

The reserve, which also hosts the Bongani Mountain Lodge, is the result of an agreement between the late Chief Charles Nkosi, representing the Mpakeni (*Zombie*) Tribal Authority and the KaNgwane Parks Corporation in 1993. The site was hence put under KaNgwane government management as a game reserve modeled around the concept of close community involvement in conservation. The locals requested a 25% share of the game reserve income (N, personal communication, 26 October, 2017). Furthermore, 60% of workers in the reserve are sourced from the neighbouring communities and 40% from the larger society (E, personal communication 18th March, 2015). Trophy hunters are occasionally invited to hunt with the proceeds credited to the village. Consequently, the community gets additional income in the form of 12 buffaloes each year with one buffalo valued at about R 15,000 or USD 1,116 (P, personal communication, 28th May, 2015).



Figure 5.3. A satellite view of the study site, its relation to some neighbouring communities and major centres such as Nelspruit. The lighter areas are places with high human disturbance and hence low vegetation cover. In addition, Figure 5.5 shows the relative boundary positions of the Mthethomusha Game Reserve with the Bongani Mountain Lodge, the Kruger National Park, Malelane Mountains and Mpakeni village with its neighbours whilst Plate 5.A depicts the topography and vegetation in the Mthethomusha Game Reserve.

5.2. METHODOLOGY

Qualitative research methods within the field of discourse studies with *Nexus Analysis* as the analytical approach (Scollon & Scollon, 2004) are used in this study. Discourse refers to how language is used in social interaction in producing and maintaining certain identities and power relations.

5.2.1 Nexus Analysis

The principal focus of nexus analysis is the intricate relationship between discourse and action. Thus, nexus analysis considers human action instead of language or culture as its unit of analysis. A robust nexus analysis must embrace the three activities of engaging, navigating and changing (Fig. 5.4); rather than focus exclusively on one. Engaging the nexus of practice denotes the social field where humans, discourses and cultural artefacts overlap to produce social action. In this research, the interventions employed to achieve sustainable management of natural resources at the local level formed the basis of analysis with the goal of highlighting the principal mediated actions and cycles of discourses.

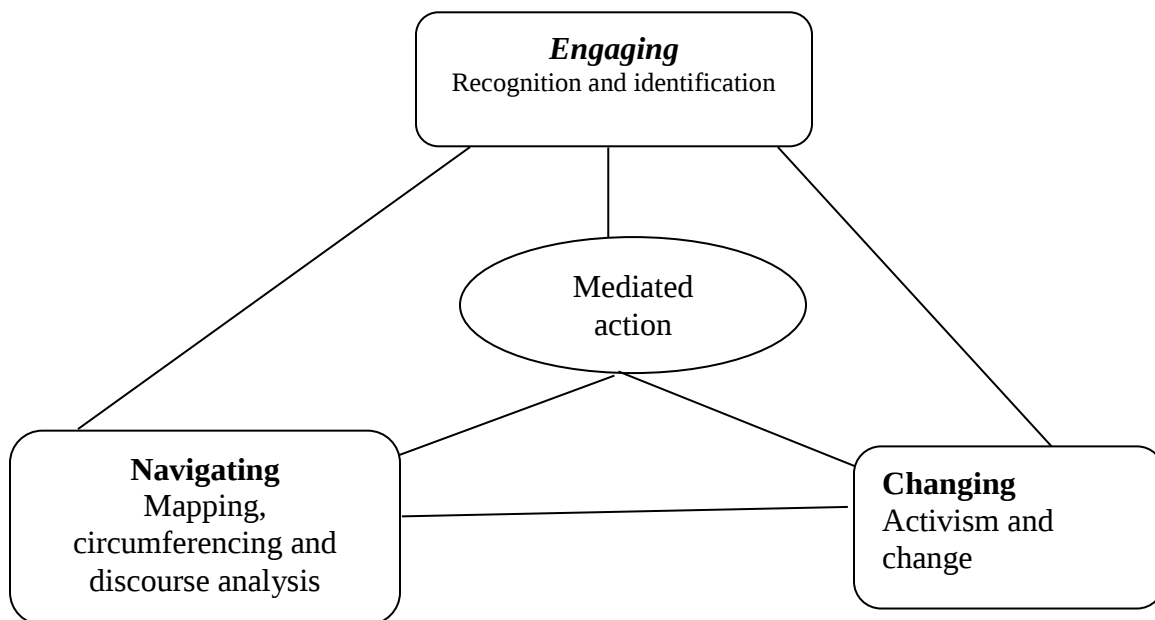


Figure 5.4. Activities of nexus analysis.

Source: Adapted from Scollon & Scollon (2004)

The principal task under the *engagement phase* involved ethnographic engagement at the study site and gathering of data on the research topic. The *navigation phase* involved the processing of the gathered data, whereas the *changing phase* deals with the possible policy implications of the findings of the study for Mpakeni and the larger society. Moreover, nexus analysis gives focus to

core mediated actions performed by social actors amidst a loosely tied '*nexus of practice*' (instead of focusing exclusively on discourse). Given the dynamic and cross-disciplinary themes underlying the study (characterized by policies, context, competing ideologies and power hierarchies), nexus analysis was deemed to be an appropriate method.

5.2.2 Research Design and Data Collection

Data were collected during October 2015 using household interviews, rapid rural appraisals (RRA) and key informant interviews. The data consisted of biographical information, perceptions of environmental governance, resource availability, trade in natural resource products, and resolution of disputes related to natural resources. Socio-economic data were gathered using a semi-structured questionnaire in households. For the interviews, 180 heads of household were randomly sampled from the four zones which constitute Mpakeni village (Fig. 5.6) with an average of ten per day. Homesteads from the four village sub-sections were visited and depending on availability and consent, the household head was interviewed. The homesteads were numbered and the odd numbers on the left and right were selected. Furthermore, ten key informants were interviewed by virtue of their unique knowledge of the study topics (USAID, 1996) to gain insight into themes relating to the objectives of this study (Appendix 5.1) using snowball sampling. These key informants represented various governance structures and included persons from local, provincial and national levels of government. Household interviews typically lasted for 40–60 minutes and key informant interviews for 30–90 minutes. Informed consent was sought from the interviewee in each case before being interviewed. The anonymity of key informants was guaranteed by assigning each of them a letter of the alphabet for identification. Ethics clearance was obtained from the University of the Witwatersrand non-medical human subjects research committee with certificate number H15/09/05. Furthermore in this research, qualitative techniques were predominantly employed such as the *case study* approach to investigate the study themes within their real life context (Yin, 2014).

Given the remoteness of the study site and lack of official data pertaining to it, a community map was produced using participatory mapping techniques to help facilitate future research (Fig. 5.6). This involved a field survey of the entire community to map the relative distribution of key socio-economic resources or communal assets. This exercise was complemented with Google Earth and ArcGIS software to create a community/asset map of Mpakeni village.

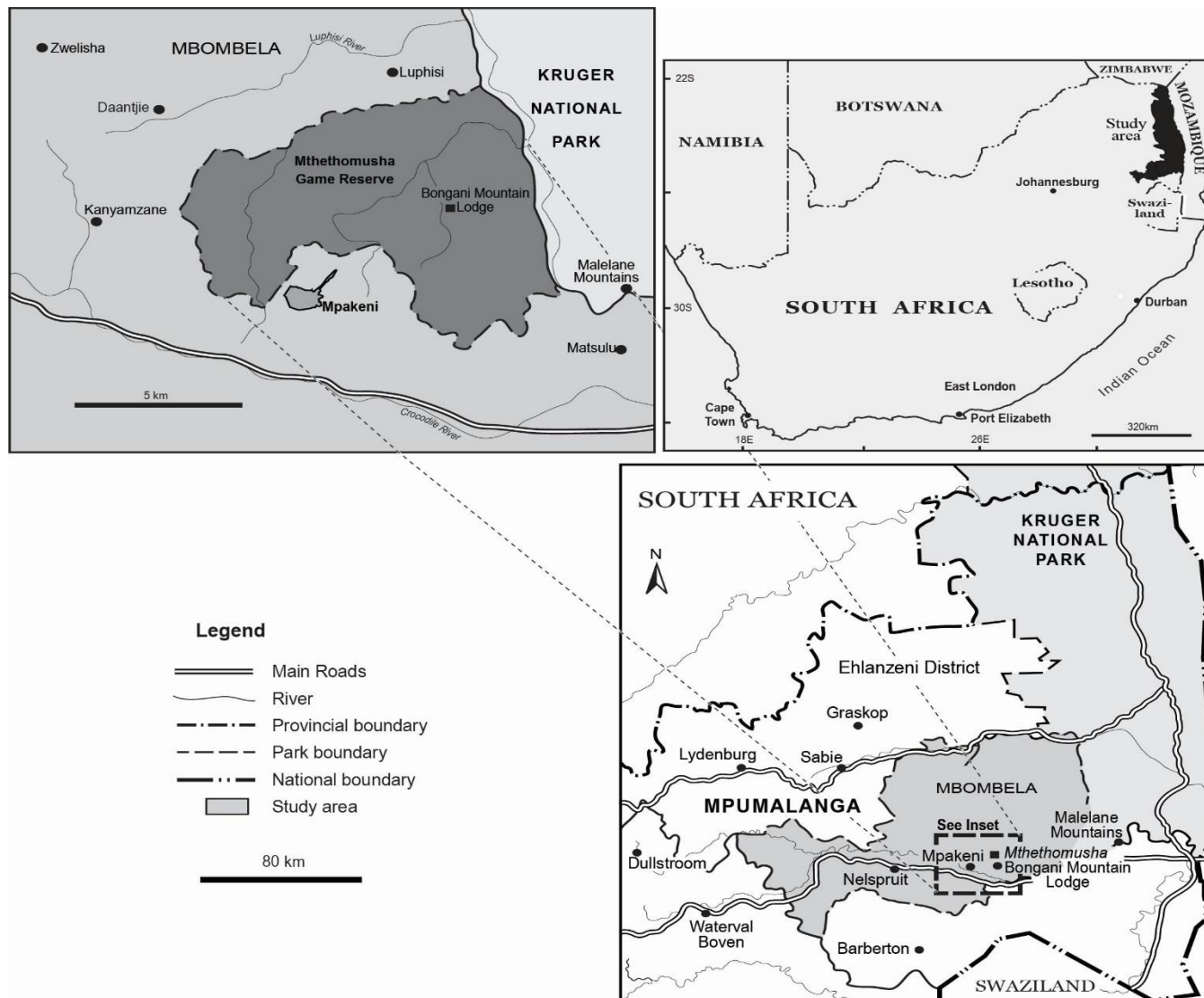


Figure 5.5. Mthethomusha Game Reserve.



Plate 5.A. Topography and vegetation of the Mthethomusha Game Reserve.

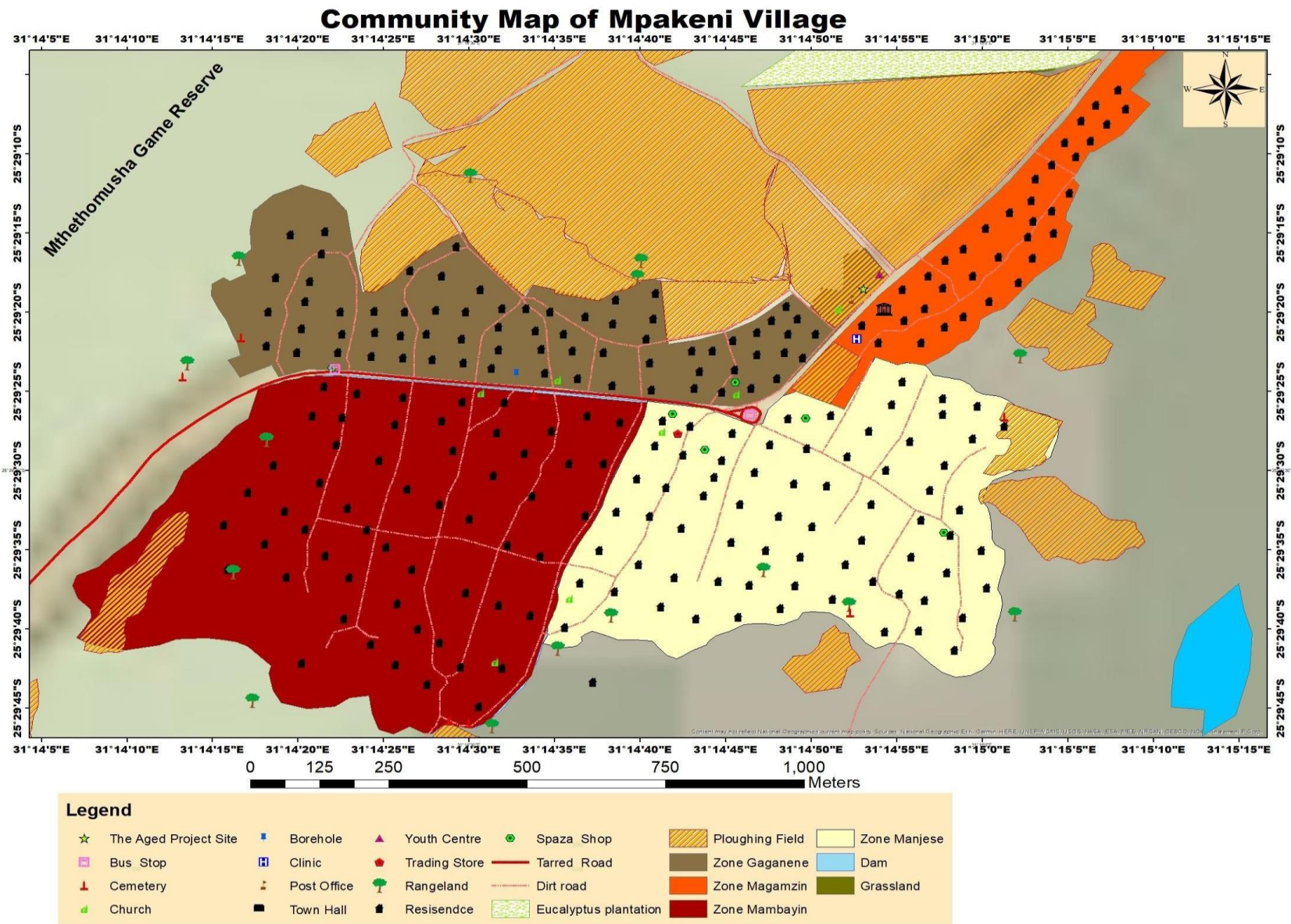


Figure 5.6. Community map of Mpakeni village.

5.2.3 Data Interpretation and Analysis

In the key informant interview process, relevant notes were taken with the interviews recorded and transcribed. Through a thematic content analysis, the predominant themes such as resource governance, inclusion and dispute resolution over natural resources arising from the interviews were merged à la *meaning condensation*. Hence, the expressions of interview subjects were summarized into brief formulations reflecting the main idea articulated (Kvale & Brinkmann, 2009). Each interviewee had a unique code instead of the respondent's name.

5.3. RESULTS

The traditional and state institutions had divergent views on how common property resources should be co-managed, which results in tensions/conflicts in their partnership and was further complicated by other background factors (Table 5.2) which set the scene for the results.

