G17M8368
Indigenous knowledge of ecosystem services in rural communities of the Eastern Cape, South Africa

Chenai Murata

A thesis submitted in fulfilment of a Doctor of Philosophy in Environmental Science

Department of Environmental Science

Faculty of Science

Rhodes University

Supervised by

Professor Anthony R Palmer and Professor Gladman Thondhlana

November 2020

Declaration

I, Chenai Murata hereby declare that this thesis is my own original work, has not been submitted for any degree or examination at any other university, and that the sources I have used have been fully acknowledged by complete references. This thesis is submitted in fulfilment of a PhD in Environmental Science in the Faculty of Science at Rhodes University, South Africa.

Signature:  Date 17/11/2020

Dedication

I dedicate this thesis to the living sprit of my late father, Philemon Murata, a man who during his life never set foot in an institution of formal learning, a traditional healer of note, a rainwater manager, and an informed, albeit illiterate, oral historian, who introduced me to both the ontology and epistemology of indigenous knowledge systems at a very tender age.

Acknowledgements

I conducted this study under the National Research Foundation (NRF) research project entitled *Indigenous Knowledge Systems (IKS) to enhance rewards for ecosystem services in rangelands infested with invasive alien plants in South Africa.* I thank the NRF for financial support, and Dr Sukhmani Mantel for administering the NRF bursary. I thank my supervisors, Prof. Anthony R Palmer and Dr Gladman Thondhlana, for providing intellectual guidance, reading my draft chapters thoroughly, and making insightful suggestions.

I thank my wife, Loveness, for her support and care of the family when I was away working on this thesis. To my mother Elina, I say that thank you for your words of encouragement: *"zvichanaka chete, chazvo kunonoka"* (although it may take time, it will be all right in the end). To my children, Chenai, Elina and Phillip: your existence in my life is why I persevered until I completed this thesis.

My study journey, from Grade 1, was a family project to which every family member contributed in various ways, including financing. I thank all my siblings, Margret, Judith, Eva, Rachel, Samson, Wilson, Edson, Phoebe, Phillip, Ephraim, Violet, Daniel, Taurai and Petros, for supporting me since Grade 1. To the spirits of those who passed on before this day, I thank you for being with me always, and all your spouses and children. Thank you, Mr Rob Sacco, for sponsoring my Advanced Level Education, and the Zimbabwean government for sponsoring my first degree. This PhD would not have been possible without your support from the beginning.

Many thanks go to the traditional and political leadership of Mgwalana, Mahlungulu, Colana, Gogela and Nozitshena for allowing me to conduct this study in your villages. I thank my respondents for patiently responding to my interview questions, and the community members who gave context to my work. Thank you to the field assistants who made this work possible: Mvuyisi Senior Tsalu, Lindiwe Mafuya, Noloyiso Otso Ngxakweni, Nombongo Somkhwitshi, Zinande Gogela, Msawenkosi Ntulini and Yamkela Gogela. Mrs Magaba Tsalu. Ms Nothembile Beatrice Ngxakweni, generously hosted me during my fieldwork. I extend my gratitude to members of the Department of Environmental Science and the Institute for Water Research for supporting me throughout my PhD. Finally, I thank my friend Dr Hlanganipai Ngirande for helping me throughout the process of putting this work together.

Foreword

A brief account of my initiation into the world of indigenous knowledge systems

Circumstances of my personal upbringing exerted substantial influence on the focus I adopted in this study. I was born to strongly traditional parents and grew up in remote rural village under chief Chikukwa in the Chimanimani District of Zimbabwe. Neither my father nor all his polygamous wives, had any formal education. All my sisters and brothers from the polygamous family ended formal education at primary level, except one brother who completed Ordinary level (Form 4) through support from external funders. My parents were unemployed and had no money to send children to secondary school.

My father was a traditionalist, an oral historian, a traditional healer and a rain-spirit medium. I grew up seeing groups of people, some from local universities and others from governmen flocking to our home to interview my father about historical events, especially wars of colonial conquest and liberation. Because he was a rain-spirit medium, he was the person to whom elders from our village and several other neighbouring villages went in times of rain-problems: late rains, prolonged heavy rains, and lightning. He also attended to other village natural disasters, such as outbreak of pests, like locusts and stalk-borers that destroyed crops.

In 1993 when we had very heavy rains in Chikukwa village, rivers overflowed and arable lands were washed away. The village had stopped functioning; no one could work in the fields, and overflowing rivers prevented children from going to school. One day a group of elderly women, came home singing and shouting, mainly in obscene language. In a poetic fashion, they recited my father's praise verses, calling him by his clan names (*Beta, Hanzu, Dhliwayo*), narrating how he was connected with the ancestral world. Finally, they kotowed and begged my father to stop the rain. Without saying a word, my father stood up and went into his hut, the hut he used for consulting with his clients, and locked himself inside. When he came out after about half an hour, the rain had already subsided, and there was no lightning anymore. The women thanked him and went back to their homes. The following day there was no rain at all. The village started to function again.

My father was also a renowned traditional healer providing health and spiritual services to many people of our village and beyond. He often asked me to fetch the roots, bark, or leaves

of medicinal plants from the forest. Many people came to our home to consult with him, some as individuals and others as groups of family members. Among his patients, there was a special group of the formally educated people: teachers, nurses and local government officials, as well as ordinary Christians, pastors and prophets.

Members of this special group visited my father late at night, usually after 22h00. They knocked on the boys' hut in which I slept with my elder brothers. After one of us opened the door, the visitors would whisper in low voices, asking us to go and tell our father that they had arrived. As the youngest in the hut, I was often tasked to inform my father. After attending to them, the next morning my father would give me a few bundles of things wrapped in paper to take on my way to school. The bundles ranged from the size of a lollipop sweet to the size of a naartjie. In a stern, low, hoarse voice, he commanded me to put the things in the bottom of my plastic bag of books and make sure no one saw them. I would have to give these things to pastor so-and-so or teacher so-and-so after school.

I obeyed my father in whatever he asked me to do, out of both genuine respect for him and fear. He was not an easy person to ask questions, especially if you were young. When I got to school, I kept the bag clutched under my armpit, even when playing football during morning break and lunchtime. I ran and fell in the playground with my bag; it did not matter to me. I had to keep the things safe and secrete.

After school, I left my friends and walked to the pastor's home, making sure I walked alone. It appeared the pastor did not want his children to see the things. As soon as he or his wife heard that I had arrived, they would quickly step towards me, sit me down, isolating me from their children. When everyone was gone, the pastor asked me to give him his things. The word 'things' was the vocabulary all parties, my father and his clients, regularly used. They never told me what these things were, but I knew they were bundles of traditional medicine. All this happened at the time I had converted to Christianity in a Pentecostal church of which I was member from 1988 to 2000. In the church, one preacher after the other, including members of my father's special group of clients, vehemently spoke against the practices of consulting traditional healers and of worshipping ancestors. They alleged that ancestors were demons, and traditional healers were witchdoctors who should not be associate with the holy Christians. They advised that, when in difficulties, rather than consulting traditional healers or performing rituals ceremonies to supplicate ancestors, Christians should pray hard and fast; the Holy Spirit

would solve all their problems. And yet, after preaching this gospel in daylight, some of them would come to my father in the privacy of a dark night to get things.

As a young child in a patriarchal society in which the young are taught to obey but not to ask questions, I resisted the temptation to ask my father what was going on. I could not ask his clients either. My curiosity was further whetted by the reality that my father never explained anything to me or to my siblings. He told me what to do, when to do it, and how to do it, but not the reasons for doing it. I grew up with a lot of questions about his world of knowing. My father passed on in 1998 at the age of 74 while I was in Form Six at a Missionary boarding school where my tuition was paid for by Mr Rob Sacco, a white Zimbabwean who had emigrated from South Africa in 1981, fleeing apartheid. In 2000, I left Christianity because I felt I was living a life of confusion and contradictions.

I have always remained curious about traditional knowledge. In 2017 when I was admitted to Rhodes University to conduct a doctoral study project in IKS, I felt this was an opportunity to study traditional knowledge in a systematic way, to sit down with the elderly and ask them the questions that I failed to ask my own father when he was alive. Consequently, I directed this study of IKS in ecosystem service along a path that deals with traditions, customs, and the use of medicinal plants, taboos, and knowledge of those with little to no formal education. This is traditional ecological knowledge (TEK).

The study began in 2017 in the villages of Mahlungulu and Mgwalana, collecting data dealing with local people's knowledge of ecosystem services (Chapter 2). About halfway the data collection process, I discovered that my respondents did not talk enough of how important aspects of traditional knowledge such as taboos, belief and sacredness influenced what they knew about ecosystem services. In separate meetings with my supervisors and field assistants, we made sense of what was happening and paved a way forward. One insight that emerged from these discussions was that the two study sites were too close to towns to constitute traditional communities.

Although the knowledge that the respondents held was non-scientific, it did not match the description of TEK; rather, it was local ecological knowledge (LEK). After writing the chapter, I relocated the study to three, more remote villages of Colana, Gogela and Nozitshena. I knew this area was traditional because I had conducted a study for my Master's degree at Gogela

village in 2008 and 2009 in which I wrote about indigenous techniques of water and soil conservation (Murata, 2010). These villages provided the data for Chapters 3, 4 and 5.

This study has provided me with both an opportunity to pursue academic growth in the field of IKS, and a personal journey to rediscover the world of my late father, a world which I have always fondly admired but without the sure knowledge of what it entails.

Abstract

This thesis is on indigenous knowledge of ecosystem services. The ecosystem service framework and its associated concepts are fairly young, having been introduced in the ecological discipline in the 1980s. The ecosystem service framework posits that the wellbeing of humans and their communities is dependent on services supplied by ecosystems. It emphasises that for the ecosystems to be able to supply the services, they need to be in a well-functioning state. This idea of well-functioning is predicated on the argument that the ecosystem service framework enjoins resource users to exercise responsible stewardship to prevent degradation and overharvesting. Moreover, the concept of dependence suggests that ecosystem services are of value to humans. The dominant means of measuring the value of ecosystem services has been the economic valuation method in which the contribution that each service makes to human wellbeing is quantified into monetary units. The framework disaggregates the services into four groups, namely provisioning, cultural, supporting and regulatory and seeks to all the pillars of human wellbeing including health, subsistence and spirituality into each of these groups. In doing all this, the framework significantly reconfigures the way we look at and present human-nature relations. This change has the potential to influence significant shifts in how ecological research and intervention programmes are conducted in the foreseeable future. However, the reality that the ecosystem service framework was formulated within, and is informed by the scientific epistemology begs the question: what do traditional rural communities who depend mainly on indigenous knowledge systems (IKS) for shaping and interoperating their relations with nature know of the ecosystem service concept? Rural communities are the ones who interact directly with nature on a day-to-day basis. This makes them a very critical component in the ecosystem service framework. Although South Africa has had studies in the ecosystem service theme, little has been done to attempt to investigate and document indigenous knowledge of ecosystem services that rural communities possess. By focusing only on scientific knowledge of ecosystem services, the South African literature does not do justice to the plural epistemologies of the ecosystem service users in the country. More importantly, the continued dearth of public information on indigenous knowledge of ecosystem services can potentially obstruct implementation of locally sensitive intervention programmes because nothing is known about how the local communities conceptualise the ecosystem service framework. All this presents a crucial gap in the South African research; one that unless effort is made to contribute towards filling it, our knowledge of how communities experience the ecosystem service framework in South Africa will remain

skewed. This study set out to investigate and document indigenous knowledge of ecosystem services in order to contribute towards filling this gap. Indigenous knowledge system is an umbrella epistemic system that includes lay ecological knowledge (LEK), traditional ecological knowledge (TEK) and many other related organized systems of knowing. Although the thesis has a chapter on LEK, its primary focus was TEK because the thesis was interested in unravelling how aspects of tradition including taboos, customs, traditional rules and belief in ancestral forces influence local communities' knowledge of some key aspects of the ecosystem service framework including knowledge of various ecosystem services, valuation of ecosystem services, management of ecosystem services and perceptions of the management practices. The decision to focus on TEK was based on the reasoning that rural communities of the Eastern Cape boast a strong reputation of being traditional, recognizing ancestral spirits, legends and taboos as critical tools of knowledge generation and transmission. Using both mixed methods in some chapters and the qualitative approach alone in others, the study collected data in five villages of Mgwalana, Mahlungulu, Colana, Gogela and Nozitshena located in the north eastern part of Eastern Cape Province of South Africa, a region formerly called Transkei. The data were collected not on ecosystem services; but on the local people's knowledge of ecosystem services. Although literature was consulted, the study regarded respondents as the primary source of data, hence the findings and conclusions presented in this thesis are about what local people know about ecosystem services. The study uses critical realist theoretical lenses to interpret respondents' reports. The lenses included the principle of the separation between ontology and epistemology, the iceberg metaphor of ontology, epistemological pluralism and the hermeneutic dimension. These lenses were used to make sense of both the knowledge system of local people and the things about which their knowledge was. As part of discussing the local people's knowledge, the study sometimes refers to science. This is not because I expected them to demonstrate knowledge similar to science. Instead, it was a critical realist dialectical way of explaining what something is by demonstrating what it is not. The study made a couple of key findings that can potentially enhance the growth of the South African ecosystem service discipline. First, respondents demonstrated knowledge of ecosystem services by mentioning a range of them such as drinking water, medicinal plants, cultural plants and fuelwood and how they affect the wellbeing of humans. However, what they did not have good knowledge of is that nature services can be classified into the four groups of supporting, regulatory, cultural and provisioning. Among the four ecosystem services groups, respondents could identify two only; provisional and cultural. Second, local communities depend heavily on ecosystem services for their well-being. The services include fuelwood,

construction timber, medicinal plants, wild fruits, wild fish, cultural services and thatch grass. Although they appreciate that ecosystem services have value to their wellbeing, local people found it difficult to represent the value in monetary units. The conditions that make it difficult for local people to perceive ecosystem services as commodities include the absence of well-defined property system, lack of a quantitative consumer tradition and absence of an economic conception of nature. Third, local people understand the need to keep ecosystems in a well-functioning state hence they implement several traditional practices to manage ecosystem services. These practices include taboos, designating certain resources as sacred, legends, customary law, as well as some secular practices including *gelesha* and stone terracing. However, it is not easy to understand how traditional management practices work because they are not empirically observable. Fourth, local people possess knowledge of the reality that if not well managed, ecosystems can undergo degradation and hence fail to supply the services needed for human wellbeing. However, they explain the causes of degradation in terms of changes observable at the empirical level and the invisible causal power of supernatural forces. The inclusion of natural forces in degradation explanations marks a departure from the scientific explanations that revolve around biophysical processes. Fifth, the use of traditional management practices such as taboos to management ecosystems is under threat at the local communities. The threat can be attributed to three groups of causes, namely changes in worldviews due to adoption of formal education and Christianity, institutional disharmony playing out between the state and local traditional leadership, and lifestyle changes. These challenges constrain the opportunity for local people to apply traditional management practices to prevent the degradation of ecosystems. The net implication of this is that it renders it difficult for researchers and policy makers to assess the effectiveness of traditional management practices because they are not being implemented in full. In light of all these findings, the thesis concludes that TEK is underlabouring for the ecosystem service framework in the sense that it is used by local communities to generate knowledge of ecological concepts and phenomena. This means that TEK does not exist for the sake of its own self. Drawing from this finding, the study proposes a framework of analysing TEK as an underlabourer for social-ecological triggers or issues. Nonetheless, there are few factors that can be sources of limitation to the study. These include the reality that it was difficult to access pure traditional knowledge because over the years the local communities have received many state-sponsored ecological intervention programmes and a possible personal bias given the reality that I grew up in a traditional household and my father was a key holder or TEK.

Table of Contents

List of Tables and Figures

List of Tables

List of figures

CHAPTER 1: INDIGENOUS KNOWLEDGE SYSTEMS IN THE SOUTH AFRICAN HISTORICAL CONTEXT: TOWARDS ECOSYSTEM SERVICE KNOWLEDGE

1.1. Introduction

This study explores the indigenous knowledge of ecosystem services in rural communities of the Eastern Cape Province of South Africa. Its focus is not the ecosystem services *per se;* rather it is on what local communities, who largely depend on an indigenous knowledge system (IKS) to understand the world and their relationship with the natural environment, know about the ecosystem services. Since the historical past, the studied communities in rural Eastern Cape have depended significantly on ecosystem services for multiple components of their wellbeing: health, subsistence, shelter, culture and spirituality (Bank, 2002; Beinart & Brown, 2013; Denison & Wotshela, 2009; Murata, 2010). Some of the ecosystem services they benefit from regularly are grazing from native rangelands, construction timber, medicinal plants, cultural objects, productive water (mainly rain), agricultural land and drinking water. As a result, the local communities are expected to have developed a knowledge of what these ecosystem services are, their economic values, and the strategies to manage them.

Because this thesis comprises stand-alone chapters intended for publication, I do not include a literature review for all the themes in this introductory chapter; doing so would make for repetitive empirical chapters. Collectively, the findings from these themes can go a long way to expanding South African ecosystem service literature from the perspective of the non-scientific knowledge tradition. This knowledge is important, given that the ecosystem service concept is applied globally to shape both intellectual understanding of, and make decisions about how humans interact with the natural environment. Rather, the chapter frames the study by providing brief discussions of major themes, including IKS.

1.1.1. The indigenous knowledge system in the South African environmental context

Indigenous knowledge systems are an epistemic tradition widely identified with rural, less literate communities, yet the knowledge system is so broad that it cannot be adequately defined using a single definition. In fact, Dei, Hall & Rosenberg (2000) conceptualise IKS not as a single body of knowledge but as multiple knowledges. The authors state,

> "Indigenous knowledges are understood as the common-sense ideas and cultural knowledges of local peoples concerning the everyday realities of living. They encompass the cultural traditions, values, belief systems, and world views that, in any indigenous society, are imparted to the younger generation by community elders. They also refer to world views that are products of a direct experience of nature and its relationship with the social world" (Dei et al., 2000: i).

Indigenous knowledge systems include local knowledge, lay knowledge, informal knowledge, tacit knowledge, and traditional knowledge (Beinart & Brown, 2013; Berkes, 2008; Dei et al., 2000; Fabricius et al., 2006). These knowledge systems are largely used in remote rural communities that are less incorporated into networks of state systems such as industrialisation, the market economy, science and technology, or formal education (Berkes, 2008; Fabricius et al., 2006; Sillitoe, 2017).

Rural South African communities, such as the isiXhosa-speakers in the former Transkei region in the Eastern Cape, have long histories of relating with the local environments from which they derive benefits. This relationship goes back to pre-colonial times (Beinart, 2003). Over the period, the communities shaped ecological ideas and relations that were largely underpinned by their tribal cultures and belief systems (Beinart, 1989: Denison & Wotshela, 2009; Dlamini & Kaya, 2017). However, the imposition of colonialism and its allied knowledge system in scientific knowledge, have led to a state of epistemic pluralism which has outlived the colonial and apartheid eras (Beinart, 2003).

Colonialism in South Africa and elsewhere was as much a project of the domination of local people, who by nativity, had the right to claim ownership of and belonging in the land, as it was a system of knowledge imperialism (Beinart, 2003). The system involved destabilisation, inferiorisation, illegitimation and displacement of the knowledge systems of the colonised, while simultaneously valorising and privileging the knowledge of the coloniser (Castellano, 2000). As a result, "indigenous knowledges have been systematically usurped and then destroyed in their own cultures by the colonising west" (Shiva, 2000: vii).

This was not a one-way process however; it was a complex contestation that involved resistance, assimilation, adaptation, modification and indigenisation (Denison & Wotshela, 2009). In some instances, indigenous communities adapted their knowledge systems through

incorporating some bits and pieces of the scientific knowledge in order to respond to new realities that emerged as a consequence of them being colonised. Some of these new realities include introduction of alien ecological species such as *Acacia mearnsii (blekwati wemhlophe)* and *Acacia dealbata (blekwati webomvu)* on the native landscapes (Scorer, Mantel & Palmer, 2019). Since their introduction in the 1800s, these alien plants have become important resources that support local communities' welfare especially thorough providing construction timber and fuelwood. Some of the alien ecological resources such as *Amaranthus thunbergii (utyuthu), Chenopodium album (imbikicane/imbicicane)* and *Bidens pilosa (umhlabangubo* are used as wild vegetables by local communities. The fact that these communities have developed and assigned indigenous names to these foreign resources serves as a compelling proof of adaption and indigenisation. The major implication of this historical reality of adaptation is that it is difficult to draw solid and clear lines that demarcate where indigenous knowledge of the study communities end, and where exactly borrowed knowledge starts. This might stand as one of the limitations of this study (See Chapter 6).

Nonetheless, the processes of adaptation have not been without problems. These challenges include power epistemic tussle between holders of scientific knowledge and holders of IKS in relation to which knowledge system explains the world better and misunderstanding of how the other knowledge system works. More than two decades after the fall of apartheid in South Africa, these contestations between cultures of the former colonial masters and indigenous cultures, and between scientific knowledge and indigenous knowledge are still far from over.

These epistemic contestations have spilled into the domain of environmental literature. For instance, in a study that sought to find ways to integrate science and IKS in order to enrich ecosystem assessment exercises, Fabricius et al. (2006) classify IKS as local knowledge and science as universal knowledge. The implication of this classification is that science is still being perceived as a superior, all-powerful knowledge system whose methods and truth-claims are thought to be applicable everywhere and in all circumstances, regardless of context. The perceptions of unequal power relations between science and IKS have gravitated into rural communities, including in the Eastern Cape of South Africa where previous research has documented cases of intense disparagement of traditional knowledge by the educated, locally called the *gqoboka* (Bank, 2000). In these communities, some people with western education contest the value of traditional practices such as ceremonies, taboos, visionary knowledge, and supplication of the ancestors as backward and uncivilised (Bank, 2002). One major implication

of this attitude towards IKS is that far less interest has been evident in studying its contributions to human-nature relations than in science.

1.1.2. On science and indigenous knowledge systems

Scholarly views on the relationship between science and IKS, of which traditional ecological knowledge and lay ecological knowledge are part, have taken different shapes over the years. Largely, early writings emphasise the difference between science and IKS (Chalmers, 1999; Feyarabend, 1987; Levi-Strauss, 1966). The central argument that characterises this scholarly era is that the two approach the world from opposite angles; while science approaches the world from an abstract standpoint, IKS proceeds from the concrete. The concrete is not only physical, but also historical. Some scholars have extended this perspective by arguing that efforts to combine science and IKS in project implementation are facing resistance on multiple fronts (Jackson, Storrs & Morrison, 2005; Nguyen & Ross, 2017). Commenting on Vietnam, Nguyen and Ross (2017) cite epistemological and institutional factors as key barriers for effectively incorporating IKS in scientific, state-led water resource management programmes. In Australian case studies, Jackson (2004) and Jackson et al. (2005) observe that even if there was a growing consensus to incorporate TEK in matters of water resources management, there was no agreed-upon approach do so. Weiss, Hamann & Marsh (2013) argue that the key barrier is that the two knowledge systems emanate from distinctively different epistemic foundations: whereas TEK is rooted in and finds its power in culture, the strength of science is its rejection of cultural context (Weiss et al., 2013).

However, scholarly views on the science-IKS relations is progressively shifting from emphasising differences between science and IKS towards embracing a complementarity argument (Brosius 2006; Davis 2006; Fabricius, Scholes & Cundill, 2006; Tengo, Brondizio, Elmqvist, Malmer & Spierenburg, 2014). The key message that characterises the argument is that science and IKS can be combined to complement each other in a single project or study. Examples include Moller, Berkes, Lyver and Kislalioglu (2004) who demonstrate how TEK and science can be used in resources monitoring; Fabricius et al. (2006) who show how science and IKS can be combined in ecosystem services assessments, and Tengo et al. (2014) who document how IKS can be combined with science to enhance resource management. These scholars argue that combining science and IKS leads to better results than using either of them alone would achieve.

The complementarity argument asserts that the reality that scientists or people with western education in general often contest and challenge IKS is not an intrinsic issue. Rather, the contestations are the result of extrinsic factors (Chapter 2). The epistemological characters of science and TEK are not necessarily mutually exclusive. The real causes of the contestations are external and include unequal power relations that play out between the global north and the global south, as well as the different ways scientists and holders of IKS may choose to practise their knowledge (Davis, 2006; Chapter 2).

Notwithstanding the ability that science and IKS can work together complementarily, the two approaches have fundamental differences in four major dimensions of knowledge construction. Firstly, they employ different methodological and epistemological approaches. They proceed from different worldviews in developing an understanding of reality. Science relies on empirical measurements and abstract principles, as well as testing hypotheses to make sense of truth-claims (Berkes, 2008; Chalmers, 1999). When truth-claims are contested, science demands that they be subjected to validity tests and verification processes which include controlled experiments. On the other hand, TEK relies heavily on experiential knowledge accumulated over time, on taboos, visionary dreams, legends, and communication with ancestors for constructing knowledge and understanding the world (Berkes, 2008).

Secondly, the reliability of a TEK truth-claim is ascertained by the degree of respect and trustworthiness the source commands in the community (Berkes, 2008), as well as by consulting *amaxhwele* (traditional healers), *izanuse* sprit mediums and *iingwevu* (local old people that are reputed for possessing vast amount of indigenous knowledge). For instance, the truth of a claim that it is taboo to kill a water frog can only be proven by the reliability of the source from which it comes or testimonies of the holders of IKS. Such a claim cannot be measured, nor can it be subjected to a hypothetical test. A truth-claim which says no one is allowed to swim in pool X because doing so is taboo cannot be proved by walking in the pool and swimming in order to see what will happen.

While a scientific mind-frame may think that walking into the pool and swimming are experimental ways of testing the validity of the claim, holders of TEK see this as the violation of taboo, which may attract unknown consequences. Unlike science, which values questioning and regards it as a sign of intellectual curiosity, TEK does not allow much room for questioning.

In fact, in IKS, the practice of asking elders why they say certain things must not be done, is generally received with contempt and regarded as insolence (Berkes, 2008).

Thirdly, whereas science is an open knowledge system in that its facts can be explained in a step-by-step account to show how they come to be what they are (Faye, 2014), IKS is a closed knowledge system. The facts of IKS are predominantly shrouded in secrecy, suspense and belief (Berkes, 2008; Dei et al., 2000). When, for instance, one is told not to use a certain tree species for fuelwood because doing so will cause fights in the family, the question of how exactly burning the tree causes fighting cannot be put in a step-by-step causal explanation; this can only be known through respect for and belief in the tradition in which the knowledge is situated.

Finally, the two knowledge systems hold contrasting attitudes towards the significance of context in knowledge construction (Berkes, 2008). While IKS is embedded in local context, including a community's culture, belief system, history and world view, science rejects context. It strives to produce universal knowledge through objective methods (Agrawal, 1995; Fabricius et al., 2006; Sillitoe, 2017). Inevitably, these differences significantly shape the ways in which holders of IKS and scientists understand the natural environment, its functioning, value, and causes of change, including degradation.

Highlighting these points of difference does not suggest that scientific knowledge and IKS cannot be used together to complement each other. I argue that this difference needs to be appreciated rather than wished away in order to maximise opportunities and bridge the limitations of both science and IKS. This study looks at two branches of IKS used by local communities to interpret and generate knowledge about ecosystem services. These are TEK and local ecological knowledge (LEK). The former is used extensively in this thesis; hence I dedicate the following section to its discussion. I do not discuss LEK in this introductory chapter because I use it in only one chapter (Chapter 2).

1.1.3. Understanding traditional ecological knowledge

Traditional ecological knowledge is

> "… a construct within IKS that focuses more on a local culture's conceptualization and interactions with their biotic and abiotic environment. Traditional ecological knowledge encompasses everything from cursory awareness of natural histories

associated with local wildlife to cultural norms for land management and resource allocation" (Becker & Ghimire, 2003: 1).

Traditional ecological knowledge is the practical knowledge about land and species, as well as the beliefs about how humans interact with the land-based resources (Berkes, 2008). The epistemology of TEK is characterised by a fluid way of knowing. It uses experience and age of the source, as well as the supernatural world as major reference points for assessing the value, trustworthiness and truthfulness of claims (Berkes, 2008). It places much emphasis on what ancestors regard as correct or wrong. Gerontocracy, a belief that wisdom comes with age, is a major vehicle for transmission of knowledge, largely from older generations to the younger ones. Gerontocracy is based on the presumption that old people have seen and experienced much and are the habitats of ancestors. TEK depends mainly on orality for storage of events and experience and "involves a knowing within the subconscious that is garnered through dreams and vision" and is intuitive (Kovock, 2005: 27).

Berkes (2008) has acknowledged and sufficiently addressed interpretational problems that surround the term 'traditional ecological knowledge'. If interpreted from a narrow occidental scientific standpoint, the term may appear oxymoronic in that ecology in this realm refers to a scientific discipline. However, the term 'ecological knowledge' refers broadly to knowledge about how living things relate with each other and their natural environment, regardless of how it is acquired (Berkes, 2008). This is the interpretation that this study adopts. The core "value of TEK lies in the fact that it is associated with a long history of resource use in a particular area and is therefore the cumulative and dynamic product of many generations of experience and practice" (Menzies & Butler, 2006: 2).

Traditional ecological knowledge is largely practical, in that it seeks to understand the world for practical reasons, such as avoiding hunger, treating diseases, instilling harmony among people, and appeasing the spiritual world (Kovock, 2005). In TEK, management of nature implies wise use of resources in a way that both respects the world, and also supports the wellbeing of human society (Thondhlana & Shackleton, 2013).

Traditional ecological knowledge is relational in that it constructs knowledge of phenomena or objects through making connections between the human world, the spiritual, and the ecological realm (Berkes, 2008). Narratives of what people do when they apply TEK are embedded in

stories about other themes such as farming, disease and health, community politics and culture (Berkes, 2008). This has implications for presenting both methodology and results. The methodological implication is that studies seeking to capture this knowledge need to adopt data collection and analysis methods that are capable of appreciating the relational influence that objects outside of TEK might have. A relational-oriented method can be time-consuming in that the researcher may be forced to spend a substantial amount of time listening to narratives, which makes it difficult to present findings in a systematically organised way, such as discussing the use of taboos first and moving on to present the use of legends. While such a neat presentation of findings is desirable, it runs the risk of dislocating TEK from the environment of reality and events, which in practice, makes it to be what it is.

Although TEK is acclaimed to have the potential to provide an alternative to scientific understanding of human-nature relations, as well as complementing mainstream management strategies, the question of how it contributes to our knowledge of how local people relate with the ecosystem service concept in the South African context has not yet been adequately addressed. What makes TEK fundamentally distinct from other branches of IKS is that it concerns itself with how facets of tradition such as taboos, worldviews, religion, social conventions, and sacredness are used as vehicles for managing ecosystems, and generating and transmitting knowledge thereof.

Rural communities of the Eastern Cape where this study was conducted are very traditional, with strong structures of tribal leadership, and a profound belief in the power of ancestors and taboos (Bank, 2002; McAllister, 2001). It remains to be seen, therefore, how these communities use their traditions in developing knowledge of, and shaping their relations with the local environments on which they depend for a significant part of their wellbeing. In this study the natural environment is not exclusively made of resources indigenous to the study sites or South Africa, but it includes all wild resources including wild vegetables that were imported through contact with the western cultures over the years. This is the case in Chapter 3 in which local people apply their traditional knowledge to value wild fruits and wild vegetables some of which originated outside of South Africa.

1.1.4. Towards a study of indigenous knowledge of ecosystem services

One major, noticeable result of the tendency to look down upon IKS is that there has been less interest in researching the knowledge system in the domain of human-nature relations than

efforts that have been directed into science. However, some local studies have been conducted to contribute towards solving this puzzle (e.g. Denison & Wotshela, 2009; Fabricius et al., 2006; Murata, 2010). Recently, the South African government, through the National Research Foundation (NRF), commissioned a research project entitled *Indigenous Knowledge Systems (IKS) to enhance rewards for ecosystem services in rangelands infested with invasive alien plants in South Africa, April, 2016.* The NRF project is a South African initiative that led to this study. Because IKS is a broad umbrella housing several knowledge systems, I chose to focus this study on a single branch: traditional ecological knowledge (TEK).

The early studies that offer an explicit definition of ecosystem services are Daily (1997) and Baskin (1997). They define ecosystem services as the processes and conditions of the natural environment which contribute to the wellbeing of humans, their communities and economies.

The authors offer a long list of ecosystem services that includes drinking water, medicinal plants, cultural plants, purification of water, and pollination of plants. The MEA (2005) classifies the services into four groups: provisioning, cultural, regulatory and supporting services. Since then, this definition and classification have become the dominant reference points in, and way of framing the ecosystem service discourse. To a large extent, the classification significantly shifted the framing of how humans interact with the natural environment from one of living with resources to one that emphasises dependence on services provided by functioning ecosystems. The need for functioning ecosystems implies that humans should implement deliberate initiatives to manage nature responsibly.

The mainstream ecosystem service discourse has contributed immensely towards advancing our understanding of the complex relations between humans and the natural environment. Menzies and Butler (2006: 5) remind us that "the birth of TEK as a major research focus and resource management tool is related to the attempted shift to an ecosystem service-based management approach" which emphasises linkages between species and human-nature dependence. However, this important relationship is not adequately reflected or acknowledged in the major contemporary ecosystem service debates (see Boyd & Banzhaf, 2007; Costanza et al., 1998; De Groot et al., 2002; Fabricius et al., 2006; Farber et al., 2002; Fisher & Turner, 2008; Wallace, 2006). A critical re-examination of traditional communities' customs, rituals, taboos and myths that regulate ecosystem service harvesting and access, as well as stewardship roles, have potential to reveal important valuable links that are missing in the science-based

ecosystem service management knowledge and practices.

1.2. Statement of the problem

Much has been written at the international level about how local communities, who largely depend on IKSs understand, assign values to and manage ecosystem services. Barkmann et al. (2008) document how lay people assign values to ecosystem services in rural Indonesia. Gómez-Baggethun, Mingorria, Reyes-García, Calvet and Montes (2010) document the challenges that TEK faces in Spain due to market integration. Pilgrim et al. (2008) discuss the reasons why TEK in management of ecosystem services is being lost in wealthier communities. Grêt-Regamey, Brunner, Altwegg, Christen and Bebi (2013) investigate how local knowledge can be integrated with expert knowledge to enhance understanding of ecosystem services in the Swiss Alps. Saylor, Alsharif and Torres (2017) document the role that TEK plays in agroecological systems in Peru. Lamarque, Quetier and Lavorel (2011) document local people's knowledge of ecosystem services and how they rank them according to their relative importance in three European mountain regions. Lewan and Söderqvist (2002) document local people's knowledge of different ecosystem services in Sweden. Finally, Boafo, Saito, Kato, Kamiyama, Takeuchi and Nakahara (2016) document the role of TEK in managing ecosystem services in Ghana.

South African ecosystem service research has focused much on the contribution of biodiversity to the supply of ecosystem services (Egoh, Reeyers, Rouget, Richardson, Le Maitre & van Jaarsveld, 2008; Reyers, O'Farrell, Cowling, Egoh, Le Maitre, & Vlok, 2009), valuation (van Wilgen, et al., 1996), the impact of' alien invasive plants on ecosystem services (Pejchar & Mooney, 2009; Van Wilgen, Cowling, & Burgers, 1996). Payment for Ecosystem Services through the Working for Water programme (Büscher, 2012; Turpie, Marais, & Blignaut, 2008). These studies reveal invaluable insights with regard to our knowledge of ecosystem services supplied by local landscapes in South Africa. However, they focus on scientific ways of understanding ecosystem services; they do not investigate or document how non-scientific knowledge communities understand the concept of ecosystem services, or how they use their local knowledge systems to manage them. The implication is that, although we know much about what indigenous communities elsewhere know of the ecosystem service concept, there is not much known about South African communities. This knowledge gap has the potential to constrain growth of, and application of the ecosystem service framework in South Africa. The

continued dearth of documented indigenous knowledge of ecosystem services can frustrate implementation of multi-disciplinary ecosystem assessment programmes in South Africa. If little continues to be publicly known about how traditional rural communities understand and manage ecosystem services, what then will inform implementation of ecosystem services intervention programmes that use TEK in the country?

This study aims to contribute towards generating that information. For this reason, the study does not concern itself with investigating ecosystem services produced by rural South African landscapes. Rather, it focuses on investigating and documenting the knowledge of local traditional communities about ecosystem services, and what those communities do to manage them. International literature has strongly affirmed the linkages between the ecosystem service concept and TEK (e.g. Berkes, 2008; Menzies & Butler, 2006; Saylor et al., 2017). The study aims to demonstrate how local communities understand these linkages by focusing on four themes: local people's knowledge of ecosystems; knowledge of the economic value of ecosystem services; traditional strategies of managing ecosystem services, and the challenges local communities face in using traditional knowledge for managing ecosystem services.

1.3. Aim and key questions of the study

The aim of the study was to find out and document indigenous knowledge of ecosystem service at five rural communities. The study took a special focus on TEK, a branch of the IKS in order to explore how key aspects of local people's traditions such as customary law, taboos and ancestors form part of, and are used in constructing, preserving and transmitting ecosystem service knowledge. The study did this through collecting data on the four empirical themes given above which generated the following five research questions:

i. What do local people know about ecosystem services, and how do they use their knowledge to manage them?
ii. What do local people know of the economic value of the ecosystem services on which they derive benefits to satisfy their welfare needs, and what makes it difficult for them to assign economic value to these services?
iii. Which traditional practices do local communities use to manage ecosystem services, and how do they implement them?
iv. How are traditional practices of management perceived at the local communities, and

what implications do these perceptions have on the broader call for inclusion of TEK in mainstream ecosystem service management?

v. What implications do these findings have to the growth of the ecosystem service discipline in South Africa?

1.4. Delineating the study

This work is an exploration of local communities' knowledge of the ecosystem services they get from their landscapes; and not of the ecosystem services. However, it is difficult to define what knowledge is (Pritchard, 2006). I use the term 'knowledge' to refer to the state of people's cognitive contact with reality, involving a justified true belief of what reality is. The justification is the reason for believing in what one believes is real (Pritchard, 2006). Knowledge is relational and plural in the sense that what and how people gain this cognitive contact is influenced by their ontology (what they consider as real) and epistemology (how they gain knowledge of this reality) (Bhaskar, 2016). This inevitably makes knowledge plural because there are many ontologies and correspondingly, several epistemologies (Bhaskar, 2016). In the concept of knowledge, I include knowing as a theoretical cognitive act, and practising the things that are known. As a result, discussions of knowledge in this work include how this knowledge is put into practice by those who hold it. Moreover, the study recognises perception as an integral part of knowledge because perception refers to the way people notice reality, especially through their senses (Oxford Advanced Learner's Dictionary, 2015).

In carrying out this study, I did not seek to understand the local ecosystem services, their values, use or the degradation that they face. Rather, I sought to explore local people's knowledge about these issues. The two-research agenda are different, and can be accomplished through using different study approaches. While the former demands that a researcher makes use of the best study techniques available to elicit the best possible information, the latter does not allow much room for manoeuvre.

Exploring people's knowledge demands that a researcher listens to what the respondents say. Although the researcher must probe and triangulate evidence with literature, the main source of information remains the respondent. As a result, the ultimate research output should consist of what respondents reported. Although this does not mean that the researcher gullibly accepts everything that respondents say, attempts to step outside the world of the respondents to get

data by other means may look scientifically judicious, but such attempts can actually be methodologically treacherous, particularly in this study.

Such attempts are also deceitful because the conclusions arrived at would be from a different source, not the local people. In line with this argument, this study methodically avoided resorting to externally designed data collection techniques, even in situations where doing so promised to elicit data that would be more appealing to conventional academic standards than what could possibly be found from the knowledge of the local people. This study's commitment to using local people's testimonies as sources of knowledge is presented in Chapter 3 in which I explore local people's knowledge regarding the economic value of ecosystems. Conventional academic thinking would expect the application of renowned scientific (economic) valuation techniques such as Willingness to Pay (WTP) or Willingness to Accept compensation (WTA). Such techniques would enable me to elicit scientifically influenced knowledge of value of ecosystem services. However, this was not the goal of the study; the goal was to discover what local people know about the ecosystem services on which they depend for a significant proportion of their wellbeing (health, livelihoods and spiritual needs).

My position was to document the knowledge of local people, and not what scientists can make of what is happening. This decision was largely informed by the findings in Chapter 2, my first empirical work that sought to study local people's knowledge of ecosystem services. In this study, I used an ecosystem service technique of disaggregating nature into four ecosystem service groups, namely provisional, cultural, supporting and regulatory (Millennium Ecosystem Assessment (MEA) 2005). Respondents struggled to talk of nature in this compartmentalised style. My conclusion, and one that guided my research effort in subsequent chapters, was that it is not appropriate to use scientific data collection techniques to study non-scientific knowledges.

The target population segment for the study was holders of indigenous knowledge. Largely, these are people who believe in the traditional religion who recognise the role of ancestors and other supernatural realities such as taboos in shaping the lives of human communities and their relations with the ecological realm. In addition, holders of IKS are mainly people little to no scientific training. Although this characterisation is correct, I interviewed these people fully aware that Christianity and scientific notions or reality have affected many people in these traditional communities over the years. While they still remain true holders of IKS, some of

these people converted to Christianity at some point in their lives but later left, while others have attended several government intervention project trainings and workshop that are informed by the scientific development model. This might have a bearing on the quality of the indigenous knowledge data that I got. Nonetheless, this was the best available selection criteria at the time.

1.5. Significance of the study

Focusing on TEK, a specific branch of IKS that deals with the natural environment, this collection of chapters provides empirical cases of how beliefs, taboos, religion and social conventions are used as sources of ecosystem service knowledge. The cases demonstrate the challenges of and opportunities for adopting TEK in contemporary rural South Africa, and the implications this has on the broader call for its inclusion in mainstream ecosystem service research and intervention programmes. The research helps identify the limitations of TEK in order to make appropriate decisions about the conditions under which to apply TEK and how to apply it. Moreover, it is important to gain knowledge of TEK's weaknesses because this provides a basis for developing its capacity to deal with contemporary ecological challenges. Furthermore, the study provides alternative insights into our understanding of the relation between people and nature. Specifically, it demonstrates that there are alternatives to interpreting the value of ecosystem services to human wellbeing. In addition, the study demonstrates that there are alternative strategies for managing ecosystem services, ones that do not fall within the realm of mainstream management systems. All this contributes valuable insights into designing and implementation of locally sensitive ecosystem service intervention programmes, especially in rural South Africa. Moreover, by injecting IKS into ecosystem service rhetoric, the study holds potential to inspire a shift in South African research efforts from seeking to understand ecosystem services from the perspective of scientific epistemology alone. Findings from this study may promote interest in studying ecosystem services within other epistemologies, especially IKS, a move which can facilitate transdisciplinarization of ecosystem service research within the country.

The study illustrates how traditional South African communities understand the concept of ecosystem services and how they relate with these services. In so doing, the study holds potential to shed useful light on how the ecosystem service concept can be applied in rural South Africa. It also demonstrates how non-scientific knowledge systems frame human-nature relations, especially with regard to assigning value to, and managing natural resources. Thus

far, not many studies have dedicated as many chapters to intensively investigating the knowledge of ecosystem services held by South African traditional communities. For that reason, this study may contribute towards fomenting future research interest in the subject in the country.

1.6. Limitations of the study

I set off to explore this knowledge fully cognisant of the reality that it is not possible, after more than 300 years of contact between local communities and western cultures, to reconstruct the original version of TEK of the communities I studied. Over the years, processes of contact with western cultures, state intervention programmes and policies significantly reconfigured the original tribal knowledge systems. The difficulty of accessing the original version of African traditions in the post-colonial era is acknowledged by Delius (2008) who studied traditional land tenure systems in South Africa. Much of the environmental knowledge that exists today in South Africa developed through several encounters between indigenous people and western settlers (Beinart, 2003). As colonisers and the colonised managed and harvested the same ecological resources on the same landscapes, the ecological knowledge of the colonial masters and native Africans inevitably became cross-pollinated.

Another limitation is that the snowball sampling technique that I used is non-random, hence it does not give all population units equal chances of being selected (Browne, 2005; Fougier & Sargeant, 1997). By recruiting respondents through social networks, snowball sampling can yield a biased sample. People that meet all the criteria but who are disliked or rejected by others may not be mentioned to the researcher. However, the study did not aim to be representative, but to be interpretive.

Furthermore, the qualitative methods which I used are still being debated among scholars with regard to whether or not the findings they arrive at can be generalised (Groleau, Zelkowitz, & Cabral, 2009; Misco, 2007; Polit & Beck, 2010). However, it is beyond the scope of this study to analyse the merits of the debate although there is a growing shift from the traditional assumption that generalisation can only be done statistically, that is, from a representative sample to the population (Danermark, Ekstrom, Jakobsen, & Karlsson, 2002; Fletcher, 2017; Polit & Beck, 2010). This shift has led to the recognition that there are many types of

generalisation, including transfactual, abductive (Bhaskar, 2016; Danermark et al., 2002; Fletcher, 2017), analytic, and case-to-case generalisation (Polit & Beck, 2010).

This new way of looking at generalisation has demonstrated that qualitative studies are able to produce generalisable findings. Nonetheless, the main focus of this study is not to make generalisations, but to provide a contextualised understanding of human-nature relations within the context of the ecosystem services concept. It aims to achieve this by employing a mixed methods approach which allows for intensive study of a few cases (Fletcher, 2017; Merriam & Tisdell, 2016; Polit & Beck, 2010).

Lastly, by focusing on documenting what people know, without pushing them to think like experts, the study might have missed an opportunity to elicit the best pieces of knowledge. It is possible that respondents could have answered my interview questions differently if I had used a different approach, such as survey forms with sets of 'good answers' as choices to tick. Nonetheless, my aim was not to get globally recommended 'good answers'. Instead, it was to elicit and document contextualised knowledge.

1.7. Organisation of the study

The study is organised in a thesis-by-publication style, containing four results chapters (2, 3, 4 and 5). Each chapter stands independently from others, albeit related to them in terms of its contribution to the overall aim of the study. Accordingly, each one of the results chapters comprises all the requisite components, including introduction, study site, methods, theoretical framework, results, discussions and conclusions to allow for ease of conversion for publication. There are cases of overlap, especially in Chapters 3, 4 and 5 which use the same study sites, methods and theoretical framework. I chose this format because each chapter pursues a different theme, and the implication is that descriptions of study site, methods and theoretical framework need to be presented in a way that aligns with that particular theme. However, the abstract, limitations of the study and references are presented centrally.

The rest of the thesis is organised as follows: Chapter 2 looks at local people's knowledge of ecosystem services and how they use this knowledge to manage ecosystems. Chapter 3 interrogates local people's knowledge of economic values of ecosystem services. Taking a cue from Chapter 2 in which respondents demonstrated difficulty understanding ecosystem

services, the chapter examines the conditions that make it difficult for local people to know the economic value of the ecosystem services from which they benefit. Chapter 4 explores the traditional practices that local people use for managing ecosystem services. The chapter focuses on how such practices are applied and the ecosystem services they are intended to manage. Chapter 5 investigates how traditional management practices are perceived at the local communities, and the implications that these perceptions have of the global enthusiasm about the incorporation of TEK in the ecosystem service discipline. Finally, Chapter 6 provides a synthesis and the conclusions of the study. It uses the key findings from the different results chapters to make an argument for the implications of the study on the global call for institutions and researchers to include TEK in ecological intervention programmes. Furthermore, the chapter proposes a framework that can serve as a tool through which to better understand the application of TEK in the ecosystem discipline, specifically in developing and politically liberal contexts like South Africa.

