

**Biodiversity conservation and rural livelihoods across four nature reserves in the Eastern Cape Province, South Africa: Striving towards a balance between livelihoods and conservation**

By

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## **DECLARATION**

I declare that this is my original work and has not been presented for a degree or any other purpose in any other university. Where references to other people's work are made, acknowledgements are duly done.

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D Angwenyi

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## ABSTRACT

The realisation that biodiversity is being lost at alarming rates, and that intact ecosystems are essential for ecological functioning and sustenance of human life, has led to biodiversity taking centre stage in national and international agencies' environmental talks agendas. Protected areas are viable option to stem biodiversity loss. However, the establishment of protected areas might have negative impacts on communities living adjacent to them, leading to poor relations and frequent conflicts between these communities and the managers of protected areas.

The Eastern Cape Province has twenty-one nature reserves and three national parks. Since the province is rural, the assumption was likelihood that households in the province depended on natural resources, specifically non-timber forest products for their day-to-day needs. Therefore, it was hypothesised that conserving natural resources, was likely to negatively impact on the livelihoods of most households adjacent to these areas, which in turn would influence their perceptions towards these resources and eventually the effectiveness of conservation efforts.

This study aimed at examining the relationship between biodiversity conservation and rural livelihoods in the Eastern Cape Province, South Africa, focusing on four nature reserves – Tsolwana, Hluleka, Mkambati and Great Fish River. The objectives of the study were to:

- I. Compare the vegetation productivity inside and outside, as well as land cover change in four nature reserves, as an indicator of conservation effectiveness.
- II. Evaluate the relationship between biodiversity conservation and livelihoods in four nature reserves.
- III. Evaluate how people's expectations of nature reserves and perceptions towards nature reserve influence their support of conservation activities.

Four hundred semi-structured questionnaires were administered to household heads of communities living at various distances from the four nature reserves, using a gradient design (based on distance). The motive of using distance was to assess whether livelihood status varied with distance from the nature reserves, since data on livelihood before the reserves' establishment could not be obtained. Through a

questionnaire survey, data on demographic information, livelihood assets, livelihood activities, livelihood strategies, livelihood trends, and impacts of the reserves on local communities were gathered. Focus group interviews were also conducted to complement the household surveys. A chi-square test was used to test if there was a relationship between distance from the reserves' boundaries and local communities' state of livelihoods. NVivo was used to analyse qualitative data. Themes substantiated using literature.

The study finds that the reserves did not have any impact on livelihood assets because most households in the study area did not directly depend on the resources found in the reserves. These households depended mostly on government grants and remittances from relatives working in other areas in the country. The reserves, however, supplied some goods and services to local communities, including meat, jobs, water, building materials, security from wild animals, education, skills development, and recreation. There were also a number of negative impacts associated with the reserves including resource use restrictions, harassment by reserves management, killing of domestic animals, and attacks on humans by wild animals escaping from the reserve.

The majority (60%) of locals had substantive knowledge of the reserves' role because of this awareness, 79% were supportive of reserves. However, there were mixed views by locals on the best way to manage these reserves. The most dominant view was that natural resources should be preserved for future generations, while meeting the current generation's livelihood needs. Other lesser views included that the reserves' management should involve locals in the management structures, either as active members or through consultation. Similarly, there were people feeling that the reserve is an obstacle to their livelihoods and should be closed and the land returned to the rightful owners.

The vegetation productivity was better inside as compared to the outside the reserves. This activity also improved in the sixteen (16) years under assessment. This implies that the ecological functionality of the reserves is better than the surrounding areas and is improving with time.

The research recommended that local communities could be an asset in conservation since most of them were in favour of the reserves. This, however, will need reserve managers to form workable partnerships with these communities, where the rights and responsibilities for both parties are defined. Besides these partnerships, lease agreements between local communities and reserves management to enhance benefits to the communities could encourage local communities to take pride in the natural resources within the reserves. This will ultimately become stewards to these resources. Development of tourism infrastructure such as curio shops and convenience stores to enhance livelihood opportunities could also help. For the local communities to be well represented it is important that the committees representing them in the various reserve matters be expanded and democratically elected. Where necessary, community awareness programmes on the importance of the reserves and the roles of local communities should be implemented.

# DEDICATION

This thesis is dedicated to my family (my wife Fhumulani Perseverance Angwenyi and my sons Christopher Aming'a Angwenyi and Zablou Oyaró Angwenyi).

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# CHAPTER 1

## GENERAL INTRODUCTION

### 1.1 INTRODUCTION

For decades protected areas have been the cornerstones of protecting biological resources and systems (Liu *et al.*, 2010; Mutanga *et al.*, 2015; Hummel *et al.*, 2019). Intact ecosystems deliver a set of goods and services that are important for ecological functions, and ultimately sustaining human life (Palacios-Agundes *et al.*, 2015; Hummel *et al.*, 2019). According to Mackenzie (2012) ecosystems also have regeneration services which include cycling and filtration services and translocation services. Mackenzie (2012) goes on to say that ecosystems stabilize climate, moderate weather extremes, regulate hydrological cycle, maintain coastal and river channel stability, compensate and substitute species when environment vary, and control pests. Ecosystems also provide life-fulfilling services like provision of aesthetic beauty, cultural, intellectual and spiritual inspiration, serenity, scientific discovery, and existence, and maintain ecological components and systems needed for the future, as well as supply of goods and services awaiting discovery).

Coad *et al.* (2008), Ferraro *et al.* (2011), Stolton *et al.* (2015) and Russi *et al.* (2016) identify a number of benefits that local communities can derive from protected areas including: 1) increase in wealth, 2) provision and improvement of infrastructure (physical, social, economic and health), 3) revitalisation of cultural institutions, 4) improvement of governance, 5) enhancement of assets, 6) increased food security, 7) diversification of livelihood options, 8) empowerment of women, 9) increasing community resilience to shocks, 10) increasing opportunities for communities to participate in natural resources management, and 11) enhanced community organisation.

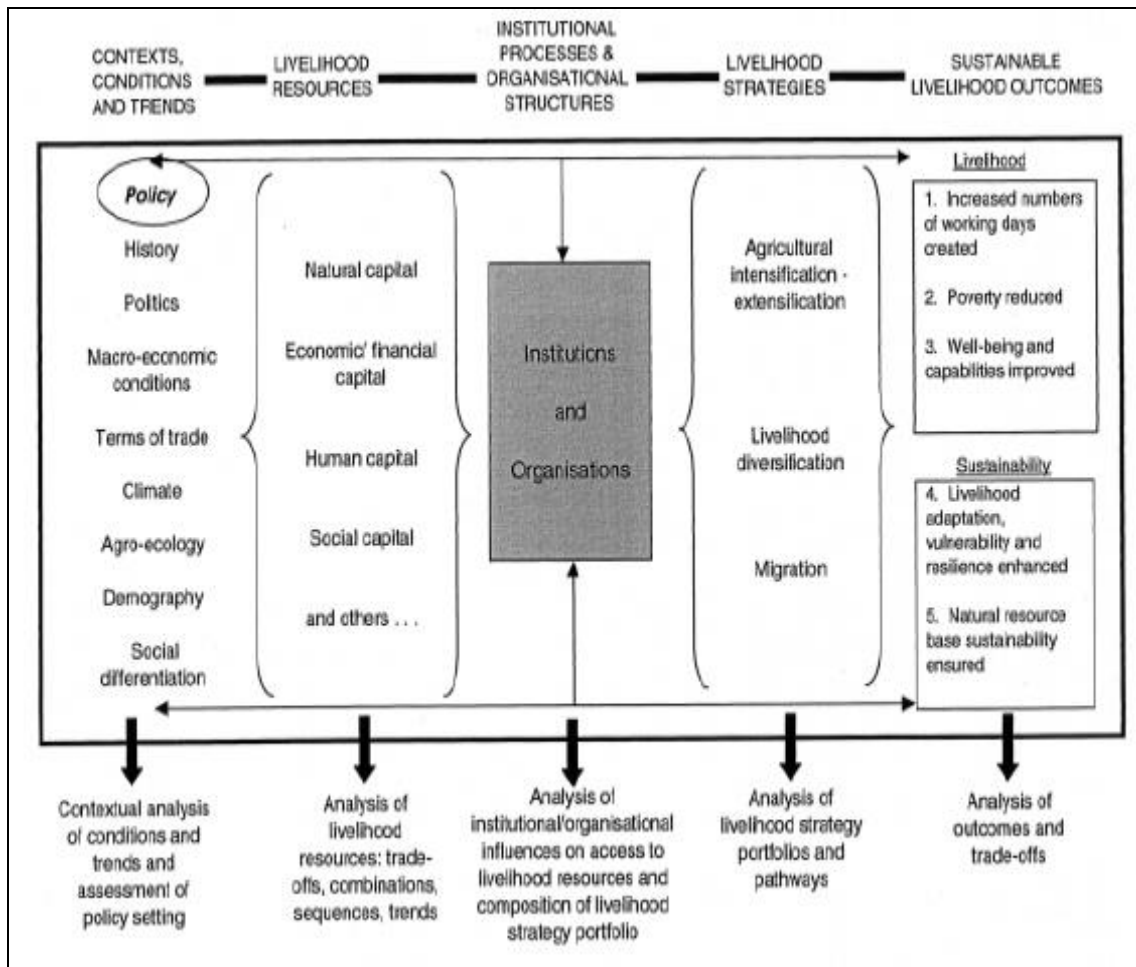
The world's biodiversity is disappearing at an unprecedented rate (Coad *et al.*, 2015; Brown *et al.*, 2018). A key driver of biodiversity loss is habitat damage (Wuwer and Attuquayefio, 2006) through human activities such as slash and burn agriculture (Gaston, 2005), overstocking resulting in overgrazing (The Royal Society, 2003), hunting (Liu *et al.*, 2010), deforestation (Cardillo, 2006), and poorly managed afforestation programmes (Hull *et al.*, 2011).

Depletion of biodiversity could endanger the functioning of ecological systems and hence render them unable to provide the necessary ecosystem services (Quijas and Balvanera, 2013; Dudley *et al.*, 2016). The realisation that biodiversity is being lost at an alarming rate (Hull *et al.*, 2011) and that intact ecosystems are essential for ecological functioning of ecosystems and sustaining human life (Ezebilo and Mattson, 2010) has led to biodiversity conservation taking centre stage in most national and international agencies' agendas. Therefore, protected areas are a viable option to stem biodiversity loss.

Between 1872, when the Yellowstone National Park was established, and the 1960s nature was viewed as having an intrinsic value independent of its value to people and was saved as an unspoiled wilderness (Andrade and Rhodes, 2012). In this period people were removed from areas designated for conservation, and economic development controlled so as not to be in conflict with natural systems (Andrade and Rhodes, 2012). Because of this view, many protected areas (PAs) have followed the conventional and exclusionary approach applied at Yellowstone in 1872 (Mutekwa and Gambiza, 2017). However, many have failed to integrate social, cultural and political issues, triggering adverse social impacts on local communities, disrupting their traditional ways of living, and limiting their control of and access to natural resources (Berkes, 2007; Liu *et al.*, 2010; Andrade and Rhodes, 2012). After the 1960s, the negative impacts that protected areas had on surrounding local communities were gradually recognised, and conservation agencies slowly started to consider the needs of local communities in the planning and management of protected areas (Cernea and Schmidt-Soltau, 2008).

In order to understand how protected areas impact on the livelihoods of those living around them, an assessment of the different capitals that underpin livelihood at the level of the individual, household, village or group is conducted using the Sustainable Livelihoods Framework (Figure 1.1). The Sustainable Livelihoods Framework was developed by Chambers and Conway in 1991. Through assessing the capitals, the vulnerability of an individual, a household, a village or a group in relation to shocks and the institutional context within which they exist can be established (Solesbury, 2003). Sustainable Livelihoods Framework captures and provides a means of understanding the fundamental causes and dimensions of any policy or programme

without collapsing the focus onto just a few factors (e.g. economic issues, food security, etc.).



**Figure 1.1: Sustainable Livelihoods Framework (Scoones, 1998 Adopted by Solesbury, 2003).**

While protected areas impact on people’s livelihoods, the key question that every social ecologist is likely to ask is whether these areas are conserving what they are supposed to conserve. It is on this basis that the following research aim and objectives are constructed.

## 1.2 GENERAL AIM AND OBJECTIVES

### 1.2.1 Aim

This study aimed to examine the relationship between biodiversity conservation and livelihoods and local communities’ views and perceptions of protected areas in the Eastern Cape Province, South Africa.

### **1.2.2 Objectives**

The general objectives of this study were to:

- IV. Compare the vegetation productivity inside and outside, as well as land cover change in four nature reserves, as an indicator of conservation effectiveness.
- V. Evaluate the relationship between biodiversity conservation and livelihoods in four nature reserves.
- VI. Evaluate how people's expectations of nature reserves and perceptions towards the nature reserves influence their support of conservation activities.

### **1.3 GENERAL RESEARCH QUESTIONS**

The Eastern Cape Province is the poorest province in South Africa (Statistics South Africa, 2012). For this reason, natural resources, specifically non-timber forest products play a crucial role in sustaining livelihoods (Mulenga *et al.*, 2012). The province is endowed with natural resources that are crucial for the ecological sustainability of the region, province, and country.

Conserving natural resources is likely to impact on people's livelihoods, which in turn will influence their perceptions towards these resources, and eventually the effectiveness of conservation efforts. The research attempted to answer the following questions:

- I. How does the vegetation productivity and land cover change inside the nature reserves compare to that in adjacent areas?
- II. What is the relationship between biodiversity conservation and people's livelihoods?
- III. How do people's expectations from the nature reserves as well as attitudes and perceptions towards the nature reserves influence their support of conservation activities?

### **1.4 GENERAL HYPOTHESES**

- I. Because people closer to the reserves have limited livelihood options compared to those far from the reserves, livelihood status will improve with increasing distance from the reserve boundaries.

- II. People closer to reserves depend more on natural resources from the reserves compared to those far from the reserves for their livelihoods, hence community expectations from the reserves will decrease with increasing distance from the reserve boundaries.
- III. Because of the conflicts that exist between local communities and protected areas, positive perceptions about nature reserves will strengthen with increasing distance, while negative perceptions will decrease with increasing distance from the reserve boundaries.
- IV. Because reserves are managed better than adjacent areas, the vegetation productivity inside the reserves is greater compared to adjacent areas.
- V. Because reserves are managed better than adjacent areas, land cover change inside the reserves will be minimal

## **1.5 SCOPE AND LIMITATIONS OF THE STUDY**

The scope of the study entailed assessing whether the management of the reserves in the Eastern Cape had any impacts on the livelihoods of those who lived adjacent to them. There are two types of protected areas in the province – privately owned and state-owned. There are no community-managed protected areas in the province. For the state-owned, the national parks are managed from the central government while the provincial authority manages the nature reserves. Of the state-owned protected areas, there are four (4) national parks and twenty-one (21) nature reserves in the province. There were fifty-four (54) privately owned reserves in the province. Initially the plan was to obtain a representation of the three categories of protected areas – national parks, provincial reserves and privately managed protected areas, but because of financial constraints, the research focussed on only four nature reserves – Great Fish River, Mkambati, Tsolwana, and Hluleka.

The effectiveness of the reserves in protecting biodiversity was based on analysing the vegetation productivity in the reserves using NDVI values derived from satellite images downloaded from the USGS website for summer 2000, 2008 and 2016. This analysis was supported or complimented by aerial photos and ground truthing.

## 1.6 OUTCOME OF THE RESEARCH

The findings from this research will be valuable to the Eastern Cape Parks and Tourism Authority and other conservation management agencies. The research will provide more insights into integrating livelihoods in conservation management in the province. Through this research a model of realising a win-win situation in conservation management was developed.

## 1.7 ORGANISATION OF THE THESIS

This thesis is in seven chapters. **Chapter 1** provides the background to conservation and livelihoods, general aim and objectives, research questions, hypotheses, assumptions and motivations. **Chapter 2** presents background literature. **Chapter 3** provides background information on the study area. **Chapter 4** presents how conservation of biodiversity in the province affects people's livelihoods. **Chapter 5** details how people's expectations of and perceptions towards protected areas influence their actions on conservation activities. **Chapter 6** provides a comparative assessment of the photosynthetic activity as a measure of conservation effectiveness of the four protected areas. Lastly, **Chapter 7** sums up the research and presents the way forward.

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## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 ROLE OF NATURAL RESOURCES IN RURAL LIVELIHOODS**

Natural resources and associated services play a critical role in the livelihoods of hundreds of millions of rural people (IUCN, 2008; Stolton *et al.*, 2015). Forests and their products, for example, are utilised by rural households on a day-to-day basis for food production (Roe *et al.*, 2009). De Merode *et al.* (2004) for example indicated that in the Democratic Republic of Congo, bush meat, fish, and wild plants contributed 3.1%, 6.2% and 9.6% respectively to the total value of food consumed in some households. Swemmer *et al.* (2017) established that communities around Kruger National Park, South Africa harvested mopane worms, thatch and medicinal plants from the park, and these are critical for their livelihoods. Natural resources can also be helpful during difficult times such as famine and floods (Fisher *et al.*, 2005).

Fisher *et al.* (2005) and Coad *et al.* (2008) argued that conservation of natural resources can have important benefits on rural livelihoods, such as providing food security in times of seasonal shortage (e.g. providing alternative foods and other resources) and in times of crisis (such as drought, crop failure or even market failure). In Mali and rural Ghana for example, households procured more wild foods during lean seasons (De Merode *et al.*, 2004). In addition, natural resources through the provision of income are also important for sustaining livelihoods (Shackleton *et al.*, 2008; Swemmer *et al.*, 2017).

Natural resources significantly assist rural households to realise most of their cash requirements, particularly in the most marginalised and vulnerable segments of society (Shackleton *et al.*, 2008; Russi *et al.*, 2016; Swemmer *et al.*, 2017). Forests for example supported living standards of the poor in Kenya through diversification of household income (Kabubo-Mariara, 2013). Shackleton *et al.* (2008) further stated that during weak economic conditions, households in most rural areas of developing countries turn to natural products for income generation. In some parts of the Democratic Republic of Congo for example, sales of fish comprised 39% of the total household income, while that of wild plants comprised 2% (De Merode *et al.*, 2004). According to Ros-Tonen and Wiersum (2003), the sedentary subsistence farmers of

southern Cameroon, on average, generated around 20% of their household income from the sale of game and Non-Timber Forest Products (NTFPs).

Other important services of natural resources include the following:

1. Sources of fodder for livestock, which provide primary subsistence and income (Sherr *et al.*, 2003)
2. Provision of medicines to most rural households (Coad *et al.*, 2008; Swemmer *et al.*, 2017). For example, research by Colchester *et al.* (2006) in Honduras and Nicaragua, determined that local communities relied on medicinal plants for their primary health care needs
3. According to Colchester *et al.* (2006), people use selected natural environments as sacred sites, and use wild resources for spiritual and religious purposes. For example, Cocks and Dold (2006) noted that in the Eastern Cape (South Africa) brooms were given to brides as wedding gifts.

Even though natural resources are important in sustaining people's livelihoods it cannot be assumed, that availability of a natural resource in an area automatically translates to improved livelihoods. A natural resource will be of value depending on the value attached to the resource in question. In most cases, the value of natural resources is a matter of societal and cultural values of an area. For example, bush meat in one area could be of livelihood importance but in another area, it is a taboo to eat bush meat. The type of resource, the prevailing culture of people, the education levels of people, people's occupation, the religion of people, as well as people's perceptions all influence whether a natural resource is useful or not.

## **2.2 THE NEGATIVE INFLUENCE OF PROTECTED AREAS ON SURROUNDING LOCAL COMMUNITIES**

The creation of protected areas has always excluded livelihood activities of surrounding communities (Adams and Hutton, 2007; Berkes, 2007; Coad *et al.*, 2008; and Chevallier and Harvey, 2016; Duana and Wenb, 2018; Pekor *et al.*, 2019). The researchers cited above stated that in most cases, when protected areas are established, people living in or adjacent to them are either relocated or restricted from accessing the resources found inside these areas, which they previously depended on for their daily needs. These researchers further noted that when this

happens, people are left homeless, jobless, economically and socially marginalised, exacerbating poverty levels. Thus, it is no wonder that Liu *et al.* (2010) stated that the establishment of protected areas could be detrimental to the livelihoods of local communities adjacent to them, especially in developing countries. Ward *et al.* (2018) found that in Madagascar the establishment of protected areas restricted local communities from collecting honey, cutting wood and goldmining. Such a restriction is seen as having negative effects on their livelihoods.

According to Dimitrakopoulos *et al.* (2010) as well as Franks and Small (2016), conservation aims are usually in conflict with local community expectations. Liu *et al.* (2010) remarked that the cause of these conflicts is that protected areas' policies ignore local people's interests, and exclude them from any planning, management and decision-making. This exclusion and the negative effects of conservation activities on adjacent communities' livelihoods inevitably lead to poaching and violent conflicts.

Ayivor *et al.* (2013), Snymann (2015) and Seoraj-Pillai and Pillay (2017) argued that conflict between protected area officials and local communities living close to protected areas involving disagreements and disputes over access to and control over resources is a major issue in nature conservation. These conflicts are as a result of constraints that protected areas impose on livelihood activities, and practices of local communities that directly or indirectly affect their livelihoods (Brandon *et al.*, 2005; Gaston *et al.*, 2008; Garcia-Frapolli *et al.*, 2009; Loveridge *et al.*, 2017; Sarker *et al.*, 2017; Green *et al.*, 2018). Ayivor *et al.* (2013) assert the following as a result of protected areas-community conflicts in Ghana; 1) a border dispute in Kyabobo National Park resulted in the tragic death of two wildlife officials, 2) a poacher in Bui National Park lost his life for resisting arrest and attacking a wildlife official, and 3) in Bui National Park local communities attacked wildlife officials and burnt down one of their camp sites. In Zambia damage of crops from wildlife interference is common and is a threat to food security among rural communities in or near Game Management Areas (GMAs) (Subakanya *et al.*, 2018). In early 2010, lions killed four people and over a hundred livestock in Mbire District of northern Zimbabwe (Matema and Andersson, 2015).

Ezebilo and Mattson (2010) stated that people living adjacent to protected areas usually pay dearly through death and injuries of community members and their livestock by wild animals escaping from protected areas. People around protected areas across Africa have suffered destruction of livelihood infrastructure (Bond and Mkutu, 2018). Cernea and Schmidt-Soltau (2008) identified crop damage, labour costs of crop defence, and physical hazard (and fear of hazard) as common around protected areas. Ezebilo and Mattson (2010) further established that cases of death of livestock and humans, stemming from escaped wild animals from protected areas, are common around protected areas. Pyhala *et al.* (2016) found that communities around several protected areas in the Congo basin suffered abuse and other human rights violations at the hands of park rangers, usually associated with aggressive anti-poaching policing. Farmers are threatened by elephants around Tanzania national parks (Chang'a *et al.*, 2016). Loss of lives and livelihoods resulting from predators is pronounced in Tsavo and Maasai Mara regions, Kenya (Makindi *et al.*, 2014; Mukeka *et al.*, 2018).

Animal raids particularly elephants and rodents on farms adjacent to protected areas in Ghana are sources of disenchantment between fringe communities and wildlife officials (Ayivor *et al.*, 2013). Ayivor *et al.* (2013), further stated that as a result of these wildlife escapes, farmers suffered economic losses but could not do anything because they were afraid of prosecution if they killed the raiding animals. This situation created antagonism between wildlife officials and local people, leading to mistrust, hatred and sometimes violent confrontations (Ayivor *et al.*, 2013).

Wild animals (for example wildebeest and buffaloes) harbour disease-causing vectors that cause diseases to domesticated animals (including malignant catarrh fever, foot and mouth disease and East Coast fever) (Melita and Medlinger, 2013; Makindi *et al.*, 2014). Melita and Medlinger (2013) discovered that the establishment of Ngorongoro Conservation Area (NCA) led to the number of livestock declining due to a combination of severe drought and diseases associated with the interaction between wildlife and livestock in the area. Livestock per head decreased (between 1959 and 1990) from 12:1 to 2:1 for cattle and from 18:1 to 6:1 for small stock (sheep and goats). Makindi *et al.* (2014) also found that in Tsavo Conservation area (TCA) buffaloes transmitted tick borne diseases (east coast fever, anaplasmosis and

babesiosis) to cattle while wildebeest passed malignant catarrh fever to livestock. Dar *et al.* (2009) found that in the Machiara National Park (Pakistan) leopards caused relatively large amounts of losses, with the percentage of livestock killed greater than the rate of restocking. Cases of impoundment of livestock, alleged by rangers to be grazing illegally, as well as fines for breaking regulations, have also been cited as some of the possible negative impacts that protected areas have on people living adjacent to them (Cernea and Schmidt-Soltau, 2008).

According to Bosak (2008) and Schott *et al.* (2016), when local people are alienated from livelihood resources (as can happen with the creation of protected areas), they are economically and socially marginalised. Ferraro *et al.* (2011) and Schott *et al.* (2016) noted that restricting access to natural resources for the poor creates new poverty traps or reinforces existing ones. For example, Qiu *et al.* (2009) in their study in China found that establishing protected marine areas along densely populated and in heavily used areas ignored the social context of conservation. Because these local coastal communities relied heavily on marine resources for their livelihoods, many were adversely affected by this exclusion approach, which resulted in them being economically marginalised.

In Indonesia for example, extraction of a wide range of forest products for subsistence and barter trade has been integral to the livelihoods of residents for many years. However, the establishment of protected areas has left these residents living with perpetual financial insecurity, resulting in them sustaining livelihoods by illegal means (Widianingsih *et al.*, 2016).

In another example, Mackenzie (2012) noted that relocated local communities around Kibale National Park (Uganda) lacked clean water, walked long distances to schools and hospitals, had poor roads, suffered illnesses, and were arrested and fined when perceived to trespass park boundaries. This is further illustrated by Himmelfarb (2006) who found that in Uganda's Mt. Elgon National Park, when people trespassed the park's boundary they were harassed, threatened, had their cattle impounded, raped (in the case of women), and in some cases killed. This, he noted, soured the relationship between park rangers and local communities. Mackenzie (2012) continued to state that although park managers granted some

communities limited access to specific resources such as bamboo and firewood within Mt Elgon National Park, the access did not meet people's needs and not everyone had this privilege.

When crops are damaged and livestock killed, people around protected areas face food shortages (Subakanya *et al.*, 2018). The gazetting of Ngorongoro/Serengeti ecosystem as a national park in 1940, for example, had devastating impacts on the livelihoods of the Maasai people. In 1975 all cultivations within the conservation area were prohibited and, because the Maasai depended upon local cultivators for crops, social ecological systems broke down leading to severe land degradation and loss of livelihoods as people lost their livestock due to disruption of grazing lifestyles and shortage of grazing pasture (Hughes, 2007). In another example, Mackenzie (2012) established that communities around Kibale National Park (Uganda) experienced increased food insecurity with hunger and malnutrition being the order of the day. Change of lifestyle through relocation also impact negatively on people's livelihoods. For example, the Ik people of Uganda, after being forcefully removed from their land to pave way for the establishment of the Kidepo National Park, abandoned their hunting and gathering tradition to adopt subsistence agriculture in barren neighbouring highlands. They subsequently suffered from prolonged famine leading to a total collapse of their society (Colchester, 2004). The relocation of the Basarwa and Bakgalagadi out of the Central Kalahari Game Reserve into Wildlife Management Areas in Botswana made people to travel long distances to get fuel wood and other crucial livelihood resources (Twyman, 2001). The establishment and management of the Ranomafana National Park in Madagascar restricted local communities' access to the parks' resources that they depended on for their livelihoods thereby diminishing their welfare (Ferraro, 2002). Sowman and Sunde (2018) found that the establishment of marine protected areas in South Africa contributed to food insecurity because of loss of tenure rights and access to natural resources.

This section has identified various negative effects associated with establishment of protected areas and these include: 1) exclusion from livelihood activities of surrounding communities leaving people homeless, jobless, economically and socially marginalised. Such an exclusion exacerbated poverty levels, 2) protected

areas' policies ignoring local people's interests and excluding them from any planning, management and decision-making leading to poaching and violent conflicts, 3) death of livestock and humans stemming from escaped wild animals from protected areas, 4) food shortages as a result of crop damage and killing and injuring of livestock and people around protected areas, and 5) change of lifestyle through relocation impacting negatively on people's livelihoods. As most of these issues are documented in literature, they are not well quantified and not linked to the socio-economic and cultural characteristics of communities living adjacent to protected areas. How the management of protected areas impacts the livelihoods of those living around it depends on whether or not their livelihoods are dependent on the resources found in these areas. In cases where the livelihoods of local communities are not linked to the resources in protected areas, the impacts are minimal if not non-existent. It is therefore not correct to generalise that the establishment and management of protected areas will have negative impacts on the livelihoods of communities living around them but rather each protected area should be analysed in context.

### **2.3 PROTECTED AREAS BENEFITS TO ADJACENT COMMUNITIES**

According to Coad *et al.* (2008) and Chevallier and Harvey (2016) the presence of protected areas in communities has several benefits to the locals. These include: 1) increase in wealth, 2) improvement of infrastructure (physical, social economic and health), 3) revitalisation of cultural institutions, 4) improvement of governance, 5) enhancement of household assets, 6) increased food security, 7) diversified livelihood options, 8) increased empowerment of women, 9) increased community resilience, 10) increased opportunities for communities to participate in natural resources management, and 11) enhanced community organisation. What benefits communities get, however, depends on the underlying relationship between local poverty and natural resource use (Bennett and Dearden, 2014; Chevallier and Harvey, 2016).

Protected areas have positive impacts that could lead local economies out of poverty traps by providing tourism business opportunities (Ferraro *et al.*, 2011; Serenari *et al.*, 2016; Mackenzie *et al.*, 2017). For example, the Gorilla Sanctuary in Congo Brazzaville through ecotourism generated revenue used to build a local health centre

and hire a health advisor. In the Royal Chitwan National Park in Nepal, a community user group was set up in 1996 to collect wildlife viewing fees that were used to set up biogas plants and operate a micro-credit scheme that provided loans to community members at low interest rates (Dudley *et al.*, 2008).

Revenue from tourism activities can enhance people's welfare. Ferraro *et al.* (2011) in their study in Costa Rica and Thailand found that the establishment of some protected areas reduced local poverty. Adams and Hutton (2007) argued that through tourism local people can receive a share of revenues from tourist fees and related economic activities (e.g. tourist facilities). Veldeld *et al.* (2012) noted that the Mikumi National Park (Tanzania) offered locals opportunities to sell handcrafts to tourists. Melita and Mendlinger (2013) established that 70% of the income of communities living around Ngorongoro Conservation area came from tourism related activities. In the Murchison Falls of Uganda, tourism activities improved the livelihoods of those living around it through employment, generation of income from tourism enterprises, revenue sharing, capacity building, improvement of health services and transport infrastructure (Mugizi *et al.*, 2018).

Protected areas can also earn local communities income through land leasing or licensing arrangements, community equity or profit-sharing schemes, or independent locally-owned commercial activities such as selling curios, food or cultural performances to tourists (Adams and Hutton, 2007; Brockington and Wilkie, 2015). For example, good management and sustainable harvesting of palms in Caprivi Game Park (Namibia) enabled local women to supplement household incomes by selling palm baskets to tourists (Ashley, 2000).

Conservation areas can create direct employment to local communities (Adams and Hutton, 2007; Serenari *et al.*, 2015). For example, in the Maya Biosphere Reserve in Guatemala, over 7000 jobs were directly created from the reserve (Dudley *et al.*, 2008). Dudley *et al.* (2008) also established that the Serengeti National Park created 395 jobs for local communities between 1993 and 2003. In the Okavango Delta System in Botswana, 923 people were employed in 30 tourist accommodation facilities in 2001, and an estimated 80% of the safari camps and lodges contributed 16.6% of the formal employment in the tourism sector in the same period (Dudley *et al.*, 2008). Mackenzie (2012) found that employment opportunities are not only

created inside protected areas, but also adjacent to it. Serenari *et al.* (2015) established that through ecotourism, communities around protected areas in Southern Chile experienced increased employment. Swemmer *et al.* (2017) found that the Kruger National Park through the Extended Public Works Programme (EPWP) and private concessionaires employed 7880 locals, mostly from the villages and towns around the park.

The presence of protected areas in a locality can improve the infrastructure of the surrounding areas (Canavire-Bacarreza and Hanauer, 2012; Swemmer *et al.*, 2017). Dudley *et al.* (2008) noted that in Lupande Game Management area (Zambia), Kisite and Mpunguti (Kenya), Bunaken National Park (Indonesia) and Selous Game Reserve (Tanzania), revenue earned from the protected area activities was distributed to village community projects like schools. Dudley *et al.* (2008) noted that the Serengeti National Park contributed US\$ 15,000 for construction, rehabilitation or maintenance of local infrastructure such as roads, between 1993 and 2003. In the Bwindi Impenetrable Forest National Park in Uganda, 60% of its operation funds went to community projects promoting conservation and development of feeder roads (Dudley *et al.*, 2008). Serenari *et al.* (2015) established that communities around protected areas in Southern Chile experienced improved infrastructure development and cultural renewal.

Ezebilo and Mattson (2010) investigated the benefits that accrued to local communities from a protected area around the Cross River National Park in Nigeria. Their study indicated that the park benefited local people through the provision of a bridge and a community hall. The research noted that these benefits were, however, not enough to compensate for the loss of non-timber forest products (NTFPs), and the attached cultural value to these products. People therefore valued NTFPs and cultural values they were getting from the park more than the services provided by the bridge and the community hall. Protected areas can provide land tenure security and resource pool protection-effect, as was the case in Cambodia (Clements *et al.*, 2014). Products cultivated or gathered in protected areas in Peru help reduce poverty and improve the lives of the people living in and around them (FAO, 2014).

As with the negative impacts, benefits accrued from protected areas are not quantified. Protected areas do not benefit adjacent communities equally. The benefits accrued to communities depend on the size of a protected area, the level of dependence of local communities on the resources from the protected areas, the number and types of programmes that are established and whether or not those programmes are targeting the local communities. The other important aspect that determines the level of benefit that local communities will get from protected areas is the structures in place for the sharing of benefits that accrue from these areas. Therefore, it cannot be correct to assume that protected areas benefit adjacent communities in the same way and scale. Benefits accrued from protected areas to local communities are context specific.

## **2.4 EFFECTS OF COMMUNITY PERCEPTIONS ON PROTECTED AREA MANAGEMENT**

Successful conservation initiatives require active participation of local communities in decision-making processes, as well as changes in perceptions in order to integrate local development with environmental conservation (Faasen and Watts, 2007; Amin *et al.*, 2015; Kioko *et al.*, 2015; Nastran, 2015; Mackenzie *et al.*, 2017; Mutanga *et al.*, 2017; Pekor *et al.*, 2019). Therefore, understanding and incorporating the views of local people in the process of decision-making, and providing alternative livelihood solutions are important steps towards successful conservation (Nana and Tchamadeu, 2014; Mir *et al.*, 2015; De Pourcq *et al.*, 2017; Mutanga *et al.*, 2017). According to Andrew-Essien and Bissong (2009), Andrade and Rhodes (2012), Thondhlana and Cundill (2017) and Yatesa *et al.* (2019), the success of conservation efforts lies in the ability of protected area managers reconciling biodiversity conservation goals with social and economic issues, and the promotion of greater compliance of local communities with protected area conservation strategies. Local communities are more likely to comply and to commit themselves to long-term conservation strategies when their knowledge and opinions are incorporated into protected area decision-making processes. Increasing benefits from protected areas and minimizing costs on fringe communities foster positive attitudes towards protected areas (Dewu and Roskat, 2017; Nguyen, 2019). However, removing local communities from lands they have been exploiting for generations without

consultation or adequate compensation and restricting them access to natural resources that are crucial for their livelihoods can result in retaliation and hostile attitudes toward protected area objectives (Andrade and Rhodes, 2012; Soliku and Schraml, 2018).

The establishment of the Nanda Devi Biosphere Reserve (India) and its Man and Biosphere policy failed because it was developed by national park authorities and international agencies with little involvement or input from local people (Maikhuri *et al.*, 2000; Bosak, 2008). Consequently, people turned against the reserve, logged a series of petitions. In 1998 they forced their entry into the core zone of the reserve to present a list of their demands, including full restoration of local rights and roles as guardians of Nanda Devi (Bosak, 2008). This happened because they could not get an acceptable response to their grievances from the authorities. Bosak (2008) further indicated that people vowed to continue to assert their rights to the core zone through forced entry until their case resolved.

State control of natural resources in southern India led to severe conflicts in 2004 between resource managers and the local people attempting to maintain their customary rights to resources. These conflicts disrupted local traditions of resource conservation resulting in people resenting these areas. Therefore, it is not surprising that local communities viewed conservation efforts with suspicion (Colchester, 2004).

Excluding people from the natural resources they depend on for their livelihoods was found to make people living around the Pendjari National Park (Benin) feel disadvantaged (Vodouhe *et al.*, 2008). The research by Vodouhe *et al.* (2008) established that in the minds of the local communities the central government had stolen their resources. This perception resulted in frequent conflicts between them and forest guards. A change in approach (including them in management and decision-making), and where local people benefited from the national park (in terms of getting medicinal plants, fruits, meat, and infrastructure) resulted in them appreciating conservation objectives (Vodouhe *et al.*, 2008).

Sekhar (2003) suggested that for protected areas to realise their goals, conservation policies should integrate sustainable use of natural resources by locals within protected areas. Sekhar (2003) further argued that doing this will encourage

communities living adjacent to protected areas to see the benefits of conservation, which in turn will lead to their support for conservation efforts. According to Ervin *et al.* (2010), if protected area practitioners and policy makers do not integrate protected areas into the broader landscape and operational strategies, neighbouring societies will not fully value the benefits and services provided by these areas, hence ending up not supporting activities relating to protected areas' management.

