AN INVESTIGATION OF PERCEPTIONS, PARTICIPATION, AND SOCIO-ECONOMIC IMPACTS OF COMMUNITY-BASED CONSERVATION PROGRAMMES: THE CASE OF BUFFELSDRAAI, KWAZULU-NATAL, SOUTH AFRICA

by

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As the candidate's supervisor, I have/have not approved this thesis/dissertation for submission.

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PREFACE

The work described in this dissertation was carried out in the School of Agriculture, Earth and Environmental Sciences, University of KwaZulu-Natal, Westville campus from June 2014 to April 2017, under the supervision of Dr. Suveshnee Munien. The study also falls within the Durban Research Action Partnership (D'RAP) which is a research collaboration between the University of KwaZulu-Natal and the eThekwini Municipality's Environmental Planning and Climate Protection Department. The study represents original work by Sizwe Sbongakonke Nkambule and has not otherwise been submitted in any form for any degree or diploma to other tertiary institutions. Where use has been made of the work of others, it is duly acknowledged in the text.

DECLARATION – PLAGIARISM

I, Sizwe Sbongakonke Nkambule (Student no: 210528232), hereby declare that:

- The research reported in this dissertation, except where otherwise indicated, is my original research.

- This dissertation has not been submitted for any degree or examination at any other university.

- This dissertation does not contain other persons' data, pictures, graphs or other information, unless specifically acknowledged as being sourced from other persons.

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DECLARATION – PUBLICATIONS

During this study I, Sizwe S Nkambule, have co-published 2 peer-reviewed articles on aspects relating to community based conservation practices, utilisation of ecosystem goods and services, and awareness, knowledge and perceptions of environmental change among low income communities within eThekwini municipality.

Publication 1
Munien, S., **Nkambule, S.S**. and Buthelezi, H.Z. 2015. Conceptualisation and use of green spaces in peri-urban communities: Experiences from Inanda, KwaZulu-Natal, South Africa. African Journal for Physical, Health Education, Recreation and Dance (AJPHERD) December 2015 (Supplement 1), 155-167.

Publication 2
Nkambule, S.S., Buthelezi, H.Z. & Munien, S. 2016, 'Opportunities and constraints for community-based conservation: The case of the KwaZulu-Natal Sandstone Sourveld grassland, South Africa', Bothalia 46(2), a2120. http://dx.doi.org/10.4102/abc.v46i1.2120.

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ABSTRACT

There has been growing concern regarding the impacts of climate change-related concerns, coupled with the realisation that these concerns will be experienced differently across countries. At the local level, these climate change-related risks are expected to be more severely felt in disadvantaged and marginalised communities, especially those with a strong reliance on their ecological resource base. Consequently, responses such as reforestation have been identified as appropriate interventions for climate change mitigation. Historically, reforestation projects have predominantly showed a strong ecological focus, however, there has been a transition to include social aspects to provide more holistic approaches. The eThekwini Municipality in partnership with Wildlands Conservation Trust and Durban Solid Waste have embarked on reforestation initiatives such as the Buffelsdraai Landfill Site Community Reforestation Project (BLSCRP) for carbon sequestration, enhancement of ecological resilience, and increase in local community adaptive capacity. In this regard, the present study examined community perceptions, participation and impacts of a community-based reforestation project. Additionally, the study used the Political Ecology, Socio-Ecological Systems, and Sustainable Livelihoods Framework as conceptual frameworks. This study adopted a mixed methodological approach with the Buffelsdraai community in KwaZulu-Natal chosen as the case study where 270 households were interviewed using a quantitative survey. This study adopted a multistage, spatially-based sampling framework, for randomisation and geographic representation. Key findings include low levels of awareness of ecological terms however, respondents' conceptualisation of these terms was closely aligned to the scientific definitions. This indicates that it is not sufficient to exclusively focus on awareness of terminologies, but it is also important to unpack how individuals conceptualise these terms. It was further found that respondents derived multiple goods and services which contributed to household natural capital. The strong reliance on these ecosystem goods and services requires conservation authorities to ensure that projects implemented within the community do not disrupt access to and utilisation of natural resources. Even though there were high level of awareness of the BLSCRP, a minority of respondents were active members. It was revealed that community members involved in the project did obtain multiple benefits. However, this was limited to a small proportion of the community. More concerning were community perceptions regarding the recruitment of individuals into the project, which caused conflict within the community. These findings highlight the importance of continuous monitoring and evaluation to determine the impacts on local communities, and overall applicability of these interventions.

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LIST OF ACRONYMS AND ABBREVIATIONS

AC	Awareness of Consequences
AR	Ascription of Responsibility
BLSCRP	Buffelsdraai Landfill Site Community Reforestation Project
CBC	Community Based Conservation
CBNRM	Community Based Natural Resources Management
CBO	Community Based Organisation
CCB	Climate, Community, And Biodiversity
CCBA	Climate Community and Biodiversity Alliance
CDM	Clean Development Mechanism
D'MOSS	Durban Metropolitan Open Space System
DANIDA	Danish International Development Agency
DSW	Durban Solid Waste
EMA	eThekwinin Municipal Area
EPCPD	Environmental Planning and Climate Protection Department
ES	Ecosystem Services
GIS	Geographic Information Systems
ICDP	Integrated Conservation and Development Project
IISD	International Institute for Sustainable Development
IPCC	Intergovernmental Panel on Climate Change
ITFL	Indigenous Trees for Life
ITK	Indigenous Technical Knowledge
IUCN	International Union for Conservation of Nature
KZN	KwaZulu-Natal
MCPP	Municipal Climate Change Protection Programme
MPA	Maputaland-Pondoland-Albany
NAM	Norm-Activation Model
NEP	New Ecological Paradigm
NGO	Non-Governmental Organisations
NTFP	Non-Timber Forest Products
PA	Protected Area
PES	Payment for Ecosystem Services