1.8. Ethical Considerations

The study was conducted in accordance with the principles set by the Rhodes University Standards Committee, and a letter of Ethical Approval of which Reference Number is 2019-0624-62 was issued by the committee. This letter served to authorise the conducting of the whole study. For this reason, in order to minimise repetition, I will not talk about ethics issues in the empirical chapters (2, 3, 4 and 5).

CHAPTER 2: INDIGENOUS KNOWLEDGE OF ECOSYSTEM SERVICES

2.1. Introduction

Ecosystem services are defined in several ways. Daily (1997: 3) defines ecosystem services as "the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfil human life." Costanza et al. (1998) view ecosystem services as the benefits that people get from ecosystems. Such benefits can be derived directly or indirectly (Costanza et al., 1998). These definitions emphasise the dependence of human wellbeing on the multiple goods and services humans obtain from ecosystems (Schröter et al., 2014). The Millennium Ecosystem Assessment (MEA, 2005) classifies ecosystem services into four categories, namely: (i) provisioning, (ii) regulatory, (iii) cultural, and (iv) supporting services. These groups have been used as reference points in several ecosystem service research and policy-making debates.

The term 'ecosystem services' was coined largely to emphasise and lay bare the extent to which the wellbeing of humans and their societies depend on the existence of a functioning ecosystem (Coutts & Hahn, 2015; Ehrlich & Ehrlich, 1981; Limburg, O'Neill, Costanza, & Farber, 2002; Mooney & Ehrlich, 1997; Schröter et al., 2014). In doing this, the ecosystem service concept simultaneously presents a case for the need for responsible ecological stewardship by managers and resource users (Lamarque et al., 2011). Thus, in addition to its epistemic function of expanding the frontiers of ecological knowledge, the ecosystem services concept has a pedagogical role to play, that is, emphasising the need for responsible resource management by making direct links between nature and human wellbeing (MEA, 2005).

Scholarly interest in developing this nascent concept is well manifest in the intense debate that has occupied many leading scholars for the past 10 years or so (Boyd & Banzhaf, 2007; Fisher & Turner, 2008; The Economics of Ecosystems and Biodiversity (TEEB), 2010; Wallace, 2008). The debate is largely locked in intricate scientific aspects of ecological resource economics, seeking to address the ability of economics to fully interpret and capture the complex and multifaceted value of ecosystems (Curtis, 2004), the need to disambiguate ecological functions from ecosystem services (Wallace, 2008), the need to avoid the accounting error of double counting in which ecosystem functions and services are both counted (Boyd & Banzhaf, 2007; Costanza, 2008; Wallace, 2008) and the problems of commodity fetishism and

market environmentalism (Kosoy & Corbera, 2010; Gómez-Baggethun & Muradian, 2015; Gómez-Baggethun & Ruiz-Perez, 2011). The knowledge that these debates produce is used to frame and develop the discourse of ecosystem services and interpret ecological phenomena such as land degradation, unsustainable harvesting, and even extinction. The interpretations are used as baseline information for planning and implementing ecosystem service intervention programmes in rural villages who may not share these scientific interpretations.

The reality that most of the ecosystem services are found in rural communities, as is the case in South Africa and elsewhere in the developing world, necessarily renders these communities important players in the ecosystem service discipline (MEA, 2005). Yet these are communities whose ecological knowledge is largely lay and non-scientific. South African literature is replete with cases of local resistance to environmental and development intervention programmes that do not consider local realities (Beinart, 2003; Kepe, 2009; Musavengane & Leonard, 2020). However, this problem is not exclusive to South Africa. Brosius (2006: 138) recounts a dispute between local Penan community and a logging company that was logging timber without consent of the locals. In this case, one Penan man asked the loggers, "If this is your land, why do you always ask us the name of rivers? You and your people are always asking what is the name of this river? If you don't know these, you don't belong here."

This is an example of the people that have complained about externally planned programmes that are implemented on their local landscapes without their inclusion. They have taken some of these complaints to distinguished global fora including the Fifth Wild Parks Congress of 2003 in South Africa, the Seventh Meeting of the Conference of the Parties to the Convention of Biodiversity of 2004 in Malaysia, and the MEA Bridging Scales and Epistemologies conference of 2004 in Egypt (Brosius, 2006). The question this raises is: In the context of South Africa's chequered history of racialised conservation and top-down development intervention programmes, what is the likelihood of the success of exclusively scientific ecosystem service understanding and intervention programmes? This study sought to investigate and document knowledge of non-scientific local communities about ecosystem services. Specifically, it looked at lay people's knowledge of ecosystem services.

The Collins English Dictionary (2005) defines a layperson as someone who does not have specialised or professional knowledge on a subject under discussion or consideration. Stacey (1994) calls lay knowledge "people knowledge", and Bartel (2014) refers to it as vernacular

knowledge. Although there may be no definitive category of who lay people are, when we talk of lay people, we are talking of the voices of subsistence farmers and people of low or no formal education; in fact, a group that is economically and politically marginalised (Brosius, 2006).

Lay ecological knowledge concerns what these social groups know about the ecosystems services from which they benefit; their interpretations of ecological phenomena including processes, changes and challenges, and their visions of an ideal landscape with optimally functioning ecosystems. I chose 'lay' rather than traditional or local knowledge because I want to emphasise a state of disciplinary dis-identity, that is, a knowledge that does not belong to any specific epistemic tradition. Lay knowledge is based upon personal, first-hand experience, or through cultural and institutional experience, and is passed on from one person to another through *inter alia* historical tales, legends, traditions, belief systems, social observances, routine societal and family practices (Bartel, 2014; Stacey, 1994).

There are several terms that are used to denote non-scientific ecological knowledge. These include traditional ecological knowledge (Berkes, 2008), indigenous ecological knowledge (Gratani et al., 2011), local knowledge (Brosius, 2006; Fabricius et al., 2006) and indigenous knowledge (Beinart & Brown, 2013; Denison & Wotshela, 2009; Murata, 2010; Sillitoe, 2017). Although these terms are closely related to lay ecological knowledge, they are more appropriate in communities which are less incorporated into modern state networks and their various accompanying forces of rapid social change, such as migration, western education, market economy and urbanisation (Beinart & Brown, 2013; Denison & Wotshela, 2009).

The two villages of Mgwalana and Mahlungulu in the Eastern Cape Province of South Africa, where this study was conducted have experienced significant levels of transformation and modification, a circumstance that lays the ground for development of a fluid knowledge system that draws from various sources. This fluid knowledge does not belong to a specific epistemic grouping, say professional or scientific. Therefore, it does not proceed on the use of a specific set of jargon, nor does it rely on a shared mode of reasoning for its conclusions.

2.1.1. Science and other knowledge systems

The division between science and other knowledge systems that loosely fall under the IKS umbrella, including lay knowledge, has been a subject of contestation (Brosius, 2006;

Chalmers, 1999; Fabricius et al., 2006). The epistemic tradition called 'science' largely alludes to positivism and empiricism, which build on non-subjective and socially uncontaminated methods of systematically observing study phenomena and arriving at conclusions (Chalmers, 1999; Faye, 2014). Probably because the thinking originated from western philosophers such as David Hume and John Locke, the scientific tradition has been synonymized with westernism (Chalmers, 1999).

However, there has been a shift from a dichotomous view of science and non-science knowledge systems, with the literature emphasising existence of more complementary than adversarial relations between the two (e.g. Brosius, 2006; Davis et al., 2006; Fabricius et al., 2006; Turnbull, 2000). The general message is that the difference that is witnessed between science and other knowledge systems is not a function of incommensurable epistemic properties intrinsic to either scientific knowledge or IKS. On the contrary, it emanates from external issues such as relations of power asymmetry that play out between the global north and global south, scientists and lay people, and the ways some people choose to practise these knowledge systems (Davis, 2006).

However, a few salient differentiators have the potential to adversely affect the interface between scientists and lay people, especially in understanding and framing the discourse of ecosystem services. Whereas science tends to be abstractive and spatially wide-scale, lay knowledge is site specific and largely co-evolves with local changes in livelihoods, culture and human-nature relations (Berkes, 2008). In a way, lay ecological knowledge tends to shape around locally experienced human-nature encounters, as well as material and socio-cultural aspirations. This speaks of a holistic conception of ecology, one made of intricate networks of the material, physical, natural, and the unobservable spiritual world. This epistemic framework has potential to add some useful dimensions to the ecosystem service subject.

This chapter reports on a study of lay people's knowledge of ecosystem services in the two villages of Mahlungulu and Mgwalana in rural South Africa. The aim of the study was to identify local people's knowledge of ecosystem services; an important aim in that it helps determine how the scientific conception of ecosystem services relates to local realities of understanding nature. By so doing, the chapter seeks to contribute to the growth of the ecosystem service knowledge by adding lay ecological knowledge. I used the findings to make a case for the need to include lay ecological knowledge during planning of ecosystem

intervention programmes. Such inclusion can enable the programmes to better address local realities and attract co-operation from recipient communities.

The section that follows provides a brief description of the study sites. The second section reports on methods I used to collect and analyse data. The third section reports on findings, and the final section uses findings from the third section to make an argument for the need to consider lay knowledge in designing and implementing ecological management and rehabilitation intervention programmes.

2.2. Study sites

Two villages situated in Sakhisizwe Local Municipality in northern Eastern Cape Province of South Africa were selected for the study. These villages are situated in two quaternary river catchments (S50E for Mahlungulu village and T12A for Mgwalana village; Figure 2.1). Both villages hold their land parcels and related natural resources under the customary tenure system (Bennett, 2008; Chimhowu & Woodhouse, 2006; Cousin, 2008) and practise mixed farming in the form of livestock and crop production. Several invasive alien plants (IAPs) have invaded both catchments, with these invasions dominated by black wattle (*Acacia mearnsii*) and silver wattle (*Acacia dealbata*). These alien plants have become part of the stock of natural capitals to the locals together with native grasslands which provide grazing services and patches of indigenous bushes which provide a range of services including fuelwood, construction timber, traditional medicine and cultural objects. Moreover, there are water sources including rivers which provide water for livestock and for laundry, as well as springs from which local communities get drinking and cooking water.

Mgwalana village is about 10 km from Cala and Elliot towns, and is a fairly young settlement formed in the mid-1970s as part of the apartheid government's programme of consolidating homelands through resettling black communities on bought-out free-hold white-owned farms. Although the other study site, Mahlungulu has a long settlement history that dates back to the late 19th century, it is not less culturally adulterated.

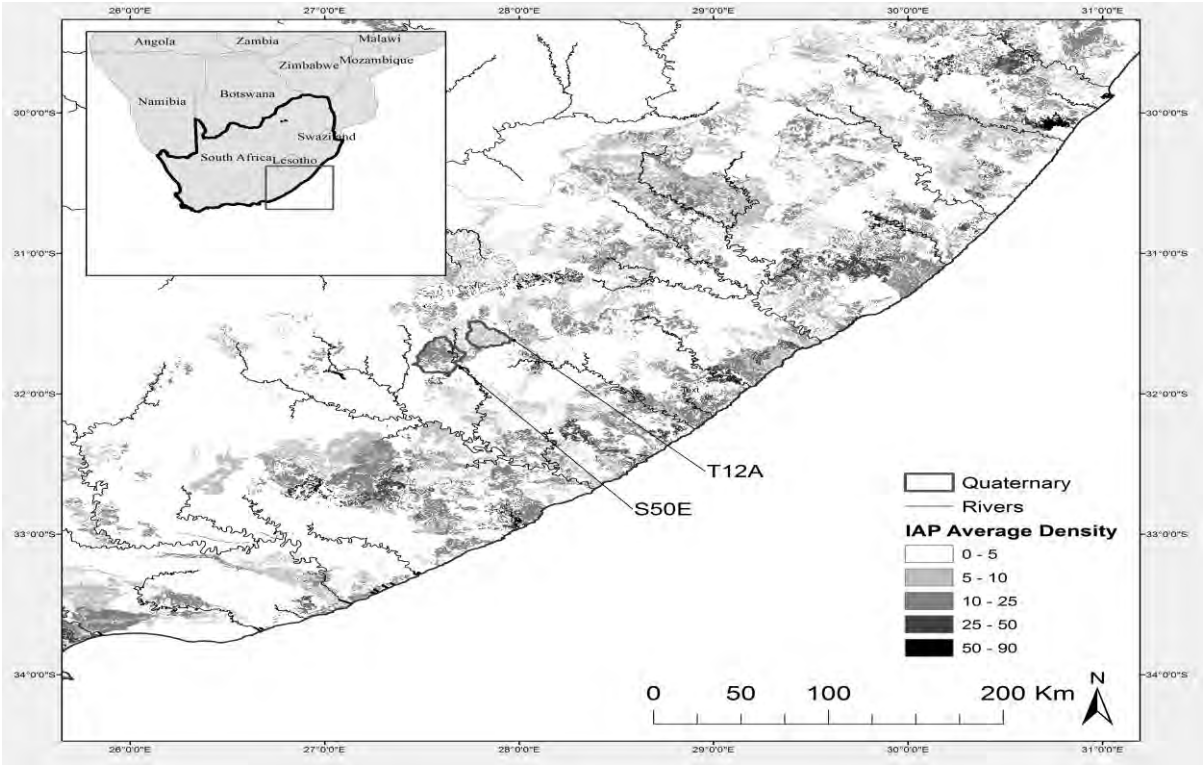

Figure 2.1. Map of study area showing the two quaternary catchments where the study villages are located

Both study sites are very close to urban centres. Mahlungulu is situated midway between the towns of Cala and Cofimvaba, while Mgwalana is closely sandwiched by Elliot and Cala towns. Their close proximity to the urban centres render the study communities prone to cultural dilution through, inter alia, daily commuting of community members to towns for work, and the close influence of municipal administration. Consequently, the two villages are atypical of traditional communities which are far from urban centres and their relations between persons in relation to resources are heavily regulated by traditional systems of administration.

2.3. Methods and tools

A mixed methods approach comprising quantitative and qualitative techniques (Creswell, 2014; Creswell, Clark, Gutmann, & Hanson, 2003; Ivankova, Creswell, & Stick, 2006; Teddlie & Tashakkori, 2003) was used in this study. The study used stratified random sampling technique for recruiting participants (Acharya, Prakash, Saxena & Nigam, 2013). In this technique the study population was grouped into various strata determined by the type of occupation as the main variable although other variables including sex and age were considered too. The resultant sample strata included village leaders from chieftaincy and local

municipality, teachers, nurses, subsistence farmers of crops and livestock. By recruiting this wide spectrum of respondents, the chapter wanted to opened space for responses from community members of different social-economic identities.

I ensured both gender and age representation and asked a local Community Development Worker (CDW) to help locate homesteads of participants to whom questionnaires were administered. The strength that the stratified sampling technique brought to this study is that it ensured that all relevant population strata were represented in the study (Acharya, Prakash, Saxena & Nigam, 2013). The occupation variable was relevant in that the occupation of a person is a close proxy of the kind of knowledge and epistemic orientation they possess. Table 2.1 shows the number of participates that were recruited to represent each stratum. I wrote the questions in English but explained them in the local isiXhosa language.

The methods involved two rounds of data collection. The first one was a quantitative study involving 33 participants selected from both villages (17 from Mahlungulu and 16 from Mgwalana). The selection criterion was that I had to recruit participants from all the social classes that were present in these villages.

Closed questions were used to collect data on participants' knowledge of the four groups of ecosystem services. The questions also asked participants to rank ecosystem services according to their importance. Furthermore, the questionnaire asked respondents to mention any other ecosystem services they knew. This question allowed response to talk about ecosystem services in the natural way they knew them, and not using the scientific framework of that conceptualises ecosystem services as either provisioning, cultural, regulatory or supporting services groups. A short, 200-word description of each of the four categories of ecosystem service (provisioning, regulatory, supporting and cultural) was recited prior to respondents ranking the list of services they recognised. I designed and loaded the survey forms onto an Android-enabled handheld-device using Kobo-Collect (www.kobotoolbox.org) for ease of data capture, analysis and storage.

I anticipated that giving such a closed set of choices would help respondents rank option-responses in order of their importance, without losing track of what had to be ranked. In doing this, I explained to the respondents, in the local isiXhosa language, what the technical terms meant. The second round was qualitative; it involved conducting in-depth interviews with 17

respondents; 9 from Mahlungulu and 8 from Mgwalana. Initial questions on demography (age, gender, dwelling type, profession, employment status, etc.) provided background on each respondent. More than two-thirds (67%) of the respondents were at least 50 years old (Figure 2.2). The respondents'' primary and secondary occupations range from those with very low levels of formal education such a gardeners to well-educated ones that include nurses and teachers (Table 2.1).

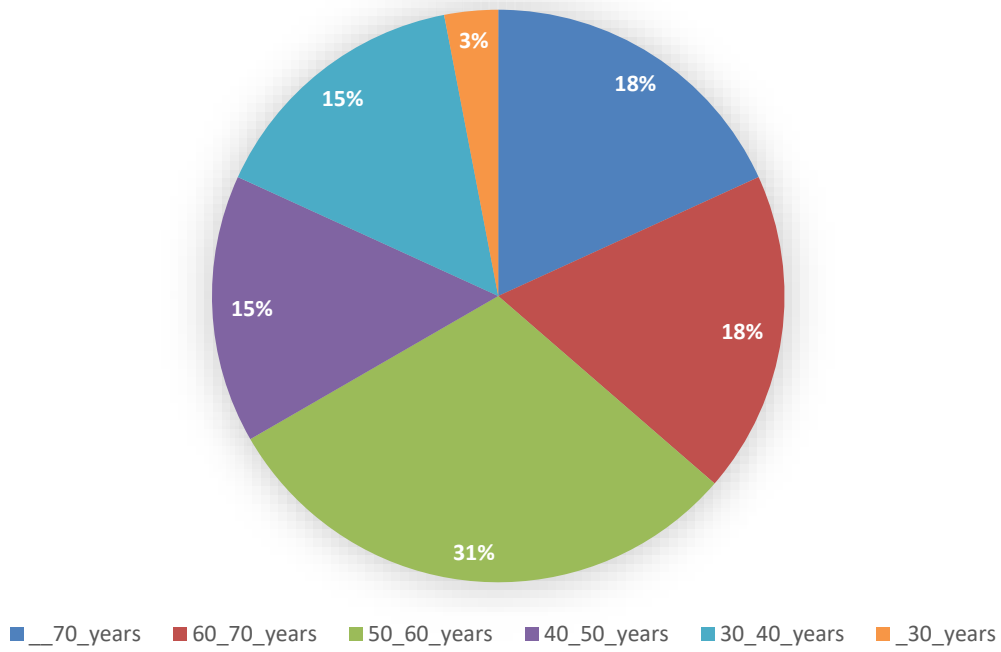

Figure 2.2. Percentage of age groups that were interviewed

These respondents were selected on the basis of their willingness to participate in the second round of data collection. The interviews were conducted in the local language and tape-recorded. I used an interview guide to ask questions, explaining what was meant by the question, and sometimes went as far as giving examples of similar cases from elsewhere around the world. The idea was both to share knowledge and to challenge the respondents to talk about what they knew about the issue in discussion. It was not necessary that the researcher and respondents agreed on what should be known about ecosystem services; what was important was that the researcher had to empathically understand what, and how, the respondents knew about the ecosystem service in question.

My motivation for using a typically ecosystem service method (which is scientific) was not to reinforce or perpetuate reliance on scientific thinking in the ecosystem service discipline, a position which, when assessed in light of my overarching argument, may be interpreted as a

Table 2.1. Types of (a) primary and (b) secondary occupations of respondents

(a)

Primary occupation	Number of respondents (n=33)
Councillor	2
Farmer and herder	2
Traditional healer	3
Farmer and traditional herder	1
Entrepreneur	2
Farmer and homemaker	2
Homemaker	9
Herder	5
Professional nurse or teacher	5
Professional farmer	1
Traditional leader and farmer	1

Secondary occupation	Number of respondents (n=33)
Local water operator	1
Farmer	1
Gardener	1
Health care assistant	1
Labourer at the wattle project	3
Domestic worker	2
Handy man	2
Seller (goods: chickens, vegetables, beads; services: tailor)	4
Shop owner	1
Retired teacher	2
Municipality grader operator	1
Seller (goods: chicken, vegetables, beads; services: tailor)	4
Shop owner	1
Retired teacher	2
Municipality grader operator	1
Community member	2
Board member	1
Teacher	1
Herder	2

self-inflicted counterpoint. Rather, I was inspired by the concept of immanent critique that "criticism of an idea or a system should be internal, that is, involve something intrinsic to what (or to the person who) is being criticized" (Bhaskar, 2016: 23). Typically, immanent criticism identifies an inconsistency or inadequacy in a theory, practice or argument and strives to demonstrate that, in virtue of the existence of this reality, the theory, practice or argument can undermine or deconstruct its own self (Bhaskar, 2016).

Consistent with this theoretical position, I chose to use the four MEA categories, namely provisioning, regulatory, cultural and supporting services of the ecosystem service framework as points of reference. Some studies have used these categories to investigate local and lay people's knowledge of ecosystem services, for example, Lewan and Söderqvist (2002) in Sweden, and Rodríguez, Pascual and Niemeyer, 2006 in Peru.

2.3.1. Data analysis

I used both quantitative and qualitative techniques for analysing data. Quantitative data was loaded on the Excel software package and a descriptive statistic function was run. The resultant data was descriptive statistics (Loeb, Dynarski, McFarland, Morris, Reardon, & Reber, 2017) which show distribution patterns of respondents' knowledge of ecosystem services. The statistics paint a graphic of which ecosystem services are least known, and which ones are most known, of course with some medium-known in between. The resultant statistics are presented in the forms of graphs and percentages. The value of this data is that it presents distribution patterns of respondents' knowledge of ecosystem service and provides an opportunity to rank the magnitude of value that each service has to the communities.

Qualitative data was analysed through use of hand-coding (Babchuk, 2019); a process that involving transcribing audio recorded data and placing some of their sections into codes using the thematic analysis technique (Chapman, Hadfield, & Chapman, 2015). The thematic coding technique involved identifying sections of the text that talk about a certain idea, concept, and practice or ecosystem service and assign it a name. That name was regarded as a theme, and all other sections of the text that talked to that theme were placed under it. Thematic coding helped me organise respondents' narratives into few thought packages that are manageable. The data from the qualitative technique was presented in the form of story-telling narratives. In some instances, the narratives are presented as explanations of statistics from the quantitative data, but in other instances they are presented alone to tell a story of what local people know.

Although data was collected from a wide spectrum of social groups including farmers, teachers, traditional leaders and municipal leaders, it was not analysed according to each group of participants because the aim of the study was not to compare the knowledge of one group to another group's. The aim was to paint an informed picture of the general state of ecosystem service knowledge in these communities. For this reason, the data was analysed according to research themes such as knowledge of provisioning services, knowledge of cultural services and ecosystem futures.

2.4. Findings and discussions

2.4.1. Recognition and ranking of ecosystem services

The discussion opened with the question of what people's ideas were around the concept of ecosystems and ecosystem services. All the respondents easily understood the concept of ecosystem, and they defined it by mentioning elements (examples of natural resources) that constitute the ecosystem such as grass, rain, wind, soil, trees, animals, birds, rivers and forests. In addition, respondents gave multiple examples of how some of these elements interact together to produce effects on both nature itself and the lives of people. One of the most cited examples concerned the interaction between rain, soil and plants. Respondents said that when rain meets the soil, plants and vegetation grow. The growing of plants benefits people directly because it leads to increased supply of agricultural foods. They also said that the growth of vegetation, especially grass, benefits people indirectly because it makes pasture available to domestic animals, such as cattle and goats, which in turn, are used as food or income generators by people. Respondents demonstrated knowledge of the reality that nature delivers services to humans (ecosystem services) although with regard to the concept of ecosystems, most of the respondents said they did not know what ecosystem services were. After I deconstructed the concept using local language concepts, respondents said they knew about ecosystem services.
I explained the MEA's (2005) four groups of ecosystem services and asked respondents to indicate which of the groups they knew about. Provisioning services were the most frequently recognised (Table 2.2), followed by cultural services. Although cultural services are non-tangible, all the respondents said that they directly use these services at several crucial occasions, including cultural ceremonies and rites of passage. There is a strong and highly revered attachment between the local communities and cultural services they receive from the landscape (Table 2.3).

Table 2.2. Provisioning ecosystem services ranked according to their importance

Ecosystem goods (% of respondents)	Order of Importance
Drinking water	1
Pasture for livestock	2
Wood for fuel	3
Wood for building and fencing	4
Medicinal plants	5
Veld/Wild foods	6

This ranking contrasts with regulatory and supporting ecosystem services, which, although critical, are experienced less directly by the residents, and were therefore the least well known. These services largely consist of the less visible services that humans derive from nature.

2.4.1.1. Provisioning services

The top three provisioning services in order of importance were water (100%), grazing pasture (52%) and wood fuel was ranked as third in importance (33%) (Table 2.2), largely because people of Mgwalana and Mahlungulu have historically based their livelihoods around livestock ranching (cattle, sheep and goats) and crop cultivation (maize, beans and pumpkins). Although the respondents continued to talk about the importance of land for their livelihoods, crop farming has substantially declined since the late 20th century, leaving households to draw heavily on external monetary streams such as social grants and remittances for subsistence (Andrew & Fox, 2004; Blair, Shackleton, & Mograbi, 2018; Bryceson, 2019; Du Toit & Neves, 2007; Shackleton, Shackleton, C., Shackleton, & Gambiza, 2013; Statistics South Africa, 2016).

Adverse changes in farming and livestock ranching started at the climax of apartheid governance in the 1970s, largely because of the administration's tactics of social engineering and territorial manipulation (Wotshela, 2004) which saw the forceful implementation of betterment planning (De Wet, 1995), forced removals, concentrated settlements and mass labour emigration by rural men to distant mining centres. To this day, the old people still aspire to a revival of the agricultural past so that households can again eat green mealies, pumpkins, and fresh beans from their gardens, and drink milk from their cows. The aspirations should be noted in future intervention programme planning.

Other provisioning services mentioned by the respondents include the following:

- Wattle for making cattle kraals
- Soil for ploughing and nurturing the fruit trees that grow without being planted
- Manure from cattle waste
- Mud for painting the inside and outside of traditional houses
- Cow dung for cleaning the inside of traditional houses

However, these services were not ranked because they garnered very low percentages in terms of their importance to respondents.

2.4.1.2 Cultural services

Among cultural services, culture-enhancing services such as the ones associated with *ulwaluko* (initiation) were ranked the most important, followed by spiritual services at second place, and cultural services that enhance sense of place were ranked third. (Table 2.3). Cultural activities such as the initiation rites of passage *intonjane* (for girls) and *ulwaluko* (for boys) were considered important by the respondents and were highly respected.

Table 2.3. Cultural ecosystem services ranked according to their importance

Ecosystem Service	Order of Importance
Culture-enhancing	1
Spiritual	2
Sense of place	3
Tourism	4
Intellectual stimulation	5

In both cases, the initiates make temporary shelters in the veld away from the built areas, where they stay for the duration of the initiation process, which usually lasts for not less than four weeks. The local people use a number of medicinal plants such as *Helichrysum pedunculatum, H. appendiculatum and Boophane disticha* during the initiation processes, especially to treat wounds.

*Ulwaluk*o for boys is not merely a cultural ritual, but it is a necessary, if not compulsory, exercise to undergo among the local isiXhosa-speaking communities, for it marks the much-

revered transition from boyhood to manhood. In more culturally sensitive sectors of the communities, until he has completed *ulwaluko*, a man may not marry, speak his views at tribal courts, drink beer or eat meat at ceremonies with other men since, regardless of his age, he is regarded as *inkwenkwe* (a young boy). The term *inkwenkwe* is derogatory and thus much despised by local men. Some female respondents reported that, during their girlhood, if a man who had not undergone *ulwaluko* proposed love to them, they would shrug him off by saying, "I am a full woman. I don't take a *poloneki*". The word *poloneki* is a derogatory term to refer to an uncircumcised manhood. It is derived from the English word poloneck, a garment that covers the neck.

2.4.1.3. Regulatory and supporting services

In contrast to provisioning and cultural services, regulatory and supporting services were not well understood by the respondents. Some of the services that people did not know about were: carbon sequestration, climate regulation, waste decomposition and detoxification, purification of air and water, production of oxygen gas, soil formation, and nutrient cycling. This made it difficult to rank them according to their importance; hence ranking was not done on these services. The reality that non-scientific communities struggle to apprehend non-visible ecological processes has been noted by several researchers (Beinart & Brown, 2013; Fabricius et al., 2006). Costanza (2008: 350) asks, "How can we expect the average citizen to understand the complex linkages between landscape patterns, precipitation patterns, wetlands and flood attenuation, when even the best scientists find this an extremely challenging task?"

After I explained these services, respondents demonstrated a clearer recognition of some of them such as purification of water, soil formation and production of oxygen gas, compared to other services, such as carbon sequestration, climate regulation and waste decomposition. The former group (regulatory services) which involves water, soil and air for breathing, are closer to human functioning than those in the latter group. On the whole, respondents did not regard these services as ecological elements; rather, they reported that they had thought that these good things depended on the power of God and ancestors.

In conversation about all the ecosystem services, including supporting, cultural, regulatory and provisioning, respondents seldom completed a discussion about how they exist and operate without touching on the work of supernatural powers. This could be a function of the holism that underpins that culture of knowledge production in knowledge systems other than science.

These knowledge systems, including lay ecological knowledge, tend to see the world as one complex whole, consisting of interlocked networks of knowledge-producing components such as the physical, the natural, the supernatural, and the human.

Thus, lay ecological knowledge challenges the scientific approach which disaggregates the world into discreet components such as ecology, human, and supernatural. However, science has registered a notable shift from its traditional fragmentive approach towards one that emphasises interlinkages. Promulgation of the social-ecological framework for studying ecological phenomena is evidence of this shift (Berkes & Folke, 1998; Ostrom, 2009; Partelow, 2018).

Other researchers (e.g. Beinart & Brown, 2013; Berkes, 2008; Fabricius et al., 2006) have observed that non-scientific knowledge systems tend to struggle to capture and interpret minuscule processes and non-physical objects. An issue for further study is to discover if this is a consequence of properties intrinsic to these knowledge systems, or if it results from external issues. The external issues could be ways in which researchers ask questions. It will be interesting to discover if survey methods that tend to ask respondents to represent the world in fragments and blocks pre-arranged by researchers, according to sequences of closed questions, is accessible to lay knowledge systems. Although many researchers have argued that non-scientific knowledge systems use a holistic approach to interpret the world (Berkes, 2008; Davis, 2006), there has been a dearth of voices to suggest appropriate methods for capturing ecosystem service knowledge in these epistemic communities.

In addition to respondents' difficulties in recognising some of the ecosystem services, the study encountered a methodological challenge. Many respondents, especially the non-literate and elderly, found it difficult to follow and to understand the logic of the quantitative method's multiple-choice technique. This was common among respondents in questions that had long ranges of options, say A-E. By the time the interviewer read option E, the respondents had forgotten what option A was.

In spite of the challenges that respondents demonstrated in trying to look at nature within the ecosystem service framework, they demonstrated rich knowledge of the elements of nature, that is, natural resources. For instance, they made a long list of wild animals (e.g. caracal or lynx, porcupine, civet cat, spotted hyena, reedbuck, mole, rabbit, jackal, meerkat or mongoose),

birds (plateau birds, ravens, hawk, hem bird, shepherd birds, southern ground hornbill, owl, vulture), reptiles (leguaan, lizard, snakes), and invertebrates (earthworms and others, like spiders, lice, locust) that they were aware of.

Respondents reported that rabbits and porcupines provide aesthetic value. Their skins and quills, respectively, are used as ornaments to decorate rooms. A mongoose is seen as useful in that its skin is used for medicinal purposes. Some of the animals were, however, reported as providing ecosystem disservices, that is, services that undermine the wellbeing of human beings (Shackleton et al., 2016). Examples were snakes and spiders that bite people, jackals and spotted hyena that eat livestock, locusts and moles that eat vegetables, and owls that are associated with witchcraft and bad luck.

These findings are supported by studies conducted by other scholars with a similar aim of investigating ecosystem service knowledge of non-scientific communities. Lewan and Söderqvist (2002) studied to what degree people in southern Sweden recognise various ecosystem services in a river drainage area by collecting data from a sample group that consisted of farmers, local officials, politicians and researchers. The study found that the ecosystem service concept was new to most informants, including those that had a natural science background, such as local environmental officials. Most of the respondents demonstrated a higher degree of recognising visible services, followed by invisible services, and lastly, human action in nature (Lewan & Söderqvist, 2002).

Lamarque et al.'s (2011) study in the French Alps produced similar findings. In response to questions about their knowledge and understanding of the concept of ecosystem services, only half the professionals mentioned that they had heard of the concept. They all gave imprecise definitions of what ecosystem services are, but they could link biodiversity and human welfare. This led Lamarque et al. (2011: 447) to conclude that "definitions and classifications of ecosystem services are purpose-dependent and should be judged on their usefulness for a particular purpose". Precise and tight definitions are useful for scientists who want to measure and quantify services, and decision makers who want to make decisions because of concrete data (Lamarque et al., 2011), but this serves little purpose in non-scientific contexts. In this study, although they had rich knowledge of ecosystem services, respondents could not fit it in the tight categories (provisioning, cultural, regulatory and supporting services) of the scientific framework that is provided by the MEA (2005).

Rodríguez et al. (2006) conducted a study aimed at identifying the ecosystems services provided by the leaf succulent Opuntia *spp* that local community members recognised in Ayacucho, Peru. Following De Groot, Wilson, and Boumans (2002), the researchers grouped ecosystem services into four categories: (a) production function, (b) habitat function, (c) regulation function, and (d) information function. Rodríguez et al. (2006) found that people recognised and assigned more value to services with direct-use value, such as Non-Timber Forest Products (NTFP), than they do to other services.

2.4.2. Lay knowledge-driven interpretation of ecological challenges

Some scholars question the efficacy of non-scientific knowledge systems in interpreting ecological challenges and devising appropriate intervention strategies. For example, Fabricius et al. (2006) maintain that the knowledge system does not respond well to quick and foreign changes in the ecosystem, such as invasion by alien plants. Du Toit, Walker and Campbell (2004) argue that ecosystems in the tropics continue to degrade unabated because of a lack of proper, adequate ecological knowledge and institutions.

Using an in-depth interview technique, respondents were asked what the most challenging ecosystem services-problems were they had historically experienced at their villages. The discussion revealed five main problems: water pollution, water shortage, overgrazing, soil erosion and invasive alien plants (IAPs), which respondents ranked in order of the magnitude of their effects on their wellbeing (Table 2.4).

The biggest problem was shortage of water that respondents said began with droughts that hit their villages in the late 1960s, early 1980s, early 1990s and early 2000s. Respondents noticed a progressive decline in rainfall from the 1980s. The communities have responded by digging wells and building brick walls around them to protect them from damage and pollution by animals. Some families have also bought rainwater-harvesting tanks to collect water off their roofs.

However, the meteorological records for Cala town (about 14 km from Mgwalana) do not support this notion of rainfall decline. Based on the long-term (>50 years) of rainfall data, the expected mean annual rainfall at Mgwalana is 680 mm (Schulze et al., 2008). Since 2000, the net primary production of Mgwalana, as determined by the MODIS PsnNet product (MOD17), has remained relatively constant, without any discernible trend (Figure 2.3).

Table 2.4. Ecological challenges ranked according to the magnitude of their effects to wellbeing

Ecosystem service challenge	Ranking
Water shortage	1
Overgrazing	2
Invasive alien plants	3
Soil erosion	4
Water pollution	5

Several authors, including Nompozolo (2000) in South Africa, Boillat and Berkes (2013) in Bolivia, and Lebel (2013) in Asia-Pacific, have shown that non-scientific communities' methods of interpreting rainfall patterns and predicting seasonal quantities are different from scientific ones.

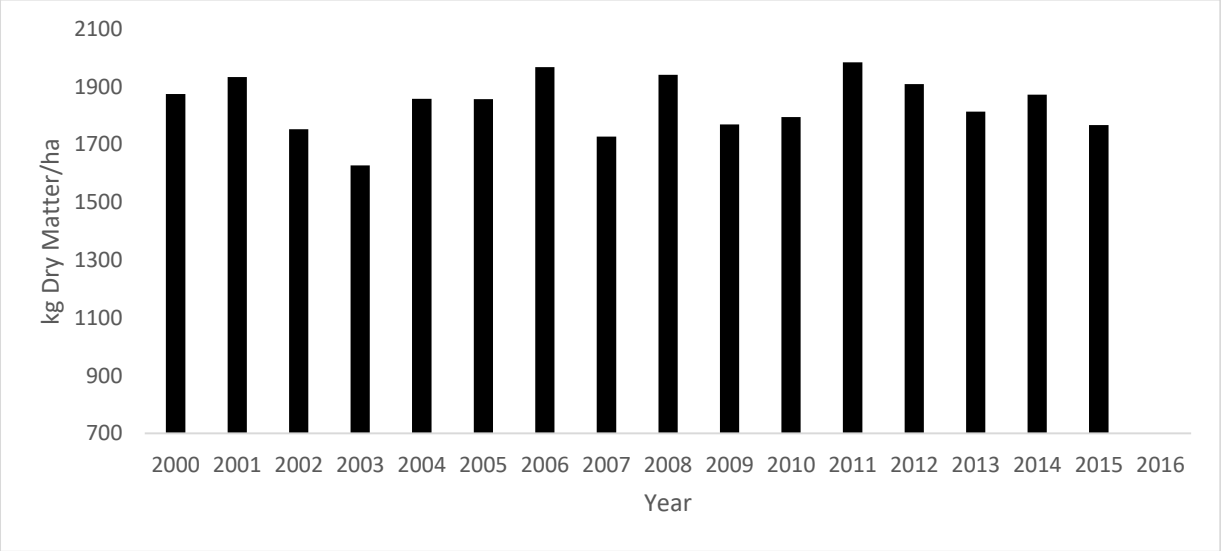

Figure 2.3. Net Primary Production in the unimproved grassland at Mgwalana

These methods include reading flowering of certain floral species, movement of the wind, seasonal timing of the rains vis-à-vis the planting season, and the appearance of certain bird species.

Agrarian communities are likely to be inclined to calculate rainfall quantities in terms of its ability to support crop cultivation and livestock farming practices in a given year. When rain comes in exactly the same quantities as it might have done the previous year, farmers are likely

to see it as much less if it arrives a month later for planting. In abstractive science, doing this might look bizarre: 800 mm remain just that, regardless of when it arrives in the year. However, a knowledge framework such as the ecosystems services concept whose role is to demonstrate the contribution of nature to human wellbeing, would be appropriate to this mode of calibrating rainfall.

Overgrazing of rangelands was the second problem that respondents said had progressively increased over the previous ten years. Overgrazing was strongly associated with the shortage of rainwater, and in some cases, by overuse of some areas because of a lack of herding or rotation of areas used by the animals. Respondents said that domestic animals were not herded because the children that were supposed to do the job were going to school and they did not practise rotational grading because they did not have fencing material. To mitigate the effects of overgrazing, the community of Mgwalana and Mahlungulu have put in place rules that prohibit indiscriminate veld burning. The communities allow controlled veld fires in September only, after the first spring rains. Burning grass at this time is locally regarded as a way of facilitating re-growth.

However, these rules are not always followed. Respondents reported that sometimes veld fires are caused by outsiders who, when driving past, throw burning cigarette stubs in the veld. Besides, there are no effective enforcement mechanisms in place; there are no dedicated personnel designated to monitor veld fires. The problem of overgrazing in this region has already been documented (e.g**.** Bennett, Palmer, & Blackett, 2012; Palmer & Bennett, 2013).

Another ecosystem problem is soil erosion. There was widespread understanding of soil protection and erosion among respondents who explained that, although soil erosion had occurred since time immemorial, its incidence had increased recently, coinciding with years of drought and the on-going phenomenon of erratic rains. Respondents blamed late and erratic rains for drying and low growth of grass, phenomena that they said lead to dry soils which erode easily. Crop farmers, in particular, had experienced soil erosion on their arable plots, and had mainly dealt with this problem by making contour ridges on the plots.

The last problem is invasive alien plants in the form of Australian invasive black wattle (*Acacia mearnsii)* that has grown on the villages' arable lands and rangelands for many decades. From the time of the arrival of black wattle (1950s, as determined from aerial imagery) to the 1980s,

some members of the community made several efforts to propagate the tree by taking seedlings from the forest and planting them in their own lands.

Until very recently, local people were not aware of the reality that black wattle was causing critical ecosystem disservices, such as invading rangelands and arable lands, as well as causing groundwater shortages. The trees provide villagers with poles for building houses, kraals, fowl runs and pigsties, as well as wood for fire, and shelter for their livestock when the weather is cold. All these are useful ecosystem services.

The knowledge that black wattle trees dry up groundwater and hence contribute significantly to drying up water sources, especially springs and wetlands, was not only new to local people, but they were informed of these processes by external agents, such as government officials and researchers. Although scientific research has already established this claim as factually true (Pejchar & Mooney, 2009; Turpie, Marais, & Blignaut, 2008), local people are still in the process of hearing, knowing, understanding and making value of this knowledge.

The implication is not just the existence of differences relating to knowledge between the locals and policy makers. Rather, these differences are reflected in, and significantly shape, how the people give meaning to the value of intervention efforts to remove the wattle, especially through the government-sponsored Expanded Public Works Programme (EPWP) in which local unemployed and indigent people are hired to clear wattle on riparian zones. Although local people have accepted the EPWP in their landscapes, they do not (as do the implementers) look at it as a programme meant to enhance the production and flow of ecosystem services. Instead, they view the EPWP programme as job creation and a poverty alleviation vehicle. Researchers including Turpie et al. (2008) and Büscher (2012) have argued that these programmes are driven by a welfare agenda, that is, to alleviate poverty through restoring ecological resources.

2.4.3. Aspired ecosystem futures

I drew the concept of ecosystem futures from scenario planning (Schoemaker, 1995), which entails eliciting narratives about an eco-future. “Scenario planning involves thinking about a wide range of plausible futures, including both well-known trends and key uncertainties, and using this information to generate a set of storylines that can guide decision making” (Bennett, Peterson, & Levitt, 2005).

Questions about what people aspire to are essentially idealistic and hypothetical. Responses to these questions need to be heavily probed; otherwise, they can be wild, and sometimes logically disconnected. As I collected responses for this theme, I considered this risk, and devised some mitigating means. When a response to desired ecosystem futures was given, I followed up by asking who the respondents thought would be responsible for making the environment reach the desired state, and how they thought the person or organisation responsible could work to make the ecosystem reach that desired state. These questions helped respondents to hypothesise with practicality in mind.

The most frequently desired ecosystem future was improved availability of water in rivers, streams and springs. One respondent said:

> "I would like the rivers to flow like they did in the olden days, because rivers are getting dry and the likelihood is that we will completely run out of water. When there is much water in rivers, even grass becomes healthy and grows in large quantities."

Respondents identified two major causes of the current depletion of volume in water sources. The first was that rain had dramatically decreased in quantity. Second, rainfall patterns had become erratic; rain often fell in short-lived heavy bouts, very late in the rainy season, and much was lost to the community in runoff. A respondent at Mahlungulu said:

> "The rain comes in little quantities. We normally receive rain in January to March and when the rain stops, it stops forever. It is difficult to cultivate land because the rain will only come in January to March."

Rain is understood to be a critical component of the broader ecosystem. One respondent expressed his strong sentiments about the value of rain when he said:

> "If it were my will or if I were capable of changing nature and everything else, I would say … I personally do not have a problem with winter, but the rain must not stop because rain is the driver of positive change. When rain is scarce, things change negatively and may dramatically reduce both crop and livestock productivity and delay productivity and even ruin nature."

The second aspiration of the respondents was to have green, healthy, tall grass back on the landscape again**.** It was reported that in the past there used to be abundant tall, green grass in

the veld. In the past, grass was used for thatching roofs because it was tall and strong. A perennial grass species called *Cymbopogon plurinodis* (bitter turpentine grass) suitable for thatching was reported to be decreasing in quantity; there is widespread fear that it will soon disappear and no longer be a resource for roof thatching.

One respondent spoke passionately about the need for green grass in the veld. He said:

> "I wish it could be green again; when the landscape is green, we benefit by breathing clean air. Second, when it is green, people can eat healthy food and livestock will be more productive. If we could receive rain, our landscape could be beautiful. Grass will be green, trees will receive adequate rainfall and water; hence it will be beautiful, including the livestock that feed on the grasses will be in good condition."

Responsibility for making this happen was reported as resting both with the local people and the government. The respondents felt that people can look after grass in several ways, for example, they can practise rotational grazing so that no portion of the grassland is overgrazed. Local people can also contribute by preventing random burning of the veld. The veld should be burnt every two years, and then rested for a year. Some of the respondents (63%) said the local traditional leaders can enforce compliance through a fine which perpetrators will have to pay at the local traditional courts. However, a sizeable number (37%) reported that they doubt if the fine system will work because perpetrators might go and lay criminal charges at the police camp against the traditional leaders for abuse of power. These respondents said the introduction of democracy in 1994 robbed traditional leaders of their power to administer punishment to community members.

Respondents added that the government can assist by giving fencing material so that villagers can divide the veld into camps to allow for rotational grazing. Rotational grazing makes it easier for livestock owners and other community members to observe and monitor the grass instead of what happens under the free-range pasturing practices which are currently used in the villages. When grazing camps are established, village members, especially livestock owners, can meet to organise how to use the grazing camps. In the past, they practised a form of rotational grazing in which they selected certain portions of the rangelands for grazing at a particular time, and rest some. They did not use fencing, but control of movement of livestock was managed through herding. Prior to democracy, herding was a major traditional rangelands

management practice and it was made possible because many children did not attend school due to the colonial and apartheid government's racially discriminatory service delivery policies. Respondents said, this changed with democracy which introduced compulsory free education policies which compel parents to send their children to school.

Respondents said the government can also appoint people to control veld fires because villagers do not have enough expertise and necessary equipment to deal with big fires. Village members can play a role in making sure that everyone in the villages observes fire prevention rules. One respondent at Mgwalana said:

> "We have historically worked as a community to monitor and control fire, hence there have been very few incidents of veld fire outbreaks in this village. In the last incident, a [white] farmer, who was able to stop the fire using his equipment, assisted us. Therefore, that kind of intervention from the government is necessary to resolve the fire problem. This should be complemented by establishment of grazing camps so that our grass can become tall once again."

The third desired ecosystem condition was fertile soil. When respondents talked about local histories of farming, strong narratives of soil, which used to be very fertile, dominated. They reported that crop cultivation used to thrive in the past when soil was still rich with green landscapes. Respondents said soil fertility was reduced by incessant dry spells, which led to depleted ground cover. One of the respondents at Mahlungulu said:

> "Basically, I think once we deal with the issue of soil erosion which affects the vegetation cover, this can lead to a number of related improvements, especially crop and vegetation growth."