Table 5.2 Conflicting institutional views on co-managing communal natural resources

State employee (G) in response to a question on mutual collaboration between state and traditional institutions in managing communal natural resources.	A traditional leader (D) in response to a question on cooperation between state and traditional institutions in managing communal natural resources.
<i>"I don't think they (traditional institution) have left a vacuum in the communities, because the conservation rangers and the inspectors can do the same job (natural resource governance) and are even more qualified to do it unlike the tree police who were unqualified to even do that work."</i>	<i>"So how can you say you are participating whereas because of those issues you cannot participate? Even if we (traditional institution) go there (municipal meetings), we are just stooges because we are not allowed to join any committee of the municipality. We don't have a say! It affects us. They (government institution) are not taking us serious. So it is a problem"</i>

5.3.1 Mutual Distrust and Suspicion Between Traditional and State Institutions

There was a serious lack of trust between the two institutions. A traditional leader (D) in response to a question on long-term cooperation between state and traditional institutions: *"We spoke with MTPA (Mpumalanga Tourism and Parks Authority) and said the issue of 99 years (lease) is nonsense for this government now so we have to renegotiate this agreement now and make sure the period is lessened. So after 10 years we want MTPA to go all out from the reserve.... so as we have claimed those land rights if the government restitution can buy us those rights from the MTPA or the other sub leases and we will be owning the lodge, the*

reserve, the animals, the plants so that new arrangement can assist. We will not beg anyone after that for the rental on the land. We will set our own terms”.

The traditional institution has been trying to renegotiate the terms of its initial contract which brought the MTPA into the area to establish and manage the Mthethomusha Game Reserve so as to curtail the powers of the Parks Authority in the area (the land upon which the nature reserve is sited is leased communal land). This is due to the claims of the traditional institution that the MTPA is interfering and undermining its operations. If such renegotiations are successful the traditional authority seeks to take control over the management of the reserve and allocate tasks to the MTPA in areas they need their expertise, mainly conservation (D). The representative of MTPA, however, believes they have the relevant *certifications* and hence are qualified to manage the reserve (G). This scenario further highlights the complex and tense working relationship which exists between the traditional institution and the state institution in managing common property resources.

5.3.2 Accountability

Accountability in terms of local governance seems to be nuanced at the study site. Moreover, even as the principal institutions charged with the management of communal natural resources are experiencing challenges with such co-management, community members also expressed differing opinions on their functioning.

A traditional leader (D) in response to a question on cooperation between state and traditional institutions in managing communal natural resources: *“But the way they (government institution) are doing things now they are trying to divide us because they are attending to the concerned group instead of attending to us and advising us about how to do things properly so people cannot come with anger to attack us”.*

A traditional councillor (J) in response to a question on enhancing inclusion at village level governance: *“The chief is not accessible to us. He does not report to the community. The constitution says if the chairperson (the chief) says ‘No’, no one can say anything else”.*

A community youth leader (I) in response to a question on good governance at the village level: *“We pay Nduna (village headman) and the leaders yearly for our stand but we do not get anything in return. We should get something”.*

5.3.3 Perspectives on the Changing Roles of Traditional Institutions in Managing Communal Resources with State Institutions

Key informants generally had mixed views on the impact of the changed roles of traditional institutions in co-managing communal resources with state institutions. A local councillor (J) in response to a question on the merits and demerits of apartheid and post-apartheid era institutions in managing common property resources at the local level: *“During the apartheid*

you could cut wet wood but now you have to ask for permission. Now it is easier to get permit with limit (restrictions) and that helps a lot”.

An employee of the Municipal government (H) who also represents the ruling party at the village level in response to the same question: *“Things (management of common property resources) are better. Now if I need wood I go to the tribal council. Formerly I did that without reporting to anyone”.*

These two statements are in stark contrast to what has been observed elsewhere in South Africa (Twine et al. 2003a; Twine et al. 2003b; Kirkland et al. 2007). However, other respondents offered a different perspective.

A retired employee (A) of the Mthethomusha Game Reserve who now works with the aged income generating project: *“The situation today (post-apartheid era management of common property resources) is not good at all. In the past (apartheid era), it was not bad like this. Abantu (community members) are complaining that now (presently) getting the permit is even a problem (takes longer than previously).”*

A member (E) of the disability project: *“In the old days (apartheid era), people did not damage the land like they are doing (currently). The rubbish (indiscriminate refuse dumping) is too much. Since you (principal investigator) came here, have you not heard about the serious rhino poaching (in the Game Reserve)? The system (post-apartheid era management of common property resources) is damaged so people are frustrated”.*

The last two statements lend credence to the arguments that the traditional institution still enjoys support in sections of the rural populace as per its role in the management of common property resources (Table 5.3). Moreover, one of the key attributes of good governance is adaptability, hence the need for the institutions to continually be relevant.

5.3.4 Reinventing the Roles of Traditional Institutions in Managing Communal Natural Resources in the Democratic Dispensation

5.3.4.1 Adapting the traditional court to mediating natural resource cases in a new era

The courts of the traditional institutions continue to play an instrumental role in rural life as people patronize the traditional courts despite the presence of similar state institutions (Claassens, 2015). A community member who farms cattle (C) in response to a question on the role of the traditional institution in resolving resource management conflicts: *“We always report to the Nduna (village headman) and then to the chief when the reserve animals kill our livestock but they have not been able to solve this problem”.* In addition, it was also observed that the straying of livestock into people’s farms leading to the damaging of crops was another common source of conflict in the area.

A traditional leader (D) in response to a question on the use of the traditional court by rural populace in the post-apartheid era in solving natural resource conflicts: *"I am telling you that people are getting more angry everyday so there is no way that these issues (natural resource disputes) can decrease; it is always increasing. It is an unfortunate part that I am not always sitting at the court because of many other commitments"*. These comments support arguments on the significance of traditional institutions in mediating natural resource related conflicts in the rural milieu (C) and build the case for their involvement in co-managing common property resources (B, I). On the reverse, both quotes suggest that these institutions are also unable to solve these issues on their own. Hence, although they are legitimate their effectiveness can be questioned.

5.3.4.2 Enhancing inclusion in the allocation and management of communal resources

An old female community member (A) involved in the aged income-generating project in response to a question on enhancing inclusion in the allocation and management of communal resources: *"Some people also quit the project because they say the Nduna is 'chowing' (appropriating) the profits (from the aged project). Also others claim the aged project (should) not be a family business: the Nduna's mother was the chairperson and when she passed on, her son (the current Nduna) is now the chairperson which they do not agree with"*.

A community youth leader (I) in response to a question about decision making regarding communal resources: *"Discussions (decisions) are taken without the consent or participation of the youth. Now for example since you came I am sure you have seen people working on the road but we do not know how the people are hired or who hired them. But it is a community issue and we cannot say anything"*. Similar views were expressed by another youth leader (B) who doubled as a local representative of the ruling party.

According to E, the disability forum aspires to go into commercial farming to earn income and enhance their livelihoods but because they have not been allocated a permanent field for their activities, they are restricted to subsistence farming. Nonetheless, respondent E indicated that he practices subsistence farming to meet his family's nutritional needs. Moreover, both I and E claimed that the youth of the village have equally not been granted a permanent site. This scenario is indicative of a probable scarcity of available land. In addition, being a successful commercial farmer involves other important factors besides securing suitable land, such as having the requisite capacity and expertise to manage farming on such a scale (Bojang & Ndeso-Atanga, 2013). Consequently, it has been observed that although there has been a drive to encourage commercial farming, the lack of expertise and capacity has largely resulted in disappointing results amongst new entrants (Hoffman, 2015). Another factor in the above narratives is the palpable influence of the rural elite in the allocation and control of communal natural resources and associated opportunities with implications for

rural households. Furthermore, results from the household head interviews show that many people think both institutions have a role to play in natural resource management (Table 5.3).

Table 5.3 Who should control access to natural resources around the village? (n= 180) respondents were asked to choose options, which were not mutually exclusive.

Actor	Response summary	
	Percentage	(Frequency)
Chief	80.6	(145)
Government	70.0	(126)
Community	29.4	(53)
Nobody	1.7	(3)

NB: Respondents chose between core actors which were not mutually exclusive. Thus, respondents chose as many relevant actors as they deemed necessary from a list. However, the *Yes* and *No* options were mutually exclusive.

5.3.5 Use of the Traditional Court to Resolve Natural Resource Conflicts

Respondents were first asked if they had experienced any natural resource related disputes which needed resolution in the past 12 months. Fifty-seven percent responded in the affirmative whilst 43% responded in the negative. Furthermore, when respondents were asked if they had resorted to the traditional courts to arbitrate such disputes, 44% (of the 57%) replied they had used the traditional courts as opposed to 56% who did not.

The relevance of customary law in natural resource governance as well as the traditional court in mediating cases relating to rural livelihoods is reflected in the proportion of respondents who had patronised the traditional court (in the past 12 months) in resolving their natural resource conflicts. Moreover, these results buttress the claims of respondents D and C on the importance of the traditional authority in mediating natural resource conflicts.

5.3.6 Natural Resource Trade and Scarcity of Resources

In addition, respondents were asked about their involvement in natural resource trade, of which 19% replied *Yes*, 79% replied *No* and 2% gave no response. These include products such as wild fruits, edible insects, bush meat, dry wood, traditional medicine and reeds for making mats. Trade in such resources is a vital supplement to the household economy and helps to meet household needs. Furthermore, 61% of respondents claim that wild resources that are crucial to rural livelihoods have declined in availability. However, 36% of respondents differed whilst 3% were *not sure*.

5.3.7 Complaints Over Loss of Potential Agricultural Land

There were tensions amongst sections of the farming community that the introduction of the Mthethomusha Game Reserve has prevented them from accessing prime agricultural land for their agricultural and other livelihood activities. A cattle farmer (C) in response to a question on how the creation of the Game Reserve has impacted agriculture related activities:

“In the apartheid times there was abundant food for our cattle because at first our cattle could go anywhere in the communal lands but now with the reserve we are restricted and left with a small area. Now we roam more to different zones but formerly we just stayed within one zone to graze”.

5.4. DISCUSSION

5.4.1 Good Governance and Effective Common Property Resource Management

Although collaborative management in natural resource governance is argued to be ideal, it becomes ineffective in the absence of a requisite management and governance framework (Thondhlana et al., 2015). Thus, natural resource management becomes problematic when it is applied at an institutional scale whose span of authority is not commensurate with the geographical scale or particular spatial dynamics of the resource (Cash & Moser, 2000). In the case of Mpakeni, this reflects in the operations of the agencies (traditional and provincial) in the governance of the communal resources. For example, climate change introduces fresh demands on management approaches to the environmental resources which the traditional institution, will not be able to adequately address on its own. In addition, the complicated nature of *wicked problems* is such that the support of grassroots institutions are needed for interventions to be effective aside state agencies (Head & Alford, 2015). Thus, an interplay of collaboration and coordination, coupled with adaptive leadership is crucial to harness stakeholder divergence to address wicked problems and associated challenges at the study site. Such challenges with oversight authority appear to be complicating the smooth co-management relationship between the state and traditional agents in the study site.

The poor consideration given to such scale and cross-scale interactions in human-environment systems produces misguided public policies and resource management systems (Lockwood et al., 2010). This situation also makes it imperative to consider trust in good governance frameworks. In the context of Mpakeni this relates to trust between community members and their institutions given alleged corruption, nepotism and lack of actions (as expatiated later in the discussions). Moreover, the highly complex nature of socio-ecological systems makes trust between the community members and related institutions essential for effective management outcomes and stakeholder support (Turner et al., 2016). This makes a case for innovative governance approaches for effective redress guided by robust knowledge (Magni, 2017). Thus, it has been observed that several social problems remain more acute than necessary due to the dearth of attention on social innovation as a tool for effectively addressing such dynamic and yet multi-faceted challenges (Mulgan et al., 2007; DST, 2012; Hart et al., 2014). This also involves a dynamic knowledge exchange process crucial for learning (Anderson & Krathwohl, 2001). Moreover, state and traditional institutions cooperate (with the support of community members) in the management of communal resources within a framework of co-management (Fig. 5.1) under conditions of socio-ecological change (Armitage et al., 2008; Magni, 2017).

A distinguishing feature of co-management in natural resource systems is the prevailing incidence of power-sharing and interactive partnerships (Cundill et al., 2013). These power sharing frameworks manifest in variants along a continuum (Fig. 5.1) (Cundill et al., 2013). At one extreme, this includes the structure whereby there is consultation with a local community but the state agency maintains total control. At the other, there exists an arrangement where the local community is vested with full control and the state agency has limited influence (Ostrom, 1990; Cundill et al., 2013). The results of this study demonstrate serious bottlenecks in the effective collaboration of state and traditional institutions in the management of communal resources. This is highlighted in the conflicting views on the management of communal natural resources between principal actors (Table 5.2) and further comments indicating the need for accountability, transparency and inclusiveness especially as emphasized by respondent D. This highlights the issue that various people think that resource management has different aims.

The poor relationship between the state and traditional institution (Table 5.2) is indicative of a lack of the positive factors (such as transparency and accountability) which would incline institutional cooperation towards effective environmental governance for sustainable development (Fig. 5.1). Furthermore, effective communication is vital for enhancing the co-evolution of opinions, agreement on facts, values and management goals in resource governance (De Nooy, 2013). The absence of effective communication between the two institutions may be complicating their effective collaboration leading to misunderstandings or misguided perceptions, which compromises the goal of co-management. Moreover, this reality is counter-productive to the national objective of strengthening the workings of rural innovation value chains that yield direct positive social outcomes for the benefit of the poor and marginalised members of society (Hart et al., 2014). Consequently, environmental degradation in the study area is tilted (Fig. 5.1) in the negative direction with attendant consequences for rural livelihoods (Result 5.3.7).

Effective management measures are necessary to prevent a scenario of the *tragedy of the commons* (Ostrom, 1990) due to unsustainable harvesting of essential resources such as fuelwood which sustains 90% of rural households' primary energy needs (Madubansi & Shackleton, 2007; Wessels et al., 2013). However, it was observed during the study that many households now use electricity for cooking which could mean the heavy dependence on fuelwood may have decreased as respondent G argues. Furthermore, there are underlying triggers to the present poor co-management relationship which need redress as it affects the common property resource governance.

5.4.2 Tension Between Traditional and Government Structures

Collaborative natural resource governance *in situ* and beyond is guided by participatory discourses based on transparency and trust-building inter alia (Mwakaje et al., 2013; Thondhlana et al., 2015). Trust is a vital feature in social self-organizing processes directed at ecosystem management as trust lubricates cooperation (Pretty & Ward, 2001). These elements collectively serve as catalysts for a thriving social innovation ecosystem (DST, 2012; Davies & Simon, 2013). Thus, the absence of trust between institutions is an obstacle to the development of collaborative measures like adaptive co-management systems. The lack of trust between the state and traditional institutions has translated into attempts by each side to renegotiate the terms of engagement due to mutual suspicion (G, D). Although G argues that state institutions possess conventional scientific training to manage natural resources, and hence are qualified to manage them, others argue that “*Sophisticated knowledge of the natural world is not confined to science*” (Nakashima et al., 2000, p. 12) because conventional science is only one form of knowledge amongst several (Nakashima et al., 2000). Hence, after the creation of the Dukuduku forest reserve (in South Africa), locals similarly contested claims that the Parks Authority (of the Ezemvelo KZN Wildlife or old Natal Parks Board) was solely qualified to manage communal natural resources alluding to intricate traditional systems which moderated hunting and other human-environment relations (Nustad, 2015). However, the current degraded state of the Dukukudu Forest (Nustad, 2015) indicates that such traditional systems may not be as effective as they are claimed to be (pointing to the need for further innovation). Especially as current socio-economic and demographic conditions are very different from those under which these knowledge and management systems evolved. On the contrary, respondent F was more optimistic arguing that the traditional institution can be involved in natural resource management training to boost joint resource governance.