REDD	Reduce Emissions from Deforestation and Degradation
SES	Socio-Ecological Systems
SL	Sustainable Livelihoods
SPSS	Statistical Package for The Social Sciences
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
UNCBD	United Nations Convention on Biological Diversity
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations Children's Fund
UN-REDD	United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries
VBN	Value-Belief-Norms
WCT	Wildlands Conservation Trust
WHO	World Health Organisation
WWF	World Wildlife Fund

CHAPTER ONE
INTRODUCTION

1.1. Preamble

The resultant impacts of climate change and escalating environmental pressures, (for example, deforestation, land degradation and ecosystem fragmentation), have often been discussed at a global level but given the effects on local communities, there has been a growing recognition of the importance of multi-scale action and response (Rodima-Taylor *et al*., 2012). Within these multi-scales, the effects of climate change are experienced differently across countries, specifically in developing countries as a result of increased vulnerability and limited adaptive capacity (Mertz *et al*., 2009). As a region, sub-Saharan Africa is considered to be among the most vulnerable regions to climate change-related risks, with 33 countries displaying high and moderately-high vulnerability (Mertz *et al*., 2009). This is further compounded by the finding that the region also ranks in the lowest quintile of adaptation capacity in relation to environmental change (Mertz *et al*., 2009).

Furthermore, it is noted that climate change-related concerns are more severely felt within disadvantaged and marginalised communities who have a heavy dependence on their natural environments and ecological goods and services (Reed *et al*., 2013; Rodima-Taylor *et al*., 2012; Wise *et al*., 2014). According to Rodima-Taylor *et al.* (2012), the impact of climate change-related concerns have the potential to inflict long-term alterations to local socio-ecological systems. Similarly, Bellard *et al.* (2012) note the impact of climate change on species, ecological networks and ecosystems which ultimately threaten, among other aspects, genetic diversity. Particularly in Africa, the threat of increased temperatures and decreased rainfall has ramifications on available water sources, with lakes expected to dry out as a result of such changes (Bellard *et al*., 2012). These changes threaten interdependent ecological processes and systems which have an effect on species interaction, composition and ecosystem functioning (Bellard *et al.,* 2012; Lawler, 2009).

Due to increased threats of climate change-related concerns and the vulnerability of African communities, issues of adaptation and mitigation become crucial at the local community level. Adaptation and mitigation targeted at ecosystems can include the utilisation of ecosystem goods and services to aid communities in adjusting to the climate related threats (Mori *et al*., 2013; Wise *et al*., 2014). Mori *et al.* (2013) argue that these strategies have the potential to

maintain or restore the state of an environment by conserving biodiversity and increasing the resilience of an ecosystem. As such, climate change mitigation strategies are described as actions taken to either minimize or prevent the effects of climate change, and can be technologically- based solutions or interventions that seek to change economic structures, societal organisations, and/or individual behaviour (Nyong *et al*., 2007).

As a means to offset climate change-related threats, there have been noted attempts by governments and environmental organisations to reduce atmospheric carbon emissions through reforestation as the more suitable carbon sequestration method (Xu *et al*., 2014). This sequestration is achieved through tree plantations whereby plant photosynthesis is used to absorb atmospheric carbon dioxide (CO_2) and restore degraded agricultural lands to forested areas (Xu *et al*., 2014). Carbon sequestration through afforestation and reforestation is among the many strategies for climate change mitigation enlisted within the Clean Development Mechanism (CDM) of the United Nations Framework Convention on Climate Change (UNFCCC), and is endorsed by the Intergovernmental Panel on Climate Change (IPCC) (Locatelli *et al*., 2011; Schirmer and Bull, 2014). Afforestation involves the conversion of historically non-forested land into forest, while reforestation involves the reintroduction of tree species to areas that have subsequently transformed or degraded (Locatelli *et al*., 2011). More specifically, reforestation is focused on restoring a portion of land back to its original forest state and composition, while afforestation is focused on establishing forests on a portion of land, regardless of whether the forest had previously or historically existed.

The ecological benefits of reforestation include improving the links of forest patches, increasing the movement and gene flow of native species, and the restoration of bio-geochemical cycling of carbon and oxygen (Cunningham *et al*., 2015). Specifically to agricultural land, reforestation can improve biodiversity, reduce the susceptibility to invasive species, increase ecological resistance to threats brought on by climate change and serve as a mitigation strategy by sequestering atmospheric carbon dioxide (Cunningham *et al*., 2015; Reynolds, 2012). According to Le *et al.* (2011), reforestation projects have traditionally emphasised wood production, water flow management and the prevention of erosion as their objectives. In relation to measuring the ecological impact of reforestation, project objectives typically seek to increase forest cover, timber production, and promote the protection of watersheds and the conservation of biodiversity (Le *et al*.2011; Panfil and Harvey, 2015).

However, there has been an increased focus on socio-economic benefits, ecosystem goods and services, and conservation (Le *et al.,* 2011). With regards to the impact on livelihoods, reforestation projects aim to promote local community empowerment, environmental education and awareness, and increase community incomes and livelihood diversification (Le *et al.* 2011; Locatelli *et al.*, 2015). This notion of promoting local level development can be noted in the verification standards of organisations such as the Climate, Community, and Biodiversity (CCB) certification scheme, and initiatives to reduce emissions from deforestation and degradation (REDD+) which also seek to incorporate socio-economic benefits (Lawlor *et al.*, 2013; Panfil and Harvey, 2015).

It was within the context of off-setting carbon emissions related to hosting the FIFA® 2010 Word Cup that the eThekwini Municipality, in collaboration with the Wildlands Conservation Trust, launched the Buffelsdraai Landfill Site Community Reforestation Project (BLSCRP) (Greater Capital, 2011). The BLSCRP was initiated in 2008 and aimed to restore sugarcane plantations and fragmented areas to indigenous forest (Greater Capital, 2011). The targeted area for reforestation is the buffer zone area which is approximately 787ha and surrounds the Buffelsdraai Landfill Site, located adjacent to the Buffelsdraai community (Diga *et al.*, 2016). Other aspects of the BLSCRP include goals of alleviating poverty through the Indigenous Trees for Life (ITFL) programme in which local community members, known as tree-preneurs, are involved in the collection and growing of tree seedlings which are then stored in nurseries and subsequently planted in the buffer zone (Douwes *et al.*, 2015). These tree-prenuers trade their trees in exchange for credit notes which may be utilised to supplement livelihood portfolios (Douwes *et al.*, 2015).