The fourth desired ecosystem future was reduced invasive alien plants. The desire to clear wattle trees was not as animated or passionately expressed as other ecosystem aspirations, such as increased water supply, revived pasturelands and soils. This was in spite of the reality that, for the previous five years, the government had been intensively driving the wattle eradication agenda through multiple community engagement means, such as public meetings, research projects and the EPWP programme. Respondents said the invasive wattle bushes must be thinned, but not cleared because local people depend significantly on ecosystem services supplied by wattle trees such as fuel wood, building timber and shed for their livestock. The reality is that local people possess more knowledge of provision ecosystem services and rank

them more highly than regulatory services. Thus, they relate more closely with provision services, such as fuel wood and construction timber they derive from wattle trees, than they do with the invisible function of raising the water table by clearing the trees.

It is important to note that some of the management practices and knowledge that respondents reported are closely related, or are quite similar to the ones that were implemented by the state as intervention programmes, especially during the homeland era of the mid to late 20th century. Such practices include rotational grazing which was extensively implemented as part of the betterment which started as rehabilitation programme in the 1930s (De Wet, 1995; Murata, 2008). One of the key implications of the reality that South African indigenous communities have been recipients of many state-led intervention programmes is that it becomes difficult for a study like this one to categorically separate indigenous from received ecological knowledge. Denison and Wotshela (2009) realise this complexity, hence they advise that we need to look at IKS as a dynamic knowledge system which has over the years, grown throw adaptation, modification and indigenisation.

2.5. Implications for planning of intervention programmes and concluding remarks

Insofar as the ecosystem service approach is intended as a practical tool that helps facilitate a practice of healthy interdependence (facilitated by intervention programmes) between nature and humanity, the issues of how beneficiaries of associated intervention programmes experience and value nature have to be taken seriously. People's experiences and value of nature are significantly a function of their mental economy.

> "Value systems refer to intra-psychic constellations of norms and perceptions that guide human judgement and action. They refer to the normative and moral frameworks people use to assign importance and necessity to their beliefs and actions" (Farber et al., 2002: 375).

Thus, the value of an ecosystem service is a function of the contribution it makes to the specific objectives, goals and condition of its user. The value of a service is coupled with the value system of its user and what they aspire to (Farber et al., 2002).

Findings from this study have brought to the fore at least three factors that planners of ecosystem management or rehabilitation programmes may need to critically consider. First,

there has to be a shared understanding of the major concepts that underpin intervention programmes between programme planners and targeted beneficiary communities. The findings show that people have long and rich histories of living on, and with multiple forms of ecosystem services, but they do not share the scientific understanding of the term 'ecosystem services' which informs and underpins the EPWP currently being implemented in their villages.

Moreover, although they are familiar with more material and cultural services, they know little about regulatory and supporting ones; these are largely non-material. The extent to which people are able to identify and differentiate things or phenomena is a function of mental economy as people tend to develop more precise knowledge of things that immediately affect their daily lives, rather than a general cognitive issue (Beinart & Brown, 2013; Berkes, 2008). In a study of ethno-veterinary knowledge in rural South Africa, Beinart and Brown (2013) found that stockowners' knowledge about the aetiology of infections was largely based on what they encountered in the visible world, rather than on an understanding of the operations of invisible causes of disease such as germs and minuscule parasites. This speaks to the reality that non-scientific ways of knowing are more oriented to the material and concrete realm than to the microscopic and abstract (Berkes, Colding & Folke, 2000). Taking full cognizance of this reality helps make intervention programmes more in tune with local people's knowledge systems, and hence helps to close the epistemic distance between science and lay knowledge.

At Mahlungulu and Mgwalana villages specifically, policy makers and directors of intervention programmes may need to find ways of domesticating the ecosystem service concept; they have to understand how local people experience nature and what they aspire to for their local landscapes. Such findings can be used as baseline information for planning EPWP. Second, programme planners need to consider what the intended beneficiary communities themselves think are the ecosystem problems. The experience of living in a place for a long time puts one in a better position than an external expert to know what 'burning' issues needing intervention are. In this study, respondents reported water shortage and overgrazing as their first and second biggest ecological problems, respectively.

Third, beneficiaries' priorities need to be considered within the context of the problem issue. Interview data on desired ecosystem futures showed what issues the villagers at Mgwalana and Mahlungulu believe need to be attended to in order of their importance (Table 2.4).

Respondents aspire to a future in which there is sufficient water in rivers and springs, as well as healthy pasture resources and fertile soil. This priority list is in tune with survival needs for communities that draw substantially big portions of their livelihoods from land and associated natural resources.

A serious consideration of these place-specific issues goes a long way to making intervention programmes socially appropriate (Springett, Owens, & Callaghan, 2007). In a paper on sociology of health, Prior (2003) noted that, by confining medical knowledge and programmes to scientific knowledge, the medical profession began to face a legitimation crisis in the late 20th century. This forced the profession to start considering lay medical knowledge in their intervention programmes (Prior, 2003). "At the professional level, the response to the legitimation crisis has been to encourage participation in decision making and a democratization of decision-making procedures" (Prior, 2003: 43). Consequently, medical professionals have substantially shifted their perception of lay knowledge, from thinking that lay people are ignorant to realising that they may see things differently from the way others do.

My argument for the need to open more space for lay ecological knowledge in the ecosystem service concept is not motivated by a will to valorise it; rather it is a practical response to a practical question. In South Africa, the EPWP programme of removing wattles is implemented on land parcels, including arable and grazing land, of these people. Attempts to discount their interests pose the risk of attracting resistance.

Efforts to include lay people's knowledge of ecosystem services must start by recognising the variety of their encounters with different elements of nature. In listening to their narratives, what matters is not how the narratives fit into the boxes of scientific conceptual categories and classifications of ecosystems services. What is important is to understand how these people interpret ecosystem services in relation to pillars of human wellbeing that include economic, social and cultural – which could shed light on how they use ecosystem goods and services, and how their use and priorities could be reflected in intervention programmes.

To achieve this, science must be willing to include 'extended facts' as legitimate sources of evidence (Dasgupta, 1990). What is needed, especially in light of the EPWP being rolled out in rural villages, is a more pragmatic and expansive conception of ecosystem services and their linkages to human welfare. The MEA's (2005) classification provides a good start in that it

makes an effort to tie in ecosystem services directly with elements of human needs. However, by analysing the ontology of ecosystem services exclusively in ecological processes, scientists have made the ecosystem service concept unintelligible to lay people. In the final analysis therefore, the widely reported finding that lay people struggle to recognise certain ecosystem services when they are interviewed by researchers, is not an ontological issue (that lay people do not believe that ecosystem services exist). Rather, it is an epistemic question as it has everything to do with how the knowledge of these ecosystem services is constructed by different epistemic communities.

Payment for Ecosystem Service programmes, which in the study communities is implemented through the EPWP, have been critiqued as promoting market environmentalism; that is, they use market interests to define the value of nature, and are based on the belief that market forces can solve ecological problems (Büscher, 2012; Dasgupta, 1990; Kosoy & Corbera, 2010). The question of whether or not it is appropriate to use money for valuing nature has been extensively debated with pros and cons on both sides of the divide (Farber et al., 2002; Kallis, Gómez-Baggethun, & Zografos, 2013) (See Chapter 3). The question becomes even more relevant in this study which is exploring how local people understand the concept of ecosystem services.

The success of the EPWP programmes in South Africa is attributed to their approach of closely associating matters of ecological health and wellbeing of local people (Turpie et al., 2008). From its inception in the mid-1990s, the EPWP was explicitly underpinned by a twofold agenda of restoring ecosystems and alleviating poverty (Turpie et al., 2008). This framing is appropriate, but what is perhaps needed is to capture and express this human-nature relationship in public and scientific discourse. The current situation at Mahlungulu and Mgwalana points to the problem of an epistemic distance that separates scientists from lay people in ecosystem service-related discussions.

Fabricius et al. (2006) have discussed techniques on how to integrate other knowledge systems and science, but there are several difficulties that scientists face in attempting to integrate findings from other knowledge systems and science. Appropriate methods to achieve this integration have not been well-developed (Fabricius et al., 2006) and research in ecosystem services and the implementation of related ecological intervention programmes may need to focus on developing these techniques.

However, leveraging lay knowledge resources is not in itself the silver bullet. Lay knowledge has some fundamental limitations that need to be considered in the ecosystem service subject. As the study has suggested, lay knowledge struggles to comprehend the connections of microscopic ecosystem elements (including ecosystem attributes, processes and functions), and finds difficulty in adapting to externally-induced ecological ills, including IAPs. A complementary working relation between lay and scientific knowledge holds potential to strengthen both knowledge systems and hence cover the gaps that weaken either side of the science-lay knowledge spectrum.

CHAPTER 3: LOCAL PEOPLE'S KNOWLEDGE OF THE ECONOMIC VALUE OF ECOSYSTEM SERVICES

3.1. Introduction

This study explores the knowledge of economic values that communities living under common property tenure in rural Eastern Cape province of South Africa possess regarding the ecosystem services they use. The thrust is to reconstruct local people's knowledge of economic values of ecosystem services. Although ultimately the study seeks to contribute insights into the subject of economic evaluation, it does not do so by adding another empirical case of what ecosystem services are worth. Instead, it contributes by looking at what rural communities, often less literate, know about the economic worth of nature. This perspective of exploring the values of nature from the angle of local people is yet to receive sufficient attention in the South African ecosystem service literature.

Taking seriously the knowledge of local users of ecosystem services is, without doubt, an important strategy in assessing the relevance of the economic valuation technique. Value is an experiential phenomenon whose existence and quality can only manifest themselves through processes of how individuals live their lives in relation to their objectives and aspirations (Bockstael, Freeman, Kopp, Portney, & Smith, 2000; Farber et al., 2002; Hein, Van Koppen, De Groot, & Van Ierland, 2006). Necessarily, this renders people whose wellbeing depends on the ecosystem services critically important sources of the economic valuation data.

In the past three decades, the discourse of the valuation of nature has been confronted by several fundamental questions. One of them is whether or not it is appropriate to assign utilitarian value metrics to nature (El Serafy, 1998; Kallis et al., 2013; Norton, 2000; Small, Munday, & Durance, 2017). Put differently, the question sought to understand if it is appropriate to measure the value of nature by the magnitude of its contribution to the wellbeing of humans and their societies. This philosophical question interrogates the ontology of nature's value, and it is a debate that has been comprehensively covered by other scholars elsewhere (e.g. Burchett, 2014; Goulder & Kennedy, 1997), hence I will not repeat it here. The ensuing consensus is that nature has both intrinsic and utilitarian values.

The ecosystem service framework, a utilitarian conception of human-nature relations that has

been embraced globally, emphasises the need to understand the magnitude of the contribution that well-functioning ecosystems make to wellbeing of humans and their economies (MEA, 2005). The framework defines ecosystem services as the benefits that humans derive, directly or indirectly, from nature and its resources (Costanza et al., 1998; Daily, 1997; MEA, 2005). By emphasising the reality that human wellbeing depends on the existence of well-functioning ecosystems, the ecosystem service framework provides a motivation for responsible resource stewardship (MEA, 2005). Scholars warn that lack of, or insufficient understanding of the value of nature leads to resource mismanagement and unsustainable harvesting across the globe (Bresnihan, 2017; Losey & Vaughan, 2006; Ring, Hansjürgens, Elmqvist, Wittmer, & Sukhdev, 2010).

The dominant means of uncovering and showing the extent to which people depend on nature has been to conduct methodically organised valuation exercises, mainly in the form of quantitative economic approaches (Boyd & Banzhaf, 2007; Wallace, 2008). From the late 1990s, much ecosystem service literature has been occupied by interests in understanding the nature and amount of this contribution (Boyd & Banzhaf, 2007; Fisher & Turner, 2008; TEEB, 2010; Wallace, 2008). The literature has largely grouped values of ecosystem services into three: ecological, socio-cultural, and monetary (see Gómez-Baggethun & Martín-López, 2015; Jacobs et al., 2018).

Value commonly refers to the importance or desirability of something. The value of an ecosystem service, therefore, is the contribution it makes towards sustaining and/or improving the wellbeing of people. Human wellbeing is a subjective concept because it is about how individuals experience their lives in the context of their settings and objectives, aspirations and needs (Bockstael et al., 2000).

This study is concerned with the economic value of nature to local communities whose wellbeing depends on nature. Economic valuation is a method that seeks to establish the value of ecosystem services by determining their monetary worth, that is, market exchange value (Farber et al., 2002; Kallis et al., 2013). Exchange value refers to the monetary potential of good/services that accrue through market exchange (Kallis et al., 2013). For a good/service to have exchange value, it needs to have a commodity status. Commodification "refer[s] to institutional, symbolic and material changes through which a good or service that was previously not meant for sale enters the sphere of market exchange" (Kallis et al., 2013: 97).

Characteristically, the exercise of economic valuation involves representing ecosystem service values by a common monetary metric. The use of monetary metrics to quantify the contributions that ecosystem services make to lives of individuals proceeds on the assumption that these individuals are prepared to trade these services in exchange for money (Heal et al., 2005).

The concept of economic valuation of nature has been critiqued for many reasons. Some authors criticise it for commodifying nature, that is, rendering nature a market commodity (Appadurai, 1988; Gómez-Baggethun & Ruiz-Perez, 2011; Kosoy & Corbera, 2010; Kallis et al., 2013) which can lead to diminution of the intrinsic value of nature (Gómez-Baggethun & Muradian, 2015). Others argue that economic valuation is neoliberal; it is premised on the thinking that solutions to the world's environmental problems rest with the markets (Pandeya, Buytaert, Zulkafli, Karpouzoglou, Mao, & Hannah, 2016). Others argue that it is susceptible to the error of double counting, a situation in which ecological functions and services are counted as ecosystem services (Boyd & Banzhaf, 2007; Costanza, 2008; Wallace, 2008). Arias-Arévalo, Martín-López and Gómez-Baggethun (2017) posit that economic valuation is typical of neoclassical economics which sees the value of things through an instrumentalist viewpoint. Furthermore, economic valuation pays limited attention to contextual aspects in terms of the processes, structures and traditions of how decisions on resource access and use are made and power is exercised; that is, the institutional mechanisms that influence relationships and resource use outcomes (DeMotts & Hoon, 2012; Vatn, 2005).

Where valuing with money has been found to be difficult, researchers have often force-marched local people to pick responses from pre-arranged sets of monetary value ranges in techniques such as avoided costs (AV), replacement cost (RC), factor income (FI), travel cost (TC), hedonic price (HP), contingent valuation (CV) willingness to pay (WTP) and willingness to accept (WTA) (Bockstael et al., 2000; Farber et al., 2002). The predetermined choices that local people make are, in turn, presented as findings of what the people think. However, the reality is that such data are a representation of what the researcher asked respondents to say, which raises the question: economic value to whom, to the researched or to the researcher? If it is to the former, it might be valuable for research methods to be open and flexible to allow the researched, who is not aware of the objectives of the study, to narrate how they experience nature's value and the context in which this value manifests itself, and so to articulate their needs.

This barrage of criticism notwithstanding, over the past three decades, economic valuation has continued to be the dominant technique of communicating the contributions that nature makes to humans. De Groot et al. (2012) and Farber et al. (2002) provide a detailed motivation for using economic valuation, in that that it raises awareness of the worth of nature to the public, and that money is the only unit measure that is commonly understood across the world; therefore, whether or not to value nature with money is no longer the question. What remains an active question, and one that motivates this study, is when and under which conditions/circumstances is it appropriate to value with money? This question interrogates the applicability of economic valuation as a method of quantifying the contribution that nature makes to the wellbeing of humans in different contexts.

The study does not reject the practice of economic valuation *in toto.* Rather, it aims to highlight monetary valuation's apparent blindness to the role of causal mechanisms required for nature to acquire a commodity status and thus be perceived by the people to whose wellbeing it contributes, as a tradable object. The study aims to show that the practice of economic valuation, without understanding the local people's perspective of such value might be socially void in some contexts, which could make economic valuation meaningless to the people whose relationship with nature they claim to represent.

This is not a study of economic value of ecosystem services in the conventional sense of the concept because it did not aim to establish the economic value of ecosystem services. Rather its aim was to explore the knowledge of local people about the economic value of the ecosystem services. Accordingly, the views and ideas of the people who experience the contributions of these ecosystem services to their lives are the focus of this study.

The use of the concept of *meaningfulness* is inspired by qualitative methodology's argument that researchers should strive to achieve an emic rather than an etic understanding of study phenomena (Merriam & Tisdell, 2016). An emic understanding involves understanding phenomena from the perspective of those who participate in it. This is different from etic understanding which involves how outsiders understand a phenomenon (Patton, 1985; Merriam & Tisdell, 2016). Economic figures of ecosystem services can only be meaningful to the extent that they are what the users to whose wellbeing the values are connected, think they represent. Costanza et al. (1998) grappled with the question of how to develop meaningful indicators of economic values of ecosystem services when these services do not have markets.

3.2. Theoretical inclination

The study used the philosophy of critical realism as both a theoretical lens and analytical instrument (Bhaskar, 2016). As a theoretical lens, critical realism was used to make meaning of the study object (knowledge of local people) and how this knowledge can be gained or acquired. As an analytical instrument, the study uses critical realism's retroductive analytic technique to establish the conditions or causal mechanisms that, if they exist, people who use ecosystem services find it difficult to perceive as commodities that can be represented in monetary units.

The argument that drives this study and its aim is that the nature of things we seek to know, and our knowledge of those things, are different realities (Bhaskar, 2016). As humans, we do not enjoy direct access to reality, that is, the things that we seek to know. We can only access those things through employing certain ways or genres of knowledge, and this knowledge is constructed in particular contexts which either make it possible or difficult for us to access knowledge of certain realities or things (Bhaskar, 2016).

The contexts within which we seek to gain knowledge of reality, and the knowledge genres we use, inevitably influence us to have correspondingly different knowledges of these things (Sayer, 2000; Bhaskar, 2016). By exploring the knowledge of local people about the economic value of their ecosystems within the socio-economic contexts provided by their villages, the study hopes to contribute an alternative way of understanding the valuation of nature; one that, although it does not undermine, marks a departure from the dominant practice of looking for economic values in grand methods. In contrast, this study considers people's knowledge as the principal source of economic value of nature.

Critical realism, by virtue of its ontology that disambiguates reality (in this case, the economic value of ecosystem services) from epistemology (how we come to gain knowledge of these economic values) offers a promising alternative to its counterpart meta-theories such as empiricism and constructivism. Empiricism and constructivism tend to reduce reality to what can be known about it (Danermark et al., 2002; Sayer, 2000). Studies that are informed by these meta-theories tend to concern themselves with finding monetary units only, while ignoring arguments about how knowledge of these values becomes possible (De Groot et al., 2012; Favretto et al., 2016). Unlike many other valuation studies, this study does not stop at

observation of empirical events (economic values), but proceeds to enquire about the underlying conditions (generative or causal mechanisms) that make local people assign the values they do to ecosystem services. I use the retroductive analytical technique to establish the conditions (Bhaskar, 2016). Retroduction involves moving from observation to theoretical explanation of events (Price, 2016). The study achieved this by collecting both quantitative (economic values) and qualitative (narratives about why respondents assign these values) data. Several informants answered "I don't know" to questions that asked their knowledge of the economic value of ecosystem services. I analysed the narrative responses to establish the conditions.

The core of retroduction is the transcendental argumentation in which one establishes the basic requisites or conditions for something to be what it is (Danermark et al., 2002). Conditions in this context refer to properties or circumstances without which something cannot exist, or be what it is (Bhaskar, 2016; Danermark et al., 2002; Sayer, 2000). The transcendental argument is a repudiation of tendencies by other meta-theories, including empiricism, which reduces knowledge to what is observable, and constructivism which reduces knowledge to concepts and discourse (Bhaskar, 2016; Danermark et al., 2002: Price, 2016; Fletcher, 2017). Yet there are other ways of apprehending reality beyond observation. In the context of this study, it is important to consider the conditions that are necessary for economic valuation because although value is real, it can only be experienced in context. By providing this insight, critical realism helps this study to add a novel dimension to valuation studies.

3.3. Description of study sites

This study was conducted at three remote villages of Colana (30°36′45,46″S 29°32′,77″E), Gogela (30°22′,535″S 29°14′,613″E) and Nozitshena (30°63′,585″S 29°21′,803″E) in the Eastern Cape province, South Africa. The study area is part of the former Transkei, a homeland that was proclaimed by the apartheid government in 1976 for largely isiXhosa-speaking people, ostensibly to promote development of their culture and traditions. Transkei was re-incorporated into the South African state system to form part of the Eastern Cape Province in 1994, following the transition to democratic rule. Administratively, the study area falls under the Umzimvubu Local Municipality. The municipality has two small towns: Mt Frere (serving Colana) and Mt Ayliff (serving Gogela and Nozitshena).

The leasehold tenure system (McKean, 1996), sometimes referred to as communal tenure (Cousins, 2008), is the dominant institutional mechanism used to govern relations among people in land management issues and related natural resources at the three villages (Stats SA, 2016). The communal tenure regime involves a complex bundle of socially embedded rights (Cousins, 2008), including collective rights of access and control of grazing, forest, river and spring resources, and individual rights over arable and residential lands (McKean, 1996).

However, *de facto,* these rights are difficult to exercise and realise in the villages, for at least two reasons. First, at the local level, there is the institution of traditional leadership, which is customarily the *de jure* owner of the village and its common property resources that include natural resources (Cousins, 2008). Second, the presence of the institution of the state, which legislatively is the nominal owner of all communal lands in South Africa, further blurs the already faint lines of resource appropriation among households and individuals at these villages. South Africa applies both civil and customary law in land administration in a confusing way which has left many questions unanswered. Such questions include who has rights of ownership or control over land resources in traditional villages between the state, local traditional leadership and the local people (Cousins, 2008; Denison, Murata, Conde, Perry, Monde, & Jacobs, 2015).

Economic activities and livelihoods at the villages have, since historical times, been largely underpinned by a distributive market ethic. This custom is a tradition of exchanging goods and services not for profit, but as a social obligation to support kin and neighbours (Bank, 1991). Livestock, including cattle, sheep and goats, form the main commodity items. Other goods include fuel wood, thatch-grass, and construction timber. For all these ecosystem goods and services, the exchange processes largely revolve around local circuits of intra-village and inter-household subsistence market relations in which exchange is not driven by marginal values, but by an ethic of mutual support and building social capital (Interview with Mr Mdletshe at Gogela village, 25 April 2018). Although recently, with the introduction of a formal marketing system, livestock, especially cattle, sheep and goats, are being sold at market prices (Gwiriri, Bennett, Mapiye, Marandure, & Burbi, 2019), the dominant practice towards natural resources including fuel wood, thatch-grass and water is of communal assets to which no one can lay absolute claim.

From 1994 onwards, rural livelihoods in South Africa became significantly monetised through

government cash-transfers to the elderly, disabled, chronically sick, and children. In Umzimvubu Local Municipality, the cash-transfers contribute a staggering 89.2% of the total annual household income, with a 43.8% poverty intensity (Stats SA, 2016). Monetisation through the state cash-transfers has led to a state of adverse incorporation of the village economics into mainstream economic markets (Du Toit & Neves, 2007). Recipient households are only involved in the monetisation process at the point of spending, which is the tail-end of the value chain of cash economics. The relevance of these social-economic features for this study is that they draw attention to the potential levels of market awareness at which local people make sense of questions related to economic values of the ecosystem services they use.

3.4. Methods and approach

The major aim of this study was to uncover the meaning of the phenomenon of the economic value of ecosystem services for those involved in the use of those services. Inevitably, this aim influenced how and why I made certain methodological decisions, some of which are less orthodox and therefore seem weak in the context of a conventional ecosystem valuation study.

Qualitative approaches, whose key epistemological assumption is that knowledge of social reality is gained by "understanding how people interpret their experiences, how they construct their worlds, and what meaning they attribute to their experiences" (Merriam & Tisdell, 2016: 6) guided the direction of the study. A key aspect to note is that interest in understanding a study phenomenon through the meanings attributed to it by participants presupposes a deliberate and methodical shift of attention from grand data collection techniques to people as principal sources of data. Qualitative approaches generate contextual (socially-constructed), non-universal (specific) and non-transcendent (historical) data which can be viewed with contempt by those with a quantitative orientation to understanding economic value (Stirling, 2010). However, qualitative data collection techniques can provide contextual contours that can inform our understanding of economic values of ecosystems. Understanding the local context requires that local people become principal stakeholders in the assessment of ecosystem values.

3.4.1. Study design

This work was designed as a multi-site, or multi-case, study involving three different villages. I chose three villages in order to capture variations and corroborating evidence which helped

enhance the reliability of my arguments and conclusions (Miles, Huberman, & Saldana, 2014). One of the frequently referenced definitions of case study is by Yin (2014:16) who states that "a case study is an empirical study that investigates a contemporary phenomenon (the case) within its real-life context, especially when the boundaries between phenomenon and context may not be clearly evident." (Miles et al. (2014) conceive of a case study as the study of a phenomenon that happens or exists in a bounded system. The bounded system could be a village, a school or any other locale with clear boundaries. The major contribution of case study to the research enterprise it that it seeks to understand social reality in context.

The significance of context is not simply to argue for relativity, that same things may have different meanings in different contexts. Rather, the role of context in this study is more fundamental in that it considers the role of context in shaping the meaning of things. Knowledge of the value of ecosystem services is constructed within contexts, hence its truth claims cannot be decontextualized. Although some scholars (Chalmers, 1999; Fabricius et al., 2006) designate scientific knowledge as universal, its claims cannot be decoupled from the context of its epistemological and ontological assumptions.

3.4.2. Sampling

I used probability sampling to select respondents. Because it ensures that all members of the population stand an equal chance of being selected, probability sampling allows for statistical inferences to be made from the sample to the population as a whole (Denison et al., 2016). There are several criteria for determining permissible sample sizes in survey studies (Babbie et al., 2001; Denison et al., 2016; Hill, 1997; Israel, 1992). Largely because this study was interested in conducting descriptive statistical analysis, I followed the recommendation that the sample size should not be less than 10% of the total population of the case village (Denison et al., 2016; Roscoe, 1975) as determined by the number of households at the study site.

A printout of satellite images (extracted from Google Earth)[1] of the three villages served as sampling frames. The images showed 350 plots at Colana, 250 at Gogela and 75 at Nozitshena. Working with a local field assistant, I identified and removed vacant residential plots, as well as other non-residential structures such as churches, community halls and schools from the

[1] Google Inc. (2013). Google Earth (version 7.1.2.2041). [Software]. Available from: http://www.filehorse.com/download-google-earth/

totals. Thus, I sampled 19% (65) of occupied houses at Colana, 21% (54) at Gogela and 46% (35) at Nozitshena. The sample percentages are different; the smaller the population size the bigger the sample percentage. This helped me to recruit many respondents in smaller villages so as to enhance depth of the final dat. I used Morey's (2014) random number table to select participating households. By using the random number-generating table, I ensured that all households at each case village stood an equal chance of being selected (Denison et al., 2016; Morey, 2014).

I recruited heads of households for participation. In cases where heads of households were not available, I interviewed the oldest household member responsible for household affairs. The same sampling, data collection procedures and analysis were applied to all three village cases. I piloted the data collection instrument for one day at each village, during which it became clear that many respondents struggled to make sense of questions that asked them to estimate ecosystem values according to monthly use.

3.4.3. Data collection

Data collection instruments were designed to collect both quantitative and qualitative (narrative) responses. However, I used open-ended questions rather than closed questions with ranges of value which asked respondents to make choices. Respondents had the freedom to give a value figure that suited their knowledge of ecosystem services. The questions provided space for respondents to give reasons for their estimates, especially in cases where they said they did not know the value. After collecting the data, the value figures were organised into ranges on an Excel sheet to make analysis and reporting more manageable.

In order to determine frequency questions[2] that local people could relate to, I grouped the different types of provisional and cultural services into three categories: daily services, *ad hoc* services, and durable services. I asked respondents to indicate the number of times they collected ecosystem goods in a month. Daily services included wild vegetables, wild fruits and fuel wood. *Ad hoc* services included those that enhance health, spiritual and cultural wellbeing. These services do not have fixed times of the year or number of times that a household is expected to need them. For instance, a household may perform a cultural rite once, thrice, or

[2] Frequency questions sought to elicit the number of times in a month, season, or year households collected certain resources from which they derived the services.

five times a year. The frequency is *ad hoc*. Consequently, I asked for the number of times they collected resources that supply these services in a year and divided the total by two to get a six-month seasonal (winter and summer) value.

The third category was durable services which, once accrued, tend to last for long periods of time, usually in excess of five years. These include construction services from timber and thatching grass since dwelling structures do not demand a fresh supply of timber or grass every year. In one of my pilot interviews, I found that grass thatch lasts typically between 15 and 30 years before it needs to be replaced. Accordingly, I asked respondents to indicate quantities of such resources used for a dwelling, and then worked with the respondents to find economic values using rates at which the resources were sold in the local village markets at that time. As a result, I used respondents' reported values to arrive at the economic value of these services on a standing dwelling structure.

The concept of conditions is a critical realist tool for building knowledge about phenomena or objects we seek to know. It proceeds from the premise that all reality, including events, objects and concepts are what they are by virtue of properties (conditions) that constitute them (Danermark et al., 2002). Therefore, to gain a full understanding of the things that research seeks to know, it must not stop at the level of empirical facts only (the level of the what, or what is); it must dig deeper into the level of conditions. In this study, I elicited narratives that explained why respondents allocated particular values to certain ecosystem services. In cases where respondents said they did not know the value of certain services, I elicited narratives on why they did not know. The elicited narratives addressed the question about what makes the respondents see the economic value of ecosystem services the way they do. This, in turn, shed light on the conditions that need to exist for local people to perceive ecosystem services as economic goods.

3.4.4. Data analysis

Consistent with the aim of the study, the process of data analysis sought to uncover the best explanations of local people's knowledge of the economic value of the ecosystem services they use. The analysis comprised two separate, but related levels. The first level was empirical, in which quantitative data were analysed. The second level was abstract, in which in-depth narratives were retroductively analysed.

On the first level, I looked for text passages and quantitative units that demonstrated respondents' knowledge of values of ecosystem services. This information was derived from the quantitative questions. Data were coded to make them manageable and fed into a data matrix. When looking for distribution of value ranges (e.g. R1–R100, R101–R200), I wanted to answer the question: How many households assign X amount of economic value to ecosystem service Y?

The second level of analysis was qualitative in which demi-regularities were identified to form initial codes. Demi-regularities are tendencies or widespread trends found in data (Fletcher, 2017). In this study, typical demi-regularities included statements such as, "I do not know because the resources are not mine".

I moved to retroductive analysis in which I sought to explain why many respondents across the three case villages could not assign economic units to the ecosystem services they use. Characteristically, retroductive analysis proceeds from analysing empirical phenomena to reconstruct basic transfactual conditions for the phenomena to be what they are (Danermark et al., 2002). Transfactual conditions are factors or constitutive properties for something to be what it is (Danermark et al., 2002). Conditions refer to circumstances that account for what a phenomenon or object is. An analysis of transfactual conditions is concerned with a fundamental as opposed to an empiricist inference of phenomena. By conducting the retroductive analysis, the study sought to arrive at what basically constitutes the phenomenon of ignorance of the economic value of nature's services.

The coding process involved several rounds. The initial 20 codes were re-read several times and then grouped together with codes with similar themes. The final number of four codes I named transfactual conditions. I used NiVivo querying technique to identify the most dominant codes, such as lack of appropriation. The study made use of direct quotes from the respondents as evidence to support claims and express meanings (Newing, 2010).

3.5. Findings and discussions

3.5.1. Socio-demographic profile of respondents

I interviewed a total of 154 respondents whose ages ranged from 50–85 years. More than half (53%) of the households were headed by women. The average household size consisted of six

members which is more than the 4.3 household size national average (Statistics SA, 2016). There were low levels of formal education with just above half (50.6%) of the respondents having no formal education at all, followed by 27.9% with primary education, 18.8% with secondary and 2.6% with tertiary education as their highest levels of qualification.

Households used a number of energy sources, including fuel wood, cow dung, paraffin, gas, and electricity. There were low rates (30%) of access to electricity. There was high dependency on ecosystem services, such as spring water for domestic use, river water for laundry and livestock, grass and timber for construction, medicinal and cultural services for health and spiritual wellbeing, as well as wild fruits, wild vegetables, bush meat and fish for food. The local communities invest heavily in livestock farming, with 55.8% of the households possessing cattle, 54.4% goats, 67.5% sheep and 96% chickens, from which they get substantial amounts of their meat diet.

3.5.2. Knowledge of the economic value of daily ecosystem services

3.5.2.1. Knowledge of economic value of wild fruits

All the participant households reported use of wild fruits (Table 3.1). A variety of wild fruits are harvested in different seasons of the year including *Opuntia ficus-indica* (*itolofiya), Physalis viscosa (iguzi), Ficus sp. (amafiya)* and *Psidium littorale (igwava). Opuntia ficus-indica* is often traded in local markets in the Eastern Cape Province. Although these fruits are not necessarily indigenous to South Africa, having been introduced through contact with white settlers, local people have indigenised, and treat them as integral components of their cultural fruits and their local landscapes. The reality that all of these fruit trees are assigned local names is evidence of the degree of indigenisation that has taken place over the years.

The fruits are sold in five-litre buckets at ZAR15 per bucket. Respondents were asked to estimate the number of five- litre buckets their household ate per month and the number was multiplied by ZAR15 to give a month value. But the technique was applied only to those who reported that they knew the value.

Table 3.1. Reported economic value of wild fruits per month

Recognised economic value	Frequency (n=154)	% of respondents
ZAR1-ZAR100	4	2.6
ZAR101-ZAR200	2	1.3
I don't know the value	148	96.1

At the study sites, people did not consider wild fruits as an important component of household foodstuff as they did in the past, and many eat them just as a luxury. The elderly reported eating wild fruit was a way of re-living the past. The young ones eat them only opportunistically when they encounter them while tending to livestock or fetching fuel wood in the forest. There are at least two major implications of this: first, household members seldom bring wild fruit home; second, those that eat them often do not remember how much they ate, or how many times in a month or season (Menton, Lawrence, Merry, & Brown, 2010).

Table 3.1 shows that a substantial proportion (96.1%) of respondents reported that that they do not know the economic value of the wild fruits their household eat. In a study of *O. ficus-indica* (*itolofiya)*, Beinart and Wotshela (2011) found that the fruit was also used for brewing beer for sale. However, the authors acknowledge that it is difficult to calculate the economic contribution of the fruit because local people do not keep records, and their harvesting trips are ad hoc, albeit the fact that the fruit is seasonal. The implication of this reality to this study is that I could not use seasonality as a proxy of quantities local people harvest because even during the ripening season of the *O. ficus-indica* local people's harvesting trips are ad hoc; they depend on various factors such as degree of need and availability of time.

These findings are supported by a study of wild fruit use in Zimbabwe by Campbell (1987). Although Campbell's study was on purely indigenous wild fruits, it bears relevance to this current study because in both cases the fruits are wild; and not domesticated. Campbell (1987) found that wild fruits were eaten mainly by children and many households did not regard them seriously as part of their diet. Respondents argued that they could not assign economic value because the fruits do not belong to any one because they are in the forest.

3.5.2.2. Knowledge of economic value of wild vegetables

Like wild fruits, wild vegetables, locally known as *imifino*, were used by all households. Respondents reported a variety of wild vegetables, including *Amaranthus thunbergii (utyuthu),*

Chenopodium album (imbikicane/imbicicane), Bidens pilosa (umhlabangubo), Solanum nigrum (umsobosobo), Urtica (urhalijane) and *Sonchus oleraceus (ihlaba/irhawu)*[3] that they eat as part of their household meals. The issue of adaptation and indigenisation (Denison & Wotshela, 2009) applies in this cases of valuation of wild vegetables. Many wild vegetables that are used in these communities bear an exotic history; some of which were introduced by white settlers, while others came to South Africa through other means. What is important in the study is not so much whether the resource is indigenous or not, but the knowledge tradition that is used to interpret and make sense of its value. The reality that IKS, especially its branch in traditional ecological knowledge (TEK) adapts to emerging realities is widely acknowledged (Berkes, 2008; Berkes & Colding, 2000; Fonseca-Cepeda, 2019; Gómez-Baggethun & Reyes-Garcia, 2013; Mazzochi, 2006).

The study found that although wild vegetables continue to be highly regarded as being healthy and medicinal, like wild fruits, they are now largely eaten by the elderly who reported that eating them connects them with their past. Some households resort to wild vegetables when they do not have money to buy domestic vegetables and meat from shops. Respondents (95%) reported that young and educated household members generally ridicule eating wild vegetables as a sign of poverty and backwardness.

It was difficult to find an effective strategy for calculating the quantities consumed by households per month. Many studies conducted on wild vegetables in South Africa focused on the use, and not economic value (e.g. Asofo-Adjei, 2004; Rose & Guillarmod, 1974; Shava, 2000). The option of using the bundle-unit of domestic vegetables, such as spinach, as a standard unit was not viable, given the reality that wild vegetables tend to have small leaves which cannot be tied into a bundle. When harvesting wild vegetables, women often use plastic jugs or tins ranging from two to five litres in size. A full five-litre plastic jug or tin full of wild vegetables is enough to make a single meal for a four to six-member household. Some respondents said this could be worth between ZAR20 and ZAR30, given the fact that some of the varieties are becoming scarce. I used the average figure of ZAR25 and multiplied it by the number of five-litre containers a household consumed per month. Only 30% of respondents could assign an economic value to the wild vegetables their households used (Table 3.2).

[3] Although these vegetables are not indigenous to amaXhosa communities of this region, they are regarded as wild vegetables because they grow by themselves in the forest.

Table 3.2. Reported economic value of wild vegetables per month

Recognised economic value	Frequency (n=154)	% of respondents
ZAR1-ZAR100	25	16.2
ZAR101-ZAR200	5	3.2
I don't know	124	80.5

3.5.2.3. Bush meat and fish

All respondents reported that their households use bush meat, and fish from rivers. The main source of fish is Umzimvubu River, one of the biggest rivers in South Africa. Villagers hunt bush meat from local forests which surround the villages. The commonly hunted wild animals reported include *Tragelaphus strepsiceros (impunzi), Phacochoerus africanus (nxakwe), Lepus saxatilis (unogwatsha)* and *Erethizontidae (incada)*. However, bush meat was not a key livelihood source.

Respondents were asked to report on the quantities of bush meat and fish they eat in a month. Together with the respondents, I calculated the value of bush meat and fish by estimating the monthly consumption amount in kilograms. I calculated bush meat at ZAR35/kg and fish at ZAR25/kg. I arrived at these figures with the respondents (Table 3.4). Bush meat is rarely sold at the study villages, although some big butcheries in the area sell bush meat, mostly *Phacochoerus africanus* and *Tragelaphus strepsiceros,* at prices ranging from ZAR30 to ZAR40/kg (Table 3.3).

Table 3.3. Reported economic value of bush meat per month

Recognised economic value of bush meat	Frequency (n=154)	% of respondents
ZAR1-ZAR100	14	9.1
ZAR101-ZAR200	18	11.7
I don't know the value	122	79.2

Table 3.4. Reported economic value of fish per month

Recognised economic value of fish from river	Frequency(n=154)	% of respondents
ZAR1-ZAR100	12	7.8
ZAR101-ZAR200	3	1.9
I don't know the value	139	90.3

3.5.2.4. Knowledge of economic value of fuel wood

All households, including those with access to electricity, depend on fuel wood for cooking, especially such high-energy demanding food such as beans, meat, and *pap (thick porridge)*, as well as for brewing beer, and baking bread and confectionary. The main tree species reportedly used for fuel wood are alien invasive species, especially *Acacia mearnsii* and *Acacia dealbata*. Households with access to electricity mainly use it for lighting and making light breakfast meals that involve cooking eggs or porridge, and making tea or coffee. They avoid using electricity for cooking high energy-demanding meals because it is expensive for households with low income levels. Dependence on fuel wood is illustrated by one respondent's statement: "We have electricity but we haven't stopped using the fuel wood; we don't even buy it. Fuel wood is still very important. I do not want to lie."

The households use a mixed means of collecting fuel wood: carrying on the head, or buying from local dealers who sell it usually in donkey cart loads, and occasionally in tractor and *bakkie* (open truck) loads. Self-collection involved carrying bundles (*inyanda*) of varying sizes as and when the need arose. The practice and process of acquiring the fuel wood are not systematic; they proceed on a needs-basis and individual household capacity. A household's manpower or financial resources at any given time determine how it gets fuel wood. This was the case across all the three villages.

Respondents were asked to estimate the number of donkey cart loads of fuel wood their households used per month. The number was multiplied by ZAR350, the local market price of a load. I then asked the respondents if the figure was a true reflection of the value of fuel wood they used in a month. More than half of the respondents (65.66%) said they did not know the monthly economic value of fuel wood. Of the less than 34.34% that said they knew, the majority (71.1%) reported between ZAR201–ZAR400 per month.

3.5.3. Knowledge of economic value of ad hoc ecosystem services

3.5.3.1. Medicinal plants

Of all the respondents, about 88% reported that they use medicinal plants for health and the other wellbeing needs of their members (Table 3.5). However, it was difficult to set a timeframe against which to measure household use of medicinal ecosystem services. I set a monthly timeframe for measuring the value of medicinal plants in the piloting data collection exercise. One respondent retorted:

"Medicine is not grocery that you have to buy, eat and finish every month. I fetch medicine from the forest when there is a sick person in the home. I do not know when sickness will strike, and which type. So, I cannot have a budget for that."

Since the monthly time-frame would not work, I asked for values per season, then divided the year into two seasons, winter and summer. The idea was not to compare economic values in winter with those in summer, but rather simply to give respondents a timeframe longer than a month. Care was taken not to give a timeframe too long for old people's memories. Many studies on the value on traditional medicine have been conducted in South Africa, but they largely focus on understanding the value through analysing sales on the market (e.g. Dold & Cocks, 2002) and use (Dold & Cocks, 2000; Zukulu, Dold, Abbott, Raimondo, 2012).

Respondents (only three) who estimated the economic value of medicinal plants from ZAR5001 to ZAR6000 were mainly those who either sell or practise as traditional healers. The majority of respondents (72.59%) had no knowledge of the economic value of the medicinal services they used. Reasons given for this included being unable to remember the number of times they collected medicinal plants, and not measuring quantities when they did collect.

Table 3.5. Reported economic value of medicinal plants per season

Recognised economic value	Frequency (n=135)	% of respondents
ZAR1-ZAR1000	9	6.66
ZAR1001-ZAR2000	10	7.41
ZAR3001-ZAR4000	8	5.93
ZAR4001-ZAR5000	7	5.19
ZAR5001-ZAR6000	3	2.22
I don't know the value	98	72.59

Studies have recognised that traditional medicine is a critical service industry in South Africa, worth about ZAR270 million per year (Dold & Cocks, 2002; Mander, 1998). However, the economic contribution of traditional medicine remains difficult to capture, hence Dold and Cocks (2002) refer to it as a hidden economy. At the study sites, households use medicinal ecological resources for multiple uses (Table 3.6).

Table 3.6. Use of medicinal plants

Use	**Frequency (n =135)**	**% of respondents**
Chase evil spirits; household health	135	100
Bring luck for employment and lovers	99	73.33
Fight court cases and other accusations	65	48.14
Treat livestock	40	29.62
Treat others and sell	14	10.37

*The numbers and percentages in this table do not add to 100% because some respondents appear in more than one category of medicinal use.

Respondents were largely unwilling to divulge names of the medicinal plants they use to 'bring luck for employment' and 'love'. The majority (80%) of them said this was a secret. The few that chose to disclose said they use herbs such as *Liquorice (umlomomnandi)*, *Helinus integrifolius (ubulawau)* and *Kedrostis nana (uthuvishe).* They place a small piece under the tongue when going to talk to a prospective employer or prospective lover. The medicine makes all their words taste sweet in the ears of the people they talk to. No one wanted to disclose names of medicinal plants used to fight court cases and other village accusations, such as when a married woman is accused of infidelity, or when a man is accused of sleeping with another man's wife.

A study on the use of medicinal items provided by other knowledges outside occidental science in traditional villages whose cultures are under heavy siege from modernisation, may fail to get honest responses. In this study, about 88% of the sample reported that they used medicinal plants in their households. During a debriefing, my field assistants who also live in the study communities, said that the number of households who use traditional medicine is higher than this (135 out of 154). They said some people avoided reporting because use of medicinal plants (traditional medicine) is criticised in these villages by Christians and educated people who associate their use with witchcraft practices.

3.5.3.2. Knowledge of economic value of cultural services

All the respondents said their households depend on various ecological resources for their cultural wellbeing. Respondents reported several cultural practices that require the use of different ecological resources (Table 3.7). However, it was difficult to elicit economic values of these resources largely because some of the cultural practices are conducted secretly (Table 3.8).

Table 3.7. Reported value of cultural services

Monetary value	Frequency (n=154)	% of respondents
ZAR1-ZAR100	12	7.79
ZAR101-ZAR200	10	6.49
ZAR201-ZAR300	4	2.60
ZAR301-ZAR400	8	5.20
I don't know the value	120	77.92

In the study of knowledge and use of ecosystem services (Chapter 2), I found that local people are very secretive about some of their cultural practices, especially initiation, such that respondents may avoid reporting freely on the resources they use. About initiation (*ulwaluko*) one informant said, "You don't share what happens on the mountain[4]. You can be beaten to death when you share the secrets." This reality makes it difficult to explore the knowledge that local people have of the economic value of these services. Valuation techniques such as pseudo markets, willingness to pay or willingness to accept may be used in such circumstances, but they cannot capture the people's lived experiences.

There are several other cultural services that locals get from ecological goods. These include creatures such as a *Pseudaspis cana (majola*), an ancestral snake of the people of the Jola clan[5] (Table 3.8).

[4] Local communities practise initiation for boys which they call *ulwaluko*. This is a very secretive and culturally compulsory practice that marks the passage of young boys into manhood. The practice involves building pole and grass huts in the bush in which they stay for the duration of the process, often two to three weeks. Locally the practice of going for initiation is euphemistically called 'going to the mountain' as a way of respecting and keeping it secret.

[5] Local communities organise families into clans. Some of the locally dominant clans are Zulu, Jola and Miya. Clan identity is a crucial determinant of how one is treated, whether with respect or not, at important community functions such as ceremonies. People of royal clans are often given more meat, and beer of better quality than others at such functions.

Table 3.8. Cultural practices and natural resources used

Cultural practice	How it is conducted
Initiation of boys *(ulwaluko)*	No details were given because secrecy is an integral part of the practice itself.
Initiation of girls *(intonjane)*	Details of what is used are secret because it involves cutting off vaginal labia, a practice that South African law criminalises.
Bringing spirits home *(ukubuyisa*)	Herbal trees, especially *Rubia petiolaris (impendulo)* and *Helichrysum odoratissimum* (*impepho),* to collect a spirit of a family member who died in an accident.
Training to be a traditional healer *(ukuthwasa)*	Initiates mysteriously disappear into big river-pools under which they stay for days and emerge with knowledge and tools to practise as traditional healers. Details of what happens under the pool are a secret.
Strengthening an infant (*imbeleko)* so it can resist and fight illnesses cast by bad spirits as sorcery	Leaves from cultural trees such as *Olea oleaster* (*umquma*) and *Ptaeroxylon obliquum (umthathi)* are used and livestock such as goat, cow or sheep is slaughtered.