Research carried out in the Bamenda Highlands (Cameroon) established that incorporating livelihood programmes changed adjacent communities' attitudes and behaviours, making them more positively predisposed towards forest protection and the demarcation of forest boundaries (Thomas *et al.*, 2001).

In this section, it is explained that to be able to achieve effective conservation there is a need to incorporate livelihood needs of those living adjacent to protected areas into decisions that involve the management of these areas. It is, however, not as simple as that. Communities are heterogeneous in nature and, therefore, their interests in protected areas are diverse. Incorporating livelihood needs of those adjacent to protected areas without factoring in the heterogeneity of the communities living around these areas might not achieve sustainable management of these areas. Whether or not local communities support the existence and management of protected areas is dependent on how they perceive the existence and management of these areas. In most cases this is influenced by the relationship between the local communities and the protected areas' managers. Besides, the relationship between protected areas' managers and the surrounding communities, the socio-economic characteristics of local communities play a significant role on how local communities view protected areas. For example, the level of education may have a direct influence on how people view protection and so is the nature of dependency on resources in the protected areas. It is, therefore, not proper not to look at attitudes and perceptions of local communities adjacent to protected areas in the context in which a protected area is located.

## **2.5 FAILURE OF EXCLUSIONARY MANAGEMENT APPROACHES TO CONSERVE BIODIVERSITY**

Poor people depend on natural resources for their survival (Edmund *et al.*, 2002; Mackenzie *et al.*, 2017). According Mackenzie *et al.* (2017), while efforts are made by governments to conserve biodiversity, they have been unable to tackle the immediate problems of the poor for whom access to biodiversity is critical (Wilkie *et al.*, 2006). In developing countries, application of the top-down approach has been problematic, with many protected areas failing to achieve their objectives. This is mainly due to capacity deficits and incursions from local communities, resulting in unsustainable resource extraction, poaching, and sabotage (Lockwood, 2009).

Where exclusionary conservation approaches were implemented, it was at the expense of people living in and around protected areas resulting in amongst other things; alienation, exclusion, economic hardships, leading to conflicts between communities and protected areas authorities (Pyhala *et al.*, 2016). Thus, it can be concluded that inhibiting local people's access is impractical, unaffordable, and ethically questionable (Redford and Fern, 2007). For example, Hughes (2007) noted that the establishment of conservation activities in Maasailand (Kenya) resulted in traditional ecosystems breaking down leading to severe land degradation and socio-economic pressures. The report noted further that because the livelihoods of the Maasai were disrupted, many lodged land claims, either to get their land back or to receive some compensation.

The key question that may arise in this section is 'did all protected areas that adopted protectionist approach fail?' A scrutiny of this question might yield different results. There are several cases where protectionist approach to conservation necessary while in others is people-centred is the best and in other settings; a mixture of the two is warranted. Different protected areas demand different approaches to manage them depending on the prevailing socio-economic and environmental conditions where they find themselves in. For example, a protected area in a remote rural area where those living around it solely depend on it for their survival with no consideration of sustainable utilisation, may warrant some degree of restriction while providing communities with alternatives. On the other hand, a protected area in a community where those living around it acknowledge its

importance and are willing to live in harmony with it may best be managed with and by the local communities.

## **2.6 EFFECTIVENESS OF PROTECTED AREAS IN CONSERVING BIODIVERSITY**

Dudley *et al.* (2016) define effectiveness of a protected area in two-fold; 1) a protected area is effective if it conserves culturally adaptive wild biodiversity (ecological effectiveness) and 2) a protected area is effective if it works properly in conserving biodiversity (management effectiveness). Riggio *et al.* (2019) state that effectiveness can be assessed based on; 1) the extent to which protected areas conserve different vegetation, 2) the representativeness of endemism with protected areas, and 3) the extent of land conversion within protected areas.

Protected areas are a key tool to protect biodiversity, safeguard ecosystem health, and provide ecosystem services, livelihoods and sustenance to local communities (Lee and Abdullah, 2019). Saura *et al.* (2019) argue that well designed and managed PA systems can effectively safeguard species and ecosystems and deliver essential ecosystem services to people. Due the importance that protected areas have, conservationists and protected area managers globally are spending millions every year in establishing and maintaining these areas (Lee and Abdullah, 2019). Terrestrial protected area coverage globally was 15% in 2015 (Barnes *et al.*, 2015) and is expected to increase to 17% by 2020 (Lee and Abdullah, 2019). Despite the expansion in coverage, studies have revealed that the design and coverage of protected areas are still inadequate in representing key biodiversity features. They are also insufficient in the management approach to address the threats and pressures facing biodiversity and have a low level of ecological integrity because of the increasing levels of environmental degradation (Barber *et al.*, 2012; Geldmann *et al.*, 2013; Barnes *et al.*, 2015; Assédé *et al.* 2018; Lee and Abdullah, 2019; Saura *et al.*, 2019).

The failure of PAs in conserving biodiversity is attributed to their management categorization has been developed based on international environmental organizations or conventions without seeking to understand their nature and purpose in relation to where they are established (Lee and Abdullah, 2019). Rodríguez–Olarte *et al.* (2011) established that most protected areas across the world are often set up based on available regional inventories of landscapes, biogeographic patterns

of terrestrial biota, or the need to protect populations of specific species without complete biogeographic records. This approach as Olarte *et al.* (2011) often led to the creation of protected areas that are later found to exclude important habitats and species, and thus limit their relevance for conservation, ultimately, rendering them ineffective. For most organisations, the increase in coverage of PAs are measures of protected areas effectiveness in biodiversity conservation (Lee and Abdullah, 2019). However, as Barnes *et al.* (2015) says, increasing the area under protection is not a perfect measure of effectiveness because conservation effectiveness of protected areas is influenced by various socio-ecological factors (Lee and Abdullah, 2019). According to Lee and Abdullah (2019), expansion of protected areas that only meet a conservation target or national commitment can possibly cause the displacement of agricultural development to areas of species diversity and perpetuate the insufficiency of threatened species protection.

Evaluation of a protected area's effectiveness is very crucial in maintaining long-term biodiversity conservation (Hockings *et al.*, 2006; Barnes *et al.*, 2015). At present, the evaluation of protected area conservation effectiveness mainly focuses on management aspects. Most evaluations emphasise the planning, implementation and outcome stages to reflect the achievement of the long-term conservation objectives, while the six elements used in the evaluation are context, planning, inputs, processes, outputs and outcomes (Lee and Abdullah, 2019).

Lee and Abdullah (2019) identified the tools that are used in the assessment of protected effectiveness including; 1) the WWF International – Rapid Assessment and Prioritisation of Protected Area Management (RAPPAM), 2) the Management Effectiveness Tracking Tool (METT), 3) UNESCO's Enhancing our Heritage (EoH) Toolkit and 4) The Nature Conservancy – Parks in Peril Scorecard. Besides these tools Lee and Abdullah (2019) also say that some assessments have used the degree of deforestation and land use changes assessment on the inside and outside of a protected area over space and time to assess protected area effectiveness. The other widely used approach that Lee and Abdullah (2019) identified involves the use of single index or multiple indices to aggregate the status of protected areas. Lee and Abdullah (2019) further state that most single index assessments emphasize issues related to land use changes, such as fragmentation, habitat loss and, species

richness and abundance. Lee and Abdullah (2019) further state that multiple indices assessments involve the use of composite indices, which is an aggregate of several single indices such as Karr's Index of Biological Integrity, the terrestrial index of the integrity (TIEI), the forest spatial integrity index, ecosystem sensitivity indices and the regional index of ecological integrity (RIEI). A composite index provides the status of protected areas in terms of representativeness of ecosystems, connectivity for wildlife movement, habitat suitability, species diversity and landscape composition (Lee and Abdullah, 2019). Lee and Abdullah (2019) conclude by saying most of assessments on protected areas effectiveness disregard social and economic aspects, further degrading the effectiveness of protected areas.

In order to correct deficiency in socio-ecological variables in protected areas effectiveness assessment policy planners, researchers and development agencies have resorted to impact evaluation (Lee and Abdullah, 2019). According to Lee and Abdullah (2019), impact evaluation is a more reliable approach because it is rigorous, evidence-based and emphasizes measuring the impact of protected areas relative to appropriate counterfactuals (i.e., the outcomes that would have occurred in the absence protection). It also believed that counterfactual comparison can show the actual outcome of the effects of protected areas. However, the data on counterfactuals are often non-existent, owing to cost, time, staff and expertise constraints, hindering the mainstreaming of impact evaluation within the conservation community (Lee and Abdullah, 2019).

Hockings *et al.* (2006) argued that studies on the effectiveness of protected areas and protected areas systems have been undertaken throughout the world, mostly based either on experience or site visits, without any rigorous approaches. Hockings *et al.* (2006) continued to note that initial rigorous work of protected area effectiveness assessment took place in Latin America (for example, in Brazil and Costa Rica), where the focus was on management processes and technical capacity. In contrast to the Latin American studies, Hockings *et al.* (2006) observed that studies which took place in the United Kingdom and Australia looked at the biological condition of protected areas. Hockings *et al.* (2006) furthermore argued that the weakness of all these studies is that they did not attempt to involve stakeholders in assessments or consider the social impacts of protected areas. Coad

*et al.* (2015) argued that despite considerable sections of the planet's land located within protected areas, biodiversity continues to decline. Mora and Sale (2011) compared the living planet index (the temporal change in the population size of 1686 vertebrate species worldwide) to the global temporal trend of the area covered by protected areas. They discovered that while the area of the Earth's land and ocean covered by protected areas has increased rapidly in the past few decades, both terrestrial and marine biodiversity experienced rapid declines in the same time span.

Effective conservation requires understanding and integration of cultural values and practices among communities adjacent to protected areas that support local livelihoods (Kioko *et al.*, 2015; Mamo, 2015). Andrade and Rhodes (2012) stated that if communities do not have incentives to support protected areas, they tend to object to any effort aimed at conserving biodiversity, and do not participate in any conservation activities. Andrade and Rhodes (2012) continued to argue that faulty designs, inefficient implementation of protected area policies as well as corrupt organisations play an important role in the poor outcomes of state-managed protected areas. They concluded by saying that these issues need to be addressed if conservation initiatives are to be effective. These views are shared by Redford and Fern (2007) who said that because of poor management many of the strict protection regimes in protected areas in the world's highest biodiversity areas are not working. According to Gutman (2001) even though conservation efforts have managed to: (1) increase the number and variety of protected areas, (2) enhanced visibility of conservation issues (nationally and internationally), (3) worked with communities, and (4) promoted national and international partnerships on conservation, several initiatives have not been able to come up with answers to address the pressing questions in the conservation-poverty nexus. Most forests (and associated biodiversity) are still disappearing at alarming rates, leaving more questions than answers about conservation effectiveness. After the United Nations Rio+20 Summit, according to Griggs *et al.* (2013), governments are under pressure to set sustainable development goals where the protection of the Earth's life support system and poverty reduction should be twin priorities. Griggs *et al.* (2013) argued that, for this to happen, proper policies and political support need to be in place. Griggs *et al.* (2013) further stated that there is a need to view the three pillars of sustainable development – economic, social and environmental – as a nested concept, rather

than viewing each in isolation. Gutman (2001) concluded that for conservation to be effective it should help rather than hinder poverty alleviation, and if the needs and concerns of the poor are not brought on board, conservation efforts will never succeed.

Hockings *et al.* (2006) argued that protected areas are only effective if they are able to protect the value they contain. Hayes (2006) noted that besides effectiveness assessment focusing on whether park policies are adequately protecting biodiversity, it should also look at the degree to which local communities are involved in decision-making processes and management responsibilities. According to Hayes (2006), by denying local people access to protected areas and by excluding them from decision-making processes in conservation, conservationists create tension between park managers and local communities, increase monitoring costs, and fail to benefit from valuable local knowledge and resource management systems. Involving communities can lead to insights that can aid conservationists to effectively manage protected areas. Furthermore, co-operation between protected areas management and adjacent communities can lead to co-production of conservation (Himley, 2009). This view is shared by Tomicevic *et al.* (2010) who proposed that in order to achieve effective conservation, state and environmental planners should involve local people in the management of protected areas. They further stated that protected areas' managers need to identify and promote social processes, which enable local communities to conserve and enhance biodiversity as part of their livelihood system.

Studies on the effectiveness of PAs in conserving wildlife reveal mixed results some suggesting that populations fare no better within protected areas compared to outside (Rodrigues *et al.*, 2004; Geldmann *et al.*, 2013; Barnes *et al.*, 2015). Notably African mammals, including predators and ungulates are suffering population declines (Craigie *et al.*, 2010). Bruner *et al.* (2001) found that parks were effective in conserving biodiversity. They further established that effectiveness of protected areas correlated with the density of the guards monitoring these areas, and probability of guards apprehending and sanctioning offenders. Rodríguez-Olarte *et al.* (2011) established that most protected areas in Venezuela had limited effectiveness for fish conservation because they were too small or included only

fragments of tributaries or drainages, or because they were located only in highland drainages where species diversity was minimal.

In this section it has been established that it is important that all protected area managers remember that managing protected areas as 'business as usual' does not provide a measure on how these areas are performing on the face of changing pressures. It is therefore of paramount importance that protected areas managers establish whether their efforts are yielding the required results. To be able to measure the results of their activities every protected area manager, therefore, must ask himself or herself 'does protected areas conserve what they are supposed to conserve?' Besides whether they are achieving their intended objectives, the big question is; what are the factors that influence the effectiveness of protected areas management? It is, therefore, of paramount importance for each protected area manager to assess whether its area is conserving what it is established to conserve. It cannot be assumed that all protected areas have failed to conserve what they are supposed to conserve.

## **2.7 INTEGRATING LIVELIHOODS IN BIODIVERSITY CONSERVATION THROUGH COMMUNITY BASED NATURAL RESOURCES MANAGEMENT**

The top-down approach to conservation has generally failed to protect wildlife as fully as intended and has brought hardship to local communities (Grimble and Laidlaw, 2002). This is because exclusion of local communities from most legal uses of wildlife leads to them paying the costs for conservation in the form of damaged crops and even human lives. Rural communities receive few legal benefits from wildlife (Redford and Fern, 2007). Exclusionary wildlife policies also provide few incentives for the sustainable use of wild animals, leading to local communities choosing to kill wildlife despite the restrictive legal codes (Mazosera *et al.*, 2006). In order to address the failures of the exclusionary approach to conservation from the mid-1980s, a community-based approach aimed at working closely with local people, drawing on their knowledge, and contributing to their livelihoods replaced the top-down approach (Grimble and Laidlaw, 2002). This is also in line with the Durban Accord of the fifth World Parks Congress in 2003 where governance, participation, equity and benefit sharing were central issues in conservation (Lockwood, 2009).

To address the hardships that local communities suffer as a result of the exclusionary approach to conservation, community-based natural resources management (CBNRM) was necessitated by the realisation that governments could not successfully and efficiently protect natural resources outside protected areas because they did not have adequate resources (Mazosera *et al.*, 2006; Hummel *et al.*, 2019). Since CBNRM enables communities to regain control over natural resources and strengthen their decision-making capabilities, advancing their involvement in project activities and improving their economic welfare, stimulates communities' interest in resource conservation. Involving local communities therefore improves their attitudes towards protected areas, which will consequently enhance local communities' self-reliance and livelihood sustainability (Andrade and Rhodes, 2012).

According to Blaikie (2006), CBNRM is preferred because it has several benefits to conservation. CBNRM: 1) is pro-poor and a safety net for the majority of rural inhabitants, especially in developing countries, 2) promotes efficient resource use and allocation, 3) use locally appropriate indigenous technical knowledge (ITK), 4) employs locally managed resource systems with clearly recognizable territorial boundaries which tend to internalize externalities (meaning that decision makers pay for the costs of their actions), 5) solve or minimize open access problems resulting from coercive and insufficiently policed state property regimes, 6) styled as a "local site of resistance," to de-humanizing invasions of the state and other external forces, 7) initiate a benign cycle of effective participation, empowerment and the development of political confidence and expertise, financial independence, as the fulcrum for democratic change, and 8) an antidote to the acknowledged failure of state-run natural resources, where the "fences and fines" approaches to wildlife protection have failed because of high economic costs for states to meet and the disenchantment associated with "fortress" conservation.

Decentralization of natural resource management makes local people feel a greater sense of ownership, thereby encouraging them to be more engaged in their management (Nygren, 2005; Chevallier and Milburn, 2015; Dudley *et al.*, 2016). Furthermore, decentralised resource management makes it easier for marginalised groups to influence environmental policies (Chevallier and Milburn, 2015).

Participation in decision making about the management of natural resources, however, requires a wide range of quite radical reforms, including transparency in transactions, accountability downwards, the granting of a considerable degree of local discretion over environmental decision-making, and a degree of competence, confidence and political sophistication by local institutions (Blaikie, 2006).

Community-based natural resource management has been widely practiced across the African continent. Examples include the conservancies of Namibia, the Administrative Management Design for Game Management Areas (ADMAGE) of Zambia, Zimbabwe's Communal Areas Management Programme for Indigenous Resources (CAMPFIRE), Integrated Conservation and Development Projects (ICDPs) in Uganda, public-private partnerships in Kenya, Rwanda and Tanzania. Other examples include community-based natural resource management in Botswana, decentralization in Malawi, transfer of forest ownership rights to local communities in Cameroon, Mali and Ghana, and co-management of forests in Ivory Coast. Their implementation, however, has had mixed results.

In the 1990s, the government of Namibia decided, with substantial input and financial support from non-governmental organizations (NGOs), to introduce CBNRM in an effort to conserve and use wildlife and other renewable living resources on communal land and promote tourism and rural economic development in communal areas (Boudreaux, 2007; Lubilo and Hebinck, 2019). With the introduction of CBNRM, residents on communal lands were required to form local organisations, defined by governing constitutions, membership, and land area, and apply to the government for user rights over the wildlife therein (Roe *et al.*, 2009). Before the conservancies were implemented, opportunities to diversify livelihoods were very limited and, aside from subsistence farming, there were few employment options for people. Finding work usually meant leaving the area (Boudreaux, 2007). The number of conservancies has since increased, with approximately fifty (50) in existence by 2007, covering 118,704 km<sup>2</sup> of land, generating millions in revenue from wildlife-based activities, such as tourism and tourist hunting and recovering wildlife populations, including rare species (black rhinos) and predators, such as lion (Roe *et al.*, 2009).

The Namibian CBNRM model worked particularly well because of various reasons: 1) the rights granted to communities over wildlife are relatively broad and secure, 2) there is no middle-man between communities and the private sector, 3) there is no local or state government tax on the revenue earned – 100% of benefits from wildlife are retained locally and, 4) the programme had a long history of development prior to the involvement of external actors and donors (Roe *et al.*, 2009; Galvin *et al.*, 2018).

Conservancies have had tremendous success in Namibia. Across northwest corner of the country animals like springbok, oryx, desert elephant, zebra, giraffe, lion, black rhino, and leopards returned to the areas (Boudreaux, 2007). The existence of animals gave local people opportunity to build businesses and create jobs that generated income, which ultimately improved their standards of living (Roe *et al.*, 2009). Many Namibians have built businesses based on eco-tourism and related activities that have helped to improve the lives of conservancy members (Boudreaux, 2007).

Boudreaux (2007) established that devolution of property rights in Namibia provided local people with positive incentives to protect and conserve the wildlife and other natural resources on their land and to find entrepreneurial ways to benefit from tourism. These incentives included: 1) entering into a joint venture with an experienced safari or lodge company to run a tourist lodge; 2) creating and operating a campsite; 3) contracting with a professional hunter for trophy hunting of some animals; 4) developing craft businesses; and 5) operating cultural or information centres. This yielded many benefits, including: 1) job creation, 2) development a variety of skills, 3) building local institutions, 4) building social capital and, 5) enhancing food security. These tangible and intangible benefits improved lives of the rural people and contributed to economic development.

Other important benefits that conservancies provided include legal access to meat through own-use hunting, the income from sale of animals, and income from trophy hunting. Conservancies typically distributed the meat from own-use hunts to local people to supplement household diets. Conservancies also kept some meat and distributed it to families when there were funerals, to traditional authorities when celebrations or ceremonies took place, or to conservancies holding their general meetings (Boudreaux, 2007). Conservancies also built and strengthened social

capital through 1) Strengthening household links with the broader community, 2) Strengthening the capacity of conservancy committee members to guide and lead others and, 3) Increasing and improving ties to the wider world (Boudreaux, 2007).

The Namibian CBNRM program, however, had some challenges, including; 1) Lack of legal right for conservancies to exclude unwanted/harmful outsiders, 2) a confused process for resolving conflicting land use claims and, 3) an institutional environment that imposes unnecessary costs on entrepreneurs and small businesses (Boudreaux, 2007).

Zambia introduced Community-based Natural Resource Management (CBNRM) projects in several rural areas. These projects attempted to combine both conservation and development initiatives into an integrated approach to promote rural development based on natural resources, as well as encouraging conservation awareness. CBNRM in Zambia was through a programme referred to as Administrative Management Design for Game Management Areas (ADMADE). The premise behind ADMADE was the recognition that wildlife was a resource critical for rural development, and that successful wildlife management required participation by local communities. Therefore, there was a need to shift from the colonial command and control philosophy of management to a more community-based approach in which local authorities are partners in wildlife decisions (Gibson and Marks, 1995). In the Bangweulu Wetland Park, Zambia, local communities were employed to notify park authorities of birds' nests in an effort to protect shoebill birds, which ended up being a successful partnership, as this threatened bird species was saved (Chevallier and Milburn, 2015).

Galvin *et al.* (2018), found that ADMADE projects improved the incomes of many local communities, reduced poaching, enhanced conservation of endangered species, and resulted in a number of development activities (i.e. grinding mill and storage shed). Additional benefits included an increase in employment, provision of meat from safaris to the locals, controlling problem animals, financial benefits, education (that enhanced the knowledge of the communities about wildlife, hence communities viewed wildlife as important, appreciated them and strived to conserve them), self-management and compensation. The Luangwa Integrated Resource Development Project (LIRDPA), one of the ADMADE projects, for example, reduced

elephant poaching by increasing the number of wildlife scouts and enhanced community interest on conservation because of revenue sharing (Gibson and Marks, 1995).

Galvin *et al.* (2018) established that, despite its successes, ADMADE projects had their challenges. Firstly, villagers resented the skewed distribution of ADMADE's economic goods because most of the projects were clustered around the chiefs' residences and as a result only chiefs' families and friends received jobs from ADMADE. Secondly, most culling operations failed to sell the subsidised meat away from the ADMADE unit headquarters as the bulk of the sales went to denizens of nearby towns, not the countryside. Thirdly, since chiefs had too much power community members had no say about hunting regulations, quotas, licenses or fees, and residents did not participate in either the negotiation or the approval process for safari concession leases. Fourthly, the programme suffered from lack of skilled personnel and poor implementation. Other failures that Wainwright and Wehrmeyer (1998) identified included; 1) many locals did not have a good understanding of the purpose of CBNRM projects due to low levels of interaction between project officials and local communities, 2) poor management, 3) lack of accountability (which made the misappropriation of funds easily possible) and, 4) community was not sufficiently involved in the decision-making process.

Pyhala *et al.* (2016) found that indigenous communities in the Congo basin had detailed ecological knowledge and traditional conservation practices, which could enhance conservation. Chevallier and Milburn (2015) found that in Odzala-Kokou National Park, Congo-Brazzaville, former poachers were trained to become co-guardians and eco-monitors to conduct wildlife research and monitoring. This helped park authorities with human expertise. The use of the poachers' knowledge was also helpful in improving conservation in the park.

Zimbabwe's Communal Areas Management Programme for Indigenous Resources (CAMPFIRE) sought to include locals and to devolve ownership of natural resources to the rural community (Gibson and Marks, 1995). Rihoy and Maguranyanga (2007) argued that CAMPFIRE activities generated substantial benefits. CAMPFIRE generated over \$20 million in revenues for local communities and district governments from 1989 to 2001, resulting in over 40,000 km<sup>2</sup> of communal land

being managed for wildlife production (Roe *et al.*, 2009). Gibson and Marks (1995) and Gavin *et al.* (2018) established that CAMPFIRE also provided community-level benefits, offered opportunities for local participation and increased enforcement through scouts. The programme also developed new social norms in the form of new understandings about the value of wildlife, in many local and professional communities (Pretty and Smith, 2009).

The extent to which the benefits from CAMPFIRE activities reached locals was questionable. This was because of common incidences of elites capturing benefits at a local level (Shackleton *et al.*, 2002; Rihoy and Maguranyanga, 2007; Matema and Andersson, 2015; Galvin *et al.*, 2018). This led to: 1) conflicts over resources, 2) increased tribal tension, and 3) confusion owing to the proliferation of institutions, such that it was unclear who did what (Larson and Soto, 2008). This further jeopardised conservation efforts. Consequently, in the Nyaminyami region for example, levels of local poaching increased (Gibson and Marks, 1995).

Public-private partnerships in natural resource management in Kenya's Laikipia District increased zebra numbers from an estimated 6,000 in the late 1960s to over 30,000 by the mid-1990s. Beside the increase in Zebra numbers, lions, hyenas and wild dogs returned to protected areas in 2000. Their numbers increased because of the development of a strong wildlife-based tourism industry, as well as private ranchers and local communities sitting aside land to conserve wildlife because of its economic benefits (Roe *et al.*, 2009). CBNRM projects in Naibunga Conservancy, Kenya, led to increased plant diversity redundancy because local communities supported conservation initiatives (Mureithi *et al.*, 2016).

A review of Integrated Conservation and Development Projects (ICDPs) in Uganda undertaken over a 15-year period around the Bwindi Impenetrable and Mgahinga Gorilla National Parks revealed that community attitudes towards the protected areas had improved dramatically between 1991 and 2003. This was because the operations of the Bwindi Trust Fund benefited from tourism and the sustainable agriculture programme promoted by CARE International (Roe *et al.*, 2009).

Malawi also instituted CBNRM projects to integrate development in natural resource management. Even though weak leadership, uneven participation, corruption, lack of

official recognition, absence of extension advice, failure to keep pace with other devolutionary measures implemented across other sectors, and inadequate income alternatives challenged the implementation of CBNRM in the country. Basing CBNRM initiatives on traditional values, beliefs and systems proved to be the pillar of success in all CBNRM initiatives (Blaikie, 2006).

Botswana introduced a number of CBNRM projects in the 1980s in order to: 1) initiate conservation strategies that are ecosystem in perspective and local in approach, including natural resource monitoring and management programmes to ensure species and ecosystem health, 2) provide opportunities for community participation and capacity for natural resource management, including their role concerning the management of forest reserves, national parks and game reserves, and 3) enhance economic and social development in rural areas by providing opportunities to qualified communities to reap benefits from the natural resource conservation (Phuthego and Chanda, 2004). In Botswana, prior to these programmes, most rural communities received little cash income from their natural resources (Lepper and Goebel, 2010). According to Selebe (2010), CBNRM projects in Botswana were based on 10 principles namely; 1) decision-making authority must be at community level, 2) decision-making must be representative, 3) the community must be as small as practical, 4) leadership must be accountable, 5) benefits must outweigh costs, 6) benefits must be distributed equitably, 7) benefits distribution must be linked to natural resources conservation, 8) planning and development must focus on capacity-building, 9) planning and development must be coordinated, and 10) CBNRM process must be facilitated.

The implementation of CBNRM in Botswana increased employment revenue that alleviated poverty and acted as a livelihood diversification strategy through the distribution of remittances. Income from ecotourism was also invested in various projects (Lepper and Goebel, 2010; Mbaiwa, 2015) that diversified employment where people were able to be employed and earned much needed incomes. Rihoy and Maguranyanga (2007) also established that community-based organisations (CBOs) offered important services for remote areas. For example, funds from CBNRM projects were used to operate grocery stores in their villages, provide vehicles for transportation, and provide financial and transport assistance to

community members in case of death. CBOs and their private sector partners also generated significant local employment. For example, community-based tourism at the Khama Rhino Sanctuary Trust became a very important source of employment for local communities, with the sanctuary employing locals in a variety of jobs, ranging from cleaners, drivers, and guides, amongst other. Rural areas in developing countries are often characterised by a shortage of facilities and industries and are inhabited by the poorest people in the society; therefore, earnings from community-based tourism created an alternative means of survival for locals (Selebe, 2010). Selebe (2010) further found that the Trust also contributed to local economic development where people who were employed used their wages to assist family members financially thereby improving their living conditions. Wages obtained from this CBNRM project (Khama Rhino Sanctuary Trust) were used for various activities including the payment of school fees, the buying of food and clothing and the construction of traditional dwellings/huts. CBNRM, therefore, became a livelihood strategy for rural dwellers, many of whom may not have had other alternatives in the rural areas.

CBNRM in Botswana, besides improving the livelihoods of local communities, enhanced conservation of biodiversity. For example, the Khama Rhino Sanctuary Trust was excellent in introducing rhino species in an area where they did not exist before (Selebe, 2010). Attitudes towards conservation improved, as was the case in Ngamiland where attitudes towards wildlife improved with the introduction of CBNRM (Rihoy and Maguranyanga, 2007).

Rihoy and Maguranyanga (2007) and Mbaiwa (2015) found that effective implementation of CBNRM in Botswana was hindered by several factors. These factors included; 1) the dominance of expatriate staff in CBNRM projects, 2) perception of CBNRM as an imported environmental paradigm by locals thereby compromising its relevance and legitimacy locally, 3) most projects especially those dominated by expatriates only served local elites at the expense of marginalised members of the community, 4) policy contradictions, for example, government efforts to boost economic growth and diversify the economy by focussing on the livestock sector at the expense of the wildlife and tourism sectors, 5) weak state of civil society, 6) in some cases, policy-making process was undertaken without

consultation, transparency or accountability, negatively affecting dialogue, public participation and engagement in policy-making debates, 7) policy vacuum which laid bare the implementation and operation of CBNRM to socio-economic and political manipulation and abuse, inconsistencies and accountability challenges, competition and conflicts between ministries and departments, and 8) financial decision-making powers and benefits handled by a small group of village elites rather than by community members in general, resulting in high levels of mismanagement, as well as misuse and abuse of the finances, and financial powers devolved to CBOs.

From mid 1990s Mozambique introduced several community-based natural resource management projects around protected areas, one of which was at the Derre Forest Reserve. Most of these projects did not yield the desired outcomes because there was no clear definition of the roles of traditional authorities and the central government. Lack of clear roles of the parties involved led to conflicts within the traditional institutions mainly due to power struggles and the perceived inefficiency of some of the chiefs. Issues related to access to education, health services, and market infrastructure were fundamentally lacking. Local people perceived the projects as being an elite movement affecting the involvement of the poorest members of the community, leaving the projects to be hijacked by the local elites (Nhantumbo, *et al.*, 2003).

Larson and Soto (2008) found that in order to address deforestation, Cameroon transferred forest ownership rights to local governments. The government further established community forest management structures in areas where communities had traditional rights. Because of structural weaknesses, however, bureaucrats and state authorities instead of benefiting the locals (Larson and Soto, 2008) captured benefits from these initiatives. These weaknesses led to revisions to the forestry law to enable community associations and cooperatives to acquire the exclusive rights to manage, and exploit up to 5,000 ha of customary forest under a 15-year contract resulting in the creation of over 100 new Community Forests. The revision of the law encouraged more involvement of village inhabitants in managing their forests so that they can reap more benefits from them. The formation of community forest associations through its community development fund brought development to villages – new houses for the communities were built, school fees were provided,

buying of generators to electrify village was installed, and emergency medical care was brought to the villagers (Roe *et al.*, 2009).

In Ghana, over 200,000 hectares of forest were demarcated under the Community Resource Management Area Policy of 2000. The policy gave participating communities full authority to control access and harvesting of resources within their management area. The approach delivered some success for conservation of natural resources through a reduction in illegal activities, increased social capital indicators because community members' perceptions of conservation were enhanced as they no longer resented resource management initiatives. Communities believed that conservation was working for the common good and most of them started supporting resource management initiatives (Roe *et al.*, 2009).

In an attempt to reduce the rate of deforestation in the Ivory Coast, the State Forest Department (SODEFOR) embarked on a forest co-management strategy in 1994 (Roe *et al.*, 2009). According to Roe *et al.* (2009), this strategy led to the establishment of Farmer Forest Committees within state owned forests, which were representatives within regional committees that decided on land use and management within the gazetted and state-owned forest. Roe *et al.* (2009) further established that through this strategy forests were divided into different zones, including an agricultural zone, where farmers are permitted to farm, but not to clear land. These zones were generally areas where villages are already in existence or forests were already severely degraded, and the allocation of these zones could involve the re-settlement of communities. Farmers were then offered 10-year leases on this land (Roe *et al.*, 2009).

In Rwanda, a venture between a community group and the private sector was launched close to the base of Mount Sabyinyo on the edge of the Park National des Volcans in 2007 (Roe *et al.*, 2009). According to Roe *et al.* (2009), SACOLA (Sabyinyo Community Lodge Association) opened a lodge and reserved the ownership rights but granted a 15-year lease to a private company to operate the business (a Kenyan company, Musiara Ltd). Roe *et al.* (2009) further established that the company paid SACOLA a bed-night fee of \$50 plus 7.5% of income. Between August 2007 and February 2008, SACOLA received US\$34,500. Other benefits from the agreement include employment with 70% of jobs filled by local

people. Furthermore, the hotel buys local produce from the community and supply services and attractions to tourists (Masozera *et al.*, 2006).

In Tanzania, more than 3.6 million hectares of forests and woodlands are managed as Village Land Forest Reserves entirely under the control of locally elected village governments, or as co-managed forests between villages and either local or central government (Roe *et al.*, 2009). Through co-management, a range of community-private tourism ventures emerged in the northern parts of Tanzania. Tour operators have entered into legal contracts with village councils, where tour operators are able to access village lands in exchange for set payments by the operator, and villages agreeing to set aside a concession area where they will not farm or settle. These agreements have maintained natural vegetation and prevented land use changes. Villagers also got direct benefits in terms of wildlife-based tourism revenues. For example, in 2007, seven villages in Loliondo Division adjacent to the Serengeti National Park earned over \$300,000 from private-village tourism agreements (Roe *et al.*, 2009).

Participatory Forest Management (PFM) in Tanzania led to positive outcomes, including; 1) improvements in water discharge and quality from PFM areas, 2) regeneration in degraded areas, 3) reduction in unregulated and unsustainable levels of harvesting (such as logging, charcoal production and hunting of game), 4) reduced incidences of fire, 5) reduced village revenue from fines due to reduction in illegal activities, 6) reduction in encroachment of agricultural land into forest areas, and 7) increases in game and wildlife numbers/diversity (Roe *et al.*, 2009).

Mali established a decentralisation natural resources management in Sowaa villages that led to slowing in the degradation of natural resources, notably concerning excessive logging and the erosion of agricultural soils (Roe *et al.*, 2009). According to Larson and Soto (2008) CBNRM in Mali was ineffective because; 1) the roles of the stakeholders (the state and local communities) were not well defined, 2) there was no participation criterion, and 3) most of the population was not organised around a fixed land area thus making the implementation of CBNRM practically impossible. The situation led to most of the populations resisting whatever CBNRM projects that was set up to accomplish.

To effectively link protected areas management to livelihoods of adjacent communities Scherl *et al.* (2004) proposed the following initiatives:

- (a) Improvement of the knowledge of the values of ecosystem services in poverty reduction.
- (b) Designing of management systems that permit certain subsistence activities in some categories of protected areas (IUCN, 2006), and provision of safety nets for poverty reduction strategies.
- (c) Making the local protected areas agencies more aware of poverty issues in order to ensure that their management activities do not inadvertently contribute to greater poverty.
- (d) Making finance and economic planning ministries aware of the values of protected areas so as to ensure that poverty reduction strategies do not lead to inappropriate activities in protected areas.
- (e) Ensuring that decisions about an individual protected area and its relationship with surrounding communities involve those communities as interested parties with clearly defined rights.
- (f) Providing access, under a permit system, to certain limited use of resources that are harvested in a non-destructive manner (such as medicinal plants, seeds or grass).
- (g) Providing goods, in the form of fish, birds and mammals that disperse out of the protected areas and are subsequently harvested by local communities outside the protected areas.
- (h) Providing opportunities to develop a tourism industry based on the protected area.
- (i) Providing access to infrastructure such as roads, electricity, improved communication and healthcare associated with supporting the protected area infrastructure.

To effectively link biodiversity conservation and livelihood objectives, Koziell and Saunders (2001) proposed the following ten principles as guidelines for governments, authorities and managers:

- 1) Use/establish participation mechanisms to bring conservation stakeholders together. Who articulates conservation values, who decides the goals for

conservation, and who gains the benefits are some of the critical issues that need to be addressed. In this regard Saunders (2001) proposes an approach that can be used to improve local stakeholders' access to conservation decisions by weighting them against:

- a) proximity to conservation areas,
  - b) dependence on conservation areas for livelihoods,
  - c) cultural linkages to conservation areas and uses of natural resources from these areas,
  - d) knowledge related to stewardship of conservation areas' assets,
  - e) existing rights to land and resources, under customary or common law,
  - f) organisational capacity for accountable decision-making on conservation,
  - g) economic viability of conservation areas based on environmental and social cost internalisation that brings equitable local benefits, and
  - h) power deficit that is seeking out those who currently have few means of influencing policy.
- 2) Adopt a transparent framework to handle the integration and trade-off of biodiversity and livelihood objectives.
  - 3) Aim to integrate conservation policies within the wider land use policy framework focussing on win-win options. Strive to avoid win-lose and lose-lose scenarios.
  - 4) Secure rights and responsibilities so that stakeholders can be both effective stewards of biodiversity and meet their livelihood needs.
  - 5) Establish standards for integrating biodiversity with other activities.
  - 6) Institute collaborative management.
  - 7) Implement adaptive approaches.
  - 8) Invest in scientific research and assessment of changing livelihood and biodiversity systems.
  - 9) Develop means to pay for local conservation activities that produce national and global benefits.
  - 10) Develop local capacities.