Although objectives of community up-liftment have been incorporated into reforestation projects, such environmental practices face numerous challenges given the history of conservation practices in South Africa. Conservation practices within South Africa have been criticised for overlooking the dependence on natural resources by local communities (Holmes-Watts and Watts, 2008). Also, historic conservation practices were often associated with discriminatory social engineering and marginalisation of certain groups, especially during the apartheid regime (Holmes-Watts and Watts, 2008). Aspects of the social engineering included forced removals of African communities on land targeted for conservation, and denial of access and rights to these land portions (Holmes-Watts and Watts, 2008). Displacement and forcible removals of communities was often associated with conservation, due to conservation itself

being a spatial strategy which involved the protection of species and ecosystems by restricting human influences and access to identified areas (Agrawal and Redford, 2009).

Fortress-based policies adopted by the conservation authorities, during the apartheid regime, sought to forcibly remove and exclude local communities within national park boundaries, barring communities from access to resources within the protected areas (Kelly, 2011; Miller *et al*., 2011). Displaced and forcibly removed communities were without access to natural resources which they traditionally had access to, thus bringing a disruption to their livelihoods (Agrawal and Redford, 2009). According to Holmes-Watts and Watts (2008), such practices were based on strong preservationist ideologies which exclusively focused on biodiversity protection, at the cost of human well-being. Such costs included land expropriation which has ultimately led to a divide between conservation authorities and affected communities (Holmes-Watts and Watts, 2008). Due to the conflicts caused by such conservation practices, there has been a negative perception of conservation held by African communities (Holmes-Watts and Watts, 2008). The historic experiences of local communities as a result of conservation practices could impact future conservation initiatives, especially those that require substantial community participation.

Participatory approaches to conservation such as community-based conservation (CBC) practices are becoming increasingly popular, especially since they aim to enhance existing socio-ecological linkages (Bremer *et al*., 2014; Buscher and Dressler, 2007; Saito-Jensen *et al*., 2010;). This increased awareness of CBC has led to the promotion of ideals centred on poverty alleviation, socio-economic development, inclusivity, stakeholder engagement and community empowerment (Kelly, 2011; Miller *et al*., 2011; Suich, 2010). Although these ideals have gained momentum in the establishment and function of CBC initiatives, it has been acknowledged that individuals within communities engage in a variety of livelihood strategies that influence their involvement and the derivation of benefits from conservation projects (Bremer *et al*., 2014; Ghazoul *et al*., 2009; Saito-Jensen *et al*., 2010). Given this diversity, it is therefore important to note that CBC initiatives could have positive and/ or negative influences on local communities, and these aspects should be continuously monitored.

Furthermore, increased involvement of local stakeholders in environmental planning may produce desirable results for both current and future programmes. Stakeholders can provide local knowledge about social, environmental and economic contexts within their location

(Picketts *et al*., 2012). Additionally, their involvement fosters increased understanding and awareness of environmental challenges, and increases the likelihood for future engagement and support for implemented programmes (Picketts *et al*., 2012). The emphasis on stakeholder involvement and public participation has come to the forefront of climate change debates and publications by various global organisations and institutions such as the UNFCCC and IPCC (Lawlor *et al*., 2013; Locatelli *et al*., 2011; Schirmer and Bull, 2014). The UNFCCC urges, among other things, for Parties to foster and encourage public participation in climate change mitigation responses (Few *et al*., 2007). The IPCC also provides guidelines and conditions to promote adaptive capacity which includes active participation of local stakeholders as well as mitigation programmes that are tailored to local needs and resources (Locatelli *et al*., 2011). These were echoed by the International Institute for Sustainable Development (IISD) which suggest that decision-making related to climate change mitigation requires effective participation and empowerment of disadvantaged communities (Few *et al*., 2007). Such an approach to climate change mitigation and adaptation is considered to be a more inclusive form of governance and planning which stresses the importance of local knowledge and opinions in decision-making processes (Few *et al*., 2007). According to Few *et al*. (2007), this is in contrast to the technical and managerialist approaches that are largely dominated by professional experts and bureaucratic powers who design and implement policy measures.

1.2. Problem identification

In developing countries, climate change-related vulnerabilities are most severe due to poverty related challenges, the lack of necessary resources and institutional support, low adaptive capacity, and exposure of disadvantaged communities to unfamiliar stressors and pressures (Bulkeley, 2010; Laukkonen *et al*., 2009; Osbahr *et al*., 2008). Although governments may acknowledge the threat posed by climate change, given the complexities of addressing socio-economic development needs, immediate climate change-related action or mitigation is often delayed (Rootes *et al*., 2012). Within the developing context, it is often observed that the poor are located on less productive and more disaster-prone lands which increase exposure to environmental risk and vulnerability (Pettengell, 2010). Due to their location, slight changes to their ecosystem can have exacerbated impacts on livelihoods and overall resilience (Pettengell, 2010). Accordingly, conservation programmes should also be cognisant of and respond to the growing threats associated with climate change (Poiani *et al*., 2011).

It has been acknowledged that climate change-related vulnerabilities often coincide with pre-existing socio-economic vulnerabilities, compounding social marginalisation and inequality (Rodima-Taylor, 2012). In some instances, it may deepen poverty, and exacerbate the vulnerability of these communities to shocks and stressors (Laukkonen *et al*., 2009; Reed *et al*., 2013). Several communities within the sub-Saharan region rely on ecosystem goods and services for food, subsistence and sustenance, therefore unpredictable environmental change threatens food and livelihood security (Egoh *et al*., 2012; Faramarzi *et al*., 2013). Consequently, climate change research now integrates social dimensions in an attempt to generate a more robust understanding of local level dynamics and the institutional influences on climate mitigatory measures (Rodima-Taylor, 2012). As a result, the concomitant institutional action is based on practice-relevant, locally-based research which incorporates a social science perspective (Rodima-Taylor *et al*., 2012). Practice-relevant research has the potential to inform future mitigation or remedial action relevant to contemporary environmental challenges.