Whenever this snake visits a household of a Jola clan, it is welcomed and treated gently because local people believe that it brings fortune to the household. Mothers feel happy when they see it sleeping next to their infants because they believe that it is bringing fortune and good life to their infants.

3.5.4. Knowledge of economic values of durable ecosystem services

3.5.4.1. Knowledge of economic value of construction timber

A rondavel is a traditional domestic structure, often a round hut, built using ecological resources that include timber, thatch grass, mud and cow dung. The question of monetary value of timber for a rondavel was one of the most difficult ones to ask in a way that would make sense to respondents, mainly because there are several types of timber used to build a rondavel. These include standing poles that make the wall *(iipali)*; long, thin ones that are placed horizontally to join the poles together; relatively thick ones that are used to make the roof (like rafters), and thin ones (purlins) that are placed horizontally to join the rafters. Respondents were asked to indicate economic values of each group, and then, altogether, we combined the

different values to get a total value. Nearly two-thirds (65%) of the respondents said they did not know what these poles are worth in monetary units.

3.5.4.2. Knowledge of economic value of thatching grass

The majority of households (79%) have rondavels at their homesteads and draw heavily on grass to thatch them. Local communities count thatching grass in bundles and respondents were asked to estimate the number of bundles on a standing rondavel. Together with the respondents, I multiplied this amount by ZAR60, the local market price. Of those that had grass-thatched rondavels, 46% said they did not know the total value (all bundles of grass put together) of thatch grass on their rondavels, while 25% said it ranged between ZAR3001-ZAR4000 and 23% said it was between ZAR2001-ZAR3000.

The most commonly used grass species for thatching are *Cymbopogon plurinodis (irwasshu)* and *Cymbopogon validus (umqunga)*. If well prepared, *Cymbopogon plurinodis* and *Cymbopogon validus* can last from 15 to 30 years on a roof. One female respondent, said her rondavel was thatched using *Cymbopogon plurinodis* before she married into that family before 1980. This grass species is now very scarce and many respondents expressed fear that it will soon become completely unavailable.

The findings reveal three very important realities: first, there is a high dependence on ecosystem services (based on reported use) in the case villages. Second, in spite of this dependence, respondents assign low economic figures to ecosystem services. Third, and most important, the majority of informants are not able to assign economic value to ecosystem services. The second reality could be a function of the third, that is, respondents tend to assign low economic figures to ecosystem services because they are unable to gauge their economic worth.

3.6. Conditions that make it difficult for local people to assign monetary values to ecosystem services

The main question I asked to elicit this data is: Why do you not know the value of ecosystem services? In other words, what makes it difficult for you to know the economic value of ecosystem services?

The study found that there are five predominant conditions that make it difficult for local people to see ecosystem services as commodities with monetary values; they are given in Table 3.9.

Table 3.9. Conditions that hinder economic valuation of ecosystem services

Transfactual condition	% of respondents (n=154)	Number of mentions[6]
Absence of a quantifying consumer tradition	100%	808
Economic valuation of nature not an intelligible concept	83%	408
Lack of appropriation	80%	400
Absence of a tradition of commodifying nature	48%	607

3.6.1. Absence of a quantifying consumer tradition

All respondents said they do not take seriously the practice of counting and taking records of what they consume. Largely, they consume according to availability; consumption of resources is highest when the resources are available and lowest when they are scarce. Unlike groceries that they buy monthly from shops, local households use natural resources as and when they are available to them. All the respondents reported that questions asking them to indicate what quantities of ecosystem services they used per month, for instance, fuel wood, were difficult because they did not keep records. When asked to give the monetary value of wild fruits, one respondent asked:

"How do you expect me to remember what amount wild fruits I eat per month when I only eat them occasionally, only when I see them ripe in the forest? No one keeps records of what they eat here."

This relates to children eating wild fruits while walking to or from school, or herding livestock, and is difficult to measure in economic terms. The reality that rural people, especially in less literate communities, do not keep records of what they consume has been reported in other studies (e.g. Grieg-Gan, Guijt, & Peutalo, 2002; Menton et al., 2010). This absence of a

[6] The number of times a particular condition was mentioned by respondents. This is not a number of respondents who mentioned a condition.

quantifying consumer tradition makes it difficult to talk of an economic relationship between traditional communities and nature in a way that these communities can relate with. The conventional valuation studies in which researchers estimate economic value of ecosystem services for the people run the risk of misrepresenting the extant economic relationship between local people and nature.

3.6.2. Economic valuation of nature not an intelligible concept

Most of the respondents (83%) who answered "I don't know" interpreted questions on monetary values as meaning they have to sell nature. A common response was, "These things are very important to me, but I cannot give them a price because they are for everyone. I cannot sell nature." This absence of a shared understanding of questions about the economic value of ecosystem services might have contributed to the high percentage rates of "I don't know" responses.

For people to interact adequately in a conversation, it is requisite that the participants are conversant with the basic objectives of the conversation (Danermark et al., 2002). The question, "What is the monetary benefit your household accrues by using medicinal plants per year?" should necessarily be understood as a question to elicit the respondent's perception of the economic value of nature. Of the all the respondents, 83% reported that the questions were not intelligible. One respondent said, "This question confuses me because I fail to understand that natural services can be sold. The question is meaningless".

3.6.3. Lack of appropriation

Many respondents (80%) said that they could not assign a monetary value to ecosystem services because they are not theirs. They said God created the ecosystem services, and therefore they do not belong to any one individual. One characteristic response was this, "These things are important, but I cannot price them because they are nature and belong to everyone. How can I sell things that does not belong to me?" Another typical response was, "It is not my grass, it is God's creation. If it was mine then I would be able to give you a price".

The problem is exacerbated by the reality that local people access these resources under the communal land tenure system, which is very confusing in post-apartheid South Africa. Communal property regimes do not confer producer rights, and at best, they provide layered, collective and contested control rights (Cousins, 2008). In order for a good or service to be

marketable, it must exist within a regime of clearly definable and verifiable property rights (Chee, 2004; De Soto, 2000). "A complementary institutional structure that allows appropriation of ecosystem services (property rights) and their sale or exchange (a market) has to exist before commodification takes place" (Gómez-Baggethun & Ruiz-Perez, 2011: 623). This is consistent with De Soto's (2000) argument that resources in Africa cannot be converted into capital because they lack clear systems of appropriation. The tendency by conventional valuation studies to overlook the influence of appropriation puts them at risk of producing figures and conclusions that are dislocated from the *de facto* nature of relations between local people and nature.

3.6.4. Absence of a tradition of commodifying nature

Less than half (48%) of the respondents argued that they could not tell the monetary worth of ecosystem services because there was no history of trading in natural resources at the villages. One respondent said:

> "How can I give a price to nature? I have never seen it being bought. They [natural resources] do not cost a cent because they are not for sale, they are nature. No one sells sun or rain. We never saw natural services being sold. We only know bartering and it is flexible and negotiated."

Responding to a question about the monetary value of medicinal plants, one respondent said, "These things were not sold when we grew up. What you do, you just pay a certain amount as a compensation for them to work". Other respondents saw ecosystem services as non-commercial, free benefits from nature. One of the typical responses was:

> "It is difficult to estimate the rand value because we do not buy these items as we get them from the forest. These are natural materials that we get without paying a cent. It is nature from our land and we freely use it for our wellbeing".

However, recent years have witnessed a growing practice of local villagers cutting fuel wood, timber and thatching grass for sale. One issue that did not come out clearly, and perhaps an issue that is worth pursuing in future studies, is what local people make of the trading in timber and thatching grass that some of them do at the villages. When they put a monetary price on timber, do they consider the price as an expression of the worth of the timber, or it is only the value of their labour involved in cutting and delivering the resources?

Thus, in order for commodification of ecosystem service to take place in these local communities, there has to be a "heavy discursive lifting" (Kallis, Gómez-Baggethun, & Zografos, 2015: 99), a process of moving what are currently seen as public, free, untradeable ecosystem services to the sphere of markets in the mental economy of local people. This involves conceptual and operational treatment of nature as a tradable object (Gómez-Baggethun & Ruiz-Perez, 2011).

3.7. Conclusions and implications

This chapter has shown that only a few respondents could assign monetary value to nature while a high proportion could not at all. The absence of a clear, well-defined property system, lack of a quantitative consumer tradition and absence of an economic conception of nature are the key conditions that make it difficult for local people to perceive of ecosystem services as commodities. The findings are supported by several previous studies. These include Gómez-Baggethun and Ruiz-Perez's (2011) argument on commodification of ecosystem services, Kosoy and Corbera's (2010) analysis of commodity fetishism and market environmentalism, Dasgupta's (1990) argument on the environment as a commodity, Gómez-Baggethun and Muradian's (2015) concept of the market frontier, Kallis et al.'s (2015) limits of monetisation, Daly's (1998) explanation of marginalism, and Muniesi's (2012) sociological analysis of the concept of value. These bodies of work discuss the properties that are needed for services to gain commodity status, that is, to be perceived as marketable products that can be measured in terms of monetary units. This current work has contributed to the development of the same discussion, but in a dialectical way. By finding that when certain conditions such as lack of appropriation are present, local people struggle to see ecosystem services as commodities, the work has demonstrated what environmental commodification is, by showing what it is not; this is dialectical ontology (Bhaskar, 2016).

The economic values expressed in this study are what the users think the ecosystem services that they use are worth. The figures represent what the local people know of the economic value of their local environments. In so doing, the figures may not represent the values that methods informed by the scientific knowledge system of valuation would have arrived at. Economic figures and conclusions reached by outsiders using expert and scientific knowledge are very useful in that they have led to development of reputable methods and models that have since been used as the main instruments for measuring the economic worth of nature over the

years. However, such conclusions are likely to miss experientially constructed views of local people who live within the ecosystems. Experientially constructed knowledge of ecosystem service values is the component that still needs to be emphasised in the practice of economic valuation. It is important to consider this component because ecosystem services form the lenses within which culture and identity are constituted.

Escobar (1995) laments the tendency of western science and expert knowledge to speak for the rest of the world, in the process silencing and subduing local voices. By exploring respondents' knowledge of the economic value of the ecosystem services from which they benefit, this study offers an alternative that has the ability to reflect local voices, perspectives and experiences in resource valuation. This might result in development of interventions that are not socially void and meaningless.

An economic value is not a permanent condition of any item, nor is it innate to certain items or services. It is constructed by people in consideration of the context in which the item or service exists and is used. Although this is not a negation of the objective existence of economic value of items or services, people can only know of the value through their contextually influenced interpretations. The implication for this study is that, when respondents replied by saying "I do not know the monetary value", this does not mean they do not value the service; it simply means the conditions in which the respondent is using the ecosystem service do not make it easy for them to assign an economic value. Furthermore, it may mean that the tools used for valuation are not amenable to local conditions that are often culturally and socially embedded.

The findings of this study present a case for the need for researchers to develop context-responsive valuation standards. The monetary metric is a useful but insufficient standard of value among traditional rural communities whose day-to-day lives do not revolve around, or even depend on a tradition of commodity transaction. For these communities, ecosystem services, though very important, are not perceived as commodities with monetary exchange value. Rather, they are social goods accessed through social institutions such as community membership and local tribal rules, not through payment of money. The market is not the institution of access to natural resource in these communities. Consequently, social valuation methods that align with, and draw from the nature of local institutions of resource access, have the potential to produce more meaningful value scores than the monetary metric can.

In drawing this conclusion, perhaps it is useful to reiterate the disclaimer made earlier: the use of the monetary metric to represent nature's worth is not the problem. This method has made valuable achievements in several contexts. What is at issue is the tendency among researchers to glance over the influence of local contextual factors in their efforts to fulfil objectives of their research projects: finding the economic contribution of nature to people of their study sites.

By using critical realism's concept of transfactual conditions, the study illuminates the relational being (existence) of economic value; that for economic value to be realised, it has to exist in relation to other concepts such as clear regimes of appropriation and a commodification tradition. This level of ontological analysis, albeit needed for a comprehensive understanding of value, is often missed in many studies. One major weakness of many valuation studies, especially of the positivist/empiricist meta-theory, is a tendency to assume that economic value of natural resources exists in an objective form, waiting to be discovered by using objective, socially detached methods. This ignores the reality that value is a social object; it can only manifest, be realised and be known through contextually situated experiential encounters between people and nature. Consequently, the nature of nature's value cannot be dislocated from the experiential context in which it manifests itself.

Precisely because the value of nature can only be accessed and realised through our knowledge of it, we ought to look for it in the knowledge of the people whose relations with nature we seek to understand, not in grand, socially detached economic theories and methods. Grand valuation methods such as travel costs, pseudo markets and hedonic prices do not derive their conclusions from circumstances unique to the study context in which human-nature relations morph. Pseudo market and shadow pricing assume that service X can have a commodity status in context B because they are commodities in contexts C and D. Consequently, such methods tend to dislocate the concept of value from the local circumstances that, ironically, are the causal mechanisms that make them manifest as a social-economic experiential object to be measured and appreciated.

In his ground-breaking book entitled, *The Mystery of Capital: Why Capitalism Triumphs in the West and Fails Everywhere Else,* De Soto (2000) invokes the argument of requisite conditions to explain the contrasting story of the presence of abundant resources but little capital and much poverty in Africa and the Third World broadly. The author argues that the material existence

of resources is not a sufficient condition or circumstance for them to earn capital commodity status; that resources can be traded on the market in exchange for money. There are other requisite conditions, especially existence of clear and well-defined property rights and an entrepreneurial culture (De Soto, 2000). De Soto (2000) argues that land, a resource that fetches a lot of money in the West, is dead capital in Africa because it is not clearly appropriated.

Drawing De Soto's (2000) argument to a conclusion, the triumph of nature's economic valuation in some parts of the world and its failure in others is more a function of conditions than it is about whether or not some communities value nature more than others do. Insofar as the practice of valuation, together with those who implement it, remains committed to the ideal of enhancing responsible stewardship through quantifying the dependence of humans on existence of functioning ecosystems, it cannot afford to discount the role of context in shaping knowledge, attitudes and perceptions that people acquire about their relations with nature. By using an emic approach to understating ecosystem values, this study has refocused attention on the local people and their communities in the valuation discourse. It is unusual that local people are taken seriously as sources of information about the economic value of nature.

CHAPTER 4: USE OF TRADITIONAL PRACTICES TO MANAGE ECOSYSTEM SERVICES AND EXPLAINING CAUSES OF DEGRADATION

4.1. Introduction

The aim of this chapter is to elucidate and describe how traditional ecological knowledge (TEK) has been, and is still applied in managing ecosystem services and explaining causes of land degradation in rural communities of the Eastern Cape Province of South Africa. The chapter discusses the practices and techniques that are used when local people apply TEK in managing ecosystem services and demonstrates the knowledge they possess with regard to the causes of land degradation. The approach in the chapter uses critical realism's iceberg metaphor (described below) to demonstrate how traditional practices of ecosystem services management, such as taboos, are layered.

The study takes people's ability to explain causes of land degradation as an integral part of management because when they know what creates a particular undesirable condition in the environment, they can implement appropriate management practices.

> "If we know what underlies a certain course of events we can also – this is the assumption – intervene and direct future courses of events and make them correspond better with our intentions and purposes in various ways. Alternatively, if we find that we cannot influence the course of events, we can still, by predicting it, better adjust accordingly" Sayer (2000: 52).

Although land degradation is a national problem in South Africa, empirical studies have shown that the problem is more acute in traditional, communally owned communities than it is on privately owned lands (Palmer & Bennett, 2013). This observation provides an impetus to research and document knowledge about how these communities manage the natural environment that provides the essential ecosystem services from which they derive benefits. Largely because of their lower levels of literacy as shown in Chapter 3, these communities depend mainly on indigenous knowledge systems (IKSs) to understand different aspects of community life, including the management of ecosystem services. This use of indigenous knowledge makes the study valuable because natural resource management is largely regarded as a scientific practice (Nel & Alberts, 2018).

Generally, the scientific understanding of management is regarded as a highly technical feat

consisting of an unambiguously defined set of objectives, methods, and monitoring tools (Nel & Alberts, 2018). In this context, environmental management proceeds as systematic methodology that comprises identification of the problem, a clear and measurable intention about what needs to be done (objectives), methods by which to achieve the objectives (management tools), and monitoring strategies (measuring if the objectives were achieved) (Nel & Alberts, 2018).

Several commentators, including Du Toit et al. (2004), Fabricius et al. (2006) Smith and Wishnie (2000), contest the ability of traditional communities to manage the environment. Smith and Wishnie (2000: 493) contend that "to qualify as conservation, any action or practice must not only prevent or mitigate resource over-harvesting or environmental damage, it must also be designed to do so". Because traditional approaches of managing resources do not follow the scientific framework that proceeds on a set of clear objectives, methods and measuring, Smith and Wishnie (2000) argue that traditional management practices cannot be regarded as part of the environmental management system. The authors prefer to credit traditional practices simply for indirectly leading to sustainable use of resources.

Nevertheless, there are alternative views to conceptualising and understanding the practice and discipline of environmental management. For instance, Barrow (2006) prefers a much wider definition of environmental management as a discipline concerned with the human-nature interface. In recognition of the breadth of the concept, Tinsley (2001) talks of alternative environmental management systems. Berkes (2008) recognises indigenous approaches of managing of the environment, especially those that are informed by TEK, as bona fide environmental management practices. Nevertheless, Berkes (2008) warns that traditional approaches are often misunderstood because they do not provide systematic, detailed information recognised as both necessary and sufficient in conventional scientific management wisdom. Therefore, whether or not traditional practices can qualify as management techniques is an ontological question. The question revolves around what we understand about the nature of the reality (the being) of both traditional practices and resource management.

Chapters 1 and 2 have explained the relationship that exists between TEK and science. These chapters have comprehensively discussed how the two knowledge traditions compare and contrast with each other, as well as how they can be used complementarily. In light of this, I will not repeat the argument here. However, I reiterate the definition of TEK because it sets the

necessary ontological parameters of what traditional communities do and the epistemological framework of how they make meaning of that which they do in the myriad practices they undertake to manage ecosystem services.

Traditional ecological knowledge is defined as "a cumulative body of knowledge, practice and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationships of living beings (including humans) with one another and with their environment" (Berkes, 2008:7). It is a branch of IKS which focuses on the relationships between humans and the natural environment (Dei et al., 2000; Berkes, 2008). TEK refers both to the way in which people acquire knowledge, and the content of the knowledge itself (what is known) (Berkes, 2008; La Duke, 1994).

This form of ecological knowledge is regarded as traditional, not because it concerns things that were valued or practised in the past, but because the term has everything to do with the reality that the knowledge depends on use of features of tradition, such as cultural and religious beliefs, taboos and related tribal conventions for its generation, transmission and application (Battiste & Youngblood, 2000). Traditional ways of knowing pertain to use of a community's culture, its conventions, observances, beliefs and worldviews as the main tools that determine what is known (ontology), and how that which is known gets to be known (epistemology). Consequently, in order to appreciate the truth-claims of TEK, one needs to be immersed in the knowledge system to understand how it proceeds from a claim to a fact.

Commenting on the attributes of indigenous knowledge in South Africa, Fabricius et al. (2006: 168) state that "its main value lies in helping local people cope with day-to-day-challenges, detecting early warning signals of change, and knowing how to respond to challenges". Berkes, Colding, and Folke (2000: 1252) explain that "the analysis of many traditional ecological knowledge systems shows that there is a component of local observational knowledge of species and other environmental phenomena". However, how exactly holders of TEK manage ecosystem services, what they do and why they do it, remains largely an unanswered question in South African ecosystem service literature. Relative to Canada (Berkes, 2000; McGregor, 2014), Australia, Senegal and Sierra Leone (Adams, 1993) and the Sahalian region (Niamir-Fuller, 1998), there is a dearth of detailed empirical cases in South Africa that interrogate what traditional communities do when they manage their local environments.

A few exceptions that have given attention to this question in South Africa include Beinart and Brown (2013) and Fabricius et al. (2006). However, Fabricius et al.'s (2006) discussion on how IKSs identify ecological change is not a detailed one because the study focused on how to integrate IKS into ecosystem service assessments. Although Beinart and Brown (2013) give very detailed empirical accounts, their study concentrates on local people's knowledge of causes of, and responses to livestock diseases, not management and degradation of ecosystems.

This chapter targets how aspects of tradition, such as beliefs, norms, taboos and myths are still used to manage ecosystem services. Using the ontology of critical realism, the work analyses TEK as a layered reality comprising three levels: the empirical, the real, and the actual. By using this analytic technique, the study seeks to elucidate the ontology of traditional management practice, and hence contribute to a better understanding of the nature of the being (reality) of traditional management practices. This may help re-direct the reader's mind-set from the temptation of wanting to employ scientific frameworks to analyse and understand traditional management practices. While scholars that include Berkes (2008) and La Duke (1994) argue that the truth-claims of TEK must be validated within the framework of the belief system, others like Smith and Wishnie (2000) assert that those truth-claims have to be subjected to a logical reasoning system in which an action is explicitly linked with intention.

Ecosystem service studies can gain much from TEK that can usefully complement and augment mainstream ecosystem service knowledge. Traditional subsistence economies, the predominant livelihood means for communities that use TEK, dictate that ecosystem service users "need to understand the way that the different plants and animals interrelate, how the ecosystem works as a whole, and how they can use that ecosystem to sustain themselves" (Menzies & Butler, 2006: 5). It is this "small-scale yet system-wide" (Menzies & Butler, 2006: 5) property of TEK that makes it a strong potential source of ecosystem service management wisdom.

This work does not seek to critique conventional scientific management wisdom; its aim is to document and demonstrate an alternative way of looking at the practice of managing ecosystems. The work is an epistemological project which seeks to demonstrate knowledge of traditional management practices by unpacking the nature and content of what (content) and why local communities do what they do in their multiple interactions with the natural environment. Describing what local people actually do when they apply TEK to manage ecosystem services has the potential to shed useful insights onto the role that TEK can play in

the emerging ecosystem services concept. The work achieves this aim through in-depth, open-ended interviews which allow respondents to narrate the practices that they use to manage their local environments.

This study had a limited scope, focusing on traditional management of grazing land and water and interpretation of degradation of land through soil erosion, water resources through drying up of wetlands, springs and rivers, and of the veld through invasion by woody species. This choice was influenced by the fact that land, water and grasslands are some of the most important sources of ecosystem services that support the day-to-day survival needs of the local communities, as has been shown in Chapters 2 and 3. By interacting with and using these resources on a daily basis, local people were expected to have developed ways of managing them, and this study sought to investigate what these practices are and how they are implemented.

4.2. Description of study sites

The study was conducted at the three remote, isiXhosa-speaking villages of Colana (30°36′45,46″S 29°32′,77″E), Gogela (30°22,′535″S 29°14′,613″E) and Nozitshena (30°63′,585″S 29°21′,803″E) in the Eastern Cape Province, South Africa. The villages are located under the Drakensberg mountain range which has an altitude that ranges from 1720 m to 3001m (Dollar & Rowntree, 1995). The region receives a mean annual rainfall ranging from 700–1300 mm, concentrated in summer (October to March) (Dollar & Rowntree, 1995).

The study area is part of the former Transkei, a homeland that was proclaimed by the apartheid government in 1976 mainly for isiXhosa-speaking people, ostensibly to promote development of their culture and traditions. Transkei was re-incorporated into the South Africa state system to form part of the Eastern Cape Province in 1994. Administratively, the villages fall under the Umzimvubu Local Municipality. Remoteness from urban centres and low literacy levels (as demonstrated in Chapter 3) mean that these communities rely mainly on TEK to understand nature and its related phenomena.

The villages of Colana, Gogela and Nozitshena have several sources of water. There are three perennial rivers at Colana, four at Gogela and seven perennial springs, while there are three perennial rivers and five springs at Nozitshena. Umzimvubu, one of South Africa's biggest

rivers, creates a boundary of approximately eight kilometres between Gogela in the south and Nozitshena in the north.

Local people use water from these rivers mainly for laundry, watering livestock, and performing religious rituals, such as baptism and initiation into traditional healing. So waterscapes have multiple production and service objectives from tangible to non-tangible services. There are several rivers and springs that have dried up over the past two to three decades. Other springs and rivers have become seasonal; they flow in summer only when there is rain.

Local vegetation comprises the East Griqualand Grassland, with patches of bush clumps (Mucina & Rutherford, 2006). Common types of grass include *Themeda triandra, Hyparrhenia species, Elionurus muticus, Cymbopogon plurinodis* and *Cymbopogon validus.* In excess of 25 % of the local landscape has been transformed by cultivation, forest plantations and residential villages, and the rest is grazing on un-improved grasslands that are part of an unfenced, free-range, communal ranching system. Although fencing, gates and water-points have been provided by the various state agencies, these are mostly in dis-array and no longer functioning. Over grazing is leading to loss of grass species and invasion by woody species especially *Vachelia karroo, Diospyros lycioides, and Ziziphus mucronata dominant in low-lying grasslands. (*Bredenkamp, Granger, & van Rooyen, 1996). Over the past few decades, alien invasive plants (AIPs) especially *Acacia mearnsii and A. dealbata,* have invaded indefinitely fallowed arable lands (Scorer et al. 2019) wetlands including river banks, springs and marshlands so heavily that the government through the Department of Environmental Affairs has been clearing these AIPs under a program called Working for Water (WfW) since the late 1990s.

Geologically, the area is dominated by mudstone and sandstone of the Beaufort Group of the Karoo Sequence while sedimentary rocks of the Molteno, Eliot and Clarens Formation are as well present. The landscape is characterized by undulating hills and expansive gentle low-lying velds with an altitude of 920 m-1740 m (Mucina et al., 2006). Of the three study villages, the most mountainous is Gogela with most of its homesteads and arable fields on steep hills that interlock along the Umzimvubu River valley.

The region receives snow for about 30 days per year. The area receives mostly summer rains

(October to March) with a monthly average precipitation of 780 mm ranging from 620 mm-816 mm per annum. It receives much of the rain in forms of thunderstorms. Daily temperatures range from -2°C to 42°C with an 18°C mean (Bredenkamp et al., 1996).

The former Transkei became one of the degradation hotspots in the late decades of the 20th century hence it received a lot of government intervention programs including rehabilitation programs and the Transkei Soil and Water Conservation Program (Hendricks, 1989). Often these are ill-informed by science, and do not achieve the environmental outcomes they promise. These state-led scientifically designed interventions met with multiple forms of resistance by local people mainly because they were implemented without proper consultation and were associated with apartheid's grand plan of social engineering (Wotshela, 2004).

4.3. Theoretical inclinations

This chapter uses critical realism to provide a lens to both the ontology and epistemology of traditional practices that local communities implement to manage ecosystem services. Critical realism is a broad meta-theory and sometimes writers present different versions, or concentrate on specific aspects of it (e.g. Bhaskar, 2016; Danermark et al., 2002; Denzin & Lincoln, 2011; Easton, 2010; Fletcher, 2017; Hartwig, 2011; Norrie, 2010; Price, 2016; Sayer, 2000). One of the major defining axioms of critical realism is that reality exists, independent of our knowledge and theories of understanding it (Sayer, 2000; Bhaskar, 2016). Critical realism rejects as an ontological fallacy any tendency to reduce ontology to epistemology (that is, to assume that our knowledge is an adequate representation of the things about which it is) (Bhaskar, 2016). The relevance of this axiom to this study is that we must not confine the ontology of ecosystem management to our knowledge of it, whether this knowledge is scientific or not. The concept of management (a reality in itself) is much broader than our limited knowledge can apprehend. To this end, we need to be open and receptive to varied conceptions of the reality of environmental management and their related accounts of implementation.

This critical realist insight is useful given that the domain of environmental management is dominantly framed within the scientific knowledge system which depicts it as a highly technical feat that can be accomplished only through a chain of predetermined logically arranged steps or activities including problem identification, formulation of objectives,

implementing management methods, monitoring, observation and evaluation (Nel & Alberts, 2018). The danger of a mono-epistemic tradition is that people tend to confound the claims of that knowledge with the things that they seek to interpret (Bhaskar, 2016). While the scientific epistemology and practice of environmental management is useful, it is not the only one. Nor, in spite of its dominance, should its truth-claims about environmental management be regarded as the ultimate truth or the mirror-reflection of the ontology of environmental management practice. Instead, what science knows about environmental management should be treated simply as scientific knowledge of environmental management; not as environmental management itself. By the same token, the truth-claims that TEK makes about environmental management should be treated just as traditional knowledge of environmental knowledge. Neither of these knowledge systems, nor any other, can directly access the ontology of environmental management. In light of this, the major business of the organised knowledge system, be it in science or TEK, is the ontological project; the perpetual search for knowledge that can give the best interpretation of reality (the world) at a given time in the progression of human history (Bhaskar, 2016). By bringing this insight, critical realism prepares us to appreciate varied truth-claims about the reality of environmental management and judge each one of them according their merits. This represents a repudiation of the tendency to dismiss some truth-claims as mere fiction and incorrect simply on the simple basis that they do not conform to what we were trained to hold as the correct knowledge.

However, unlike relativism, critical realism rejects the assumption that all knowledge claims are equally correct (Bhaskar, 2016). When assessing knowledge claims, critical realism uses the holy trinity which comprises commitment to ontological realism (the things about which our knowledge is are real), epistemological relativism (our knowledge about these things can be different) and judgemental rationalism (we can make a rational judgement about the strengths and weaknesses of these different knowledge systems) (Bhaskar, 2016). The holy trinity allows researchers, to assert that although our knowledge is fallible and without sure foundations, and is always knowledge under particular socially and linguistically mediated descriptions, nevertheless, there can be rational grounds for preferring one to another truth-claim, description, belief or theory (Bhaskar 2016). However, the rational judgementalism principle needs to take heed of key contextual factors such as the epistemic character of the knowledge system whose truth-claims are being assessed. The implication is that claims from TEK should be assessed using standards of measure from that knowledge system.

Acceptance of traditional practices of management such as assignation of taboo status to resources has been hampered by the reality that such practices are generally misunderstood. This misunderstanding has led to multiple criticism levelled against traditional management practices (Berkes, 2008). One major criticism is that traditional practices of resource management do not demonstrate intention and a clear process flow from intervention to outcome (Smith & Wishnie, 2000). The misunderstanding has largely been a function of the reality that our knowledge of reality broadly, and our apprehension of the ontology of traditional management practices in particular, is limited. This limitation has been given rise to, and perpetuated by a general dearth of interest among researchers to engage and explicate the ontologies of the things about which their studies are. This has created an ontological problem that has particularly hampered progress in trans-epistemic communication in the field of environmental management.

Critical realism's ontology can assist resolve this problem. The ontological position of critical realism is that reality comprises three distinctive yet interconnected layers: the empirical, the actual and the real (Bhaskar, 2016; Fletcher, 2017). This conception of reality is called the iceberg metaphor of ontology (Figure 4.1) (Fletcher, 2017). In this study, I use the metaphor to shed light on the stratified reality of traditional management practices with the aim to contribute knowledge of what they are.

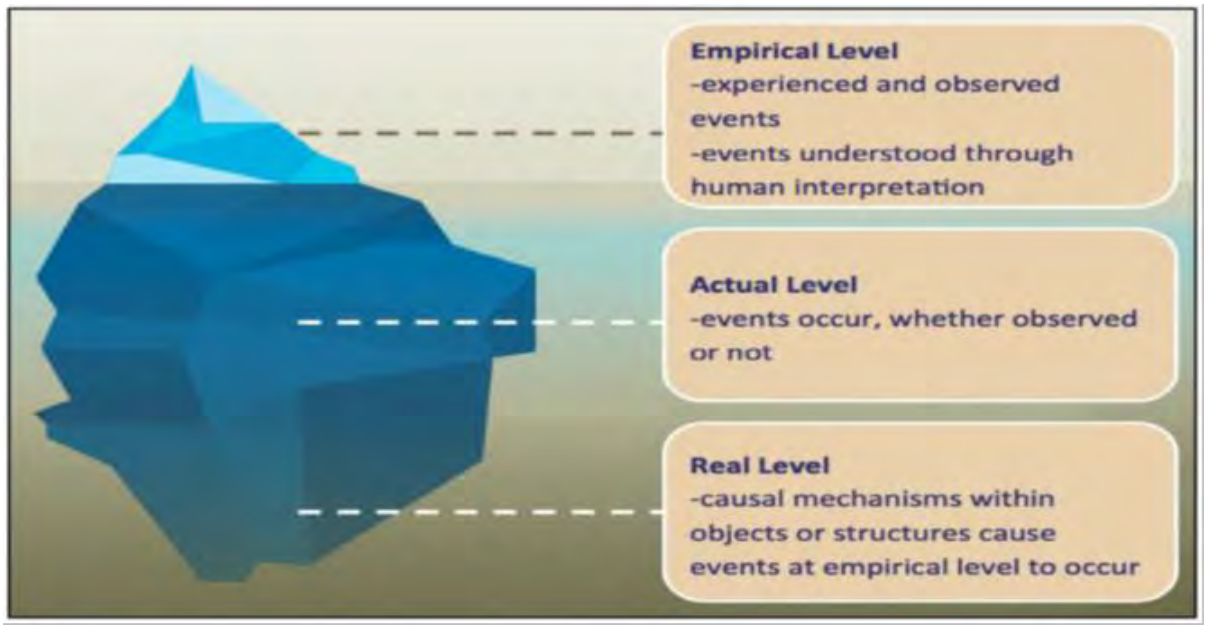

Figure 4.1. The iceberg metaphor for critical realist ontology (Fletcher, 2017)

The first layer is the empirical level at which we experience events (reality). At this level, reality can be measured empirically and explained, but our understanding of it is mediated by our experience and interpretation. In this study, the empirical level concerns the level at which we witness and interpret the phenomena that become, or events that happen when a management practice is implemented, such as the rain falling when ancestors are propitiated, and increase in hydraulic flow when alien species are cleared off riparian zones. This is the transitive level at which meanings and conceptions about management of ecosystem services are made (social understanding of reality). This level allows researchers to observe and measure reality, hence the scientific knowledge system finds it as an intelligible and acceptable platform at which to study and interpret reality. The empirical level conforms to scientific knowledge's model of management as an aggregate of logically connected activities that are observable and measurable (Nel & Alberts, 2018). However, some of the traditional management practices do not work in ways that conform to the empiricist ontology and this has made traditional management practices to be rejected as not deserving to be treated as management practices (e.g. Smith & Wishnie, 2000).

The middle layer is the level of the actual. There is no filter of human experience or interpretation at the level of the actual, and events occur regardless of whether we experience them or not (Fletcher, 2017). The level of the actual is where management effort and initiatives occur regardless of whether we interpret them as management practices or as something else. Regarding an initiative as a management practice has little to do with the ontology of the initiative in question; but it is an epistemological issue which depends largely on the nature of the knowledge system one uses when they make that assessment. So in short, environmental management does not need our affirmation that indeed it is real in order for it to take place. With or without our knowledge of, environmental management takes place at the level of the actual.

In the context of scientific management, for instance, the level of the actual is where clearing of alien invasive plans such as *Acacia mearnsii* takes place. Our admission that indeed clearing of alien floral species in riparian ecosystems constitutes management, has little if any, to do with the action itself; instead such a conclusion is influenced by our epistemic training (what we were taught to know as environmental management). Largely due to the dominance of scientific knowledge in shaping and informing the mainstream environmental management studies, some practices, although real, are not interpreted as such.

The third layer is the level of the real at which causal structures or causal mechanisms exist (Fletcher, 2017). Causal mechanisms are the properties inherent in an object that produce the events we observe at the level of the empirical (Bhaskar, 2016; Fletcher, 2017). "All social structures possess causal powers and liabilities. These are potentialities inherent in an object or structure that enable or constrain it from acting in a certain way" (Fletcher, 2017: 183).

Using the clearing of alien plants example the linkage between causal powers of management practice and restored hydrological flow can be empirically observable and logically explained by using scintillometer to estimate total evapotranspiration (Clulow, Everson, & Gush, 2011). However, the causal linkage between a taboo and maintenance of water availability and flow in a spring cannot be explained in such empirical and logical steps. It can only be established through consultation with local spirit mediums and traditional healers, but at the moment these are not recognised in the mainstream management discipline as sources of resource management knowledge.

Reality (tradition in this study) "has powers and mechanisms which we cannot observe but which we can experience *indirectly* by their ability to cause – to make things happen in the world" (Danermark et al., 2002: 20). The assumption that reality contains causal mechanisms that make things happen is not a hidden concept unknown to everyday social life. When trying to make sense of events in everyday social life, we commonly make remarks such as, "Something is going on below the surface" (Danermark et al., 2002). Such remarks point to our acknowledgement of the reality that events happen in layers, and some of the layers are not observable to us.

However, conditions in the social world can as well prevent or facilitate the actualisation of an object's causal power. The implication is that, even if an object (an environmental management practice) and its potentialities takes place at the level of the real, certain events that have to be observed at the level of the empirical may not eventuate unless there are appropriate conditions in existence. Appreciation of this condition-dependent power of objects to causally influence events can improve our ability to engage in trans-epistemic communication in the discipline of environmental management. Use of taboos, for instance, may or may not result in preventing drying up of water resources depending on the availability of necessary conditions. This precludes us from making arguments such as 'taboos cannot manage resources because at

village X they were implemented to protect a spring from drying, but it dried up'. The reality that the taboo did not produce results does not present a sufficient negation of the claim that taboos possess causal powers that can protect springs from drying up. Rather, it could be that, there were certain liabilities present that constrained the causal power of the taboo from causally lead to the event (prevention of drying up of the spring). Consequently, an observation that a taboo failed to prevent a spring from drying up at a certain point in time in a certain community should not be treated as evidence that a taboo is not a management technique.

These two theoretical insights (disambiguation of epistemology from ontology and the iceberg metaphor of ontology) are often not expressly used and explained in management research. They were used in this study to explain the spectrum of the ontology of traditional management practices and open our minds to the reality of epistemological pluralism. By using these lenses to analyse the traditional management practices, the study holds the potential to improve our understanding of various traditional management practices.

4.4. Methods and approach

I designed this work as a multi-site or multi-case study involving three different villages. One of the frequently referenced definitions of case study is by Yin (2014: 16) who says "a case study is an empirical study that investigates a contemporary phenomenon (the case) within its real-life context, especially when the boundaries between phenomenon and context may not be clearly evident". This is supported by Miles et al. (2014) who define a case study as the study of a phenomenon that is happening or existing in a bounded system. The bounded system could be a village, a school, or any other locale with clear boundaries. This is the definition I adopted in this study.

Congruent to critical realism, and to qualitative methodology, case study design concerns itself with understanding phenomena within a context. My focus on understanding meaning dissuaded me from using other designs, such as surveys and experiments, whose concern is mainly to measure and capture distribution of frequencies (Maxwell, 2012).

I used the snowball sampling technique to recruit research participants. Snowball sampling uses participants to help the researcher identify other people whose social qualities make them relevant sources of data (Browne, 2005; Sadler et al., 2010). Typically, snowball sampling is

used in studies whose target informants are 'hidden' subgroups of populations, either because they have low numbers in a bigger population, or their social identity is sensitive, such as sex workers (Browne, 2005; Farquhar, 1999; Sadler et al., 2010). I considered that, because holders of TEK are mainly elderly people and that the knowledge is no longer popularly practised in the villages, they were likely to constitute small groups in their respective villages. Owing to their small numbers, holders of TEK are likely to know each other through social networks. Hence, I used the snowball recruitment technique (Browne, 2005).

Because TEK is significantly associated with a good understanding of the history of a community and how its customs evolved over time, I recruited the elderly residents of 60 years and older whose families have a long history of living in their village of residence for at least two generations. These were men and women that were born in the late 1950s and earlier[7]. The significance of the criterion of having a long family history of living in the village is that such participants are likely to have good knowledge of the history of the village, its major ecological landscape, as well as the evolution of the village and its tribal traditions.

At all the three case villages, the first step was to interview a local traditional leader, especially headmen. After the interview session, I asked the traditional leader to refer me to people who would fulfil my criteria (explained above). After interviewing those people, I asked them to give me their own referrals. I recruited a total of 83 respondents of which 35 were sampled from Colana, 33 from Gogela and 17 from Nozitshena. The sampling was census because I recruited all the referrals I was given at each case village. Colana has a total of 350 households, Gogela 250 and Nozitshena 75. Because I wanted this study to lead to insights and understanding of the phenomenon of traditional ecosystem service management, I used in-depth interviews. The in-depth interview technique allows respondents to speak widely without the restriction of having to choose from a set of pre-set options (Merriam & Tisdell, 2016). This helped me elicit detailed narrative responses from which to discern underlying meanings and thoughts. I needed to gain access to underlying meanings in this study in order to apply the abductive data analysis technique.

Although my interview questions were open-ended, they focused on traditional management

[7] In South Africa, this was the era of reserves, which later developed into homelands inhabited according to tribal grouping, and ruled by traditional leaders using customary laws, and who organised their social and economic lives according to tribal traditions and conventions.

of grazing lands, water resources and arable lands. The interview questions provided information on application of traditional management techniques such as myths, beliefs, taboos and harvesting practices. The questions sought to understand how these practices were implemented and what made them work or otherwise. I used a tape recorder to capture respondents' testimonies and saved them as audio data.

4.4.1. Data analyses

Data analysis started with the hand-coding technique. In spite of the rise of computer-assisted coding such as Atlas.ti and NiVivo, hand-coding is still used by many researchers (Saldana, 2014) because it enables the researcher to come closer to the data (Babchuk, 2019). My first step was to transcribe the data into text with two-and-a-half-inch margins on both sides of the text to allow space for inserting codes. The second stage was re-familiarisation, for which I read through the text four times.

The third stage involved initial coding in which I assigned codes (descriptors) to selected text passages. "A code is typically a researcher-generated construct that assigns meaning to the data passage and sets the stage for categorization" (Babchuk, 2019: 5). I wrote the initial codes in the left-hand margins; they were short summaries of the meanings that selected text segments conveyed. The fourth stage involved creating categories in which I grouped together all codes with similar messages; these categories were written in the right-hand margins. All the categories that were not relevant to the research question were discarded in a process called focused coding (Babchuk, 2019).

The fifth stage was abductive, or theoretical coding, in which I proceeded from the surface meaning of categories to a deeper level of abstraction (Fletcher, 2017) in a process which involved identifying tendencies. Tendencies are actions or properties which are characteristic of a given object or construct (Fletcher, 2017; Wynn Jr & Williams, 2012). Unlike in positivism, tendencies in critical realism do not occur in a law-like form, but it is typically possible or plausible that they occur in particular objects or contexts (Wynn Jr and Williams, 2012).

4.5. Findings and discussion

4.5.1. Traditional management of grazing lands and explanation of their degradation

Respondents at Colana, Gogela and Nozitshena reported that grasslands were heavily degraded leading to a shortage of fodder resources for livestock that include goats, sheep, and cattle. They cited two causal factors for grassland degradation. The first was colonisation by AIPs especially *Acacia mearnsii* (black wattle) and *Acacia dealbata* (silver wattle). According to the respondents (100%), local people regard wattle bushes as an important ecological resource that provided a range of crucial services, such as building timber, fuel wood, and shelter for livestock against extreme weather conditions such as frost, hailstorms, and hot sun.

After wattle was introduced in South Africa in the mid to late 1800s by government to alleviate shortage of fuel wood and provide bark for the tannin industry (Le Maitre et al., 2002), local influential families, including those of royalty, the educated and the rich started growing the trees in their backyards around the 1970s and 1980s as household resources. Because wattle is a highly invasive plant, it expanded from the planted plots into grazing lands, arable plots, and waterways, such as river banks and springs.

This narrative by local people is corroborated by Scorer et al. (2019) who studied the expansion of AIPs in the region. The majority of respondents (86%) reported that waterways, including riverbanks, stream banks and wetlands, are the most heavily invaded, followed by grazing lands and fallowed arable plots. This is corroborated by a land-cover change analysis conducted by Scorer et al. (2019) which found that wattle invasion is faster in disturbed lands, such as abandoned fields, than in undisturbed landscapes. This study did not attempt to measure the extent of invasion because its overall aim was to hear what the people know, not what scientific knowledge can say.

Majority of the respondents (88%) said they started to notice that wattle trees were causing degradation of grasslands around 2004, and they provided two causal explanations about how wattle trees degrade grasslands. Many respondents (89%) said wattle trees possess poison that kills all flora that grows under them, especially grass. Less than half (46%)[8] said the cause of

[8] Values do not add to 100% because some respondents gave more than one causal factor.

degradation was the thick canopies of wattle bushes which do not allow sunshine to reach undergrowth grass.

Another invasive plant is *Chrysocoma ciliata (isirhalarhala)*. This is a hardy, dense short shrub about 20 cm in height. It grows mainly in grasslands on hillsides and gentle river plains. The shrub is unpalatable to cattle and sheep, although goats and donkeys occasionally browse it (Figure 4.2). The result has been selective grazing which leaves *Chrysocoma ciliata* undisturbed.

Figure 4.2. Grassland invaded by Chrysocoma ciliata at Nozitshena village

Respondents (72%) said that when a grassland is overgrazed it becomes vulnerable to invasion by woody species including *Chrysocoma ciliata, Vachellia karroo* trees, *Oedera nordenstamii*, aloe, cactus, and thorny shrubs.

There are two main traditional practices of managing pasture resources practised at the study sites. The first one is controlled fire burning. This involves burning of grass once every two years in spring. This two-year cycle allowed grass species to grow long roots into the soil. Because the roots had grown very deep, they were not burnt when there was fire. After burning, the roots would shoot out into new grass. The traditional agro-ecological calendar was used to ensure that the burning happened just few weeks before the beginning of the rain season. The

reasoning behind this is that the new grass must receive rain when it is still young in order for it to grow healthy and fast.

This bi-annual event is organised by local traditional leaders after consulting with the community members. Final decision on when to set the fire and the exact portions of grasslands to be burnt were made through deliberations at the local traditional court *(koMkhulu).* The deliberations largely revolved around ensuring safety of residential property and the need to leave some portions unburnt in order not to starve livestock.

The other rangelands traditional management practice is *lavulazana.* The *lavulazana* practice is a strictly controlled management method that involves demarcating portions of pasture that can be grazed or not grazed at a particular point in time. Bio-physical features such as stones, rivers, hills and trees are used to demarcate the grazing areas. Selection of pieces of grasslands to graze at a certain time was based on knowledge of maturity of grass and using a traditional agro-ecological calendar. Typically features such as flowering and change of colour from deep green to brown are taken as indicators of mature grass suitable for grazing. In addition pasture in low lying velds and riparian zones were set aside for grazing in the dry season when it is dry in other parts of the local landscapes. In this practice, grazing happens under strict control of herders that ensure that the livestock do not crossover to portions set aside for future use and arable plots. Just like fire burning, the *lavulazana* practice is a communal method that involves collective decision-making about which pasture lands are made available for livestock.

4.5.2. Traditional management and causes of degradation of water resources

All respondents reported that historically, the three local villages were endowed with several water sources that included wetlands, springs and rivers. At Colana there are three perennial rivers (Ntenga, Goxe and Colana) that dissect the village, and four perennial springs (Emthathini, Emachobeni, Emachabeni and Umriva). At Gogela there are four perennial rivers (Umzimvubu, Celinkungu, Ndakeni and Eskolweni), and seven perennial springs. Nozitshena has three perennial rivers (Umzimvubu, Gcininkomo and Mdwebu), and five perennial springs (Maqhingane, Eparafini, Esilibeni, Empompini and Eskolweni). The local people assign names to these water sources as a way of honouring them. Naming also facilitates ease of water resources management because it makes it easier for the local people to talk about, and easily locate the water bodies when something happens to them.