5.4.3 Poor Participation in Decision Making and Power Relations

In general the literature on stakeholder participation, implies poor participation in decision making and power relations between communities and leadership (Claassens, 2015; Chirenje et al., 2013). This study, however, considered lack of participation or power in decision making by the Traditional Authorities which is a novel take on the issue of participation and power in CPR governance. Respondent D laments the current situation where the traditional institution is virtually powerless in the decision making process (Table 5.2) especially pertaining to the management of communal resources (Fig. 5.6 & Plate 5.A) and the Game Reserve (Figs. 5.5 & 5.6), unlike the apartheid era when the traditional institution had *carte blanche* in its management of common property resources. This correlates with similar observations that currently, traditional institutions are sidelined in the decision-making process and their sphere of influence is increasingly encroached upon and is sometimes usurped by the new state agencies (Kirkland et al., 2007; Claassens, 2015). Other respondents (A, I, E), however, equally deplore the exclusiveness and poor transparency record of traditional institutions which is in consonance with similar studies on this theme (Eberbach et al., 2015). This is attributed to the situation where most areas in the former homelands or Bantustans ended

up badly ecologically degraded, through the high densities of people and livestock as well as poor management practices inter alia (Hoffman, 2015).

Collaborative structures are touted as being premised on equal power sharing. However, the state often monopolizes power to the detriment of local community actors, especially traditional authorities (Thondhlana et al., 2015). This has fuelled the debate that as the state has vested interest in conservation, it cannot be considered as neutral, hence the call for independent mediators to introduce fairness and further enhance co-management in resource governance (Gondo, 2011; Plummer et al., 2012; Plummer et al., 2017). Moreover, most respondents were in favour of the traditional (80%) and state institutions (70%) managing communal resources with 29% for the community and 1.6% against any form of control (Table 5.3). This is a healthy scenario as most people are receptive to the idea of common property resources being managed rather than a laissez-faire approach which would eventually result in further degradation (Kgosikoma et al., 2013) of communal natural resources as per the tragedy of the commons (Ostrom, 1990). Moreover, the active involvement of all relevant stakeholders is a cardinal principle in the context of social innovation (Phills et al., 2008; Mulgan et al., 2007).

5.4.4 Reinventing the Role of Traditional Courts in Mediating Natural Resource Cases

As adaptability of institutions to meet the needs of society is one of the attributes of good governance (Abernethy et al., 2014; OHCHR, 2016), the traditional authority equally needs to innovate and adapt to the changing context of the rural landscape. Hence, to help preserve their relevance in the democratic dispensation, traditional institutions rallied around the Traditional Courts Bill in defence of their role in adjudicating justice which respondent D claims is threatened and encroached upon by state institutions. This came to a crescendo when a local king in a different area was convicted for “*arson, kidnapping, assault with intent to do grievous bodily harm and defeating the ends of justice*” (Weeks, 2015). This case, amongst others which have spiked in the post-apartheid era, buttresses the claim that democratic transition has incentivized individuals to demand their civic rights (Kirkland et al., 2007; Claassens, 2015). A related action centred on land involving people from the study area gained media attention (Mlangeni, 2017). Nonetheless, traditional authority is still revered and continues to dispense justice as 44% of respondents had been to the traditional courts to seek arbitration on various land-related issues. However, this study did not investigate to what extent the outcomes were satisfactory. Moreover, there is an upsurge in natural resources related cases directed to the traditional institution (D) despite alternative state channels, lending credence to the continued importance of such institutions in regulating natural resource use (Claassens, 2015). Furthermore, conflicts are a common denominator in every society which can facilitate social progress when effective mechanisms for redress are established (Munyaradzi et al., 2014; Ghebretেকে, 2017). However cohesive a society may seem, due to its varied competing interests and value systems, it cannot be immune from conflict.

The effectiveness of traditional dispute resolution over natural resources can be influenced by the social setting and cultural aspects of the related community (Muigua, 2014; De Juan, 2017). This is more so for an ethnically diverse society such as South Africa where traditional customs may vary from ethnic group to ethnic group (Claassens, 2015). It would hence be helpful to formalise the complementarity of the traditional institution in terms of conflict resolution in natural resources guided by a clear legal and policy framework. Moreover, given the reported incidences of abuse of power by traditional institutions (Weeks, 2015; Claassens, 2015), an enforcement mechanism for the verdicts of traditional dispute resolution frameworks needs to be introduced for a harmonised dispute resolution system. Moreover, a framework for appeals to judgements of traditional dispute resolution mechanisms would also need to be introduced. This underscores the essence for synergy between the state and traditional institutions. This synergy could be developed as a form of hybrid natural resource conflict resolution.

Ultimately, the poor co-management relationship and the attendant ineffective management of common property resources is further aggravating the vulnerable nature of rural livelihoods (Kirkland et al., 2007; De Brauw et al., 2014). Social innovation harnesses the resources of core actors to effectively address such pressing social issues (Phills et al., 2008; Mulgan et al., 2007).

5.4.5 Impact of Poor Institutional Cooperation and the Resultant Ineffective Environmental Governance on Rural Livelihoods

5.4.5.1 Agriculture and natural resource trade

The Agricultural Research Council of South Africa postulates that agriculture is the most effective way for combating poverty in the short term (ARC, 2015). Furthermore, the climate of an area, suitable arable land, nutrients, rainfall, irrigation all have a combined effect on the soil's physical, chemical and biological characteristics and hence its productivity and ecosystem function (Kgosikoma et al., 2013). Nonetheless, there are constraints such as climate change, decreasing agricultural land and water resources and an increase in pest and disease pressure (Parry et al., 2007; ARC, 2015; DEA, 2016). These coupled with the growing incidence of alien plant invasion of Mpakeni (D) are a disincentive for the teeming rural youth to adopt agriculture as a means of employment (ARC, 2015). Invasive weeds such as Triffid weed (*Chromolaena odorata*), Parthenium weed (*Parthenium hysterorus*) and Lantana (*Lantana camara*) create impenetrable stands which affect the productive potential of the land and leaves vast areas unsuitable for agriculture including livestock grazing (Hoffman, 2015).

The creation of the Mthethomusha Game Reserve (Figs. 5.5 & 5.6) is claimed to have denied community members fertile land for their agriculture related activities including pasture for livestock (C). Furthermore, the introduction of some animals considered to be dangerous into

the reserve is also a source of concern. Such animals (lion, hyena, jackals, and leopards) though a lucrative source of revenue for the reserve are blamed for preying on livestock and causing communal tensions (C). In the view of this respondent, the best solution is to rid the community of these dangerous animals and the reserve altogether as they are not being compensated for their losses despite several complaints to the traditional institutions. Both the state and traditional institution blame each other for the slow pace of compensating people who have lost livestock due to the reserve animals, which disincentivises people from expanding their livestock production or starting one (C). Such lack of redress can also translate into desperate measures being adopted by aggrieved farmers to protect their livelihoods. Farmers adjacent to the Maasai Mara reserve in Kenya resorted to poison-laced cow carcasses to kill lions preying on their livestock. Several other endangered animals such as white-backed vultures also died from feeding on the toxic carcasses (Actman, 2015).

Sixty one percent (61%) of respondents indicated some wild resources they used to harvest have become scarce in recent times (Result 5.3.7), whilst another 19% of respondents trade in natural resource products (Result 5.3.7). Such resources include medicinal plants, edible insects and fruits. The World Health Organization estimates circa 80% of the populace in Africa depend on such traditional medicines to satisfy their primary health care needs (WHO, 2002). Thus, the degradation or loss of particular species compromises rural wellbeing (Shackleton & Shackleton, 2015) but can be limited by the good governance of such resources.

Effective governance is crucial to securing the long-term security of supply of such wild resources as well as associated socio-political risks (Darby, 2018). The majority of transparency and accountability mechanisms in the natural resources domain are centred on enhancing national level governance systems (Darby, 2018). However, it is imperative to also consider the key roles of the traditional authorities such as approving natural resource concessions, managing conflicts between resource users and in ensuring that revenues generated by major natural resource projects are converted into sustainable development in the communities where those resources are located (UNEP, 2013; Darby, 2018). Tailored interventions need to be introduced targeted at the transparency and accountability needs of communities and civil society groups at the local level — as a watered down version of existing national-level transparency programmes.

5.4.5.2 Fairness in allocating rural projects and opportunities

In the rural areas of South Africa, the heavy dependence of the unemployed on the social grants of the elderly is evident (Shackleton & Shackleton, 2015). To productively harness the resources of the elderly, the *Aged* project (Fig. 5.6) was conceived in the study area (NGO initiative) to engage the aged in the area to produce mats, fences, floor polish and vegetables as an alternative revenue source. However, the rural elite are accused of appropriating the project proceeds and turning the communal project into a family industry hence its demise. Similarly, the disabled forum and the youth claim that despite numerous requests for a

permanent site to run their activities, they are still occupying a temporary site and hence are unable to do anything meaningful (E, I). Moreover, respondent I lamented that opportunities are given to the cronies of the rural elite. Similar accusations from the village folk are reported to have led to acts of arson as disgruntled villagers set fire to the Mthethumusha Game Reserve to voice their displeasure (Mlangeni, 2014).

It is with such concerns about the rights of such disadvantaged groups that the mushrooming of civic rights groups in rural areas has been welcomed in some quarters to the chagrin of the rural elite who are less receptive to such accountability structures (Claassens, 2015). Furthermore, traditional leaders have voiced their opposition to independent ownership of land within their tribal boundaries (Claassens, 2015). Hence, to provide equal opportunities for disadvantaged groups as part of good governance, democratic structures hold more promise (D). Moreover, to achieve real empowerment and equitable rural social change, pro-poor innovation policy development must involve the direct participation of marginalised rural communities (Hart et al., 2014). Therefore, the marginalisation of disadvantaged groups in natural resources governance is against the ideals of inclusivity in terms of good governance. Given that such groups are also heavily dependent on such resources (Hart et al., 2014; Hoffmann, 2015), this compromises cooperation/support of such key stakeholders and hence effective environmental governance.

5.4.5.3 Benefit sharing between communal areas and conservation programmes

It is argued that the key issue in conservation is how to reconcile human needs and conservation imperatives in tandem (Anthony, 2007; Johann, 2007; Dressler & Buscher, 2008; McHale et al., 2013). Moreover, the narrative of local community versus state institution partnerships in conservation is fraught with numerous cases of broken promises as community members blame conservation agencies for not honouring their promises to provide benefits such as jobs inter alia for their land (McShane et al., 2011; Thondhlana et al., 2015). Hence, the complaints by several informants as per the non-provision of jobs and other social amenities upon the creation of the reserve are not unique (J, I, H, B). Similar complaints and related actions in the study area have also been reported in the media (Mlangeni, 2014). This is synonymous with the situation in Botswana where with the creation of the Central Kalahari Game Reserve (CKGR) as the second largest reserve in Africa, the San (regarded as the indigenous peoples of southern Africa) have been forced out of areas they sojourned for centuries (Survival International, 2015). In general, conservation history on relationships between conservation areas and adjacent communities or communities that were forcibly moved shows grave hostility between conservation authorities and local communities (Ramutsindela, 2003; Spenceley & Goodwin, 2007). Furthermore, there have been frequent complaints that the lofty promises made to the indigenous San and the associated conservation goals were not being met as a result of misguided policies (Survival International, 2015). This draws parallels with the concerns of some key informants (J, I, H, B). Moreover, it has also been observed that isolated efforts from individual tourism

establishments have minimal effects on the majority of the populace of dense rural milieu except a minority of individuals who gain directly (Spenceley & Goldwin, 2007; Rylance & Spenceley, 2013; Cauchi-Santoro, 2016).

Additionally, in Kenya the establishment of the Amboseli and Maasai Mara wildlife conservation areas have separated the Maasai from the fauna with which they initially co-existed and this has contributed to their impoverishment (Okech, 2010). Consequently, there is a growing debate that mainstreaming conservation interests with the development needs of poor communities is a recipe for failure (Dressler & Buscher, 2008; McShane et al., 2011). However, others argue that the success or failure of such projects hinges on the socioeconomic and cultural factors, thus such interventions should integrate more of the human dimension of nature conservation than solely scientific aspects (Muhumuza & Balkwill, 2013). Moreover, the true test of good governance is its ability to meet basic socio-economic needs (OHCHR, 2016). Social innovation has gained global currency in response to such pressing socio-economic, environmental and demographic challenges, and the realisation that innovation should address priorities arising from unemployment and poverty (DST, 2012; Hart et al., 2014; Avelino et al., 2017).

5.4.6 Promoting the Rule of Law to Enhance Environmental Governance

A common narrative in the accounts of all key respondents is the admission that there is a general disregard for the rule of law after apartheid which has permeated all facets of rural life and equally reflected in the wanton abuse of laws governing human-environment relations. Hence, 70% of all key respondents (B, C, D, F, G, H, I) alluded to this phenomenon. As respondent D explained (and corroborated by B, F, G, H, I), environmental challenges such as rhino poaching, illegal sand mining and cutting of trees are often associated with lack of employment opportunities; *“Unemployment can be managed if there is law, but now there is no respect for the law”* (D), highlighting the abuse of rights coupled with the shirking of civic responsibilities (Twine et al., 2003a). Respondent G also gives more insight on this phenomenon claiming people are now emboldened to disregard laws due to their free access to legal aid: *“You can arrest someone but they can go easily. They (have) rights to a lawyer, now people can charge you with wrongful arrest; the criminal procedure gives more rights to the accused. Formerly you could arrest and detain someone but now they have access to free lawyer and legal aid”* (G). The indiscriminate abuse of power by authorities (both traditional and state) was one of the key demerits of the apartheid era (Eberbach et al., 2015) hence such developments which serve as checks and balances are equally seen as positive (Claassens, 2015). Nevertheless, it is argued that the advent of political freedom and democracy has been interpreted by some as unbounded freedom which reflects in the misinterpretation of civic rights and responsibilities with implications for the respect of rule of law (Twine et al., 2003a; Kirkland et al., 2007). However, attitudes and values that promote responsibility and solidarity are vital for good governance (OHCHR, 2016).

Most respondents alluded to the poor compliance to regulations in the post-apartheid era as the common denominator in explaining the alarming scale of burgeoning environmental challenges such as poaching, indiscriminate refuse dumping, invasion of alien weeds, illegal sand mining and encroachment on conservation land which hitherto were generally under control (B, C, D, F, G, H, I). This is complicated by a general breakdown in community values and the growth of individualism coupled with household-centered behaviours, which has translated into the demise of traditional values and associated communal lifestyle patterns (Kirkland et al., 2007). Furthermore, it is argued (respondent D) that the effectiveness of traditional authority in ensuring compliance to environmental regulations is compromised by budgetary cuts from the national government which have affected its ability to recruit the chief's *tree police* as a law enforcement instrument to complement the efforts of state institutions (Kirkland et al., 2007). Ultimately, sustainable development is argued (including the world's religious leaders) as not solely premised on economic and statistical terms, but also essentially involving ethical dimensions (UNESCO-UNEP, 2003; IISD, 2015) such as responsible environmental conduct (Fig. 5.2). Hence, rules of access and management are necessary to maintain common property resources from season to season (Ostrom, 1990). Such views are made equally explicit in the Millennium Ecosystems Assessment Report (Millennium Ecosystem Assessment, 2005).

5.5. CONCLUSION

Environmental resources form the principal basis of rural livelihoods and their sustenance. Traditional institutions still play vital roles in the management of such resources in the era of democratic transition. This has made the joint collaboration between state and traditional institutions imperative in the present democratic dispensation and necessitating management innovation. Nonetheless, for such co-management frameworks to be successful there is the need for some core ingredients such as inclusiveness, fairness, transparency, trust and accountability. These elements also serve as catalysts that safeguard a thriving social innovation ecosystem. Moreover, the absence of these core elements results in further weakening of the desired effective joint partnership between state and traditional institutions. Hence, the potential of state and traditional institutions to effectively manage communal resources is being compromised by the ensuing animosity, lack of transparency and distrust which is straining the needed cordial relations between the two institutions. This compromises effective natural resource governance with impacts on rural livelihoods further exacerbated by an inadequate understanding of civic rights which has resulted in their abuse by some rural folk. Other socio-economic influences such as compliance with regulation, employment opportunities, migration and demographics also affect the overall success of environmental governance. Hence, in nurturing these crucial elements in state versus traditional institutions these other socio-economic factors also need to be taken into consideration to produce sustained results in the effective management of communal resources. Good governance involves information and education, thus the two institutions need to collaborate in educating the rural populace on civic responsibilities and the impacts

of environmental degradation on rural livelihoods. An interesting outcome of the study is that unlike other areas in the same province, traditional natural resource governance in the study site is relatively enhanced although inadequate in addressing the scale of environmental degradation. The prevailing friction and seeming turf war between the core actors may have led to a situation where each is trying to outperform the other (in the exercise of their duties) with inadvertent consequences for the management of the area's common pool resources. Thus, as the core actors currently appear to be operating in silos, their effective collaboration will harness both their resources to improve the management of common pool resources as well as address the challenge of scale. Moreover, effective communication is crucial for limiting misconceptions and enhancing harmonious co-management of communal resources.