Integrating livelihood needs in protected area management has tangible benefits but also has its own pitfalls. It is, however, not enough to describe the benefits and costs of integrating livelihood needs in protected areas management without putting them in the context in which these benefits and costs occur. For example, merely

identifying and describing the jobs that are generated from protected areas management without looking into how much difference that it makes to the livelihoods of people is not enough. Assuming that integrating livelihood needs into protected areas management does not necessarily translate into support of protected areas management by local communities. Every effort that is implemented in the management of protected areas should be analysed in the context in which it is implemented. The communal dynamics that determine how costs and benefits are shared should first be assessed and understood before implementing any CBNRM initiative. The relationships that local communities have with natural resources should be at the centre of any CBNRM initiative if CBNRM initiatives are to succeed.

## **2.8 CONSERVATION IN SOUTH AFRICA**

The first official protected areas in South Africa were forest reserves of Knysna and Tsitsikamma, proclaimed in terms of the Cape Forest Act of 1888. These were followed by the establishment of the forest services in Natal in 1891 and in the Orange Free State (now known as Free State province) and Transvaal (now divided into the Gauteng, North West, Limpopo and Mpumalanga provinces) by 1903 (DEAT, 1997). According to DEAT (1997), also established during this time were the Pongola and Sabie Game Reserves in the Transvaal in 1894 and 1898 respectively, the Hluhluwe, Umfolozi and St. Lucia Game Reserves in Zululand in 1895, and the Giant's Castle in the Drakensburg (Natal) in 1903. The location of these areas was determined by the presence of tsetse flies and malaria, or areas where agricultural potential was poor (DEAT, 1997).

In 1926, the first National Parks Act was promulgated that changed the conservation paradigm (DEAT, 1997). Most protected areas were established in segregated homelands where people were seen as unnatural and ecologically unsound (Fabricius *et al.*, 2004). Establishment of protected areas was often accompanied by forced removals and resource dispossession among black people (Peterson, 2010). This aggravated existing poverty levels of the poor and marginalised communities in the affected areas (Rangarajan, 2003).

According to Sandwith *et al.* (2005), as well as Holmes-Watts and Watts (2008), South Africa has well-developed framework laws that promote the effective

participation of previously disadvantaged rural communities in the management and use of protected natural resources. These include:

- (a) National Environmental Management: Biodiversity Act (Act No. 10 of 2004) which provides for the preparation and adoption of a national biodiversity framework that will ensure an integrated, coordinated, and uniform approach to biodiversity management by organs of the state in all spheres of government, NGOs, the private sector, local communities, other stakeholders and the public.
- (b) The White Paper for Sustainable Forestry Development in South Africa which emphasizes the participation of forest and woodland-dependent communities in the management of state forests and woodlands.
- (c) The National Forestry Action Plan (NFAP) of 1997 and the National Forest Act (NFA) (No. 84 of 1998); both requiring that forests be developed and managed in ways that conserve biodiversity, ecosystems and habitats while simultaneously sustaining the supply of socio-economic and environmental benefits through the collaborative management of the Department of Water Affairs and Forestry (DWAF) and local communities.
- (d) The National Water Act (Act No. 36 of 1998) which promotes participatory management of South Africa's water resources.
- (e) The Communal Property Association Act (Act No. 28 of 1996) that enables communities to form juristic persons for holding and managing properties on the basis agreed to by members of a community.
- (f) Broad-Based Black Economic Empowerment Act (Act No. 53 of 2003) that enables Black people to control, manage and own natural resources.

Nelson *et al.* (2007) and Holmes-Watts and Watts (2008) argued that even though policies spell out participatory management, at grassroots level conservations officials do not heed these policy decisions. A vast majority of officials inappropriately consider nominal attendance of meetings by local people as active involvement in management. Many natural resources management officials tend to control access and decision-making power over natural resources and prefer rural communities to play passive roles (Holmes-Watts and Watts, 2008). Resource managers are, in most cases, selective when they administer the law – pay much attention to private

landowners but have little or no regard to rural communities' needs (Nelson *et al.*, 2007).

Conservation of biodiversity in South Africa has not been effective (Peterson, 2010). Peterson (2010) associated this with; 1) poor conservation planning, 2) exclusionary approach to conservation, 3) non-cooperative governance, 4) lack of public participation, 5) deficiencies in the management, and 6) insufficient funds to expand and properly manage protected area networks. He argued that prior to 2000, planning of protected areas was inadequate and many protected areas arose in an *ad hoc* manner, not ecologically representative, too small for meaningful conservation, managed in isolation from adjacent land uses/areas, and administrative boundaries did not coincide with ecological boundaries, undermining effective conservation.

In South Africa, since the 1980s, parks that are established on land owned privately, either by individuals or community groups, are managed as contractual parks in accordance with a joint management agreement (Roe *et al.*, 2009). These are devised by a board comprising representatives of both the landowners and the conservation authority. Roe *et al.* (2009) recommended that parks should; 1) create incentives to neighbouring landowners so as to bring their land into protect areas (PAs) without transfer of title (e.g. Addo Elephant National Park), 2) establish new PAs on community land (e.g. Richtersveld National Park), and 3) return title deeds to community groups formerly evicted to make way for the establishment of PAs (e.g. Makuleke land claim).

Roe *et al.* (2009) established that in the Richtersveld National Park, the residents receive land rent from SANParks which, is paid into a community trust. The Makuleke people reached an out of court settlement with the National Parks Board in 1996. This granted the transfer of title for 20,000 hectares of land back to community members who were evicted in 1969 when their land was incorporated into the Kruger National Park. Roe *et al.*, (2009) further established that the condition of the transfer was that conservation activities must continue on the land for 99 years, with no residence or agriculture. The land claim is managed under a Communal Property Association (CPA), established in 1999, which has leased the area to SANParks for fifty (50) years. All conservation activities are the responsibility of SANParks, while

the CPA has the rights to commercial and cultural activities in the area. These contractual parks have contributed to conservation objectives and provided landowners with considerably greater benefits than could have normally been available to park-adjacent communities (Roe *et al.*, 2009).

This section has highlighted that protected areas have existed in South Africa for quite some time. Through this period, establishment and management of protected areas have had their successes and failures. These successes and failures are however not quantified and put in context. The country has also undergone changes in the political landscape that have influenced how conservation management has been implemented. South Africa is also a country that is economically and socially divided, and this will always influence protected area design and management policies. For example, most areas in the former 'homelands' are highly populated and poverty-stricken. Consequently, most people from these areas are likely to highly depend on natural resources for their livelihoods hence they are likely to resent any efforts aimed at alienating them from the natural resources they depend on for their livelihoods. It is therefore important to understand and integrate the socio-economic and political dynamics in the country when describing protected area management. Through this, a true picture of protected area management will be presented.

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## **CHAPTER 3**

# **DESCRIPTION OF THE EASTERN CAPE PROVINCE AND STUDY SITES**

### **3.1 LOCATION AND SIZE**

The Eastern Cape Province occupies 13.9% of South Africa's land surface (Statistics South Africa, 2012). The province is located on the south-eastern seaboard of South Africa. It is bordered by the Indian Ocean on the eastern side, and by the southernmost extremities of the Drakensburg range on the north western side (Statistics South Africa, 2012). It shares borders with the Kingdom of Lesotho, and with provinces of the Free State, Northern Cape, Western Cape, and KwaZulu-Natal (Statistics South Africa, 2004). Administratively, the province is divided into six district municipalities (Oliver Tambo, Ukhahlamba, Alfred Nzo, Amatole, Chris Hani, and Western District (also referred to as Cacadu), one metro (Nelson Mandela), as well as several local municipalities (indicated in red) (Figure 3.1).



Figure 3.1: Eastern Cape Province ([www.ecdc.co.za](http://www.ecdc.co.za)).

### 3.2 CLIMATE

The Eastern Cape has a diverse climate in relation to rainfall and temperature. The province is comprised of 85% arid or semi-arid zones. Rainfall increases from west to east, and coastal areas are much wetter than inland areas. Most of the western half of the province receives about 400 mm of rain per annum, whereas the eastern part of the province is much wetter, with rainfall exceeding 1 000 mm towards the mountainous areas of Maclear and Mount Fletcher, as well as the coastal areas of the province ([www.weathersa.co.za](http://www.weathersa.co.za)).

There are four rainfall regimes in the Eastern Cape. The first is the summer rainfall, which is experienced throughout the northern and inland parts of the province ([www.weathersa.co.za](http://www.weathersa.co.za)). The second is a bimodal rainfall with early and late summer maxima. It is experienced in the coastal areas of the province and most areas south of a line running roughly east to west at the latitude of Mthatha. The third is a year-round rainfall which is experienced throughout the extreme west of the coast with early and late summer maxima. The coast on the extreme west receives year-round

rainfall. The last is a winter rainfall regime, which occurs throughout the headlands of Cape Recife and Cape St Francis ([www.weathersa.co.za](http://www.weathersa.co.za)).

Topography is the main factor influencing rainfall at local level. Orographic effects (lifting of air masses due to changes in the surface level of the earth) may cause differences of several hundred millimetres in the annual rainfall even over short distances ([www.weathersa.co.za](http://www.weathersa.co.za)).

Occasionally, hail occurs in the Eastern Cape. Hail intensity varies throughout the province relative to eastern and western areas. In the southwest of the province, hail may occur on average less than one day per year whereas in the northeast, hail may fall on average more than eight days per year ([www.weathersa.co.za](http://www.weathersa.co.za)).

The Eastern Cape has high irradiation for most of the year due to its latitude, which is between 30°S and 34°S. Differences in the degree of cloud cover result in differences in potential evapotranspiration. The areas of lowest potential evapotranspiration coincide with the areas of highest rainfall, and vice-versa. Potential evapotranspiration of about 1 250 mm per annum is experienced by high rainfall areas along the coast ([www.weathersa.co.za](http://www.weathersa.co.za)).

Frost duration increases with increasing altitude, and the period increases from south to north of the province ([www.weathersa.co.za](http://www.weathersa.co.za)). The north eastern mountains may experience frost duration of up to 120 days whereas the eastern coastal strip is frost-free. Frost is absent or occurs occasionally in the coastal districts during the colder months of June, July and August. The province experiences snow in winter in certain areas north of Cradock. The hottest months of the year are usually December, January and February when a temperature of 42.5°C and evaporation as high as 50% are not unusual. Certain areas of the province experience humid atmospheric conditions because of the prevailing winds and the sea mists ([www.weathersa.co.za](http://www.weathersa.co.za)).

### **3.3 TOPOGRAPHY**

The general topography of the Eastern Cape is steep. About a third of the province consists of mountain ranges with large differences in local relief (Kakembo *et al.*, 2009). Plateaus with medium to large differences in local relief cover just over half of

the area (53.3%). Only a small part consists of relatively level plains (11.0%) and river valleys (4.6%). The valleys are usually deeply incised, and the occurrence of level land of alluvial origin is generally limited and localised. Three altitude levels are found in the Eastern Cape, and all three are separated by two mountain ranges. The first level is the coastal plateau, which has an altitude of between 300 m and 500 m. The second level is the midland plateau with an altitude of about 1 000 m to 1 200 m. The last level is the highland plateau with an altitude of approximately 1 500 m. There is a third mountain range in the northern part of the Eastern Cape, namely the Drakensberg Mountains (Kakembo *et al.*, 2009).

### **3.4 GEOLOGY AND SOILS**

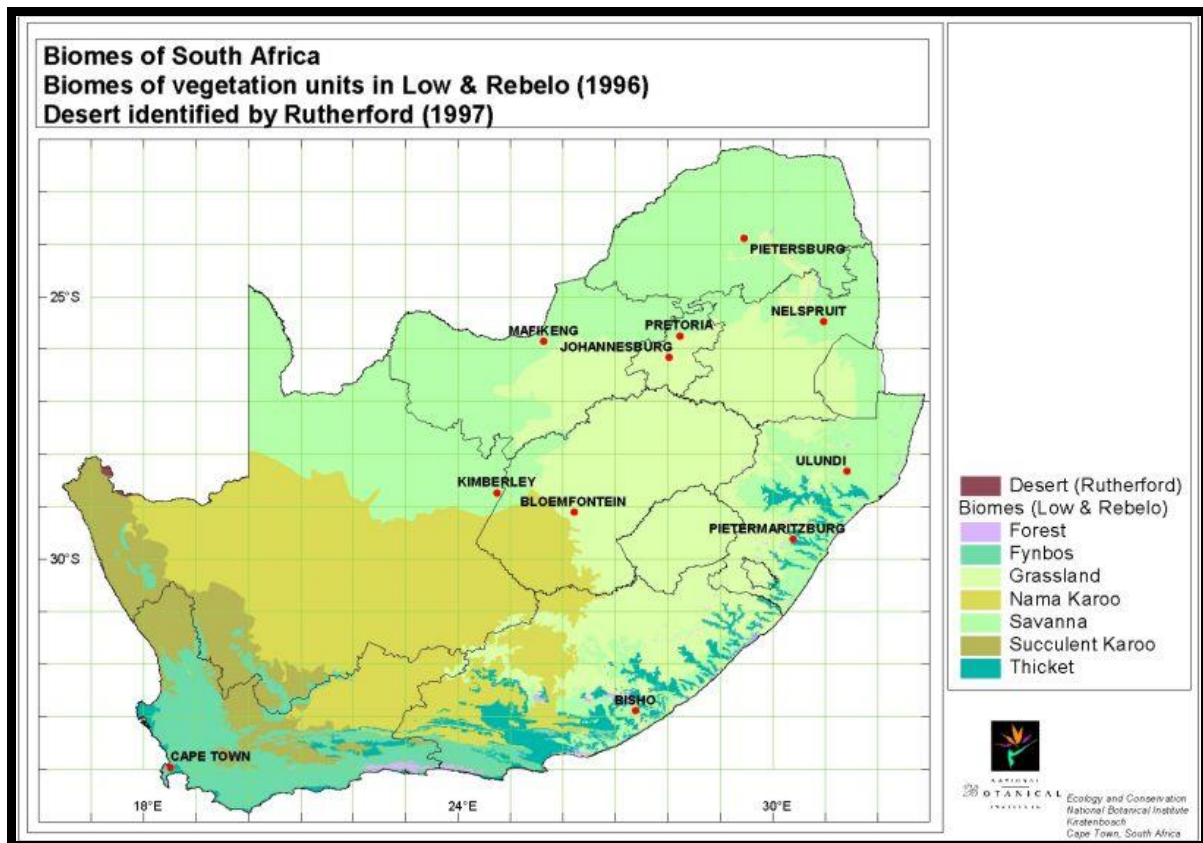
The Eastern Cape Province is comprised of rocks that consist of coarse sandstones, and rest on eroded Karoo sequence rocks (Kakembo *et al.*, 2009). Kakembo *et al.* (2009) indicated that the conglomerates are composed of sub-angular dolerite boulders, ranging up to 5 m across with sub-ordinate clasts of shale, lydianite (baked mudstone) and sandstone.

The soil type in the Eastern Cape Province is a mixture of loam and clay, with a few patches of sand (Laker, 1999). According to Laker (1999), the soils are generally formed due to the weathering of the underlying rock formation.

### **3.5 VEGETATION**

There are seven biomes in the Eastern Cape (Figure 3.2). The first is Grassland that covers 39.8% of the province. The second is the Nama Karoo, which covers 25.4% of the province, followed by Thicket, covering 16.4%. The fourth biome is Savanna, which covers 10.2%. Fynbos biome covers 6.0%. The sixth biome is Forest, which covers 2.2%, and the last is Succulent Karoo, which covers less than 0.1% (Mucina and Rutherford, 2006).

There is a varying degree of vegetation conservation throughout all the biomes. The best conserved is Fynbos with 67.1% of its total area conserved, followed by the Thicket with 23.7% of its total area conserved. Succulent Karoo is third with 17.4%, and finally Forest with 15.8% (Mucina and Rutherford, 2006).



**Figure 3.2: Biomes of South Africa (Reid, 2016).**

The Thicket biome is found mainly in the larger river valleys. The Grassland biome occurs mostly in the eastern half of the Eastern Cape and consists of sour and sweet veld. The western half of the province is dominated by the Nama Karoo biome, which is mainly utilised by sheep, and goats while in the southwest of the province have a small area of Succulent Karoo. There are two types of Savanna biomes in the province. The first is the sub-humid type, which is found in the southeast of the province, and the second is the semi-arid type found in the southern-central part of the province. Most of the Fynbos biome is found in the southwest part of the province. Lastly, the Forest biome occurs in scattered patches, both along the coast and inland (Mucina and Rutherford, 2006).

### **3.6 HUMAN SETTLEMENT AND DEMOGRAPHY**

The population of the Eastern Cape was 6 302 525 people in 1996 and increased to 6 436 763 in 2001 and 6 562 053 in 2011 (Statistics South Africa, 2012). The report further indicated that the population density of the province stood at 37.2 people/km<sup>2</sup> in 1996, which increased to 38 people/km<sup>2</sup> in 2001. In terms of the population

groups, in 1996 Black African accounted for 86.9%, Coloureds 7.5%, Whites 5.3%, while Indian and Asian only accounted for 0.3%. In 2001, these figures changed to 87.5% for Black Africans, 7.4% for Coloureds (mixed racial group), 4.7% for Whites, and 0.3% for the Indian and Asian group (Statistics South Africa, 2012).

In the Eastern Cape the most spoken language is isiXhosa (around 83% in 2001) (Statistics South Africa, 2004). Other languages (English, Afrikaans, IsiNdebele, IsiZulu, Sepedi, Sesotho, Setswana, Siswati, Tshivenda, and Xitsonga) are also spoken in the province (Statistics South Africa, 2012).

The report (Statistics South Africa, 2012) showed that as far as population groups were concerned, most of the Coloured people had secondary education. However, most people with Grade 12 are Whites and Indians, while the majority of persons without a formal education are Black.

In terms of market status, in 2001, 31.9% of the work-age population were employed, 13.4% were unemployed and 54.7% was not economically active (Statistics South Africa, 2012). The report further indicated that these percentages varied considerably across population groups. The report further noted that unemployment was highest among Coloureds (18.4%), followed by black (13.6%), while the White population had the lowest unemployment rate (3.9%). Most of the employment in the province was in the informal sector.

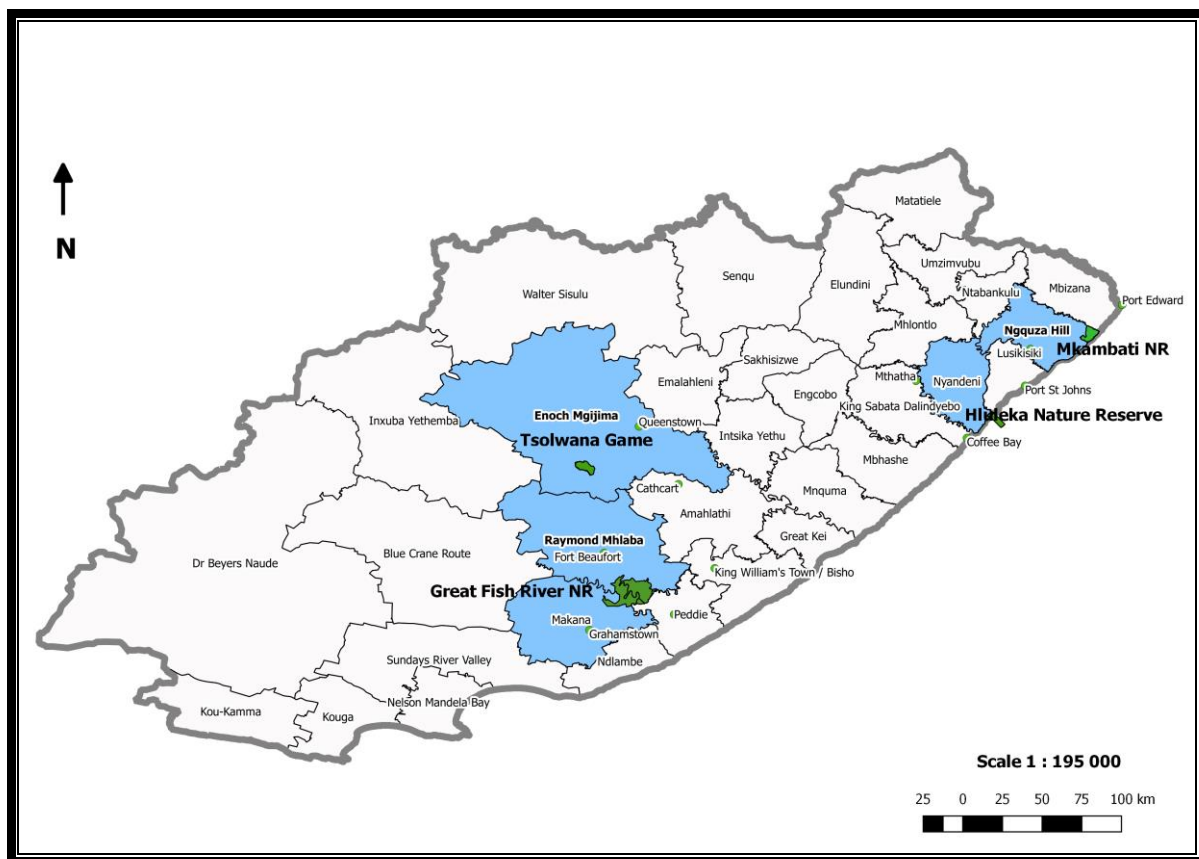
According to Statistics South Africa (2012), most people in the Eastern Cape live in rural areas. In 2011, the Eastern Cape had the highest percentage (48.5%) of households living in informal and traditional dwellings. The province also had the highest percentage (17.7%) of households without toilets in 2011 while 2.3% of the households were still using the bucket system (Statistics South Africa, 2012).

### **3.7 STUDY SITES**

#### **3.7.1 Location and size**

Hluleka Nature Reserve is located in the magisterial district of Ngqeleni (Figure 3.3) and lies approximately 87 km south east of Mthatha and 45 km south west of Port St Johns along the coast at 31°49'S29°18'E. The reserve covers an area of approximately 770 hectares (ECPB, 2006a). Mkhambati Nature Reserve is situated

on the coast of north-eastern Pondoland, between Port Edward (30 km to the north east) and Port St Johns (59 km to the south west). The reserve covers an area of 7900 ha (Figures 3.3 and 3.5). The reserve covers an area of 772 ha (ECPB, 2006c). Tsolwana Nature Reserve is located on the edge of the Winterberg Mountain range, mid-way between Queenstown and Cradock. Tsolwana Nature Reserve covers an area of 8500 ha (ECPB. 2006d). Great Fish River Nature Reserve lies in the valley of the Great Fish River, between the town of Grahamstown and Fort Beaufort, extending eastwards all the way to the Kieskama River. The reserve is a complex of three reserves that combined together – the Andries Vosloo Kudu Reserve, the Double Drift Nature Reserve and the Sam Knott Nature Reserve – into a large 45 000-hectare reserve (ECPB. 2006b) (Figure 3.3)



**Figure 3.3: Location of the study sites in the Eastern Cape Province (Created by CSS Geographic Information Specialists, 61 New Street, Grahamstown)**

### **3.7.2 Flora and Fauna**

About 70% of Hluleka nature reserve is covered by coastal forest while the remaining 30% is covered by thicket vegetation and coastal grassland. The reserve is home to such animals as the Cape buffalo, leopard, lion, chacma baboon, blue wildebeest, bushbuck, blesbok, kudu, eland, reedbuck, red wildebeest, impala, springbok, zebra, black-backed jackal, blue duiker, common duiker, large-spotted genet, rock dassie, tree dassie, bushpig, and different species of birds, fish, as well as insects (ECPB, 2006a).

Mkambati Nature Reserve has a rich biodiversity, which is influenced by the area's climatic and soil conditions (ECPB, 2006c). Vegetation of the area is dominated largely by grasslands. Patches of subtropical forest are found in riverines and coastal dunes. Many of the plant species found in the area are endemic or near endemic species (ECPB, 2006c).

Tsolwana nature reserve has grassy plains and Acacia thornveld, which is home to a wide variety of fauna and flora. The reserve has giraffe, wildebeest, white rhino, many species of antelope like eland, springbok, blesbok and mountain reedbuck as well as the Cape mountain zebra, chacma baboon, bat-eared fox and ostrich (ECPB, 2006d).

Great Fish River Nature Reserve has an abundance of big game, like hippo, kudu, Cape buffalo, elephant, lion, and over 100 endangered black rhino – one of the fastest growing populations of the black rhino in South Africa (ECPB, 2006b).

### **3.7.3 Climate**

The climate of Hluleka Nature Reserve is subtropical and humid, with a high average rainfall of 730 mm, falling mostly between October to March. The temperature ranges between 25<sup>0</sup>C and 13<sup>0</sup>C, and the relative humidity is high (ECPB, 2006a).

Mkambati Nature Reserve's climate is mild with a relatively high humidity. Most of the rainfall falls between September and March with June being the driest month and March the wettest. Mkambati Nature Reserve is a summer rainfall area with a mean

annual rainfall of about 1200 mm, of which at least 50 mm is expected every month of the year (ECPB. 2006c).

Tsolwana Nature Reserve experiences varying temperatures and unpredictable heavy summer storms. Winters are cold with snow falling frequently. The reserve also experiences southerly wind spells during winter season. Tsolwana nature reserve experiences rain in winter (with the average annual rainfall of around 350 mm) but hot in summer when temperatures can reach 38°C (between November and March). Winter can be very cold when snow cover is common (ECPB. 2006d).

Great Fish River nature reserve is located in a semi-arid climate. Both rainfall and temperature, however, vary markedly within the reserve because of variations in the topography. The lowland sections of the reserve are usually hot and dry, while the higher areas are cool and wet. The high rainfall season runs from October to March (ECPB. 2006b).

### **3.7.4 Geology**

The terrestrial part of Hluleka nature reserve consists of hills vegetated with grassland, while the coast consists of mainly rocky shore interspersed with small sandy beaches and a lagoon (ECPB, 2006a). Mkambati nature reserve is characterised by sandy soils (ECPB, 2006c). Tsolwana Nature Reserve is in a mountainous area (ECPB. 2006d). The Great Fish River Nature Reserve has a rugged landscape that is bisected by the Great Fish River. A riverine thicket forms a narrow band along the river's banks allowing Cape bushwillow, karee and sweet thorn, as well as the endangered blue crane a thriving environment (ECPB. 2006b).

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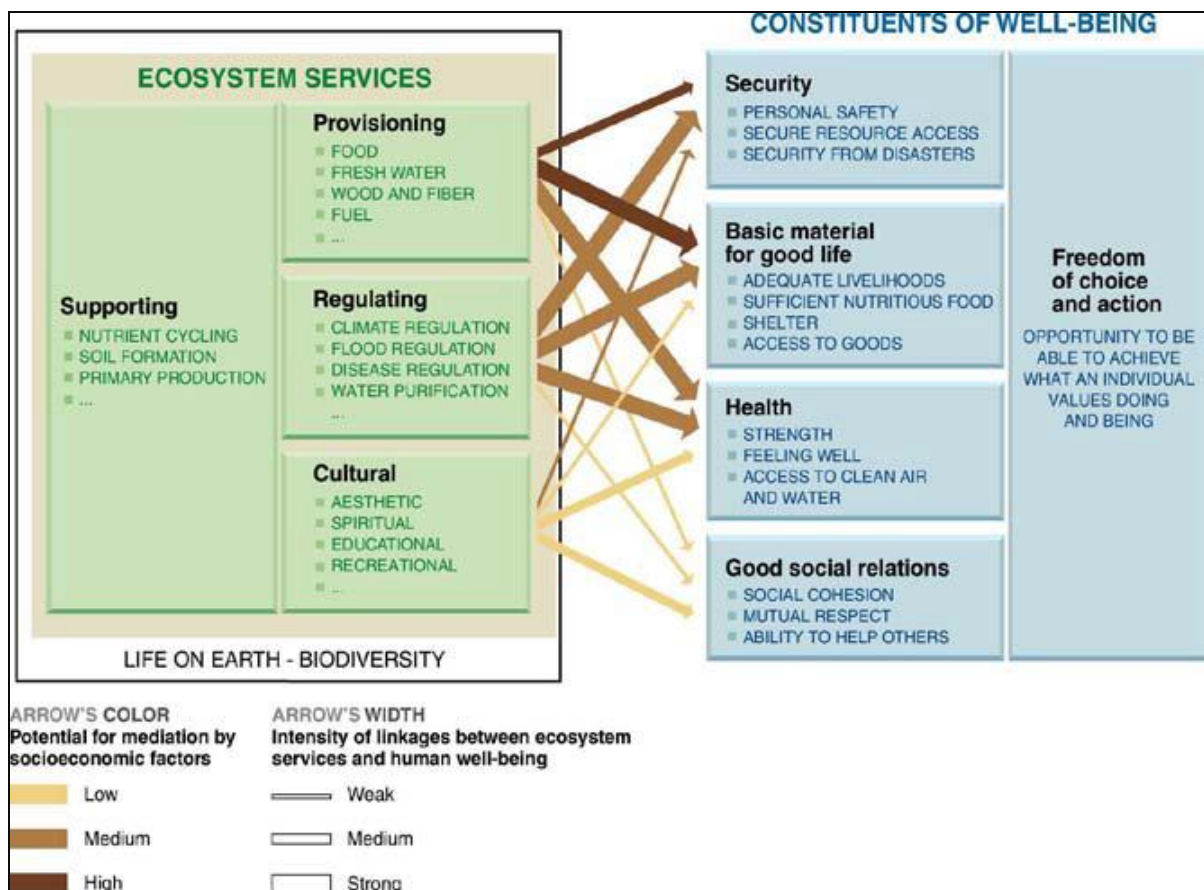
# CHAPTER 4

## THE RELATIONSHIP BETWEEN LOCAL COMMUNITIES' LIVELIHOODS AND BIODIVERSITY CONSERVATION

### 4.1 INTRODUCTION

Protected areas contain natural resources that provide various goods and services (Figure 4.1) that play a critical role in the livelihoods of hundreds of millions of rural people globally (Millennium Ecosystem Assessment, 2005; IUCN, 2008). Forests and their products for example are utilised by rural households on a day-to-day basis for food production (Roe *et al.*, 2009). About 1.3 billion people draw their livelihoods from forest resources, 70% of the world's population relies on medicinal plants (Coad *et al.*, 2008; Convention on Biological Diversity, 2010), and the livelihoods of more than three (3) billion people depend on marine and coastal biodiversity (Convention on Biological Diversity, 2010). Natural resources significantly assist rural households to realise most of their cash requirements, particularly in the most marginalised and vulnerable segments of society (Shackleton *et al.*, 2008). In dry ecosystems, open woodlands are critical sources of fodder for livestock which provide primary subsistence and income (Sherr *et al.*, 2003). According to Colchester *et al.* (2006) natural resources are important from a cultural perspective as most people use certain natural environments as sacred sites and use wild resources for spiritual and religious purposes.

According to the Convention on Biological Diversity (2010), the type and level of access of human communities to required ecosystem goods and services can therefore differentiate poor and vulnerable groups from others. In most cases, when protected areas are established, people living in or adjacent to protected areas are either relocated or restricted from accessing the resources found inside these areas which they solely depend on for their daily needs (Salafsky and Wollenberg, 2000; Adams and Hutton, 2007; Berkes, 2007; Franks and Small, 2016). When this happens, people are left homeless, jobless, economically and socially marginalised, exacerbating their poverty levels (Liu *et al.*, 2010; Clements *et al.*, 2014).

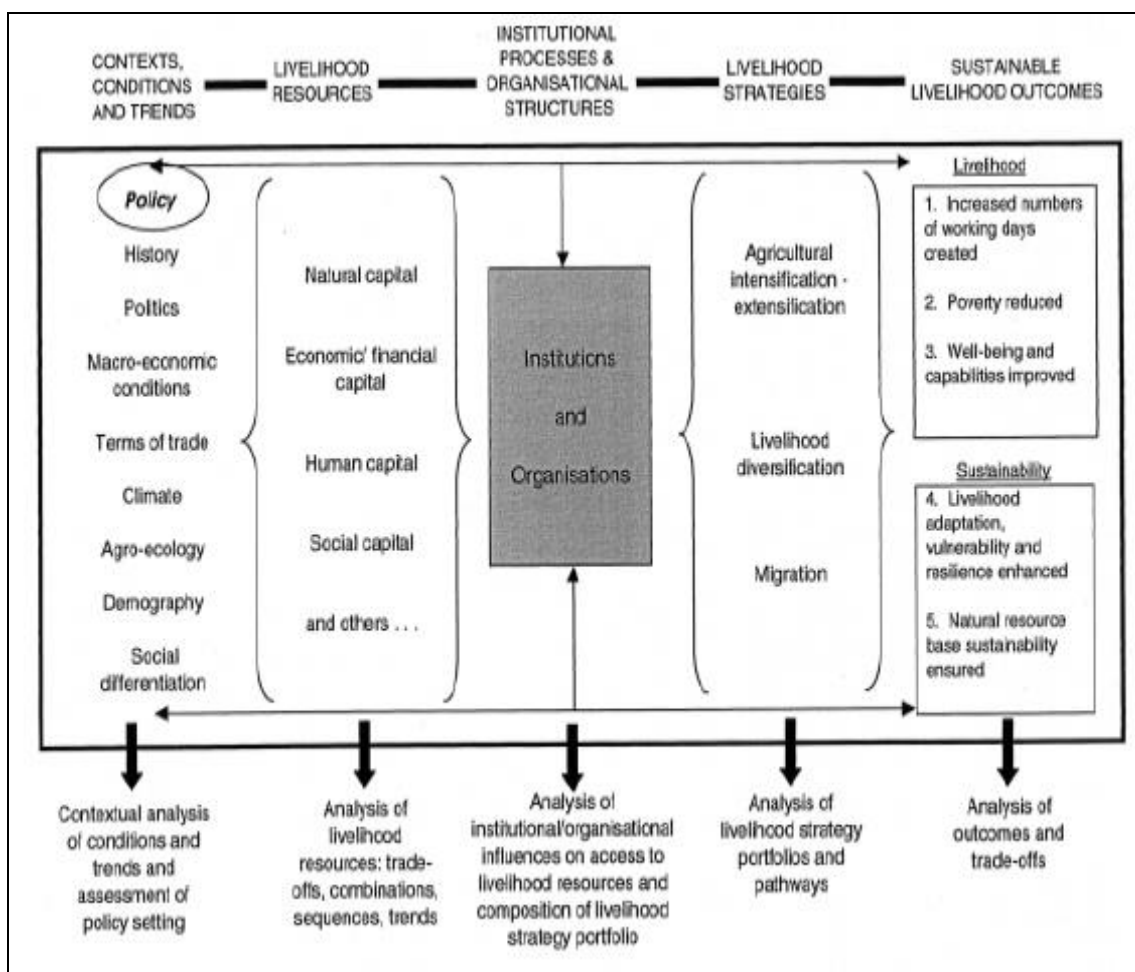


**Figure 4.1: Ecosystem services (Millennium Ecosystem Assessment, 2005).**

To be able to assess how the creation of protected areas affect local people, the underlying relationship between local people and natural resource use and the type and implementation of the rules and regulations imposed by the protected areas on resource use need to be well understood (Clements *et al.*, 2014). As Scoones (1998) argued, the ability of a household to pursue different livelihood strategies is dependent on the basic material and social, tangible and intangible assets that people have in their possession. Therefore, the extent to which protected areas are likely to affect local communities depends on the assets at their possession.

According to Ellis (2000) as well as FAO and ILO (2009), livelihoods consist of the capabilities, assets - both material and social resources - and activities required for a means of living by an individual or household. A livelihood is sustainable when it can cope with and recover from stresses and shocks, maintain or enhance its capabilities and assets. It should also provide net benefits to other livelihoods locally and more widely, both now and in the future, while not undermining the natural resource base.

A Sustainable Livelihood Framework (Figure 4.2), which was created by Chambers and Conway in 1991 (Solesbury, 2003) was used as a framework to assess the livelihood effects on communities living around the four nature reserves. The framework has been applied in different parts of the world to assess the various impacts of development projects on livelihoods. It consists of livelihood assets and activities, people's/household's vulnerability and coping strategies, policies, institutions and processes that affect availability and access to livelihood assets (which will influence the activities to be undertaken in pursuit of livelihoods), and livelihood outcomes (<http://www.ifad.org/sla>).



**Figure 4.2: Sustainable livelihood framework (Scoones, 1998 Adopted by Solesbury, 2003).**

Livelihood assets that people or households have access to and use include natural resources, technologies, their skills, knowledge and capacity, their health, access to education, sources of credit, and their networks of social support. The type and

amount of assets that people have access to is strongly influenced by their vulnerability context which takes into account trends (economic, political and technological), shocks (epidemics, natural disasters, civil strife) and seasonality (changes in prices, production and employment opportunities) (FAO and ILO, 2009).

Access to and use of assets and vulnerability context of individuals/households, together with the prevailing social, institutional and political environment affect the type of strategies that individuals or households will undertake to attain their livelihoods (FAO and ILO, 2009). FAO and ILO (2009) indicated that an enabling policy and institutional environment make it easier for people to gain access to assets they need for their livelihoods while a disabling policy and institutional environment may discriminate against them thus making it difficult for them to get access to land, livestock, capital and information (FAO & ILO, 2009). Unstable or unsatisfactory livelihood outcomes may result where there are low levels of livelihood assets, high degree of vulnerability to external shocks, and insufficient livelihood support from surrounding institutions (e.g. local government, financial markets FAO and ILO, 2009).