Many respondents (84%) said several rivers and springs had dried up in the past two to three decades, allegedly because of AIPs, particularly *Acacia mearnsii* and *Acacia dealbata*, but also because of the breakdown of traditional practices of resource management. The extent of water resource degradation since the time when wattle trees became noticeable on the local landscape followed this pattern: six springs and one wetland dried up at Gogela, five springs and two wetlands dried up at Colana, while Nozitshena lost four springs and three wetlands. Many rivers, including the Umzimvubu, are progressively becoming shallow, showing bare stones, especially in dry seasons. Some of these springs and rivers have become seasonal; they flow in summer, only when there is rain.

All respondents attributed the drying up of water sources to both ecological and supernatural factors. The ecological explanation blames the expansion of wattle bushes for sucking up water. Holders of TEK use a processual argument to explain causation when explaining how wattle trees *(Acacia mearnsii*) cause springs and rivers to dry up. Respondents said they base their claim on the fact that before wattle trees colonised the local landscape, springs had water and rivers were full to their banks. A typical response to the question about how they knew that *Acacia mearnsii* was responsible for the degradation of water resources in springs, wetlands and rivers was:

> "We did not have *Acacia mearnsii* in this area before, and our rivers were full of water. Now there is [sic] a lot of these trees on our landscape and springs are drying up. We just see things are different from the way they used to be".

The reality that wattle trees emerged in the landscape at a later stage following which springs, rivers and wetlands showed signs of drying up, and others actually dried up, is the explanation that local people give as evidence that wattle trees suck up underground water. This is a processual way of explaining causation. Critical realism recognises the processual approach in which causation is explained in form of a narrative of the sequence of events as a legitimate technique of explaining cause (Maxwell, 2012).

This way of explaining causation can be illustrated in this deductive[9] argument in which *P*=premise and *C*=conclusion:

[9] Deductive reasoning links premises (statements of claim) with conclusions. In a deductive argument, if all premises are held to be true, then it follows that the conclusion is true too. The first premise is a conditional statement and the second premise is an antecedent. The conclusion is a consequence of the two premises.

*P*1: There are wattle trees on the local landscape.
*P*2: Whenever there are wattle trees water sources dry up.
C: Water sources in the local landscape dried up because there are wattle trees.

This argument revolves around the physical realm of ecological processes in the sense that it explains causes of degradation by what people can see. It uses a historical timeline perspective to locate the point of causation. In this sense it is the temporal boundary point between the time when wattle trees were not yet on the landscape and the point when they arrived that explains causation (why it should be held to be true that wattle trees causally influence degradation of water resources). This is a physical-oriented ontology of causation.

However, this does not mean that TEK is not capable of comprehending, and explaining the invisible realm of ecological phenomena. TEK explains invisible ecological processes using the belief-epistemic technic in which what cannot be seen by the eye is held to exist and operate in the supernatural realm. Its existence is affirmed not by explication of an empirically intelligible cause and effect equation; instead it is affirmed by a belief in the objective reality of supernatural powers that produce and give it generative power to causally influence ecological processes. Such a belief is not a merely whimsical social property that individuals can easily pick up and drop depending on their interests at a given time or in a given circumstance. Belief is a serious cognitive position based on a strong feeling that something exists (Oxford Advanced Learner's Dictionary, 2015), and the feeling develops as a result of effective engagement with the supernatural world which takes place in form of a complex combination of repeated experiential encounters and transmission of knowledge from others, particularly the elderly.

Local people's use of supernatural forces to explain causation in ecological processes was demonstrated when they were explaining why alien trees and indigenous trees affected water resources differently. At the study sites, it was found that indigenous floral species such as *Ptaeroxylon obliquum (umthathi) and Ptaeroxylon obliquum* or *Salix mucronata (mngcunube)* were at springs or on riverbanks, but such water sources did not show signs of drying up.

However, in contrast to alien species such as *Acacia mearnsii,* respondents reported that indigenous trees did not cause drying up of water resources. The differential effect of indigenous and alien trees was explained as a supernatural reality. Some respondents,

especially traditional leaders and traditional healers reported that *Ptaeroxylon obliquum and Ptaeroxylon* were used by their forebears from time immemorial to provide several ecosystem services such as making traditional ploughs *(amakhuba)* and performing cultural ceremonies. As a result of this historical relationship with local communities, these indigenous tree are used as habits of ancestral spirits. Because they house the ancestors, these indigenous trees do not degrade the local water resources; instead, they protect them from drying up as a way of safeguarding the welfare of local communities who are descendant of the ancestors. The respondents argued that all springs and marshlands that had *Ptaeroxylon obliquum or Ptaeroxylon* were perennial. In contrast, scientists have explained the causal role of wattle trees in water resource degradation as minuscule ecological processes of high evapotranspiration resulting from the trees' evergreen, non-deciduous leaves (Le Maitre et al., 2002).

Respondents allude the arrival of AIPs on their local landscapes to the broader process of change that is happening in all spheres of social life. They argue that the root cause of all this change is ancestral anger; ancestors are angry with modern society because the Christianised community members accuse the ancestors of being demons and part of witchcraft. Furthermore, respondents said people with formal education do not agree that ancestors are real. Instead, the educated argue that the whole issue about ancestors is a mere myth that should not be taken seriously by anyone. Holders of TEK look at the issue of water resource degradation as part of a whole changing world life that includes social behaviour among people and reckless human activities that are causing global warming which is often accompanied by destructive rainstorms and droughts.

Some respondents (45%) said they had detected early warnings of these current problems that included water sources drying up. The warning signs started in the 1980s in the form of unusual changes in weather patterns, such as stormy destructive rainfalls, heavy snow that killed livestock, and dangerous lightning that struck people and homesteads. They complained about this and asked for the collective community to talk to ancestors, but nothing was done because influential people had adopted western education and religion. The suggestion of talking to ancestors was dismissed as mere superstition.

Respondents reported that local communities used to, and still – albeit to a lesser extent – implement several practices to manage water resources. Spring water for instance, was managed through a belief system. Local people believe that faunal species including

Potamonautes sidneyi (unonkala), Xenopus laevis (noplata) and *Gyrinidae (inkwili*) were responsible for protecting water sources, including springs, rivers and wetlands, from drying up. These species were accorded a special status in the communities, making it taboo to kill them in the belief that killing them or chasing them from the springs would cause the springs to dry up. Respondents reported that applying and obeying this traditional belief helped their communities to make springs function well so that they would continue to supply ecosystem services, especially drinking water.

Local people also used *customary law* to protect spring water from degradation through pollution. According to the local customary law, the land and all it natural resources belong to the community. The local notion of community comprises the living, the dead, and the coming generations. Local customary law prohibited practices such as bathing and doing laundry, urinating or defecating in or near springs. Furthermore, it prohibited herders from watering their livestock at springs. These customary water management laws were enforced by local traditional leaders, including sub-headmen, headmen and chiefs. These are the custodians of tradition. Anyone found contravening these laws would be regarded as disobeying the community, and would be charged at the Chief's traditional court. Those found guilty were usually asked to pay a fine in the form of livestock including goats, sheep and chickens.

The relationship between people and local rivers was further regulated by *taboos* that designated some parts of rivers as sacred. Rivers such as Umzimvubu and Celinkungu (both at Gogela village) had pools that were designated as sacred because they were inhabited by an *inyoka* (mermaid). The word *inyoka* means 'snake', but is used in a somewhat euphemistic way to demonstrate respect for the mermaid by likening it to a snake, which is a common species.

Such pools were given signal-names, for example, *Enyokeni* (where a mermaid lives), *Enkanyambeni* (where whirlwind occurs), *Kwacamagu* (where happy ancestors live) and *Tshekhulu* (where big boulder lives). Through the traditional belief system, local people perceived the big boulder as a living being and so respected it. These pools were no-go areas, which prevented children, who often swim in rivers, from disturbing the surrounding vegetation. By attaching supernatural beings to these water bodies, local people would not cut down bushes around them; thus, the pools and their rivers were protected from degradation. From an ecosystem services management perspective, the belief system was important because it ensured that rivers remained healthy and able to provide services such as water for domestic

use and livestock, and places for religious functions, especially baptism and initiation of traditional healers.

In addition to the management of spring and river water resources, local people practised traditional rainwater management. Rainwater supports services that are critical for local people's wellbeing, such as water for crop and pasture production. Crops and pasture are important pillars of livelihoods in these communities; their mixed farming involves crop cultivation and livestock rearing. Respondents reported that since the historical past, their communities faced three main rainwater problems: droughts, late rains, and stormy destructive rains. These problems render rain unable to deliver the services needed by local people, especially crop production, which made it imperative for the communities to implement some rainwater management practices to ensure that these services continued to be available to them. The practices included traditional belief system, and in-field water harvesting techniques.

A belief system that included taboos was used to manage stormy rains. Storms are not helpful for agrarian communities whose demand for rain is mainly to support animal rearing and crop cultivation. Respondents reported that their villages have a history of storms and snow that dates back to time immemorial. Storms are not a desirable way of receiving rain because they tend to destroy crops and built infrastructure such as houses and schools. Moreover, storm water gets lost through heavy runoff that washes away topsoil and erodes arable and grazing lands. Respondents prefer soft, gentle rains which recharge the soil and lead to high yields.

The problem of late rains was managed through traditional practices that included local women playing a cooking-stick game. The game was played if rains had taken too long to fall, especially as late as November. Women from one village would secretly go to a neighbouring village. When they arrived at a homestead of their choice, one of them would get into the kitchen, pretend that they were thirsty, and ask for drinking water. While the home member was busy fetching the water, the visiting woman would pick up a cooking-stick and run out. She would throw it to her group members. They would run away from the village while throwing the cooking-stick from one member to another. Women of the village from which the cooking-stick was stolen would give chase, aiming to take back the stick. When they arrived back at their village, the chasers would turn back to their village. Then within a short time, rain would start falling. This would be followed by singing of ancestral praise-songs and ululation by women and men from all local villages.

If assessed from a scientific ecological management perspective with its attendant aim of intervention, TEK's explanation of causation can be easily dismissed as unhelpful. Scientific ecological management concept emphasises the need for intervention as a way of re-engineering degraded ecosystems to some desirable conditions (Nel & Alberts, 2018). This is different to TEK and its associated conception of human-nature relations which infuses management in the day-to-day activities of human-nature encounters and relations that include harvesting and conservation. Unless appropriate theoretical lenses such as critical realism's axiom of epistemic pluralism are used, this novel way of explaining ecological degradation risks being dismissed in mainstream environmental management knowledge as senseless and hence useless. Nonetheless, the principle of epistemic pluralism can help us appreciate that it is just another way of explaining degradation, which is different from the scientific one. In light of this axiom, the fact that local people explain degradation using the physical and supernatural realms whose analytical properties scientists generally have little regard for, is not a sufficient reason to conclude that they possess limited knowledge of degradation.

Furthermore, using the principle of the separation of our knowledge from the things about which our knowledge is, one can argue that we cannot dismiss the claim that ancestral spirits that inhabit in indigenous trees causally influence continued availability of water in springs simply because other knowledge systems do not regard this as real. The truth-claims that these other knowledges make are not a direct representation of the reality of environmental management; instead, they are mere interpretations which can be correct or otherwise. Likewise, the local people's claims should be treated as no more than interpretations and be judged on their merits. In his explanation of the separation of ontology from epistemology, Sayer (2000) reminds us that no knowledge system (be it science or TEK) possess the power to directly access reality. In pursuit of the ontological project (effort to explain reality), the best that any knowledge system can do is to offer interpretations that are closer to reality than what alternative knowledges can do at a given point in time (Sayer, 2000).

Apart from the belief system, local people practice stone terracing to manage rain water. Stone terracing is an in-field water and soil management practice that involves constructing lines of stones horizontally across the length of a marked portion of an arable plot (Figure 4.3) (Denison & Wotshela, 2009: Murata, 2010). Local people initiated the practice as far back as the 19th century to support crop cultivation on steeply arable lands. Stone terracing is practised at Gogela village because many arable plots are on steeply sloping hills interspersed along the

Umzimvubu River. On this topography, rainwater is easily lost through runoff and is unable to support crop production.

Figure 4.3. Stone terraces on arable field at Gogela village

Commentators on South African agrarian history (Bundy 1988; Sobahle, 1982) have noted that crop cultivators have always confronted problems of soil erosion in steep topography. The role of terrace walls is to obstruct runoff as it flows from the upper sides or portions of croplands. The general interval of terrace walls on an arable plot was eight to ten metres, an interval big enough to allow for movement of a span of oxen during ploughing, but short enough to prevent runoff from building the energy necessary for high velocity. Stone terraces are not waterproof, but they reduce runoff velocity, facilitating percolation of rainwater into the soil where it forms soil moisture which is an important service to support crop production, and by extension, the provisioning needs of local communities.

Yet another traditional practice of managing rainwater is *gelesha*. The word *gelesha*, is an isiXhosa term which refers to the practice of turning up the soil prior to planting, through tilling in arable lands after harvesting crops (Denison & Wotshela, 2009). The practice of *gelesha* helps loosen the soil so that it absorbs and stores precipitation that falls in the forms of rainwater, snow and dew (Denison & Wotshela, 2009; Van Averbeke, 2003). The *gelesha* enables the plots to store water in situ, and, historically, was an annual practice embedded in the farming calendar of local people. Local people would start *gelesha* when the digging star

(Orion constellation), locally known as *isilimela,* appeared in the sky in spring, and planting would start in October.

4.5.3. Explaining degradation and management of arable lands

Local communities derive an important benefit from arable lands. When they are in a well-functioning condition, arable lands provide ecosystem services that include storage and provision of nutrients, and water for crops, services which support local people's livelihoods. However, respondents said since historical times, degradation in the form of erosion and loss of soil fertility have been the major disabler of croplands' capacity to supply these ecosystem services to local communities. Respondents made clear connections between the degradation of land through soil erosion and failing livelihood opportunities. They recognised that crop cultivation had declined substantially because of soil erosion, which washes away the fertile topsoil. By demonstrating knowledge causal relationship between degraded soils and low harvesting yields, local communities show that they know of the ecosystem service concept. Hoffman and Ashwell (2001) make a similar argument when they identify one of the effects of degradation as crippling livelihoods.

Local communities use two traditional strategies to manage soil fertility. The first is applying organic manure in arable fields; this is largely livestock and ash manure which is used as base fertiliser during crop planting. Another way of applying organic manure was *ukubuqisa*. *Ukubuqisa* is an isiXhosa term which refers to the practice of grazing livestock, especially cattle, in arable fields after harvesting. As the cattle feed on crop residue, they drop dung in the fields which helps fertilise the soil. The second traditional soil fertility management strategy was fallowing. Local people would use an arable field for about five consecutive years, and thereafter leave it uncropped for three to five years. During the fallow period, natural vegetation would recolonise the fields and dead twigs and leaves would rebuild the organic top spoil. These management practices enhanced the capacity of arable lands to provide agro-ecosystem services such as generation and provision of nutrients to crops.

Local people responded to incidents of erosion, especially in arable lands, by constructing terrace ridges made of stones, and filling gullies using stones and soil. An in-depth study of stone terracing technique by Murata (2010) concluded that the technique is indigenous; as it was initiated by local people way back, in the early 19th century. However, it is difficult to make a clear-cut distinction between indigenous management practices and the ones introduced

by the state in South African environmental history because the state has dominated conservation programmes since the late 19th century.

Nonetheless, local people demonstrated a limited understanding of the phenomenon of soil erosion. During the interviews, they talked of soil erosion of one type, the local name of which is *indonga* (plural; *iindonga*). Respondents reported that *iindonga* are gullies created when runoff washes a lot of soil from some portions of the landscape. Local landscapes at all the three villages are extensively defaced by *iindonga*, especially in arable lands that have been fallow over many years, and on steep grazing plots. Kakembo and Rowntree (2003) and Keay-Bright and Boardman (2006) conclude that lengthy land fallowing causes gully erosion.

In an aetiological analysis of the word *indonga*, that involved discussions with both local people and isiXhosa-speaking colleagues with postgraduate qualifications in Environmental Science at Rhodes University, I found that the word is an equivalent of donga erosion, an English word. The close syntactical affinity that exists between the two words 'donga' and '*indonga'* suggests that one of the two cultures adopted it from the other and indigenised it over time. Early conservation literature in the 19th century mentions the word 'donga erosion' and indicates that it means the same as 'gully erosion' (Beinart, 1984; Lyons, Tooth, & Duller, 2013). Because of this, the study concluded that the word *indonga* and knowledge of this type of erosion are indigenous to local people.

However, the reality that local people talk of the multi-type phenomenon (including, donga, rill and sheet erosion) of soil erosion as just one thing, *indonga,* demonstrates a state of limited knowledge which, potentially, has negative implications for locally designed management strategies. The presence of a word to name a concept or object in a particular culture is a reliable indicator of the existence of that concept or object in that cultural community (Berkes, 2008). By orienting their knowledge to a single type of erosion, (that is donga erosion) local people miss a very big and important component of the soil erosion phenomenon. As Vanacker et al. (2000) have demonstrated, development of dongas (*iindonga*) can be a sign of rill or sheet erosion that has progressively intensified without intervention. During interviews, no respondent mentioned any locally known type of erosion that can be an equivalent of sheet or rill erosion.

By arguing that traditional knowledge demonstrates a limited understanding of soil erosion, this study does not intend to compare traditional knowledge of erosion to other knowledge systems. Rather, the study is exercising the principle of rational judgementalism encapsulated in critical realism's 'holy trinity'. The holy trinity states that although we should appreciate the reality that there could be plural knowledge systems that offer correspondingly different interpretations of a single phenomenon, some interpretations can describe the phenomenon better than what others can do (Bhaskar, 2016). In the context of these findings it can be concluded that although TEK is recognised as a legitimate source of soil erosion wisdom, it demonstrate a limited ability to describe the nature of the phenomenon. However, the insight that the holy trinity provides is that rather than wishing that traditional knowledges mimics other knowledge systems, we need to work towards improving it within its unique framework of knowing. The tendency to assess TEK using tools from other knowledge systems and to expect it to interpret reality in the same way those knowledge systems do presents the risk of hampering its opportunities to develop in its own unique way that is consistent with its epistemic properties.

4.6. Conclusions

This chapter has looked at traditional practices that local people use to manage ecosystem services that include water, pasture and arable lands. Traditional management practices although not necessarily unrecognised, are often subject of criticism and misinterpretation by writers within the mainstream resource management epistemic community. In order to both unravel some insights that some of these critiques might be missing and to deepen our understanding of the ontology of traditional management practices, the chapter has used three principles of critical realism as lenses through which to make sense of local people's reports. These principles include the argument that our knowledge is merely an interpretation, and not a representation of the things it is about. The second principle is that there is a possibility of having many varied and correct truth-claim about a single reality. The third one is that reality is layered into three different but interconnected levels.

By using these principles, the chapter has offered alternative explanations of traditional management practices that are not usually found in studies that look at this subject. One key insight relates to how we need to treat the reality of difference that exists between local people's ecological knowledge and of mainstream science especially in relation to how both parties

explain causes of resource degradation and practise related management strategies. The study has demonstrated that TEK tends to fuse together matters of belief and purely ecological (natural processes and functions) factors when explaining degradation. This fusion is also manifest in the practices they implement to avoid degradation of these resources.

When explaining invisible ecological phenomena such as causes of drying up of water resources, local people use a belief system in which the ancestral realm is known for causally influencing the ability of ecosystems to provide services to humans. By ascribing causal power to supernatural beings, local people's knowledge marks a difference from mainstream scientific knowledge which tends to explain all ecological processes, minuscule or physical, through measuring and subjecting empirically observable processes to logical explanatory reasoning. Mainly because of being unable to appreciate this difference, many scholars have concluded that TEK is incapable of comprehending and explaining minuscule ecological processes (Beinart & Brown, 2013; Costanza, 2008; Fabricius et al., 2006).

This conclusion may be incorrect and misleading. As has been demonstrated in this chapter, traditional communities may be capable of understanding invisible ecological processes, but their ways of explaining them are different from the mainstream scientific ones. Tendencies among researchers to ignore other knowledge systems as alternative sources of wisdom, can therefore, be the reason why such conclusions are reached, and accepted as truthful findings. The conclusions can influence designing and implementation of intervention programmes which are not in synch with local ways of knowing. By using the principle of epistemic pluralism, this chapter contributes towards liberating our minds from such mono-epistemic mind-sets that have a potential to constrain the growth of the ecosystem service discipline. In line with the chapter's findings, local people may not need intervention programmes that teach them about how to understand invisible causes of resource degradation because they already have the knowledge. Instead, they need programmes that help strengthen their knowledge and enhance its ability to work complementarily with other knowledge systems.

Another dimension that although very insightful, is not well-reflected in studies that focus on management of ecosystem services, is that reality (including traditional management practices) is layered comprising multiple levels; the empirical, the actual and the real. What takes place at each layer contributes to the ultimate and complete nature of reality. By using the multilayer analysis (the iceberg ontology), this study has contributed towards completing the puzzle about

the reality of traditional techniques of ecosystem service management. The puzzle revolves around how to explain how exactly traditional practices such as taboos or propitiating ancestors can causally influence changes in natural resources.

In trying to answer this question, the iceberg ontology has demonstrated that what we observe at the level of the empirical, for instance the falling of rain, is just but an iceberg of a much deeper reality that include generative power that cause the rain to fall when traditional techniques such as playing the cooking-stick game are implemented. Our common tendency to analyse reality by observing and measuring events that occur at the empirical level alone rob us of the opportunity to see the whole circumference of traditional management systems. The dearth of literature that offer causal explanations has significantly influenced pessimism in, and sometimes total rejection of traditional techniques such as taboos as sheer fictitious fable without practical foundations.

Furthermore, the level of the actual which argues that events occur unfiltered, and such events remain real regardless of how we experience them, has introduced another important dimension which rarely gets mentioned in resource management literature. This argument seeks to reject tendencies to reduce the multifaceted complex reality of resource management to our experience of it. The chapter has found that local people practise ecosystem service managed through implementing many techniques such as taboos, designating some water resources as sacred, controlled veld burning, *gelesha* and stone terracing. The ontological level of the actual suggests that whether or not our experience of these practices confirm them as management techniques or not is an interpretive, and not an ontological question. The fact is that management is taking place. We can only get access to a part of the vast reality of management, and the interpretations we ascribe to this part is significantly influenced by our epistemic training which sets standards for what we can admit as management. Consequently, what we have experienced should not be treated as the complete sum of the reality of resource management; rather it is just but an iceberg. In making this analysis, the chapter has contributed a rebuttal to the ongoing question especially from mainstream management scholarship about whether or not traditional practices can qualify to be regarded as management practices proper (Smith & Wishnie, 2000). By unravelling these dimensions of reality, the chapter holds potential to improve our understanding of traditional resource management practices implemented by local communities. Resource management studies that do not attempt to explain these dimensions risk leaving many ontological questions unanswered hence do little

to resolve misunderstanding that generally hurdle initiatives aimed at promoting traditional management practices.

One lesson that can be drawn from these findings and analysis is that local communities possess knowledge of resource degradation and they implement several practices to combat it. However, some of the management techniques are not intelligible to observation and measurement-based verification methods. Instead of ignoring such practices, related intervention programmes have to take this into consideration and find ways of incorporating them in their implementation plans. Doing so can help in the formulation of locally relevant programmes. Intervention programmes that ignore local realities may be scientifically appropriate, but contextually irrelevant, and consequently risk being resisted by local people. This has been the tragedy of scientifically informed intervention programmes in the South African ecological history, including the Betterment Programme of the mid-20th century (Murata, 2008).

Nonetheless, even though critical realism has situated TEK as source of alternative resource management knowledge that has to be understood and assessed in its own right, the chapter revealed that it has its own limitations. Local people tend to possess limited knowledge of the phenomenon of land degradation, especially erosion which they talk of in terms of formation of dongas only. The respondents did not demonstrate knowledge of physically small types of erosion such as rill. The ability of traditional knowledge to explain minute ecological phenomena have been questioned by a number of scholars (Beinart & Brown, 2013; Costanza, 2008; Fabricius et al., 2006).

These limitations of traditional knowledge coupled with the reality that unless one carefully uses particular theoretical lenses such as the iceberg metaphor, they may not get to understand the complex ontology of traditional practices, raises a fundamental implication question. The question is; given the difficulty of unpacking the layered ontology of traditional management practises such as taboos, how do local people perceive traditional techniques of ecosystem service management in these local communities? I set out to address this question in the next chapter (Chapter 5). It is not usual that we care to use sophisticated theoretical lenses in our ordinary day-o-day encounters with the world (Bhaskar, 2016). Bhaskar (2016) refers our usual ways of interpreting reality as an ordinary attitude, which he says can cause epistemic problems because it rarely uses theoretical lenses which are necessary for capturing the complex relations

between our knowledge and things about which our knowledge is.

CHAPTER 5: PERCEPTIONS OF, AND CHALLENGES TO IMPLEMENTATION OF TRADITIONAL ECOSYSTEM MANAGEMENT PRACTICES AT THE LOCAL COMMUNITIES

5.1. Introduction

This chapter investigates how traditional ecological knowledge (TEK) is perceived at the local communities, especially regarding the role it can play in the management of ecosystem services. The chapter focuses on how local people make sense of various traditional management practices such as use of taboos in the context of resource management. The cognitive process of making sense of something is a hermeneutic project which involves using knowledge acquired through our senses to arrive at a judgement that something is X or is not X. Doing so involves deployment of perceptions to make sense of reality. Perceptions are part of people's knowledge because they provide the basis for justifying what we think is true or false.

Chapter 4 documents the traditional practices that local communities implement and in the process, it unravels two main findings that may have a bearing on how the practices can be perceived at the local communities. One of them is that traditional knowledge tends to have limitations in understanding some ecological challenges, especially the ones that are not very physically identifiable. The other one is that the ontology of traditional resource management practices (for example, application of taboos) does not lend itself readily intelligible to ordinary day-to-day methods of interpreting reality. These two findings motivate the questions: (a) how are traditional practices of resource management perceived at the local communities of Colana, Gogela and Nozitshena? and (b) what implications do these perceptions have on the potential role of traditional ecological knowledge (TEK) in management of ecosystem services in the South African traditional communities?

The reality that in spite of the wealth of management knowledge that the local people reported they possess (Chapter 4), degradation is high, necessitates an in-depth investigation into how these practices are faring at the communities. The chapter did not seek to address the efficacy of traditional management practices in solving ecological challenges. Rather, it limited its remit to investigating whether the practices are being embraced or rejected by the local communities whose resources they are supposed to manage. It is crucial to know whether or not a practice

is being accepted and implemented before we start to talk about its efficacy. This is because, unless it is fully implemented, a management practice cannot demonstrate its strengths or weaknesses. Thus unless we know that traditional management practices are being fully implemented, statements such as 'traditional management practices are not capable of doing X and Z', are likely to be misplaced and hence deceitful. In light of this, it is important to explore how local people are making sense of the management practices because doing so can shed insights about whether or not the practices are being fully implemented. Findings from this study can provide a useful groundwork to future studies which aim at assessing the efficacy of traditional management practices.

Rural communities of South Africa, especially in the former Transkei where this study was conducted, are known for practising traditional knowledge systems (Bank, 2002). These communities are the ones whose natural environments are more degraded than those occupied by non-traditional people, such as commercial farmers (Palmer & Bennett, 2013; Scorer et al., 2019). The reality of heavily degraded landscapes and ecosystems is continuing in rural Eastern Cape at the time when South African literature is increasingly becoming replete with conclusions that traditional communities possess a wealth of traditional knowledge that the contemporary global society can leverage in order to sustainably manage the natural environment (Chalmers & Fabricius, 2007; Denison & Wotshela, 2009; Murata, 2010). These local studies are supported by empirical case studies conducted elsewhere which conclude that indigenous knowledge system, especially its environmental branch called TEK has helped several traditional communities to sustainably manage resources, hence it must be taken as an important source of environmental management wisdom (Ayaa & Waswa, 2016; Berkes et al., 1998; Ngara, 2013; Pearce, Ford, Willox, & Smit, 2015; Sillitoe, 2017; Tengo et a., 2007). Influential global policy publications have joined the bandwagon, proposing that traditional knowledge systems have to be taken seriously and must be considered in policy formulation and incorporated in intervention programmes (Convention on Biological Diversity (CBD), 2004; MEA, 2005; World Commission on Environment and Development (WCED), 1987). However, the apparent contradictions between the claims made by literature and local environmental realities raises uncertainties regarding what is happening with regards the situation of TEK in South Africa.

Chapters 1 and 4 have provided extensive definitions and discussions of TEK, the knowledge system that informs traditional management practices; hence I will not repeat the discussions.

Traditional ecological knowledge depends on using features of tradition, such as cultural and religious beliefs, taboos and related tribal conventions for its sustenance, transmission and application (Battiste & Henderson, 2000; Berkes, 2008). Belief in, and respect for tradition, including its key aspects, such as taboos, ancestral spirits and myths, form the central cog of sustenance of TEK in a community (Battiste & Youngblood, 2000; Berkes, 2008; LaDuke, 1994). Some scholars have pointed out that tradition, the institution within which TEK is embedded, and post-colonial liberal democracy, cannot work hand-in-hand because the two derive their legitimacy from different sources. While the former is derived from pre-colonial social-political roots, the latter is a successor of colonial system (Meer & Campbell, 2003; Ray, 1996). This sentiment provides a useful contextual environment that can potentially provide useful insights into the challenges that TEK faces in the contemporary democratic South Africa.

Studies conducted elsewhere have demonstrated that the enthusiasm that has characterised the discourse of TEK for the past three decades is being undermined by a growing fear that the knowledge system is not being embraced, and in some instances, its truth-claims are being actively contested. A study by Pieroni, Quave, & Santoro (2004) found that some modernising communities in Italy were losing knowledge of traditional medicine. Another study shows that the use and knowledge of plants has declined in the Tsimane community of the Bolivian Amazon due to the reality that the local communities have integrated into the market economy (Reyes-Garca, Vadez, Byron, Apaza, Leonard, Perez, & Wilkie, 2005). Furthermore, a study of changes in cultural traits associated with TEK among the Amazonian indigenous communities found that due to modernisation, TEK is lost faster in villages that are closer to urban centres than in remote ones (Reyes-Garcia, et al., 2013). Moreover, TEK is being contested and hence declining in the Bolivian Amazon and Donana region of Spain due to forces of social change including modernisation, education, and integration into the market economy (Gómez-Baggethun et al., 2013).

More cases of contestation and loss of TEK have been found in Spain (Gómez-Baggethun & Reyes-Garcia, 2010), Canada (Turner et al., 2000), Amazon (Reyes-Garcia et al., 2005; Reyes-Garcia et al., 2013), China (Ahmed et al., 2010), Ecuador (Guest, 2002), Vanuatu (McCarter & Gavin, 2014) and India, Indonesia and the United Kingdom (Pilgrim, Cullen, Smith, & Pretty, J. (2008). The drivers and processes of loss of TEK are complex, and include changes in knowledge systems, conversion from traditional religion to foreign religions, adoption of

western education, and state-imposed restrictions in access to natural resources (Turner & Turner, 2008).

In the South African literature, the question of how TEK is being perceived and whether its related management practices are being embraced or contested remains largely unaddressed. South African studies have mainly been concerned with investigating how traditional knowledge is used by local communities to manage the natural environment and its services. Some of examples of these studies include Chalmers and Fabricius (2007) who discuss the value of local ecological knowledge in management of ecosystem services in the Wild Coast of South Africa; Denison and Wotshela (2009) and Murata (2010) who investigated indigenous ecological knowledge in managing rainwater and soil resources, and Critchley and Netshikovhela (1998) who investigated traditional practices of soil conservation. Largely, local studies project traditional knowledge as a virtuous system that has a lot to offer in the domain of management of the environment and its services.

The few South African studies which focus on the challenges and weaknesses of traditional knowledge systems include Fabricius et al. (2006) who conclude that the knowledge system tends to struggle with explaining causation and coping with foreign-induced environmental changes. Another study by Beinart and Brown (2013) who found that traditional knowledge system struggles to comprehend and explain minuscule processes such as germ and bacterium infections. Nonetheless, these studies do not look at how traditional knowledge system is perceived. In South Africa, a study that attempts to talk about how traditional management practices are perceived is by Kapfudzaruwa and Sowman (2009). In their study of Water User Associations (UWAs) in South Africa, Kapfudzaruwa and Sowman (2009) found that TEK is facing challenges such as not being included in mainstream water governance programmes. Nonetheless, Kapfudzaruwa and Sowman (2009) did not do an in-depth investigation of why traditional management practices are side-lined. Consequently, the question of what actually is happening with traditional management practices in rural South Africa continues to pose a knowledge gap.

This chapter sets out to contribute towards filling this gap by investigating how traditional management practices are perceived at the three local communities of Colana, Gogela and Nozitshena. Although the communities are rural and traditional, each one of them under traditional leadership structures, they are not homogenous. Previous studies (Bank, 2002) have

shown that the amaXhosa communities in this region are characterised by internal divisions that mainly emanate from social properties such as acquisition of education, religious orientation, and worldviews. All these social properties can influence members of the same community to perceive traditional management practices differently.

The major contribution of this chapter is that it typologises the challenges, and by so doing, it helps streamline them according to their core defining features, which can better inform intervention programmes. Moreover, by making the challenges its central theme, the chapter has the potential to ignite future research interest in the direction not only of celebrating traditional knowledge, but to focus on investigating if the knowledge system is being fully implemented or not, in the first place. Establishing this knowledge can provide useful groundwork to debates on why in spite of an abundant wealth of ecological knowledge, traditional communities experience high levels of resource degradation in South Africa. This, in addition, can shed light into the role that TEK can potentially play in shaping the direction of the ecosystem service discourse.

5.2. Theoretical inclinations

5.2.1. The interpretive or hermeneutic dimension of critical realism

In this chapter I used critical realism's interpretive or hermeneutic dimension, the dimension of dynamism and the dimension of context to make sense of the multiple challenges that traditional ecosystem management practices face at the local communities. Hermeneutics concerns itself with the complexities of interpreting social phenomena (human action). "Interpretation is a ubiquitous activity, unfolding whenever humans aspire to grasp whatever *interpretanda* they deem significant" (Mantzavinos, 2020: no page number). There are two levels of hermeneutics; the ontological hermeneutics and the epistemological hermeneutics (Mantzavinos, 2020). While ontological hermeneutics deals with interpretation of the being (existentialism), epistemological hermeneutics concerns itself with ascription of meaning to reality (what does that which exists mean). In this study I used the latter because what is at stake is not the existential nature of traditional management practices (e.g. what taboos are); rather it is whether or not the taboos constitute management techniques. This is an issue about our interpretation of the practices *vis a viz* the domain of resource management.

The challenges include divergence of worldviews and religious beliefs that play out between

holders of TEK who are the main actors in the implementation of these practices and non-traditionally minded people including fellow community members. The latter group largely comprises Christian converts and people with fairly high levels of formal education; from secondary to tertiary. The main contentious issues revolve around interpretation and meanings that are ascribed to traditional management practices such as taboos, as well as the role that supernatural forces including ancestors can play in management of ecosystem services. These interpretations and their associated truth-claims tend to be informed by, and reproduce worldview polarities that draw a diving line between the local traditional religion and Christianity. While the former acknowledges the active role of ancestors in protecting the welfare of humans and the integrity of nature, the local version of Christianity does not recognise this. Furthermore, the contestations over the place of traditional practices in management of ecosystem services tend to coalesce around the differences (perceived otherwise) between formal education and IKS in so far as the two strive to explain the ecological world.

Critical realism's hermeneutic dimension was used to shed theoretical light and guide our interpretations of these contestations. The hermeneutic dimension holds that all social phenomena including objects, processes and abstracts "are intrinsically meaningful, and hence meaning is not only externally descriptive of them, but constitutive of them" (Sayer, 2000: 17). In light of this, all social phenomena including management practices inherently carry meanings, and hence their meaning is not socially constructed. Nonetheless, meaning cannot be known unless it is accessed, interpreted and communicated. The process of doing this is influenced by the interpreter and communicator's social properties including their worldview, religious beliefs and epistemic orientation (Bhaskar, 2016; Danermark et al., 2002). So depending on their socialisation, different interpreters may see and communicate equally different meanings of the same social phenomenon. These different meanings can be a constraint to successful interpersonal and intercommunity dialogue.

Although the phenomena (e.g. traditional management practices) exist in an objective state, that is they are what they are regardless of our socially influenced interpretations of them, and hence they can be measured, the meanings we ascribe to them can only be understood, and not measured (Bhaskar, 2016; Sayer, 2000). Consequently, there is always a hermeneutic element in social life because in order for two or more actors to get into a dialogue about a particular phenomenon they have to understand each other's interpretations.

Social actors are not only confronted with the reality of having to interpret the phenomena communicated to them by their fellow social actors (e.g. that they should not kill certain species of frogs because doing so can upset ancestors who in turn may causally lead to drying up of a spring), they as well need to enter the hermeneutic circles of the communicators. In this regard, non-holders of TEK do not only need to interpret what the taboo that says killing *Gyrinidae (inkwili*) can causally lead to drying up of a water resource, but they also need to enter the epistemic world of the individual who communicate this. This is a double hermeneutic; a burden of interpretation that does not apply to scientific actors (Sayer, 2000). It is the latter that is often difficult, hence a source of contestations because social actors do not usually share similar social properties, especially religious beliefs, epistemic orientations and cultures. Scientific actors whose hermeneutic remit is primarily to make sense of physical objects (e.g. soil, rocks and trees) do not suffer the burden of double hermeneutics (Sayer, 2000).

Bhaskar (2016) explains this hermeneutic complexity by disaggregating reality into transitive and intransitive dimensions. The intransitive dimension is the social phenomenon (e.g. making use a certain tree species a taboo) while the transitive dimension is constituted by our interpretations of what that phenomenon means; that is whether we regard the taboo as a resource management practice or we dismiss it as a mere fable. The transitive dimension may change or vary from one social actor to the other, but the phenomena (intransitive dimension) remains what it is (a taboo) (Bhaskar, 2016).

Social meanings are related to and significantly shaped by the context in which the social phenomena unfold. Contextual factors that influence what we make of social phenomena include cultural, economic (lifestyle), social (the kind, and levels of education acquired) and political (policies). What may constitute environmental management to an individual with tertiary training in formal education may not be similar to what a holder of traditional knowledge thinks. And what may constitute a fact to the latter can be interpreted as a fable by the former.

5.2.2. Critical realist dimension of dynamism

The second critical realist dimension used in this chapter is that reality, including events and processes, occur in a dynamic open system that cannot be directly controlled (Bhaskar, 2016; Danermark et al., 2002; Sayer, 2000). This contrasts with the positivist approach that studies phenomena in closed laboratory-controlled environments (Wynn Jr & Williams, 2012). The

social realities, such as application and transmission of TEK, cannot be contained and controlled in a laboratory-like experiment environment; they depend on a multitude of changing conditions, as communities evolve over different eras (Berkes, 2008). Attendant conditions *inter alia*, social-cultural, political, economic, although not in a strictly causal way, possess generative power to either enable or constrain the occurrence of phenomena such as people's trust in and use of taboos in resource management, and their belief that ancestors can interact with the living in ways that can change the way the environment functions. The shifts and developments, especially in the domain of political administration and livelihoods that have taken place in post-apartheid South Africa (See section on study context in this chapter and chapter 2) have potential to influence how local communities perceive and practise traditional management practices. Such conditions can enable or act as liabilities to efforts by holders of TEK, to pass it down their children and young generations.

The boundaries within which social phenomena unfold are typically dynamic; they change over time. These changes make it difficult to assume, as several researchers and international organisations do, that traditional management practices that were applied in the past, in different contextual environments, are still applicable in the contemporary traditional communities (Wynn Jr & Williams, 2012). Precisely because of its acknowledgement of dynamism, critical relist study shifts its focus from the positivist concern with repeatability of events to tendencies of things to occur within a particular contextual setup and time (Wynn Jr & Williams, 2012). Thus changing conditions within communities may fundamentally influence people's perceptions of different traditional practices of resources management. A vast amount of literature has demonstrated this point in many study cases (Ahmed et al., 2010; Guest, 2002; Gómez-Baggethun & Reyes-Garcia, 2013; McCarter & Gavin, 2014; Reyes-Garcia et al., 2005; Reyes-Garcia et al., 2013; Turner, Ignace, & Ignace, 2000; see also Chapter 1).

5.3. Context of the study

This section is presented in a way that departs from the conventional approach of describing a study site. Instead of focusing on biophysical, social and economic features of the study sites specifically, the section presents the context in which the study phenomena (traditional management practices) get to be interpreted and implemented. This less conventional approach of describing study sites was necessitated by the realisation that factors that influence how local

people perceive the role of traditional practices in ecosystem service management might be of a national scale, especially political and economic developments. Because of this, this section briefly introduce the study sites and quickly moves to describe wider contextual factors that bear potential to influence how resource management knowledge is shaped.

I conducted this study at the three remote, isiXhosa-speaking villages of Colana (30°36′45,46″S 29°32′,77″E), Gogela (30°22,′535″S 29°14′.613″E) and Nozitshena (30°63′,585″S 29°21′,803″E) in Eastern Cape Province, South Africa. Unlike many site descriptions which focus on details of geographical features of a study area, this one is concerned with the history and dynamics of political and economic changes that took place at both the local and national levels. Such changes give context to some of the reasons why some of the local people regard TEK with contempt and hence frustrate efforts to apply it in management of local ecosystem services.

Upon achieving democracy in 1994, South Africa adopted a national constitution built on liberal principles that include equality of persons, gender equality, human rights and governance through democratically elected representatives (RSA, 1996). While the constitution provides for leadership by elected government officials, in sections 211-212, it recognises the role of traditional leaders to continue to supervise the practice of indigenous knowledge, customs and customary law under its regulation (RSA, 1996; Bank & Southall, 1996). The constitution also provides that traditional leaders must play the roles of *ex officio* members in local government and advisers at provincial and national government levels (Bank & Southall, 1996).

The state determines the scope and nature of the key responsibilities and powers of traditional leaders in maintaining community culture and customs, as well as presiding over traditional rural courts that use customary law (Republic of South Africa (RSA), 1998). The constitution created three spheres of government – national, provincial and local – and provides that municipalities be formed in all areas of South Africa, including in rural villages headed by traditional leaders (Republic of South Africa (RSA), 1996). The state and traditional leadership systems operate quite differently, although some scholars have advanced the argument that the latter can be used to complement the former (e.g. Sklar, 1986). The distinction between the two led Bank and Southall (1996) to describe post-apartheid leadership arrangement as a case of several traditional states behind the state. Ntsebeza (2004) argues that post-apartheid South

Africa's constitutional position of mixing liberal democratic institutions with unelected traditional leadership is contradictory. This contradiction is a source of confusion for both traditional leaders and rural people, and its influence has spilt into the domain of natural resources management.

Traditional leaders are not sure about the scope of their powers in community issues such as justice and law, land administration and control over natural resources including forests, pasture and water sources. Prior to democracy (1994) these community issues were presided over by traditional leaders, albeit with indirect state intervention (Ntsebeza, 2004). Faced with the introduction of elected local government officials including ward councillors, rural people are confused with regard to which structure of leadership to pay allegiance to: traditional leaders or elected state officials (interview with Mr Mdletshe, 10 October 2018). In some villages of the former Transkei, traditional leaders have withdrawn from all community administrative issues, including management of natural resources, and have left these matters to ward councillors and civic organisations (Bennett, 2013).

Furthermore, the space of customary law in democratic South Africa is not clear. While the national constitution recognises customary law and provides that traditional leaders can apply it in rural communities, section 211(2) of the constitution gives the legislature powers to repeal any customary law and replace it by civil law if that law is found not to be in line with principles of liberal democracy (Kapfudzaruwa & Sowman, 2009; RSA, 1996).

As forces of social change such as formal education, Christianity, monetization of livelihoods and material accumulation gravitate to the countryside, rural communities of the former Transkei are caught up in intra-household and intra-community contestations around identity formation. The contestations are fought between two cultural formations; the *qaba* (those resisting modernisation) and the *gqoboka* (those modernised, including Christians and formally educated) (Bank, 2002). While the former emphasise the original traditional amaXhosa cultural practices, including propitiating ancestors, conducting traditional ceremonies and use of traditional knowledge system, the latter have adopted western culture. They have embraced Christianity and worship the Holy Spirit, they emphasise formal education as the sole source of wisdom. These are the political and social contexts within which the application of TEK in managing ecosystem services is being interpreted and perceived in contemporary rural communities of the Eastern Cape in South Africa.

5.4. Methods and approach

The study used a qualitative case study approach to explore the challenges that efforts to practice TEK face. The study focused on the three case villages of Colana, Gogela and Nozitshena. The chosen method gave respondents space to narrate their knowledge, experiences and perceptions about the study theme without the restriction of having to choose from a pre-determined set of answers, as is the case in quantitative surveys. This argument is very relevant to this study because it situates our understanding of how TEK fares at the local communities through the perceptions of the actors on the ground. The qualitative approach makes for a good complement of the hermeneutic dimension I use as the theoretical lens because both hold that knowledge can only be understood and not measured (Bhaskar, 2016; Merriam & Tisdell, 2016; Mantzavinos, 2020). Using the open-ended interview technique, the study elicited data on how local people perceive some practices of TEK, especially when they are applied in resource management.

I have discussed, in detail, the definitions and relevance of a case study approach to this study in Chapter 4 (Methods section), so will not repeat the discussion here. There is a total of 350 households at Colana, 250 at Gogela and 75 at Nozitshena. A snowball sampling technique was used to recruit respondents (extensively discussed in Chapter 4, Methods section) and recruited a total of 83 respondents: 35 from Colana, 33 from Gogela and 17 from Nozitshena villages. I achieved a census sample in that I recruited all the local people that I was referred to by my respondents. I was interested in recruiting the elderly women and men of 60 years and older. In addition to the advanced age, these elderly community members needed to belong to families who had a long history of living in these case villages. Such history should stretch for at least two generations. These criteria were important in that they enabled me to pick respondents who had lived through many decades of the histories of their villages. Such respondents were deemed to be better positioned than the young ones to compare how TEK used to be applied in the past with the present situation.

Working with two local field assistants at each study community, I administered open-ended interview sessions in the local isiXhosa language. The interview sessions were between 50 minutes and 1.5 hours in length. I digitally recorded the interviews using a cell phone and a tape recorder.

Although my questions were open-ended, I concentrated on getting information on the following issues: first, inquired about the traditional practices of tradition that are actually used to manage ecosystem services at the local communities. Specifically, questions on this issue sought to find out if traditional practices such as taboos, sacredness and social conventions are used. This question was asked because traditions may vary from community to community. In fact, different belief systems may lead to different versions of TEK. Second, I investigated the perceived challenges and contestations that confront efforts to implement traditional management practices in the three communities. Questions on this issue were particularly directed at eliciting respondents' testimonies of perceptions of their fellow community members, and even government officials towards use of TEK as a source of resource management wisdom.