In relation to the Buffelsdraai community, there is limited understanding of how local community members are responding to the BLSCRP initiative. Although the ecological benefits of reforestation are crucial to the overall goal of mitigating climate change, there is a need to unpack the social aspects related to reforestation. Similarly, it is important to unpack local levels participation in CBC initiatives and climate change mitigation in an attempt to inform levels of awareness and extend the multiple benefits derived from these programmes. Lowe *et al.* (2006) assert that attempts to understand public perception of environmental threats should be complimented by an examination of the underlying factors that influence these perceptions.

1.3. Motivation for the study

The city of Durban is endowed with a variety of terrestrial and aquatic ecosystems, coupled with areas of mega biodiversity which require protection (Boon *et al*., 2016). The city of Durban is located within the Maputaland-Pondoland-Albany (MPA) corridor which is characterised as one of the Global Biodiversity Hotspots, and consists of forests types such as the Northern Coastal and Eastern Scarp Forest (Douwes *et al*., 2015). The MPA comprises 7000 species of vascular plants, of which 25% are considered to be endemic to the MPA (Boon *et al*., 2016). Additionally, the city's ecosystems provide goods and services to communities that are dependent on their ecological resource base, and therefore are at risk to climate change-

related threats which are expected to increase the frequency and intensity of floods, reduce water availability, and change the distribution of plant and animal species (Roberts and O'Donoghue, 2013). These climate change-related risks occur in a context where the city of Durban faces challenges associated with poverty, rapid urbanisation and environmental degradation (Roberts and O'Donoghue, 2013). The BLSCRP is a strategy that aims to address climate change mitigation, enhance ecological resilience, and promote socio-economic development (Roberts and O'Donoghue, 2013). However, the linkages between society and their natural surroundings is also vital in informing suitable interventions that aim to address climate change and socio-economic development concurrently. Smajgl *et al*. (2011) state the relationship between society and its surrounding natural environment is dynamic, complex and non-linear in nature, and also reflects on aspects such as policy and economics. Murray-Rust *et al*. (2011) argue the need to emphasise the factors that determine socio-ecological interactions because society's well-being is dependent on various ecosystem services and goods. Therefore, the loss and degradation of ecosystems is both an environmental and developmental challenge.

Several studies argue that society and ecology cannot be understood or examined in isolation, given their inter-relatedness, thus warranting the use of frameworks such as the socio-ecological systems (SES) (Casado-Arzuaga *et al*., 2013; Gruber, 2010; Leyshon, 2014; Murray-Rust *et al*., 2011). Despite the realisation of this inter-relatedness, research shows a dominance of biophysical-based studies on climate change, with specific focus on greenhouse gas reductions, and projections and modelling of climate change-related threats (Bellard *et al*., 2012; Huey *et al*., 2012; Kotir, 2011). The value of such biophysical-based research is crucial to addressing and responding to the risks and impacts associated with climate change. However, more recently, there has been an increased focus on community perceptions and subjective values of climate change (Amundsen, 2015; Raymond and Brown, 2011). This shift towards understanding social aspects is also echoed in research aimed at devising sustainable environmental strategies to protect ecosystems (Casado-Arzuaga *et al*., 2013).

Despite the scientific debate and development of projection models about the impacts of climate change-related concerns, there is a level of uncertainty amongst the general public about the actual effects climate change may have in their community (Etkin and Ho, 2007). This uncertainty is suggested to be the reason why climate change-related effects are not at the forefront of societal challenges within certain communities (Lowe *et al*., 2006). As approaches

to mitigate climate related concerns have increasingly been criticised for assuming that the general public has a knowledge deficit in comparison to the scientific experts who investigate the phenomenon (Lowe *et al*., 2006). Furthermore, these approaches are criticised for not understating the broader socio-cultural contexts, thus undermining the importance of public perception and knowledge of the risks and threats posed by climate change (Lowe *et al*., 2006). Etkin and Ho (2007) add that these risks are linked to the social construction of their natural surroundings, and how communities perceive and relate to the threats upon themselves and others.

The role of public perception arguably influences the capacity to participate in discussions and actions related to climate change, and is a crucial aspect for effective policy formulation (Becken *et al*., 2013; Brody *et al*., 2008). Consequently, there is a need to explore the knowledge and perceptions of communities in addressing climate change mitigation because the misconception of threats can influence the willingness to engage with and implement suitable strategies at the individual level (Etkin and Ho, 2007). It is further noted that misconceptions of threats may act as a social barrier to the acceptance of climate change mitigation programmes, as these shape whether or not communities perceive mitigation as a necessary action (Rayomond and Brown, 2011; Tam and McDaniels, 2013; Wolf and Moser, 2011). Thus, it can be argued that responses by governments to environmental challenges is determined not only by scientific evidence, but also on the clarity and perception of the public (Etkin and Ho, 2007).

It is within this background that the proposed study sought to establish not only how communities relate to their surrounding environment, but how they respond to community-based conservation practices, such as the BLSCRP. The community's relation to the environment was explored through a utility value approach, for example the natural resources necessary for supplementing livelihood and cultural purposes. In determining responses to conservation practices, community perceptions of the BLSCRP is explored by addressing how communities perceive and engage with this project. The findings generated from this study will hopefully contribute to the understanding of the community involvement in CBC projects, which may also inform future practices. As a result the research questions listed in the subsequent section framed the current study.

1.4. Research questions

Additionally, in response to the need for policy and practice relevant research this study aims to lessen the gap by addressing the following questions:

- What is the socio-economic profile of the community?
- What are the levels of awareness and perceptions of ecological concepts relevant and related to conservation, biodiversity, and climate change?
- Do the local community members utilise these natural spaces and what ecosystem services and goods do they derive from it?
- Are community members aware of the various municipal programmes that have been implemented within the community, in particular, the BLSCRP?
- What are the community responses to the BLSCRP?
- What are the impacts of the BLSCRP in the Buffelsdraai community?