The establishment of protected areas places restrictions on the use of resources that had previously been “commons” and freely available to local and indigenous communities, exacerbating poverty and marginalisation, leading to loss of livelihoods and dislocation of communities (Colchester, 2004; Mohammed, 2015; <http://www.ifad.org/sla>). Several studies (Agrawal and Gibson, 1999; Koziel, 2001; Neefjes, 2001; Edmund *et al.*, 2002; Roe and Elliott, 2006; Wilkie *et al.*, 2006; Cernea and Schmidt-Soltau, 2008; Mutekwa and Gambiza, 2017) have shown that poor people depend on natural resources for their survival hence access rights and security as well as governance of these resources are fundamental to both livelihood and conservation integrity. According to Bosak (2008), declaration of areas of land as parks or reserves restricts access of local communities to natural resources that they harvest to meet their daily requirements. This makes them economically and socially marginalised (Cernea and Schmidt-Soltau, 2008) which adversely affects their livelihoods (Adams and Hutton, 2007).

In the absence of data before and after protected areas are established, researchers opted to use study variations in livelihood status with distance from the reserve

boundaries. Clements *et al.* (2014) surveyed the impacts of two protected areas on livelihoods in Cambodia by selecting respondents from inside the protected areas, 4-12 km and 20-60 km from the protected area boundaries. Kiptot and Franzel (2012) studied the variations on meat and fish consumption with distance in Serengeti National Park. Kramer *et al.* (1997) investigated local communities' perceptions of timber and fuelwood benefits from four protected areas in Bangladesh using distance from the protected areas boundaries. Oates (1999) assessed the local people's attitudes in Koshi Tappu Wildlife Reserve, Nepal, using distance from the reserve boundary.

## **4.2 SPECIFIC AIM AND OBJECTIVES**

### **4.2.1 Aim**

The aim was to assess the relationship between conservation of biodiversity and the livelihoods of local communities adjacent to the four nature reserves.

### **4.2.2 Objectives**

The objectives were to:

- I. Assess the relationship between biodiversity conservation and livelihood capitals of local communities.
- II. Ascertain the benefits that flow from the reserves to the local communities.
- III. Analyse the relationship between biodiversity conservation and livelihood strategies of local communities.
- IV. Determine the relationship between biodiversity conservation and livelihood activities of local communities.

## **4.3 SPECIFIC RESEARCH QUESTIONS**

- I. How does biodiversity conservation in the four nature reserves affect the livelihood capitals of local communities?
- II. How do local communities benefit from the four nature reserves in terms of ecosystem goods and services?
- III. How does biodiversity conservation in the four nature reserves affect the livelihood activities of local communities?
- IV. How does biodiversity conservation in the four nature reserves affect the livelihood strategies of local communities?

#### 4.4 SPECIFIC HYPOTHESES

- I. Biodiversity conservation has a negative influence on the livelihood capitals of local communities around the four nature reserves. This is because the reserves limit access to the resources that local communities depend on to achieve their livelihoods.
- II. The reserves are endowed with natural resources necessary for attaining livelihoods of those who live in and around them. Limiting access to these resources could be detrimental to the livelihoods of these people.
- III. Because biodiversity conservation limits the livelihood options available for communities living around protected areas, those communities closer to the four nature reserves have limited livelihood options compared to those far from the reserves.

#### 4.5 DATA TYPES AND METHODS

##### 4.5.1 Data types

To be able to assess variations on livelihoods capital with distance from protected areas, information on natural, physical, human, financial and social capitals that households owned or had access to, was collected as per table 4.1.

**Table 4.1: Type of data collected from the field**

Livelihood capital	Livelihood variable
Human	This focused on the number of people: In full time employment In part time employment Engaged in livelihood activities With degrees and above With diplomas With specialised certificates With leaving certificates/matric In formal business In informal business

Physical	<p>Nature of housing infrastructure used</p> <p>Nature of road infrastructure used</p> <p>Availability of proximity or Onsite water infrastructure</p> <p>Availability of onsite electricity infrastructure</p> <p>Availability of onsite solar infrastructure</p> <p>Access to a paraffin depot</p> <p>Nature of sanitation (toilet/latrine)</p> <p>Access to a television set</p> <p>Access to a radio set</p> <p>Access to a telephone or cellular phone</p> <p>Access to a postage infrastructure</p> <p>Availability and access to tourism development infrastructure</p> <p>Distance to the nearest school</p> <p>Distance to the nearest health facility</p> <p>Mode of transport (whether people had personal cars, used buses or minibus (taxis) or vans (pickups with closed canopies)</p>
Financial	<p>Income from:</p> <ul style="list-style-type: none"> <li>• Fulltime employment</li> <li>• Part-time Employment</li> <li>• Formal business</li> <li>• Informal Business</li> <li>• Social grants</li> <li>• Remittances</li> </ul> <p>Expenditure on:</p> <ul style="list-style-type: none"> <li>• Food</li> <li>• Clothing</li> <li>• School fees</li> </ul>

	<ul style="list-style-type: none"> <li>• Transport</li> <li>• Health Care</li> <li>• Rental</li> <li>• Interest</li> <li>• Interest on loans</li> </ul>
Natural	<p>Ownership or access to land for cultivation</p> <p>Ownership or access to land for grazing</p> <p>Availability or ownership of soil for brick making and sand mining</p> <p>Ownership as well as the types and number of livestock</p> <p>Availability and access to fisheries</p> <p>Availability and access to forest resources</p> <p>Availability and access to quality natural water sources</p> <p>Availability and access to wildlife (other than fisheries) resources</p> <p>Availability and access to grass for thatching</p>
Social	<p>Availability and access to:</p> <ul style="list-style-type: none"> <li>• Family kinships</li> <li>• Communal grazing structures</li> <li>• Communal food distribution</li> <li>• Communal relief and emergency societies</li> <li>• Communal building societies</li> <li>• Inter-household farming arrangements</li> <li>• Burial societies</li> <li>• Communal credit facilities</li> </ul>

- |  |  |
|--|--|
|  | <ul style="list-style-type: none"><li>• Community meetings</li></ul> |
|--|--|

To be able to analyse variations on the sustainability state of households livelihoods data on the type and number of activities that households engaged in in pursuit of their livelihoods was collected. These activities included livestock farming (cattle, sheep, goats, and pigs), poultry farming, commercial crop production, subsistence crop production, fishing, hunting, formal business, hawking and other informal business activities, traditional medicine, gathering, formal and informal employment.

To be able to assess the vulnerability state, households were asked what they do when livelihood status is high or low. External and internal support for households to shield against unexpected livelihood shocks was also investigated. Information on the consistency of livelihoods in the previous 10 years (2000 – 2009) was also collected. The research also investigated the causes of the observed trends.

Respondents were also asked to provide narratives on the direct positive or negative impacts that they experienced because of the establishment of reserves in their community. This was used to conduct cost and benefit analysis of reserves on local communities.

#### **4.5.2 Methods**

A group of trained research assistants carried out fieldwork on heads of households in selected villages in the four nature reserves. With the aid of a map, villages in each site were listed and then grouped together based on distance: 0 – 10 km, 11 – 20 km, 21 – 30 km, and 31 km and farther from the reserves' boundaries. From each stratum, villages were proportionately selected using a simple random sampling. With the aid of data from Statistics South Africa (2012), households from the selected villages were listed and a sample of households was randomly drawn. The study sites were visited during 2012–2013 for the collection of data where 375 questionnaires (137 for Mkambati Nature Reserve, 60 for Great Fish River Nature Reserve, 81 for Tsolwana Nature Reserve, and 97 for Hluleka Nature Reserve) were administered. Through a questionnaire, data on demographic information, livelihood assets, livelihood activities, livelihood strategies, livelihood trends, and impacts of the reserves on communities were gathered.

Focus group interviews were also conducted between August and December 2013 to complement the household surveys. Sixteen focus groups, consisting of between four and eight household heads that were selected by households on the basis that they knew much about the reserves and could represent their interest. The meetings were held at headmen's homes that the participants selected as convenient to them and were facilitated in IsiXhosa (by trained field assistants). Four focus group sessions were conducted per site, one per distance category: 0-10 km, 11 – 20 km, 21 – 30 km, and 31 km and farther from the reserves' boundaries.

The top 10 main livelihood activities that households in the study areas adopted to earn a living were rated on a scale of 1 to 10, where 1 was the most unsustainable activity and 10 was the most sustainable based on its magnitude and certainty. These scores were then added up and averaged.

Nature and extent of variations of livelihood assets, livelihood activities, livelihood strategies, and livelihood trends as distance from the reserves varied were cross-tabulated to extract Chi-square ( $\chi^2$ ) and P-values, which were used to make inferences on the extent to which the reserves impacted on the livelihoods of those who are living in and around them.

With aid of QSR's NVivo, the qualitative research component involved two distinctive approaches to research – aggregating the findings of very similar findings where the key concepts were clearly defined in advance and configuring the findings of dissimilar in order to define key concepts and develop theoretical understanding. The process started by delving into the data and then full texts to see the key issues and recurrent themes. Once most of the key themes were identified, codes were created and data were sub-divided into sections for in-depth analysis (Weish, 2002). Analysis was refined considering the created themes and coding continued iteratively, but simultaneously accommodating the available data. The research findings were divided into overlapping subsets whose findings addressed livelihood assets (natural, financial, human, physical and social), livelihood activities, livelihood strategies and ecosystem goods and services. Information gathered from document review and participant observation informed the results. Review of literature

regarding protected areas and local communities also contributed information that aided the analysis.

## **4.6 RESULTS**

### **4.6.1 Changes in livelihood activities with distance from the reserves' boundaries**

The number of households practising subsistence farming as the main livelihood activity increased with increase in distance from the reserves' boundaries. At 0-10 km region 22% of the households indicated that they depended on subsistence farming for their livelihood. This increased to 26% at 11 – 20 km region, declined to 11% at 21 – 30 km region, then increased to 41% at 31 km and farther.

Households engaged in formal business as the main livelihood activity increased with increase in distance from the reserves' boundaries. At 0-10 km region 15% of the households indicated that they depended on formal business for their livelihood. This changed to 31% at 11 – 20 km region then to 0% at 21 – 30 km region, then to 54% at 31 km and farther.

Generally, the number of people practising commercial farming as the main livelihood activity increased with distance from reserves' boundaries. At 0-10 km region 20% of the households indicated that they depended on commercial crop production for their livelihood. This changed to 16% at 11 – 20 km region then to 6% at 21 – 30 km region, then increased to 58% at 31 km and farther.

The number of people relying on formal employment as the main livelihood activity increased with increase in distance from the reserves' boundaries. At 0-10 km region 19% of the households indicated that they depended on formal employment for their livelihood. This changed to 26% at 11 – 20 km region then to 7% at 21 – 30 km region, then to 48% at 31 km and farther.

There were, generally, more people closer to the reserves on informal business as the main livelihood activity compared to farther from the reserves. At 0-10 km region 22% of the households indicated that they depended on subsistence farming for their livelihood. This changed to 24% at 11 – 20 km region then to 12% at 21 – 30 km region, then to 41% at 31 km and farther.

Variations in livelihood activities with distance from the reserves' boundaries are summarised in table 4.2.

**Table 4.2: Changes of livelihood activities with changes in distance from the reserve boundaries**

Variable	Variation with distance	$\chi^2$ Value	P-Value	Degrees of Freedom	Significance at 95%
Subsistence farming	Increased	9.14	0.103	5	Not significant
Formal Business	Increased	5.04	0.411	5	Not significant
Commercial farming	Increase	42.961	0.000	15	Highly significant
Formal employment	Increased	1.237	0.941	5	Not significant
Informal employment	Increased	0.830	0.975	5	Not significant

#### **4.6.2 Variations in livelihood capital with distance from the reserves' boundaries**

The average market value of land increased with increase in distance from the reserves' boundaries. The average land value was ZAR 1784 at 0-10 km region, changing to ZAR 2894 at the 11 – 20 km region, then ZAR 6059 at 21 – 30 km region. At the 31 – 40 km region the land value was ZAR14678, while at 41 – 50 km it was ZAR 22001, and finally at 51 km and farther it was ZAR 30022. The association between value of land and distance was also found to be strong (PHI=0.337).

The occupation of respondents did not significantly change with increase in distance from the reserves' boundaries. The percentage of civil servants was 7% at 0-10 km region, changing to 21% at 11 – 20 km region, then to 7% at 21 – 30 km region, then to 21% and 36% at 31 – 40 km and 41 – 50 regions respectively, before changing to 7% at 51 km and farther. The association between occupation of respondents and distance was also found to be strong (PHI=0.332).

Unemployment percentage decreased with increase in distance from the reserves' boundaries. Unemployment was 78% near the reserves (0 – 10 km), changing to 14% at 11 – 20 km, then 4% at 21 – 30 km and finally 4% for 31 – 40 km, 41 – 50 km and 51 km and farther.

The number of respondents with high school and above as their highest level of education increased with increase in distance from the reserves' boundaries. At 0-10 km region 19% of respondents had at least high school level of education, changing to 21% at 11 – 20 km region, to 16% at 21 – 30 km region, 10% at 31 – 40 km region, 12% and 22% at 41 – 50 km and 51 km and farther regions, respectively. The relationship between distance from the reserves' boundaries and number of people with at least high school as the highest level of education was strong (PHI=0.344).

Dependence on social grants as a source of household income was independent of distance from the reserves' boundaries. Annual income from disability grants as a source of household income increased with increase in distance from the reserves' boundaries. Annual income from child grants as a source of household income increased with distance from the nature reserves' boundaries. Generally, average household income increased with increase in distance from reserves' boundaries.

Distance that respondents had to walk to access a shop increased with increase in distance from the reserves' boundaries. People closer to the reserves depended on local shops for their household goods while those far from the reserves bought their household goods from the shopping malls. For this reason, households closer to the reserves walked less distance to access the shops while those far from the reserves walked longer to reach shops.

The distance that residents travelled to access a school increased with increase in distance from the reserves' boundaries. Households closer to the reserves were well serviced compared to those far from the reserves. This relationship was strong (PHI=0.358).

The distance that residents travelled to access a health clinic increased with increase in distance from the reserves' boundaries. People closest to the reserves were better serviced with health facilities than those farther from the reserves.

The quality of housing infrastructure significantly improved with increase in distance from the reserves' boundaries. Generally, there was an improvement in housing infrastructure with an increase in distance from the reserves' boundaries. This relationship was strong (PHI=0.340). Rondavels and mud flats dominated the 0 – 10 km region, but with an increase in distance from the reserves' boundaries households with rondavels and mud flats declined, but semi-permanent and permanent houses emerged.

The quality of road infrastructure significantly improved with increase in distance from the reserves' boundaries. closer (0 – 10 km) to the reserves, 99% of the households had gravel, while 1% had only a passage. This relationship was, however, redundant (PHI=0.905). Most respondents interviewed said that these roads were impassable during the wet season and too dusty during dry periods. They also stated that these roads made most motorists to refrain from using them. Residents complained of the inadequacy of transportation services because of inaccessible or impassable roads, leading to the operators in this region overcharging residents. This overcharging also had an effect in the prices of basic commodities in this region, as most of the goods were expensive, according to the residents. At 11 – 20 km zone the road infrastructure was 100% gravel. As with the 0 – 10 km zone, these roads were dusty during dry periods and muddy during wet ones. From the focus group interviews, it was established that the roads were impassable during wet seasons. This also affected the prices of basic commodities in this zone. In the 21 – 30 km zone still gravel road dominated. As with the other zones, these roads were impassable during the rainy season and dusty during the dry seasons. In the 31 km and farther zone 27% of the households were using tar roads. Even the nature of the gravel roads started improving at this zone. Besides the dust that was a problem during dry season, the gravel roads in this zone were passable even during the wet season.

The quality of water infrastructure significantly improved with an increase in distance from the reserves' boundaries. More people were without potable water within their reach at the 0 – 10 km region than 31 km and farther region. Looking at all the distances, 11 to 20 km had the highest percentage (70%) of people without potable water. On a reserve-by-reserve basis, households around Mkambati Nature

Reserve from the edge of the reserve up to 20 km did not have water within their reach. At 21 – 30 km region access to communal taps was 9% which increased to 34% in 31 km and farther. Most of the households in this area indicated that the municipality erected taps in the community that only worked to less than a year then stopped working. Around the Great Fish River Nature Reserve, access to communal taps was 71% at 0 – 10 km region, reduced to 8% at 11 – 20 km region, then increased to 100% thereafter. Access to water infrastructure in Mkambati Nature Reserve increased from 29% at 0 – 10 km region to 80% at the 11 – 20 km region before dropping to 0%. At the 11 – 20 km region, there was 12% of the households of Great Fish River nature reserve who were depending on municipal tanks for water which they confessed were unreliable. In Tsolwana Nature Reserve, at 0 – 10 km region, 88% of the households had access to communal taps, 8% to municipal tanks (which they said were reliable) while 4% did not have any access to water infrastructure. At the 11 – 20 km region, 90% of the households had access to communal taps while 10% of them did not have any access. At 21 – 30 km region, households with access to water increased to 24%, access to communal taps reduced to 71%, while 5% relied on municipal tanks. At 31 km and farther, access reduced to 5%, access to communal taps increased to 86%, while 9% had access to boreholes. In Hluleka Nature Reserve, access to water was a challenge to the residents. At 0 – 10 km region, 91% of the households did not have access to water while 9% had access to communal taps. At 11 – 20 km region, households without access to water increased to 95% while those with access to communal taps reduced to 5%. At 21 – 30 km access to communal taps increased to 9% then reduced to 7% at 31 km and farther. Those households without access to water were 91% in 21 – 30 km region then increased to 93% in 31 km and farther. This relationship was however redundant (PHI=0.768).

The number of households connected to electricity increased with increase in distance from the reserves' boundaries. Generally, the percentage of households with access to electricity increased with distance. There were more households with electricity 31 km and farther from the reserves as compared to 0 – 10 km to the reserves. Looking at the trends on a reserve-by-reserve basis, households around Mkambati Nature Reserve did not have access to electricity until 31 km and farther where 70% of them indicated that they had access. In Hluleka Nature Reserve the

story was almost the same. At 0 – 10 km, all households indicated that they did not have access to electricity. At 11 – 20 km those without access reduced to 95%, then to 82% at 21 – 30 km finally to 76% at 31 km and farther. In Tsolwana Nature Reserve, at 0 – 10 km and 11 – 20 km regions, all households had access to electricity. The percentage of households with access to electricity then reduced to 81% at 21 – 30 km, and thereafter increased to 95% at >31 km. At the Great Fish River Nature Reserve, access to electricity was not a problem as all (100%) households in all the regions had access. This relationship was moderately strong (PHI=0.224).

The quality of sanitation infrastructure improved with increase in distance from the reserves' boundaries. What varied (from field observation) was the type of sanitation facilities that households used. Most of the households in 0 – 10 km distance range to the reserves used pit latrines that are built with zinc sheets while those at 31 km and farther from the reserves used pit latrines that were built from concrete blocks. The 21 – 30 km distance range was the worst in terms of access to sanitation (33% of the households did not have access to a sanitation facility) because 85% of the households around the Hluleka Nature Reserve did not have access to sanitation. Hluleka was the reserve with the worst performance of access to sanitation, because at 0 – 10 km, 73% of the households did not have access to sanitation, at 11 – 20 km this percentage increased to 85%, before decreasing to 22% at 21 – 30 km then increasing to 26% at 31 km and farther. Except for the 11 – 20 km distance range, where 20% of the households did not have access to sanitation, the Great Fish River Nature Reserve showed a good picture in terms of access to sanitation. The Tsolwana and Mkambati nature reserves had mixed results, resulting in no apparent trend. The relationship was also found to be redundant (PHI=0.702).

The percentage of people with television sets increased with increase in distance from the reserves' boundaries. The trends were not the same from reserve to reserve. At the Mkambati Nature Reserve, at 0 – 10 km households with television sets was 43% then it decreased to 25% thereafter started increasing to 73% at 21 – 30 km region and 78% at 31 km and farther. At the Great Fish River Nature Reserve, households with television sets was 95% at 0 – 10 km region, decreased to 84% at 11 – 20 km region, then increased to 100% thereafter. At the Tsolwana Nature

Reserve, the households with television sets was 79% at 0 – 10 km region, decreasing to 65% at 11 – 20 km region, then increasing to 81% at 21 – 30 km region and 87% at 31 km and farther. In Hluleka Nature Reserve, households with television sets was 46%, increased to 100% at 11 – 20 km region, then decreased to 91% at 21 – 30 km region and 84% at 31 km and farther. The survey also established that access to the private television channels was not a challenge. There were a few households with at least one member having a permanent job who were able to subscribe to paying channels. This relationship was, however, redundant (PHI=0.519).

The percentage of people having access to one type or the other of a radio increased with increase in distance from the reserves' boundaries. On a reserve-by-reserve level, at the Mkambati Nature Reserve people with radio sets started with 57%, at 0 – 10 km region, declined to 44% at 11 – 20 km region, then increased to 91% at 21 – 30 km region, and finally dropped to 78% at 31 km and farther. At the Great Fish River Nature Reserve, people with radio sets started at 67% at 0 – 10 km region, increased to 78% at 11 – 20 km region, then declined to 50% at 21 – 30 km region and finally increased to 80% at 31 km and farther. At the Tsolwana Nature Reserve people with radio sets started at 79% at 0 – 10 km region, dropped to 65% at 11 – 20 km region, and then steadied at 86% for 21 – 30 km and 31 km and farther regions. At the Hluleka Nature Reserve, people with radio sets started at 27% at 0 – 10 km region, increased to 65% at 11 – 20 km region, then declined to 45% at 21 – 30 km region and finally increased to 90% at 31 km and farther. This relationship was moderately strong (PHI=0.229).

The percentage of people owning any form of a phone increased with increase in distance from the reserves' boundaries. Ownership of phones started high at 0 – 10 km region, decreased at 11 20 km region, increased at 21 – 30 km region and finally decreased at 31 km and farther. For Hluleka Nature Reserve, the trend was that the percentage started low at 0 – 10 km region, increased at 11 – 20 km region, decreased at 21 – 30 km region, and finally increased at 31 km and farther region. This relationship was strong (phi=0.345).

All households in the study area had one form or another of a postage facility. Accessing letters from local shops was the most dominant postage facility in all the

reserves at all distances. Personal postage boxes were used at Great Fish River at 11 – 20 km region while the hospital was used at Mkambati at 31 km and farther. The post office was mostly used at Hluleka at 11 – 20 km region and the school, mostly, at Mkambati and Great Fish River at 0 – 10 km region. About 83% of the households used local shops as their centres of receiving letters. The schools and general post office also played a major role as centres of collecting letters. In general, the number of households without access to postage facilities increased with increasing distance from the reserves boundary.

In the study area because of the nature of the roads, all households adjacent to the nature reserves used vans as their mode of transport while in the middle and far distances, taxis and buses were dominant. It was only one percent of the households (far from the reserves) that owned a car and used it for transport. From focus group interviews, it was established that these vans were uncomfortable for human transport and buses, although comfortable, when used in the remote areas were never available all the time. The taxis were the most reliable and available most of the times when needed. Unavailability of transport made people to cancel their journeys most of the times. This was a problem because sometimes people cancelled even important appointments or could not go and buy essential commodities.

The percentage of households that used vans as their mode of transport was not the same in all the reserves. At a reserve-by-reserve basis, this percentage was highest at 0 – 10 km from the reserves' boundaries in Mkambati and Great Fish River nature reserves and 11 – 20 km region in Hluleka Nature Reserve. This was because the roads in these areas were unsuitable for taxis/buses or small cars. From focus group interviews, it was established that these vans were uncomfortable for human transportation. In all other regions, taxis/buses were the dominant mode of transport. It was also established that buses, although comfortable, when used in the remote areas were never available all the times, and taxis were the most reliable and available most of the times.

The percentage of people depending on families decreased with an increase in distance from the reserves' boundaries. There were more households with strong

family ties at 31 km and farther from the reserves than at 0 – 10 km from the reserves.

The percentage of people depending on inter-household labour did not change with increase in distance from the reserves' boundaries. Not many households in the study area indicated that they had access to inter-household labour. Regarding the few that indicated that they had access, the percentage started high at 0 – 10 km, decreased slightly at 11 – 20 km, increased slightly again at 21 – 30 km, and decreased again at 31 km and farther. From group interviews this was linked to the type of activities that households engaged in (whether they required support from others or not). Most households, except in Great Fish River and Tsolwana nature reserves, did not have many activities that required support from neighbours.

The percentage of people having access to communal grazing pastures generally decreased with increase in distance from the reserves' boundaries. Generally, access to communal grazing pastures increased with distance up to 21 – 30 km zone then decreased. The percentage of households with access to communal grazing pastures was closely associated with livestock husbandry. In the 0 – 10 km region, the highest percentage was at the Tsolwana Nature Reserve. In the 11 – 20 km zone, the highest percentage was at the Great Fish River Nature Reserve. At 21 – 30 and 31 km and farther zones, it is the Hluleka Nature Reserve that had the highest percentage.

The percentage of people having access to communal food distribution increased with increase in distance from the reserves' boundaries. From the group interviews, it was established that this scenario was associated with the government food parcels that people received. There were, however, those households (like the case with Great Fish River Nature Reserve) that did not receive these parcels and relied on communities to help them in times of hunger.

The percentage of people having access to communal relief efforts increased with increase in distance from the reserves' boundaries. Generally, access to relief efforts increased with distance up to 21 – 30 km zone then decreased. On the reserve level, Mkambati nature reserve started low in the first two zones then increased thereafter decreased. For Great Fish River and Tsolwana nature reserves, the trend was

starting high, decreasing then increase before decreasing again. Hluleka Nature Reserve started low, increased then decreased continuously.

The percentage of people depending on communal farming arrangements did not change with increase in distance from the reserves' boundaries. The lowest percentage was on the 11 – 20 km distance region. This was indicative of a lack of crop farming activities in the study sites. Housing support was not an asset that households in the study sites accessed. Apart from Mkambati Nature Reserve, households in all the study sites did not have access to housing support.

The percentage of people depending on private burial schemes decreased with increase in distance from the reserves' boundaries. At 0-10 km it was 52%, increased to 59% at 11-20 km, then 44 percent at 21-30, and finally to 43 percent at 31 km and farther. In Tsolwana Nature Reserve, the percentage of households subscribing to private burial schemes decreased with distance while those depending on communal plans increased with distance. In the same reserve, the percentage of households without access to a burial scheme increased with distance. In Mkambati Nature Reserve, the percentage of households subscribing to private burial schemes as well as communal plans increased with distance while those without access to any burial plan decreased with distance. At the Tsolwana Nature Reserve, those with access to both communal and private burial plans decreased with distance while those without any increased with distance. Around the Hluleka Nature Reserve, the fluctuation was ever changing.

Variations on livelihood capital with increase in distance from the reserves' boundaries are summarised in table 4.3.

**Table 4.3: Variation of livelihood capital with changes in distance from the reserve boundaries.**

Variable	Variation with distance	$\chi^2$ Value	P-Value	Degrees of Freedom	Significance at 95%
Value of land	Increased	65.900	0.001	35	Highly significant
Occupation	Increased	39.906	0.261	35	Not significant

Unemployment	Decreased	42.916	0.041	30	Significant
Level of education	Increased	42.719	0.062	30	Not significant
Dependency on old age grants	Increased	31.399	0.643	35	Not significant
Dependency on disability grant	Increased	29.096	0.513	30	Not significant
Dependency on child grant	Increased	26.908	0.835	35	Not significant
Household income	Increased	42.096	0.831	35	Not significant
Distance to the nearest shop	Increased	22.426	0.013	10	Significant
Distance to the nearest school	Increased	17.253	0.304	15	Not significant
Distance to the nearest health facility	Increased	43.247	0.002	20	Highly significant
Quality of housing infrastructure	Improved	41.807	0.000	15	Highly significant
Quality of road infrastructure	Improved	29.602	0.012	35	Significant
Quality of water infrastructure	Improved	79.602	0.003	25	Highly significant
Quality of sanitation infrastructure	Improved	47.372	0.913	35	Not significant
Connection to	Increased	213.308	0.000	35	Highly

electricity					significant
Access to Television	Increased	97.643	0.000	45	Highly significant
Access to radio	Increased	43.241	0.0324	20	Significant
Access to a phone	Increased	42.226	0.407	20	Not significant
Dependency on families	Decreased	48.432	0.006	15	Significant
Dependence on inter-household labour	No variation	76.521	0.745	35	Not significant
Access to communal grazing pastures	Decreased	37.857	0.031	35	Significant
Access to communal food distribution	Increased	29.972	0.856	25	Not significant
Access to communal relief efforts	Increased	27.547	0.726	25	Not significant
Access to communal farming arrangements	No change	36.742	0.726	35	Not significant

Dependence on private burial schemes	Decreased	34.541	0.041	35	Significant
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#### 4.6.3 Livelihoods trends (Consistency/inconsistency) with distance of the reserves' boundaries

The percentage of people with consistent livelihood did not significantly change ( $\chi^2 = 17.738$ ;  $P = 0.605$ ;  $df = 20$ ) with increase in distance from the reserves' boundaries. This relationship was moderately strong ( $PHI=0.221$ ). However, there were more households whose livelihood status was better farther from the reserves compared to closer to the reserves. At 0 – 10 km region, Hluleka Nature Reserve had the highest percentage of households surviving while Great Fish River nature reserve had the highest percentage of people who could afford. Mkambati Nature Reserve had the highest percentage of household whose livelihoods were unstable while Tsolwana Nature Reserve had the highest percentage of households whose livelihoods were improving and worsening at the same time. At 11 – 20 km region, Hluleka Nature Reserve had the highest percentage of households surviving while Great Fish River nature reserve had the highest percentage of people whose livelihoods were worsening. Mkambati Nature Reserve had the highest percentage of household whose livelihood was unstable and worsening while Tsolwana Nature Reserve had the highest percentage of households whose livelihoods were improving. At the 21 – 30 km region, the Hluleka Nature Reserve had the highest percentage of households whose livelihood was unstable while Great Fish River nature reserve had the highest percentage of households who could afford. Tsolwana Nature Reserve had the highest percentage of households whose livelihoods were improving. At 31 km and farther, Hluleka Nature Reserve had the highest percentage of people who could afford their livelihoods. Tsolwana Nature Reserve had the highest percentage of households whose livelihoods were improving while Great Fish River Nature Reserve had the highest percentage of households with unstable livelihood status. Mkambati Nature Reserve had the highest percentage of households who were just living with no hope as to where the following day's meal will come from.

#### **4.6.4 Variations in livelihood strategies with distance of the reserves' boundaries**

Residents of the study area adopted different strategies to get through the hard times. These strategies included: 1) migrating to relatives, 2) intensifying or extensifying their agricultural activities, 3) changing their diet, 4) changing their eating routines, 5) making use of claims, 6) diversifying their livelihoods activities, 7) borrowing (either food or money) from friends or shops, 8) relying on neighbours/family/friends (without going to stay with them), 9) making use of what they had saved (food or money) when times were better, and 10) doing nothing (deplete resources).

At times of hardship, the percentage of people opting to go and live with friends and relatives decreased with increase in distance from the reserves' boundaries. At 0 – 10 km region, 6% of the households opted for this as a coping mechanism increasing to 18% at 11 – 20 km region before reducing to 0% at 21 – 30 km region, then increasing to 59% at 31 – 40 km regions. The percentage declined to 12% at 41 – 50 km region, and finally reducing to 6% at 51 km and farther.

In hard times, the percentage of people adopting agricultural extensification and intensification changed up and down with increase in distance from the reserves' boundaries. At the 0 – 10 km 16% increasing to 20% at the 11 – 20 km region. It declined to 8% at 21 – 30 km region before increasing to 22% at 31 – 40 km region. At the 41 – 50 km region, it stood at 10% before increasing to 24% at 51 km and farther.

At times of low status, the percentage of people changing diet generally decreased with increase in distance from the reserves' boundaries. At 0 – 10 km region, 26% of the households changed their diet as a way to cope during low status. This number was 22% at 11 – 20 km region, 13% at 21 – 30 region, 14% at 31 – 40 km region, 12% at 41 – 50 km region and 14% at 51 km and farther.

At times of low status, the percentage of people changing their eating routine decreased with increase in distance from the reserves' boundaries. At the 0 – 10 km region, the percentage of household that changed their eating routine was 16%, increasing to 28% at 11 – 20 km region before declining to 10% at the 21 – 30 km

region. At 31 – 40 km region it stood at 16%, reclining to 13% at 41 – 50 km region before increasing to 17% at 51 km and farther region.

At times of low status, the percentage of people who made use of claims changed up and down with increase in distance from the reserves' boundaries. At 0 – 10 km region, 22% made use of claims as a coping strategy. This number increased to 32% at 11 – 20 km region before dropping to 8% at 21 – 30 km region, then increasing to 18% at 31 – 40 km region. At 41 – 50 km region, the number stood at 12% before reducing to 8% at 51 km and farther region.

At times of low status, the percentage of people adopting livelihood diversification changed up and down with increase in distance from the reserves' boundaries. At 0 – 10 km region, 23% of the households made use of livelihood diversification as a coping strategy. This number increased to 32% at 11 – 20 km region, dropping to 16% at 21 – 30 km region. At 31 – 40 km region, the numbers stood at 19%, decreasing to 7% and 3% at 41 – 50 km and 51 km and farther regions respectively.

At times of low status, the percentage of people who just lived (doing nothing) decreased with increase in distance from the reserves' boundaries. 21% of households at 0 – 10 km from the reserves depleted resources. This number increased to 32% at 11 – 20 km region, reducing to 7% at 21 – 30 km region then increased to 20% at 31 – 40 km region. At 41 – 50 km region, this number stood at 12% then decreased to 8% at 51 km and farther region.

At times of low status, the percentage of people who made use of savings decreased with increase in distance from the reserves' boundaries. At 0 – 10 km region, 25% of the households made use of savings as a coping strategy. This number increased to 26% at 11 – 20 km region before declining to 10% at 21 – 30 km region. It increased to 16% at 31 – 40 km region, then decreased to 6% at 41 – 50 km region then increased to 16% at the 51 km and farther region.

Variations on livelihood strategies with increase in distance from the reserves' boundaries are summarised in table 4.4.

**Table 4.4: Variation of livelihood strategies with changes in distance from the reserve boundaries**

Variable	Variation with distance	$\chi^2$ Value	P-Value	Degrees of Freedom	Significance at 95%
Live with friends or relatives	Decreased	22.730	0.000	5	Highly significant
Agricultural intensification and extensification	Increased	8.606	0.126	5	Not significant
Change of diet	Decreased	4.676	0.457	5	Not significant
Change of eating routine	Decreased	3.303	0.653	5	Not significant
Used of claims	No particular trend	5.678	0.339	5	Not significant
Livelihood diversification	No particular trend	6.511	0.260	5	Not significant
Just lived/doing nothing	Decreased	12.308	0.031	5	Significant
Use of savings	Decreased	12.743	0.026	5	Significant

#### **4.6.5 Changes in benefits from and costs associated with reserves with distance from the reserves' boundaries**

The percentage of people who indicated that they depended on the reserves in one way or another significantly decreased ( $\chi^2 = 74.261$ ;  $P = 0.000$ ;  $df = 25$ ) with increase in distance from the reserves' boundaries. This relationship was very strong ( $\text{PHI}=0.453$ ). At 0 – 10 km, 98% of the households indicated that they depended on the reserves for their livelihoods. This number decreased to 42 at 11 – 20 km region.

At 21 – 30 km region, it was 34%, while it decreased to 8% at 31 km and farther region.

The percentage of people who indicated that they were negatively impacted by the reserves significantly decreased ( $\chi^2 = 79.441$ ;  $P = 0.006$ ;  $df = 25$ ) with increase in distance from the reserves' boundaries. The number of households who indicated that they experienced negative impacts was 33% at 0 – 10 km region, reducing to 24% at 11 – 20 km region, before increasing to 27% at both 21 – 30 km and 31 km and farther regions. The negative impacts included restriction to resource access, payment for resources inside the reserves, animal attack, displacement and shooting of dogs that strayed into the reserves.

The percentage of people who indicated that they received benefits from the reserves did not significantly decrease ( $\chi^2 = 9.127$ ;  $P = 0.104$ ;  $df = 5$ ) with an increase in distance from the reserves' boundaries. At 0 – 10 km region, 10% of the households indicated that they benefited from the reserves in one way or another. This number declined to 2% at 11 – 20 km region, then 0% at 21 – 30 km region, before increasing to 2% at 31 km and farther region. This relationship is also weak ( $PHI=0.159$ ). On the specific benefits, the number of households accessing game meat and building materials decreased with distance from the nature reserves. Access to clean water was only indicated by the households around Tsolwana Nature Reserve where the percentage decreased with distance from the reserve. The other benefits that respondents indicated that they were accessing were a chance to view the wild animals free of charge, jobs, and skills training opportunities, all these benefits decreased with distance from the reserves' boundaries.

## **4.7 DISCUSSION**

### **4.7.1 Changes in livelihood activities with distance from the reserves' boundaries**

There was no specific activity that one could pinpoint that it was the main livelihood activity regardless of the distance from reserves' boundaries. Residents engaged in a combination of activities to earn their living – subsistence farming, informal businesses, commercial farming, formal employment, formal business, and informal employment. The main factors that influenced the choice of livelihood activity were

the place where one resided in relation to the major urban centre and size of land. Residents closer to the reserves engaged in businesses (formal and informal) while those closer to the reserves depended on social security systems. Local communities did not practice farming because the land they had was only enough for a housing structure. Those closer to the town centres engaged in informal activities because the town centres provided opportunities for the businesses. The size of land that households had was a limiting factor in the choice of livelihood activity as most households did not have enough land to accommodate several activities of their choice. Therefore, it implies that reserves had no influence on household's choice of livelihood activities. Ifeanyi-Obi and Matthews-Njoku (2014) in their study in southeast Nigeria found that age, years of education and monthly income are the major socio-economic factors influencing choice of livelihood activities. In another study Xu *et al.* (2015) found the maximum years of education of any household member, the age of the household head, the number of labourers in a household, household location, as well as formal and informal social networks influenced the choice of household livelihood activities. According to Perret (2001), only 9% of households in the Eastern Cape Province practised crop production as their source of cash income. According to Delius and Schirmer (2001), in the 1960s population pressure led to diminishing access to land in South Africa. This was made worse by the pre-1994 policies of separate development where black people were crowded into homelands leading to overutilization of land (<http://soer.deat.gov.za/22>).