5.6. REFERENCES

Abernethy, K. E., Bodin, Ö., Olsson, P., Hilly, Z., Schwarz, A., 2014. Two steps forward, two steps back: The role of innovation in transforming towards community-based marine resource management in Solomon Islands. *Global Environmental Change*. 28, 309–321.

Actman, J., 2015. Vultures also dead from Kenya lion poisoning. *National Geographic*. <http://news.nationalgeographic.com/2015/12/20151209-vultures-lion-poisoning-kenya-masai-mara/> accessed on 14.12.2015.

Andersson, K. P., Ostrom, E., 2008. Analyzing decentralized resource regimes from a polycentric perspective. *Policy Sciences*. 41 (1), 71–93.

Anderson, L. W., Krathwohl, D. R., 2001. Taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives. Longman, New York, pp. 336.

Anthony, B., 2007. The dual nature of parks: Attitudes of neighbouring communities towards Kruger National Park, South Africa. *Environmental Conservation*. 34 (3), 236–245. <https://doi.org/10.1017/S0376892907004018>.

ARC., 2015. Annual Report for 2015/16. <http://pmg-assets.s3-website-eu-west-1.amazonaws.com/161020ARC.pdf> accessed on 23.05.2015.

Armitage, D., Marschke, M., Plummer, R., 2008. Adaptive co-management and the paradox of learning. *Global Environmental Change*. 18 (1), 86–98.

Avelino, F., Wittmayer, J. M., Pel, B., Weaver, P., Dumitru, A., Haxeltine, A., Kemp, R., Jørgensen, M. S., Bauler, T., Ruijsink, S., O'Riordan, T., 2017. Transformative social innovation and (dis)empowerment. *Technological Forecasting & Social Change*. 145, 196–105. <http://dx.doi.org/10.1016/j.techfore.2017.05.002>.

Banerji, A., 2016. Global & National Leadership in Good Governance. *UN Chronicle*. 52 (4). <https://unchronicle.un.org/article/global-and-national-leadership-good-governance> accessed on 06.07.2016.

Berkes, F., Colding, J., Folke, C., 2003. Navigating Social–Ecological Systems: Building Resilience for Complexity and Change. Cambridge University Press, Cambridge, pp. 393.

Blackhurst, R., 2008. Joint Maputo River Basin Water Resources Study: Moçambique, Swaziland and South Africa. Combined Task Report 8.2-8.4/2007. <http://www.dwa.gov.za/maputobasinatlas/Reports/English/Report%208.2%20to%208.4%20-%20Current%20&%20Potential%20Dev%20-%20V2.0%20-%20May%20200.pdf> accessed on 02.04.2016.

Blomquist, W., Ostrom, E., 1985. Institutional capacity and the resolution of a commons dilemma. *Policy Studies Review*. 5 (2), 383–394. <https://doi.org/10.1111/j.1541-1338.1985.tb00364.x>.

Bojang, F., Ndeso-Atanga, A., 2013. African youth in agriculture, natural resources and rural development. *Nature & Faune*. 28 (1), 1–106.

Cash, D. W., Moser, S. C., 2000. Linking global and local scales: Designing dynamic assessment and management processes. *Global Environmental Change*. 10 (2), 109–120. [https://doi.org/10.1016/S0959-3780\(00\)00017-0](https://doi.org/10.1016/S0959-3780(00)00017-0).

Cauchi-Santoro, R., 2016. Mapping community identity: Safeguarding the memories of a city's downtown core. *City, Culture & Society*. 7 (1), 43–54. <https://doi.org/10.1016/j.ccs.2015.12.003>.

Chidumayo, E. N., Gumbo, D. J., 2010. The Dry Forests and Woodlands of Africa: Managing for Products and Services. Earthscan, Washington, pp. 304.

Chirenje, L. I., Giliba, R. A., Musamba, E. B., 2013. Local communities' participation in decision-making processes through planning and budgeting in African countries. *Chinese Journal of Population Resources & Environment*. 11 (1), 10–16. <https://doi.org/10.1080/10042857.2013.777198>.

Claassens, A., 2015. Law, land and Custom, 1923–2014: What is at Stake Today?, in Cousins, B., Walker, C. (Eds.) *Land Divided, Land Restored: Land Reform in South Africa for the 21st Century*. Jacana Media, Johannesburg, pp. 68–84.

Cousins, B., Walker, C., 2015. Introduction, in Cousins, B., Walker, C. (Eds.) *Land Divided, Land Restored: Land Reform in South Africa for the 21st Century*. Jacana Media, Johannesburg, pp. 1–23.

Cundill, G., Thondhlana, G., Sisitka, L., Shackleton, S., Blore, M., 2013. Land claims and the pursuit of co-management on four protected areas in South Africa. *Land Use Policy*. 35, 175–178.

Darby, S., 2018. Natural Resource Governance. Transparency & Accountability Initiative, London, pp. 69.

Davies, A., Simon, J., 2013. Engaging Citizens in Social Innovation: A Short Guide to the Research for Policy Makers and Practitioners. A deliverable of the project: “The theoretical, empirical and policy foundations for building social innovation in Europe” (TEPSIE), European Commission – 7th Framework Programme. European Commission, Brussels, pp. 22.

DEA., 2016. National Climate Change Adaptation Strategy. Department of Environmental Affairs, Pretoria, pp. 123.

De Brauw, A., Mueller, V., Lee, H. L., 2014. The role of rural–urban migration in the structural transformation of Sub-Saharan Africa. *World Development*. 63, 33–42.

De Juan, A., 2017. “Traditional” resolution of land conflicts: The survival of precolonial dispute settlement in Burundi. *Comparative Political Studies*. 50 (13), 1835–1868. <https://dx.doi.org/10.1177/0010414016688006>.

De Nooy, W., 2013. Communication in natural resource management: Agreement between and disagreement within stakeholder groups. *Ecology & Society*. 18 (2), 44–56. <https://doi.org/10.5751/ES-05648-180244>.

Dold, T., Cocks, M., 2012. *Voices from the Forest: Celebrating Nature and Culture in the Xhosaland*. Jacana Media, Auckland Park, pp. 236.

Dressler, W., Buscher, B., 2008. Market triumphalism and the CBNRM 'crisis' at the South African section of the Great Limpopo Transfrontier Park. *Geoforum*. 39 (1), 452–465. <https://doi.org/10.1016/j.geoforum.2007.09.005>.

DST., 2012. Final Report of the Ministerial Review Committee on the Science, Technology and Innovation Landscape in South Africa. DST, Pretoria, pp. 43.

Eberbach, K., Kubera, A., Okoth, N. L., Watanabe, A., 2015. ‘Contemporary Traditional Leaders a Study on Land and Governance in South Africa’, *International Colloquium for Debate and Proposals on Governance in Africa*. Polokwane and Pretoria, 17–20 June. Paris, Institut de Recherche et Débat sur la Gouvernance (IRG), pp. 230.

Ellis, F., 2000. *Rural Livelihoods and Diversity in Developing Countries*. Oxford University Press, Oxford, pp. 273.

Ferrar, A. A. & Lötter, M. C. 2007. Mpumalanga Biodiversity Conservation Plan Handbook. Mpumalanga Tourism & Parks Agency, Nelspruit, pp. 88.

Folke, C., Colding, J., Berkes, F., 2003. Synthesis: Building Resilience and Adaptive Capacity in Social-Ecological Systems, in Berkes, F., Colding, J., Folke, C. (Eds.) *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*. Cambridge University Press, Cambridge, pp. 352–387.

Ghebretেকে, T. B., 2017. Traditional natural resource conflict resolution vis-à-vis formal legal systems in East Africa: The cases of Ethiopia and Kenya. *African Journal on Conflict Resolution*. 17 (1), 29–53.

Gondo, T., 2011. Adaptive co-management of natural resources: A solution or problem? *Journal of Human Ecology*. 33 (2), 119–131. <https://doi.org/10.1080/09709274.2011.11906354>.

Halliday, A., Glaser, M., 2011. A management perspective on social ecological systems: A generic system model and its application to a case study from Peru. *Human Ecology Review*. 18 (1), 1–18.

Hampson, J., Challis, W., Blundell, G., De Rosner, C., 2002. The rock art of Bongani Mountain Lodge and its environs, Mpumalanga province, South Africa: An introduction to problems of Southern African rock-art regions. *The South African Archaeological Bulletin*. 57 (175), 15–30.

Hardin, G., 1968. The tragedy of the commons. *Science*. 162 (3859), 1243–1248. <https://doi.org/10.1126/science.162.3859.1243>.

Hart, T., Jacobs, P., Ramoroka, K., Mangqalaza, H., Mhula, A., Ngwenya, M., Betty, L., 2014. Social innovation in South Africa's rural municipalities: Policy implications. Policy Brief March 2014. Human Sciences Research Council (HSRC), Pretoria, pp. 6. <http://www.hsrc.ac.za/uploads/pageContent/4574/2014%20March%20pb%20social%20innovation.pdf> accessed on 15.05.2018.

Head, B. W., Alford, J., 2015. Wicked problems: Implications for public policy and management. *Administration & Society*. 47 (6), 711–739. <https://doi.org/10.1177/0095399713481601>.

Hoffman, M. T., 2015. Environmental Change in Twentieth-Century South Africa and its Implications for Land Reform, in Cousins, B., Walker, C. (Eds.) *Land Divided, Land Restored: Land Reform in South Africa for the 21st Century*. Jacana Media, Johannesburg, pp. 56–67.

IISD., 2015. UN Sustainable Development Summit Highlights. *Earth Negotiations Bulletin* (ENB). 32 (22). <https://enb.iisd.org/vol32/enb3222e.html> accessed on 27.09.2015.

Janssen, M. A., 2013. The role of information in governing the commons: Experimental results. *Ecology & Society*. 18 (4), 4–27. <http://dx.doi.org/10.5751/ES-05664-180404>.

Johann, E., 2007. Traditional forest management under the influence of science and industry: The story of the alpine cultural landscapes. *Forest Ecology & Management*. 249, 54–62.

Kgosikoma, O. E., Mojeremane, W., Harvie, B. A., 2013. Grazing management systems and their effects on savanna ecosystem dynamics: A review. *Journal of Ecology & the Natural Environment*. 5 (6), 88–94.

King, B., 2005. Spaces of change: Tribal authorities in the former Kangwane homeland, South Africa. *Area*. 37 (1), 64–72.

Kirkland, T., Hunter, L. M., Twine, W., 2007. “The bush is no more”: Insights on institutional change and natural resource availability in rural South Africa. *Society & Natural Resources*. 20 (4), 337–350.

Kvale, S., Brinkmann, S., 2009. *InterViews: Learning the Craft of Qualitative Research Interviewing*. Sage Publications, London, pp. 376.

Levin, K., Cashore, B., Bernstein, S., Auld, G., 2012. Overcoming the tragedy of super wicked problems: Constraining our future selves to ameliorate global climate change. *Policy Science*. 45, 123–152. <https://doi.org/10.1007/s11077-012-9151-0>.

Lockwood, M., Davidson, J., Curtis, A., Stratford, E., Griffith, R., 2010. Governance principles for natural resource management. *Society & Natural Resources*. 23 (10), 986–1001.

Low, A. B., Rebelo, G., 1996. *Vegetation of South Africa, Lesotho and Swaziland*. Department of Environmental Affairs & Tourism, Pretoria, pp. 750.

Madubansi, M., Shackleton, C. M., 2007. Changes in fuelwood use and selection following electrification in the Bushbuckridge lowveld, South Africa. *Journal of Environmental Management*. 83 (4), 416–426. <https://doi.org/10.1016/j.jenvman.2006.03.014>.

Magni, G., 2017. Indigenous Knowledge and Implications for the Sustainable Development Agenda. *European Journal of Education*. 52, 437–447.

Maplandia., 2015. Mpakeni Map — Satellite Images of Mpakeni. <http://www.maplandia.com/south-africa/mpumalanga/nsikazi/mpakeni/> accessed on 23.03.2015.

McHale, M. R., Bunn, D. N., Pickett, S. T, Twine, W., 2013. Urban ecology in a developing world: Why advanced socioecological theory needs Africa. *Frontiers in Ecology & the Environment*. 11 (10), 556–564.

McShane, T. O., Hirsch, P. D., Trung, T. C., Songorwa, A. N., Kinzig, A., Monteferri, B., Mutekanga, D., Van Thang, H., Dammert, J. L., Pulgar-Vidal, M., Welch-Devine, M., Brosius, J. P., Coppolillo, P., O'Connor, S., 2011. Hard choices: Making trade-offs between biodiversity conservation and human well-being. *Biological Conservation*. 144 (3), 966–972.

Millennium Ecosystem Assessment., 2005. *Ecosystems and Human Well-Being: Synthesis*. Island Press, Washington, pp. 155.

Mlangeni, T., 2014. People destroy precious grazing land. *Mpumalanga News*. <https://mpumalanganews.co.za/180612/people-destroy-precious-grazing-land/> accessed on 30.07.2019.

Mlangeni, T., 2017. Mpakeni Mlegeni land claimants want their land back. *Mpumalanga News*. <https://mpumalanganews.co.za/315267/mpakeni-mlegeni-land-claimants-want-land-back/> accessed on 30.07.2019.

Mowo, J., Adimassu, Z., Masuki, K., Lyamchai, C., Tanui, J., Catacutan, D., 2011. The importance of local traditional institutions in the management of natural resources in the highlands of Eastern Africa. Working Paper No. 134. World Agroforestry Centre, Nairobi, pp. 27.

Muhumuza, M., Balkwill, K., 2013. Factors affecting the success of conserving biodiversity in national parks: A Review of case studies from Africa. *International Journal of Biodiversity*. 2013, 1–20. Article ID 798101. <http://dx.doi.org/10.1155/2013/798101>.

Muigua, K., 2014. Natural Resources and Conflict Management in East Africa. Paper Presented at the 1st NCMG East African ADR Summit (Kenya). Windsor Golf Hotel, 25–26 September. Centre for Advanced Studies in Environmental Law & Policy (CASELAP), Nairobi, pp. 53.

Mukuka, D. M., 2006. *A Critical Review of Public-Private Partnerships in the Management of Water Services Delivery: The Case of Nelspruit* (Unpublished masters thesis). University of Kwazulu Natal Scholarly Works, Durban, pp. 113. https://researchspace.ukzn.ac.za/xmlui/bitstream/handle/10413/1935/Mukuka_Dominic_M_2006.pdf?sequence=1&isAllowed=y accessed on 30.07.2019.

Mulgan, G., Tucker, S., Ali, R., Sanders, B., 2007. Social innovation: What it is, Why it Matters and How it can be Accelerated. Oxford Saïd Business School, Oxford, pp. 52. [https:// young foundation.org/wp-content/uploads/ 2012/10/Social-Innovation-what-it-is-why-it-matters-how-it-can-be-accelerated-March-2007.pdf](https://youngfoundation.org/wp-content/uploads/2012/10/Social-Innovation-what-it-is-why-it-matters-how-it-can-be-accelerated-March-2007.pdf) accessed on 10.08.2017.