5.4.1. Data Analysis

The process of data analysis was guided by a critical realist inferential technique called abduction. In critical realism, the concept of inference is not used to denote the conventional notion of logical derivations (induction and deduction), but rather, it refers to organised ways of reasoning, thinking and arguing in a wider sense (Danermark et al., 2002). Unlike its scientific counterparts, such as positivism, which are interested in empirical generalisations through induction and deduction, critical realism is interested in reaching transfactual or theoretical generalisations through applying abductive reasoning (Bhaskar, 2016; Danermark et al., 2002).

Abduction involves studying empirically concrete events and using them to understand underlying, unobservable structures (Danermark et al., 2002). The process of doing this involves re-description or re-contextualisation of events, mostly in terms of a causal mechanism or process that serves to explain the state, condition or happening in a causal manner. The abductive analytical technique provides a good fit to the hermeneutic and dynamism realist dimensions I use in this chapter as theoretical lenses in that the re-description of phenomena involve processes of interpretation and communicating meaning.

While deduction proves that something must be in a certain way, abduction shows how something might be. Abductive reasoning achieves this by proceeding from conceiving a concrete event to a deeper conception of it. This means to "observe, describe, interpret and explain something within the frame of a new context" (Danermark et al., 2002: 91). When

analysing data on challenges that traditional practices of resource management confronts in local communities, I related the individual testimonies to wider and structural phenomena such as political, social or economic change.

After transcribing the data, I used hand-coding for analysis. Because I wanted to move from observable events to transfactual meanings, the process of data analysis involved four iterative stages. In the first stage I analysed three transcripts, one from each village case. I wrote down all narratives that made reference to challenges of using TEK in managing ecosystem services. These challenges became my first codes. After that I analysed all the transcripts, grouping all challenge-related narratives under these codes. I created new codes in cases in which I found text passages that talked of different (additional) challenges to those I had already found in the first three transcripts. The second stage involved re-reading the codes in order to identify similarities and differences between them. In this process I grouped together all codes that were similar and separate all those that were different. For example, codes such as 'children do not respect traditional beliefs any more' and 'children do not understand our culture' would be grouped together as one code.

Stage three involved the search for transfactual meanings. In this process, I looked for the deeper structural factors that could underlie each code. Transfactual coding was guided by a typical abductive question: what is it that is general in these individual narratives of empirical phenomena? For instance, in the codes that say 'the educated disregard use of taboos as mere fable' and the one that says 'people regard ancestors as demons', I found that worldview was the underlying general issue here because it is a challenge that emanates from the reality that certain people see the world differently from the way holders of TEK do. I got three main transfactual codes at this stage of analysis: worldview, institutional, and lifestyle. These codes enabled me to see the challenges as general and structural rather than individual, isolated events or realities. The fourth and last stage involved splitting the transfactual codes into more specific sectors. For example, the concept of worldview is wide, hence leaving analysis at that level may not be very helpful. I then looked for more specific issues or aspects of these transfactual challenges. As a result, I found three sub-codes under world view, two under institutional, and one under lifestyle.

The core analytical property of abduction is its ability to describe individual concrete events as both individual phenomena and as manifestation of, or part of general structures (Danermark

et al., 2002). It was helpful in this study because I wanted to find meanings about the contestations and resistances that confront TEK in contemporary South Africa. Although they are easily observable, such contestations do not often betray their linkages with structural issues such as changes in governance, belief and educational systems. Studies that ignore these underlying linkages may not be able to streamline the challenges in ways that facilitate sector-specific intervention. In a way, such studies may not be able to show the sectors (whether national governance policy, relationship between religions, or the relationship between traditional knowledge system and western education system) that need intervention in order to solve these challenges.

5.5. Findings and discussions

This section presents the findings of the study by discussing a practice reported by respondents and the challenges that efforts to implement it face. The style of presentation involves describing how a particular practice is implemented and the resources it is meant to manage. Although describing management practices in this chapter may look like repeating the issues I discuss in chapter 4, I argue that doing so is necessary in that it gives context to the challenges which are the main focus of this present chapter. Moreover, I mitigated the risk of repetition by using many practices that I do not talk about in chapter 4. The study found that efforts to use traditional practices such as taboos as techniques of resource management face many challenges. These challenges are presented as typologies according to the structural categories they fit into; worldview, institutional and lifestyle.

5.5.1. Worldview challenges confronting traditional management practices

A worldview is a cognitive orientation that provides a framework within which individuals or communities see the world; that is how they understand and perceive reality (Collins English Dictionary, 2005; Oxford Advanced Learner's Dictionary, 2015). This cognitive orientation exerts an influence on what individuals or communities believe to be true knowledge, take as real or myth, and consider as important or useless in varied domains of life, including management of ecosystem services. The worldview challenges found at the three communities are subdivided into a diminishing sense of nation, and disrespect for taboos and social conventions.

5.5.1.1. Diminishing sense of nation

All respondents said the most important condition that enabled previous generations in the past to manage resources using traditional practices was a principle of respect for the nation. Traditional people's concept of the nation is different from that of the modern state system which denotes a collection of all the people and their lands which live under the same government (Oxford Advanced Learner's Dictionary, 2015). The respondents spoke of the nation (*isizwe*) as their space of territorial jurisdiction, its resources, and the dead and living people. The sense of nationhood emanates from a feeling that they belong to, and enjoy jurisdictional power over the land of the community and its resources. It is the symbiotic interaction and interdependence between the living, the dead, and the ecosystem services that make up the concept of *isizwe* (nation).

The majority of respondents (70%) said this complex circle of interaction between people, natural resources and the dead has been significantly broken by the emergence of the state in the space of resources management at local community level. The state has imposed its jurisdiction over local resources in both ownership and management through the Department of Environmental Affairs which owns and manages natural resources including forests, the Department of Water and Sanitation which owns and manages unallocated water resources in these communal villages, and the Department of Agriculture and Land Reform which is the nominal owner of all communal land resources.

Consequently, the interrelationships between local people and their environments is no longer as robust as it was in the past. Some of the resources management rules that the state has imposed, such as disallowing local communities from cutting thatch grass on roadsides, force local people to cut the grass at night. This practice of 'harvesting by the night' is in a way a form of resistance to state intervention. The sense of environmental morality that connected local people and nature in the past has been blocked by the imposing image of the state. Although local people continue to see the same image of forests, grasslands and species of wild animals they saw in the past, the sense of moral attachment and ethical responsibility to care for nature has been replaced by fear and hate of the punitive, impersonal state environmental laws. One of the state environmental laws that have displaced traditional management practices, pertains to burning of veld fires for management of pasture resources. In the past, local communities set fire on grazing lands at set times of the local ecological calendar to both induce renewal of grass and control ticks. However, the state has taken over the role of setting

veld fires, in the process making it a criminal offence for local people to use fire as a traditional resource management tool.

The loss of the concept of *isizwe* among local people can be understood by appreciating the effects that context can have in shaping social phenomena. The arrival of the state in the local social-ecological space provided a different context which re-configured the relations between people and nature. The state-dominated context causally changed the roles and responsibilities of local people towards nature from being owners with a morally imposed duty of care to poachers who have to be policed lest their actions destroy nature. This context-induced shift of roles bears a hermeneutic implication which further constrain use of traditional practices at the three communities. Because the state has rendered them poachers to be policed, the local people's interpretation of what nature is has shifted from being a communal asset that needs their care, to be a state resource that can be accessed through use of clandestine methods such as 'harvesting by night.'

The significance of the concept of *isizwe* in sustaining and practising traditional management techniques may not be appreciated by officials who lack experiential knowledge of the relationship between traditional communities and their local environments. As demonstrated above, local people understand nature not as the elements of resources that exist, but as the interactions and interrelationships between these elements. In this regard, state officials have broken the interrelationship between local people and their environments. Thus, the role of state officials in management of local resources needs to be renegotiated in order to take account of traditional ecological worldviews and knowledge systems.

5.5.1.2. Disrespect for taboos and social conventions

Traditional ecological knowledge is informed and heavily influenced by a cognitive orientation that sees supernatural forces as part of the ecological world, ones who possess powers to generate events that can lead to negative or positive effects (Berkes, 2008). Respondents reported that this was the worldview of past generations in their communities. In the past, the communities of Colana, Gogela and Nozitshena used taboos to protect useful and high-demand ecosystem services from degradation and over-exploitation.

The ecosystem services that were assigned taboo values were mainly those that were very important to community life and could easily become scarce. Such ecosystem services included spring water on

which they depended for drinking, brewing beer, and cooking food. Spring water was protected through a belief system in which creatures, including *Potamonautes sidneyi (unonkala), Xenopus laevis (noplata)* and *Gyrinidae (inkwili*), were known to be responsible for protecting springs from drying up. The creatures were accorded a special status in the communities, making it taboo to kill them, in the belief that killing them or chasing them from the springs would cause the springs to dry up and lead to a shortage of a critical ecosystem service; drinking water.

Respondents reported that, in the past, their forebears strongly respected the relationship between nature and people. Some natural resources, such as snakes and chameleons were given totemic status, and by so doing, were protected from being killed by fellow village members. Examples include *Pseudaspis cana (majola* snake*)* and *Chamaeleonidae (sigcilikishi)* which are totemic animals to some clans. These natural resources were believed (and still are, but to a lesser extent) to provide cultural ecosystem services which included media of communication between the living and ancestors, bringing luck and health to the living and general protection of families and clans against their enemies. Consequently, these totemic resources were protected from wanton killing. When people of these clans, for instance, kill *Pseudaspis cana* by accident, they apologise to the snake and dig a hole in which to bury it properly.

Pseudaspis cana are locally known for using pools (in rivers) as their habitats. The services that *Pseudaspis cana* provide are to protect the river from drying up and prevent waterborne accidents, such as drowning and washing away of people by floods. As a result, the snake was highly respected among the local people. By way of demonstrating respect, all women of the Majola clan will not pull up their dresses when crossing at or near a point where the snake lives. They would rather wet the edges of their dresses because *Pseudaspis cana* was in that water. Pulling up their dresses would traditionally be seen as a sign of disrespect for the snake and was believed to invite dire consequences, such as drowning and destructive floods. All respondents reported that, currently, some of the local people do not respect theses traditions anymore. They wantonly kill the *Pseudaspis cana* snake, and violate the taboos. The perpetrators contest the role of taboos in facilitating and regulating human-nature relations. As a result, said the respondents, many rivers are drying up and drowning accidents abound. There were two cases of drowning at Gogela village in 2018 (when I was collecting data for this study) and respondents interpreted the incidents as results of ancestral anger. Respondents also reported that, in the past 20 years following democracy, many rivers have dried up because some of the local people disrespect tradition. These include three rivers at Colana, two rivers

and a stream at Gogela, and two formerly perennial streams at Nozitshena.

According to the local people's TEK, it is also taboo to kill a *Danaus plexippus* (*iphelandle)*. *Danaus plexippus* provide an important ecosystem service in that they signal the coming of rain. Traditionally, when *Danaus plexippus* were seen flying in a group moving from east to west, local people knew that rain was coming. This helped farmers prepare for tilling the soil and planting. Killing *Danaus plexippus* was made a taboo in the belief that if one is killed, livestock would not multiply, but would start dying, one by one. Nonetheless, respondents reported that now some of the local people disobey this taboo. One major consequence of this is that local farmers have lost an important ecosystem service.

Traditionally, the taboo system was used for forest resources as well, especially trees. Trees that were designated as taboo were prohibited from household use, either as fuel wood or construction timber. Most of these trees provide a range of ecosystem services that include cultural, aesthetic, and provisioning. The cultural service included use in traditional rituals. Aesthetic services included making the landscape beautiful, simply good to look at. Lastly, provisioning services included goods such as wild fruits and medicinal plants.

Some of the taboo trees and the negative consequences that were believed to befall people who violated the taboos include:

(i) *Phytolacca dioica*. This is an aggressive alien invasive species and is locally known as *Sdungamzi* (causer of family trouble). It originated in South America and arrived in South Africa in the 20th century. This tree may not be harvested or used for any purpose within the homestead. It is believed that families that violate the taboo will suffer from incessant intra-family conflicts.

(ii) *Rapanea melanophloeos.* This tree is locally called *Sqoni*. It is taboo to use *Rapanea melanophloeos* as fuel wood or construction timber. It is believed that the fire made from this tree causes men's testicles to swell and heavy menstrual periods for women.

(iii) *Gymnosporia nemorosa*. This tree is locally called *Mbangandlala.* It is taboo to use it as fuel wood or construction timber. The word *Mbangandlala* literally translates as 'one that causes poverty'. It is believed that inhaling smoke or absorbing heat from the tree's fire causes

poverty through a number of misfortunes, including losing one's job or having family members lose their jobs wherever they are employed. Once this happens, hardship befalls the family.

(iv) *Gardenia thunbergia,* locally called *Sendelenja*. The term '*Sendelenja'* literally translates as 'testicles of a dog'. According to local tradition, it is taboo to use the tree as fuel wood because it is believed that the fire from it causes men's testicles to swell and become painful.

All respondents said that all these taboo trees are now being harvested and used for various domestic needs, including fuel wood and construction timber. When asked why they harvest the trees, the perpetrators argue that taboos are simply fable that should not be taken seriously. They argue that cutting a tree cannot cause painful menstruation in women, or a family member to lose a job. They say there is no link between these trees and the biological system of a woman, nor can the trees causally influence the nature of the relationships between working family members and their employers.

The disrespect of tradition, especially taboos can be looked at as a hermeneutical issue that is playing out as liability or constraint to implementation of traditional management practices. The contestation is not about whether or not people agree that taboos exist; whether some people do not understand that taboos are taboos. Instead, it is a hermeneutic question emanating from shared differences in interoperating the role that taboos can play in resource management. This interpretational difference is shaped by, and it manifests fundamental epistemic dissimilarities in IKS and formal education which is largely scientific by way of its methods of enquiry and verification of truth-claims. The interpretations held by holders of TEK in which they ascribe management role to taboos are based on belief, albeit not necessarily a fable. Unless the other social actors on the other side of the epistemic divide can successfully enter a double hermeneutic in which they do not only strive to make sense of the taboo, but also make sense of what is going on in the cognitive processes of the traditionalists, this interpretational problem will never get to be resolved. So, in three communities what is constraining traditional management of resources is not because it uses taboos, but it is because the power of taboos in managing resources is interpreted differently.

Furthermore, the dynamism dimension can help explain why use of taboos in resource management is being contested in the current generation of local community's members but was embraced in the past. Acceptance of the claim that taboos are management tools is based

on a worldview which sees supernatural forces as guardians of both humans and natural resources. This worldview was very strong and prevalent in the past, hence taboos were embraced in resource management practices. However, worldviews, just like their associated social realities including culture, are dynamic; they evolve and adapt due to, and as a means of responding to emerging phenomena that make up the context in which they exist. Analysed in this way, the dynamism dimension can help answer the question about why taboos were embraced as resource management tools in the past but are contested in the present.

5.5.1.3. Disrespect for legends

In addition to taboos, legends were used as part of the traditional practice of managing ecosystem services. There is a well-known legend of a big marshy, perennial wetland locally named Entombini (a woman's place) at Gogela village. Respondents said that, according to a local legend, the wetland was given this name because people used to see a mysterious, beautiful Caucasian woman there. The woman was the owner of the wetland, was responsible for managing it and protecting it from degradation through pollution, and drying up. Community members would occasionally see the woman putting her laundry on trees and tall grass at the wetland. The Entombini wetland was one of the main sources of cold, clean, tasty drinking water for local people. There were certain things that people were not allowed to do at the Entombini wetland. These included bathing in, or urinating and defecating around the wetland. Nor were people allowed to water their livestock at the wetland. It was believed that doing so would upset the woman, and this would bring unspecified consequences to the perpetrators. Respondents said when – from the late 1990s – some of the local people started to disrespect the rules by watering livestock and urinating at the wetland, the woman left the wetland, the wetland started to lose water gradually, and finally dried up around 2002.

All respondents stated that the entire worldview that shaped and gave meaning to all these traditional practices is waning. The current generation of the local communities do not perceive supernatural forces as part of the ecological realm. Respondents blamed the infiltration of western education and Christianity for this shift in worldview. There is a growing general negativism against traditional management practices, including taboos and mythology, among the current generation who regard them as signs of *ubuqaba* (uneducatedness) and backwardness.

As a result, efforts mainly by the elderly, to enforce taboos are resisted and challenged as being

merely old-age beliefs without practical value. Respondents said the *gqoboka* (people with western education and western religion) challenge traditional people to prove that taboos and other facets of tradition can actually affect the functioning of the ecological world. However, holders of TEK find it difficult to prove this because traditional practices and beliefs cannot be subjected to experimental testing. Nor can their ways of working be empirically observed.

Sacred creatures that, in the past, were believed to possess powers to manage water resources including *Potamonautes sidneyi, Xenopus laevis*, *Danaus plexippus* and *Gyrinidae* are now being killed without fear of consequences. Furthermore, taboo trees such as *Gymnosporia nemorosa, Rapanea melanophloeos, Gardenia thunbergia* and *Phytolacca dioica* are harvested for domestic use by several households. All the respondents argued that they are certain that some environmental problems that affect the local communities, such as springs drying up, late rains, storms and heavy snow could have been less acute if people respected traditional management practice.

The shifts that this study found to be playing out in ascribing meaning to traditional practices *vis a vis* management of natural resources can be explained by the realist disagregative analysis of reality as comprising the intransitive and the transitive dimensions. Every era or generation (albeit noting that generations are not homogenous realities) in human history has its own interpretations (transitive dimension) of social phenomena depending on each one's key social properties such as education, worldview, culture and religion. These interpretations change with the changing of the attendant key social properties and the passing of generations, but these changes do not mean that the intransitive dimension (traditional management practices in this study) have changed (Bhaskar, 2016). The reality that taboos species, legends and sacred creatures were known as management tools by past generations, but now dismissed as useless fictions by current generations does not mean they have changed.

Moreover, all knowledge is interpretive and not representational of the things about which it is (Bhaskar, 2016; Sayer, 2000). Whether it is scientific knowledge or TEK, the best it can ever do is to advance a claim that is capable of describing reality better than any other available rival claims at the time. This means all knowledge is fallible. Traditional ecological knowledge is of course, not the silver bullet. However, observations that it fails to do certain things can be taken as opportunities to further develop it, rather than dismiss and reject it. Appreciation of the axiom that all knowledge is limited and hence fallible holds the opportunity to make us

appreciate that even the scientific knowledge system, which uses logical and observable validity tests, has its own limitations in the business of explaining the world, and management of natural resources in particular. Fabricius et al. (2006) point to several weakness of science, including that it struggles to comprehend and explain non-quantifiable phenomena or objects.

5.5.1.4. Adoption of Christianity and western education

Religion and belief play a crucial role in the generation and implementation of traditional management practices. Historically, the communities of Colana, Gogela and Nozitshena believed in ancestors whom they regarded as the link between them and *uThixo* (the creator). Through dreams and visions, ancestors communicate knowledge and warnings to the living about matters of ecosystem service management and utilisation, including impending droughts, rains and knowledge of medicinal plants. All the respondents said it is difficult these days to tell their fellow community members about knowledge from dreams because they are chastised as demonic and superstitious. The version of Christianity preached in some churches at the local communities argues that there is nothing called 'ancestors'; it argues that when a person dies, they are dead. The dead cannot come back and talk to the living. This local version teaches its followers that what they think are ancestors are in actual fact demons, hence they must pray and chase them away every time they come to their dreams. Consequently, adoption of Christianity significantly undermines TEK which takes seriously the role of ancestors in creating and transmitting ecological knowledge necessary for formulation and implementation of traditional resource management practices.

The changes in worldviews have as well led to misinterpretations of some of the traditional management practices by those who do not subscribe to them (non-traditionalists). One key case in which worldview differences lead to the challenge of misinterpretation regard the traditional practice of rainwater management. At the three communities rainwater management involve key players such as *amaxhwele* (traditional healers), community tribal leaders, and *izanuse* (spirit mediums) who communicate with the ancestral world when there is rainwater challenges such as delayed rains, stormy rains which destroy crops and houses and thunderous rains which pose danger to human life (See Chapter 4). These people were consulted by the community to ask ancestors to solve the rain problem at hand. In some cases the consultation would be accompanied by a traditional ceremony at which *umqomboti* (traditional beer) was brewed and livestock were slaughtered. Respondents said in many cases, soon after the consultation, the rain problem would get solved. This practice has been used over a long

historical time at the study sites.

However, from the inception of democratic governance in 1994, local people have progressively abandoned these traditional practices of rainwater management. The practices have been under siege mainly from the *gqoboka* (people with western education and western religion) who reject TEK as superstitious, unscientific, and without rational foundations. All the respondents said the *gqoboka* contest this practice and argue that no one can make rain, an argument that is often made in an effort to broadly discredit the powers of traditional people in respect of rain and water resource management.

The word 'rainmaker' itself is problematic and contributes significantly to this contestation. Dictionary definitions refer to a rainmaker as a person with powers to make rain (The Collins English Dictionary, 2005: Oxford Advanced Learner's Dictionary, 2015). The translated name, 'rainmaker', gives the impression that traditional people claim to have powers to make or create rain. This has earned traditional knowledge a barrage of attack from people of scientific knowledge (Guthiga & Newsham, 2011). But this criticism is misplaced because it emanates from a misinterpretation of the phenomenon of traditional rainwater management. This is because the people responsible for managing rainwater are locally called *izangoma zemvula* (doctors of rain), not *abenzi bemvula* (makers of rain) as the dictionary translation and critiques of traditional rain management argue. The individuals who are well known for managing rainwater are locally given praise names such as *Izanemvula* (he or she who comes with rain). If the translated name 'doctors of rain' is looked at within the English language context, it can be seen that tendencies to call traditional people that deal with rain problems as 'rainmakers' are misplaced. Such tendencies may be result of lack of adequate knowledge of what traditional rainwater management involves.

The respondents said critiques of traditional knowledge have capitalised on this translation mistake and charge that if holders of TEK have power to make rain, why did the villages suffer the same way other places did in 1973/74, 1983/84 and 1991/1992 drought spells? However, the truth is that the rituals were never used to create or make rain. This criticism is reminiscent of the proverbial giant who created his straw man, put him in the boxing ring in order to crush him down. The actual role of *izangoma zemvula*, and the one that is recognised by respondents, was to control and manipulate how and when rain comes so that communities could maximise their chances of benefiting from it.

One respondent at Colana and another at Gogela clarified this confusion: if there was no rain in the sky in that year, no rain would come. However, if it was a rain year, the rain would come at the time that would enable people to start ploughing. This mistranslation has endured among scholars to this day (e.g. & Newsham, 2011; Jackson et al., 2005; Guthiga). Holders of TEK who deal with rainwater issues are not rainmakers, but they are traditional rain-managers, whose role is rainwater management.

Local communities have always emphasised the role of spirits, including the creator (locally known as *uThixo*) and ancestors, in the creation and management of water together with its sources such as pools, fountains and rivers. The fact that traditional communities defer the powers of rainmaking to supernatural powers, such as the creator and ancestors, has been found in many studies conducted elsewhere (Barber & Rumley, 2003; Langton, 2002; Moult, 2011; Turner & Berkes, 2006).

The problem of misinterpreting TEK generally, and its related management practices in particular constrains effective communication between holders of TEK and non-traditionalists, especially the young generation. All the respondents stated that when the educated are told not to do certain things because they are taboo, such as making love in sacred forests or bushes, they do not take this seriously. In line with their training in scientific empiricism, the educated challenge holders of TEK by asking what will happen if they break the taboos. The elderly people have nicknamed the educated young generation as *bonokontoni* (those who always ask, what will happen if I do it?). The practice of questioning instructions or wisdom is not encouraged in TEK; holders of TEK regard questioning as disrespectful. This point is supported by Berkes (2008) who characterises TEK as a belief-knowledge-practice complex. According to this characterisation, TEK is [true] knowledge by virtue of the fact that it is believed to be so. And by believing it to be [true] knowledge, people put TEK into practice in circumstances such as traditional management of ecosystem services. Contestations between scientific knowledge and other knowledge systems that belong in the umbrella group of indigenous knowledge systems has been noted in other bodies of work (Brosius, 2006; Chalmers, 1999; Dei et al., 2000).

The arrival of western education and Christianity at the three local communities induced a contextual change, which impacts on how people look at traditional knowledge. The two ways

of understanding the ecological realm that are different from what was previously known. Christianity brought a belief system that countered the local region's respect for and belief in ancestors. The impact of Christianity's counter belief system to local people's perception of traditional management practices cannot be overemphasised. Traditional management techniques such as legends, sacredness and taboos base their legitimacy on the belief held in traditional religion that ancestral spirits can dwell on ecological species and use these as vehicles to reach out to the wider social and ecological realms either to provide protection or to administer punishment. By countering this belief, Christianity has basically gone a long way to removing the launching pad of traditional management practices.

The situation has been exacerbated by acquisition of formal education, which unlike TEK which uses a combination of belief system, gerontocracy and consulting *amaxhwele (*traditional healers) and *izanuse* (spirit mediums) in order to prove truth-claims, the western education system emphasises empirical observation and experiments. The cause-effect relationship between the presence of a mystic woman in a wetland and protection of its water from degradation and eventually drying up cannot be empirically observed, nor can it be subjected to an experimental test. In the final analysis, the contextual changes introduced by western education and Christianity to the local communities have a hermeneutic implication. The reality that the role that taboos play in resource management cannot be empirically proven tends to shift local interpretations from regarding TEK as a legitimate source of ecological facts and wisdom to a compendium of fables and fiction that should never be taken seriously.

5.5.2. Institutional challenges confronting traditional management practices

Institutional challenges pertain to constraints that efforts to implement traditional management practices suffer because of the influence of constitutional provisions and state policies. These provisions and policies have put in place new rules of the game (North, 1990) that constrain transmission and practice of traditional strategies for managing ecosystem services, as well as enforcement of traditional beliefs and customary law. In short, institutional challenges revolve around instances of disharmony between state laws and policies on the one hand, and traditional practices and customary law, on the other. Such challenges include the existence of legal pluralism and disempowerment of traditional leaders and parents.

5.5.2.1. Legal pluralism and disempowerment of the institution of traditional leadership

All the respondents cited the introduction of legal pluralism as a major challenge confronting

effort to implement traditional management practices in democratic South Africa. Legal pluralism refers to the existence and interplay of multiple orders of legal administration that, in some instances, operate side by side, or in others overlap and exert competing influence over processes (Murata, Ndlovu $ Ganyani. in press; Von Benda-Beckman, 2002). Respondents reported that, whereas in their rural communities they have historically used customary law administered by institutions of traditional leadership as the legal framework which set standards for wrong and right actions when interacting with the environment, the state has added civil environmental law. Civil law is administered by institutions of the state, including the local municipality and government departments. These two legal orders apply in all facets of community life, including management of ecosystem services.

Several respondents (73%) reported that officials from the Umzimvubu Local Municipality, the Department of Agriculture and Land Reform, and the Department of Environmental Affairs have introduced resource management rules that are different from their traditional ones. Historically, the communities used customary law to empower traditional leaders to enforce resource management practices. Such practices included decisions about when and how to burn rangelands, and how to manage harvesting of rare and important tree species such as *Ptaeroxylon obliquum (mthathi)* and *Salix mucronata (mngcunube)*. Government officials are now the absolute authority who hold power to decide on matters of resource management, including when and how resources are harvested and accessed. By doing this, the institutions of government are displacing traditional management practices and virtually making them irrelevant in the domain of ecosystem service management.

Traditional ecological knowledge uses customary law to organise and regulate communities' interaction with ecological resources. Customary law provides the legal framework for resource use and management through pronouncement and enforcement of social conventions that prohibit people from doing certain things. For instance, respondents reported that according to TEK, the land and related natural resources in the local communities are owned by the local communities who govern them through their leaders. Accordingly, the traditional leaders, in consultation with their people, must be the ones responsible for managing local resources, and possess institutional power to enforce management rules. Fines for contravening rules and practices of managing ecosystem services should be paid at the local traditional courts, not at magisterial courts.

However, civil law provides that the state is the owner of all communal lands and their resources (Cousins, 2008). The law has vested responsibilities and powers of natural resources management in communal areas, including Colana, Gogela and Nozitshena, in various departments of the state such as the Department of Agriculture, Department of Environmental Affairs, and Department of Rural Development and Land Reform (Kapfudzaruwa & Sowman, 2009). Cases of contravention of resources management laws are adjudicated at magisterial courts using civil law.

At Colana and Gogela respondents reported that there had been several cases of local community members hauled into local magisterial courts for harvesting *Ptaeroxylon obliquum (mthathi).* According to the respondents, local people feel that customary law, a key legal institution in practising and teaching traditional management practices, has been displaced by civil law and its related institutions of governance. A situation of legal pluralism, in which several legal orders are used simultaneously to govern society, if not well handled, can breed confusion and multiple problems (Bennet, 2008; Tamannaha, 1993; Von Bend-Beckman, 2002).

It was also reported that, prior to democratic rule, traditional leaders enjoyed more power over village life, including use and management of natural resources such as pasture, arable land, forests and water resources. Although the national constitution of the democratic government recognises traditional leaders, there are no policies that oblige organs of state to seek their (traditional leaders) permission before implementing programmes. The Traditional Leadership and Governance Framework Act of 2003, one of the most pro-traditional leadership policy documents, only encourages officials of the state to create partnerships with traditional leaders when implementing projects in rural communities (Republic of South Africa (RSA), 2003).

Respondents reported that government officials take advantage of this policy gap to side-line local traditional leaders in implementing resource management programmes. A case in point is the Working fir Water (WfW) programme. This programme is a government-sponsored ecosystem service management programme involved in clearing alien invasive plants, especially *Acacia mearnsii (Ublekwati wemnyama)* and *Acacia dealbata (Ublekwati webomvu)* in order to restore water flow in riparian zones (Blignaut et al., 2010; Büscher, 2012). Respondents argued that, although this programme is implemented in their communities, their traditional knowledge system and local traditional leadership are not integrated ito the

programme. Several respondents (88%) reported that traditional leaders were more powerful during colonialism and apartheid administrations than they are under the democratic government, a claim that is supported by literature which argues that, under colonialism and apartheid, traditional leadership was left to run the day-to-day village life albeit, in a semi-autonomous status (Mamdani, 2018; Ntsebeza, 2008).

In addition, municipalisation[10] of rural South Africa, which started in 1995 and was consolidated in the 2000 municipal demarcation exercise in which rural villages were co-opted into wards under the leadership of elected ward councillors, made traditional leaders lose territorial control over the landscapes on which the ecosystem services are generated. Matters of jurisdiction over landed resources and village life broadly at the study sites and many other villages remain a serious source of conflict and contestation between traditional leadership and municipal officials. While traditional leaders claim rightful jurisdiction on the basis of heredity and customary law, the democratic constitution and a plethora of legislative instruments have entrusted municipal officials with all responsibilities and power to drive village development, including management and rehabilitation of ecological resources. Ntsebeza (2008) argues that it is difficult to make traditional leaders part of a liberal democratic system because they are not elected. He argues that traditional leaders' practice of claiming legitimacy on heredity is despotic, hence it flies in the face of a democratic administrative system.

The role of civil law and the state in how some local people perceive traditional management practices demonstrates that in order for traditional management practices to be implementable, certain institutional conditions need to exist. Although the study did not find sufficient evidence to prove that the institution of the state and its associated instruments of governance such as civil law are inimical to TEK, its findings hint at the need to re-negotiate the relations of power between the state and traditional institutions. The aim of this re-negotiation should be to come up with an administrative framework that make state policies and laws sensitive to the character of TEK.

5.5.2.2. Disempowerment of parents and state takeover of household governance

At the study sites, all respondents reported that they found it difficult to teach their children

[10] For details on the legislative position on municipalisation of rural South Africa and its distribution of power between municipal officials and traditional leaders refer to the White Paper on Local Government (RSA, 1998).

traditional management practices anymore because the democratic government overly interferes in matters of household administration, especially in relations between parents and their children. Generally, traditional management practices such as the one that makes it taboo to use certain trees (e.g. *Rapanea melanophloeos*) for domestic purposes require strict obedience. All the respondents said because they are still young and don't possess a full understanding of TEK, children are generally likely to get tempted to disobey such a taboo because need easy means to collect fuelwood. When children violate the management taboo, parents as the primary transmitters of TEK, may need to use punitive measures a means of enforcing obedience. However, the policies of the democratic government criminalise corporal punishment even when it is exercised by parents to their children within the domestic space. One elderly man at Gogela village said:

> "Today's youth do not listen to us. When we discipline our children, government calls it abuse. We are living in democracy. You are even afraid of government, because you do not know what the government will say if you discipline your child. As parents start to lose control over their homes, things fall apart. There is a lot of damage happening at household level because we no longer practise our customary laws. Instead, we are using the law of government. If I discipline my children today, social workers and police vans will be up and down these mountains now. So how do I teach them? When they said children must not be disciplined, it is the day things began to be ruined. We [parents] lost control over our families."

Unlike the facts and rules of scientific management methods whose cause-and-effect explanations are capable of providing clearly discernible links between ecological issues and resultant problems (e.g. that growth of *Acacia mearnsii* on riparian zones causes depletion of water resources due to excessive water loss through transpiration), how exactly burning of *Rapanea melanophloeos* can cause excessive mensuration of women cannot be easily expend to children. Children in particular and all other community members generally, do not need to understand the facts about some of the traditional management practices in order to implement or respect them. Instead they simply need to respect the truth-claims made in respect of these practices and obey the rules. This makes the power of parents to instil discipline very critical in the transmission of traditional management knowledge.

The role of parents and community elders in transmitting TEK to and enforcing taboos among children cannot be overemphasised (Berkes, 2008; Cicin-Sain & Knecht, 1995; Ohmagari & Berkes, 1997). In a study of transmission of TEK among the Cree societies of Canada, Ohmagari and Berkes (1997) found that children are taught TEK by their parents through apprenticeship from a young age. The homestead is the central space of learning, and parents and other family elders are the teachers whose duties are to impart TEK to their children through various strategies, including practical demonstration, storytelling and enforcing rules. The implication of this is that parents and their role of presiding over matters of household administration, as well as formulating rules and enforcing them, needs to be respected. This empowers parents to teach their children how to apply TEK in managing ecosystem services.

The twin realities of the disempowerment of parents and state takeover of the domestic space can be analysed using the realist dimensions of context and dynamism. The democratic state's policy of intervening in the domestic space and reconfigure parents-children relations provides a contextual factor that bears significant implications to the processes of teaching traditional management practices. All of the respondents reported that without the power to enforce discipline, it was difficult to play their role of teachers of TEK. They argued that some key aspects of TEK such as tabooism, sacredness and belief in ancestors, can only work when people are disciplined and obedient. Owing to the fact that these are matters of faith, traditional practices do not leave much room for questioning and therefore some strict regimes of obedient behaviour must be enforced. The changes in context in which parents have been forced to move from being the principal administrators of the household with powers to enforce rules, to powerless co-participants is gradually removing them from the TEK-transmission equation. Inevitably, this is creating a gap that unless some mechanisms are found to fill it or mitigate its effects, the interest in and enthusiasm around the re-strengthening TEK in the contemporary democratic South Africa may be frustrated.

The state and the configuration of its relations with local communities and citizens are not static; but dynamic. Although traditional management practices have been implemented within the framework of state power since around the 1700 (Beinart, 2003), the state has over the years evolved from being colonial, apartheid and democratic. At every stage of the evolution, the state provides different opportunities and challenges to the role of parents as transmitters of TEK. For instance, the apartheid government was not concerned about civil rights of black people, and hence it did not interfere much in the local administrative arenas, especially the

household space, of traditional communities. In contrast, in its pursuit to enforce the constitutional provisions of equality between persons, the democratic government actively intervene in matters of household administration. This dimension of dynamism can help explain why in the past, even when the state was already there, traditional management practices fared better than they do in the present.

5.5.3. Lifestyle challenges confronting traditional management practices

Lifestyle challenges to TEK concern attitudes, tastes, values, preferences and outlooks that constitute the character of an individual or community's mode of life (Collins English Dictionary, 2005; Oxford Advanced Learner's Dictionary, 2015). Lifestyle is a key enabler or constraint to implementation of traditional management practices because, as scholars have noted, TEK is not just a way of knowing; it is practical in the sense that it is a way of doing things that individuals or communities need in order to support aspects of their wellbeing, including health, diet, spirituality and shelter (Berkes, 2008; LaDuke, 1994). The nature of support that traditional management practices may have on people's wellbeing at a particular point in time may exert significant influence on how the people perceive the relevance of these practices. The major lifestyle challenge that traditional management practices confront at the three communities is integration of village life into the market economy.

5.5.3.1. Integration of village life into the market economy

The key lifestyle challenge facing TEK is that local communities have significantly shifted from a lifestyle which used to draw heavily from ecosystem services, to a market-based mode of living characterised by commodity accumulation. A substantial proportion of respondents (88%) reported that, because of improved market linkages between the countryside and centres of industrial production, their fellow community members are now able to carry on life with less direct dependence on nature's services. For instance, it is now possible for local people to build nice houses out of zinc and brick without going into the forest to cut timber and grass. Because of the availability of bricks and zinc, which look smarter than poles and grass, local people's housing tastes have changed significantly. When planning to construct houses, local people now consider industrial products as their first preference and tend to use poles and grass as last resort, when they cannot afford to buy zinc and bricks.

Traditional practices of building houses with poles and grass are increasingly denigrated as signs of poverty and backwardness. This negative attitude towards traditional building material

is also reinforced by the government's Reconstruction and Development Programme (RDP) which builds brick and zinc houses for the indigent citizens. The RDP stipulates that houses built for the indigents must be decent in these communities. The RDP's concept of a decent house is a shelter with brick walls, glass windows, zinc roof and ceilings (Republic of South Africa (RSA), 2004). Nearly three-quarters of the respondents (74%) said these developments have rendered traditional management practices such as designating some forests resource as sacred in order to regulate harvesting of their timber products unnecessary because the timber is no longer as important as it was in the past. Of course, there are still some instances in which local people use traditional building material, especially when building cultural shelter such as rondavels and *amaboma* (temporary huts built in the forest for initiation of boys) as discussed in Chapters 2 and 3. However, this is now a forced choice, and constitutes a very small proportion of the local construction practice.

Changes in lifestyle have also adversely affect application of TEK in the management of provisional ecosystem services that support subsistence. Historically, subsistence agriculture in the form of dryland crop cultivation and animal husbandry were the mainstays of livelihoods for these communities. All the respondents spoke fondly of a past in which they used to live on the land. The main crops were maize, pumpkins and beans, which collectively, formed the local staple diet. Detailed history of the rise and fall of subsistence farming in the former Transkei region has been documented by Bundy (1988). The respondents said success in farming depended mainly on the practice of appropriate traditional management techniques which included maintaining soil fertility, preventing erosion, planting at appropriate times of the agricultural calendar, and managing soil water (See Chapter 4). The impetus to manage these ecosystem services is now being undermined by widespread accumulation of money through increased job opportunities found in major urban and mining centres, as well as the social grant system. The respondents said accumulation of money enables households to eat 'quality' fresh meat, vegetables and legumes without farming. The effects of the rural communities' integration into the market economy in the Eastern Cape were also observed by Du Toit, Skuse and Cousins (2007).

In the past, when local communities obtained most of their food from farming, TEK was embraced because it provided the wisdom that they needed to support productive farming. Such wisdom taught farmers how to implement management strategies, including *gelesha* (a practice of turning the soil before planting) to manage soil water, stone terracing to manage erosion,

filling up dongas using small stones to reclaim eroded land parcels (See Chapter 4), and a taboo system for rainwater management. Previous studies at Gogela village, traced the history of stone terracing from the beginning of crop cultivation in the late 1800s to de-agrarianisation in the late 1990s (Denison & Wotshela, 2009; Murata, 2010).

However, all these traditional practices are not taken seriously anymore because the local communities' livelihoods are no longer directly tied to the functioning of the natural environment. For instance, local communities get most of their food supplies from trading stores, and not from farming, which has led to fallowing arable fields indefinitely. Fallowing has come with abandoning erosion management practices. Consequently, donga erosion, the major type of erosion at the sites, is worse in fallowed arable plots than it is in undisturbed land parcels. Many respondents (90%) stated that fallowing arable lands was the major cause of donga erosion because no one feels incentivised to spend their energy rehabilitating fields that they do not intent to cultivate. The respondents reported that donga erosion started to be serious in the late 1980s and continues to grow with increased fallowing.

Local communities previously depended heavily on medicinal plants for the health of their livestock and had to develop some management practices such as use of taboos to protect the plants from overharvesting. The taboos prohibited resource users from using some of the medicinal trees and shrubs for domestic purposes, especially fuelwood and construction. However, in the present management of medicinal plants is not taken seriously anymore largely because livestock farmers now depend on scientific methods such as dipping and immunisation for livestock health. The state made dipping compulsory in the early decades of the 1900s and established trading shops to supply livestock medication in the local towns of Mt Frere, Mt Ayliff and Kokstad. This marked the beginning of the abandonment of traditional livestock health knowledge among the communities. In their study of ethno-veterinary practices in the provinces of South African including the Eastern Cape, Beinart and Brown (2013) found that frequency of use of traditional medicine declined with the rise of state intervention which promoted scientific medicine and dipping practices.

Before the scientific health care system was made easily accessible in local communities by establishing local clinics and district hospitals, TEK was the key source of human health knowledge. Traditional healers and some herb specialists were the main providers of health services, using traditional methods. Knowledge of medicinal plants, their names, where they

were found, whether in dry areas or wetlands, the time of the year in which they were found, and how to administer them to patients, was highly revered in the past. A sizeable number of respondents (40%) boasted that knowledge of traditional medicine was so strong in the past that they never went to clinics or consulted doctors when they were growing up.

However, this knowledge is vanishing as state officials encourage local people to look for health services in clinics and hospitals. As a result, informants attribute the loss of knowledge of traditional medicine to the state-sponsored immunisation practices and the rise of modern medicine. Some respondents (45%) said they suspect that diseases such as HIV/AIDS, sugar diabetes, cancer and hypertension were brought on by modern medicine, especially immunisation injections that are administered to people during infancy.

Changes in communities' lifestyles have some bearing on the relevance of TEK and its associated management practices in those particular communities. Traditional ecological knowledge is not just a way of knowing, but a way of living because its use supports the systems of production, housing technology, health and culture (LaDuke, 1994; Berkes, 2008). The argument that the use of TEK is closely tied with lifestyles of those who use it, is consistent with previous studies conducted in South Africa (Crichley & Netshikovhela, 1998; Denison & Wotshela, 2009; Murata, 2010; Nompozolo, 2000) which found that traditional strategies of water resources management were used to support local agrarian livelihoods.

The implications of changes in lifestyle to implementation of traditional management practices can be explained by critical realism's dimension of dynamism. Traditional management practices might have worked in the local communities in the past, but this is not a guarantee that they can work in the present, nor in the future. Communities are dynamic; they continuously evolve and adapt to emerging conditions that bear an effect to their existence. The conditions that might have been present in these communities in the past, may no longer be there in the present. Traditional ecological knowledge is closely tied to the welfare needs of people and their communities (Berkes, 2008). These welfare needs make the necessary conditions for whether traditional management practices are embraced as relevant or dismissed archaic. However, no condition is permanent, and hence traditional management practices may receive different treatment in the same community but at different times of that community's history. Appreciation of the reality that communities (including traditional communities) are dynamic, and that the conditions that are found to each one of them at any given time in history

are not permanent, can help researchers and policy makers to resist the temptation to think that because traditional management practices were used in the past, they can be used in the present.

5.6. Conclusions

The central finding of this chapter is that TEK and its associated management practices are being contested at the local communities. The contestations revolve around differences in worldviews between traditionalists and non-traditionalists, misalignment between policies of the state and practices of local traditional institutions, changes in lifestyle and problems in interpreting some concepts of traditional management practices. The worldview challenges pertain to the reality that some ways understanding the world, in terms of what can be taken as real or fictitious, have emerged in the recent past. The worldviews are not compatible with many traditional management practices because they do not recognise some of the key pillars of tradition including ancestors and taboos as bonafide elements of the ecological realm. The presence of the two different worldviews, the recently emerged one and the old one, has laid a ground for formation of epistemic pluralism at the local communities.

The worldview challenges found at local community level are also manifest in published academic works. For instance, Smith and Wishnie (2000) raised concerns about whether or not taboos and notions of sacredness can be accepted as resource management strategies. The major contention is the argument that, in order for any initiative to be recognized as a management practice, it has to show that it was implemented with the intention to be used as a tool for management (Alvard, 1998; Smith & Wishnie, 2000). However, this argument seems to ignore the reality that traditional practices work more through symbolic meanings and less through logical reasoning. In TEK things do not need to be logically clear to make sense.

In fact, attempts to reveal how concepts such as sacredness, taboos and myths operate may serve to undermine their power, which resides in secrecy (Hickey, 2006). When assessing or listening to reports about what people do when they implement traditional management practices, it is important to consider the epistemic context in which the practices manifest. Traditional ecological knowledge is a knowledge-belief-practice complex (Berkes, 2008) in which some things are done in certain ways, not because doing so makes logical sense, but because it is consistent with the dictates of traditional resource management and, only when such things are done exactly in the prescribed ways, can they produce the desired management

results. There is need for worldview-focused intervention programmes that educate local community members about some key facets of TEK, such as belief systems, taboos and legends, and how they fit into the broader ontology of TEK, as well as ecosystem service management.

At the three communities, epistemic pluralism stems from the reality that each of the two worldviews influences its own epistemology; TEK and science. Each one of these knowledge systems uses its own set tools for verifying truth-claims. The scientific knowledge systems contest TEK's use of dreams and visionary knowledge as sources of resource management wisdom because they do not lend themselves amenable to its verification techniques. What makes the challenge to traditional management practices in this case is not the presence of epistemic pluralism *per se'*, but is that the holders of these different knowledge systems (especially those with scientific education) do not recognise that their knowledge system is not the only one with powers to explain the ecological realm. In light of this finding, efforts need to be made to educate local people of the possibility of having more than one knowledge system. Moreover, local people may have to be made aware that, although they are different, TEK and scientific knowledge can be used together to complement each other. Studies conducted elsewhere have demonstrated that science and TEK are not mutually exclusive, but they lead to production of better results if combined (Butler, Tawake, Skewes, Tawake, & McGrath, 2012; Fabricius et al., 2006; Hoagland, 2017).

Another set of challenges is institutional. These challenges result from the dissonance that plays out between the policies and practices of liberal democracy, and traditional leadership and customary law, the critical scaffolding pillars of TEK and primary enforcement agents of rules of traditional management practices. In post-apartheid South Africa whose administrative philosophy is premised on the liberal principles of its founding constitution, traditional practices of leadership and justice are widely criticised and, at best, starved of state support on allegations that they are patriarchal and inimical to the development of a liberal civil democracy (Ntsebeza, 2008). Core areas of contention are the roles of traditional leaders in management of natural resources, and the scope of applicability of customary law. Another source of challenge is the role of parents in teaching and enforcing discipline among their children. Turner et al. (2000) conclude that efforts to integrate TEK in modern conservation practices must recognise and respect the complete set of its properties, including its philosophical assumptions.