The communities in the study sites depended on government grants as their main livelihood activity, with a few depending on remittances from their relatives or their loved ones in cities across the country. This scenario is associated with skewed apartheid policies where former homelands were deprived of meaningful developments. This encouraged people to leave their homes for employment in mines and factories in cities around the country (Nontembeko, 2013).

Because of low levels of education, the rate of unemployment in the study area was high. Although there were teachers, nurses and police in the study areas, most households depended on either informal businesses or casual work to make ends meet. According to Perret (2001), most rural people generate their cash income through informal businesses, cheap labour and working in kind.

#### **4.7.2 Variations in livelihood capital with distance from the reserves' boundaries**

The reserves did not have significantly affect the livelihood capital that households had in pursuit of livelihood. The state of livelihood capital was because of location and government policy and their implementation. For example, the distance that residents walked to access schools, shops and health facilities increased with distance from the reserves' boundaries. Since the reserves did not have any capital investment projects, it was expected that areas closer to the reserves could not have enough schools, shops and health facilities. This is contrary to Mackenzie (2012) who established that residents adjacent to protected areas walk long distances to access shops and schools. The availability of schools and health facilities could be attributed to the South African government prioritisation of providing health and educational facilities to all citizens in the country, putting more emphasis on the rural and the marginalised communities. The availability of shops on the other hand could be attributed to the involvement of foreign nationals who operate shops in remote rural areas across South Africa. Communal areas in rural South Africa have a long history of environmental and political neglect and most are highly degraded, making them unproductive (<http://soer.deat.gov.za/22>). Besides environmental degradation, most rural areas are far from major urban centres that are hives of activities. This makes them unattractive to potential investors. In addition, communal areas do not have properly developed infrastructure to make their land valuable.

There were more people without potable water within their reach near the reserves than far away from the reserves. This, however, had no reflection on the existence of reserves. According to the Development Bank of Southern Africa (DBSA) (2012) weak institutional capacity, shortage of skills, political interference in municipal operations in the development of infrastructure, affect the capacity of municipalities to provide adequate and sustainable water supply. (DBSA) (2012) further argued that because of these challenges, sometimes water infrastructure is developed without due consideration to the availability of water resources, leading to situations where the infrastructure cannot be used. This was the case in the study area where there was inadequate and/or unsustainable water supply systems. South Africa is a

water scarce country and people without access to potable water struggle to make ends meet (DWA, 2012). According to the Constitution of South Africa, every South African has a right to access sufficient and clean water (RSA, 1996). Because of this, the government has taken upon itself to make sure that piped water is supplied to all its citizens (World Bank, 2011). Despite all the efforts, not everyone has access to sufficient and clean water (World Bank, 2011; DWA, 2012). In low-income countries of Africa, only 40 percent of the population has private connections to piped water networks (Morella *et al.*, 2008).

Access to electricity in the study areas was a challenge. This was not linked to the nature reserves. According to the Development Bank of Southern Africa (DBSA) (2012), the state of poor rural electricity infrastructure in South Africa is due to aging infrastructure, low reserve margins and increasing demand. According to Malzbender and Kamoto (2005), under the apartheid government, prior to 1994, government policies geared at serving the needs of the minority white population group. Energy policies (including electricity provision) focused on ensuring enough supply of cheap black labour to the mining, chemical and agricultural industries, which formed the backbone of the South African economy. Most people without electricity are black South Africans and electrification levels in rural areas generally fall short of the ones in urban areas. In both rural and urban areas, the poorest people are the most without access to electricity. According to Jamal (2015), more than 60% of households in rural South Africa do not have access to electricity, with the majority found in former homelands.

As was the case with electricity, most households in deep rural areas (closer to the reserves) did not have proper sanitation but those closer to urban centres (away from the reserves) were better served with sanitation services. This was attributed to insufficient household incomes that made it difficult for most of the households to afford erecting proper sanitation infrastructure. Although respective municipalities were trying their best to help, there were massive backlogs. Even though South Africa has made impressive progress in terms of sanitation coverage, free basic sanitation is not provided equally or evenly as some households especially in rural areas do not have access to proper sanitation services (World Bank, 2011).

The nature and condition of transportation infrastructure in the remote areas was in dire state closer to the reserves. The road infrastructure was impassable during wet times and dusty during dry periods. The mode of transport was also unsuitable for human transport, as only vans could be able to use the nature of the roads found in these areas. In addition, the schedules of the few buses that operated in the study area were not flexible because they left very early in the morning, before most of the people could wake up and returned very late, making it difficult for the residents of these areas to live a normal life. The state of transport infrastructure in extremely rural areas denied people access to the necessary goods and services and made the prices of basic commodities too high. An effective transport system is vital for the economic growth and social development of any region. According to the Development Bank of Southern Africa (DBSA) (2012), the poor state of transport infrastructure in rural South Africa is due to under-investment in road infrastructure, and huge backlogs in road maintenance and rehabilitation due to lack of capacity and resources in rural provinces to manage and maintain their roads adequately. Effective transport promotes efficient movement of goods and passengers, accelerates service delivery, and promotes effective investment (RSA, 2013). South Africa, however, is one of the most unequal countries in the world in all spheres, including transport, where urban areas are well developed, while rural areas are underdeveloped (Pieterse, 2010; Seeking and Nattrass, 2005). According to Van Vuuren (2008), more than 60% of rural households in South Africa have no access to public transport. Van Vuuren (2008) argued that the lack of access to transport means mobility, and entrance to basic social services and the economic mainstream come at a high social and economic cost.

Most families in the study area relied on remittances from family members to survive. This was because most of the households were still living in well-knitted family structures that formed the basis of their identity and belonging. Reliance on remittances decreased with distance from the reserves' boundaries. Family kinship provides a sense of belonging, solidarity and protection (Fleischer, 2007). Perret (2001) established that in the Eastern Cape Province at least 40% of the households had access to remittances from family members working somewhere else.

Access to enough land for all household activities was a challenge in the study area. The only piece of land that one could access was where he/she could erect a house and the rest was communally owned, of which the use was regulated by communal structures. Because of this, the type and number of activities that one could engage in were limited. This is in line with findings by Delius and Schirmer (2001) who found that the apartheid policy of segregation led to diminishing access to land. The government has been trying to address the backlogs of the past regime but it has not been able to reverse the situation in all areas because of resource constraints (budgetary and human capacity constraints). Even though Perret (2001) found that all households in the Eastern Cape Province had access to rangelands, the use of that land was not easy because of the complexity and dynamics of communal structures. Access to land meant nothing to anyone if the people did not have the rights to personally use the land. For example, if the land was for grazing, it could only benefit those who had livestock.

Majority (82%) of the households did not have access to communal support. This was because most households preferred family support as opposed to communal support. This contradicts Lim (2009) who found that in Africa, family and community network systems or kinship is the first line of defence in times of misfortune. Lim (2009) continued to state that communities provide financial, emotional and physical security during difficulty times. According to Fleischer (2007), family and community also provide a sense of belonging, solidarity and protection.

Unemployment statistics decreased with increase in distance from the reserves' boundaries. This, however, could not be attributed to the nature reserves but to a lack of employment opportunities and insufficient skills among the inhabitants in the rural areas where the reserves were located. Low levels of skills could be attributed to high rates of school dropouts while lack of employment opportunities could be ascribed to low levels of development in these areas. South Africa is one of the most unequal countries in the world, facing a persistent and by some measures widening gap in inequality (Pieterse, 2010; Seeking and Nattrass, 2005). The majority of rural inhabitants in South Africa are unemployed (Perret, 2001).

#### **4.7.3 Livelihoods trends (Consistency/inconsistency) with distance of the reserves' boundaries**

There were fluctuations in households' livelihoods. However, these fluctuations were not linked to the presence of the reserves. This is because whether households were closer to or far from the reserves, the livelihood fluctuations were the same. It can therefore be concluded that the fluctuations could be attributed to the fact that most of the households closer to the reserves found themselves in the rural areas that are deprived of necessary infrastructure for development. The scarcity of infrastructure is due to government's lopsided development, where infrastructure development is devoted to those areas deemed to bring benefits. Rural areas are perceived to be areas where investment in infrastructure is a waste of resources unless there are minerals. Unfortunately, the study area is one of those areas where investment in infrastructure was seen as a waste of resources. According to Baird and Leslie (2013), the presence of protected areas creates variance in the livelihoods of those living adjacent to them.

#### **4.7.4 Variations in livelihood strategies with distance from the reserves' boundaries**

Most households' strategies were only survivalist in response to a range of constraints and risks they were faced with on a day-to-day basis. Most of them expressed how they were rendered destitute whenever the weather conditions were unfavourable. Rural livelihood strategies are dynamic adaptation processes through which rural people first survive and then improve their well-being over time (Devereux, 1999; Stack *et al.*, 2003; Ruiz Perez *et al.*, 2004). Stack *et al.* (2003) in an analysis of the mopane worm trade in Southern Africa found that households followed a mix of accumulation, diversification, and shock response strategies in order to survive. These can be grouped into four categories – accumulative, adaptive, coping, and survival. According to Stack *et al.* (2003), livelihood strategies play different roles in rural areas and these roles can be categorised into 'hanging on', 'stepping up' and 'stepping out'. 'Hanging on' describes strategies that enable households to maintain their present livelihood (to survive) while 'stepping up' comprise accumulation of productive resources to expand current strategies and income and 'stepping out' comprise accumulation of resources that can be used as a

base from which to shift to different more profitable livelihood strategies. Alemu (2012) noted that rural households with the potential to diversify their income sources into non-farm activities are relatively better off than those that depend on farm activities (off-farm and farm) alone or take up non-farm activities as their less important sources of livelihood. According to Baird and Leslie (2013), people use livelihood diversification as a coping and/or risk mitigation strategy in response to various shocks and uncertainties. Baird and Leslie (2013) discovered that in Tarangire National Park, Northern Tanzania, livelihood diversification strongly correlated with distance from the park. Baird and Leslie (2013) established that households near the park sought various means to reduce variance in wealth and income in response to uncertainty associated with the park, compared to those far from the park. In the four sites people adopted more than one strategy to survive because they had limited resources to engage in stable livelihood activities and had to live on trial and error ways to survive.

Households in the study area adopted different strategies to get through the hard times. These strategies ranged from migrating to relatives, intensifying or extensifying their agricultural activities, changing their diet, changing their eating routines, making use of claims, diversifying their livelihoods, borrowing (either food or money) from friends or shops, relying on neighbours/family/friends (without going to stay with them), making use of what they had saved (food or money) when times were better, and doing nothing (deplete resources). Most of the households had nothing to do but consume all that they had hoping that the future will be merciful. Beside this, change of diet and eating routine also featured a lot. Households adopted multiple strategies to earn a living because for most households, no one strategy was stable in supporting their livelihoods. The use of multiple strategies was a way to cushion against any failure of one strategy. Most of the households were living in states of uncertainty regarding their livelihood activities. According to Ellis (2000), rural households engage in multiple activities and rely on diversified income portfolios. According to Ellis (2000), capability to diversify is beneficial for households at or below the poverty line. Ellis (2000) continued to argue that having alternatives for income generation makes a difference between minimally viable livelihoods and destitution. Ellis (2000) argued further that better-off households are able to diversify more than poor ones.

There was a significant variation in the number of people who adopted migration as a coping strategy during low livelihood status. The majority of households in the 11-30 km zone from the reserves used migration as a coping mechanism during low livelihood status. Only a few far from and closer to the reserves adopted this strategy. This means that most people in the vicinity of the reserves expected that the reserves' management should address their livelihood needs and those far to the reserves were well off to be able to afford their livelihoods than depending on friends and relatives. When livelihoods are hard, friends and relatives come to people's rescue (Lim, 2009). Most poor people leave their homes to stay with friends and relatives until the situation improves.

There was no significant relationship between agricultural intensification and extensification and distance from nature reserves. Xu *et al.* (2015) found that 56% of farmers in the mountainous settlements in the three Gorges reservoir areas of China had low dependence in agriculture and could not expand their operations because of insufficient agricultural support systems. Many households did not practice agriculture, an indication of their dependence on shops for food. This was one of the causes of escalating prices of food in most of the shops in the study area. If the shops in the vicinity did not have food, most households had to travel long distances in search of food, spending the little money they were getting from government grants just to get food on their tables. This, sometimes, led to some households not being able to get other basic needs. The research also established that there were more households closer to the reserves adopting change of diet as a coping strategy compared to those far from them. Most people interviewed said that their diets are low, and they had no more room to change. Changing to them was like living in destitution. Ellis (2000) argued that the use of agriculture intensification and extensification as a coping strategy during hard times is no more in sub-Saharan Africa because the region is changing from rural to non-rural configuration, and most households relying on non-farm activities to survive.

#### **4.7.5 Changes in benefits and costs associated with reserves with distance from the reserves' boundaries**

Although the reserves created jobs for the locals, they were not massive as there were insufficient establishments in the area for enough job creation opportunities.

The only employment opportunities were in the reserve lodges and as security guards. There were no land leasing or licensing arrangements, no community equity or profit-sharing schemes, or independent locally owned commercial activities (such as selling curios, food or cultural performances to tourists) that are necessary to enhance benefits from the reserves. Besides the lack of tourism infrastructure, local people did not have communal structures that could be used as platforms for tourism development. The Gorilla Sanctuary in Congo Brazzaville through ecotourism generated revenue that was used to build a local health centre and hire a health advisor (King *et al.*, 2009). In the Royal Chitwan National Park in Nepal, a community user group was set up in 1996 to collect wildlife-viewing fees that were used to set up biogas plants, and operate a micro credit scheme that provided loans to community members at low interest rates (Dudley *et al.*, 2008). Veldeld *et al.* (2012) noted that the Mikumi National Park (Tanzania) offered locals opportunities to sell handcrafts to tourists. Melita and Mendlinger (2013) established that 70% of the income of communities living around Ngorongoro Conservation area came from tourism related activities. Good management and sustainable harvesting of palms in Caprivi Game Park (Namibia) enabled local women to supplement household incomes by selling palm baskets to tourists (Ashley, 2000). Dudley *et al.* (2008) established that the Maya Biosphere Reserve in Guatemala directly created over 7000 jobs, Serengeti National Park created 395 jobs between 1993 and 2003, and in the Okavango Delta System. In Botswana, 923 people were employed in 30 tourist accommodation facilities in 2001.

There were no communal projects that addressed people's needs. There were no infrastructure developments in the study sites because of lack of formal structures or formal provisions for their developments. This means that the reserves did so little to improve the livelihoods of those living and around them. This is contrary to Canavire-Bacarreza and Hanauer (2012) who argued that protected areas can improve the infrastructure of surrounding areas, ultimately improving the living conditions of those living in and around them. Dudley *et al.* (2008) observed that in Lupande Game Management area (Zambia), Kisite and Mpunguti (Kenya), Bunaken National Park (Indonesia) and Selous Game Reserve (Tanzania), revenue earned from the protected area activities was distributed to village community projects like schools. Dudley *et al.* (2008) further noted that the Serengeti National Park contributed US\$

15, 000 for construction, rehabilitation or maintenance of local infrastructure such as roads, between 1993 and 2003. The Bwindi Impenetrable Forest National Park in Uganda distributed 60% of its funds to community projects promoting conservation and development of feeder roads (Dudley *et al.*, 2008). Ezebilo and Mattson (2010) found that the Cross River National Park in Nigeria build a bridge and a hall for the local communities.

The people around the four nature reserves benefited from the reserves in different ways that improved their livelihoods. In Tsolwana and Great Fish River nature reserves, local communities accessed meat from the reserves that improved their nutritional value. Around the Hluleka and Mkambati nature reserves local communities got building materials (thatching grass and building poles). At the Tsolwana Nature Reserve, local communities reported access to water and grazing fields during drought. Clements *et al.* (2014) evaluated the impacts of protected areas in Cambodia and discovered that households bordering the PAs were significantly better off due to greater access to resources inside PAs. On the other hand, Bennett (2010), Brockington and Schmidt-Soltau (2004), as well as Cernea and Schmidt-Soltau (2008) argued that local people's livelihoods and even survival often depend on local and regional natural resources. Thus, biodiversity and natural resource conservation initiatives can often come in conflict with livelihood strategies. Therefore, establishment of protected areas can have adverse effects on neighbouring communities, mainly through displacement, reduction in food security and loss of livelihoods.

In some cases, there were reports of children and the elderly were killed by escaping animals, especially hippos. Although there was no crop damage reported, respondents frequently mentioned death of dogs that trespassed onto the reserves. Cases of goats and sheep frequently going missing were also reported. The goats were assumed to have trespassed to the reserves, killed by either jackals or reserves' management. Ezebilo and Mattson (2010) stated that people living adjacent to protected areas usually pay dearly through death and injuries of community members and their livestock reportedly caused by wild animals escaping from protected areas. According to Cernea and Schmidt-Soltau (2008), crop damage, labour costs of crop defence, and physical hazard (and fear of hazard) are

common around protected areas. Cernea and Schmidt-Soltau (2008) further established that cases of death of livestock and humans stemming from escaped wild animals from protected areas are common around protected areas. Dar *et al.* (2009) found that in the Machiara National Park (Pakistan) leopards caused relatively large amounts of loss, with the percentage of livestock killed greater than the rate of restocking. Cases of impoundment of livestock alleged by rangers to be grazing and illegally as well as fines for breaking regulations have also been cited as some of the possible negative impacts that protected areas have on people living adjacent to them (Cernea and Schmidt-Soltau, 2008). Injuries inflicted to people around the reserves because of escaping hippos were reported.

Owing to the way these local coastal communities relied heavily on marine resources for their livelihoods, many were adversely affected by this exclusion approach, which resulted in them being economically marginalised. The people around Hluleka and Mkambati Nature Reserves were restricted access to fishing and medicinal plants that affected their way of life. According to Bosak (2008), when local people are alienated from livelihood resources (as happens with the creation of protected areas), they are economically and socially marginalised. Ferraro *et al.* (2011) noted that restricting access to natural resources for the poor create new poverty traps or reinforces existing ones. For example, Qiu *et al.* (2009) in their study in China found that establishing protected marine areas along densely populated and in heavily used areas ignored the social context of conservation.

#### **4.8 CONCLUSION**

The study has established that although there were variations in some livelihood assets, these variations could not be attributed directly to the presence of the reserves in the study area but to the location of the study sites in the rural setting. Unlike what other scholars (Mackenzie, 2012; Clements, 2014, Nana and Tchamadeu, 2014; Franks and Small, 2016) have established, the reserves in the study area did not have significant impacts on the livelihoods of those living adjacent to them. This may be because of the fact that most people's households did not directly depend on the resources found in the reserves. Most households in the study area did not depend directly on natural resources for their livelihoods but on government security systems and remittances from relatives working in other place

in the country. There were cases where households indicated that they benefited from the reserves through essential goods and services.

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# **CHAPTER 5**

## **LOCAL COMMUNITIES' KNOWLEDGE OF AND PERCEPTIONS ABOUT CONSERVATION IN FOUR NATURE RESERVES IN THE EASTERN CAPE PROVINCE, SOUTH AFRICA**

### **5.1 INTRODUCTION**

According to Bennett (2016), perceptions about conservation refers to beliefs, attitudes, norms, preferences, and motivations of behaviour responses and levels of support about aspects of conservation like governance, management of impacts of conservation and sharing of benefits from conservation. Perceptions can also refer to the way individuals observe, understand, interpret, and evaluate actions, experiences, individuals, policies or outcomes of conservation. Local communities' perceptions and behaviours concerning protected areas are influenced by a number of factors among them; (1) the level of trust towards institutions responsible for environmental management and their effectiveness (Bogaert *et al.*, 2009; Kim, 2009), (2) the changes imposed during the designation of a protected area (Garcia-Frapolli *et al.*, 2009), (3) the level of awareness among citizens (Petrosillo *et al.*, 2009) and (4) the personal attributes of individuals (Alessa *et al.*, 2003).

In order to achieve both development and conservation, community based natural resource management (CBNRM) is the best option (Wainwright and Wehrmeyer, 1998; Mazosera *et al.*, 2006; Selebe, 2010). CBNRM enables communities to regain control over natural resources while at the same time strengthening their decision-making capabilities, advancing their involvement in project activities and improving their economic welfare in the process enhancing efficiency, self-reliance and sustainability (Wainwright and Wehrmeyer, 1998). When communities have control over natural resources their interests in resource conservation are stimulated (Selebe, 2010).

According to Mazesoara *et al.* (2006) and Bennett (2016), for effective CBNRM factors that influence communities' perception about conservation management and

their involvement in management of natural resources should be investigated and understood. Mazosea *et al.* (2006) identified the following factors: 1) nature of resource under consideration, 2) socioeconomic and cultural milieu of the area, 3) opportunities to generate employment and economic activities, 4) community capacity to undertake management responsibilities, and 5) policy and institutional uncertainties. If the resource under consideration is sensitive and likely to be threatened and if local communities have limited skills and experience to deal with resource conservation, for example, government agencies in-charge would be hesitant to engage in CBNRM (Mazesora *et al.*, 2006). According to Bennett (2016) as well as Mutekwa and Gambiza (2017), the level at which local communities support conservation activities is determined by many factors including; (1) nature and magnitude of impacts from conservation, (2) quality of governance, (3) appropriateness and exclusiveness of governance structures, (4) legitimacy of policies, rules and decision makers, and (5) equity and distribution of costs and benefits. When local communities are excluded from protected area management and their needs and aspirations are ignored, it becomes extremely difficult to enforce conservation policies (Hayes, 2006; Andrade and Rhodes, 2012; Mutekwa and Gambiza, 2017).

## **5.2 AIM AND OBJECTIVES**

### **5.2.1 Aim**

The aim was to assess local communities' knowledge of and perceptions about the four reserves and how these perceptions influenced their participation in and support of conservation activities.

### **5.2.2 Objectives**

The objectives were to:

- I. Assess local communities' knowledge on the role of and the management of the reserves.
- II. Assess local communities' perceptions about the location and management of the reserves.
- III. Assess how local communities' perceptions influenced their participation in and support of conservation activities.

### **5.3 RESEARCH QUESTIONS**

- I. To what extent do local communities know about the role and management of reserves?
- II. How do local communities perceive the location and management of the reserves?
- III. How do local communities' perceptions on the location and management of the reserves influence their participation in and support of conservation activities?

### **5.4 HYPOTHESES**

- I. Communities closer to the reserves because of their daily interaction with the reserves know what the reserves are for and how the reserves are managed compared to those far from the reserves.
- II. Because of negative effects of reserves on people's livelihoods, communities closer to the reserves resent their location and management compared to those far from the reserves.
- III. Communities with negative attitudes are less likely to participate or ready to participate and support conservation activities compared to those with positive attitudes.

### **5.5 DATA TYPES AND METHODS**

#### **5.5.1 Data types and data collection**

A group of trained research assistants carried out fieldwork on heads of households in selected villages in the four nature reserves. With the aid of a map, villages in each site were listed down and then grouped together based on distance: 0 – 10 km, 11 – 20 km, 21 – 30 km and 31 km and farther from the reserves' boundaries. From each stratum, villages were proportionately selected using simple random sampling. With the aid of data from Statistics South Africa (2012), households from the selected villages were listed and a sample of households was randomly drawn. The study sites were visited during 2012–2013 for the collection of data where 375 questionnaires (137 for Mkambati Nature Reserve, 60 for Great Fish River Nature Reserve, 81 for Tsolwana Nature Reserve, and 97 for Hluleka Nature Reserve) were administered. Data on: (1) knowledge of the role and management of the reserves, (2) costs and benefits from the reserves, (3) location of the reserves, (4) participation

in reserve activities and (4) reserve management structures were gathered using a questionnaire.

Knowledge focussed on whether the respondents knew what the reserves were for and how the reserves were managed. Respondents were asked to rate (on a scale of 0 – 5 where 0 meant they did not know anything and 5 meant they knew everything) including: (1) what reserve are, (2) what is in the reserves, (3) who manages the reserves, (4) the staff members working in the reserves, (5) the activities that take place in the reserves and (6) what the reserves are supposed to do. Costs and benefits looked at the nature and magnitude of the impacts, provisioning of ecosystems goods and services as well as equity in the distribution of these costs and benefits. On the costs, respondents were asked their views on (1) resource access and use, (2) effect of reserves on land tenure, (3) reserves' contributions on displacements, (4) reserves' threats to domestic animals, (5) reserves' threats to humans, (6) reserves' contribution to tourism development, (7) reserves' contribution to household income, and (8) reserves' effects on crops. On the benefits, respondents were asked their views on (1) access and use of non-timber forest products, including meat, (2) access and use of forest products, (3) access and use of water, (4) reserves' influence on climate, (5) reserves' contributions to disease control, (6) reserves' recreational contributions, (7) reserves' spiritual contributions, and (8) reserves' educational contributions. With regard to location, the survey looked at (1) whether or not the local communities liked the siting of the reserves, (2) why they liked or disliked the siting of the reserves, and (3) how the siting could be improved. Governance issues included: (1) how community meetings involving reserves' issues were conducted, (2) how communities were informed of the meetings, (3) ways of engaging community members in reserves' issues, (4) how communities' views and aspirations were integrated in decision making about reserves, (5) how feedback was provided to communities, and (6) how communities' needs were incorporated in policies and actions about reserves. Regarding communities' perceptions on the reserves the respondents were asked to: (1) rate (on a scale of 0 – 5 where 0 meant not willing at all and 5 meant extremely willing) their willingness to participate in conservation matters, (2) provide reasons for their rating, and (3) indicate how their willingness or unwillingness influenced their actions like breaking of fences, poaching, illegal harvesting of resources from the

reserves, and custodianship of wildlife.

Focus group interviews were also conducted between August and December 2013 to complement the household surveys. Sixteen focus groups consisting of between four and eight household heads that were selected by households on the basis that they knew much about the reserves and could represent their interest were interviewed. The meetings were held at headmen's homes that the participants selected as convenient to them. The local IsiXhosa language was used. Four focus group sessions were conducted per site, one per distance category: 0-10 km, 11 – 20 km, 21 – 30 km and 31 km and farther from the reserves' boundaries.

### **5.5.2 Data analysis**

Quantitative data were cross-tabulated to extract Chi-square ( $\chi^2$ ) and P values that were used to make inferences on the extent to which respondents' knowledge and perception of varied with distance from the reserves' boundaries.

With the aid of NVivo, qualitative research involved two distinctive approaches to research – aggregating the findings of very similar findings where the key concepts were clearly defined in advance and configuring the findings of dissimilar in order to define key concepts and develop theoretical understanding (Weish, 2002). The process started by delving into the data and then full texts to see the key and recurrent trends. Once most of the key trends were identified codes were created and then data were sub-divided into sections for in-depth analysis. Analysis was refined considering the created trends and coding continued iteratively but systematically and simultaneously accommodating the available data. The research findings were divided into overlapping subsets whose findings addressed 1. respondents' knowledge of the role of reserves and how the reserves were managed, 2. respondents' views on the location of the reserves, 3. respondents' perceptions about the reserves' managers and the way the reserves were managed, 4. respondents' perceptions on the nature and extent of costs and benefits from the reserves, and 5. whether their knowledge of the reserves and their management, views on the location of the reserves, and perceptions about of the reserves' management influenced their' participation in conservation activities. Information gathered from the review of documents and participant observation informed the

results. Review of literature regarding protected areas and local communities' perceptions also contributed information that aided the analysis.

## **5.6 RESULTS**

### **5.6.1 Variations in communities' knowledge on the role of reserves and reserves' management with distance from the reserves' boundaries**

The percentage of people who knew the role of the reserves decreased with increased in distance from the reserves' boundaries. The relationship between local communities' knowledge of the role of reserves and distance from a reserve was moderately strong (PHI=0.263). Communities closest to the reserves knew more on what the functions of reserves were than those farther away. There were about twice the number of communities (82%) within 0 – 10 km from the reserves' boundaries who knew the functions of reserves compared to those living more than 30 km from a reserve.

There was an increase in the percentage of people who knew (1) the rules of reserve management, (2) why the rules had to be implemented, (3) how the rules were implemented, (4) ways of involvement, and (5) the rights and responsibilities of communities with increase in distance from the reserves' boundaries. There were about three times the number of communities (61%) more than 30 km who knew how the reserves are managed compared to those living closest to the reserves (0 – 10 km) (22%). This association was weak (PHI=0.196).

### **5.6.2 Changes in perceptions about costs and benefits from the reserves with distance from the reserves' boundaries**

Percentage of people who saw reserves as important decreased with distance from the reserves' boundaries. On average, over 79% of the respondents indicated that the reserves were important for the conservation of biodiversity and supplying the necessary goods and services for both humans and ecosystem functioning. Over 24% viewed the reserves as important for their services like climate regulation, biodiversity conservation, and water purification. While 39% viewed the reserves for the provision of water, meat and building materials, 7% saw reserves as place for recreation, 4% felt the reserves were places where they could learn about nature and natural resource management, and the remaining 6% saw reserves as having

potential to stimulate economic growth and create jobs through ecotourism. More people (66%) closer (0 – 10 km) to the reserves indicated that reserves had benefits compared to 12% far (31 km and farther) from the reserves. As much as there were these benefits, however, 81% of the respondents felt that most of the benefits (especially meat and jobs) were only accessible to friends and families of those in the management committee. The association between communities' views on benefits from the reserves and distance from the reserves' boundaries was, however, weak (PHI=0.159).

There were more people closer to the reserves that experienced and viewed reserves as a risk to their lives compared to farther from the reserves. There were about five times (63%) more respondents closest to the reserves (0 – 10 km) who indicated that reserves affected their lives in one way or another compared to 13% more than 30 km from the reserves' boundaries. The association between communities' views on effects from the reserves and distance from the reserves' boundaries was strong (PHI=0.746). People living in the proximity of Hluleka and Mkambati Nature Reserves said that the sale of crayfish and mussels was integral to their livelihoods, but one needed a license to extract them. They said that the restrictions attached to this licensing were affecting negatively on their livelihoods. Although the locals acknowledged the need for seasonal restrictions in fishing, they did not welcome it because they believed that the mussels were sometimes abundant but were left to die and rot because the reserves managers were implementing the conditions of this policy without proper information about the abundance of these animals. They said that mussels grew on top of each other and eventually died because there was insufficient substrate for them to grow upon. There were more people closer to the reserve who shared the view that restrictions on the use of mussels should be informed by proper information compared to those far from the reserves. Those far from the reserves indicated that whether there were restrictions or not, it did not make a difference in their lives.

### **5.6.3 Differences in perceptions about the location of the reserves with distance from the reserves' boundaries**

There was a decrease in the number of communities who were satisfied with location of the reserves with increase in distance from the reserves' boundaries. The number

of respondents satisfied with location changed with distance from the reserves' boundaries. More households (76%) far (31 km and farther) from the reserves were satisfied with the location of the reserves, compared to those (33%) closer (0 – 10 km) to them. The relationship between people's views about the location of the reserves and distance from the reserves' boundaries was moderately strong (PHI=0.277). Most of the people who resented the reserves felt the nature reserves were merely an obstacle to their access to resources, development and impediment on their 'rights'. For many of them everything they need 'ivalelwe kwelahlathi' (is enclosed in that reserve).

#### **5.6.4 Variations in perceptions about reserves' management with distance from the reserves' boundaries**

There was an inverse relationship between distance from the reserve boundaries and the number of people who disapproved the legitimacy of the choice of reserve managers and their management styles. About seventy-one (71%) of the respondents closest to the reserves (0 – 10 km) did not approve of the way the reserves were managed (management styles) compared to 11 % at more than 30 km from the reserves' boundaries. Those resenting the managers and their management styles felt that reserve managers were imposed on them from East London (the headquarters of the Eastern Cape Parks and Tourism Authority). The local communities felt that an 'imbizo' (meeting) should be called every time there are new appointments of managers to formally introduce the managers to them and open lines of communication between the nature reserves and the people.

Most participants (86%) viewed the reserves as a continuation of the apartheid policies that excluded them from participation, and thus made their lives miserable. In Hluleka Nature Reserve, for example, for a long time everybody had to have a pass to enter the gate of the reserve for any purpose. To them this was no different to the 'dompass' law under the apartheid government which required people to carry identification everywhere they went. The nature reserve was an imposition which saw them spiraling down the poverty cycle. Hluleka Nature Reserve was a gateway in and out of Mdzweni village but people of the village expressed their dissatisfaction with the reserve management because they were only allowed to pass through the reserve between 6 am and 6 pm while before and after these hours access was

prohibited. Whoever had to come after these times had to find alternatives, which were often longer, and inconveniencing. The restriction was a huge problem especially in times of health emergencies such as childbirth and sickness when vehicles were needed for assistance as people could not access emergency services.

There was an inverse relationship between distance from the reserves' boundaries and local communities' views on the inclusiveness of the local communities in the reserves' management decision-making structures. Almost three quarters (74%) of the communities closest to the reserves (0 – 10 km) compared to 4% at more than 30 km from the reserves' boundaries felt the reserve management deliberately excluded them from reserve activities and in the process did not consider their needs when taking decisions. Most (65%) of the respondents were of the view that the process through which the village committee members were chosen to represent them at the reserve management meetings was undemocratic. They said that those people in the committees were chosen by the chiefs and not the community members and were 'agents of the chiefs' who were there to push for the chiefs' interests at the expense of the wider community.

There were various proposals on what needs to be done by the reserves management to achieve both conservation and development objectives. There was no significant change in communities that proposed coexistence with distance from the reserves' boundaries. Overall, 89% of the respondents felt that the reserves and people could coexist provided their livelihood needs are integrated in the management of the reserves. Closest to the reserves (0 – 10 km), 82% of the communities were for core-existence compared to 92% at more than 30 km from the reserves' boundaries.

The number of communities proposing strict reserves as the best way to manage increased with distance from the reserves' boundaries. Closest (0 – 10 km) to the reserves' boundaries only 12% of communities proposed strict controls compared to 58% at more than 30 km from the reserves' boundaries.

The number of people suggesting more the community-based approach as the best method to manage the reserves decreased with increase in distance from the

reserves' boundaries. Closest to the reserves (0 – 10 km) 59% of the communities proposed community-based conservation compared to 17% at more than 30 km from the reserves' boundaries. This is reflected on the significant decrease in the communities' expectations of support from the reserves decreased with increase in distance from the reserves' boundaries. Closest to the reserves (0 – 10 km) 67% of the communities expected to be involved compared to 16% at more than 30 km from the reserves' boundaries. This relationship was very strong (PHI=0.391).

There was a decrease in communities' expectation on access to natural resources in the reserves and benefits accrued from reserves' operations with increase in distance from the reserves' boundaries. Closest to the reserves (0 – 10 km) 91% of the communities expected to use the resources inside the reserves for their livelihoods compared to 2% at more than 30 km from the reserves' boundaries.

The percentage of people willing to participate in reserve activities decreased with increase in distance from the reserves' boundaries. The relationship was very strong (PHI=0.351). Closest to the reserves (0 – 10 km) 52% of the respondents were willing to participate compared to 19% who were willing to participate at more than 30 km from the reserves' boundaries. Most (73%) of the respondents said that they were willing to participate only if the reserve managers 'treated them as humans'. They were concerned that their participation could not make a difference as the managers made decisions irrespective of what the local communities want. There were also those who did not see any benefits of participating because 'they had too much to worry about than wasting their time in issues that would not put food on their tables'. They said that they would only participate if this could improve their livelihoods.

Variations on communities' 1. knowledge on the role of the reserves, 2. knowledge on the rules of management of the reserves, 3. views in the importance of the reserves, 4. views in the negative impacts of the reserves, 5. satisfaction of the location of the reserves, 6. resentment of reserves' management, and 7. views on how the reserves should be managed with increase in distance from the reserves' boundaries are summarised in Table 5.1.

**Table 5.1: Variation of communities' knowledge, views and perceptions with changes in distance from the reserve boundaries**

Variable	Variation with distance	$\chi^2$ Value	P-Value	Degrees of Freedom	Significance at 95%
Knowledge on the role of reserves	Decreased	9.656	0.006	5	Highly significant
Knowledge on the rules of managing the reserves	Increased	3.343	0.016	5	Significant
Views on whether the reserves are important	Decreased	42.719	0.032	30	Significant
Experienced negative effects and perception of reserves as a risk to lives and livelihoods	Decreased	38.825	0.002	30	Highly significant
Satisfaction of location of the reserves	Increased	54.98	0.000	10	Highly significant
Resentment of reserves' management styles	Decreased	42.068	0.000	15	Highly significant
Inclusion of local	Decreased	65.088	0.001	35	Highly significant

communities in reserves management					
Strict conservation	Increased	120.749	0.000	45	Highly significant
Co-existence	No change	84.114	0.861	45	Not significant
Community based approach to conservation	Decreased	17.243	0.039	10	Significant
Expectation of support from the reserves	Decreased	55.359	0.016	35	Significant
Expectation of access to natural resources in and other benefits from the reserves	Decreased	40.98	0.000	6	Highly significant
Willingness to participate in reserves' activities	Decreased	44.576	0.042	30	Significant

## 5.7 DISCUSSION

### 5.7.1 Variations in knowledge on the role of reserves and reserves' management with distance from the reserves' boundaries

Local communities had substantial knowledge on the role of nature and natural resources. They said that the main aim of the protected areas was environmental

conservation. This is an indication that if local residents were given a chance they are likely to be custodians of the reserves' resources. According to Rao *et al.* (2003), people in and around protected areas have substantial knowledge on what protected areas are for. According to Gandiwa *et al.* (2014), information about local people's knowledge and perceptions about conservation is important in the success of wildlife conservation because understanding and acknowledging residents' knowledge and perceptions about wildlife conservation can build constructive relationships between residents and protected area management. Berkes (2004) argued that putting humans at the centre of ecosystem management requires the building of ecological knowledge systems and relationships because ecosystems are complex adaptive systems characterised by historical dependency.