1.5. Aim and objectives

The main aim of the study is to investigate the factors influencing perceptions, participation, and socio-economic impacts of the Buffelsdraai Landfill Site Community Reforestation Programme in the Buffelsdraai community, KwaZulu-Natal.

Specific objectives are as follows:

1. To generate a socio-economic and demographic profile of households in Buffelsdraai.
   This provided the socio-demographic and spatial context in which perceptions, attitudes and levels of awareness can be understood and analysed. Also, this assisted in determining how individuals relate to their surrounding environment.

2. To examine local community knowledge, perceptions and attitudes towards biodiversity, conservation and climate change.
   The success of programmes is arguably linked to how communities relate to and understand the motivation behind the implementation of municipal programmes, and their support towards them. As such, this objective probed current levels of community knowledge, perceptions awareness which can inform future community engagement and consultation.

3. To examine the utilisation of ecosystem goods and services.

   The purpose of the objective was to identify which resources the communities use, and the benefits they derive from these resources. This will further allow the establishment of a pattern of consumption and prioritisation of specific ecosystem goods and services by the community.

4. To examine community participation, impacts and responses to the BLSCRP.

   Although the implemented programme is intended to produce socio-ecological benefits and ecological enhancement, it is also important to consider how they intend to benefit communities. This objective further enabled this study to establish how community members obtain and tap into the benefits generated by the BLSCRP. In this regard, positive responses can aid in identifying which aspects of the programme are effective, while negative responses highlight the tensions and conflicts produced by the programme.

5. To forward recommendations for future community-based initiatives within low-income communities.

   The results generated from this study are used to formulate recommendations which can contribute to the design of projects within the Buffelsdraai community, and other communities with a similar socio-economic context.

1.6. Brief summary of methodological approach

The research inquiry adopted a case study approach which focused on the Buffelsdraai community. This study adopted a mixed methodological approach to data collection which was informed by the pragmatism philosophy. Additionally, an abduction approach was used in the data analyses which was based on both inductive and deductive reasoning to identify key data trends. Within the typologies of mixed methods design, concurrent triangulation was selected as the appropriate design to facilitate to use of multiple theories and data sources. The study's time horizon was cross-sectional with data collection interested at gathering data of a snapshot of community dynamics. The survey instrument utilised to gather data was a questionnaire which included closed-ended questions and probing open-ended questions as a means to extract qualitative data and enrich the quantitative findings. The collected data was captured and analysed through the application of the Statistical Package for the Social Sciences (SPSS) (Version 23). Statistical analyses such as Pearson's Chi Square test, Likelihood Ration and Fisher's Exact tests were carried out to ascertain statistical significance and verify findings.

1.7. Structure of dissertation

This dissertation is divided into six chapters. Chapter One introduced the relevant background and provided context in which the study is located and conceptualised, as well as providing the aim and objectives of the study, and a brief overview of the methodological approach. Chapter Two highlights the three conceptual frameworks that guided the study. Chapter Three presents the relevant literature that informed the research process. Chapter Four provides a brief background of the study area as well as the chosen methodology adopted in this study. Chapter Five presents a description of the data and the subsequent analyses that followed. Chapter Six, the concluding chapter, lists the summary of key findings, recommendations and overall concluding remarks of the study.

1.8. Conclusion

This study seeks to establish not only how communities relate to their surrounding environment, but also how they respond to CBC practices aimed at protecting the ecosystem using the BLSCRP as an example. The data and key findings emanating from the proposed study, will hopefully improve understanding of the community level dynamics, which may be used for future conservation projects undertaken within the community or under similar socio-economic landscapes. The next chapter provides an overview of the conceptual frameworks that guided this study.

CHAPTER TWO
CONCEPTUAL FRAMEWORK

2.1. Introduction

This chapter outlines the three conceptual and theoretical frameworks that guided this study. Given the multiple dimensions of this research the political ecology, socio-ecological systems, and sustainable livelihoods framework are the conceptual frameworks that were used. The political ecology framework was identified as the overarching framework for the study as it encapsulates the relevant themes and discussion points associated with political response of the BLSCRP, and the way in which this initiative seeks to address challenges related to ecology. As part of the BLSCRP's aim to enhance ecosystem services as part of community adaptation, the socio-ecological systems framework was adopted as a complimentary framework in which, amongst other things, the community's dependence and utilisation of ecosystem services could be understood. Additionally, initiatives such as the BLSCRP have placed an emphasis on enhancing local community livelihoods, thus requiring this study to further adopt the sustainable livelihood framework to unpack existing local livelihood strategies and how the project has contributed to local community livelihoods.

2.2. Political ecology

The political ecology approach seeks to address the links between society and nature, arguing that both the social and environmental dimensions are intertwined (Adams and Hutton, 2007). It allows for inquiry as to how political, ecology and environmental processes interrelate, and how this may in turn influence and resolve both social and environmental change (Nygren and Rikoon, 2008). According to Nygren and Rikoon (2008), the political ecology framework emphasises how communities utilise local resources in relation to broader socio-political and economic contexts, and the manner in which control and access to natural resources is negotiated and contested. With strong influence from Marxist thinking, the political ecology framework widens its scope to analyse political and economic contexts, and acknowledges specific locality and heterogeneity of ecological conditions under analysis (Jones, 2006).

Specific to conservation practices, the framework considers local dynamics, trends in economic change, politics of environmental management and the ecological results they produce as a fundamental relationship (Adams and Hutton, 2007). In terms of climate change-related threats, the framework is key for analysing the political responses within a particular

environment and the social contexts in which the intended outcomes play out (Adams and Hutton, 2007). With regards to the political dimensions of the above discussed, institutions such as government and non-governmental organisations (NGOs) play a significant role in distributing power, rights, access to various ecological components. In this case, the municipality is seen as a central figure that has shifted some of the power to an NGO such as Wildlands Conservation Trust (WCT), Durban Solid Waste (DSW) and the community which are now active members in the reforestation programme. The state is considered the central actor in the legitimisation and exercise of power and control (Adams and Hutton, 2007). Thus, actions taken by the state with reference to climate change mitigation and conservation are considered political action within the scope of the political ecology framework. The framework allows for viewing the changes in conservation practices by giving attention to historical factors.