The institutional challenges cannot necessarily be alluded to the presence of the state in local communities. In other words, the results do not imply that traditional ecological management practices cannot be embraced in contexts of liberally democratic state systems. Studies conducted elsewhere have demonstrated that TEK can work within democratic state systems (Laforest, Hébert, Obbard, & Thiemann, 2018; Turner et al., 2000). However, the problem at the study sites is that the South African state system, although it recognises traditional leaders in its constitution (RSA, 1996), does not allow space for the traditional institutions to effectively play a role in matters of resource management.

Efforts to respect and resuscitate traditional management practices in contemporary rural South Africa must implement programmes aimed at re-negotiating relationships of complementarity between tradition and liberal democracy, between state officials and traditional leaders, as well as between civil law and customary law. Most importantly, the South African constitution and other related laws should unambiguously recognise and promote the space of customary law as a legitimate judiciary tool in rural communities through passing Acts that provide for the need to incorporate TEK and putting down implementation plans. Enforcement of TEK in management of ecosystem services depends on the *de facto* legitimacy and power of customary law. In the current circumstances, customary law and civil law are being applied in a somewhat confusing state of legal pluralism; it is not clear under what circumstances and how can local people, especially holders of TEK, can apply customary law.

The challenges that result from shifts in local communities' lifestyles seem to be the most difficult to solve because they arise out of progress in development. The developments that have been achieved in the domain of health and medicine are so valuable that any proposition that seems to suggest that people go back to old healthcare systems are likely to be unpopular with the government. Perhaps a useful suggestion would be to implement programmes that educate local people about how TEK can remain relevant in communities which are less directly dependent on the supply of ecosystem services. This approach would involve a discursive lifting from the traditional conception of TEK as a way of living to TEK as a somewhat abstractive knowledge system without direct links with immediate practical welfare needs.

This work makes three major contributions to the development of literature on the use of TEK in the ecosystem service discipline. First, it demonstrates that efforts to apply TEK in

contemporary South Africa are constrained by several challenges. This finding goes a long way to providing insights into the question around why traditional communities are heavily degraded in spite of the wealth of traditional management knowledge they possess. By discovering that TEK suffers multiple challenges that undermine efforts to effectively implement it in resource management, the study shifts focus from looking for problems within traditional management practices themselves to factors outside of these practices. A study by Fabricius et al. (2006) points at the weaknesses of traditional management practices and conclude that this could explain, to an extent, the phenomena of heavy degradation in traditional communities. Although this current study does not reject findings by Fabricius et al (2006), it adds a dimension that has not been sufficiently given attention in South African ecosystem service studies. This dimension demonstrates that conditions in contemporary South Africa do not allow space for full implementation of TEK in resource management. So analysis on degradation of traditional landscapes including the one by Palmer and Bennett (2013) should consider the reality that traditional management practices are not fully implemented. This could as well explain why degradation is widespread in these communities. This analysis shifts attention from thinking that the weaknesses of TEK are causes of degradation in traditional communities.

Second, the use of critical realist theoretical lenses that include the dimensions of dynamism and context has unravelled conditions that are necessary for acceptance of TEK as a bonafide source of ecological wisdom. These conditions include presence of a worldview which recognises that supernatural forces are part of the ecological realm, a state system that allows space for effective participation of traditional leadership institutions in resource management, an epistemological system which appreciates that there are many ways of verifying truth-claims and a life style that significantly and directly depends on ecosystem services. The idea of necessary conditions is a critical realist concept that is concerned with establishing things or factors that if they are not present, certain social phenomena cannot happen or cannot be what they are (See Chapter 3; Danermark et al., 2002).

The third contribution is that the study has streamlined the challenges into structural categories which can go a long way to helping decision makers develop sector-focused, as opposed to generic, intervention programmes to solve these challenges. By using abductive analysis, this study establishes connections between cases of individual people contesting TEK with wider structural issues. It recontextualised local people's perceptions of TEK as institutional,

worldview and lifestyle issues. The major business of abductive reasoning is to establish wider structural connections in individual vents and phenomena (Danermark, et al., 2002).

CHAPTER 6: SYNTHESIS, IMPLICATIONS AND LIMITATIONS OF THE STUDY

6.1. Introduction

The main aim of this study was to find out and document indigenous knowledge of ecosystem services at five rural communities of Mgwalana, Mahlungulu, Colana, Gogela and Nozitshena in the Eastern Cape province of South Africa. The study was motivated by a desire to contribute towards filling a knowledge gap in the South African ecosystem service literature which is a result of the reality that the scientific knowledge system is being used as the dominant source of ecosystem service knowledge, while little attention has been given to indigenous knowledge system (IKS) (See Chapter 1). The study (Chapter 1) argues that although effort has been made in previous studies to investigate and document indigenous knowledge of ecosystem services in South Africa, there might be two fundamental challenges that can potentially constrain the growth of the ecosystem service discipline in the country.

The first one is a theoretical challenge. This emanates from the reality that the existing ecosystem service literature is largely on the scientific knowledge system alone. Although this literature is very useful, it does not do justice to South Africa' plural epistemic landscape that comprises the scientific knowledge system and IKS. Although the two are not mutually exclusive and can be integrated, they still share recognisable differences that can lead to quite different ways of understanding ecosystem services. Unless these differences (how IKS and scientific knowledge understand ecosystem services) are well understood and appreciated, they can frustrate communication between specialists and professionals on the one hand, and traditional communities on the other.

The second one is that the theoretical challenge can adversely impact implementation of locally sensitive intervention programmes. It is mainly rural communities, some of which are traditional and hence possess low or no formal education (Chapter 3), whose welfare directly depends on ecosystem services, and these communities experience high levels of resource degradation (Palmer & Bennett, 2013). This makes it important that the ecosystem service research in South Africa incorporates the IKS, especially its branch in traditional ecological knowledge (TEK). The need to focus the indigenous knowledge of ecosystem services on TEK is that it provides a set of culture-specific tools such as taboos and legends that can significantly shape how different communities relate with nature.

This chapter synthesises the study findings, assesses the extent to which the principal aim of the study was met and looks at the implications that the study has on the growth of the ecosystem service discipline in South Africa. It then proposes a framework through which to analyse how best TEK can be understood in relation to the role it plays in advancing our knowledge of human-nature relations. A new framework is needed because the study found that one of the problems that is constraining our ability to meaningfully engage with, and appreciate the value of local communities' TEK is that we (the non-traditionalist commentators) tend to misinterpret both the ontological and epistemological nature of TEK and its associated resource practices. The meta-theory of critical realism was used in the study to provide theoretical lenses that serve to enhance our interpretation of local communities' knowledge of ecosystem services; how they assign value to the services and how they manage them. Chapter 5 shows that there are challenges of understanding traditional knowledge within the local communities.

6.2. A synthesis of findings

The synthesis section is disaggregated into sub-themes each of which presents findings from the four research questions of the study. The sub-themes are knowledge of ecosystem services, the valuation of ecosystem services, traditional management of ecosystem services, and the challenges of implementing traditional practices in the management of ecosystem services. These themes were addressed separately, each in a stand-alone chapter with its own findings and conclusions.

6.2.1. Research Question 1: Which ecosystem services do local people understand, with special reference to the MEA' (2005) four groups?

Chapter 2 details my investigation (using a mixed methods approach) into how local communities of Mgwalana and Mahlungulu understand nature within the ecosystem services concept. Emerging in the 1980s (Ehrlich & Ehrlich, 1981), the ecosystem service concept presented a new framework of looking at, and understanding the topography of human-nature relations. The defining feature of the concept is that it positions nature as a service provider to human communities and re-organises human-nature relations in terms of how humans depend on services from the four groups of ecosystem services: provisioning, cultural, supporting and regulatory services (MEA, 2005). The reality that humans depend on the benefits they derive

from well-functioning ecosystems does not represent a new way of thinking about nature; one that was not known to local communities. In the study, the local communities identified quite a range of ecosystem services they have been depending on since a time immemorial. These ecosystem services include grazing resources, drinking water and initiation of boys and girls from youth to adulthood through use of the veld and some medicinal and cultural plants. Moreover, the ecosystem service concept's idea of looking at nature as an interconnected, complex whole is not unknown to local people. Respondents provided multiple examples of how different elements of nature interact and combine together to produce effects on both nature itself and the lives of people. One of the most frequently mentioned examples was about the interaction of rain, soil and plants. Respondents said that when rain meets the soil, plants and vegetation grow. Growing plants benefit people directly through increased supply of agricultural foods. Respondents also reported that growing vegetation, especially grass, benefits people indirectly because it makes pasture available to domestic animals, such as cattle, sheep and goats, which in turn, are used as food or for generating income. These explanations show that local people understand ecological complexity, constituted through their day to day livelihood activities, which is an integral part of the ecosystem service concept.

However, what is new to the local people and the IKS widely is the ecosystem service framework's grouping of ecosystem services into the four groups of provisioning, supporting, regulatory and cultural services (MEA, 2005). Although they could recognise and list quite a range of ecosystem services, the respondents demonstrated limited knowledge of breaking nature into discreet components, and fit every aspect of their wellbeing into these components. In light of this finding, this study can conclude that the knowledge of ecosystem services that the local people do not possess is not that their wellbeing depends on nature, but it is that nature can be disaggregated into discreet compartments. The issue of knowledge deficiency here is not that local people do not know that ecosystem services serve different aspects of the wellbeing of humans. They possess this knowledge because they know which services to use for instance when they want to perform initiation of their children; this is a cultural practice for which they specifically choose cultural services. The issue is about the MEA' (2005) terms; provisioning, cultural, supporting and regulatory. These terms were conceptualised within the scientific epistemology and in a language foreign to local communities. Consequently, these terms do not have direct translations into the local isiXhosa language. Of course, translation-explanations were used in the study, but they tended to dislocate the terms from the epistemic and linguistic milieus in which they were originated.

Although the MEA's (2005) grouping of ecosystem service is quite helpful, its relevance is likely to be felt by scientists only who need specific data to inform policy makers. Local communities are largely concerned about their relations with nature; the benefits they derive from it, how to harvest and use natural resources, as well as how to manage them to prevent degradation and over harvesting. This stock of ecosystem service knowledge is sufficient for people who are interested in developing knowledge that can enable them to sustainably live with their local environment, and not policy making.

The other major finding is that respondents found it difficult to recognise regulatory and supporting services. These two groups provide services through invisible and minuscule ecological processes such as carbon sequestration, purification of water by wetlands, and pollination. In contrast to provisioning and cultural services that are more visible and directly experienced, regulatory and supporting services are experienced indirectly. Another important finding is that in their explanations of how they receive ecosystem services, respondents often referred to the role played by supernatural forces, especially ancestors, God, and unobservable species such as mermaids.

In addition to respondents' difficulties in recognising some of the ecosystem services, the study encountered a methodological challenge. Many respondents, especially the non-literate and elderly, found it difficult to follow and understand the logic of the quantitative method's multiple-choice technique. This was especially the case where questions had long ranges of options, say A–E. By the time the interviewer read option E, the respondents had already forgotten what option A was. This finding raises questions about whether or not rigid and strictly structured data collection methods, such as surveys, are appropriate techniques to use in studies that involve less literate communities. This finding is supported by Chee (2004) who, in a study in China, noted that using survey techniques to study ecosystem services in non-scientific communities suffered challenges of guessed responses because respondents struggle to follow the closed options.

In light of this, it would be advisable for ecosystem service research to use qualitative data collection methods in less literate communities. These methods include narrative, open-ended interviews, and oral history. Because these methods do not restrict respondents to particular ways of thinking, they allow local people to organise their narratives into storytelling lines contextualised in both time and space (Butina, 2015; Creswell, 2013; Merriam & Tisdell,

2016). The ability to frame and understand the relations between people and nature within contexts is crucial in that it helps bring the ecosystem service concept closer to varied lived experiences.

6.2.2. Research Question 2: What do local people know of the economic value of the ecosystem services on which they depend, and what makes it difficult for them to assign economic value to these services?

To deepen our understanding of indigenous ecosystem service knowledge, Chapter 3 set out to explore local people's knowledge of the economic value of ecosystem services at the three communities of Colana, Gogela and Nozitshena. The key aim of the work was to capture local people's knowledge of the economic value of ecosystem services, not to quantify the economic worth of these services. The main motivation of this research question was the realisation of the reality that traditional rural communities are the ones who mainly depend directly on ecosystem services for various aspects of their wellbeing, including food, shelter, health and spirituality. This dependence makes it important to know how the communities, within the context of their circumstances and knowledge system, understand and perceive the economic value of these services.

In terms of local communities' knowledge of the economic value of ecosystem services, the study arrived at two major findings that are seldom discussed in conventional economic valuation studies. The first is that local communities struggle to determine the economic value of nature's services. Across all ecosystem services, including medicinal, fuelwood, cultural, construction timber, wild vegetables, most responses were, "I do not know the value". However, the fact that the majority of local people could not assign an economic value to ecosystem services does not mean that they do not perceive them as valuable. Rather, it simply suggests that they do not consider nature as a commodity that possesses a market exchange value.

These findings have at least two important implications for the ecosystem services economic valuation discourse. First, economic figures assigned to ecosystem services may not represent the complete story about the contribution that nature makes to human wellbeing because the act of assigning these economic figures not only depends on how much the ecosystem services in question are worth, but also on a plethora of other factors, including people's ability to perceive nature as a commodity that can be exchanged for money.

Second, but related, monetary valuation can mask important dynamics that shape human-nature relations at local community levels. The picture that economic valuation portrays is of a straight line dynamic; that is, high resource dependence leads to high economic figures. Nonetheless, in other circumstances, high resource dependence may not lead to correspondingly high economic figures. For example, in this study (Chapter 3, section 3.5.3.2.) although all the households depend on cultural services, the majority of the respondents who indicated that they knew the value of cultural ecosystem services valued them at less than ZAR400 per year. This is in sharp contrast to findings of studies conducted elsewhere in which ecosystem services are ascribed high monetary values. For instance Bhandari et al. (2018) value cultural services supplied by the Panchase Protected Forests in Nepal at USD 234 395; about ZAR3 984 715 per year.

In order to explain these findings, the study employed critical realism's retroduction, analysing qualitative responses to arrive at the conditions that, when they exist or are present, users of ecosystem services struggle to perceive the services as economic commodities. The study found that the key conditions include the absence of a clear and well-defined property system, the lack of a quantitative consumer tradition, and the absence of an economic conception of nature; these make it difficult for local people to perceive ecosystem services as commodities.

An economic value is not a permanent condition of any item, nor is it innate to certain items or services. Instead, it is constructed by people in the contexts in which the item or service exists and is used. Although this is not a negation of the objective existence of economic value of items or services, people can only know of the value through their contextually influenced interpretations. The implication of this is that an ecosystem service that could be valued at ZAR1000 in Sydney (of course Australia does not use South African rands, but I have used the currency here in order to maintain consistency), may be valued at far less than that in the rural communities of South Africa. The global valuation studies such as Costanza et al. (1998) risk masking many locally situated valuations complexities such as how certain communities experience ecosystem value within the contexts of their unique settings.

The study contributes to the growth of the economic valuation discourse by introducing two dimensions. The first dimension is local people's knowledge as the primary instrument of valuation. In this, the study marks a departure from conventional valuation studies which tend to give primacy to scientific or expert valuation techniques. The study illustrates the importance

of understanding the economic value of nature from those whose wellbeing depends on it. Secondly, the study demonstrates the importance of considering how conditions in which the ecosystem service use takes place shape local people's perceptions of nature's value. For example Chapter 3 (section 3.6) shows that conditions such as absence of clear rights on resources makes it difficult for the local resource users to place economic values of the resources. Therefore, a monetary metric may not be a sufficient standard of value among traditional rural communities whose day-to-day lives do not revolve around, or even depend on a tradition of commodity transaction. For these communities, ecosystem services, though very important, are not perceived as commodities with monetary exchange value. Rather, they are social goods accessed through social institutions, such as community membership and local tribal rules. Consequently, social valuation methods that align with, and draw from the nature of local institutions of resource access, hold potential to produce more meaningful value scores than monetary metrics.

Precisely because the value of nature can only be accessed and realised through our knowledge of it, we ought to look for the value in the knowledge of the people whose relations with nature we seek to understand, not in grand, socially detached economic theories and methods. Failure to do this raises the risk of producing valuation results that do not speak to the realities of the communities to whose wellbeing the ecosystem services are said to be contributing. By using critical realism's concept of transfactual conditions, the study illuminates the relational being (existence) of economic value; that is, for economic value to be realised, it has to exist in relation with other concepts, such as clear regimes of appropriation and a commodification tradition. Ignoring these conditions, may lead to evaluation studies that do not resonate with local people's understanding of ecosystem services.

6.2.3. Research Question 3: Which traditional practices do local communities use to manage ecosystem services, and how do they implement them?

Chapter 4 presented an exploration of traditional practices of managing ecosystem services that the local communities of Colana, Gogela and Nozitshena have practised in the historical past. The study made several important findings that, if taken seriously, may inform how the ecosystem service management discourse can proceed in the South African context. The first finding is that local communities conceive of the services that they get from nature, such as drinking water from springs, agricultural (productive) water from rain and laundry water from rivers, as products of both natural and supernatural forces.

The role of supernatural forces is not a widely acknowledged issue in the mainstream ecosystem services discourse. The mainstream concept of what ecosystem services are and how they come into being emphasises the work of natural processes (see Boyd & Banzhaf, 2007; Costanza, 2008; Fisher & Turner, 2008; MEA, 2005; Wallace, 2008). This understanding does not capture the knowledge system of traditional communities who mainly use traditional ecological knowledge (TEK) to explain nature. Chapter 4 (section 4.5) shows how local communities embed supernatural forces in their explanations of causes of degradation, and the associated management practices they implement. For instance, local communities believe that drying up of water in both springs and rivers can be caused by people's failure to respect traditional resource management practices such as taboos. This way of explaining ecological phenomena is not yet well embraced in the mainstream ecosystem service literature. For instance, in an ecosystem assessment study in South Africa, Fabricius et al. (2006) struggled to make sense of some of the explanations that local people gave. This misalignment between local communities' knowledge and that of scientists (researchers within the mainstream knowledge system) has the potential to constrain opportunities to transdisciplinarise the ecosystem service framework.

Local people's belief that degradation of ecosystems can be caused by upsetting supernatural forces influences how they conceptualise and practise management. The study found that people apply a number of traditional practices to manage ecosystems, including ascribing taboo status to certain species and declaring some water bodies, such as springs and pools, as sacred. The other technique is rainwater management, which involves local women playing a cooking-stick game. Although the study (Chapter 4) did not attempt to argue that the belief system is an effective management technique, it asserts that it has to be included in the mainstream ecosystem service discourse because it is a major knowledge system that local communities use.

One of the potential major contributions of this study is the effort it makes to include and seriously consider TEK in ecosystem service research in South Africa. The study has attempted to explain the complex nature of the reality of traditional management practices. In particular, the study explains some of the rarely considered layers of the otology of practices such as taboos. These layers are the actual and the real (Chapter 4, section 4.3), which although are connected to the empirical level at which events are observed when they occur, they are invisible and the roles they play may not be easily comprehensible to non-traditionalists. As a

result, this study attempts to address the question on why researchers within the mainstream ecosystem service knowledge find it difficult to understand some of the management practices that local people use.

By revealing that traditional management practices are very complex and mainly unobservable realities, the study influences us to shift from the conventional question about traditional practices in resource management. The question has mainly been on whether or not traditional practices implemented by local people using IKS, can qualify to be regarded as management practices (Smith & Wishnie, 2001). Using the critical realism axiom that argues that there is difference between the intransitive and the transitive dimensions of reality, and hence there is a possibility of having plural and competing truth-claims about a single reality, the study argues that what actually is the problem is not that traditional management practices cannot manage the environment. However, the actual problem is that we possess limited knowledge of how traditional management practices work. Instead of us admitting that we do not know how traditional practices exactly manage nature, we argue that the practices do not manage nature simply because we do not know how they do it. In light of this, the growth of the ecosystem service knowledge in South Africa stands to benefit substantially if effort is invested in understating how traditional management practices work. This holds potential to pave way for inter-epistemic management programmes in which scientific knowledge and TEK can be used complementarily.

In addition to the belief system, local people practise a number of secular water resources management techniques, including stone terracing and *gelesha.* All these techniques are small-scale methods of harvesting and storing water at point of use, that is, within the arable fields and vegetable gardens. These techniques can still be adopted in contemporary communities mainly because they depend on simple, indigenous technology which the communities have used over long periods of time. Moreover, they can be integrated with modern techniques to optimise opportunities offered by TEK.

6.2.4. Research Question 4: How are traditional management practices perceived at the local communities, and how do these perceptions affect attempts to implement them in management of ecosystem services?

Chapter 5 explored the challenges that efforts to implement traditional management practices to manage ecosystem services faces in the local communities of Colana, Gogela and

Nozitshena. The overarching finding that this chapter arrived at is that the continued existence and use of traditional practices in management of ecosystem services is under threat. The threat emanates from the setting that traditional communities in the present times present as the context in which management of ecosystem services is taking place. This chapter categorises the settings into three main groups in order to facilitate ease of analysis.

One of the groups is wide adoption of western education and the Christian religion at the local communities. This has influenced the emergence of worldviews that shift significantly from the traditional ways of understanding the ecological domain which embraces the concept of supernatural forces, especially ancestors, as legitimate sources of ecological knowledge. This worldview serves as one of the necessary conditions that must exist if practices such as taboos and propitiating of ancestors are going to be embraced in the management of ecosystem services. If people dismiss ancestors as unreal and taboos as mere fiction, it begs the question: how then can they implement traditional management practices? The introduction of the scientific knowledge system which is mainly transmitted in English has brought translation problems which can add more challenges to implementation of traditional management practices. One of the glaring examples of wrong translation is the case of *izangoma zemvula* which are incorrectly translated as rainmakers. Such cases lead to the problem of analytical misappropriation in which facts and truth-claims about something which is known are used to describe something which is not known but is mistaken with the thing that is known. Problems like this constrain the development of the ecosystem service knowledge both at the local communities and among researchers widely.

Furthermore, the shifts in worldview which have come with a horde of scientific methods of verifying truth-claims such as experiments, rigorous questioning and logically intelligible step-by-step explanations of phenomena, have significantly confused the development of ecosystem service knowledge because in some instances scientific knowledge tools are used to verify truth-claims about traditional management practice. Although the scientific knowledge tools have, over the years, usefully contributed to development of the ecosystem service knowledge, they might not be appropriate for verification of truth-claims about traditional ecosystem management practices which take their wisdom from TEK. The implication of this is that even in cases in which certain truth-claims are found to be untrue, it remains difficult to point out where exactly the problem is: were the claims found to be untrue because they are just untrue, or it is because wrong tools of verification were used? If this epistemological problem is not

resolved, indigenous ecosystem service knowledge in South Africa may continue to be a contested affair for a long time.

The second group of challenges that may pose significant liabilities to the development of indigenous ecosystem service knowledge at the local communities is a disharmony playing out between the institutions that are involved in the management of ecosystem services. These include the state and its associated environmental policies on the one hand, and local traditional leadership with its related customary environmental laws and practices on the other. While these challenges might have started with the formation of the state during colonialism about three centuries ago, they have become more acute with the introduction of democracy. The state emphasises the central planning approach and use of its organs in resource management. In contrast, traditional leadership follows a decentralised approach in which every local community implements its own management practices according to its unique set of traditional rules and beliefs (Chapter 5, section 5.5.2.1).

The state claims its power to centrally plan and manage local resources on the basis that it is the *de jure* owner of the whole country including the local communities. On the other hand, the traditional leadership base their power to govern local resources on the reality that they are the descendants of the ancestral founders of the communities in which the resources are. Because of this, both institutions are critically important for the development of TEK, and particularly its associated practices of resource management in South Africa. The instructional challenges pose a big constraint, with potential to decide the future of traditional practices of resource management in South Africa. Efforts at policy level need to be made to harmonise the roles of the state and local traditional leadership in the implementation of resource management practices.

The study found that the local traditional leadership is losing their power to implement their duties. The main cause is the democratic legislation, which does not seem to be well tuned to tradition. The chapter's findings show that the national constitution of South Africa's democratic government vacillates with regard to the scope of power it provides to traditional leaders and customary law in the administration of local communities. The constitution created three spheres of government: local, provincial and national. Local government is responsible for administering local communities through the installation of municipal officials, such as ward councillors. The municipal officials use civil law and have virtually usurped the authority

and power of local community leadership. This chapter argues, that contemporary democratic South Africa does not have the institutional arrangements necessary for practising TEK in natural resources management. However, this should not be interpreted as an argument for incommensurability between tradition and democratic governance. Studies which have investigated the relationship between tradition and democracy have advanced mixed arguments. For instance, Ntsebeza (2008) does not see how unelected traditional leadership institutions can become part of a democratically run state while (Sklar, 1986) suggests that the two can work together to complement each other.

The scope of rights of the state and local traditional leadership over local resources such as ownership rights, control rights and transactional rights needs to be clearly spelt. The current situation is one of uncertainty particularly on the part of local traditional leadership. The uncertainty is constraining the traditional leadership's potential to champion implementation of traditional management practices and enforce their related rules. This significantly obscures the development of indigenous knowledge of ecosystem services in the country.

The third group of challenges to implementation of traditional management practices pertain to the developments in lifestyle that have taken place over the years, especially following the establishment of the democratic governments which emphasises service delivery as its key social developmental policy. Implementation of the service delivery policy has led to significant lifestyle changes at the local communities. These include increased access to health centres for medical services, increased employment opportunities and access to government grants (cash transfers). The net effect of all these developments is that local communities now depend much less on nature's services. Increased accumulation of money through employment and government grants makes it easy for local communities to substitute ecosystem services such as construction timber and thatch grass for industrial products including bricks and zinc.

Reduced direct dependence on nature's services among traditional communities can potentially lead to equally reduced impetus to develop their knowledge of it and manage its resources. In fact, one of the key founding aims of the ecosystem service framework is to make clear the reality that humans depend on the services produced by nature's resources, and if they understand this, humans are likely going to appreciate the need to sustainably manage nature (Daily, 1997; MEA, 2005). Studies conducted elsewhere have demonstrated that progress in human development has led to decline in traditional communities' TEK (Ahmed et al., 2010;

Gómez-Baggethun & Reyes-Garcia, 2010; McCarter & Gavin, 2014). This finding is crucial in the sense that it helps position our analysis of TEK in South Africa in the context of the reality of social progress. The study organises the different challenges into three groups according to their characters, which may help decision makers to tailor their responses to suit each group's unique nature of challenges. In addition, the chapter generates insights into the role that TEK can play in shaping the ecosystem service discourse, especially in South Africa.

Overall, Chapter 5 contributes to the development of our understanding of indigenous knowledge of ecosystem services in at least two ways. The first one is that by finding reasons for which traditional management practices are being contested in the local communities, the Chapter shows the conditions that when they are present in a community, it becomes difficult to use TEK in management of ecosystem services. The implication to the overarching aim of the study (thesis) is that we need to consider indigenous knowledge of ecosystem services in context.

The second one is that by discovering the reality that TEK is being contested and hence fail to get the opportunity to be implemented in full, the study contributes to towards addressing the question on why traditional communities are heavily degraded in South Africa in spite of the reality that they possess vast amount of resource management knowledge. The reality that it is being contested, denies TEK the opportunities to realise the full scope of its potential in managing natural resources. Whether or not traditional management practices can effectively prevent degradation of natural resources remains a difficult question to answer because of what is happening in these local communities. So, in a nutshell, these findings serve to highlight the point that degradation in traditional communities is not necessarily because traditional management practices that are used are not effective. Rather, it is as well a result of the fact that the traditional practices are not being implemented in full; and hence they cannot be expected to deliver optimum results. In light of these findings, this chapter proposes a framework that can be used as a tool to guide future analysis of indigenous knowledge of ecosystem services, with a special focus on TEK.

6.3. A framework of TEK as a social-ecological underlabourer

Over the years, research has argued that many indigenous communities use TEK to inform and guide their interactions with nature including generating general ecological knowledge,

harvesting behaviour and resource management practices, and this has been demonstrated in the preceding chapters of this thesis (Chapters 2, 3, 4 & 5). However, what may need to be done is to shift our analysis of TEK from the one that focuses on describing what TEK is to an analysis that looks at it as an underlabourer whose role is to explicate social-ecological concepts.

Traditional ecological knowledge is applied by indigenous communities to help them interpret and understand a myriad of social-ecological issues in real life settings (See Chapters 2, 3, 4 & 5). These social-ecological issues often present themselves in two broad groups; the negative and positive. The negative social-ecological issues are typically the phenomena that pose some threats to local people's ability to continue living on nature such as drought, resource degradation and colonisation of local landscapes by alien invasive plants (AIPs). These require local communities to use TEK in order to gain knowledge of what they are, what causes them and how best to prevent them or mitigate their effects. In this case TEK is used to generate reactionary knowledge. On the other hand, the positive social-ecological issues are typically new concepts that emerge in our continuing search for the best possible ways to frame and explain the complexities of human-nature relations. These include concepts such as resource management, resilience and the ecosystem service framework. In this group of social-ecological triggers, TEK is used to proactively generate knowledge that can contribute to the growth of knowledge about human-nature relations.

In both cases (whether to generate proactive or reactionary knowledge) TEK's function is to explain the ecological domain. In light of this, one can argue that local communities use and perceive of TEK as a social-ecological underlabourer, and hence it has to be analysed as such. The metaphor of underlabouring is a critical realist concept that refers to a situation in which some knowledge systems or philosophies are used for "clearing the ground" (Bhaskar, 2016: 2) for other knowledge domains including metatheories, disciplines and concepts. When a knowledge system or philosophy underlabours for another concept, its function is to explicate and generate insights about that concept. In so doing, the quality of the underlabouring knowledge is largely determined by its demonstrated ability to generate knowledge and insights about the concept for which it underlabours.

A framework for analysing TEK has been offered by Berkes (2008). Berkes (2008) proposes that TEK needs to be understood as a knowledge-practice-belief complex which recognises

that communities possess a set of cultural knowledge about their local ecological surroundings that may include species taxonomy and resources use. The knowledge is put into practice especially to regulate harvesting and use practices. The practices are implemented within the context, and use of cultural elements such as taboos. Over extended periods of practice, certain successful parts of the knowledge are concluded to be working, and such conclusions morph into a belief. Henceforth, the practices are stored and transmitted to other individuals and generations as beliefs; practices that are known to have worked and hence are believed to continue working.

Berkes' (2008) knowledge-practice-belief framework was intended at explaining the ontology of TEK, not to explicate how it should be understood as an underlabourer or knowledge tool that can inform contemporary ecological concepts such as resource management and the ecosystem service framework. Building on Berkes' (2008) framework, I suggest a useful way of analysing TEK is to look at it as an underlabourer, and not as a stand-alone knowledge system which exists for its own self. Traditional ecological knowledge is an epistemic tool used to interpret the complexities of human-nature relations. Because of this, TEK underlabours for the ecological discipline. The role of TEK is not to explicate itself, that is to make us understand what it is; but to underlabour for other concepts. For this reason, what Berkes' (2008) insightful and very well-thought knowledge-practice-belief framework does not do is to assist us understand how TEK underlabours for ecological concepts. In light of this, I suggest the framework of TEK as an underlabourer (Figure 6.1).

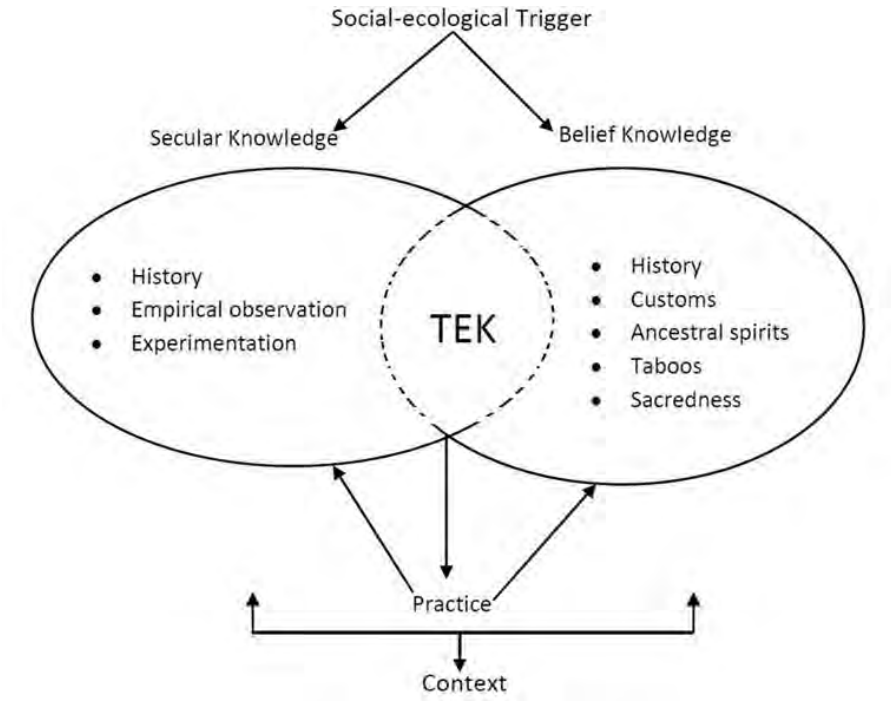

Figure 6.1. Framework of TEK as an underlabourer for social-ecological triggers

The framework looks at TEK as an ever-evolving product of the relationship of embeddedness that exists between secular and belief knowledge in a community. During the process of mutual gravitation both knowledges experience cross-pollination in which they borrow ideas from each other. The process of mutual gravitation leads to formation of an intersection in which secular knowledge and belief knowledge meet in an existential arrangement of embeddedness. It is in this intersection that TEK resides and operate from. Consequently, because TEK is a complex composite of secular and belief knowledge, it is not exclusively about taboos, sacredness, totems and myths; but it also includes some secular practices such as stone terracing and gelesha (See Chapter 4).

The two knowledge branches are represented by circles, the secular to the left and the belief to the right. Each of the two knowledges has its own set of tools including worldviews, vocabulary and verification methods. However, because they exist in the same community in which they are used to develop understanding of the same local landscapes, the belief and secular knowledges undergo processes of mutual gravitation in which they both move towards each other.

Traditional ecological knowledge's role of underlabouring begins with the striking of a social-ecological trigger. The social-ecological trigger may either be positive or negative. Positive

triggers are those that stimulate development of new knowledge without presenting a danger; an example is the emergence of the ecosystem service concept in the 1980s (Ehrlich & Ehrlich, 1981). This instigated TEK to develop new knowledge that could help explain the phenomenon of human-nature relations. Negative social-ecological triggers are those that threaten the functioning and resilience of human-nature relations such as the invasion of grasslands by woody species. In both cases, TEK has to work (underlabour) in order to respond to the trigger. The new knowledge that TEK produces as part of its response to the social-ecological trigger is implemented (practice). At this level of practice is where knowledge that works (the one that gives a good response to the trigger) and knowledge that does not work (the one that fails to respond well to the trigger), are discovered.

The discovered facts are sent back to the knowledge branches as feedback which leads to evolving of TEK through adapting new knowledge, discarding the knowledge that does not work and entrenching old good knowledge. Both the new and old good knowledge are thrown back into implementation (practice). This leads TEK to engage in a perpetual state of evolving as it needs to be continuously apace with emerging social-ecological triggers which may come in the form of concepts such as the ecosystem service framework or ecological phenomena like degradation or emergence of AIPs on local landscapes. In all these situation, TEK's role is to generate knowledge of these triggers.

The ability of TEK to effectively underlabour for a social-ecological trigger depends, to a large extent, on two major factors: the origin of the trigger (whether the trigger is a local or foreign) and the context in which the underlabouring is taking place. Traditional ecological knowledge tends to be able to comprehend and explicate triggers of local origin much better than it does the ones that originate from outside of the local landscapes. This is demonstrated in Chapter 2 in which local knowledge struggles to relate with the ecosystem service framework, especially its approach in which it splits nature's services into groups.

All this endeavour to underlabour for the social-ecological trigger takes place in contexts. Even if the trigger is local, the context in which TEK underlabours for that trigger significantly determine the quality of the end product. Context include factors such as political, worldview, educational and economic disposition of a community or country. The major function of context is that it either permit or obstruct TEK to activate all its power to underlabour. For instance, a worldview that is inimical to traditional beliefs (See Chapter 5) obstructs efforts to

fully put TEK into practice. When this happens, TEK gets to be implemented partially, hence its ability to effectively underlabour for that particular social-ecological trigger for which it was put into practice is attenuated.

6.4. Reflections and self-criticism

To a large extent, the study achieved its aim of unravelling indigenous knowledge of ecosystem services at the local communities of South Africa. The findings can potentially provide valuable insights into how IKS, especially its branch of TEK can help us understand the relations that play out between local traditional communities and nature with special reference to the ecosystem service concept. Nonetheless, the findings of the study might mask some possible sources of limitations that I encountered during the course of conducting this study. This section attempts to present a self-critique by outlining some of the major possible limitations of the study.

First, although the study constantly makes reference to people that hold scientific knowledge and those of the Christian religion, I did not recruit those people for interviews. The descriptions about how Christian converts and holders of scientific knowledge (formal education) are based on reports that I got from holders of TEK whose knowledge of ecosystem services was the focus of this study. The other source of these descriptions was published literature. This omission might have limited the quality and amount of data that I would possibly get regarding how scientists and Christians perceive TEK and its related management practices. On reflection, it might have been beneficial to the study to provide space for the formerly educated and Christians to share their views about TEK.

Moreover, the differences between holders of TEK and formally educated people in understanding ecosystem services that are demonstrated in respondents' testimonies may not necessarily be a true reflection of the relationship between scientific knowledge and IKS. The differences might have been influenced by external factors that have little to do with the endogenous properties of these knowledge systems, such as power relations and how certain individuals choose to perform their knowledge system (Fabricius et al., 2006). These two knowledge systems share many commonalities, hence they can be integrated to improve our knowledge of ecosystem services.

The issue of recruiting holders of TEK only, and not respondents from other knowledge systems was necessitated by the overarching aim of the study: to investigate indigenous knowledge of ecosystem services at local communities. In an effort to achieve this aim, the study used the qualitative methodology with its associated snowball sampling method. Although the snowball sampling method assisted the study to recruit relevant respondents (individuals that possessed indigenous knowledge of ecosystem services), it might be a source of bias in that respondents might have avoided referring to the researcher (me) some people that might possess the knowledge but they disliked them. Additionally, the methodology put respondents and their testimonies as the principal source of data given that the study aim was about unravelling their knowledge (what they know about ecosystem services). This limited the intensity of probing used to ascertain respondents' reports.

Another possible source of limitation is that given the historical reality that South African rural communities have been in contact with the western culture for centuries through, *inter alia*, conquest, sending household members to attend formal education and receiving state-sponsored environmental intervention programmes, it was difficult to draw a hard line between IKS, indigenised knowledge and western (scientific knowledge). The study concedes that much has happened to modify IKS, especially its branch in TEK, from its original version. This reality was quite evident in chapters that dealt with traditional practices of managing resources (Chapter 4).

Over the years, the local communities' indigenous knowledge was influenced by several state-sponsored intervention programmes which were informed by the deductive scientific knowledge systems. These included agricultural extension programmes which encouraged rangeland management practices that were founded upon deductive experimental science knowledge. Rotational grazing practices are firmly established in the rangeland science literature as being successful in preventing and reversing degradation. The history of providing fencing and poles is steeped in the belief that grazing camps would enable communities to regulate their livestock in much the same way that commercial farmers do e.g. resting camps in summer to provide winter grazing, only grazing within the recommended carrying capacity of the region, etc. However, it has been found that most fencing programmes in communal areas have been in-effective, with many reasons being given for this lack of success, including but not limited to gates being left open, fencing being stolen, water points becoming

dysfunctional so that livestock have to be moved and non-compliance to traditional decisions by non-resident owners among others.

Furthermore, this long period of contact with the western culture had a bearing on the species of resources that the local communities testify their knowledge about. Many of the wild vegetable and wild fruits that the local communities are using are not entirely indigenous to South Africa. These wild vegetables include *Amaranthus thunbergii (utyuthu), Chenopodium album (imbikicane/ imbicicane), and Bidens pilosa (umhlabangubo.* Nonetheless, the fact that these are alien resources is not very important because they grow naturally and form part of the local stock of suppliers of ecosystem services. Through processes of adaptation and indigenisation, local communities have embraced the alien imported species as part of their natural landscape, and this is evidenced by the reality that they have given indigenous names to these resources (See Chapter 3).

In addition, my personal background could be yet another possible source of limitation in this study (See Foreword). Not only did I grow up in a traditional family, born to a father who was a traditional healer and a rainwater manager, I actually developed love and respect for IKS. To this day, my love and respect for IKS has not changed. This personal background/upbringing might have, in a way, influenced my processes of data interpretation. Although my analysis of the ontology of traditional management practices such as taboos was informed by critical realism it might have been influenced by my lived experience.

References

Acharya AS., Prakash, A., Saxena P., & Nigam A. (2013). Sampling: Why and how of it? *Indian Journal of Medical Specialities, 4*(2): 330-333.

Adams WM. (1993). Indigenous use of wetlands and sustainable development in West Africa. *Geographical Journal, 159*(2), 209–218.

Agrawal, A. (1995). Dismantling the divide between indigenous and scientific knowledge. *Development and change, 26*(3), 413-439.

Ahmed, S., Stepp, J. R., Toleno, R. A., & Peters, C. M. (2010). Increased market integration, value, and ecological knowledge of tea agroforests in the Akha highlands of Southwest China. *Ecology and Society, 15*(4), 1-19.

Alvard, M. S. (1998). Evolutionary ecology and resource conservation. *Evolutionary Anthropology: Issues, News, and Reviews: Issues, News, and Reviews*, *7*(2), 62-74.

Andrew, M., & Fox 1, R. C. (2004). 'Undercultivation' and intensification in the Transkei: a case study of historical changes in the use of arable land in Nompa, Shixini. *Development Southern Africa*, *21*(4), 687-706.

Appadurai A. (Ed.). (1988). *The social life of things: Commodities in a cultural perspective*. Cambridge: Cambridge University Press.

Arias-Arévalo, P., Martín-López, B., & Gómez-Baggethun, E. (2017). Exploring intrinsic, instrumental, and relational values for sustainable management of social-ecological systems. *Ecology and Society*, *22*(4), 1-16.

Asafo-Adjei, R. T. (2004). From imifino to umfuno: A case study foregrounding indigenous agricultural knowledge in school-based curriculum development. Master's dissertation, Rhodes University, South Africa.

Aswani, S., & Hamilton, R. J. (2004). Integrating indigenous ecological knowledge and customary sea tenure with marine and social science for conservation of bumphead parrotfish (Bolbometopon muricatum) in the Roviana Lagoon, Solomon Islands. *Environmental conservation*, *31*(1), 69-83.

Ayaa, D. D., & Waswa, F. (2016). Role of indigenous knowledge systems in the conservation of the bio-physical environment among the Teso community in Busia County-Kenya. *African Journal of Environmental Science and Technology*, *10*(12), 467-475.

Babbie E, Mouton J, Vorster P & Prozesky B. (2001). *The practice of social science.* Cape Town: Oxford University Press Southern Africa.

Babchuk, W. A. (2019). Fundamentals of qualitative analysis in family medicine. *Family Medicine and Community Health*, *7*(2), 1-10.

Bank, L., & Southall, R. (1996). Traditional leaders in South Africa's new democracy. *The Journal of Legal Pluralism and Unofficial Law*, *28*(37-38), 407-430.

Bank, L. (1991). *Beyond the bovine mystique: entrepreneurship, class and identity in QwaQwa*. University of the Witwatersrand, African Studies Institute.

Bank, L. (2002). Beyond red and school: Gender, tradition and identity in the rural Eastern Cape. *Journal of Southern African Studies*, *28*(3), 631-649.

Barkmann, J., Glenk, K., Keil, A., Leemhuis, C., Dietrich, N., Gerold, G., & Marggraf, R. (2008). Confronting unfamiliarity with ecosystem functions: the case for an ecosystem service approach to environmental valuation with stated preference methods. *Ecological economics*, *65*(1), 48-62.

Barrow CJ. (2006). *Environmental management for sustainable development* (2nd ed.). New York: Routledge.

Bartel, R. (2014). Vernacular knowledge and environmental law: cause and cure for regulatory failure. *Local Environment*, *19*(8), 891-914.

Baskin Y. (1997). *The work of nature: How the diversity of life sustains us*. New York: Island

Press.
Battiste, M., & Youngblood, J. (2000). *Protecting Indigenous knowledge and heritage: A global challenge*. UBC Press.
Becker, C. D., & Ghimire, K. (2003). Synergy between traditional ecological knowledge and conservation science supports forest preservation in Ecuador. *Conservation ecology*, *8*(1), 1-12.
Beinart, W., & Brown, K. (2013). *African local knowledge and livestock health: Diseases and treatment in South Africa*. Johannesburg: Wits University Press.
Beinart, W., & Wotshela, L. (2011). *Prickly pear: The social history of a plant in the Eastern Cape*. Johannesburg: Wits University Press.
Beinart, W. (1984). Soil erosion, conservationism and ideas about development: A southern African exploration, 1900–1960. *Journal of Southern African Studies*, *11*(1), 52-83.
Beinart, W. (1989). Introduction: the politics of colonial conservation. *Journal of Southern African Studies*, *15*(2), 143-162.
Beinart, W. (2003). *The rise of conservation in South Africa: Settlers, livestock and the environment, 1770-1950*. Oxford: Oxford University Press.
Bennett, J. E., Palmer, A. R., & Blackett, M. A. (2012). Range degradation and land tenure change: insights from a 'released'communal area of Eastern Cape province, South Africa. *Land Degradation & Development*, *23*(6), 557-568.
Bennett, T. (2008). 'Official vs living' customary law: Dilemmas of description and recognition. In Claassens A & Cousin B (Eds.) *Land Power and custom: Controversies generated by South Africa's Communal Land Rights Act (*138–153). Cape Town: UCT Press.
Bennett, J., Palmer, A & Blackett, A. (2012). Range degradation and land tenure: Insights from a "released" communal area of Eastern Cape Province, South Africa. *Land Degradation and Development, 23*, 557–568.
Bennett, E. M., Peterson, G. D., & Levitt, E. A. (2005). Looking to the future of ecosystem services. *Ecosystems*, *8*(2), 125-132.
Bennett, J. E. (2013). Institutions and governance of communal rangelands in South Africa. *African Journal of Range & Forage Science*, *30*(1-2), 77-83.
Berkes, F., & Folke, C. (1998). Linking social and ecological systems for resilience and sustainability. In Berkes F & Folke C (Eds.) *Linking social and ecological systems: Management practices and social mechanisms for building resilience* (1–25) 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. (1993). Traditional ecological knowledge in perspective. In *Traditional ecological knowledge: Concepts and cases,* Inglis J (ed.), pp.1–10, Ottawa: International Program on Traditional Ecological Knowledge.
Berkes, F. (2008). *Sacred ecology* (2nd ed.). New York: Routledge.
Bhandari, A. R., Khadka, U. R., & Kanel, K. R. (2018). Ecosystem services in the Mid-Hill forest of western Nepal: A case of Panchase Protected Forest. *Journal of Institute of Science and Technology*, *23*(1), 10-17.
Bhaskar, R. (2016). *Enlightened common sense: The philosophy of critical realism.* Routledge: London and New York.
Blair, D., Shackleton, C. M., & Mograbi, P. J. (2018). Cropland abandonment in South African smallholder communal lands: Land cover change (1950–2010) and farmer perceptions of contributing factors. *Land*, *7*(4), 1-20.
Blignaut, J., Mander, M., Schulze, R., Horan, M., Dickens, C., Pringle, C., & McKean, S. (2010). Restoring and managing natural capital towards fostering economic

development: Evidence from the Drakensberg, South Africa. *Ecological Economics*, *69*(6), 1313-1323.