There were communal structures that guided them to manage resources that were of importance to them. They had controls on when to and when not to harvest some species, how to manage outsiders and destroyers of their resources, what penalties to impose on those who break the law just to name a few. Considering this, it will be a mistake if reserves' management did not tap into local conservation knowledge in order to sustain the management of the reserves. Ecological knowledge systems are associated to the long-term relationships that communities have developed with nature. Agrawal and Gibson (1999), Berkes (2007) and Rao *et al.* (2003) argued that communities and protected areas have developed an understanding that, for years, has led them to co-exist. According to Fabricius *et al.* (2004), ordinary men and women have long been managing natural resources either consciously or unconsciously through local rules, taboos, and belief systems that they have developed in particular contexts.

Lack of knowledge on how reserves were managed was associated with exclusion of local communities from the operations of the reserves. Berkes (2004) argued that when humans are considered separately from nature, traditional ecological knowledge that could be valuable to sustainable management of natural resources is lost. Himley (2009) argued that involving communities can lead to insights that can aid conservationists to effectively manage protected areas because these insights lead to cooperation and co-production of conservation knowledge. Conservationists can make fuller use of local knowledge and insights to ensure that environmental

policymaking is tailored to local needs and thus avoid making big mistakes that can arise from central policies that ignore local realities (Wiggins *et al.*, 2004).

### **5.7.2 Changes in perceptions about costs and benefits from the reserves with distance from the reserves' boundaries**

Local communities indicated that the reserves were important for the conservation of biodiversity that is essential for supplying goods and services for both humans and ecosystem functioning. This is an indication that they did not have problems with the existence of reserves. As indicated by many respondents, the only challenge most households had was the way they were excluded from the mainstream management of the reserves. This implies that local communities are willing to be partners in the management of these reserves. If the reserves' management could involve the local communities in the management of reserves, the communities could be assets in the day to day running of the reserves, a condition necessary for effective management of protected areas. Berkes (2004) found that biological diversity met people's livelihood needs by providing food, medicines, fresh air, water, shelter, and clean and health environment. Agrawal and Gibson (1999) and Wambuguh (2007) argued that if communities do not benefit from resources, they tend to object to any effort aimed at conserving biodiversity, and do not participate in any conservation activities. According to Nelson *et al.* (2007), accumulation of costs of living with wildlife at the local level and the capture of wildlife's economic benefits elsewhere create local disincentives to conserve wildlife.

Local communities are more likely to comply and to commit themselves to long-term conservation strategies when their knowledge and opinions are incorporated into PA decision-making processes (Andrade and Rhodes, 2012), and they perceive or believe to be receiving equitable benefits from conservation (Bennett, 2016). When adjacent communities suffer costs associated with protected areas they develop anger, resentment and unwillingness to cooperate with protected areas management (Stoll-Kleemann and O'Riordan, 2002; Colchester, 2004; Mshale, 2008) and view protected areas as places and resources stolen from them (Vodouhe *et al.*, 2008; Mutekwa and Gambiza, 2017). When local communities are excluded from day to day running of protected areas, they become resentful leading to conflicts with

reserve management and wildlife from protected areas, which ultimately hinder protected areas from achieving their conservation objectives.

Nelson Mandela said (at the World Parks Congress in Durban in September 2003), “the future of protected areas is not guaranteed unless the needs of the local communities are addressed” (Dowie, 2009). Research has shown that incorporating livelihood programmes in conservation planning (Thomas *et al.*, 2001), involving adjacent communities in the management of protected areas (Bissong and Andrew-Essien, 2010), and increasing benefits to the adjacent communities (Vodouhe *et al.*, 2008) can result in protected areas achieving their goals of conserving biodiversity (Ervin *et al.*, 2010). Boudreaux (2007) established that devolution of property rights in Namibia provided local people with positive incentives to protect and conserve the wildlife and other natural resources on their land and to find entrepreneurial ways to benefit from tourism. Enhancement of benefits from conservation in Zambia’s ADMADE projects enhanced community interest on conservation because of revenue sharing (Gibson and Marks, 1995).

Most local communities saw no benefit in conserving biodiversity because the few benefits that accrued from the reserves (like meat and jobs) were only accessible to friends and families of those in the management committee. They said that this was because of the lack of proper structures on benefit sharing, a situation that encouraged corruption. The number of people sharing these sentiments decreased with distance from the reserves’ boundaries. This is an indication that if proper structures that strengthen benefit sharing are put in place, there is a high likelihood that benefit sharing can be used as a tool to enhance local support for the management of reserves and ultimately enhance the effectiveness of these areas. According to Gibson and Marks, (1995), weak benefit sharing structures led to ADMADE projects’ benefits to be clustered around chiefs’ residences, and the chief’s family and friends being the most likely recipients of jobs. The benefits from CAMPFIRE activities did not reach all the intended recipients because of high incidences of elite capture (Shackleton *et al.*, 2002; Rihoy and Maguranyanga, 2007), leading to 1) conflicts over resources, 2) increased tribal tension and 3) confusion.

The study established that access to the reserves' resources was their biggest challenge. Whenever their animals (sheep, goats and dogs) trespassed to the reserves, they were killed. This led to economic and social hardships. Because of this, local communities resented the management of the reserves. They cited restricted access to livelihood resources as the main cause of their miseries. Research by Stoll-Kleenmann and O'Riordan (2002) Sekher (2003), Colchester (2004), Ervin *et al.* (2010), Vodouhe *et al.* (2008) and Bennett and Dearden (2014) found that most people residing adjacent to protected areas resent these areas. Thus, they end up not supporting their existence and the resultant conservation efforts simply because they see no benefits flowing to them, resulting in a case of "us"-and-"them".

### **5.7.3 Differences in perceptions about the location of the reserves with distance from the reserves' boundaries**

The few people that were dissatisfied with the presence of the reserves said that the reserves increased diseases that frequently affected them and their livestock, escaping animals frequently attacked and injured or killed them and their livestock. Most local communities, however, did not resent the location of the reserves but were against the restriction of access to resources that were necessary for their livelihood. They felt that the reserves were an obstacle to their development and well-being. Mir *et al.* (2015), in their study in the Kashmir Valley found that despite 75 percent of the communities suffering crop damage and 23 percent suffering livestock predation from wild animals, majority of the respondents expressed favourable attitudes towards wildlife, with only 16 percent expressing negative perception.

The number of people who resented the way the reserves were managed and the costs they incurred because of the presence of the reserves decreased with distance from the reserves' boundaries. This implies that if costs from the reserves can be minimised and local communities are involved in the day-to-day running of the reserves, local communities are likely to support the existence of reserves. For example, excluding people from the natural resources they depend on for their livelihoods made communities living around Pendjari National Park (Benin) to feel disadvantaged and perceived the government as having 'stolen' their resources

(Vodouhe *et al.*, 2008). Vodouhe *et al.* (2008) found that this perception led to frequent conflicts between resource managers and local communities.

#### **5.7.4 Variations in perceptions about reserves' management with distance from the reserves' boundaries**

Most local communities closer to the reserves disapproved of the managers that were managing the reserves as most of them felt the managers were imposed on them from East London (the headquarters of Eastern Cape Parks and Tourism Authority). This created mistrust between the local communities and the reserve managers. According to Lockwood (2009) a good protected areas management system that will promote effectiveness should be (a) legitimate, (b) transparent, (c) accountable, (d) inclusive, (e) fair, (f) connected, and (g) resilient. Deliberative and inclusionary process improves the quality of decision-making process so that the outcome is implementable, acceptable to all stakeholders, transparent and enduring (Milligan *et al.*, 2009). When the governance is good participants learn from the process and are satisfied that the decision-making process in which they participated allowed them to express their thoughts (Berkes, 2004; Hayes, 2006; Milligan *et al.* 2009). According to Pretty and Smith (2004), inclusive approach to conservation improves trust and reduces transactions costs for managing protected areas. Stakeholder participation also reduces the likelihood that those in the periphery of the decision-making context or society are marginalised (Reed, 2008).

Most local communities viewed the reserves as a continuation of the apartheid policies that excluded them from participation, and thus made their lives miserable. Some respondents from around Hluleka and Mkambati Nature Reserves indicated that if they had an opportunity, they would seize the land under conservation and use it to improve their lives. Those who were deprived of access to resources, attacked by wild animals, harassed, their animals impounded or killed, or had conflicts with the reserves' management were highly in favour of the closure of the reserves. Those who were receiving or previously received benefits from the reserves (jobs, meat, water, building materials, revenue sharing, education, bursaries, etc.), on the other hand, were in favour of the existence and management of the reserves. This implies that in situations where people are paying or have paid the costs for running protected areas, the majority are likely to resent the presence and management of

these areas whereas in situations where people receive benefits the majority will be in support of protected areas. It is therefore clear that minimizing costs and enhancing benefits from protected areas will improve relationships between communities and protected areas' managers. This will go a long way towards achieving effective management of these areas. Fabricius and de Wet (2002) found that in 1994 the frustrations of the communities of Dwesa/Cwebe resulted in the invasion of the protected areas, massive cutting down of trees, wildfires and excessive vandalism of shellfish. Fabricius and de Wet (2002) also found that the youth of Mkambati, as a sign of frustrations, hunted wildlife with dogs and firearms while those who were afraid to be apprehended used wire snares. Understanding and incorporating the views of local people in the process of decision-making and providing alternative livelihood solutions are important steps towards successful conservation (Nana and Tchamadeu, 2014).

Most people were not willing to participate in conservation activities because they saw not value in doing so. They were, however, willing to participate in the reserve management provided they were treated as equal partners in the running of the reserves. Tomicevic *et al.* (2009) argued that the involvement of local communities in conservation is a precondition for their effectiveness and that state authority and environmental planners need to identify and promote social processes that enable local communities to conserve and enhance biodiversity as part of their livelihood system. When communities buy into conservation goals, they bring knowledge and local resources, including surveillance and social controls (Rechlin *et al.*, 2008). For this to happen, however, understanding people's relationships with the environment and fuller recognition and incorporation of local knowledge is essential (Twyman, 2001).

## **5.8 CONCLUSION**

Local communities had knowledge on what the reserves were for and this did not relate to change in distance from the reserves' boundaries. Because of the negative effects that communities experienced because of what they referred to as 'anti-human' management styles, communities resented the existence of the reserves. This resentment was more pronounced closest to the reserves than far from them. The communities perceived the reserves as an integral component of their

livelihoods, and, despite the hardships they incurred due to the authoritative management style, they proposed that the reserves should be conserved for them and future generations. The dominant proposal on how to effectively manage the reserves was to manage it with communities at the centre of decision making, and they were willing to participate. The number of those making this proposal decreased with distance from the reserves' boundaries.

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## **CHAPTER 6**

### **ASSESSMENT OF PLANT PRODUCTIVITY AND LAND COVER CHANGE ACROSS FOUR NATURE RESERVES IN THE EASTERN CAPE, SOUTH AFRICA**

#### **6.1 INTRODUCTION**

Land cover loss is a threat to biodiversity (Pacheco *et al.*, 2018; Baude *et al.*, 2019; Kobayashi *et al.*, 2019). Land cover loss negatively impacts on biodiversity by causing habitat loss, fragmentation and degradation (Juanita *et al.*, 2019; Linoa *et al.*, 2019). Habitat loss and fragmentation decrease population size, promote the loss of species genetic diversity, disrupts species geographical distribution and facilitate species loss (Xu *et al.*, 2018; Linoa *et al.*, 2019). When land cover loss occurs at a rate beyond the speed of species migration it makes the persistence of species populations difficult and leads to decreased biodiversity (Baude *et al.*, 2019; Kobayashi *et al.*, 2019). Land cover loss leads to changes in landscape structure, landscape functions and in the provision of the amount and quality of the ecosystem services (Baude *et al.*, 2019), increasing the risk of invasion by alien species hence posing a threat to native species (Kobayashi *et al.*, 2019). The loss of biodiversity inevitably leads to a decline in ecosystem services (Pacheco *et al.*, 2018). Mucova *et al.* (2018) established that 27.4% (almost 500 million hectares) of global land degradation takes place on the African continent.

Protected areas are acknowledged as a key tool to protect biodiversity, safeguard ecosystem health, and provide ecosystem services, livelihoods and sustenance to local communities (Chape *et al.*, 2005; Figueroa and Sanchez-Cordero, 2008; Leverington *et al.*, 2010; Mucova *et al.*, 2018; Lee and Abdullah, 2019). Saura *et al.* (2019) argue that well designed and managed protected area (PA) systems can effectively safeguard species and ecosystems, and deliver essential ecosystem services to people. Because of the importance that protected areas have, conservationists and protected area managers globally spend millions every year in establishing and maintaining these areas (Lee and Abdullah, 2019). Terrestrial protected area coverage globally was 15% in 2015 (Barnes *et al.*, 2015), and is

expected to increase to 17% by 2020 (Lee and Abdullah, 2019). Despite the expansion in coverage, studies (Barber *et al.*, 2012; Geldmann *et al.*, 2013; Barnes *et al.*, 2015; Lee and Abdullah, 2019; Saura *et al.*, 2019) have revealed that the design and coverage of protected areas are still inadequate in representing key biodiversity features, are insufficient in the management approach to address the threats and pressures facing biodiversity and have a low level of ecological integrity, because of the increasing levels of environmental degradation. Barber *et al.* (2012) identified a lack of qualified staff, funds and poor management models, as some of the factors causing failure of protected areas to buffer multiple and widespread threats to biodiversity. Effective conservation of biodiversity in protected areas depends on identification of ecological boundaries and assessing land use trajectories and habitat fragmentation within these boundaries (Adhikari and Hansen, 2018). It is further noted by Geldmann *et al.* (2013) that for conservation strategies to be successful it is critical to find out if, where and how PAs are working by integrating economic, social, and conservation outcomes in decision-making.

Assessment of the degree of land cover and land use changes on the inside and outside of a protected area over space and time has been used as a proxy to assess protected area effectiveness (Lee and Abdullah, 2019). This assessment makes use of vegetation indices to analyse the ecological conditions of various geographic regions (Hagginbottom and Symeonakis, 2014). Normalized Difference Vegetation Index (NDVI) (one of the widely used vegetation indices) indicates vegetation status (Cui *et al.*, 2013). NDVI values ranges between -1.0 and +1.0, where barren surfaces (rock, sand or snow) usually portray low values, sparse vegetation (shrubs or grasslands) show moderate values (between 0.2 and 0.5), while dense vegetation correspond to high values (0.6 to 0.9) (Cui *et al.*, 2013). NDVI values increase with the amount of vegetation present in an area, an indication of photosynthetic activity (Hagginbottom and Symeonakis, 2014; Wegmann *et al.*, 2014). When analysed over time NDVI can reveal where vegetation is thriving or under stress, as well as changes in vegetation due to human activities (Wegmann *et al.*, 2014; Song *et al.*, 2017; Xue and Su, 2017). Vegetation plays an important role as an indicator of global changes since it can show ecological condition directly (Liu *et al.*, 2013). Areas with high vegetation productivity are likely to have high photosynthetic activity (Cui *et al.*, 2013; Liu *et al.*, 2013; Song *et al.*, 2017), because photosynthetic activity

in an ecological community influences the community of animals, fungi and heterotrophic microbes present in that community (Sage and Stata, 2015). Therefore, understanding photosynthetic activity in an ecological community and how this influences ecological and evolutionary processes helps one to understand patterns of biodiversity through time (Sage and Stata, 2015).

## **6.2 AIM AND OBJECTIVES**

### **6.2.1 Aim**

The aim was to assess whether the four protected areas were effective in conserving biodiversity, and ultimately providing the necessary goods and services necessary for maintaining ecological functions and sustaining lives.

### **6.2.2 Objectives**

The specific objectives were to:

- I. Determine vegetation productivity differences between inside and outside of the four nature reserves using NDVI.
- II. Analyse differences in land covers classes across the four nature reserves using NDVI.

## **6.3 RESEARCH HYPOTHESES**

We hypothesise that;

- I. The vegetation productivity between inside and outside the nature reserves is significantly different because the reserves buffer external pressure from the outside.
- II. Because the reserves are managed properly, we hypothesise that there are no significant changes in vegetation productivity within the nature reserves between 2000 and 2016.
- III. There are no significant differences in land covers across nature reserves because they are managed properly.

## **6.4 DATA TYPES AND METHODS**

In a changing environment, traditional *in situ* approaches to biodiversity monitoring have made significant steps quantifying and evaluating biodiversity at many scales but they are limited to comparatively small areas (Lauscha *et al.*, 2016). According to

Lauscha *et al.* (2016), earth observation (EO) techniques have provided a solution to overcome this shortcoming by measuring entities of interest at different spatial and temporal scales, increasing the focus on measuring, quantifying and modelling biodiversity based on air- and spaceborne EO techniques.

#### **6.4.1 Data types**

Geo-coded, radiometrically calibrated and ortho-rectified LANDSAT imagery of end of summer period (May) of 2000, 2008 and 2016 were downloaded from the USGS website. The 2008 images were used for comparing the vegetation productivity inside and outside the reserves, while the 2000 and 2016 images were used to assess changes in vegetation productivity within the reserves as well as analyse land cover change within this period. The selection of the images was on the premise that end of summer is the time of maximum vegetation growth. Care was taken to avoid images taken when there was excessive cloud cover, as this could have affected the classification and change detection process. Aerial photographs from the National Geo-Information of 2000 and 2016 were used to ascertain the vegetation productivity and land cover changes that were assessed from LANDSAT images.

#### **6.6.2 Data analysis**

Generation of a land cover map was conducted using Landsat 8 satellite imagery for 2000, 2008 and 2016. The images were first georeferenced thereafter radiometric and geometric correction was done. Landsat 8 surface reflectance products were then used to create composite images (Bands 1 to 7) for the study sites. Training sites were identified visually based upon the aerial photographs from Google Earth and knowledge of the site acquired from site visits. The training classes included: forest/dense vegetation, bare surface, grass/shrubs and water bodies. ArcGIS 10.3 Image Classification tools were used to conduct a Maximum Likelihood supervised classification. The quality of the classification was then assessed using a confusion (error) matrix. From the classification, maps illustrating land cover for the four study sites for 2000 and 2016 were created showing three or four land covers, depending on the site.

The LANDSAT images were geometrically referenced, and boundaries of reserves superimposed on them. Clipped Landsat images were then loaded in the ERDAS

IMAGINE software to derive Normalized Difference Vegetation Index (NDVI) values. In order to compare differences in vegetation productivity between the inside and outside of the reserves shape files of 30 points for both inside and outside the reserves (using the 2008 images) were created to extract the NDVI values.

One-way Analysis of Variance (ANOVA) was conducted to determine whether there was a significant statistical difference in vegetation productivity between the inside and the outside of the four reserves, as well as significant statistical differences in vegetation productivity within the four nature reserves between 2000 and 2016. In order to determine where the differences in vegetation productivity between the inside and the outside of the reserves occurred in the four nature reserves, where changes in vegetation productivity in the four nature reserves between 2000 and 2016 occurred, and where changes occurred in the four land covers, a Bonferroni test was conducted.

## 6.7 RESULTS

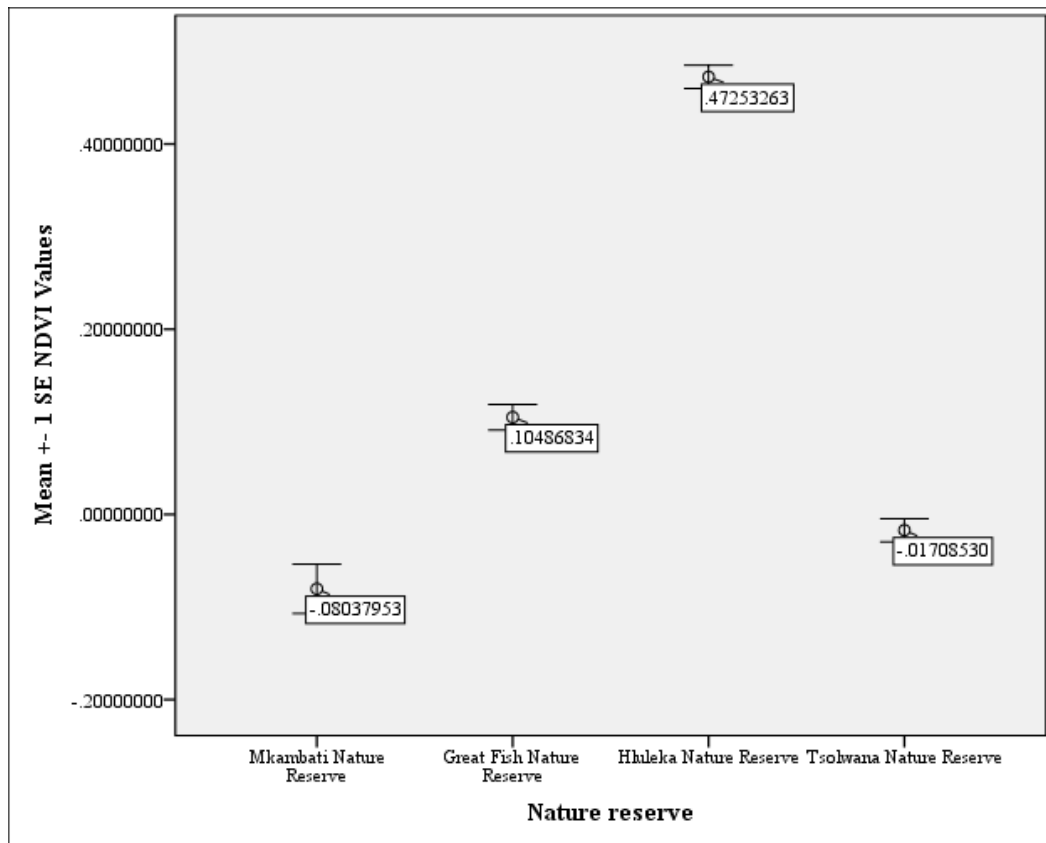
### 6.7.1 DIFFERENCES IN VEGETATION PRODUCTIVITY BETWEEN INSIDE AND OUTSIDE OF THE FOUR NATURE RESERVES

There were significant differences in vegetation productivity between the inside and outside of the four nature reserves ( $F = 87.834$ ;  $df = 3$ ;  $P = 0.000$ ). It was also established that there were significant differences in vegetation productivity (in both inside and outside) across the four nature reserves ( $F = 862.645$ ;  $df = 3$ ;  $P = 0.000$ ). On a reserve by reserve basis, there were significant differences in vegetation productivity between the inside and the outside ( $F = 302.592$ ;  $df = 1$ ;  $P = 0.000$ ) (Table 6.1 and Figure 6.2).

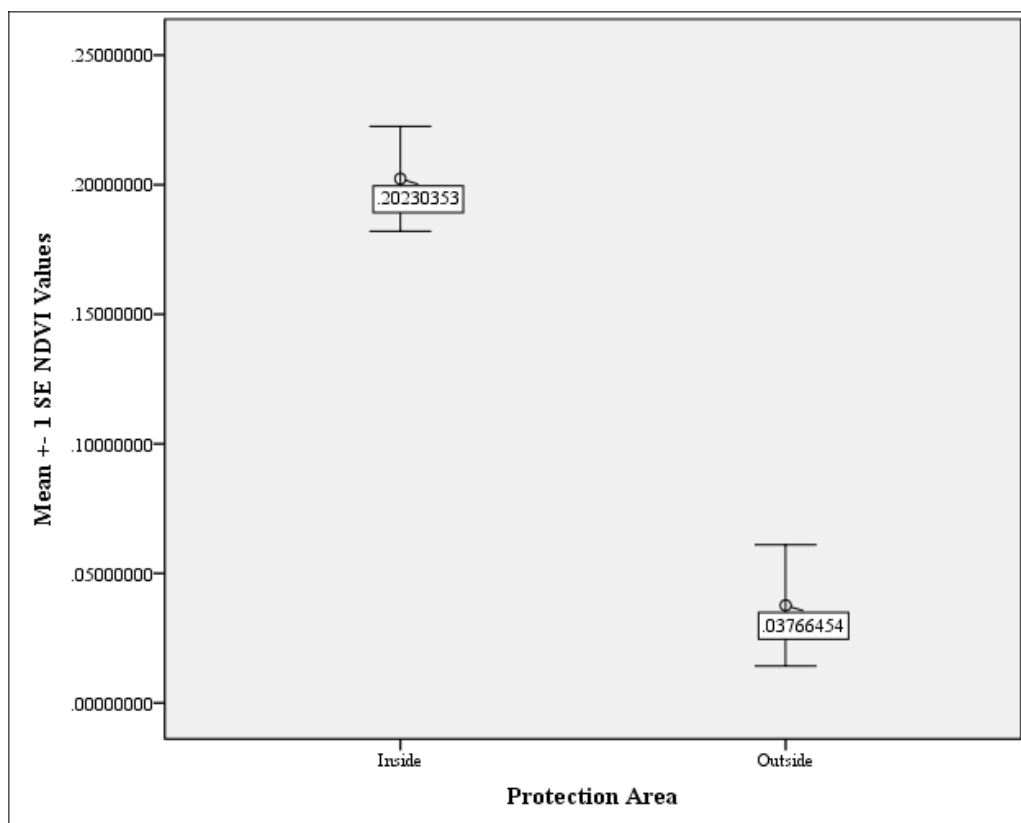
**Table 6.1: Results of vegetation productivity differences between the inside and outside of the nature reserves for 2008**

Source	Type III Sum of Squares	Df	Mean Square	F	P-Value
Between reserves	11.007	3	3.669	682.645	0.000
Inside and outside	1.626	1	1.626	302.592	0.000
Within reserves	1.416	3	0.472	87.834	0.000

Through the Bonferroni test it was established that there were significant differences in vegetation productivity between the inside and the outside across the four nature reserves ( $P = 0.000$ ). The highest difference was in Hluleka Nature Reserve, followed by Great Fish River Nature Reserve, then Tsolwana Nature Reserve while Mkambati Nature Reserve had the lowest difference (Figure 6.1).



**Figure 6.1: Differences in vegetation productivity between the inside and outside the four nature reserves for 2008.**



**Figure 6.2: Vegetation productivity differences between the inside and outside the reserves for 2008.**

### **6.7.2 CHANGE IN VEGETATION PRODUCTIVITY BETWEEN 2000 AND 2016 IN THE FOUR NATURE RESERVES**

All the four nature reserves experienced land cover changes between 2000 and 2016. In the period 2000 to 2016, the total changes in the four land covers were as follows; 1) grass cover reduced by 5.6%, 2) Dense vegetation/forest increased by 46.8%, 3) water bodies decreased by 15.9%, and 4) bare surface decreased by 25.1%. The reserve by reserve changes are presented in Table 6.2. In Mkambati there were increases in grass (9.2%) and forest cover (1.4%) while bare surface decreased (10.6%). There were no water bodies identified in the Mkanbati Nature Reserve. In Great Fish River Nature Reserve, there was a decrease in grass/herbs and water bodies by 16.6% and 15.1% respectively, while dense vegetation and bare surface increased by 15.5% and 16.3%, respectively. In Hluleka Nature Reserve, bare surface and low shrubs decreased by 20.9% and 12.9% respectively while forest increased by 33.8%. There were no water bodies identified in this

reserve. In Tsolwana Nature Reserve, water bodies, bare surface and dense vegetation decreased by 0.8%, 9.9% and 4.0%, respectively while grass increased by 14.7%.

**Table 6.2: Land cover change inside the nature reserves between 2000 and 2016.**

CLASSES	2000		2016		DIFFERENCE		
	Area (Hectares)	Cover (%)	Area (Hectares)	Cover (%)	Area (Hectares)	%	
MKAMBATI	Grass	2371.7	31.7	3063.3	40.9	691.7	9.2
	Forest	465.9	6.2	566.9	7.6	101.0	1.4
	Bare Surface	4652.2	62.1	3859.6	51.5	- 792.6	-10.6
GREAT FISH RIVER	Grass/Herbs	12173.9	27.8	4898.0	11.2	- 7276.0	-16.6
	Dense Vegetation	10248.9	23.4	17041.0	39.0	6792.1	15.5
	Water Bodies	7790.6	17.8	1169.4	2.7	- 6621.2	-15.1
	Bare Surface	13522.4	30.9	20627.6	47.2	7105.2	16.3
	Total	43735.9	100	43736.0	100.0		
HLULEKA	Low Shrubs	234.9	45.0	167.4	32.1	- 67.5	-12.9
	Forest	117.1	22.4	293.6	56.2	176.5	33.8
	Bare Surface	170.4	32.6	61.4	11.8	-109.0	-20.9
	Total	522.4	100	522.4	100.0		
TSOLWANA	Grass	2064.9	26.1	3227.2	40.9	1162.4	14.7
	Dense Vegetation	733.5	9.3	417.2	5.3	-316.3	-4.0
	Water Bodies	423.2	5.4	360.7	4.6	- 62.5	-0.8
	Bare Surface	4668.4	59.2	3884.8	49.2	- 783.6	-9.9
	Total	7889.9	100	7889.9	100		

Generally, there was no significant change in vegetation productivity between 2000 and 2016 ( $F = 0.20$ ;  $df = 1$ ;  $P = 0.890$ ). There was also a high significant change in vegetation productivity between reserves ( $P = 22.779$ ;  $df = 3$ ;  $P = 0.000$ ). There was a significant difference in land cover classes across the four nature reserves as well ( $F = 4.354$ ;  $df = 3$ ;  $P = 0,037$ ) (Table 6.2).

**Table 6.3: Change in vegetation productivity between 2000 and 2016 within the inside of the four nature reserves.**

Source	Type III Sum of Squares	Df	Mean Square	F	P-Value
Intercept	444587125.975	1	444587125.975	53.195	.000
Between reserves	571140093.833	3	190380031.278	22.779	.000
Year	168856.038	1	168856.038	.020	.890
Class	109173774.793	3	36391258.264	4.354	.037
Reserve * Year	506672.727	3	168890.909	.020	.996
Reserve * Class	119719783.684	9	13302198.187	1.592	.250
Year * Class	22420667.770	3	7473555.923	.894	.481

Comparing vegetation productive between reserves, there were significant differences in some areas. There was a significant difference in vegetation productivity change (between 2000 and 2016) between Great fish river and Mkambati ( $P = 0.001$ ), Great fish river and Hluleka ( $P = 0.000$ ), and Great fish river and Tsolwana ( $P = 0.001$ ), while there was no differences in vegetation productivity between Mkambati and Tsolwana, Mkambati and Hluleka as well Tsolwana and Hluleka.

In terms of land cover classes, there was a significant difference in change in vegetation productivity (between 2000 and 2016) between bare surface and water bodies ( $P = 0.034$ ). Between 2000 and 2016, the largest changes in vegetation productivity between 2000 and 2016 took place in Great Fish River Nature Reserve (Figure 6.3). Bare surface was the land cover class where the highest changes between 2000 and 2016 took place (Figure 6.4).

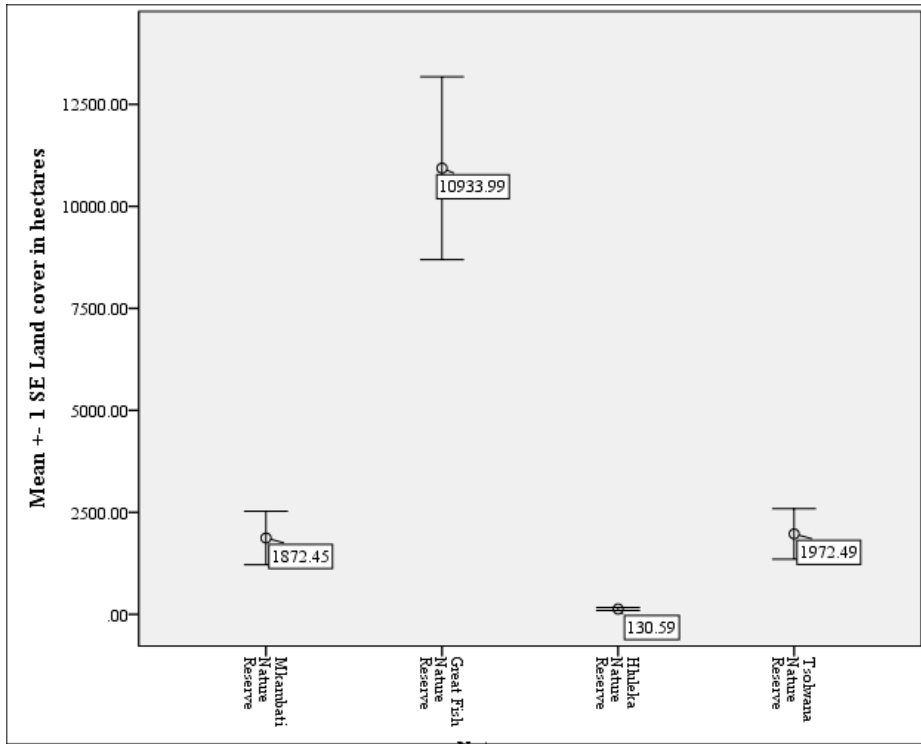


Figure 6.3: Changes in vegetation productivity between 2000 and 2016 in the four nature reserves.

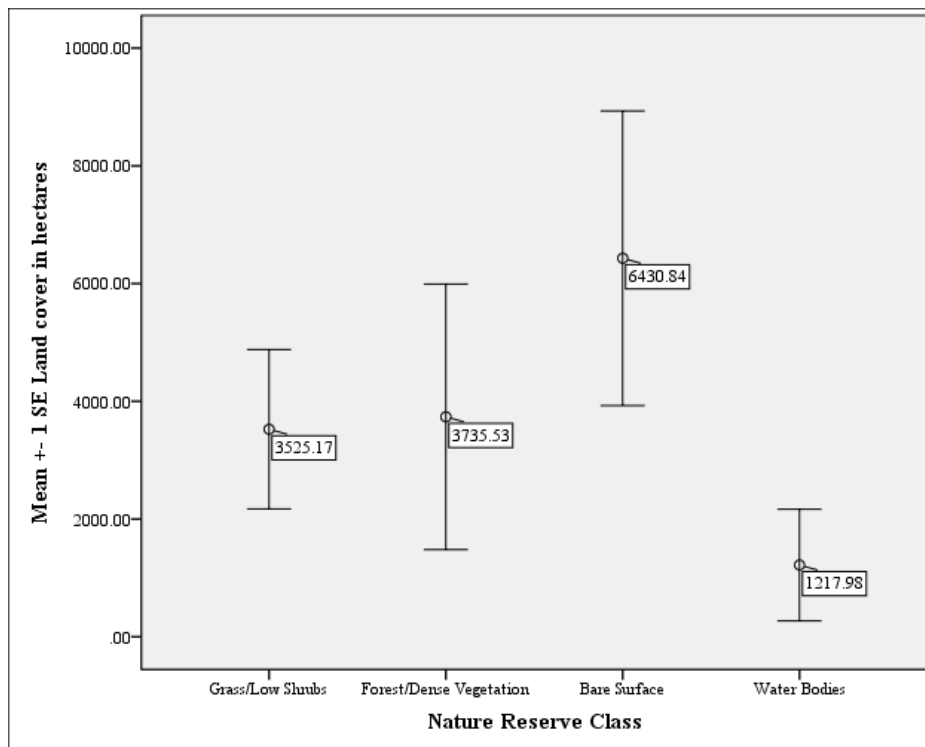


Figure 6.4: Changes in land cover between 2000 and 2016 across land cover classes.

## **6.8 DISCUSSION**

### **6.8.1 DIFFERENCES IN VEGETATION PRODUCTIVITY BETWEEN INSIDE AND OUTSIDE OF THE FOUR NATURE RESERVES**

There was a significant difference in vegetation productivity between inside and outside the reserves, an indication that the reserves were effective in shielding the resources within them from external pressure. The performance of the reserves was, however, not the same. The highest disparities between the inside and the outside occurred in Hluleka Nature Reserve, followed by Great Fish River Nature Reserve, then Tsolwana Nature Reserve, while Mkambati Nature Reserve was where the difference in vegetation productivity between the inside and the outside was at the lowest.

The difference in vegetation productivity between the inside and the outside of the nature reserves in the Eastern Cape could be attributed to several factors including; 1) intensive settlement patterns around the reserves, 2) improved patrol to enhance enforcement of rules and policies by the reserve management, 3) improved relations between the reserves' management and the local communities, 4) high poverty levels for communities living around the reserves, 5) overexploitation of natural resources on unprotected areas, and 6) high staff morale in some of the reserves (especially at the Great Fish River Nature Reserve).