In the context of this study, the political ecology framework was chosen as the overarching framework for the study due to the BLSCRP being classified as an institutional response to mitigate climate change-related threats and enhance ecosystem services. The political ecology framework also allows for the exploration of power relations between the municipality carrying out the BLSCRP and the communities in which this programme is implemented. The different roles played by the state, non-governmental organisations and local community stakeholders are of crucial importance, as these power dynamics have a bearing on perception, attitudes and community participation in the project. Given that the study places additional emphasise on the distribution of power, participation in this study was used as a tool to understand where the power lies in terms of how participation is encouraged, and in what forms. It has been observed that the power dynamics in natural resources management and conservation have traditionally been a centralised practice in which community members are excluded from the inception and design phases of projects. Given this realisation of the centralised power dynamics, decentralisation of power has become one of the aspects for more inclusive approaches to conservation (Child and Barnes, 2010; Fabricius and Collins, 2007; Nelson and Agrawal, 2008).

2.3. Socio-ecological systems

The term socio-ecological systems (SES) has been used to denote the understanding and concept of the various interactions between human societies and their natural environment, arguing that the separation of social and environmental systems is an arbitrary practice when

undertaking research (Folke, 2006). Thus, there is a need to unpack ecological functioning within the context of social dynamics in a certain geographical location (Folke, 2006). The various interactions that occur between society and nature include land-use decisions, changes in land cover, biodiversity, production systems, consumption patterns, as well as disposal networks (Redman *et al*., 2004).

The interactions between the ecological systems and a given society are both complex and dynamic, warranting a trans-disciplinary perspective when analysing various socio-ecological interactions (Murray-Rust *et al*., 2011). Such an analysis is crucial for biodiversity management as it requires an understanding of human-nature interactions from different perspectives (Ohl, 2010). These interactions can include the way the natural environment is consumed, utilised and managed. The framework also allows for the understanding of societal responses to environmental and policy change, as well as the intended and actual outcomes policies may produce (Smajgl *et al*., 2011). This multiple perspective can be gained through the collaboration of scientific experts from across disciplines, as well as non-experts and relevant stakeholders (Gruber, 2010). Leyshon (2014) argues that the worldview of ecosystems being a singular system has been scrutinised for focusing on individual components, and subsequently overlooking the complexity of such systems.

The SES framework was used in this study as it had already been observed that as an outcome of the BLSCRP, the community of Buffelsdraai has an active relationship with their surrounding natural environment. This active relationship is observed with community members involved in the collection and growing of tree seedlings for the BLSCRP, and the eThekwini municipality's endeavour to enhance ecosystem services as part of its aim to mitigate and adapt to climate change-related threats. Specific to this study, the SES framework aids in conceptualising how the Buffelsdraai community utilises the available ecosystem goods and services. The utilisation of ecosystem goods and services was based not only on consumption, but also on cultural fulfilment. The framework is ideal for exploring the interactions between community livelihood portfolios, and the various biophysical resources that may be utilised to sustain their livelihoods. The utilisation of ecological goods and services to enhance adaptive capacity has been identified as one of the key factors influencing the design and implementation of the Buffelsdraai Reforestation programme (Douwes *et al*., 2015). However, Martin *et al.* (2013) warn against conservation practices that result in the disruption of community utilisation of ecosystem services. As such, it was necessary to further adopt a

framework to unpack the local community context, the contribution of ecosystem services to community livelihoods, and to understand how political actions can influence these communities. It was therefore necessary to incorporate the sustainable livelihoods framework as part of the conceptual frameworks of this study.

2.4. Sustainable livelihoods framework

The approach emerged in the 1980s through discussions on poverty reductions and the means to understand the manner in which individuals manage with poverty (Gutierrez-Montes *et al*., 2009). A central premise is that it is fundamental to consider where people live, what resources are in their control, and the already obtained knowledge and skills (Tao and Wall, 2009). The term livelihood incorporates the capabilities, assets such as resources, access and claims to the resources and the various activities involved to attain a means of living (Hammill *et al*., 2005). In reference to sustainability, this would include the ability to cope and recover from external pressures and shocks, sustain or improve capabilities and assets, as well as provide opportunities for future generations (Hammill *et al*., 2005).