Boafo, Y. A., Saito, O., Kato, S., Kamiyama, C., Takeuchi, K., & Nakahara, M. (2016). The role of traditional ecological knowledge in ecosystem services management: the case of four rural communities in Northern Ghana. *International Journal of Biodiversity Science, Ecosystem Services & Management*, *12*(1-2), 24-38.

Bockstael, N. E., Freeman, A. M., Kopp, R. J., Portney, P. R., & Smith, V. K. (2000). On measuring economic values for nature. *Environmental Science and Technology,* 34(8): 1384–1389.

Boillat, S., & Berkes, F. (2013). Perception and interpretation of climate change among Quechua farmers of Bolivia: Indigenous knowledge as a resource for adaptive capacity. *Ecology and society*, *18*(4), 1-13.

Boyd, J., & Banzhaf, S. (2007). What are ecosystem services? The need for standardized environmental accounting units. *Ecological economics*, *63*(2-3), 616-626.

Bredenkamp, G., Granger, J.E., & van Rooyen, N. (1996). Eastern thorn bushveld: Savanna biome. In Low, A. B., & Rebelo, A. G. (Eds.) *Vegetation of South Africa, Lesotho and Swaziland*. Department of Environmental Affairs and Tourism, Pretoria.

Bresnihan P. (2017). Valuing nature-Perspectives and issues. *National Economic and Social Council, Research Series* No. 11: 1–60.

Brosius, J. (2006). What counts as local knowledge in global environmental assessments and conventions? In Reid, W.V., Berkes, F., Wilbanks, T., & Capistrano, D. (Eds.) *Bridging scales and knowledge systems: Concepts and applications in ecosystem assessment* (129–144). Washington DC: Island Press.

Browne, K. (2005). Snowball sampling: using social networks to research non-heterosexual women. *International journal of social research methodology*, *8*(1), 47-60.

Bryceson, D. F. (2019). Gender and generational patterns of African deagrarianization: Evolving labour and land allocation in smallholder peasant household farming, 1980–2015. *World Development*, *113*(C), 60-72.

Bundy, C. (1988). *The rise and fall of the South African peasantry,* (2nd ed.). Cape Town: David Philip Publications.

Burchett, K. (2014). Anthropocentrism and Nature. An Attempt at Reconciliation. *TEORIA-RIVISTA DI FILOSOFIA*, *34*(2), 119-137.

Büscher, B. (2012). Payments for Ecosystem Services as Neoliberal Conservation: (Reinterpreting) Evidence from the Maloti-Drakensberg, South Africa. *Conservation and Society*, *10*(1), 29-41.

Butina, M. (2015). A narrative approach to qualitative inquiry. *Clinical Laboratory Science*, *28*(3), 190-196.

Butler, J. R., Tawake, A., Skewes, T., Tawake, L., & McGrath, V. (2012). Integrating traditional ecological knowledge and fisheries management in the Torres Strait, Australia: the catalytic role of turtles and dugong as cultural keystone species. *Ecology and Society*, *17*(4), 1-19.

Campbell, B. M. (1987). The use of wild fruits in Zimbabwe. *Economic botany*, *41*(3), 375-385.

Castellano, M. B. (2000). Updating Aboriginal traditions of knowledge. *Indigenous knowledges in global contexts: Multiple readings of our world*, 21-36.

Chalmers, A.F. (1999). *What is this thing called science?* (3rd ed.). Buckingham: Open University Press.

Chalmers, N., & Fabricius, C. (2007). Expert and generalist local knowledge about land-cover change on South Africa's Wild Coast: can local ecological knowledge add value to science?. *Ecology and Society*, *12*(1), 1-15.

Chapman, A. L., Hadfield, M., & Chapman, C. J. (2015). Qualitative research in healthcare: an introduction to grounded theory using thematic analysis. *Journal of the Royal College of Physicians of Edinburgh*, *45*(3), 201-205.

Chee, Y. E. (2004). An ecological perspective on the valuation of ecosystem services. *Biological conservation*, *120*(4), 549-565.

Chimhowu, A., & Woodhouse, P. (2006). Customary vs private property rights? Dynamics and trajectories of vernacular land markets in Sub-Saharan Africa. *Journal of Agrarian Change*, *6*(3), 346-371.

Cicin-Sain, B., & Knecht, R.W. (1995). Analysis of Earth Summit prescriptions on incorporating traditional knowledge in natural resource management. In Hanna, S., & Munasinghe, M. (Eds.) *Property rights and the environment* (105-118). Washington DC: Beijer International Institute of Ecological Economics and the World Bank.

Collins English Dictionary (2005). UK: HarperCollins Publishers.

Clulow, A.D., Everson, CS., & Gush, BM. (2011). "The long-term impact of acacia mearnsii trees on evaporation, streamflow and groundwater resources." Water Research Commission Report No. TT 505/11. Pretoria: Water Research Commission.

Costanza, R. (2008). Ecosystem services: multiple classification systems are needed. *Biological Conservation*, *141*(2), 350-352.

Costanza, R., d'Arge, R., De Groot, R., Farber, S., Grasso, M., Hannon, B., & Raskin, R. G. (1997). The value of the world's ecosystem services and natural capital. N*ature*, *387*(6630), 253-260.

Costanza R., d'Arge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neill, R.V., Paruelo, J., Raskin, R.G., Sutton, P., & van den Belt, M. (1998). The value of the world's ecosystem services and natural capital. *Ecological Economics*, *25*(1), 3–15.

Costanza, R. (2008). Ecosystem services: multiple classification systems are needed. *Biological Conservation*, *141*(2), 350-352.

Cousins, B. (2008). Contextualizing the controversies: Dilemmas of communal tenure reform in post-apartheid South Africa. In Claassens, A., & Cousin, B. (Eds.) *Land power and custom: Controversies generated by South Africa's Communal Land Rights Act* (3–31). Cape Town: University of Cape Town Press.

Coutts, C., & Hahn, M. (2015). Green infrastructure, ecosystem services, and human health. *International Journal of Environmental Research and Public Health*, *12*(8), 9768-9798.

Creswell, J.W., Clark, V.L.P., Gutmann, M.L., & Hanson, W.E. (2003). Advanced mixed methods research designs. In Tashakkori, A., & Teddlie, C. (Eds.) *Handbook of mixed methods in social and behavioural research (*209–240). Thousand Oaks, CA: Sage Publications.

Creswell, J.W. (2013). *Qualitative inquiry and research design: Choosing among five approaches*. (3rd ed.). Thousand Oaks, CA: Sage Publications.

Creswell, J.W. (2014). *Research design: Qualitative, quantitative and mixed methods approaches*. Thousand Oaks, CA: Sage Publications.

Critchley, W. R., & Netshikovhela, E. M. (1998). Land degradation in South Africa: conventional views, changing paradigms and a tradition of soil conservation. *Development Southern Africa*, *15*(3), 449-469.

Curtis, I. A. (2004). Valuing ecosystem goods and services: a new approach using a surrogate market and the combination of a multiple criteria analysis and a Delphi panel to assign weights to the attributes. *Ecological Economics*, *50*(3-4), 163-194.

Daily, G. (1997). Introduction: What are ecosystem services? In *Nature's services: Societal dependence on natural ecosystems*, Daily, G (ed.), pp. 1–10. Washington DC: Island

Press.
Daly, H. E. (1998). The return of Lauderdale's paradox. *Ecological Economics*, *25*(1), 21-23.
Danermark, B., Ekstrom, M., Jakobsen, L., & Karlsson, J.C. (2002). *Explaining society: Critical realism in the social sciences*. London: Routledge.
Dasgupta, P. (1990). The environment as a commodity. *Oxford Review of Economic Policy, 6*(1), 51–67.
Davis, M. (2006). Bridging the gap or crossing the bridge? Indigenous knowledge and the language of law and policy. In Reid, W.V., Berkes, F., Wilbanks, T., & Capistrano, D. (eds.) *Bridging scales and knowledge systems: Concepts and applications in ecosystem assessment* (145–164). Washington DC: Island Press.
Dei, G. J., Hall, B., & Rosenberg, D. G. (2000). Introduction. In Dei, G. J. S., Hall, B., & Rosenberg, D. G. (Eds.) *Indigenous knowledge in global context: Multiple readings of our world (*1–17). Toronto: Toronto University Press.
De Groot, R.S., Brender, L., van de Ploeg, S., Costanza, R., Bernard, F., Braat, L., Christie, M., Crossman, N., Ghermandi, A., Hein, L., Hussain, S., Kumar, P., McVittie, A., Portela, R., Rodríguez, L. C., ten Brink, P., & van Beukering, P. (2012). Global estimates of the value of ecosystems and their services in monetary units. *Ecosystem Services, 1*(1), 50-61.
De Groot, R. S., Wilson, M. A., & Boumans, R. M. J. (2002). A typology for the classification, description and valuation of ecosystem functions, goods and services. *Ecological Economics*, *41*(3), 393–408.
Delius, P., & Schirmer, S. (2000). Soil conservation in a racially ordered society: South Africa, 1930–1970. *Journal of Southern African Studies, 26*(4), 719–742.
De Soto, H. (2000). *The mystery of capital: Why capitalism triumphs in the west and fails everywhere else.* Great Britain: Bantam Press.
De Wet, C. (1987). Betterment planning in South Africa; Some thoughts and its history, feasibility and wider implications. *Journal of Contemporary African Studies*, *6*(1/2), 85–122.
De Wet, C. (1995). *Moving together, drifting apart: Betterment planning and villagisation in a South African homeland*. Johannesburg: Witwatersrand University Press.
DeMotts, R., & Hoon, P. (2012). Whose elephants? Conserving, compensating, and competing in Northern Botswana. *Society and Natural Resources*, *25*(9), 837–851.
Denison, J., Dube, S. V., Masiya, T. C., Moyo, T., Mpyana, J., Murata, C., van Averbeke, L. L., & van Averbeke, W. (2016). "Smallholder irrigation entrepreneurial development pathways and livelihoods in two districts in Limpopo Province*".* Water Research Commission Report No. 2179/1/16. Pretoria: Water Research Commission.
Denison, J., Murata, C., Conde, L, Perry, A., Monde, N., & Jacobs, T. (2015). "Empowerment of women through water use security, land use security and knowledge generation for improved household food security and sustainable livelihoods in selected areas of the Eastern Cape". Water Research Commission Report No. 2083/1/15. Pretoria: Water Research Commission.
Denison, J., & Wotshela, L. (2009). "Indigenous water harvesting and conservation practices: Historical context, cases and implications". Water Research Commission Report No. TT 392/09). Pretoria: Water Research Commission.
Denzin, N. K., & Lincoln, Y. S. (2011). *The Sage handbook of qualitative research*. Thousand Oaks, CA: Sage.
Díaz, S., et al. (2015). The IPBES Conceptual Framework—connecting nature and people. *Current Opinion in Environmental Sustainability*, *14*, 1-16.
Dlamini, N., & Kaya, H. O. (2017). Environmental security, indigenous knowledge systems and implications for food security in South Africa. *Journal of Human Ecology, 53*(2),

135–140.
Dold, T., & Cocks, M. (2000). *Indigenous plant use of the amaXhosa people on the eastern border of the Great Fish River Reserve, Eastern Cape*. Directorate of Museums and Heritage Resources of the Eastern Cape Province at the Albany Museum.
Dold, A. P., & Cocks, M. L. (2002). The trade in medicinal plants in the Eastern Cape Province, South Africa. *South African Journal of Science*, *98*(11), 589-597.
Dollar, E. S. J., & Rowntree, K. M. (1995). Hydroclimatic trends, sediment sources and geomorphic response in the Bell River catchment, Eastern Cape Drakensberg, South Africa. *South African Geographical Journal*, *77*(1), 21-32.
Dove, M. R. (2006). Indigenous people and environmental politics. *Annual Review of Anthropology*, *35,* 191–208.
Du Toit, A., & Neves, D. (2007). In search of South Africa's second economy: Chronic poverty, economic marginalisation and adverse incorporation in Mt. Frere and Khayalitsha. *Africanus, 37*(2), 145–174.
Du Toit, A., Skuse, A., & Cousins, T. (2007). The political economy of social capital: Chronic poverty, remoteness and gender in the rural Eastern Cape. *Social Identities, 13*(4), 521–540.
Du Toit, J. T., Walker, B. H., & Campbell, B. M. (2004). Conserving tropical nature: current challenges for ecologists. *Trends in Ecology & Evolution*, *19*(1), 12-17.
Dupar, M. (2019). "IPCC's Special Report on climate change and land: What's in it for Africa?" Cape Town: Climate and Development Knowledge Network, Overseas Development Institute and SouthSouthNorth.
Easton, G. (2010). Critical realism in case study research. *Industrial Marketing Management*, *39*(1), 118-128
Egoh, B., Reeyers, B., Rouget, M., Richardson, D. M., Le Maitre, D. C., & van Jaarsveld, AS. (2008). Mapping ecosystem services for planning and management. *Agriculture, Ecosystems and Environment*, *127*(1-2), 135–140.
Ehrlich, P., & Ehrlich, A.. (1981). *Extinction: The causes and consequences of the disappearance of species*. New York: Random House.
El Serafy, S. (1998). Pricing the invaluable: The value of the world's ecosystem services and natural capital. *Ecological Economics*, *25(*1), 25–27.
Ellen, R., & Harris, H. (2000). Introduction. In *Indigenous environmental knowledge and its transformations: Critical anthropological perspectives*, Ellen, R., Parkes, P., & Bicker A. (eds.), pp. 1–32. Australia: Harwood Academic Publishers.
Escobar, A. (1995). *Encountering development: The making and unmaking of the Third World*. Princeton, NJ: Princeton University Press.
Fabricius, C., Scholes, R., & Cundill, G. (2006). Mobilizing knowledge for integrated ecosystem assessments. In Reid, W. V., Berkes, F., Wilbanks, T., & Capistrano, D. (Eds.), *Bridging scales and knowledge systems: Concepts and applications in ecosystem assessmen*t (165–184). Washington DC: Island Press.
Farber SC, Costanza R & Wilson MA. (2002). Economic and ecological concepts for valuing ecosystem services. *Ecological Economics*, 41(3): 375–392.
Farquhar, C. (1999). Are focus groups suitable for 'sensitive' topics? In *Developing focus group research: Politics, theory and practice*, Barbour, R., & Kinzinger, J. (eds.), pp 46–63. London: Sage.
Faugier, J., & Sargeant, M. (1997). Sampling hard to reach populations. *Journal of Advanced Nursing*, *26*(4), 790–797.
Favretto, N., Stringer, L. C., Dougill, A. J., Dallimer, M., Perkins, J. S., Reed, M. S., ... & Mulale, K. (2016). Multi-criteria decision analysis to identify dryland ecosystem service trade-offs under different rangeland land uses. *Ecosystem Services*, *17*, 142-151.

Faye, J. (2014). *The nature of scientific thinking: On interpretation, explanation, and understanding*. UK: Palgrave Macmillan.
Feyerabend P. (1987). *Farewell to reason.* London: Verso.
Fisher, B., & Turner, R. K. (2008). Ecosystem services: classification for valuation. *Biological conservation*, *141*(5), 1167-1169.
Fletcher, A. J. (2017). Applying critical realism in qualitative research: Methodology meets method. *International Journal of Social Research Methodology*, *20*(2), 181–194.
Fonseca-Cepeda, V., Idrobo, C., & Restrepo, S. (2019). The changing chagras: traditional ecological knowledge transformations in the Colombian Amazon. *Ecology and Society*, *24*(1), 1-16.
Gómez-Baggethun, E., & Martín-López, B. (2015). Ecological economics perspective in ecosystem services valuation. In *Handbook of ecological economics*, Martínez-Alier, J., & Muradian, R. (eds.), pp. 260–282. London: Edward Elgar.
Gómez-Baggethun, E., & Muradian, R. (2015). In markets, we trust? Setting the boundaries of market-based instruments in ecosystem service governance. *Ecological Economics, 117*, 217–224.
Gomez-Baggethun, E., & Reyes-Garcia, V. (2013). Reinterpreting change in traditional ecological knowledge. *Human Ecology, 41*(14), 643–647.
Gómez-Baggethun, E., & Ruiz-Perez, M. (2011). Economic valuation and the commodification of ecosystem services. *Progress in Physical Geography, 35*(5), 613–628.
Gómez-Baggethun, E. R. I. K., Mingorria, S., Reyes-García, V. I. C. T. O. R. I. A., Calvet, L., & Montes, C. (2010). Traditional ecological knowledge trends in the transition to a market economy: empirical study in the Doñana natural areas. *Conservation Biology*, *24*(3), 721-729.
Goulder, L. H., & Kennedy, D. (1997). Valuing ecosystem services: Philosophical bases and empirical methods. In *Nature's services: Societal dependence on natural ecosystems,* Daily, G.C. (ed.). pp. 23–48. Washington DC: Island Press.
Gratani, M., Butler, J. R., Royee, F., Valentine, P., Burrows, D., Canendo, W. I., & Anderson, A. S. (2011). Is validation of indigenous ecological knowledge a disrespectful process? A case study of traditional fishing poisons and invasive fish management from the Wet Tropics, Australia. *Ecology and Society*, *16*(3), 1-14.
Grêt-Regamey A, Brunner SH, Altwegg J, Christen M & Bebi P. (2013). Integrating expert knowledge into mapping ecosystem services trade-offs for sustainable forest management. *Ecology and Society*, 18(3): 34(1-21).
Grieg-Gan, M., Guijt, I., & Peutalo, B. (2002). "Local perspectives on forest values in Papua New Guinea: The scope for participatory methods." London: IIED.
Groleau, D., Zelkowitz, P., & Cabral, I. E. (2009). Enhancing generalizability: moving from an intimate to a political voice. *Qualitative Health Research*, *19*(3), 416-426.
Guest G. (2002). Market Integration and the Distribution of Ecological Knowledge within an Ecuadorian Fishing Community. *Journal of Ecological Anthropology*, 6(1): 38–49.
Guthiga, P., & Newsham, A. (2011). Meteorologists meeting rainmakers: indigenous knowledge and climate policy processes in Kenya. *IDS Bulletin*, *42*(3), 104-109.
Gwiriri, L. C., Bennett, J., Mapiye, C., Marandure, T., & Burbi, S. (2019). Constraints to the sustainability of a 'systematized' approach to livestock marketing amongst smallholder cattle producers in South Africa*, International Journal of Agricultural Sustainability*, *17*(2), 189–204.
Hartwig, M. (2011). Bhaskar's critique of the philosophical discourse of modernity. *Journal of Critical Realism, 10*(4), 485–510.
Heal, G., Barbier, E. B., Boyle, K. J., Covich, A., Gloss, S. P., Hershner, C. H., Hoehn, J. P.,

Pringle, C. M., Polasky, S., Segerson, K., & Shrader-Frechette, K. (2005). *Valuing ecosystem services: Towards better environmental decision making*. Washington DC: National Academies Press.

Hein, L., Van Koppen, K., De Groot, R. S., & Van Ierland, E. C. (2006). Spatial scales, stakeholders and the valuation of ecosystem services. *Ecological Economics*, *57*(2), 209-228.

Hendricks, F. T. (1989). Loose planning and rapid resettlement: the politics of conservation and control in Transkei, South Africa, 1950–1970. *Journal of Southern African Studies*, *15*(2), 306-325.

Hickey, F. R. (2006). Traditional marine resource management in Vanuatu: Acknowledging, supporting and strengthening indigenous management systems. *SPC Traditional Marine Resource Management and Knowledge Information Bulletin*, *20*(11), 11-23.

Hoffman, T., & Ashwell, A. (2001). *Nature divided: Land degradation in South Africa*. Cape Town: University of Cape Town Press.

Hoagland, S. J. (2017). Integrating traditional ecological knowledge with western science for optimal natural resource management. *IK: Other Ways of Knowing, 3*(1), 1-15.

Huesemann, M. H. (2001). Can pollution problems be effectively solved by environmental science and technology? An analysis of critical limitations. *Ecological Economics*, *37*(2), 271–287.

INDEX, M. T. (2004). Convention on biological diversity. *Science*, *279*, 860-863.

Iniesta-Arandia, I., Del Amo, D. G., García-Nieto, A. P., Pineiro, C., Montes, C., & Martín-López, B. (2015). Factors influencing local ecological knowledge maintenance in Mediterranean watersheds: Insights for environmental policies. *Ambio*, *44*(4), 285-296.

Israel, G. D. (1992). "Determining sample size". Fact Sheet PEOD-6. Florida Cooperative Extension Service, University of Florida.

Ivankova, N. V., Creswell, J. W., & Stick, S. L. (2006). Using mixed methods sequential explanatory design: From theory to practice. *Field Methods*, *18*(1), 3–20.

Jackson, S., Storrs, M., & Morrison, J. (2005). Recognition of aboriginal rights, interests and values in river research and management: Perspectives from northern Australia. *Ecological Management and Restoration*, *6*(2), 105–110.

Jackson, S. (2004). "Preliminary report on aboriginal perspectives on land-use and water management in the Daly River region, Northern Territory." Darwin: CSIRO.

Jacobs, S., Dendoncker, N., Martín-López, B., Barton, D. N., Gómez-Baggethun, E., Boeraeve, F., … & Washbourne, C. L. (2016). A new valuation school: Integrating diverse values of nature in resources and land use decisions. *Ecosystems, 22*, 213–220.

Jacobs, S., Martín-López, B., Barton, D. N., Dunford, R., Harrison, P. A., Kelemen, E., ... & Kopperoinen, L. (2018). The means determine the end–pursuing integrated valuation in practice. *Ecosystem services*, *29*, 515-528.

Kakembo, V., & Rowntree, K. M. (2003). The relationship between land use and soil erosion in the communal lands near Peddie Town, Eastern Cape, South Africa. *Land Degradation & Development*, *14*(1), 39-49.

Kallis, G., Gómez-Baggethun, E., & Zografos, C. (2013). To value or not to value? That is not the question. *Ecological Economics*, *94*, 97-105.

Kallis, G., Gómez-Baggethun, E., & Zografos, C. (2015). The limits of monetization in valuing the environment A reply to Gsottbauer et al. *Ecological Economics*, *112*, 170-173.

Kapfudzaruwa, F., & Sowman, M. (2009). Is there a role for traditional governance systems in South Africa's new water management regime?. *Water SA*, *35*(5), 683-692.

Keay-Bright, J., & Boardman, J. (2006). Changes in the distribution of degraded land over time in the central Karoo, South Africa. *Catena (Giessen)*, *67*(1), 1-14.

Kepe, T. (2009). Shaped by race: Why "race" still matters in the challenges facing biodiversity conservation in Africa? *Local Environment*, *14*(9), 871–878.
Kosoy, N., & Corbera, E. (2010). Payments for ecosystem services as commodity fetishism. *Ecological Economics*, *69*(6), 1228–1236.
LaDuke W. (1994). Traditional ecological knowledge and environmental futures. *Colorado Journal of International Environmental Law and Policy*, *5*(127), 127-148.
Laforest, B. J., Hébert, J. S., Obbard, M. E., & Thiemann, G. W. (2018). Traditional ecological knowledge of polar bears in the northern eeyou marine region, québec, canada. *Arctic*, *71*(1), 40-58.
Lamarque, P., Quetier, F., & Lavorel, S. (2011). The diversity of the ecosystem services concept and its implications for their assessment and management. *Comptes Rendus Biologies*, *334*(5-6), 441-449.
Le Maitre, D. C., van Wilgen, B. W., Gelderblom, C. M., Bailey, C., Chapman, R. A., & Nel, J. A. (2002). Invasive alien trees and water resources in South Africa: case studies of the costs and benefits of management. *Forest Ecology and Management*, *160*(1-3), 143-159.
Lebel, L. (2013). Local knowledge and adaptation to climate change in natural resource-based societies of the Asia-Pacific. *Mitigation and Adaptation Strategies for Global Change*, *18*(7), 1057–1076.
Loeb, S., Dynarski, S., McFarland, D., Morris, P., Reardon, S., & Reber, S. (2017). Descriptive analysis in education: a guide for researchers. (NCEE 2017–4023). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance.
Levi-Strauss, C. (1966). *The savage mind.* Chicago: University of Chicago Press.
Lewan, L., & Söderqvist, T. (2002). Knowledge and recognition of ecosystem services among the general public in a drainage basin in Scania, Southern Sweden. *Ecological Economics*, *42*(3), 459–467.
Limburg, K. E., O'Neill, R. V., Costanza, R., & Farber, S. (2002). Complex systems and valuation. *Ecological Economics*, *41*(3), 409-420.
Losey, J. E., & Vaughan, M. (2006). The economic value of ecological services provided by insects. *Bioscience*, *56*(4), 311-323.
Lyons, R., Tooth, S., & Duller, G. A. T. (2013). Chronology and controls of donga (gully) formation in the upper Blood River catchment, KwaZulu-Natal, South Africa: Evidence for a climatic driver of erosion. *The Holocene*, *23*(12), 1875–1887.
Mamdani, M. (2018). *Citizen and Subject: Contemporary Africa and the Legacy of Late Colonialism.* Princeton: Princeton University Press.
Mander, M. (1998). *Marketing of indigenous medicinal plants in South Africa: A case study of KwaZulu-Natal*. Rome: Food and Agricultural Organization.
Mantzavinos, C. (Spring 2020 Edn.)."Hermeneutics", *The Stanford Encyclopedia of Philosophy*,Edward Zalta (ed.).
Maxwell, J. (2012). *A realist approach for qualitative research.* Los Angeles: SAGE.
Mazzochi, F. (2006). Western science and traditional knowledge: despite their variations, different form so knowledge can learn from each other. *Ambio Reports, 7*(5), 463-466.
McAllister, P. A. (2001). *Building the homestead: Agriculture, labour and beer in South Africa's Transkei*. London: Routledge.
McCarter, J., & Gavin, M. C. (2014). Local perceptions of changes in traditional ecological knowledge: a case study from Malekula Island, Vanuatu. *Ambio*, *43*(3), 288-296.
McGregor, D. (2014). Traditional knowledge and water governance: The ethic of responsibility. *Alternative*, *10*(5), 493–507.
McKean, M. A. (1996). "Common property: What is it, what is it good for, and what makes

it work? Forest, Trees and People Programme." Phase II Working Paper: FAO.
Millennium Ecosystem Assessment (MEA) (2005). "*Introduction and conceptual framework. Ecosystems and human wellbeing: A framework for assessment."* Washington, DC: Millennium Ecosystem Assessment, p 26–48.
Meer, T., & Campbell, G. (2003). *"Traditional leadership in democratic South Africa."* Durban: Democracy Development Programme.
Menton, M. C., Lawrence, A., Merry, F., & Brown, N. D. (2010). Estimating natural resource harvests: Conjectures?. *Ecological Economics*, *69*(6), 1330-1335.
Menzies R & Butler C. (2006). Introduction: Understanding Ecological Knowledge. In *Traditional ecological knowledge and natural resource management,* Menzies, C (ed.), pp 1–20. Lincoln and London: University of Nebraska Press.
Merriam, S. B & Tisdell, E. J. (2016). *Qualitative research: A guide to design and implementation* (4th ed.). San Francisco: Jossey-Bass.
Miles, M. B., Huberman, A. M., & Saldana, J. (2014). *Qualitative data analysis: A methods sourcebook* (3rd ed.). Thousand Oaks, CA: Sage.
Misco, T. (2007). The frustrations of reader generalizability and grounded theory: Alternative considerations for transferability. *Journal of Research Practice*, *3*(1), 1-11.
Moller, H., Berkes, F., Lyver, P. O. B., & Kislalioglu, M. (2004). Combining science and traditional ecological knowledge: monitoring populations for co-management. *Ecology and Society*, *9*(3), 1-15.
Mooney, H., & Ehrlich, P. (1997). Ecosystem services: A fragmentary history. In *Nature's services: Societal dependence on natural ecosystems*, Daily, G. (ed.), pp. 11–22. Washington DC: Island Press.
Morey L. (2014). "*Introduction to statistics and biometry*". Pretoria: Tshwane University of Technology.
Mucina, L., Hoare, D. B., Lotter, M. C., Du Preez, P. J., Rutherford, M. C., Scott-Shaw, C. R., Bredenkamp, G. J., Powrie, L.W., Scott, L., Camp, G. T., Cilliers, S. S., Bezuidenhout, H., Mostert, T. H., Siebert, S. J., Winter, P. J. D., Burrows, J. E., Dobson, L., Ward, R. A., Stalmans, M., Oliver, E. G. H., Siebert, F., Schmidt, E., Kobisi, K., & Kose, L. (2006). Grassland biome. In Mucina, L., & Rutherford, M. C. (Eds.), *The vegetation of South Africa, Lesotho and Swaziland* (349-431). South African National Biodiversity Institute: Pretoria.
Muniesi, F. (2012). A flank movement in the understanding of valuation. *Sociological Review*, *59*(2), 24–38.
Murata, C., Ndlovu, L., & Ganyani, L. (in press). Demystifying contemporary customary land tenure system(s) in legally plural Sub-Saharan Africa.
Murata, C. (2008). An examination of betterment planning: *The case of Gqumashe, Ciskei, South Africa, 1960-1994.* Honours dissertation, University of Fort Hare, South Africa.
Murata C. (2010). *Stone terracing for crop cultivation in Gogela settlement of the Transkei, Eastern Cape, South Africa.* MPhil. Dissertation, University of Fort Hare, South Africa.
Musavengane, R., & Leonard, L. (2019). When race and social equity matters in nature conservation in post-apartheid South Africa. *Conservation & Society*, *17*(2), 135-146.
Nel, J. G., & Alberts, R. (2018). Environmental management and environmental law in South Africa: An introduction. *In Environmental management in South Africa*, King, N. D., Strydom, H. A., & Retief, P. F. (eds.) (3rd edition), pp.1–54. Cape Town: Juta and Company (Pty) Ltd.
Newing, H. (2010). *Conducting research in conservation: Social science methods and practice*. London, UK: Routledge.
Ngara, R. (2013). Indigenous knowledge systems and the conservation of natural resources in the Shangwe community in Gokwe district, Zimbabwe. *International Journal of*

Asian Social Science, *3*(1), 20–28.
Nguyen, T. H., & Ross, A. (2017). Barriers and opportunities for the involvement of indigenous knowledge in water resources management in the Gam River Basin in north-east Vietnam. *Water Alternatives*, *10*(1), 134–159.
Niamir-Fuller, M. (1998). The resilience of pastoral herding in Sahelian Africa. In *Linking social and ecological systems: Management practices and social mechanisms for building resilience*, Berkes, F., & Folke, C. (eds.), pp. 250-284. Cambridge: Cambridge University Press.
Nompozolo, S. (2000). *An analysis of the characteristics and constraints of smallholder commercial farmers in the Transkei region, the Eastern Cape, South Africa*. Master's Dissertation, University of Fort Hare, South Africa
Norrie, A. (2010). *Dialectic and difference: Dialectical critical realism and the grounds of justice.* London and New York: Routledge.
North D. (1990). *Institutions: Institutional change and economic performance*. Cambridge: Cambridge University Press.
Norton, B. G. (2000). Biodiversity and environmental values: in search of a universal earth ethic. *Biodiversity & Conservation*, *9*(8), 1029-1044.
Ntsebeza, L. (2004). Democratic decentralisation and traditional authority: Dilemmas of land administration in rural South Africa. *The European Journal of Development Research*, *16*(1), 71-89.
Ntsebeza, L. (2008). Chiefs and the ANC in South Africa: The reconstruction of tradition? In *Land power and custom: Controversies generated by the South African Communal Land Act*, Claassens, A., & Cousins, B. (eds.), pp. 238–261. Cape Town: University of Cape Town Press.
Ohmagari K & Berkes F. (1997). Transmission of indigenous knowledge and bush skills among the Western James Bay Cree women of Subarctic Canada. *Human Ecology*, *25*(2), 197–222.
Ostrom, E. (2009). A general framework for analysing sustainability of social-ecological systems. *Science, 325*(5939), 419–422.
Oxford Advanced Learner's Dictionary. (2015). *International student's edition* (9th ed.). Oxford: Oxford University Press.
Palmer, A. R., & Bennett, J. E. (2013). Degradation of communal rangelands in South Africa: towards an improved understanding to inform policy. *African Journal of Range & Forage Science*, *30*(1-2), 57-63.
Pandeya, B., Buytaert, W., Zulkafli, Z., Karpouzoglou, T., Mao, F., & Hannah, D. M. (2016). A comparative analysis of ecosystem services valuation approaches for application at the local scale and in data scarce regions. *Ecosystem Services*, *22*, 250-259.
Partelow, S. (2018). A review of the social-ecological systems framework. *Ecology and Society*, *23*(4), 1-25.
Patton MQ. (1985). *Quality in qualitative research: Methodological principles and recent developments.* Paper presented at the invited address to division J of the American Educational Research Association, Chicago, IL (April).
Pearce, P., Ford, J., Willox, A. C., & Smit, B. (2015). Inuit traditional ecological knowledge (TEK), subsistence hunting and adaptation to climate change in the Canadian Arctic. *Arctic, 68*(2), 233–245.
Pejchar, L., & Mooney, H. A. (2009). Invasive species, ecosystem services and human wellbeing. *Trends in Ecology and Evolution*, *24*(9), 497–504.
Pieroni, A., Quave, C. L., & Santoro, R. F. (2004). Folk pharmaceutical knowledge in the territory of the Dolomiti Lucane, inland southern Italy. *Journal of Ethnopharmacology*, *95*(2-3), 373-384.

Pilgrim, S. E., Cullen, L. C., Smith, D. J., & Pretty, J. (2008). Traditional ecological knowledge is lost in wealthier economies and communities. *Environmental Science and Technology*, *42*(4), 1004–1009.

Polit, D. F., & Beck, C. T. (2010). Generalization in quantitative and qualitative research: Myths and strategies. *International Journal of Nursing Studies*, *47*(11), 1451-1458.

Price, L. (2016). Using retroduction to address wicked problems. In *Crisis systems: A critical realist and environmental critique of economics and the economy,* Naess, P., & Price, L. (eds.), pp, 18–39. New York: Routledge.

Prior, L. (2003). Belief, knowledge and expertise: the emergence of the lay expert in medical sociology. *Sociology of Health and Illness*, *25*(3), 41-57.

Pritchard, D. (2006). *What is this thing called knowledge?* London: Routledge.

Ray, I. D. (1996). Divided sovereignty: Traditional authority and the state in Ghana. *Journal of Legal Pluralism and Unofficial Law*, *37*(38), 181–202.

Republic of South Africa (RSA). (1996). *Constitution of the Republic of South Africa (18 of 1996).* Pretoria: Government Printers.

Republic of South Africa (RSA). (1998). *White Paper on Local Government. Department of Provincial and Local Government.* Pretoria: Government Printers.

Republic of South Africa (RSA). (2003). *White Paper on Traditional Leadership and Governance. Department of Provincial and Local Government*. Pretoria: Government Printers.

Republic of South Africa (RSA). (2004). *A comprehensive plan for the development of integrated sustainable human settlements. Department of Human Settlements*. Pretoria: Government Printers.

Reyers, B., O'Farrell, P. J., Cowling, R. M., Egoh, B. N., Le Maitre, D. C., & Vlok, J. H. (2009). Ecosystem services, land-cover change, and stakeholders: finding a sustainable foothold for a semiarid biodiversity hotspot. *Ecology and Society*, *14*(1), 1-23.

Reyes-García V, Guèze M, Luz AC, Paneque-Gálvez J, Macía MJ, Orta-Martínez M, Pino J, Rubio-Campillo X. (2013). Evidence of traditional knowledge loss among a contemporary indigenous society. *Evolution and Human Behavior*, 34: 249–257.

Reyes-Garca, V., Vadez, V., Byron, E., Apaza, L., Leonard, W., Perez, E., & Wilkie, D. (2005). Market economy and the loss of folk knowledge of plant uses: Estimates from the Tsimane'of the Bolivian Amazon. *Current Anthropology*, *46*(4), 651-656.

Ring, I., Hansjürgens, B., Elmqvist, T., Wittmer, H., & Sukhdev, P. (2010). Challenges in framing the economics of ecosystems and biodiversity: the TEEB initiative. *Current Opinion in Environmental Sustainability*, *2*(1-2), 15-26.

Rodríguez, L. C., Pascual, U., & Niemeyer, H. M. (2006). Local identification and valuation of ecosystem goods and services from Opuntia scrublands of Ayacucho, Peru. *Ecological Economics*, *57*(1), 30-44.

Roscoe, J. T. (1975). *Fundamental research statistics for the behavioral sciences* (2nd ed.). New York: Holt Rinehart and Winston.

Rose, E. F., & Guillarmod, A. J. (1973). Plants gathered as foodstuffs by the Transkeian peoples. *South African Medical Journal*, *47*(8), 1688–1690.

Sadler, G. R., Lee, H. C., Lim, R. S. H., & Fullerton, J. (2010). Recruitment of hard-to-reach population subgroups via adaptations of the snowball sampling strategy. *Nursing and Health Sciences*, *12*(3), 369-374.

Saldana, J. (2014). *The coding manual for qualitative researchers* (2nd ed.). Los Angeles: Sage.

Sayer, A. (2000). *Realism and social science*. London: Sage Publications.

Saylor, C. R., Alsharif, A. K., & Torres, H. (2017). The importance of traditional ecological knowledge in agroecological systems in Peru. *International Journal of Biodiversity*

Science, Ecosystem Services and Management, *13*(1), 150–161.
Schoemaker, P. J. (1995). Scenario planning: A tool for strategic thinking. *Sloan Management Review*, *36*(2), 25-50.
Schröter, M., Van der Zanden, E. H., van Oudenhoven, A. P., Remme, R. P., Serna-Chavez, H. M., De Groot, R. S., & Opdam, P. (2014). Ecosystem services as a contested concept: a synthesis of critique and counter-arguments. *Conservation Letters*, *7*(6), 514-523.
Scorer, C., Mantel, S. K., & Palmer, A. R. (2019). Do abandoned farmlands promote spread of invasive alien plants? Change detection analysis of black wattle in montane grasslands of the Eastern Cape. *South African Geographical Journal*, *101*(1), 36-50.
Semali, L. M., & Kincheloe, J. L. (1999). What is indigenous knowledge and why we should study it? In *What is indigenous knowledge? Voices from the academy*, Semali, L. M & Kincheloe, J. L. (eds.), pp. 3–57. New York: Falmer Press.
Shackleton, R., Shackleton, C., Shackleton, S., & Gambiza, J. (2013). Deagrarianisation and forest revegetation in a biodiversity hotspot on the Wild Coast, South Africa. *PloS One*, *8*(10), 1-12.
Shackleton, C. M., Ruwanza, S., Sinasson Sanni, G. K., Bennett, S., De Lacy, P., Modipa, R., Mtati, N., Sachikonye, M., & Thondhlana, G. (2016). Unpacking Pandora's Box: Understanding and categorising ecosystem disservices for environmental management and human wellbeing. *Ecosystems*, *19*, 587–600.
Shanley, P., Galvão, J., & Luz, L. (1997). Limits and strengths of local participation: A case study in eastern Amazonia. *PLA NOTES*, 27, 64-67.
Shava, S (2000). *The use of indigenous plants as food by a rural community in the Eastern Cape; An educational exploration*. Masters Dissertation, Rhodes University, South Africa.
Shiva, V. (2000). Foreword: Cultural diversity and the politics of knowledge. In Deil, G. J. S., Hall, B. L., & Rosenberg, D. G. (Eds.) *Indigenous knowledges in global contexts: Multiple realities of our world* (vii-x). Toronto: University of Toronto Press.
Sillitoe, P. (2017). Indigenous knowledge and natural resource management: An introduction featuring wildlife. In Sillitoe, P. (Ed.) *Indigenous knowledge: Enhancing its contribution to natural resources management* (1–14). UK: Oxfordshire.
Sklar, R. (1986). Democracy in Africa. In Chabal, P. (Ed.), *Political domination in Africa: Reflections on the limits of power* (17–29). Cambridge: Cambridge University Press.
Small, N., Munday, M., & Durance, I. (2017). The challenge of valuing ecosystem services that have no material benefits. *Global Environmental Change*, *44*, 57-67.
Smith, E. A., & Wishnie, M. (2000). Conservation and subsistence in small-scale societies. *Annual Review of Anthropology*, *29*(1), 493-524
Sobahle, WM. (1982). *Agricultural practices in the Ciskei with emphasis on the human factor.* Master's Dissertation, University of Fort Hare, South Africa.
Springett, J., Owens, C., & Callaghan, J. (2007). The challenge of combining 'lay' knowledge with 'evidence-based' practice in health promotion: Fag ends smoking cessation service. *Critical Public Health, 17*(3), 243–256.
Stacey, M. (1994). The power of lay knowledge: A personal view. In Popay, J., & Williams, G. (Eds.), *Researching the people's health (*85–98). London: Routledge.
Statistics South Africa. (2016). Community survey. Statistical release P0301. http://cs2016.statssa.gov.za/wp-content/uploads/2016/07/NT-30-06-2016-RELEASEfor-CS-2016-_Statistical-releas_1-July-2016.pdf [2February 2019].
Stirling, A. (2010). Keep it complex. *Nature*, *468*(7327), 1029-1031.
Swallow, B. M., Kallesoe, M. F., Iftikhar, U. A., van Noordwijk, M., Bracer, C., Scherr, S. J., ... & Mallee, H. (2009). Compensation and rewards for environmental services in the developing world: framing pan-tropical analysis and comparison. *Ecology and*

Society, *14*(2), 1-10.
Tamanaha, B. Z. (1993). The folly of the 'social scientific 'concept of legal pluralism. *Journal of Law and Society*, *20*(2), 192-217.
Teddlie, C., & Tashakkori, A. (2003). Major issues and controversies in the use of mixed methods in the social and behavioral sciences. In Teddlie, C., & Tashakkori, A(Eds.) *Handbook of mixed methods in social and behavioral research (*3–50). Thousand Oaks, CA: Sage Publications.
TEEB The Economics of Ecosystems and Biodiversity. (2010). 'The Economics of Ecosystems and Biodiversity', Ecosystems. http://www.teebweb.org/ [21 May 2018].
Tengö, M., Brondizio, E. S., Elmqvist, T., Malmer, P., & Spierenburg, M. (2014). Connecting diverse knowledge systems for enhanced ecosystem governance: the multiple evidence base approach. *Ambio*, *43*(5), 579-591.
Tengö, M., Johansson, K., Rakotondrasoa, F., Lundberg, J., Andriamaherilala, J. A., Rakotoarisoa, J. A., & Elmqvist, T. (2007). Taboos and forest governance: informal protection of hot spot dry forest in southern Madagascar. *AMBIO: A Journal of the Human Environment*, *36*(8), 683-691.
Thondhlana, G. (2011). *Dryland conservation areas, indigenous people, livelihoods and natural resource values in South Africa. The case of Kgalagadi Transfrontier Park*. PhD Thesis, Department of Environmental Science, Rhodes University.
Thondhlana, G., & Shackleton, S. (2015). Cultural values of natural resources among the San people neighbouring Kgalagadi Transfrontier Park, South Africa. *Local Environment*, *20*(1), 18-33.
Tinsely S. (2001). *Environmental management plans demystified: A guide to implementing ISO14001*. London: Spon Press.
Turnbull D. (2000). *Masons, tricksters, and cartographers: Comparative studies in the sociology of scientific and indigenous knowledge*. Amsterdam: Harwood Academic.
Turner, N. J., & Turner, K. L. (2008). "Where our women used to get the food": cumulative effects and loss of ethnobotanical knowledge and practice; case study from coastal British Columbia. *Botany*, *86*(2), 103-115.
Turner, N. J., Ignace, M. B., & Ignace, R. (2000). Traditional ecological knowledge and wisdom of aboriginal peoples in British Columbia. *Ecological Applications*, *10*(5), 1275-1287.
Turpie, J. K., Marais, C., & Blignaut, J. N. (2008). The working for water programme: Evolution of a payments for ecosystem services mechanism that addresses both poverty and ecosystem service delivery in South Africa. *Ecological Economics*, *65*(4), 788-798.
Van Averbeke, W. (2003). *Optimising soil water use in the central Eastern Cape*. Unpublished draft, COSA, Technikon Pretoria.
Van Wilgen, B. W., Cowling, R. M., & Burgers, C. J. (1996). Valuation of ecosystem services. *BioScience*, *46*(3), 184-189.
Vanacker, V., Govers, G., Loaiza, G., Dercon, G. J., Deckers, J. A., & Poesen, J. (2000). Influence of land use changes on the intensification of gully erosion in a semi-arid mountainous environment. In *International Symposium on Gully Erosion under Global Change, Date: 2000/04/16-2000/04/19, Location: KU Leuven, Leuven, Belgium.*
Vatn, A. (2005). Rationality, institutions and environmental policy. *Ecological Economics*, *55*(2), 203-217.
Vatn, A. (2000). The environment as a commodity. *Environmental Values, 9*(4), 493–509.
Vinyeta, K., & Lynn, K. (2013). "Exploring the role of traditional ecological knowledge in climate change initiatives." *General Technical Report PNW-GTR*-879: 1–37.
Von Benda-Beckmann, F. (2002). Who's afraid of legal pluralism?. *The Journal of Legal Pluralism and Unofficial Law*, *34*(47), 37-82.

Voulvoulis, N., & Burgman, M. A. (2019). The contrasting roles of science and technology in environmental challenges. *Critical Reviews in Environmental Science and Technology*, *49*(12), 1079–1106.

Wallace, K. J. (2006). A decision framework for natural resource management: a case study using plant introductions. *Australian Journal of Experimental Agriculture*, *46*(11), 1397-1405.

Wallace, K. J. (2007). Classification of ecosystem services: problems and solutions. *Biological Conservation*, *139*(3-4), 235-246.

Wallace, K. (2008). Ecosystem services: Multiple classifications or confusion?. *Biological Conservation*, *2*(141), 353-354.

Weiss, K., Hamann, M., & Marsh, H. (2013). Bridging knowledges: Understanding and applying indigenous and western scientific knowledge for marine wildlife management. *Society and Natural Resources*, *26*(3), 285-302.

World Commission on Environment and Development (WCED). 1987. *Our common future*. Oxford and New York: Oxford University Press.

Wotshela, L. (2004). Territorial manipulation in apartheid South Africa: Resettlement, tribal politics and the making of the northern Ciskei, 1975–1990. *Journal of Southern African Studies*, *30*(2), 317–337.

Wynn Jr, D., & Williams, C. K. (2012). Principles for conducting critical realist case study research in information systems. *MIS Quarterly*, 787-810.

Yin, R. K. (2014). *Case study research: Design and methods* (5th ed.). Thousand Oaks, CA: Sage.

Zukulu, S., Dold, T., Abbott, T., Raimondo, D. (2012). *Medicinal and Charm Plants of Pondoland.* Pretoria: South African National Biodiversity Institute.