As noted in chapter 5, the success of any protected area in achieving its conservation objectives depends on its relationship with the surrounding communities. The relationship between the local communities and the reserves' management in Great Fish River Nature Reserve was sound, which was the contributing factor in conserving the reserve's biodiversity. This sound relationship was due to reserve's management having an efficient community support structures, where the community members benefit from the reserves by getting meat and old equipment. In chapter 5 it was also noted that where community members were involved in the reserve activities, they held positive views about the operations within the reserves. This was another factor behind the success of Great Fish River Nature Reserve in maintaining high vegetation productivity within its borders. The reserve management regularly invited surrounding communities to the reserve whenever they held meetings where their needs were discussed and taken in consideration

when making important decisions. This corroborates with WWF (2014) and Leverington *et al.*'s (2010) findings that appropriately staffed protected areas, with good environmental education and community outreach, and excellent enforcement capacity are effective in conserving biodiversity. Leverington *et al.* (2010) further found that the condition of protected area resources strongly correlated with the support and constraint of the external environment, and with inputs and processes including research and monitoring, staff numbers and training, effectiveness of administration, natural resource management and communication and involvement of adjacent communities. WWF (2014) found that education and awareness play a vital role in building support for protected areas. Management is more effective where a planned and effective education and awareness programme fully linked to the objectives and needs of the protected area is in place. Muhumuza and Balkwill (2013) argued that most protected areas are effective when they put more emphasis on the human dimension of biodiversity conservation. The state of biodiversity inside Great Fish River Nature Reserve could be attributed to its strong emphasis on their relationship with the local communities. Other authors (Amin *et al.*, 2015; Kioko *et al.*, 2015; Mutanga *et al.*, 2017) also argue that successful conservation initiatives require buy-in and active participation of local communities in decision-making processes as well as changes in perceptions in order to integrate local development with environmental conservation.

As indicated in chapter 4 most people living around Mkambati Nature Reserve were poor and depended heavily on natural resources that nature could provide to sustain their livelihoods. In chapter 5 most respondents complained of a poor relationship between them and the reserve management because of restricted access to the resources within the reserve that they needed for their livelihoods, which occasionally forced them to illegally harvest these resources (mainly grass and medicinal plants) whenever they get an opportunity. This could be the reason for it having the lowest difference in vegetation productivity between the inside and the outside. Both the inside and outside had low vegetation cover. Kobayashi *et al.* (2019) argue that land use activities have a potential to modify landscapes leading to changes in biodiversity. As Wilkie *et al.* (2006) found, if protected areas are unable to tackle the immediate problems of the poor, for whom access to biodiversity is critical, they cannot be able to conserve the biological resources within their borders.

Mutanga *et al.* (2017) argue that in cases where the relationship between local communities and protected area management is sour, there is mistrust leading to conflicts and illegal exploitation of protected area resources.

Hluleka Nature Reserve had the highest difference in vegetation productivity between the inside and outside. The improved vegetation productivity within the reserve could be attributed to allowing the adjacent local communities access to natural resources with the reserves. The low vegetation productivity outside the reserve can be attributed to excessive use of natural resources due to high population density outside the reserve. The findings from Hluleka Nature Reserve resonate with those of Andrade and Rhodes (2012) who argued that many parks have succeeded in conserving biological resources within their borders because they fully integrate cultural, social and political issues in their biodiversity management. Andrade and Rhodes (2012) argue that integration of local communities improves relations between park managers and local communities reducing mistrust, conflicts and illegal exploitation of protected area resources.

There was a significant difference in vegetation productivity between inside and outside Tsolwana Nature Reserve. As indicated in chapter 5 there was a good relationship between the reserve management and the local communities. The local communities benefited from the reserves by accessing clean water, firewood and meat. They also participated in reserve meetings where their inputs were integrated into reserve management thereby improving the relationship between the local communities and the reserve management. Because of the good relationship between the local communities and the reserve management, the local communities embraced the reserve and its resources, and this contributed towards effective conservation. According to Amin *et al.* (2015), Kioko *et al.* (2015) and Mutanga *et al.* (2017), when local communities benefit from protected areas they embrace and participate in the activities of these areas, ultimately enhancing their effectiveness.

### **6.8.2 LAND COVER CHANGE WITHIN THE FOUR NATURE RESERVES BETWEEN 2000 AND 2016**

Generally, between the period 2000 and 2016 land cover in the four nature reserves did not significantly change. There were however changes on cover by cover basis. Dense vegetation/forest increased while grass, water bodies and bare surface

decreased. Most of these changes can be associated with lack of effective enforcement, poor financing of the reserves (forcing their managers to intensify unsustainable tourism activities to be able to raise money to keep themselves afloat), unsustainable exploitation of natural resources within these reserves by adjacent communities, and climate change (mostly prolonged drought). As Phillips (2000) argued, few if any natural protected areas in the world enjoy a fully funded status, limiting them on the conservation programmes which can be undertaken ultimately hindering their effectiveness. Paterson (2009) identified numerous flaws in the legal framework that provided for the identification, declaration and management of the majority of protected areas in South Africa including 1) poor definition of administrative responsibilities, 2) a profusion of laws, 3) lack of coordination, 4) outdated regulatory approaches, 5) inadequate planning, 6) insufficient resource allocation, and 7) a failure to link conservation imperatives with the needs of local inhabitants; which have hampered effective protected area management in the country.

Hopkins *et al.* (2015) argued that changes in climate, although varying from species to species and ecosystem to ecosystem affect protected areas both directly and indirectly. Sippel *et al.* (2018) argue that direct plant physiological responses to drought stress lead to a reduction in gross primary productivity (GPP). Zhou *et al.* (2019) found that the 2009 and 2010 droughts in karst regions of Southwestern China led to NPP reduction by 14.7% and 8.4%, respectively. In another study, von Buttlar *et al.* (2018) found that a combination of drought and heat led to a strong decrease in GPP, leading to C sink reduction. Páscoa *et al.* (2018) established that the drought event in 2000 in South-eastern Europe provoked a generalised decrease in vegetation activity. Besides the effects of drought, restricting local communities access to natural resources that are crucial for their livelihoods results in retaliation and hostile attitudes toward protected area objectives, which ultimately hinder effective conservation (Andrade and Rhodes, 2012; Soliku and Schraml, 2018).

Most of the increases in vegetation productivity in Mkambati Nature Reserve occurred on the western side of the reserve and the decreases on the eastern side of the reserve. The areas where increases in vegetation productivity occurred are areas inaccessible by people because of their remoteness, while those where there

were decreases are those closer to human settlements and areas where people were restricted access to mussels and crayfish that they solely needed for their livelihoods. Dudley *et al.* (2008) argued that restricted access to natural resources in protected areas that communities solely depend on for their livelihoods make people resent these areas and engage in unsustainable activities whenever an opportunity arises. Muhumuza and Balkwill (2013) found that remoteness of the area where protected areas are located can lead to their effectiveness. Muhumuza and Balkwill (2013) further argued that if communities surrounding protected areas are poor and do not have livelihood alternatives, they are likely to overexploit resources found in protected areas. This was the case with Mkambati Nature Reserve as was illustrated in chapter 4.

Most of the increases in vegetation productivity in Great Fish River Nature Reserve took place across the whole reserve and the decreases took place mostly on the north eastern side of the reserve. The northern side of the reserve is surrounded by densely populated settlements while the southern side is mostly surrounded by large commercial farmers. The communities on the northern section of the reserve highly depended on resources from the reserve for their livelihood compared to the other areas of the reserve. Muhumuza and Balkwill (2013) argued that location of protected areas in areas of high population density can lead to overexploitation of natural resources from protected areas contributing to their ineffectiveness.

In Hluleka Nature Reserve there were significant decreases in vegetation productivity, especially forest cover. Although the reserve underwent a long spell where there was no permanent reserve manager, its state of vegetation did not change negatively. Access to reserve resources did not negatively affect the vegetation productivity. Despite the reserve not having enough staff during this period as well, the few who were there were committed enough to conservation priorities. The only negative effect on vegetation productivity was from the expansion of accommodation facilities and the increase of visitor numbers to the reserves through the promotion of tourism. The findings of this study contradict Bruner *et al.* (2001) and Dudley *et al.* (2008) who found that most protected areas were ineffective in conserving biodiversity because of insufficient staff and inability to implement policies.

The changes in vegetation productivity in Tsolwana Nature Reserve were due to climate change where most dense vegetation was converted to grass and shrubs. Zhang *et al.* (2012) in their study in southwestern China found that droughts had significant impacts on vegetation productivity and terrestrial carbon cycling. Graw *et al.* (2017) in their comparison of vegetation-precipitation dependencies in a normal year (2011/2012) with those conditions during a drought year (2015/2016) in the Eastern Cape Province, South Africa found that grassland vegetation generally was strongly affected by the amount of precipitation received. Zhang *et al.* (2016) in their analysis of the effects of drought on primary productivity in China established that severe droughts substantially reduced annual and seasonal NDVI. In another study in the Lower Mekong Basin, Zhang *et al.* (2014) found that the droughts in 2005 and 2010 reduced NPP by 14.7% and 8.4%, respectively.

## **6.9 CONCLUSIONS**

The vegetation productivity in all the four reserves was generally better inside than outside, an indication that the reserves were effective in containing external pressure that could negatively affect the state of biodiversity within them. These differences were however not the same across all the four nature reserves. The difference was highest at Hluleka Nature Reserve (which was associated with intense settlement patterns outside the reserve and effective monitoring and enforcement within the reserve, coupled with good community-reserve management relations). The difference in vegetation productivity between the inside and outside was lowest in Mkambati Nature Reserve, which was attributed to unsustainable use of natural resources within the reserve. Both Great Fish River Nature Reserve and Tsolwana Nature Reserve adopted integration of local communities in their running of the reserves and ensured that they got the support of these communities, contributing to the success of conserving vegetation within these areas. There were mixed changes in land cover within all the nature reserves. There were areas where there were gains and areas where there were losses. Bare surface decreased, forest/dense vegetation increased, while grass cover decreased. Overall, vegetation cover increased, an indication that there was an improvement in vegetation productivity between 2000 and 2016. It can therefore be concluded that the reserves were effective in maintaining ecosystem integrity, hence conserving biodiversity.

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# CHAPTER 7

## SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

### 7.1 INTRODUCTION

According to Brandon *et al.* (2005), advocating for authoritarian protectionism has and will not achieve the desired end of nature conservation especially in developing countries because most people living around protected areas depend on resources in these areas to sustain their livelihoods. Brechin *et al.* (2002) recommended some measures that could help to sustainably conserve biodiversity, including: (a) establishing explicit parameters for socially integrated processes, (b) applying knowledge in context and adopting problem-oriented approach to conservation of biodiversity, (c) developing systematic social scientific knowledge, (d) increasing capacity for organisational coordination and collaboration, (e) establishing parameters for appraisal of socially integrated processes, and (f) establishing workshops among social and ecological scientists to find a common ground and generate strategies for managing protected areas.

Forming a more effective link between protected areas management and surrounding community's strategies can help in making protected areas contribute to poverty reduction (Scherl *et al.*, 2004). Scherl *et al.* (2004) argued that for this to happen the following changes must be met: (a) improvement of the knowledge of the values of ecosystem services in poverty reduction, (b) designing of management systems that permit certain subsistence activities in some categories of protected areas and provision of safety nets for poverty reduction strategies, (c) making the local protected areas agencies more aware of poverty issues in order to ensure that their management activities do not inadvertently contribute to greater poverty, (d) making the finance and economic planning ministries well aware of the values of protected areas so as to ensure that poverty reduction strategies do not lead to inappropriate activities in protected areas, (e) ensure that decisions about individual protected areas and their relations with surrounding communities involve those communities as interested parties with clearly defined rights, (f) providing access,

under permit system, to certain limited use of resources that are harvested in a non-destructive manner (such as medicinal plants, seeds, or grass), (g) providing goods, in the form of fish, birds and mammals, that disperse out of the protected areas and are subsequently harvested by local communities outside the protected areas, (h) providing opportunities to develop a tourism industry based on the protected area, and (i) providing access infrastructure, such as roads, electricity, improved communication and health care associated with supporting the protected area infrastructure.

Brockington *et al.* (2006) argued that it is vital to understand the dynamics of co-existence (sometimes referred to as reconciliation ecology) if we are to achieve effective management of protected areas. Brockington *et al.* (2006) further argued that decisions to evict people or restrict their access to resources should be governed by pragmatic ecological considerations rather than ideals of wilderness as conservation extends far beyond the boundaries of protected areas.

## **7.2 SUMMARY OF FINDINGS**

### **7.2.1 Variations in livelihood capital with distance from the reserves' boundaries**

Employment statistics improved with distance in that there were more people employed far from the reserves than closer to them. Even the type of jobs improved with distance as people far from the reserves were employed in more permanent jobs than those closer to the reserves. The number of people with at least a high school level increased with distance from the reserves' boundaries.

Financial resources did not change much with distance from the reserves' boundaries. Income from full time employment and social grants (child, pension, and disability) did not vary with distance. The value of land increased with distance from the reserves' boundaries.

On the physical infrastructure, nature and state of housing infrastructure improved with distance in that there were more people with better houses far from the reserves as compared to those closer to the reserves, where the majority of them had mud-built roundavels. Roads were better far from the reserves compared to closer to the reserves as some people closer to the reserves did not have proper road network

(only passages) and most of those far from the reserves had tar roads. The percentage of people without onsite water facilities decreased with distance. Access and quality of sanitation facilities improved with distance as there were more people with flushing toilets far from the reserves than closer to them. Most people closer to the reserves were using pit latrines built with iron sheet walls. Access to radio, television, and cellular phones increased with distance. Access to postage facilities decreased with distance. Distance to the nearest health facility increased with distance and that of the nearest school did not vary with distance as schools were within reasonable distances (mostly less than 5 km). Taxis were the most preferred mode of transport and their use did not vary with distance. In the remote parts of the study area (Mkambati and Hluleka Nature Reserves) people used buses that were operating on strict timetables, and if they missed the buses, they had to cancel their trips.

On the social assets, the percentage of people with strong family kinship increased with distance and percentage of people with access to communal relief food support increased with distance. The percentage of people accessing communal grazing pastures, housing support, inter-household labour, inter-household farming arrangements, communal burial support, and credit did not vary with distance. The percentage of people having access to private burial schemes increased with distance.

### **7.2.2 Changes in livelihood activities with distance from the reserves' boundaries**

On the livelihood activities, subsistence crop production was not dominant in the study area hence there was no change in the number of people practising subsistence crop production with distance. The same was the case with formal employment, formal businesses and commercial crop production. What most people did was to engage in multiple activities in pursuit of their livelihoods where the diversification decreased with distance from the reserve boundaries. The only activity that changed with distance was informal businesses where people engaged in these activities decreased with distance.

### **7.2.3 Livelihoods trends (Consistency/inconsistency) with distance of the reserves' boundaries**

In terms of livelihood inconsistencies, it was established that livelihood inconsistency decreased with distance. There were more people closer to the reserves whose livelihood status fluctuated on regular basis. In terms of the type of trends, there were more people closer to the reserves whose livelihoods were getting worse as compared to those far from the reserves. On the other hand, there were more people far from the reserves whose livelihoods were getting better (improving) compared to those closer to the reserves. The causes of livelihood inconsistencies closer to the reserves were mainly nature- and socially-based (climate, soil conditions, death of bread winners and crime rates) while far from the reserves the inconsistencies were mainly because of financial reasons (loss of jobs).

### **7.2.4 Variations in livelihood strategies with distance from the reserves' boundaries**

People adopted different methods to survive difficult times. Among these strategies were migration, agricultural extensification and intensification, change of diet, change of eating routines, use of claims, use of savings, borrowing, livelihood diversification and call on debts. Percentages of people using agricultural extensification and intensification change of diet and use of claims did not change with distance. Migration as a coping strategy was employed mostly in the middle distances and so was borrowing. The percentage of people changing their eating routine, diversifying their livelihood options, and using savings decreased with distance from the reserves' boundaries.

### **7.2.5 Changes in benefits and costs associated with reserves with distance from the reserves' boundaries**

Impacts from the reserves decreased with distance. The percentage of people benefiting from the reserves (meat, jobs and building materials) decreased with distance from the reserves' boundaries. The percentage of people negatively impacted as a result of the presence of the reserves also decreased with distance. Decrease in livelihoods as a result of resources restrictions was the most talked of

the negative impacts. Other negative impacts were harassment by the reserves' management, killing of domestic animals, and attack by escaping wild animals.

#### **7.2.6 Variations in knowledge on the role and management of reserves with distance from the reserves' boundaries**

Knowledge of the role of protected areas is important for their effective management. Most of the people in the study area were aware of the role of the reserves (conservation of biodiversity and promoting economic growth through tourism). The percentage of people knowing the role of the reserves did not vary with distance from the reserves' boundaries.

The way protected areas are managed can have an effect on how communities view them, as either hating them or embracing them. The survey established that the percentage of people who appreciated nature as a result of the way the reserves were managed decreased with distance from the reserves boundaries and those that resented the reserves also decreased with distance. Even though the trend was that there were more people who appreciated nature or resented the reserves closer to the reserves as compared to far from the reserves, there were more people who appreciated nature than those who resented the reserves.

#### **7.2.7 Differences in perceptions about the location of the reserves with distance from the reserves' boundaries**

Generally, people did not have a problem with the existence of the reserves. The only problem they had was that the management teams excluded them from what was happening in the reserves. They wanted to be part and parcel of the daily running of the reserves.

There were mixed views on the best way to manage the reserves. The most notable view was that nature should be preserved for future generations while meeting today's generation's livelihood needs. The other view was that the reserves' management should involve the locals in the management structures (either as active members or through consultation). There were a few people who felt that the reserve is a problem to their lives and should be closed and the land given to the rightful owners. Views on the best way to manage did, however, not vary with distance from the reserves' boundaries.

People had mixed expectations from the reserves. The most notable expectation from the reserves was that the reserves management should create jobs for the surrounding communities, and this decreased with distance from the reserves' boundaries. The other expectations were that the reserves should meet the surrounding communities' livelihood needs as well as involving the local people in the structures of the reserves' management. These expectations also decreased with distance from the reserves' boundaries.

### **7.2.8 Vegetation productivity and land cover change**

Besides Great Fish River Nature Reserve, the vegetation productivity was better inside than outside the reserves. Between 2000 and 2016, there was a general increase in vegetation productivity (as indicated by higher NDVI values). The increase in vegetation productivity in the reserves and between 2000 and 2016 implies that the reserves were effective in conserving biodiversity within their borders.

## **7.3 CONCLUSION**

The vegetation productivity with the reserves was higher compared to the outside. There were higher NDVI values in 2016 as compared to 2000 across the reserves in general. Overall, the vegetated land covers (dense vegetation, forests, grass, shrubs, or low growth) expanded. Unlike most areas around the world, communities around the reserves in the Eastern Cape did not depend directly on the resources within the reserves for their livelihoods because of their dependence on social grants as a main source of livelihood.

Although the livelihood status of people in the study area changed with distance, it could not be directly linked to the presence of the reserves but because of other factors like the variations in education, business and employment opportunities. People in the vicinity of the reserves were in a remote setting that did not have enough business and employment opportunities as well as lacked access to quality education.

Owing to the way farming in South Africa is carried out by specialised farmers, farming was never an activity that local people depended on. Most people depended on shops for their food, which was not a good sign as the shop owners overcharged

them, pushing them more and more into debt resulting in more people continuously living in poverty.

Looking at the overall picture on the livelihood status, the reserves did not have any influence on the livelihoods of those living adjacent to them. Therefore, the hypothesis that livelihood status improves with distance from the reserves' boundaries does not hold in the case of the Eastern Cape.

Unlike other studies that have established that communities living around protected areas resent these areas, the percentage of people who resented the reserves in the Eastern Cape was lower than those who appreciated their presence. Most people were aware how important protected areas are for both the ecosystem and livelihoods hence supported their existence. The only thing they expected was that the management of the reserves should involve them in their management, and that their livelihood needs be aligned to the management process. This is a good sign for the sustainability of these areas. Positive perceptions about the reserves did not increase with distance from the reserves' boundaries. On the other hand, negative perceptions about the reserves did not decrease with distance. People's expectations from the reserves, however, decreased with distance from the reserves' boundaries.

To achieve sustainability in protected areas management there need to be a shift in the perception of communities in the conservation of these areas. The protected areas managers need to start seeing adjacent communities as partners and not enemies to conservation. In this partnership both parties (adjacent communities and the protected areas managers) have rights and responsibilities towards one another and the protected areas. The rights of adjacent communities are sustainable livelihoods, access to accurate and transparent information, sharing of accrued benefits from conservation activities. On the other hand, the adjacent communities have responsibilities towards protected areas management including wise use of resources, provision of reliable and accurate information to protected areas managers, accountability for their actions, sharing of costs for protection of biodiversity, and attending meetings called for protection of biodiversity. The responsibilities for protected areas managers to adjacent communities include accountability to adjacent communities on their actions on conservation, sustaining

adjacent communities' livelihoods, educating the adjacent communities on the importance of conservation, and ensuring that policies on conservation are implemented in a fair and justified manner. Therefore, in order for biodiversity conservation to be sustainable, it should follow a rights-responsibility model (Figure 7.1).

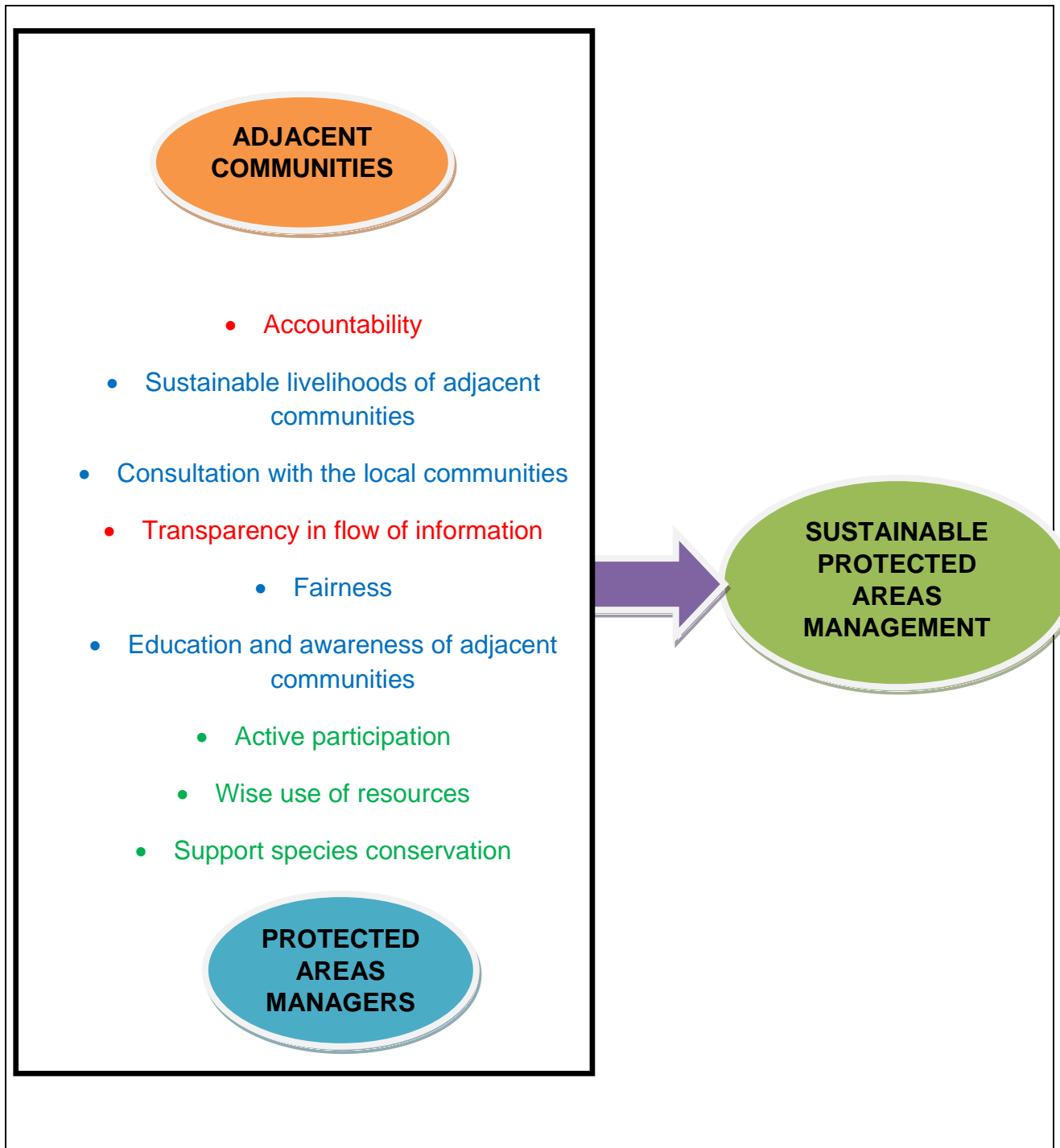


Figure 7.1: Sustainable protected areas management model.

In the model (Figure 7.1), words indicated in red are the responsibilities for both the adjacent communities and the protected areas managers, the ones in green are the responsibilities of the adjacent communities, and the ones in blue are the responsibilities of the protected areas managers. If the partnership between the adjacent communities and the protected areas managers can be implemented as per the stated principles, sustainability in the management of protected areas is likely to be achieved. If the needs of adjacent communities are attended to and their views and concerns are taken in account when managing protected areas, it will lead to a win-win situation. When people's livelihoods are not improved, people are trapped in poverty, will be disgruntled and most probably mismanage resources. Various CBNRM cases reviewed in this thesis have shown that protected areas will achieve their objectives when the relationship between their managers and the surrounding communities is a healthy one.

## **7.4 RECOMMENDATIONS**

### **7.4.1 Recommendations for policy and decision makers**

Since people living around the reserves have strong interest in the management of the reserves, the reserves management can take advantage of this interest and incorporate them into the management of the reserves. Conservation of biodiversity is not for the state agencies only and does not only take place within the boundaries of protected areas. Communities living around protected areas have a huge role to play towards the realisation of sustainable biodiversity conservation.

This research has established that most households living adjacent to the nature reserves were living in abject poverty. Consequently, strategies should be developed to address their livelihood needs before they start encroaching on reserves. These include:

- Payment for ecosystem services through lease agreements between local communities and reserves management, sharing or benefits accrued from conservation of biodiversity with the communities and development of tourism infrastructure to enhance livelihood opportunities could be some of those strategies.

- Rules of assisting the local communities with benefits that accrue from the reserves should be drawn by the reserves management and should be all inclusive and as transparent as possible, so as to promote equitable sharing of benefits and enhance participation of local communities in conservation activities.
- Skills development initiatives that are aligned to biodiversity conservation and tourism and ecotourism should be developed by the reserves managers at the study area so that people living around the reserves should be trained and incorporated in the management structures of the reserves.
- The existing community consultative forums should be strengthened so as to involve all the people living adjacent to nature reserves.
- Where necessary, lease agreements should be drawn up between reserves and local communities adjacent to the reserves.
- Controlled and sustainable use of natural resources should be introduced by the reserves management where they are absent.

#### **7.4.2 Recommendations for adjacent communities**

Local communities need to:

- Take pride on the natural resources in the reserves.
- Develop structures to enable them to actively participate in the management of the reserves.
- Develop a sense of ownership of the natural resources in the reserves.
- Build working relationships with the reserves management that are based on legitimacy, transparency, accountability, and fairness.
- Develop a sense of appreciation of the efforts of other stakeholders in the management of the reserves.

#### **7.4.3 Recommendations for future research**

- There is a need for future researchers to conduct research on the extent to which various management structures are effective in conserving biodiversity.
- Future research should be conducted on a complete biodiversity assessment of the province.

- Future research should be extended to the other protected areas – national parks, privately-managed reserves as well as community controlled protected areas.
- Similar research can be extended to other reserves that are provincially managed to compare findings with the findings of this study.
- Research should be conducted to establish whether the sustainable use of natural resources in the reserves could be possible in major protected areas within South Africa.

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# APPENDICES

## Appendix 1: A community survey questionnaire-English

Q. No.....
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This questionnaire forms part of the data collection techniques for the requirement for a PhD degree at the department of Environmental Science, Rhodes University, Grahamstown. **The research is on conservation and rural livelihoods in the Eastern Cape, South Africa.** The aim of the research is understand the relationship between conservation and livelihood in selected nature reserves in the Eastern Cape, South Africa. Information gathered through this questionnaire will be solely for research purposes. Your views and opinions will be kept confidential. No identities are sought in this questionnaire therefore your identity will be kept anonymous. You are kindly asked to participate in the study.

*(Tick the box and provide written responses where applicable)*

Name of the conservation area \_\_\_\_\_

Name of the Village \_\_\_\_\_

Estimated distance (Km) from the conservation area \_\_\_\_\_

### DEMOGRAPHIC INFORMATION

#### Gender of respondent

1. Male	2. Female
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#### Age of respondent

1. <25 yrs	2. 26-35 yrs	3. 36-45 yrs	4. 46-55 yrs	5. 56-65 yrs	6. >65 yrs
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#### Marital status

1. Single	2. Married	3. Separated
4. Divorced	5. Widowed	6. Other (Specify)

### Occupation

1. Unemployed		2. Labourer (casual worker)	
3. Domestic		4. Business owner	
5. Civil servant		6. Farmer	
7. Retired/Pensioner		8. Other (specify)	

### Highest education level

1. No formal education		2. ABET	
3. Primary school		4. High School	
5. Diploma		6. Degree	
7. Honours		8. Masters	
9. PhD		10. Other (Specify)	

### Size of household by gender

1. Male		2. Female	
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### Size of household by age

1. <25 yrs		2. 26-35 yrs		3. 36-45 yrs		4. 46-55 yrs		5. 56-65 yrs		6. >65 yrs	
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### Residence

1. Born here		2. Born outside (state where and date settled here)	
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## Household size by education level

1. No formal education		2. ABET	
3. Primary school		4. High School	
5. Diploma		6. Degree	
7. Honours		8. Masters	
9. PhD		10. Other (Specify)	

## LIVELIHOOD ASSESSMENT

### Livelihood Activities

Activity	Ordering
Livestock farming (cattle)	
Livestock farming (Sheep)	
Livestock farming (Goats)	
Livestock farming (pigs)	
Livestock farming (other) (specify)	
Poultry farming	
Crop cultivation (commercial) i.e., Cash crops (specify)	
Crop production (subsistence) (specify)	
Fishing	
Hunting	
Formal business (Specify)	
Informal business (Hawking)	
Informal Business (Traditional Doctor)	
Gathering	

Formal employment (specify)	
Informal employment (specify)	
Other (specify)	

**Livelihood Strategies**

Was your livelihood consistent throughout the last year?

Yes		No	
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If not explain -----  
-----  
-----  
-----  
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At times of low status, which of the following strategies did you adopt?

Migration (Explain)	
Agricultural intensification and extensification	
Change of diet	
Change of eating routine	
Make use of claims	
Call on debts	
Livelihood diversification (Explain)	
Depleted the resources	
Made use of the savings	
Other (Specify)	

Provide the trends of your livelihood status in the past 10 years -----  
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Explain the causes of the observed trends -----

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Explain what you usually do when your livelihood status is low -----

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What do you usually do at times when your livelihood status is high? -----

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Explain the major opportunities you have to improve your livelihood in the future -----

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**Livelihood resources**

**Natural capital**

Resource	Description
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Land for cultivation (in Hectares)	
Land for Grazing (in Hectares)	
Soil for making blocks/ sand mining	
Livestock (List the type of livestock, including poultry and their numbers)	
Fisheries (Including Fish and other Water Resources)	
Forest (for firewood and Building materials)	
Water Sources (Including quality and distance if not on sight)	
Wildlife (Including all terrestrial wild resources)	
Grass for Thatching	

## Physical Capital

Resource	Description
Housing Infrastructure (including building and roofing materials)	
Road Infrastructure	
Water Infrastructure	
Electricity Infrastructure	
Solar Infrastructure	
Paraffin depot	
Toilet/latrine	
Television	
Radio	
Telephone	
Post office	
Tourism development Infrastructure	

Farming Equipments(Specify)	
Fishing Equipments (Specify)	
Nearest Shop (with distance)	
Transportation assets	
Nearest School (Including distance)	
Nearest Health Facility (Including distance)	
Other (specify)	

### Human Capital

Number of People in full time employment	
Number of People engaged in livelihood activities	
Number of people with degrees and above	
Number of people with diplomas	
Number of people with certificates	
Number of people with leaving certificates/matric	
Number of People with specialized skills (e.g. carpentry) but unemployed	
Number of People in part time employment	
Number of people in formal business	
Number of people in informal business (including traditional medicine)	
Number of people engaged in other livelihood activities (specify)	

## Financial capital

Resource	Value in Rands
Value of the house(s)	
Value of land	
Annual value of cultivated products	
Annual value of Livestock and livestock products (including poultry)	
Annual income from forest resources	
Annual income from sand mining and other mining activities	
Annual income from full time employment (of household members)	
Annual income from Fisheries (Including Fish and other Water Resources)	
Annual income from part time employment	
Annual income from formal business	
Annual income from Wildlife (Including all terrestrial wild resources)	
Annual income from Informal business (including hawking and traditional medicine practices)	
Annual income from pension	
Annual income from disability grant	
Annual income from child grant	
Annual income from relatives	
Annual income from credit facilities	
Annual incomes from donors	
Income from other sources (specify)	

Value of farming equipment	
Value of fishing equipment	
Annual expenditure on food for the household	
Annual expenditure on clothing for the household	
Annual expenditure on rental (if any)	
Annual expenditure on school fees	
Annual expenditure on transport	
Annual expenditure on health care	
Annual unpaid loans	
Interest on loans	
Other annual expenditure (Specify)	

### **Social Capital**

Resource	Description
Family kinship	
Inter-household labour	
Communal grazing pastures	
Communal food distribution	
Communal relief societies	
Inter-household farming arrangements	
Building societies	

Burial societies	
Communal credit facilities	
Participation in community meetings	
Other (specify)	

Which natural resources that is most dependable? Explain your answer -----  
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 -----

If this species is in the protected area, how is their access affected your livelihood? --  
 -----  
 -----  
 -----  
 -----

**Institutions mediating availability of, access to, quality of and status of livelihood resources**

Explain who is responsible for the management of the livelihood resources?-----  
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 -----  
 -----

Explain how local people are involved in the management of livelihood resources ----  
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 -----  
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 -----

Explain any community rules/arrangements that govern availability, access and utilization of livelihood resources -----

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-----

Explain how the way the protected areas has affected your livelihood -----

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-----

Explain how you are involved in the management of the protected area -----

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Explain any other external forces that affect your livelihood -----

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**KNOWLEDGE, EXPECTATIONS, ATTITUDES AND PERCEPTIONS**

**Knowledge**

Do you understand the role of protected areas? Explain -----

-----  
-----  
-----

Were you or any of your family members consulted when the protected area was established? Explain -----

-----

-----  
-----

**Attitudes and perceptions**

Are you satisfied with the location of the protected area?

1. Yes		2. No	
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Explain your answer -----  
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Do you like the way the protected area is managed?

1. Yes		2. No	
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Explain your answer -----  
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-----

Explain how the way the protected area is managed has influenced your perception about nature and nature conservation -----

-----  
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-----

Does the protected area bring you benefits?

1. Yes		2. No	
--------	--	-------	--

Explain your answer -----  
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## Expectations

How do you expect the protected area to benefit you? -----

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Explain how best should the protected area be managed for it to achieve its mandate of protecting biodiversity and improving people's livelihoods -----

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Thank you very much for your time in responding to this questionnaire. If you have any questions about this research or you would like further information, please contact:

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### Appendix 3: Representation of households' housing infrastructure.