The sustainable livelihoods (SL) framework attempts to conceptualise various factors which can either constrain or enhance the available livelihoods opportunities, and attempts to highlight how these opportunities relate to and influence one another (Serrat, 2010). The SL frameworks considers pro-poor approaches as the main priority, which emphasises the livelihood systems of those communities in a state of poverty, and/ or are exposed to environmental and economic stress (Butler and Mazur, 2007). The SL framework is considered a people-centred paradigm with particular focus on the inherent capacities and knowledge systems within a community (Tao and Wall, 2009). The CBC initiatives such as reforestation aim to enhance livelihoods through the accumulation of asset accrual (Le *et al*., 2011; Locatelli *et al*., 2015). In this regard, the SL framework was deemed a suitable framework to examine the impacts of the BLSCRP on local community livelihoods.
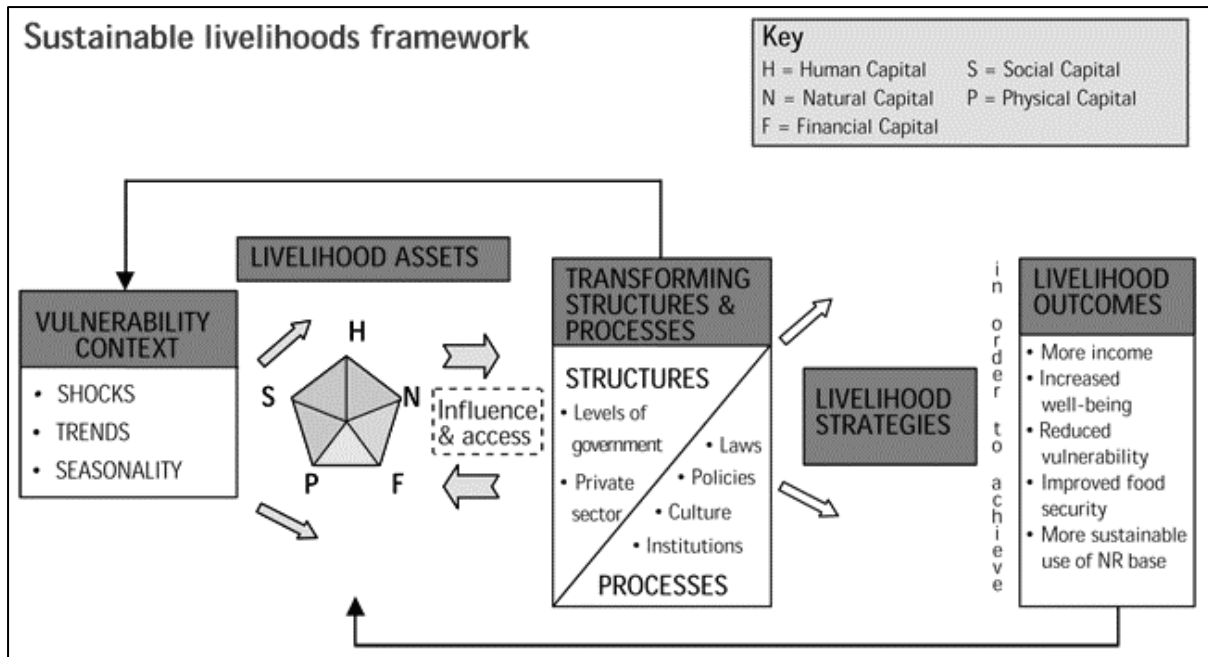
Figure 2.1. Sustainable Livelihoods Framework (Source: Vedeld et al., 2012: 22)

In ensuring a people-centred approach to development or adaptation strategies, the SL framework proposes that interventions need to take into consideration the objectives and priorities of those individuals or communities (Toner and Franks, 2006). The intended strategies should be ideally based on the resources/capitals the community has already obtained (Toner and Franks, 2006). Furthermore, strategies ought to achieve a reduction in community vulnerability and increase resilience by supporting individual and collective actions (Gutierrez-Montes *et al*., 2009).

There are five capitals which underpin livelihood assets within the SL framework, and these are defined as natural (N), social (H), physical (P), human (H) and financial (F) capital (Mazibuko, 2013). Natural capital refers to the natural resource base which includes land, water and biophysical resources that individuals or households have access to (Mazibuko, 2013). Social capital is the informal institutions such as religious and self-help groups, as well as cooperatives which are seen as enabling mechanisms for individuals to seek assistance in times of hardship, conflict and powerlessness (Bazezew *et al*., 2013). The stock of social capital may be calculated by determining the collective membership of an individual to various institutions and groups. For example, the more memberships an individual obtains the greater the contribution to their livelihood (Bazezew *et al*., 2013). Physical capital, referred to as built capital, includes access to infrastructure, machinery and housing (Serrat, 2010). Additionally,

human capital includes knowledge, education, skills, labour and health. Furthermore, Bazezew *et al*. (2013) state that household size is also directly proportional to human capital. Financial capital refers to income, pension, remittances, and access to credit, and not limited to monetary capital (Serrat, 2010). It also takes into consideration those assets which may be transformed to liquidity such as livestock (Mazibuko, 2013).

Reed *et al.* (2013) suggest that attempts to utilise the SL framework should emphasise existing capital assets the household possesses, rather than focusing on capital assets that are lacking. These capital assets may be grouped into various types, namely those which may be consumed, stored and preserved, and those which can be invested to build upon and produce new resources (Gutierrez-Montes *et al*., 2009). Additionally, capital assess are also sub-divided into those which are tangible and intangible. On the one hand, intangible capitals include social, human, cultural and political capital, while tangible capital includes natural, financial and built capital (Gutierrez-Montes *et al*., 2009).

In relation to climate change-related research, the SL framework provides a platform for analysis of both the capital assets that form part of a particular livelihood portfolio, as well as conceptualise how factors such as climate change and institutional responses to this change can affect a particular livelihood (Reed *et al*., 2013). The framework further enables the understanding of how livelihood strategies may be enhanced or reconfigured as a means to promote adaptive capacity of communities to cope with change, and diversify their strategies (Reed *et al*., 2013). This reconfiguration of livelihoods may occur through transforming structures and process which is often in the form of local government structures which through their policies and laws attempt to shape livelihood outcomes (Serrat, 2010). In relation to this study, these transforming structures and process are evident in the eThekwini municipality acting as the transforming structure, through programmes such as the BLSCRP that aims to increase local capacity and development. Additionally, the framework acknowledges that various stakeholders are affected differently by climate change, as their adaptive capacity is determined by the capacities and access to the various capitals (Reed *et al*., 2013).

The vulnerability context is also deemed equally important when using the SL framework to understand impacts on local communities, particularly in the case when access to resources may be denied and could further jeopardise livelihood sustainability. In this case, conservation practices or existing programmes such as the BLSCRP may enhance vulnerability rather than

resilience. Although the project seeks to enhance community livelihoods, the limited distribution of benefits to livelihoods can increase inequality within the community. Additionally, given that an objective of the BLSCRP is to promote socio-economic benefits, this warranted the need for this study to adopt the SL framework as the project has intended outcomes to influence community livelihood strategies. The SL framework was crucial to this study as it permitted the study to account for the various livelihood strategies adopted at the individual and household level, thus permitting the researcher to profile the socio-economic context within the community. The framework also aids in highlighting discussions and findings related to household and community vulnerability and the multiple stressors which affect the community. Furthermore, through the lens of the SL framework, assets and capital or lack thereof provides insight to potential social, environmental and economic challenges and opportunities.