Munyaradzi, M., Christopher, M. M., Shava, T., 2014. Traditional authority in community based natural resource management (CBNRM): A critical investigation of the role of traditional authority in fisheries management in Gache Gache communal lands of Kariba, Zimbabwe. *Fish and Aquaculture Journal*. 5 (2), 1–7. <http://dx.doi.org/10.4172/2150-3508.1000093>.

Mwakaje, A. G., Manyasa, E., Wawire, N., Muchai, M., Ongare, D., Mugoya, C., Masiga, C. W., Nikundiwe, A., 2013. Community-based conservation, income governance, and poverty alleviation in Tanzania: The case of Serengeti ecosystem. *The Journal of Environment & Development*. 22 (1), 51–73.

Nakashima, D., Prott, L., Bridgewater, P. 2000. Tapping into the world's wisdom. *UNESCO Sources*, 125 (July–August), 12.

Nustad, K. G., 2015. *Creating Africas: Struggles Over Nature, Conservation and Land*. Hurst Publishers, London, pp. 224.

OHCHR., 2016. Good Governance and Human Rights. United Nations Human Rights. <http://www.ohchr.org/EN/Issues/Development/GoodGovernance/Pages/GoodGovernanceIndex.aspx> accessed on 10.05.2016.

- Okech, R. N., 2010. Wildlife-community conflicts in conservation areas in Kenya. *African Journal on Conflict Resolution*. 10 (2), 64–80.
- Ostrom, E., 1990. *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge University Press, Cambridge, pp. 298.
- Parliamentary Monitoring Group., 2018. The Structure of Government. <https://pmg.org.za/page/structure-of-government> accessed on 07.12.2018.
- Parry, M., Canziani, O., Palutikof, J., Van der Linden, P., Hanson, C., 2007. *AR4 Climate Change 2007: Impacts, Adaptation and Vulnerability*. Cambridge University Press, New York, pp. 987.
- Phills, J. A., Deiglmeier, K., Miller, D. T., 2008. Rediscovering social innovation. *Stanford Social Innovation Review*. 6 (4), 34–43.
- Plummer, R., Crona, B., Armitage, D. R., Olsson, P., Tengö, M., Yudina, O., 2012. Adaptive co-management: A systematic review and analysis. *Ecology & Society*. 17 (3), 11–32. <http://dx.doi.org/10.5751/ES-04952-170311>.
- Plummer, R., Baird, J., Dzyundzyak, A., Armitage, D., Bodin, Ö., Schultz, L., 2017. Is adaptive co-management delivering? Examining relationships between collaboration, learning and outcomes in UNESCO biosphere reserves. *Ecological Economics*. 140, 79–88. <https://doi.org/10.1016/j.ecolecon.2017.04.028>.
- Prakash, C. T., Joshi, B., 2015. Local and regional institutions and environmental governance in Hindu Kush Himalaya. *Environmental Science & Policy*. 49, 66–74. <https://doi.org/10.1016/j.envsci.2014.09.008>.
- Pretty, J., Ward, H., 2001. Social capital and the environment. *World Development*. 29 (2), 209–227.
- Puddington, A., 2015. *Discarding Democracy: Return to the Iron Fist*. Washington, Freedom House. <https://freedomhouse.org/report/freedom-world-2015/discarding-democracy-return-iron-fist> accessed on 10.05.2016.
- Ramutsindela, M., 2003. Land reform in South Africa's national parks: A catalyst for the human-nature nexus. *Land Use Policy*. 20 (1), 41–49. [https://doi.org/10.1016/S0264-8377\(02\)00054-6](https://doi.org/10.1016/S0264-8377(02)00054-6).
- Reeves, A., Lemon, M., Cook, D., 2013. Jump-starting transition? Catalysing grassroots action on climate change. *Energy Efficiency*. 7 (1), 115–132. <http://dx.doi.org/10.1007/s12053-013-9212-z>.
- Rim-Rukeh, A., Irerhievwie, G., Agbozu, I. E., 2013. Traditional beliefs and conservation of natural resources: Evidences from selected communities in Delta State, Nigeria.

International Journal of Biodiversity & Conservation. 5 (7), 426–432. <https://doi.org/10.5897/IJBC2013.0576>.

Rylance, A., Spenceley, A., 2013. Living outside the fence: Opportunities for neighbouring communities to supply products and services to the Sabi Sand Game Reserve, South Africa. *African Journal for Physical Health Education, Recreation & Dance (AJPHERD)*. 19 (3), 294–308.

SALGA., 2018. Provincial Executive Committees and Municipalities. <https://www.salga.org.za/About%20Us%20PEC.html> accessed on 02.12.2018.

Sa-venues.com. (2019). Mthethomusha Game Reserve. <https://www.sa-venues.com/game-reserves/mthethomusha.php> accessed on 31.07.2019.

Scholz, R. W., 2011. Environmental Literacy in Science and Society: From Knowledge to Decisions. Cambridge University Press, Cambridge, pp. 631.

Scollon, R., Scollon, S. W., 2004. Nexus Analysis: A Practical Field Guide for Mediated Discourse Analysis. Routledge, London, pp. 22.

Scoones, I., 1998. Sustainable Rural Livelihoods a Framework for Analysis. IDS Working paper 72. The Institute of Development Studies, Sussex, pp. 22.

Shackleton, S. E., Shackleton, M. C., 2015. Not just farming: Natural resources and livelihoods in land and agrarian reform, in Cousins, B., Walker, C. (Eds.) *Land Divided, Land Restored: Land Reform in South Africa for the 21st Century*. Jacana Media, Johannesburg, pp. 191–205.

South African Government., 2015. Traditional Affairs. <http://www.gov.za/about-government/government-system/traditional-leadership> accessed on 09.11.2015.

Spenceley, A., Goodwin, H., 2007. Nature-based tourism and poverty alleviation: Impacts of private sector and parastatal enterprises in and around Kruger National Park, South Africa. *Current Issues in Tourism*. 10 (2–3), 255–277. <https://doi.org/10.2167/cit305.0>.

Survival International., 2015. The Bushmen. <https://www.survivalinternational.org/tribes/bushmen> accessed on 03.05.2015.

Thondhlana, G., Shackleton, S., Blignaut, J., 2015. Local institutions, actors, and natural resource governance in Kgalagadi Transfrontier Park and surrounds, South Africa. *Land Use Policy*. 47, 121–129.

Turker, D., Vural, C. A., 2017. Embedding social innovation process into the institutional context: Voids or supports. *Technological Forecasting & Social Change*. 119, 98–113.

Turner, R. A., Addison, J., Arias, A., Bergseth, B. J., Marshall, N. A., Morrison, T. H., Tobin, R. C., 2016. Trust, confidence, and equity affect the legitimacy of natural resource governance. *Ecology & Society*. 21 (3), 18–32. <http://dx.doi.org/10.5751/ES-08542-210318>.

Twine, W., 2005. Socio-economic transitions influence vegetation change in the communal rangelands of the South African lowveld. *African Journal of Range & Forage Science*. 22 (2), 93–99. <https://doi.org/10.2989/10220110509485866>.

Twine, W., Moshe, D., Siphugu, M., 2003a. Harvesting of communal resources by “outsiders” in rural South Africa: A case of xenophobia or a real threat to sustainability? *International Journal of Sustainable Development & World Ecology*. 10, 263–274.

Twine, W., Moshe, D., Netshiluvhi, T., Siphugu, V., 2003b. Consumption and direct-use values of savanna bio-resources used by rural households in Mametja, a semi-arid area of Limpopo province, South Africa. *Research Letter. South African Journal of Science*. 99 (9–10), 467–473.

UN., 2015. Goal 16: Promote Just, Peaceful and Inclusive Societies. <http://www.un.org/sustainabledevelopment/peace-justice/> accessed on 09.11.2015.

UNDP., 2015. Goal 15: Life on Land. <http://www.undp.org/content/undp/en/home/sdgoverview/post-2015-development-agenda/goal-15.html> accessed on 01.02.2016.

UNEP., 2013. Good Governance of Natural Resources is Vital for Peace and Economic Development. <https://www.unenvironment.org/news-and-stories/press-release/good-governance-natural-resources-vital-peace-and-economic> accessed on 08.12.2018.

UNESCO-UNEP., 2003. Cultural Diversity and Biodiversity for Sustainable Development. A jointly convened UNESCO and UNEP high-level Roundtable during the World Summit on Sustainable Development (South Africa). Johannesburg, 3 September. UNEP, Nairobi, pp. 60. https://wedocs.unep.org/bitstream/handle/20.500.11822/13741/Cultural_Diversity_and_Biodiversity.pdf?sequence=2&isAllowed=y accessed on 06.03.2016.

USAID., 1996. Performance Monitoring and Evaluation Tips – Conducting a Key Informant Interview. https://pdf.usaid.gov/pdf_docs/PNABS541.pdf accessed on 20.12.2012.

Van den Bergh, J. M., Truffer, B., Kallis, G., 2011. Environmental innovation and societal transitions: Introduction and overview. *Environmental Innovation & Societal Transitions*. 1 (1), 1–23.

Van Riet, W. P., Claassen, P., Van Rensburg, J. A. J., Van Viegen, T., Du Plessis, L., 1997. *Environmental Potential Atlas for South Africa*. J. L. Van Schaik, Pretoria, pp. 60.

Wade, R., 1987. The management of common property resources: Collective action as an alternative to privatisation or state regulation. *Cambridge Journal of Economics*. 11 (2), 95–106. <https://doi.org/10.1093/oxfordjournals.cje.a035024>.

Weeks, S. M., 2015. Of a Cruel King and the Bitter Battle for the Soul of South Africa's Democracy. The Conversation. <https://theconversation.com/of-a-cruel-king-and-the-bitter-battle-for-the-soul-of-south-africas-democracy-49063> accessed on 15. 10.2015.

Wessels, K. J., Colgan, M. S., Erasmus, B. F. N., Asner, G. P., Twine, W. C., Mathieu, R., Van Aardt, J. A. N., Fisher, J. T., Smit, I. P. J., 2013. Unsustainable fuelwood extraction from South African savannas. *Environmental Research Letters*. 8 (1), 2–11. <http://dx.doi.org/10.1088/1748-9326/8/1/014007>.

Westley, F., Carpenter, S. R., Brock, W. A., Holling, C. S., Gunderson, L. H., 2002. Why systems of people and nature are not just social and ecological systems, in Gunderson, L., Holling, C. S. (Eds.) *Understanding Transformations in Human & Natural Systems*. Island Press, Washington, pp. 103–119.

WHO., 2002. Traditional Medicine Strategy 2002–2005. World Health Organisation, Geneva, pp. 70.

Yin, K.R., 2014. Case Study Research Design and Methods (5th ed.). Thousand Oaks, Sage, pp. 282.

5.7. Appendices

Appendix 1. Household Questionnaire

Section A. Biographical Data

Gender Male Female

Age Range 18-24 25-34 35-44 45-54

 55-64 65-74 75-84 85 or over

Prefer not to say....

Natural Resource Trade and Availability

1. Does this household sell resources/products?

Yes **No**

2. Twenty years ago, could you get enough from the bush when you needed it, **when in season** ?

Resource/ Product	Enough now?			Enough 20 years ago?		
	Yes	No	N/A	Yes	No	N/A
Wild Vegetables						
Wild fruit (e.g. marula)						
Edible insects (e.g. locusts, maxonja)						
Bushmeat (e.g. birds, rabbits, buck)						
Dry fire wood						
Traditional medicine						
Wood for fences & kraals (from the bush)						
Wood for building walls or roofs (from the bush)						
Wood for making carvings, utensils & implements (from the bush)						
Thatching grass						
Reeds for making mats						
Grass or twigs for making sweepers						
Grazing land for livestock						
Land to cultivate crops						

3. Are there things you used to find which you no longer find?

Yes No

4. Who do you think should control access to the natural resources around this village?

(Read the list & circle the appropriate number -more than one possible)

1 Nobody

2 Chief and induna (and their police)

3 Community Development Forum (CDF)

4 Government (e.g. nature conservation or forestry)

5 The community

6 Somebody else:.....

7 I don't know

Disputes related to natural resources

5. Has any member of this household approached the chief or induna for assistance (e.g. mediating a dispute) in the last 12 months?

Yes

No

Don't know

2 . Questions for Key Informant Interview

1. How has the role (s) of traditional institutions changed in the democratic dispensation?
2. What are the positives and challenges?
3. How will you describe the relationship between the new democratic structures and traditional institutions?
4. Are there conflicting/overlapping challenges? (e.g. the green scorpions, field rangers and tree police)
5. Has there been a vacuum with the departure of the tree police/ green scorpions from the rural landscape?
6. What were the merits or demerits of the former system which made it effective or otherwise?
7. How can the challenges of the former system be overcome and the advantages be enhanced?
8. Are there new environmental challenges confronting the society?
9. What accounts for the increasing rate of young people going into poaching?
10. Are there any interventions designed to help stem the tide of young people involved in poaching?
11. How can inclusion be enhanced in the community decision making to benefit the disadvantaged populations?

CHAPTER 6. Synthesis and general discussion:

Harnessing opportunities in the nexus of land-based livelihood adaptation and natural resource governance in the face of complex socio-ecological challenges

6.1. INTRODUCTION

Globally, the livelihoods of over 2.5 billion people are contingent on land-based livelihoods (such as agriculture) and environmental resources (FAO, 2016). However, a confluence of factors coupled with climate change compromise the ecosystem services that support such livelihoods. The ubiquitous need for novel solutions to pressing social challenges is evident in all facets of communal life (Mulgan et al., 2007), including food insecurity and degradation of natural resources. Hence, social innovation is considered to be a viable instrument for addressing such complex socio-ecological challenges with implications for related livelihoods (Bretthauer, 2014; Ide, 2015). The key aim of this study was to investigate the cardinal factors that separately or together with climate variability may be influencing land-based livelihood adaptation and effective natural resource governance at the rural community level in the context of a former homeland communal area of South Africa.

The objectives of the study were to:

- Explore the influence of key village level actors (in co-management frameworks) and nonagrarian policies on the effective management of common pool resources and land-based livelihoods (respectively) in the rural milieu.
- Investigate the influence of key individual traits of respondents such as gender, age, education and spatial patterns (location of farming activity) on strategy uptake for sustainable agriculture and enhanced climate adaptation.

Determine the impact of key individual traits of respondents on the number of land-based assets used/owned by smallholders and related numbers of agricultural strategies pursued for sustainable land-based livelihoods.

6.2. SUMMARY AND DISCUSSION OF FINDINGS

6.2.1 Social Grants and Beneficiaries' Participation in Land-based Livelihoods

Social grants facilitate beneficiaries' engagement in land-based livelihoods. Here, I explored the relative engagement in land-based livelihoods between social grants recipients and non-recipients. I tested the hypothesis that social grants beneficiaries are disincentivised to engage in productive labour such as agriculture compared to non-beneficiaries. To achieve this, I investigated the differences in participation of land-based livelihood activities amongst social grants beneficiaries and non-beneficiaries. The study was informed by the argument that the inception of social grants in the post-apartheid era, although lauded as one of the important actioned policy interventions in the rural setting (Neves & Du Toit, 2013), is associated with unintended consequences for rural livelihoods, especially engagement in agriculture and related activities amongst beneficiaries (Ferguson, 2015). However, the outcome of interviews with 182 household heads and 58 key informant indicates that social grants facilitate beneficiaries' participation in agriculture. The results of this study indicate

that some community members are too indigent to invest in land-based livelihood activities. The additional grant income empowers more of the destitute sections of the population to be involved in land-based livelihood activities (Neves et al., 2009). Therefore, the poorest in addition to accessing social grants to help them survive (SASSA, 2016; Chirau, 2018) are now equally able to engage in land-based livelihood activities (Chapter 2). This result became more evident when I compared the relative participation in livestock production which is considered a capital-intensive venture, between grant recipients and non-recipients (Chapter 2). Moreover, comparatively more grant recipients were involved in mixed farming than non-recipients. Mixed farming is regarded as congenial for agricultural resilience and climate adaptation particularly amongst smallholders. Furthermore, in many poor rural communities, livestock is the only asset of the poor and vulnerable (Rojas-Downing et al. 2017). It can hence be inferred that social grants are indirectly facilitating smallholders' climate adaptation and livelihood resilience in the face of multiple stressors. In addition, the study results contrast with the claim that there is a widespread decline in agriculture participation in rural milieux (Hebinck et al. 2011; Cousins, 2013), as 95% of respondents were involved. However, in this study I did not investigate the level of engagement or scale of respondents' participation in agriculture. Moreover, this result indicates that there is a need for improved extension support, given that the majority of farming respondents rechannelled their grants to enhance their agriculture. Given this outcome (see Tables 2.1, 2.3, 2.5, 2.7 & 2.8), the null hypothesis that "Social grants beneficiaries are disincentivised to engage in productive labour such as agriculture unlike non-beneficiaries", is rejected whilst the alternate hypothesis (claim) is accepted. That is, "Social grants beneficiaries are facilitated to engage in productive endeavour such as agriculture".