Distance	Reserve	Percentage with Huts/Roundavels	Percentage with Mud flats	Percentage with Semi-permanent & RDPs		Percentage with Permanent
0-10 km <b>(n = 86)</b>	Mkambati	29	71	0		0
	Great Fish River	0	19	43		38
	Tsolwana	8	25	33		33
	Hluleka	64	9	27		0
	<b>Average</b>	<b>25</b>	<b>31</b>	<b>26</b>		<b>18</b>
11-20 km <b>(n = 91)</b>	Mkambati	25	50	19		6
	Great Fish River	20	16	40		24
	Tsolwana	0	25	40		35
	Hluleka	75	15	5		5
	<b>Average</b>	<b>30</b>	<b>27</b>	<b>26</b>		<b>18</b>
21-30 km <b>(n = 42)</b>	Mkambati	18	64	18		0
	Great Fish River	0	0	0		100
	Tsolwana	0	5	19		76
	Hluleka	36	36	28		0
	<b>Average</b>	<b>14</b>	<b>26</b>	<b>16</b>		<b>44</b>
31 km and farther <b>(n = 181)</b>	Mkambati	21	54	18		5
	Great Fish River	9	9	10		74
	Tsolwana	9	15	46		30
	Hluleka	20	39	10		31
	<b>Average</b>	<b>15</b>	<b>29</b>	<b>21</b>		<b>40</b>

#### Appendix 4: Representation of the households' nature of road infrastructure.

Distance	Reserve	Percentage with passage	Percentage with gravel	Percentage with tar
0-10 km <b>(n = 86)</b>	Mkambati	0	100	0
	Great Fish River	0	100	0
	Tsolwana	4	96	0
	Hluleka	0	100	0
	<b>Average</b>	<b>1</b>	<b>99</b>	<b>0</b>
11-20 km <b>(n = 91)</b>	Mkambati	0	100	0
	Great Fish River	0	100	0
	Tsolwana	0	100	0
	Hluleka	0	100	0
	<b>Average</b>	<b>0</b>	<b>100</b>	<b>0</b>
21-30 km <b>(n = 42)</b>	Mkambati	0	100	0
	Great Fish River	0	100	0
	Tsolwana	5	95	0
	Hluleka	0	100	0
	<b>Average</b>	<b>1</b>	<b>99</b>	<b>0</b>
31 km and farther <b>(n = 181)</b>	Mkambati	7	45	48
	Great Fish River	0	50	50
	Tsolwana	0	100	0
	Hluleka	0	100	0
	<b>Average</b>	<b>2</b>	<b>74</b>	<b>25</b>

**Appendix 5: Representation of households' access to and type of water infrastructure.**

Distance	Reserve	Percentage without access to any form of on-site water infrastructure	Percentage with access to:		
			Communal tap	Tank	Borehole
0 - 10 km <b>(n = 86)</b>	Mkambati	100	0	0	0
	Great Fish River	29	71	0	0
	Tsolwana	4	88	8	0
	Hluleka	91	9	0	0
	<b>Average</b>	<b>56</b>	<b>42</b>	<b>2</b>	<b>0</b>
11 - 20 km <b>(n = 91)</b>	Mkambati	100	0	0	0
	Great Fish River	80	8	12	0
	Tsolwana	10	90	0	0
	Hluleka	95	5	0	0
	<b>Average</b>	<b>71</b>	<b>26</b>	<b>3</b>	<b>0</b>
21 - 30 km <b>(n = 42)</b>	Mkambati	91	9	0	0
	Great Fish River	0	100	0	0
	Tsolwana	24	71	5	0
	Hluleka	91	0	9	0
	<b>Average</b>	<b>52</b>	<b>45</b>	<b>4</b>	<b>0</b>
31 km and farther <b>(n = 181)</b>	Mkambati	66	34	0	0
	Great Fish River	0	100	0	0
	Tsolwana	5	86	0	9
	Hluleka	93	7	0	0
	<b>Average</b>	<b>41</b>	<b>57</b>	<b>0</b>	<b>2</b>

### Appendix 6: Representation of households access to electricity.

Distance	Reserve	Percentage with access
0-10 km <b>(n = 86)</b>	Mkambati	0
	Great Fish River	100
	Tsolwana	100
	Hluleka	0
	<b>Average</b>	<b>50</b>
11-20 km <b>(n = 91)</b>	Mkambati	0
	Great Fish River	100
	Tsolwana	100
	Hluleka	95
	<b>Average</b>	<b>74</b>
21-30 km <b>(n = 42)</b>	Mkambati	0
	Great Fish River	100
	Tsolwana	81
	Hluleka	82
	<b>Average</b>	<b>66</b>
31km and farther <b>(n = 181)</b>	Mkambati	70
	Great Fish River	100
	Tsolwana	95
	Hluleka	76
	<b>Average</b>	<b>85</b>

### Appendix 7: Representation of households' access to sanitation.

Distance	Reserve	Percentage with access
0-10 km <b>(n = 86)</b>	Mkambati	93
	Great Fish River	100
	Tsolwana	100
	Hluleka	27
	<b>Average</b>	<b>80</b>
11-20 km <b>(n = 91)</b>	Mkambati	69
	Great Fish River	80
	Tsolwana	95
	Hluleka	15
	<b>Average</b>	<b>65</b>
21-30 km <b>(n = 42)</b>	Mkambati	100
	Great Fish River	100
	Tsolwana	100
	Hluleka	78
	<b>Average</b>	<b>94</b>
31 km and farther <b>(n = 181)</b>	Mkambati	88
	Great Fish River	100
	Tsolwana	91
	Hluleka	74
	<b>Average</b>	<b>91</b>

### Appendix 8: Representation of households' access to television.

Distance	Reserve	Percentage with access
0-10 km <b>(n = 86)</b>	Mkambati	43
	Great Fish River	95
	Tsolwana	79
	Hluleka	46
	<b>Average</b>	<b>65</b>
11-20 km <b>(n = 91)</b>	Mkambati	25
	Great Fish River	84
	Tsolwana	65
	Hluleka	100
	<b>Average</b>	<b>68</b>
21-30 km <b>(n = 42)</b>	Mkambati	73
	Great Fish River	100
	Tsolwana	81
	Hluleka	91
	<b>Average</b>	<b>86</b>
31 km and farther <b>(n = 181)</b>	Mkambati	78
	Great Fish River	100
	Tsolwana	87
	Hluleka	84
	<b>Average</b>	<b>87</b>

### Appendix 9: Representation of households' access to radio.

Distance	Reserve	Percentage with access
0-10 km <b>(n = 86)</b>	Mkambati	57
	Great Fish River	67
	Tsolwana	79
	Hluleka	27
	<b>Average</b>	<b>57</b>
11-20 km <b>(n = 91)</b>	Mkambati	44
	Great Fish River	78
	Tsolwana	65
	Hluleka	65
	<b>Average</b>	<b>63</b>
21-30 km <b>(n = 42)</b>	Mkambati	91
	Great Fish River	50
	Tsolwana	86
	Hluleka	45
	<b>Average</b>	<b>68</b>
31 km and farther <b>(n = 181)</b>	Mkambati	86
	Great Fish River	80
	Tsolwana	86
	Hluleka	90
	<b>Average</b>	<b>85</b>

**Appendix 10: Representation of households' access to telephone/cellular phones.**

Distance	Reserve	Percentage with access
0-10 km <b>(n = 86)</b>	Mkambati	100
	Great Fish River	100
	Tsolwana	100
	Hluleka	45
	<b>Average</b>	<b>86</b>
11-20 km <b>(n = 91)</b>	Mkambati	100
	Great Fish River	80
	Tsolwana	75
	Hluleka	70
	<b>Average</b>	<b>81</b>
21-30 km <b>(n = 42)</b>	Mkambati	100
	Great Fish River	100
	Tsolwana	100
	Hluleka	55
	<b>Average</b>	<b>89</b>
31 km and farther <b>(n = 181)</b>	Mkambati	74
	Great Fish River	90
	Tsolwana	78
	Hluleka	70
	<b>Average</b>	<b>78</b>

### Appendix 11: Representation of households' access to postage facility.

Distance	Reserve	Percentage using school	Percentage using shop	Percentage using post office	Percentage using personal box	Percentage whose mails are delivered at the door	Percentage using hospital
0-10 km (n = 86)	Mkambati	14	86	0	0	0	0
	Great Fish River	34	52	14	0	0	0
	Tsolwana	0	100	0	0	0	0
	Hluleka	0	100	0	0	0	0
	<b>Average</b>	<b>12</b>	<b>86</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>0</b>
11-20 km (n = 91)	Mkambati	0	100	0	0	0	0
	Great Fish River	0	84	12	4	0	0
	Tsolwana	0	100	0	0	0	0
	Hluleka	0	35	65	0	0	0
	<b>Average</b>	<b>0</b>	<b>80</b>	<b>19</b>	<b>1</b>	<b>0</b>	<b>0</b>
21-30 km (n = 42)	Mkambati	0	100	0	0	0	0
	Great Fish River	50	50	0	0	0	0
	Tsolwana	0	100	0	0	0	0
	Hluleka	0	100	0	0	0	0
	<b>Average</b>	<b>13</b>	<b>88</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
31 km and farther (n = 181)	Mkambati	3	97	0	0	0	4
	Great Fish River	2	78	20	0	0	0
	Tsolwana	0	53	40	7	0	0
	Hluleka	7	48	41	0	0	0
	<b>Average</b>	<b>3</b>	<b>69</b>	<b>25</b>	<b>2</b>	<b>0</b>	<b>1</b>

## Appendix 12: Representation of households' mode of transport.

Distance	Reserve	Percentage using vans	Percentage using taxi/bus	Percentage using own car
0-10 km <b>(n = 86)</b>	Mkambati	30	70	0
	Great Fish River	50	50	0
	Tsolwana	0	100	0
	Hluleka	0	100	0
	<b>Average</b>	<b>20</b>	<b>80</b>	<b>0</b>
11-20 km <b>(n = 91)</b>	Mkambati	0	100	0
	Great Fish River	0	100	0
	Tsolwana	0	100	0
	Hluleka	15	85	0
	<b>Average</b>	<b>4</b>	<b>96</b>	<b>0</b>
21-30 km <b>(n = 42)</b>	Mkambati	0	100	0
	Great Fish River	0	100	0
	Tsolwana	0	100	0
	Hluleka	0	100	0
	<b>Average</b>	<b>0</b>	<b>100</b>	<b>0</b>
31 km and farther <b>(n = 181)</b>	Mkambati	0	100	0
	Great Fish River	0	100	0
	Tsolwana	0	95	4
	Hluleka	0	100	0
	<b>Average</b>	<b>0</b>	<b>99</b>	<b>1</b>

**Appendix 13: Representation of households' access to kinship support.**

Distance	Reserve	Percentage with access
0-10 km <b>(n = 86)</b>	Mkambati	58
	Great Fish River	56
	Tsolwana	60
	Hluleka	55
	<b>Average</b>	<b>57</b>
11-20 km <b>(n = 91)</b>	Mkambati	58
	Great Fish River	75
	Tsolwana	71
	Hluleka	37
	<b>Average</b>	<b>60</b>
21-30 km <b>(n = 42)</b>	Mkambati	100
	Great Fish River	100
	Tsolwana	57
	Hluleka	64
	<b>Average</b>	<b>80</b>
31 km and farther <b>(n = 181)</b>	Mkambati	100
	Great Fish River	100
	Tsolwana	80
	Hluleka	85
	<b>Average</b>	<b>91</b>

**Appendix 14: Representation of households' access to inter-household labour (support).**

Distance	Reserve	Percentage with access
0-10 km <b>(n = 86)</b>	Mkambati	0
	Great Fish River	31
	Tsolwana	55
	Hluleka	21
	<b>Average</b>	<b>27</b>
11-20 km <b>(n = 91)</b>	Mkambati	8
	Great Fish River	46
	Tsolwana	25
	Hluleka	22
	<b>Average</b>	<b>25</b>
21-30 km <b>(n = 42)</b>	Mkambati	0
	Great Fish River	50
	Tsolwana	48
	Hluleka	18
	<b>Average</b>	<b>28</b>
31 km and farther <b>(n = 181)</b>	Mkambati	0
	Great Fish River	21
	Tsolwana	27
	Hluleka	11
	<b>Average</b>	<b>15</b>

**Appendix 15: Representation of households' access to communal grazing pastures**

Distance	Reserve	Percentage with access
0-10 km <b>(n = 86)</b>	Mkambati	33
	Great Fish River	19
	Tsolwana	65
	Hluleka	5
	<b>Average</b>	<b>31</b>
11-20 km <b>(n = 91)</b>	Mkambati	25
	Great Fish River	82
	Tsolwana	46
	Hluleka	52
	<b>Average</b>	<b>51</b>
21-30 km <b>(n = 42)</b>	Mkambati	13
	Great Fish River	50
	Tsolwana	62
	Hluleka	91
	<b>Average</b>	<b>54</b>
31 km and farther <b>(n = 181)</b>	Mkambati	8
	Great Fish River	30
	Tsolwana	48
	Hluleka	92
	<b>Average</b>	<b>45</b>

### Appendix 16: Representation of households' access to communal food relief.

Distance	Reserve	Percentage with access
0-10 km <b>(n = 86)</b>	Mkambati	25
	Great Fish River	31
	Tsolwana	15
	Hluleka	3
	<b>Average</b>	<b>19</b>
11-20 km <b>(n = 91)</b>	Mkambati	8
	Great Fish River	36
	Tsolwana	8
	Hluleka	11
	<b>Average</b>	<b>16</b>
21-30 km <b>(n = 42)</b>	Mkambati	0
	Great Fish River	50
	Tsolwana	48
	Hluleka	9
	<b>Average</b>	<b>27</b>
31 km and farther <b>(n = 181)</b>	Mkambati	0
	Great Fish River	25
	Tsolwana	20
	Hluleka	5
	<b>Average</b>	<b>12</b>

### Appendix 17: Representation of households' access to communal relief efforts

Distance	Reserve	Percentage with access
0-10 km (n = 86)	Mkambati	8
	Great Fish River	13
	Tsolwana	20
	Hluleka	11
	<b>Average</b>	<b>13</b>
11-20 km (n = 91)	Mkambati	8
	Great Fish River	11
	Tsolwana	13
	Hluleka	52
	<b>Average</b>	<b>21</b>
21-30 km (n = 42)	Mkambati	25
	Great Fish River	50
	Tsolwana	33
	Hluleka	27
	<b>Average</b>	<b>34</b>
31 km and farther (n = 181)	Mkambati	2
	Great Fish River	14
	Tsolwana	22
	Hluleka	25
	<b>Average</b>	<b>16</b>

**Appendix 18: Households' access to inter-household farming arrangements.**

Distance	Reserve	Percentage with access
0-10 km (n = 86)	Mkambati	25
	Great Fish River	13
	Tsolwana	20
	Hluleka	0
	<b>Average</b>	<b>15</b>
11-20 km (n = 91)	Mkambati	17
	Great Fish River	18
	Tsolwana	13
	Hluleka	7
	<b>Average</b>	<b>14</b>
21-30 km (n = 42)	Mkambati	0
	Great Fish River	0
	Tsolwana	48
	Hluleka	0
	<b>Average</b>	<b>12</b>
31 km and farther (n = 181)	Mkambati	0
	Great Fish River	0
	Tsolwana	35
	Hluleka	10
	<b>Total</b>	<b>11</b>

**Appendix 19: Representation of households' access to communal housing support.**

Distance	Reserve	Percentage with access
0-10 km <b>(n = 86)</b>	Mkambati	8
	Great Fish River	0
	Tsolwana	0
	Hluleka	0
	<b>Average</b>	<b>2</b>
11-20 km <b>(n = 91)</b>	Mkambati	8
	Great Fish River	0
	Tsolwana	0
	Hluleka	0
	<b>Average</b>	<b>2</b>
21-30 km <b>(n = 42)</b>	Mkambati	0
	Great Fish River	0
	Tsolwana	0
	Hluleka	0
	<b>Average</b>	<b>0</b>
31 km and farther <b>(n = 181)</b>	Mkambati	0
	Great Fish River	0
	Tsolwana	0
	Hluleka	0
	<b>Average</b>	<b>0</b>

**Appendix 20: Representation of households' access to and type of burial societies/plans.**

Distance	Reserve	Percentage that do not have access to any form burial plan	Percentage that have access to:	
			Communal burial plan	Private burial plan
0-10 km <b>(n = 86)</b>	Mkambati	33	8	59
	Great Fish River	13	31	56
	Tsolwana	10	10	80
	Hluleka	34	55	11
	<b>Average</b>	<b>23</b>	<b>26</b>	<b>52</b>
11-20 km <b>(n = 91)</b>	Mkambati	25	33	42
	Great Fish River	29	11	60
	Tsolwana	13	20	67
	Hluleka	22	11	67
	<b>Average</b>	<b>22</b>	<b>19</b>	<b>59</b>
21-30 km <b>(n = 42)</b>	Mkambati	0	38	62
	Great Fish River	0	50	50
	Tsolwana	24	29	47
	Hluleka	27	55	18
	<b>Average</b>	<b>13</b>	<b>43</b>	<b>44</b>
31 km and farther <b>(n = 181)</b>	Mkambati	0	40	60
	Great Fish River	0	50	50
	Tsolwana	20	32	48
	Hluleka	30	55	15
	<b>Average</b>	<b>13</b>	<b>44</b>	<b>43</b>

## Appendix 21: Representation of employment statistics of respondents.

Employment	Reserve	0-10 km (n = 86)	11-20 km (n = 91)	21-30 km (n = 42)	31 km and farther (n = 181)
Unemployed	Mkambati	93	69	73	72
	Great Fish River	62	56	0	39
	Tsolwana	75	50	70	63
	Hluleka	82	90	82	49
	<b>Average</b>	<b>78</b>	<b>66</b>	<b>56</b>	<b>56</b>
Casual labourers	Mkambati	7	13	18	11
	Great Fish River	33	12	50	10
	Tsolwana	12	15	15	0
	Hluleka	9	5	0	5
	<b>Average</b>	<b>15</b>	<b>11</b>	<b>28</b>	<b>7</b>
Formal business	Mkambati	0	0	0	1
	Great Fish River	0	4	0	17
	Tsolwana	4	0	0	0
	Hluleka	0	0	0	1
	<b>Average</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>5</b>
Civil servants	Mkambati	0	6	9	6
	Great Fish River	5	0	0	19
	Tsolwana	0	5	0	0
	Hluleka	0	5	0	6
	<b>Average</b>	<b>1</b>	<b>4</b>	<b>2</b>	<b>8</b>
Farmers	Mkambati	0	6	0	0
	Great Fish River	0	0	0	0
	Tsolwana	0	0	0	0
	Hluleka	0	0	0	0
	<b>Total</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>
Pensioners	Mkambati	0	6	0	9
	Great Fish River	0	28	50	17
	Tsolwana	8	30	55	38
	Hluleka	9	0	13	20
	<b>Average</b>	<b>4</b>	<b>16</b>	<b>30</b>	<b>21</b>

## Appendix 22: Representation of highest level of education of respondents.

Education	Reserve	0-10 km (n = 86)	11-20 km (n = 91)	21-30 km (n = 42)	31 km and farther (n = 181)
No formal education	Mkambati	43	1	18	22
	Great Fish River	10	12	50	10
	Tsolwana	33	35	5	14
	Hluleka	18	5	20	12
	<b>Average</b>	<b>26</b>	<b>20</b>	<b>14</b>	<b>18</b>
ABET	Mkambati	0	0	0	0
	Great Fish River	0	0	0	0
	Tsolwana	0	5	10	0
	Hluleka	0	0	10	7
	<b>Average</b>	<b>0</b>	<b>1</b>	<b>7</b>	<b>2</b>
Primary school	Mkambati	21	13	36	32
	Great Fish River	33	52	0	37
	Tsolwana	21	30	19	29
	Hluleka	73	45	40	35
	<b>Average</b>	<b>33</b>	<b>37</b>	<b>27</b>	<b>36</b>
High school	Mkambati	43	50	45	36
	Great Fish River	48	32	50	35
	Tsolwana	46	25	62	11
	Hluleka	0	40	30	40
	<b>Average</b>	<b>37</b>	<b>36</b>	<b>50</b>	<b>37</b>
Diploma	Mkambati	0	6	0	4
	Great Fish River	5	4	0	0
	Tsolwana	0	5	0	0
	Hluleka	9	5	0	6
	<b>Average</b>	<b>3</b>	<b>5</b>	<b>0</b>	<b>4</b>
Degree	Mkambati	0	0	0	2
	Great Fish River	5	0	0	19
	Tsolwana	0	0	5	0
	Hluleka	0	5	0	3
	<b>Average</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>2</b>
Junior certificate	Mkambati	0	0	0	3
	Great Fish River	0	0	0	0
	Tsolwana	0	0	0	0

	Hluleka	0	0	0	0
	<b>Average</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>

### Appendix 23: Representation of household's livelihood trends.

Distance	Reserve	Percentage improving	Percentage fluctuating (up and down)	Percentage worsening	Percentage affording	Percentage living with no hope as to where the following day's meal will come from
0-10 km <b>(n = 86)</b>	Mkambati	7	21	43	7	21
	Great Fish River	24	10	29	14	24
	Tsolwana	25	4	50	13	8
	Hluleka	9	9	27	9	45
	<b>Average</b>	<b>16</b>	<b>6</b>	<b>54</b>	<b>7</b>	<b>17</b>
11-20 km <b>(n = 91)</b>	Mkambati	6	25	31	19	19
	Great Fish River	20	8	56	4	12
	Tsolwana	30	20	20	10	20
	Hluleka	10	15	35	5	35
	<b>Average</b>	<b>17</b>	<b>16</b>	<b>37</b>	<b>9</b>	<b>21</b>
21-30 km <b>(n = 42)</b>	Mkambati	0	18	9	27	45
	Great Fish River	0	0	0	50	50
	Tsolwana	33	5	43	5	14
	Hluleka	0	27	27	18	27
	<b>Average</b>	<b>16</b>	<b>13</b>	<b>29</b>	<b>16</b>	<b>27</b>
31 km and farther <b>(n = 181)</b>	Mkambati	8	10	41	11	30
	Great Fish River	10	33	17	20	20
	Tsolwana	23	15	24	10	28
	Hluleka	13	17	26	23	22
	<b>Average</b>	<b>18</b>	<b>19</b>	<b>27</b>	<b>16</b>	<b>25</b>

**Appendix 24: Representation of variations of number of livelihood strategies adopted with estimated distance from the reserves' boundaries.**

Number of strategies	Reserve	0-10 km (n = 86)	11-20 km (n = 91)	21-30 km (n = 42)	31 km and farther (n = 181)
1 strategy (including those who deplete resources)	Mkambati	67	50	78	60
	Great Fish River	31	25	50	30
	Tsolwana	35	38	43	33
	Hluleka	79	19	64	12
	<b>Average</b>	<b>53</b>	<b>33</b>	<b>59</b>	<b>34</b>
2 strategies	Mkambati	8	25	13	23
	Great Fish River	13	36	50	50
	Tsolwana	10	38	19	33
	Hluleka	11	22	27	43
	<b>Average</b>	<b>11</b>	<b>30</b>	<b>27</b>	<b>37</b>
3 strategies	Mkambati	25	17	0	11
	Great Fish River	31	36	0	20
	Tsolwana	20	13	10	17
	Hluleka	8	29	0	21
	<b>Average</b>	<b>21</b>	<b>24</b>	<b>3</b>	<b>17</b>
4 strategies	Mkambati	0	0	0	3
	Great Fish River	25	4	0	0
	Tsolwana	30	13	14	17
	Hluleka	2	11	9	21
	<b>Average</b>	<b>14</b>	<b>7</b>	<b>6</b>	<b>10</b>
5 strategies	Mkambati	0	8	0	3
	Great Fish River	0	0	0	0
	Tsolwana	5	0	14	0
	Hluleka	0	19	0	2
	<b>Average</b>	<b>1</b>	<b>7</b>	<b>4</b>	<b>1</b>

**Appendix 25: NDVI values of 30 randomly selected points for the inside and outside of Mkambati Nature Reserve.**

NDVI values for 30 randomly selected points from the image of the outside of Mkambati Nature Reserve		NDVI values for 30 randomly selected points from the image of the inside of Mkambati Nature Reserve	
1	-0.325843	1	0.069444
2	-0.276596	2	0.169014
3	-0.157025	3	0.140845
4	-0.319588	4	0.127820
5	-0.274725	5	0.120567
6	-0.316456	6	0.142857
7	-0.250000	7	0.158621
8	-0.280702	8	0.183673
9	-0.161905	9	0.015385
10	-0.230769	10	0.115942
11	-0.268817	11	0.078014
12	-0.326316	12	0.075758
13	-0.291139	13	0.185714
14	-0.236364	14	0.259740
15	-0.287356	15	0.159420
16	-0.358974	16	-0.029851
17	-0.195876	17	0.084507
18	-0.284211	18	0.058824
19	-0.260000	19	0.144828
20	-0.333333	20	0.118881
21	-0.252336	21	0.094595
22	-0.307692	22	0.154930
23	-0.296703	23	0.159420
24	-0.282609	24	0.073529
25	-0.407407	25	0.107692
26	-0.307692	26	0.132353
27	-0.224138	27	0.136364
28	-0.288889	28	0.115942
29	-0.272727	29	0.162162
30	-0.205882	30	-0.057692
Mean NDVI value = -0.286326 Standard deviation = 0.118004		Mean NDVI value =0.115310 Standard deviation= 0.063056	

**Appendix 26: NDVI values of 30 randomly selected points for the inside and outside of Great Fish River Nature Reserve.**

NDVI values for 30 randomly selected points from the areas surrounding Great Fish Nature Reserve		NDVI values for 30 randomly selected points inside Great Fish Nature Reserve	
1	0.14942528	1	0.518519
2	0.12359551	2	0.068182
3	0.09278350	3	-0.014925
4	0.10638298	4	0.118280
5	0.09677419	5	0.129032
6	0.20000000	6	0.238095
7	0.13043478	7	0.027778
8	0.12941177	8	-0.156627
9	0.13333334	9	0.152174
10	0.17500000	10	0.111111
11	0.12359551	11	0.134021
12	0.12765957	12	0.170732
13	0.11363637	13	-0.040816
14	0.10416666	14	-0.011765
15	0.08737864	15	0.058824
16	0.16666667	16	-0.115789
17	0.15662651	17	-0.053763
18	0.15662651	18	0.025000
19	0.16049382	19	0.250000
20	0.14942528	20	0.230769
21	0.07843138	21	0.160000
22	0.0803922	22	0.092437
23	0.11578947	23	0.151515
24	0.08000000	24	0.272727
25	0.11827957	25	0.108434
26	0.11340206	26	-0.162393
27	0.12359551	27	0.084337
28	0.13953489	28	0.009709
29	0.0927835	29	0.149425
30	0.15294118	30	-0.191489
Mean NDVI value = 0.1259522 Standard deviation = 0.0305447		Mean NDVI value = 0.048534 Standard deviation = 0.089061	

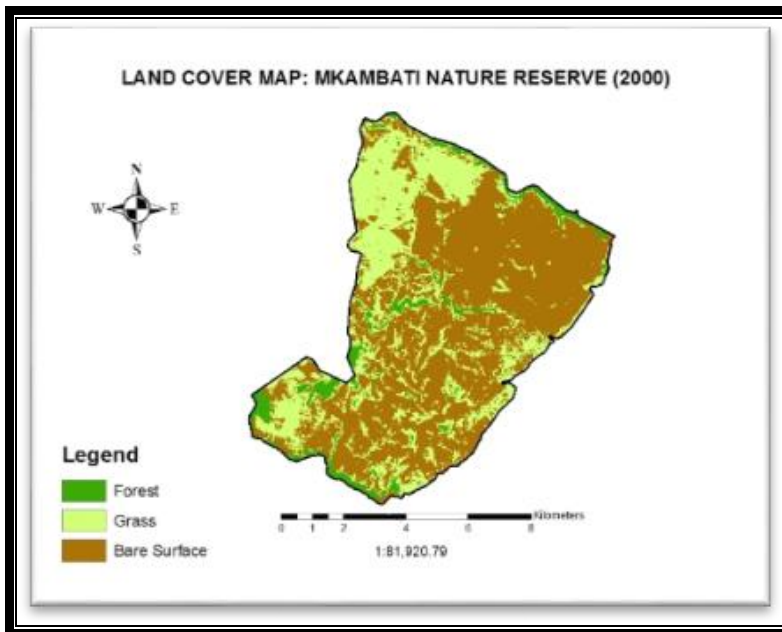
**Appendix 27: NDVI values of 30 randomly selected points for the inside and outside of Hluleka Nature Reserve.**

NDVI values for 30 randomly selected points from the inside Hluleka Nature Reserve		NDVI Values for 30 randomly selected points from the areas outside of Hluleka Nature Reserve	
1	0.527273	1	0.34020618
2	0.505618	2	0.35416666
3	0.647059	3	0.38144329
4	0.531915	4	0.47499999
5	0.652893	5	0.40206185
6	0.606557	6	0.36734694
7	0.535714	7	0.38144329
8	0.612903	8	0.35922331
9	0.527778	9	0.38947368
10	0.578947	10	0.44186047
11	0.593496	11	0.37500000
12	0.440860	12	0.46153846
13	0.582609	13	0.39393941
14	0.590164	14	0.37864077
15	0.634409	15	0.39583334
16	0.492537	16	0.39784947
17	0.625000	17	0.38297874
18	0.620000	18	0.37373737
19	0.487603	19	0.36734694
20	0.537313	20	0.40425533
21	0.514563	21	0.36170211
22	0.500000	22	0.38947368
23	0.606557	23	0.39130434
24	0.435294	24	0.40659341
25	0.661017	25	0.38144329
26	0.480769	26	0.46341464
27	0.475728	27	0.35849056
28	0.492537	28	0.43529412
29	0.426230	29	0.37500000
30	0.638298	30	0.40425533
Mean NDVI value = 0.536046 Standard deviation = 0.088357		Mean NDVI value = 0.393010 Standard deviation = 0.0331065	

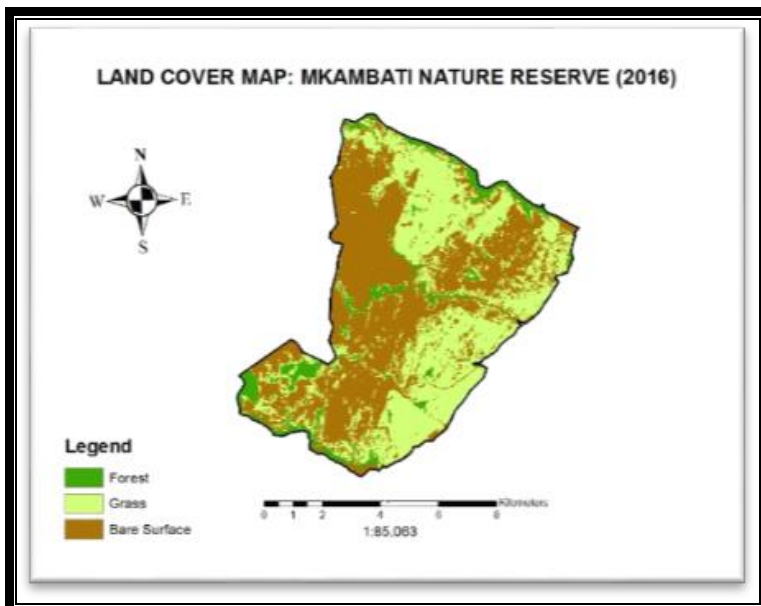
**Appendix 28: NDVI values of 30 randomly selected points for the inside and outside of Tsolwana Nature Reserve.**

NDVI values for 30 points randomly selected from outside of Tsolwana Nature Reserve		NDVI values for 30 points randomly selected from the areas from the inside of Tsolwana Nature Reserve	
1	-0.168675	1	0.03067485
2	-0.142857	2	0.0483871
3	-0.123457	3	0.04054054
4	-0.008264	4	0.05600000
5	-0.056910	5	0.08800000
6	-0.088435	6	0.04516129
7	0.0566038	7	0.03401361
8	0.0000000	8	0.03658536
9	-0.0769231	9	0.03225806
10	0.0142857	10	0.11428571
11	0.0886076	11	0.08571429
12	-0.119048	12	0.06250000
13	-0.144509	13	0.08620690
14	-0.100775	14	0.07462686
15	-0.200000	15	0.03496503
16	-0.108443	16	0.04285714
17	-0.136691	17	0.02666667
18	-0.162162	18	0.03597122
19	-0.177083	19	0.04697987
20	0.131868	20	0.03597122
21	-0.124260	21	0.04347826
22	-0.129032	22	0.05633803
23	-0.141243	23	0.04166667
24	-0.106918	24	0.04575163
25	-0.135802	25	0.05479452
26	-0.069767	26	0.10569106
27	-0.125828	27	0.06578948
28	-0.160000	28	0.07812500
29	-0.169591	29	0.08270676
30	-0.081761	30	0.10924370
Mean NDVI value = -0.092215 Standard deviation = 0.081250		Mean NDVI value = 0.0580650 Standard deviation = 0.0251810	

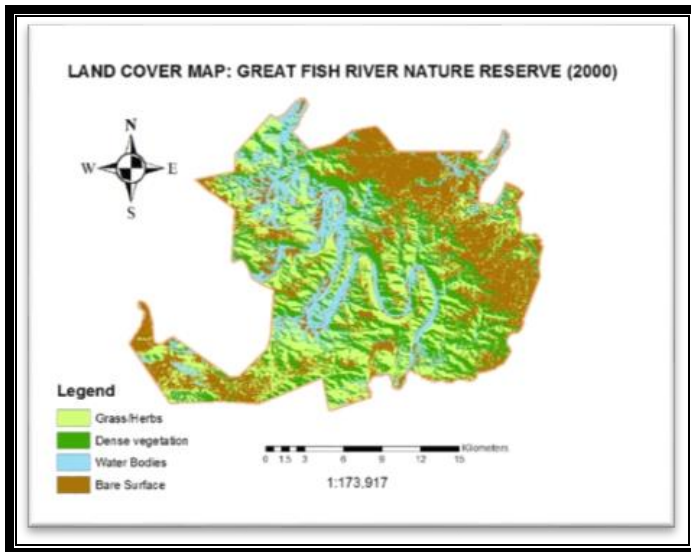
Appendix 29: A 2000 Land Cover map for inside of Mkambati Nature Reserve



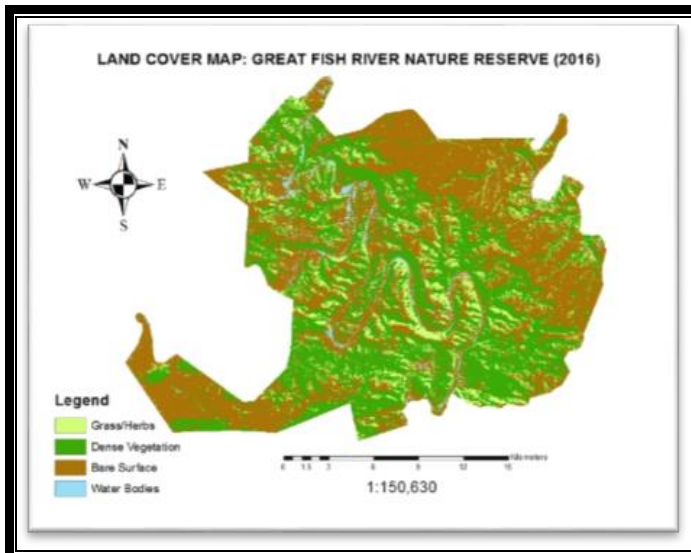
Appendix 30: A 2016 Land Cover map for inside of Mkambati Nature Reserve



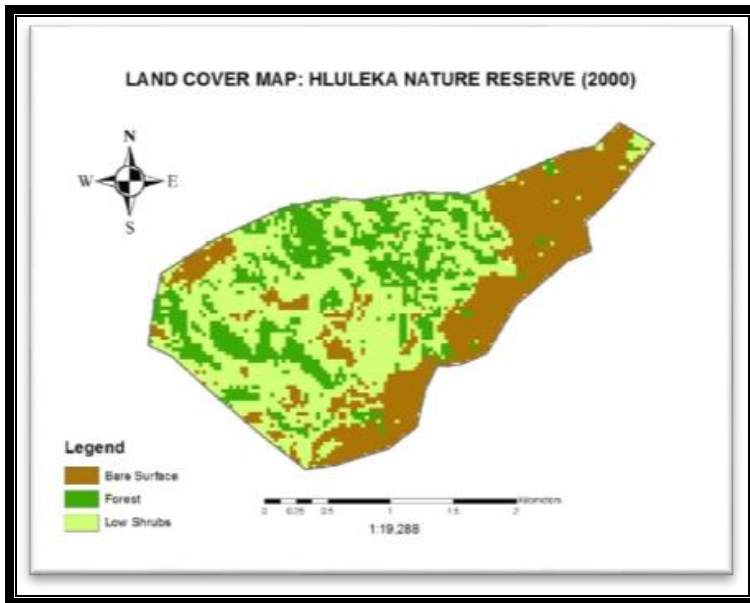
Appendix 31: A 2000 Land Cover map for inside Great Fish River Nature Reserve



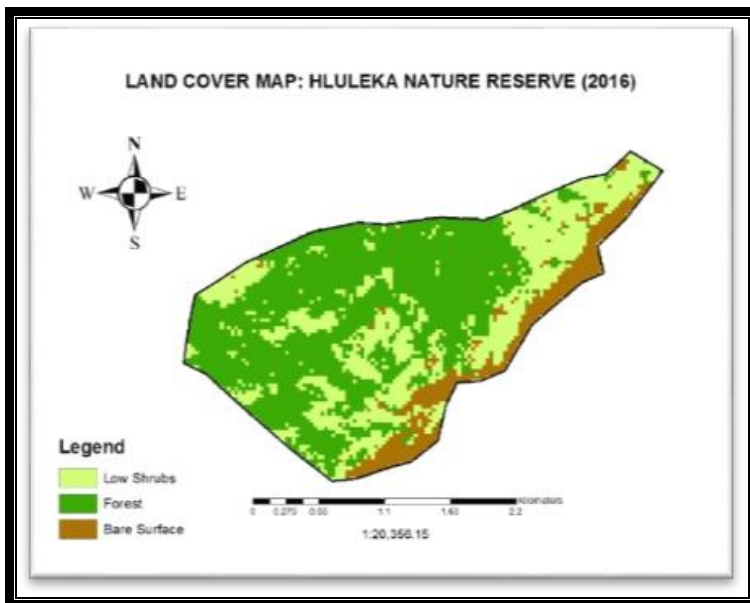
Appendix 32: A 2016 Land Cover map for inside Great Fish River Nature Reserve



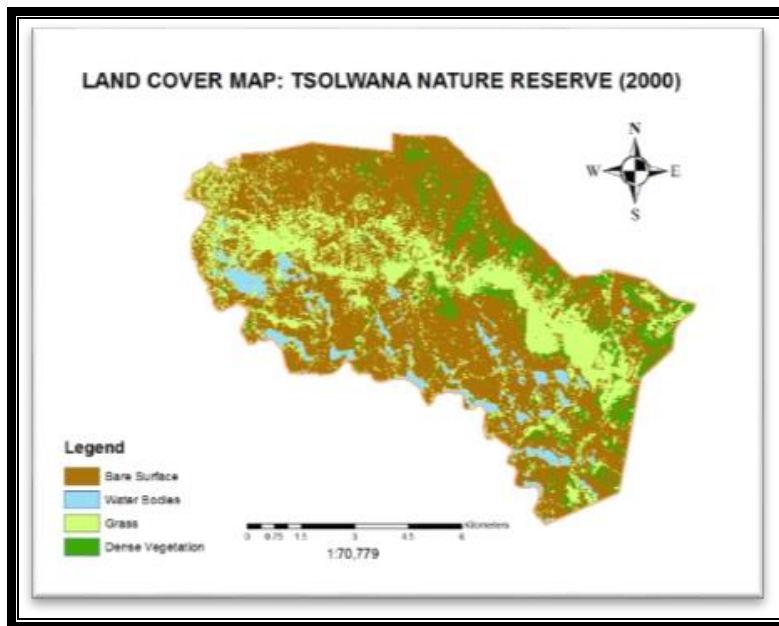
Appendix 33: A 2000 Land Cover map for inside of Hluleka Nature Reserve



Appendix 34: A 2016 Land Cover map for inside of Hluleka Nature Reserve



Appendix 35: A 2000 Land Cover map for inside Tsolwana Nature Reserve



Appendix 36: A 2016 Land Cover map for inside Tsolwana Nature Reserve