Given that livelihoods in the former Bantustans of post-apartheid South Africa remain precarious, the grants are the most predictable and stable form of income to the indigent and vulnerable households such as female-headed, the aged and disabled (Chirau, 2018). In addition, there is growing acknowledgement in the households poverty literature that vulnerabilities – of income, health, social exclusion and service delivery – are connected, and that support programmes should focus not only on enhancing the accessibility of the poor to resources and assets but also empower them to harness these assets and make decisions (Kirsten, 2011). Study results indicate that the social grants are helping smallholder beneficiaries in this vein. It can therefore be argued that the indigent's accessibility to social protection serves as an instrument for mitigating increased vulnerability under a changing climate. This affords an important safety net that reduces livelihood vulnerability of the beneficiary and expands the livelihood activities of their households (Tables 2.5, 2.7 & 2.8). Consequently, such rural development policy intervention can strengthen local people's capacity to respond to drivers of change, while diversification of the livelihood portfolio can make them more climate-resilient (Masunungure & Shackleton, 2018).

The need for novel solutions to complex socio-economic challenges by way of social innovation, cuts across the social strata including those at the grassroots or the bottom of the income pyramid (DST, 2012; Hart et al., 2014; Avelino et al., 2017). In much of the global south, agriculture and natural resources are vital to the sustenance of the poor and vulnerable. Hence, by facilitating indigent people's participation in agriculture and hence their livelihood adaptation to the impacts of climate change and land degradation. Moreover, it is noteworthy that social innovation is not unique to the welfare or non-profit sector but can also be driven by market incentives and related dynamics (DST, 2012; Hart et al., 2014; Avelino et al., 2017). The results of this study surmise that the introduction of social grants has boosted the local agricultural market and incentivized financially compromised members to engage in land-based livelihoods (Chapter 2). This includes livestock production which is capital-intensive, thereby empowering more people to participate in the local market and carve a niche for their farm produce. Furthermore, the study findings from Chapter 4 indicate that for people to successfully practice or experiment with novel strategies (per their livelihoods), they first need to have some level of land-based assets. Thus, in empowering the poorer members of the community to partake in land-based livelihoods, it can be inferred that social grants promote the building of critical land-based assets (of the poor) to experiment with novel practices. In addition, these study findings indicate that social grants have other positive livelihood impacts such as higher educational enrolment and improved nutrition (Chapter 2) which are important to developing the human resources capacity of rural communities. Moreover, both the sustainable livelihood framework and the Human Development Index stress the importance of developing critical human resources capital to address social challenges and facilitate societal development (Scoones, 2015; UNDP, 2016). Hence, it can be surmised that social grants contribute to developing the essential human resources capacity of beneficiaries (and their households) and thereby indirectly contribute to social innovation.

These study findings also have a bearing on policy recommendations for countries that might be considering introducing social grants. The World Bank database indicates there are currently circa twenty-six countries worldwide with varying forms of social grants targeting vulnerable groups with the aim of reducing poverty, promoting social integration, and creating conditions for sustainable livelihoods (Fiszbein et al., 2009; Govender, 2011). However, governments and policymakers are under pressure to prove the cost effectiveness of these social interventions and show whether they essentially help their targeted populace (Blomquist, 2003; Govender, 2011). The results of this study hence highlight the positive contributions of social grants to the land-based livelihoods of beneficiaries and their households vis-à-vis the South African context.

6.2.2 Variances in Strategy Uptake Across Key Traits Vis-À-Vis Agricultural Productivity and Sustainable Woodland Resource Management

A smallholder's age and educational attainment has a positive influence on their adoption of a mitigation strategy. With regards to this, I tested two hypotheses. First, I tested the hypothesis that key individual traits such as gender and age have no positive association with strategy uptake amongst smallholders. Secondly, I tested the hypothesis that the location of farming activity has no positive relationship with strategy uptake in smallholder systems.

In the face of poor climatic conditions such as the 2015/16 drought (attributed to cyclical El Nino), argued to be the worst in South Africa since 1904, studies have highlighted the importance of innovation in smallholder systems for resilience and productivity (Cousins, 2013; DEA, 2016). The results of this study show that key individual parameters such as respondents' educational levels and age were positively associated with the adoption of individual mitigation strategies at the study site. However, the association between strategy uptake and gender was insignificant. In the light of this outcome, the null hypothesis that "Key individual traits such as gender, educational level and age have no positive association with the uptake of agricultural strategies in response to environmental dynamics" is rejected for *educational level* (Table 3.11) and *age* ($p < 0.001$, see Table 3.8). However the null hypothesis is accepted for *gender* (see Table 3.5). Consequently, the alternate hypothesis (claim) is accepted for *gender*; "Key individual traits such as gender have a positive association with the uptake of agricultural strategies in response to environmental dynamics."

The location of farming activity recorded a significant impact on strategy uptake after controlling for other variables in a logistic regression model (Chapter 3). Hence, spatial patterns coincidentally had a positive relationship with the strategy uptake at the study site. Therefore, the results of this study indicate that an area's strategic location such as it hosting vital agricultural assets (e.g. a pond or communal cattle dip), can inadvertently position the area as an epicentre of crucial interactions (Chapter 2), transforming it into a community of practice which stimulates innovations (Goulet, 2013; Dolinska & d'Aquino 2016). Given this outcome, the null hypothesis that "The location of farming activity has no positive association with strategy uptake in rural smallholder systems" is rejected whilst the alternate hypothesis (claim) is accepted (See Tables 3.9 & 3.15). That is "The location of farming activity has a positive association with strategy uptake in rural smallholder systems". My study results suggest these factors collectively, represent core pillars/scaffolds of innovation as they facilitate strategy uptake. These ingredients given their discernible influence must therefore be given focus in innovation policies tailored for the rural environment to enhance policy effectiveness and success of related interventions as expatiated in Chapter 3. This will help ensure success of efforts at enhancing the sustainability of vulnerable land-based livelihoods such as agriculture which is critical to the sustenance of rural households.

In addition, respondent farmers were interviewed about the principal challenges they face in their adoption of a mitigation strategy. According to the farmers, inadequate financial capital coupled with low access to information were amongst the principal hurdles to the successful uptake of a strategy. Such limitations to innovation have also been observed in other studies (Cousins, 2013; Hoffmann, 2015). Farmers at the study site therefore relied on alternative sources such as their social grants to help cope with the costs of their farm-related activities (Chapter 2). Furthermore, given the dearth of extension services in the area, it was observed that the local farmers association obtained additional agricultural inputs from other provinces (Chapters 2 & 5). Social innovation empowers actors to address societal challenges and stimulate social change (Avelino et al., 2017). Moreover, social innovation has gained global currency in response to such pressing socio-economic, environmental and demographic challenges, and the realisation that innovation should address priorities arising from unemployment and poverty (DST, 2012; Hart et al., 2014; Avelino et al., 2017). The proactive measures being taken by the farmers is analogous with the core goals of social innovation. Moreover, the market scene generated on the day of social grants disbursement (5th day of each month) in the study area (Plate 3.E) as well as the weekly cattle dipping (Plate 3.B) coincidentally served as avenues for cross-pollination of farming-related ideas (Chapter 3). In indigenous communities such as at the study site, oral traditions are ingrained in the social fabric, thus it was observed that radio and television were also common sources of information to farmers during the community mapping and interview phases (Chapter 3). Electronic media are therefore conducive for disseminating farm-related information inter alia at the study site (Chapter 3). Furthermore, addressing the limitations to uptake to innovation (as listed by the farmers) inter alia is important for facilitating the successful entry of smallholder farmers into the mainstream economy as a government priority and policy aim. In addition, it will help facilitate the socio-economic development of these rural areas which are regarded as poverty endemic.

6.2.3 Disparities in Agricultural Diversification Across Key Parameters (Gender, Age, Educational Levels and Space)

Age, educational attainment and the locality of activity significantly affect the ability of smallholders to employ a suite of strategies in support of their land-based livelihood activities. Penultimately, I explored the relationship between smallholders' agricultural diversification (both in terms of diversity of asset types owned/used, and in diversity of types of strategies pursued) and related key parameters. I tested two hypotheses in this regard. Firstly, I tested the hypothesis that there is a positive relationship between key parameters such as age, gender and location of farming activity with the numbers of land-based assets used/owned by smallholders. Secondly, I tested the hypothesis that some key parameters (such as age, gender and location of farming activity) affect the numbers of agricultural strategies pursued by smallholders to secure their livelihoods.

Land-based livelihoods and associated assets are crucial elements of rural economies (Shackleton et al., 2000; UNECA et al., 2015; NEPAD, 2016). Furthermore, the Intergovernmental Panel on Climate Change (IPCC), released a special report (48th Session of the IPCC) in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty (Masson-Delmotte et al., 2018). The report highlighted the impacts of higher global and local temperatures on various sectors key to the prosperity of people and economies like agriculture. It is argued that the IPCC Special Report's anticipated climate change may well make current agricultural practices unviable (New, 2018). This makes interrogating factors that affect smallholder systems' resilience and productivity essential.

The results of this study indicate that factors such as respondents' age, level of education and locality of farming activity are significant influencers on their capacity to diversify their livelihood strategies in support of their land-based livelihood activities (Chapter 4). Moreover, to successfully derive optimum benefits from their land-based assets, smallholders must deploy a suite of novel strategies to harness the livelihood opportunities associated (Chapters 3 & 4). This effective deployment of such strategies is mediated by an interplay of different factors (Chapter 3). It was evident that smallholders in the 35–54 years age cohort exhibited extensive diversification in comparison to vulnerable groups such as the youth and the elderly. The elderly respondents who were social grant beneficiaries used their social grants to help them enhance their agriculture-related activities. This underscores the safety-net and livelihood enhancing function of the social grants scheme (SASSA, 2016). However, for the youth it is not clear which alternative sources they relied upon to shore up their livelihoods. It might be possible that young single mothers on social grants could also channel their grants into agriculture-related activities should they be engaged in such. Moreover, the social grants beneficiary categories does not include able-bodied unemployed youth (SASSA, 2016). However, this theme was not investigated during the study. Furthermore, such vulnerable groups are a key focus of the LNOB concept, for which social innovation helps facilitate their empowerment for equitable rural social change (DST, 2012; Hart et al., 2014). This is also congenial to the national objective of strengthening the workings of rural innovation value chains that yield direct positive social outcomes for the benefit of the poor and marginalised members of society (Hart et al., 2014).

In addition, education had a positive influence on respondents' level of diversification with reference to land-based livelihood strategies at the study site. Education also comes with the advantage of increasing interest, flexibility to adapt and proactivity towards new technologies (Barrantes & Yagüe 2015). Moreover, respondents with relatively lower educational levels demonstrated relatively lower levels of strategy diversification. This suggests that improved educational participation at the study site would be congenial for strategy diversification. This is important given the generally low levels of education at the study site (Chapters 2 & 5). Nevertheless, it is acknowledged that the benefits of education are often compromised in the

absence of adequate socio-economic conditions that enable people to develop decent livelihoods (Chapter 4). In the light of this outcome, the null hypothesis that “There is no positive relationship between key parameters such as age, gender, location of farming and gender with the numbers of land-based assets used/owned by smallholders” is rejected for *educational level* ($p < 0.05$, see Table 4.5) *age* ($p < 0.001$, see Table 4.6) and *locality of farming* ($p < 0.05$, see Table 4.14).

Moreover, in terms of diversity of asset types owned/used, respondents’ educational level, age and locality were the determinant factors (Chapter 4). Given this outcome, the null hypothesis that “There is no positive relationship between key parameters such as age, gender, location of farming and gender with the numbers of land-based assets used/owned by smallholders” is rejected for *educational level* ($p < 0.05$, see Table 4.10), *age* (see Table 4.14) and *locality of farming* ($p < 0.05$, see Table 4.12).

It is noteworthy that the lack of any statistically significant relationship between gender and strategy diversification as well as land-based assets used/owned at the study site augurs well for agricultural development as it limits gender disparity in managing climate impacts with consequences for household food security. Furthermore, it is argued that generally women are more vulnerable to climate impacts compared to men due to their culturally assigned household duties and limited influence in decision making (Villamor, 2017). Thus, addressing gender disparity in agriculture aside from boosting farm yields and therefore food and nutrition security globally, capacitates women to engage in other economically viable activities that contribute to the economy. The findings of this study are crucial for adaptation planning in the light of the recent IPCC special report (SR15). Ultimately, the findings of this study indicate that smallholders’ age, educational level and site of farming activity are core determinants in agricultural diversification both in terms of numbers of land-based assets used/owned as well as number of strategies pursued. This has implications for the design of local level vulnerability-reduction interventions, and can be applied broadly in informing formulation of interventions elsewhere. Hence, the findings contribute to the debate in literature concerning Sustainable Development Goal 8 (Decent Work and Economic Growth), about creating the conditions that allow people to enhance their livelihoods such as agriculture and related assets/infrastructure, as a means of increasing productivity and reducing unemployment levels in the context of the SDG 8 (UNDP, 2018). Moreover, it contributes to scholarship on the significance of assets in enhancing the productivity and lessening the vulnerability of poor peoples’ livelihoods.

6.2.4 Impact of the Changing Roles of Traditional Leaders on the Management of Communal Natural Resources

The dilution of the role of traditional institutions in the management of communal resources in the post-apartheid era compromises effective natural resources co-management at the local level. This section of the study investigated the changing roles of traditional institutions

in the management of natural resources and the challenges to effective co-management with state institutions. I tested the hypothesis that the changing roles of traditional institutions in the management of communal resources impacts the effectiveness of related natural resource co-management frameworks.

The accounts from community members at the study site (as well as the South African constitution) indicate that the joint collaboration between state and traditional institutions is imperative in the present democratic dispensation (Chapter 5). Such collaboration between different actors in meeting social goals is also in consonance with the ideals of social innovation as novel ideas have to secure support of relevant actors if they are to thrive (Mulgan et al., 2007). Nonetheless, for such co-management frameworks to be successful there is the need for some core ingredients such as inclusiveness, fairness, transparency, trust and accountability (Chapter 5) as expatiated by the Co-management Cooperation Continuum Lever. Moreover, the absence of these core elements compromises the desired effective joint partnership between the state and traditional institution at the study site as encapsulated by the respondents' accounts (Chapter 5). Hence, the potential of state and traditional institutions to effectively manage communal resources is being compromised by the ensuing animosity, lack of transparency and distrust which is straining the necessary cordial relations between the two institutions (Lockwood et al., 2010). This compromises effective natural resource governance with impacts on rural livelihoods (Mwakaje et al., 2013), further exacerbated by an inadequate understanding of civic rights which has resulted in their abuse by some rural folk (L., personal communication, July 30, 2015). This study's findings are in agreement with the null hypothesis that "The changing roles of traditional institutions in the management of communal resources negatively impacts the effectiveness of related natural resource co-management frameworks". Therefore, the null hypothesis is accepted.

Other socio-economic influences such as compliance with regulation, employment opportunities, demographics and migration also affect the overall success of environmental governance. In response to such socio-economic and environmental pressures, societies formulate new ideas and adopt measures by way of innovation to safeguard their livelihoods (Phills et al., 2008). These elements collectively serve as catalysts for a thriving social innovation ecosystem (DST, 2012; Davies & Simon, 2013). Hence, in nurturing these crucial elements in state versus traditional institutions, these other socio-economic factors also need to be taken into consideration to produce sustained results in the effective management of communal resources.

Good governance also involves information and education, thus the two institutions need to collaborate in educating the rural populace on civic responsibilities and empowering them to address the impacts of environmental degradation on rural livelihoods (Chapter 5). Moreover, effective communication is crucial for limiting misconceptions and enhancing harmonious co-management of communal resources amongst core institutions (Cundill et al., 2013;

Thondhlana et al., 2015). The harmonious co-management of communal resources (in the context of this study) therefore has a bearing on policy recommendations regarding the Sustainable Development Goals 11, 13, 15 and 16 regarding sustainable cities and communities, climate action, life on land and robust institutions respectively. Moreover, the IPCC Special Report (SR15) characterises countries in the Southern African Development Community (SADC) region as climate change “hotspots” — hot, dry and water-stressed countries (Masson-Delmotte et al., 2018; New, 2018). This scenario demands concerted efforts from both institutions in developing adaptation strategies and mainstreaming climate resilience into public, private and community sectors.

The difficulty of realising institutional change is at the centre of a several environmental governance problems in an interconnected and rapidly changing contemporary global community (Beunen & Patterssen, 2019). Thus, the theory of institutional change provides a compelling lens for understanding the interplay between actors and institutional structures in environmental governance (Elsner, 2012). Collaboration amongst institutions in the context of environmental governance involves a wide range of scales and actors to be considered and dealing with unpredictable circumstances and dynamics, which come with unpredictable consequences (Ostrom, 2008; De Koning, 2014). Given that the different institutional actors serve different interests, there is the need for actors to be more strategic and have a very broad political and contextual awareness.

This may be lacking or inadequate in the case of the customary versus state institutions. Based on the responses from the study respondents and literature reviews, it can be argued that there exists an “institutional inertia” which is compromising the needed collaboration between the customary and new institutions. This can also be traced to a history of distrust and to some extent sabotage which acts as a barrier to desirable pathways of change in environmental governance. Moreover, it is acknowledged that institutional change occurs in a specific context, characterised by particular configurations of actors, institutions, and power-knowledge dynamics. Thus, the associated outcomes cannot be isolated from this context as change does not come easily. The ensuing tensions between the two institutions are hence to be expected and put in context to help introduce tailored interventions.

This is more so for natural resource management (NRM), which involves interdisciplinary work and in a Foucaultian sense, the co-creation of power and knowledge in the governance of natural resources (Van Assche et al., 2017). This power/knowledge shapes how collective action and collaborative systems are organized. Power/knowledge configurations fluctuate through new or transformed discourses, through new actors joining governance, or through institutions pushing governance in a new direction (De Koning, 2014). In a Foucaultian perspective, the nature of effects of new power/knowledge configurations is however unpredictable, as the influences on power/knowledge are diverse. Hence, the development

of adaptive governance in a co-management framework needs to acknowledge that the process is complex and imperfect.

6.2.5 Policy Recommendations and Future Research

6.2.5.1 Policy recommendations

Enhancing the multiplier effect of grants on livelihoods through the agriculture value chain

These study findings indicate that grant recipients involved in some form of land-based livelihood activity, reinvest their grants to enhance their livelihoods (Chapter 2). Thus, the added value or knock-on effects on rural livelihoods is significantly increased amongst grant recipients involved in some form of livelihood activity in comparison to recipients who are not engaged in any productive labour (Chapter 2). Ultimately, social grants are invested in beneficiary households' livelihood activities, with the aim of achieving higher returns from the value addition (Chapter 2). Currently, people are investing their personal resources and hence the commitment is likely to be higher.

In addition, *nudging* as per behavioural science posits positive reinforcement and indirect suggestions that produce non-compulsive compliance of groups and individuals (Zagorsky, 2017). Meeting the household nutritional requirements has become increasingly dependent on cash incomes (Pereira, 2014) such as social grants (Chapter 2). Hence, in terms of the social grant scheme, beneficiaries or areas with a high population of grant recipients can be incentivised by the benefits of the agricultural endeavours and hence *nudged* into using their social grants to enhance their livelihoods and wellbeing. Moreover, smallholders can be motivated and empowered by providing enhanced extension services, training in agribusiness and other vocational skills that can supplement or serve as additional income generating opportunities. This can be coupled with capacity building on savings and investment skills to enhance the benefits of the grants and adequately tackle the triple challenges of poverty, joblessness and inequality (Ferguson, 2015; Turok, 2017; Chirau, 2018). Such challenges which are more vivid on the rural landscape are also core thematic areas of social innovation (DST, 2012; Hart et al., 2014). Thus, social innovation as a tool for social transformation promotes equitable rural social change and pro-poor innovation policy development that helps to *Leave No One Behind* (Davies & Simon, 2013; Avelino et al., 2017).

Fostering a conducive environment for innovation in smallholder systems

Education and training (formal and informal) are ingredients for innovation (Chapters 3 & 4). The results of this study indicate that the cross-pollination and uptake of farm-related innovation (in the context of mitigation strategies) are being coincidentally facilitated by the informal market and fringe interactions during the weekly cattle dipping at the study site. This suggests that the potential for such avenues to promote farmer-to-farmer information dissemination deserves focus. Relatedly, it has also been suggested that South Africa

introduces a land-grant system that connects research, education, training and extension similar to other BRICS (Brazil, Russia, India, China and South Africa) nations such as Brazil and India (Swanepoel, 2017). This involves assuming dual roles of teaching, in one capacity, and research or extension, on the other hand (Swanepoel, 2017). Thus, academics play an integral role in the entire process. For example, in their role as quasi-extension officers, academics guide farmers in the field, with the aim of facilitating sustainable production and rural development (Halvorson, 2016; Mehta et al., 2017). The lessons learnt are disseminated in academia. This study shows that smallholders are custodians of biocultural heritage with vital knowledge and experiences that can substantially contribute to the success of such an initiative. Smallholders must therefore be regarded as equal players in such multi-stakeholder collaboration and also play an integral role in the entire process. This situation promotes the diffusion of information to and from – making farmers privy and important contributors to novel research information, and making the university/research institution knowledgeable about field problems to animate the research and teaching agenda (Liu, 2015; Swanepoel, 2017). There is also the need for training extension officers with the requisite competence and practical experience to effectively support smallholder farmers (Farmers Weekly, 2017).

Safeguarding and maximising value of land-based livelihoods

The 2017 edition of the World Economic Forum Global Risks Report highlights a positive correlation between climate change and increasing wealth and income disparities (WEF, 2017). Given the high incidence of unemployment and deepening wealth gaps across the social strata and South Africa's position as one of the world's most unequal societies, novel approaches to developing the economy are necessary such that job creation for the largely unskilled workforce is enhanced (Neves & Du Toit, 2013; Turok, 2017).

Poor smallholders are relatively more dependent on land-based livelihood assets as they have limited off-farm options compared to wealthier farmers (Chapter 4). This highlights the invaluable role of land-based livelihood assets as crucial safety nets for vulnerable groups (Chapter 2). Such vulnerable groups need support in agri-business to effectively harness their resources and secure their livelihoods (Chapter 4). There is therefore the need for training in more sustainable land use practices given the scarcity of arable land and palpable impacts of climate change on agriculture (Chapter 5).

To help safeguard such land-based livelihoods and associated assets, government policies need to create favourable conditions for rural smallholder systems to thrive (Schackleton et al., 2000; Lee et al., 2009; Swanepoel, 2017). This includes facilitating access to agricultural land, favourable market terms and financial support. Increased investment in the agricultural value chain and its development is one viable approach coupled with technical and entrepreneurial training (Farmers Weekly, 2017).

Education is a catalyst for wealth creation and harnessing of assets by the relatively well educated, which helps engender an enhanced safety net (Chapter 4). This indicates that efforts to improve educational enrolment in the rural milieu needs to be reinforced. This has implications for the National Development Plan (Vision 2030) of transforming the rural areas into places of innovation and thriving businesses that bolster the economy (National Planning Commission, 2015).

Enhancing effectiveness of multi-stakeholder collaborative governance frameworks

Ultimately, the political landscape in the post-apartheid era has introduced fresh demands on natural resource governance (Hebinck et al., 2011; Cundill et al., 2013; Thondhlana et al., 2015). Adaptive management is not just an outcome, but a continuous process that requires actors' capacities to learn and influence decision-making processes (Djalante et al., 2013). The mushrooming of civic rights groups in rural areas, demanding accountability from local leaders is a healthy development which policy needs to protect given the animosity of traditional leaders towards such development (Chapter 5). This is essential for effective management of scarce common pool resources and addressing the complex dynamics of climate change on rural livelihoods through a multi-stakeholder approach (Chapter 5). Moreover, given the increasing degradation of rural livelihoods, rural resilience and competitiveness, novel ways of thinking, fresh alliances, novel processes and novel approaches to dialogue are demanded (Chapter 5).

In addition, the co-management framework in the democratic dispensation is beneficial to the goals of social innovation as it is a hybrid and premised on a multi-disciplinary approach (Cattacin & Zimmer, 2016; Turker & Vural, 2017). Moreover, the intercourse of traditional and scientific knowledge occasioned by the collaboration of the two institutions is crucial to the conservation and sustainable use of biodiversity and ecosystems for sustainable development (Chapter 5). Policy must therefore promote the interaction of the two core institutions and associated knowledge systems in the management of common pool resources and addressing the complex dynamics of climate change.

6.2.5.2 Future research

The literature on social welfare schemes such as social grants indicates that they have a number of livelihood enhancing benefits that facilitate local economic development (World Bank, 2014; Mabugu & Chitiga-Mabugu, 2019). However, reports of misuse of the social grants have also been recorded (World Bank, 2014; Mabugu & Chitiga-Mabugu, 2019). Study findings (Chapter 2) indicate that social grants help beneficiaries alleviate the cost of their agricultural activities such as farm labour. It is acknowledged that social capital plays an important role in overcoming farm labour challenges and coping with adverse socio-economic conditions in many rural communities such as the study site. The missing component is how social grants enhance or compromise social capital which is vital in meeting labour needs in many poor rural areas. Further research is needed to explore how social grants affect the social capital building of beneficiaries.

Livelihood diversification is argued to be essential for coping with economic and environmental shocks, thus safeguarding livelihood security given the precarious conditions that affect rural life in several developing nations (Ellis, 2008; Gautam & Andersen, 2016). Moreover, the diversification of livelihoods is seen as crucial for resilience with consequences for household welfare (Gebru et al., 2016; Dinku, 2018). However, diversification is often used in terms of multiple livelihoods but not within livelihoods (Chapters 3 & 4). Moreover, the relationship between the two is unclear. It would be interesting to investigate how diversification of strategies within livelihoods (such as agriculture) relates with diversification across different livelihoods along key individual or household traits. This will help to understand whether smallholders' engagement in multiple livelihoods affects their agricultural productivity or has other implications for the sustenance of their agricultural activities.

People with disabilities are marginalised and often excluded from full participation in society worldwide (APCD et al., 2013; SAHRC, 2018). In South Africa, disabled people are confronted with several forms of discrimination in diverse social spheres, including in access to gainful employment and other socio-economic opportunities (SAHRC, 2018). Study outcomes (Chapter 5) indicate that the disabled group at the study site feel marginalised in accessing land and allied resources to expand their agricultural activities. In the light of the LNOB, further research will be helpful to investigate how disabled farmers fare in terms of land-based asset classes in comparison to able-bodied farmers and the implications for food security and rural development.

Natural resource-induced conflicts are universal, but are accentuated by a number of factors in contemporary society such as an increasing competition over scarce and finite resources (Ayling & Kelly, 1997; UN, 2018). It was observed that disputes related to natural resources were common amongst respondents. Both the traditional court and state structures were used to mediate such disputes. However, the nature of the disputes related to natural resources sent for arbitration between the two was not investigated. Given the traction gained by the Traditional Courts Bill and complaints from study participants about the arbitration and compensation processes, it would be interesting to investigate the types of natural resources-related disputes sent to these institutions along key traits to help inform interventions on improving the arbitration processes.

6.3. REFERENCES

APCD., Nippon Foundation., & FAO. (2013). Regional Workshop on Disability-Inclusive Agribusiness Development. Bangkok, Asia-Pacific Development Center on Disability (APCD), 66 pp.

Avelino, F., Wittmayer, J. M., Pel, B., Weaver, P., Dumitru, A., Haxeltine, A., Kemp, R., Jørgensen, M. S., Bauler, T., Ruijsink, S., & O'Riordan, T. (2017). Transformative social innovation and (dis)empowerment. *Technological Forecasting & Social Change*, 145, 195–206. <https://doi.org/10.1016/j.techfore.2017.05.002>.

Ayling, R., & Kelly, K. (1997). Dealing with conflict: Natural resources and dispute resolution. *The Commonwealth Forestry Review*, 76 (3), 182–185.

Barrantes, C., & Yagüe, J. L. (2015). Adults' education and agricultural innovation: A social learning approach. *Procedia - Social and Behavioural Sciences*, 191, 163–168.

Beunen, R., & Patterssen, J. J. (2019). Analysing institutional change in environmental governance: Exploring the concept of 'institutional work'. *Journal of Environmental Planning & Management*, 62 (1), 12–29. <https://doi.org/10.1080/09640568.2016.1257423>.

Blomquist, J. (2003). Impact evaluation of social programs: A policy perspective. Social Safety Nets Primer Notes, No. 14. Washington, World Bank, 2 pp. <http://documents.worldbank.org/curated/en/386851468140967391/Impact-evaluation-of-social-programs-a-policy-perspective> accessed on 02.04.2016.

Bretthauer, J. M. (2014). Conditions for peace and conflict: Applying a fuzzy-set qualitative comparative analysis to cases of resource scarcity. *Journal of Conflict Resolution*, 59 (4), 1–24. <https://doi.org/10.1177/0022002713516841>.

Cattacin, S., & Zimmer, A. (2016). Urban Governance and Social Innovations. In: Brandsen T., Cattacin S., Evers A., & Zimmer A. (Eds.). *Social Innovations in the Urban Context. Nonprofit and Civil Society Studies* (An International Multidisciplinary Series), (pp. 21–44). Cham-Heidelberg, Springer. https://doi.org/10.1007/978-3-319-21551-8_2.

Chirau, T. J. (2018). Female headed household's rural livelihood trajectories in post-apartheid former Bantustans of South Africa: Emerging evidence from the Eastern Cape. *Bangladesh e-Journal of Sociology*, 15 (1), 148–162.

Cousins, B. (2013). Smallholder irrigation schemes, agrarian reform and 'Accumulation from Above and from Below' in South Africa. *Journal of Agrarian Change*, 13 (1), 116–139.

Cundill, G., Thondhlana, G., Sisitka, L., Shackleton, S., & Blore, M. (2013). Land claims and the pursuit of co-management on four protected areas in South Africa. *Land Use Policy*, 35, 171–178.

Davies, A., & Simon, J. (2013). Engaging Citizens in Social Innovation: A Short Guide to the Research for Policy Makers and Practitioners. A deliverable of the Project: "The Theoretical, Empirical and Policy Foundations for Building Social Innovation in Europe" (TEPSIE), European Commission – 7th Framework Programme. Brussels, European Commission–DG Research, 22 pp. <https://youngfoundation.org/wp-content/uploads/2013/11/Engagign-citizens-in-social-inno.pdf> accessed on 09.04.2016.

DEA. (2016). National Climate Change Adaptation Strategy. Pretoria, Department of Environmental Affairs, 123 pp.

De Koning, J. (2014). Unpredictable outcomes in forestry – governance institutions in practice. *Society & Natural Resources*, 27 (41), 358–371. <https://doi.org/10.1080/08941920.2013.861557>.

Dinku, A. M. (2018). Determinants of livelihood diversification strategies in Borena pastoralist communities of Oromia regional state, Ethiopia. *Agriculture & Food Security*, 7, 41–49. <https://doi.org/10.1186/s40066-018-0192-2>.

Djalante, R., Holley, C., Thomalla, F., & Carnegie, M. A. (2013). Pathways for adaptive and integrated disaster resilience. *Natural Hazards*, 69 (3), 2105–2135.

Dolinska, A., & d'Aquino, P. (2016). Farmers as agents in innovation systems. Empowering farmers for innovation through communities of practice. *Agricultural Systems*, 142, 122–130.

DST. (2012). Final Report of the Ministerial Review Committee on the Science, Technology and Innovation Landscape in South Africa. Pretoria, Department of Science & Technology (DST), 43 pp.

Ellis, F. (2008). The Determinants of Rural Livelihood Diversification in Developing Countries. *Journal of Agricultural Economics*, 51 (2), 289–302. <https://doi.org/10.1111/j.1477-9552.2000.tb01229.x>.

Elsner, W. (2012). The theory of institutional change revisited: The institutional dichotomy, its dynamic, and its policy implications in a more formal analysis. *Journal of Economic Issues*, 46 (1), 1–44. <https://doi.org/10.2753/JEI0021-3624460101>.

FAO. (2016). Increasing the Resilience of Agricultural Livelihoods. Rome, Food & Agriculture Organisation (FAO), 20 pp.

Farmers Weekly. (2017). The Three Things Black Farmers Need. <https://www.farmersweekly.co.za/opinion/blog/letter-from-the-editor/three-things-black-farmers-need/> accessed on 12.12.2017.

Ferguson, J. (2015). *Give a Man a Fish: Reflections on the New Politics of Distribution*. Durham, Duke University Press, 280 pp.

Fiszbein, A., Schady, N., Ferreira, F. H. G., Grosh, M., Keleher, N., Olinto, P., & Skoufias, E. (2009). *Conditional cash transfers: Reducing present and future poverty - overview*. A World Bank Policy Research Report. Washington-DC, World Bank, pp. 383. <http://documents.worldbank.org/curated/en/983221468139491900/Conditional-cash-transfers-reducing-present-and-future-poverty-overview> accessed on 06.09.2017.

Gautam, Y., & Andersen, P. (2016). Rural livelihood diversification and household well-being: Insights from Humla, Nepal. *Journal of Rural Studies*, 44, 239–249. <https://doi.org/10.1016/j.jrurstud.2016.02.001>.

Gebru, G. W., Ichoku, H. E., & Phil-Eze, P. O. (2016). Determinants of livelihood diversification strategies in Eastern Tigray region of Ethiopia. *Agriculture & Food Security*, 7 (62), 1–9. <https://doi.org/10.1186/s40066-018-0214-0>.

Goulet, F. (2013). Narratives of experience and production of knowledge within farmers' groups. *Journal of Rural Studies*, 32, 439–447.

Govender, M. (2011). *Conditional Cash Transfers as a Means of Addressing Poverty in South Africa* (Unpublished doctoral Thesis). Pretoria, University of South Africa (UNISA) Scholarly Works, 415 pp. http://uir.unisa.ac.za/bitstream/handle/10500/5303/thesis_govender_m.pdf?Sequence=1 accessed on 17.10.2018.

Halvorson, G. A. (2016). The role of a 1994 land grant college. *Rangelands*, 38 (1), 14–15.

Hart, T., Jacobs, P., Ramoroka, K., Mangqalaza, H., Mhula, A., Ngwenya, M., & Betty, L. (2014). Social innovation in South Africa's rural municipalities: Policy implications. Policy brief March 2014. Pretoria, Human Sciences Research Council (HSRC), pp. 6. <http://www.hsrc.ac.za/uploads/pageContent/4574/2014%20March%20pb%20social%20innovation.pdf> accessed on 15.05.2018.

Hebinck, P., Fay, D., & Kondlo, K. (2011). Land and agrarian reform in South Africa's Eastern Cape Province: Caught by continuities. *Journal of Agrarian Change*, 11 (2), 220–240. <https://doi.org/10.1111/j.1471-0366.2010.00297.x>.

Hoffman, T. (2015). Environmental Change in Twentieth-Century South Africa and its Implications for Land Reform. In: Cousins, B., & Walker, C. (Eds.). *Land Divided, Land Restored: Land Reform in South Africa for the 21st Century*, (pp. 56–67). Johannesburg, Jacana Media.

Ide, T. (2015). Why do conflicts over scarce renewable resources turn violent? A qualitative comparative analysis. *Global Environmental Change*, 33, 61–70. <https://doi.org/10.1016/j.gloenvcha.2015.04.008>.

Kirsten, M. A. (2011). *Improving the well-being of the poor through microfinance: Evidence from the Small Enterprise Foundation in South Africa* (Unpublished doctoral Thesis). Stellenbosch, University of Stellenbosch Scholarly Works, 315 pp. http://resep.sun.ac.za/wp-content/uploads/2017/10/kirsten_improving_2011.pdf accessed on 13.05.2019.

Lee, D. R., Neves, B., Wiebe, K., Lipper, L., & Zurek, M. (2009). Rural Poverty and Natural Resources: Improving Access and Sustainable Management. ESA Working Paper, No. 09-03. Rome, FAO, 132 pp. <http://www.fao.org/3/a-ak422e.pdf> accessed on 01.08.2019.

Liu, S. (2015). Spillovers from universities: Evidence from the land-grant program. *Journal of Urban Economics*, 87, 25–41.

Lockwood, M., Davidson, J., Curtis, A., Stratford, E., & Griffith, R. (2010). Governance principles for natural resource management. *Society & Natural Resources*, 23 (10), 986–1001.

Mabugu, R., & Chitiga-Mabugu, M. (2019). Are social grants a threat to fiscal sustainability? Human Sciences Research Council (HSRC). <http://www.hsrc.ac.za/en/review/hsrc-review-november-2013/social-grants-fiscas> accessed on 04.02.2019.

Masson-Delmotte, V., Zhai, P., Pörtner, H., Roberts, D., Skea, J., Shukla, P. R., Pirani, A., Moufouma-Okia, W., Péan, C., Pidcock, R., Connors, S., Matthews, J. B. R., Chen, Y., Zhou, X., Gomis, M. I., Lonnoy, E., Maycock, T., Tignor, M., & Waterfield, T. (Eds.). (2018). IPCC, 2018: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. In Press. https://www.ipcc.ch/site/assets/uploads/sites/2/2019/06/SR15_Full_Report_High_Res.pdf accessed on 06.10.2018.

Masunungure, C., & Shackleton, S. E. (2018). Exploring long-term livelihood and landscape change in two semi-arid sites in southern Africa: Drivers and consequences for social–ecological vulnerability. *Land*, 7 (2), 50–73. <https://doi.org/10.3390/land7020050>.

Mehta, S., Lal, R., & Hansen, D. (2017). US Land-Grant Universities in India: Assessing the consequences of agricultural partnership, 1952–1972. *International Journal of Educational Development*, 53, 58–70. <https://doi.org/10.1016/j.ijedudev.2016.12.009>.

Mulgan, G., Tucker, S., Ali, R., & Sanders, B. (2007). Social innovation what it is, why it matters and how it can be accelerated. Oxford, Skoll Centre for Social Entrepreneurship (Saïd Business School), 52 pp. http://eureka.sbs.ox.ac.uk/761/1/Social_Innovation

pdf accessed 08.12.2017.

Mwakaje, A. G., Manyasa, M., Wawire, N., Muchai, M., Ongare, D., Mugoya, C., Masiga, C. W., & Nikundiwe, A. (2013). Community-based conservation, income governance, and poverty alleviation in Tanzania: The case of Serengeti ecosystem. *The Journal of Environment & Development*, 22 (1), 51–73. <https://doi.org/10.1177/1070496512471949>.

National Planning Commission. (2015). Our Future— Make It Work. National Development Plan (2030). Pretoria, National Planning Commission, 489 pp. https://nationalplanningcommission.files.wordpress.com/2015/02/ndp-2030-our-future-make-it-work_0.pdf accessed on 23.04.2018.

NEPAD. (2016). Yaounde Declaration and Plan of Action. 2nd Africa Rural Development Forum. Yaoundé, 8 – 10 September, 2016. Midrand, NEPAD, 3 pp. <https://www.nepad.org/publication/yaounde-declaration-and-plan-action-2nd-africa-rural-development-forum> accessed on 05.06.2018.

Neves, D., & Du Toit, A. (2013). Rural livelihoods in South Africa: Complexity, vulnerability and differentiation. *Journal of Agrarian Change*, 13 (1), 93–115. <https://doi.org/10.1111/joac.12009>.

Neves, D., Sampson, M., Van Niekerk, I., Hlatshwayo, S., & Du Toit, A. (2009). The Use and Effectiveness of Social grants in South Africa. Research Report to the FinMark Trust. Cape Town, Institute for Poverty, Land and Agrarian Studies (PLAAS) and Economic Policy Research Institute (EPRI), pp 12. www.finmarktrust.org.za/.../getfile.aspx?...%20The%20use%20and%20effectiveness%20of%20social%20grants%20in accessed 04.05.2016.

New, M. (2018). What latest assessment on global warming means for southern Africa. The Conversation. <https://theconversation.com/what-latest-assessment-on-global-warming-means-for-southern-africa-104644> accessed on 02.09.2018.

Ostrom, E. (2008). Institutions and the environment. *Economic Affairs*, 28 (3), 24–31. <https://doi.org/10.1111/j.1468-0270.2008.00840.x>.

Pereira, M. L. (2014). The future of South Africa's food system: What is research telling us? Stellenbosch University, Southern Africa Food Lab, 54 pp. http://awsassets.wwf.org.za/downloads/safl_the_future_of_south_africas_food_system.pdf accessed on 04.06.2016.

Phills, J. A., Deiglmeier, K., & Miller, D. T. (2008). Rediscovering social innovation. *Stanford Social Innovation Review*, 6 (4), 34–43.

Rojas-Downing, M. M., Nejadhashemi, A. P., Harrigan, T., & Woznicki, S. A. (2017). Climate change and livestock: Impacts, adaptation, and mitigation. *Climate Risk Management*, 16, 145–163. <https://doi.org/10.1016/j.crm.2017.02.001>.

SAHRC. (2018). Research brief on disability and equality in South Africa 2013 – 2017. South African Human Rights Commission (SAHRC). <https://www.sahrc.org.za/home/21/files/RESEARCH%20BRIEF%20ON%20DISABILITY%20AND%20EQUALITY%20IN%20SOUTH%20AFRICA%202013%20to%202017.pdf> accessed on 04.02.2019.

SASSA. (2016). A Statistical Summary of Social Grants in South Africa Fact Sheet. Issue No. 12 of 2016 – 31 December 2016. https://www.google.com/search?rlz=1C1GCEU enZA821Zm A82 1&ei=9KNBXbzBJfGb1fAPvKm16A8&q=A+statistical+summary+of+social+grants+in+South+Africa+Fact+sheet%3A+Issue+no+12+of+2016+%E2%80%93+31+December+2016&oq=A+statistical+summary+of+social+grants+in+South+Africa+Fact+sheet%3A+Issue+no+12+of+2016+%E2%80%93+31+December+2016&gs_l=psy-ab.12..0i22i30.28251.45024..62465...0.0..0.270.540.1j0j2...1....1j2..gws-wiz.....0..0i71j0.vQ1IzdlviE&ved=0ahUKEwi8i43Ard_jAhXxTRUIHbxUDf0Q4dUDCAo accessed on 04.09.2016.

Scoones, I. (2015). Sustainable livelihoods and rural development. Bourton, Practical Action Publishing, 168 pp.

Shackleton, S., Shackleton, C., & Cousins, B. (2000). The Economic Value of Land and Natural Resources to Rural Livelihoods: Case Studies from South Africa. In: Cousins, B. (Ed.). *At the Crossroads. Land and Agrarian Reform in South Africa into the 21st Century*, (pp. 35–67). Cape Town & Braamfontein, Programme for Land and Agrarian Studies (University of the Western Cape and National Land Committee).

Swanepoel, F. (2017). Agriculture training in South Africa badly needs an overhaul. Here are some ideas. The Conversation. <https://theconversation.com/agriculture-training-in-south-africa-badly-needs-an-overhaul-here-are-some-ideas-85272> accessed on 12.12.2017.

Thondhlana, G., Shackleton, S., & Blignaut, J. (2015). Local institutions, actors, and natural resource governance in Kgalagadi Transfrontier Park and surrounds, South Africa. *Land Use Policy*, 47, 121–129.

Turker, D., & Vural, C. A. (2017). Embedding social innovation process into the institutional context: Voids or supports. *Technological Forecasting & Social Change*, 119, 98–113.

Turok, I. (2017). A shift in thinking is needed to counter South Africa's startling rise in poverty. The Conversation. <https://theconversation.com/a-shift-in-thinking-is-needed-to-counter-south-africas-startling-rise-in-poverty-83462> accessed on 12.12.2017.

UN. (2018). The EU-UN partnership on land, natural resources and conflict prevention. <http://www.un.org/en/land-natural-resources-conflict/> accessed on 04.02.2019.

UNDP. (2016). Human development index (HDI). Human Development Report 2016. <http://report2016.archive.s3-website-us-east-1.amazonaws.com/> accessed on 04.05.2016.

UNDP. (2018). What are the sustainable development goals? <http://www.undp.org/content/undp/en/home/sustainable-development-goals.html> accessed on 05.06.2018.

UNECA., African Union., African Development Bank Group., & UNDP. (2015). MDG Report 2015: Assessing Progress in Africa Toward the Millennium Development Goals. Addis Ababa, Economic Commission for Africa (UNECA), 112 pp. https://www.uneca.org/sites/default/files/PublicationFiles/mdg-2015_eng_16sep_rev2.pdf accessed on 05.06.2018.

Van Assche, K., Beunen, R., Duineveld, M., & Gruezmacher, M. (2017). Power/knowledge and natural resource management: Foucaultian foundations in the analysis of adaptive governance. *Journal of Environmental Policy & Planning*, 19 (3), 308–322. <https://doi.org/10.1080/1523908X.2017.1338560>.

Villamor, G. (2017). Men and women farmers in Benin are responding differently to climate-change. The Conversation. <https://theconversation.com/men-and-women-farmers-in-benin-are-responding-differently-to-climate-change-72110> accessed on 09.05.2017.

WEF. (2017). The Global Risks Report 2017 (12th Edition). Geneva, World Economic Forum, pp. 78. http://www3.weforum.org/docs/GRR17_Report_web.pdf accessed on 12.12.2017.

World Bank. (2014). South Africa Economic Update: Fiscal Policy and Redistribution in an Unequal Society. World Bank Other Operational Studies 20661, The World Bank. Washington-DC, World Bank Group, pp. 59. <http://documents.worldbank.org/curated/en/933231468101334970/South-Africa-economic-update-fiscal-policy-and-redistribution-in-an-unequal-society> accessed on 04.02.2019.

Zagorsky, J. L. (2017). Economist who helped behavioural ‘nudges’ go mainstream wins Nobel. The Conversation. <https://theconversation.com/economist-who-helped-behavioral-nudges-go-mainstream-wins-nobel-85430> accessed on 12.12.2017.