2.5. Conclusion

The chapter provided an overview of the multiple conceptual and theoretical frameworks which guided the study. It is crucial to note that it is these frameworks which guided literature review in the following chapter as well as the chosen research methodology. The above frameworks are an indication of the multi-dimensional nature of this study. The adopted conceptual frameworks have assisted in providing a broader and more robust understanding of the main concepts and their interrelatedness in unpacking how individuals and communities relate to and interact with their natural environment. The following chapter describes the literature that was used to inform this study.

CHAPTER THREE
LITERATURE REVIEW

3.1. Introduction

This chapter presents thematically, the relevant literature informing this study. This includes beginning with an overview of the climate change discourse which sets the context in which this study can be understood, followed by discussions related to climate change adaptation and mitigation as responses to addressing the challenge of climate change-related concerns. Additionally, these discussions revolving around climate change adaptation and mitigation form the background in which subsequent review of literature is framed. Further discussions will focus on biodiversity and ecosystem goods which are crucial components in climate change adaptation and mitigation, given the ecological and social importance of maintaining and protecting the state of the environment. Given the role of biodiversity and ecosystem goods and services in providing a myriad of benefits to various socio-ecological systems, conservation is therefore vital for ecological and social resilience. As such, the study further reflects on literature related to conservation discourses and practices. Furthermore, these discussions build a narrative in which we can understand the way conservation practices have historically been and are currently informed and implemented. In closing, this chapter will also provide a review of discussions on perceptions which are related to climate change, biodiversity and conservation.

3.2. Climate change discourse

It is acknowledged that climate change-related threats shall negatively affect the more vulnerable groups in a community, particularly those within low income groups (Appleby *et al*., 2017). According to Appleby *et al.* (2017) such realisation is also evident the IPCC 2014 report which stated the need for research, development, implementation and evaluation of these vulnerable groups, particularly at the community level. Thornton *et al.* (2014) add that an important part of policy targeted at reducing vulnerability needs to focus on enhancing adaptive capacity at the individual level, first. As such, there has been the need to promote community-based strategies which seek to improve local livelihoods of resource-dependent communities, and increasing their resilience against climate change-related threats (Wise *et al*., 2014). These community-based strategies focus on existing ecosystem services available to these communities, and seek to enhance adaptive capacity by sustaining the state of ecosystem goods and services (Wise *et al*., 2014).

Climate change policy has been predominantly informed by a biophysical scientific discourse, which has led to social aspects being understated within policy responses (Appleby *et al*., 2017). Arguably, climate change policy must consider all aspects of climate change-related threats, which affect both biological and human systems (Thornton *et al*., 2014). For example, an increase in rainfall variability will have a negative effect on forest ecosystem provisioning services which in turn limits the ability of natural resources dependent communities to derive benefits from the provisioning services (Thornton *et al*., 2014). It is from this context, conservation practices can play an important role in climate change mitigation, specifically in reducing the rate of deforestation and forest degradation (Belle *et al*., 2016).

Maxwell *et al*. (2015) state that conservation can further reduce vulnerability to climate change-related threats by restoring ecosystem services, ensuring sustainable harvesting of resources, and reduce the impact of extreme events such as flooding. According to Panfil and Harvey (2015), the importance of conservation within the climate change discourse is evident in the UNFCCC sixteenth Conference of the Parties (COP16) which argued that REDD+ projects need to focus on the conservation of natural forest and biological diversity, and that funding be directed to projects that conserve forests ecosystem services, as well as promote social benefits. Although it is acknowledged that areas rich in biodiversity contribute to local livelihoods through ecosystem benefits, it must also be noted that it is a considerable challenge to merge biodiversity conservation objectives with local development needs (Amin *et al*., 2015).

In relation to this study, the BLSRP provides an opportunity in which reforestation can be understood as a response to addressing the complexities of climate change-related threats, which include the mitigation of the said threats, ecological restoration, and enhancement of local community livelihoods. Reforestation forms part of the strategies to reduce the threats of climate change and promote ecological restoration, as well as produce ecological and socio-economic co-benefits (Alexander *et al*., 2011). According to Le *et al.* (2011), the success of reforestation projects requires evaluation and updating of information starting with the planting phase, and keeping track during the maturing phase of the forest. This type of approach to evaluation allows for readjustments to be made to ensure the materialising of both environmental and socio-economic goals of reforestation projects (Le *et al*., 2011). Reforestation projects aim to enhance forest productivity and ecosystem services, and contribute to community livelihoods (Le *et al*., 2011; Orsi *et al*., 2011). Ensuring the

accomplishment of these objectives is further enshrined in the Forest Landscape Restoration (FLR) approach which was devised by the IUCN and WWF (Orsi *et al*., 2011). According to Orsi *et al* (2011), the FLR approach emphasises the establishment of a forest landscape which produces benefits for ecology and society. As stated earlier, the biophysical focus in the climate change discourse has led to the understating of social aspects. However, the inclusion of a social science orientation within climate change discourse is valuable in providing a more comprehensive understanding of the context in which climate change-related threats occur, thus necessitating relevant interventions. In unpacking the social component of the climate change discourse, it is crucial to reflect on the importance of local and/or community perceptions.

Research on climate change perceptions has covered aspects such as levels of awareness, knowledge, perceived causes, willingness to participate in mitigation actions, perceived risk and individual responses to threats (Crona *et al*., 2013; Jang, 2013; Lee *et al*., 2015). In this regard, unpacking perceptions towards climate change enables researchers to further encourage pro-environmental behaviour and attitudes (Jang, 2013). These public perceptions can be understood through the individual recognition of climate change-related threats, the realisation of contributing factors, the level of concern regarding perceived threats, and perceived responsibility of address such threats (Capstick *et al*., 2015). The manner in which action is taken to address climate change-related threats is arguably influenced by public perceptions of the causes and resultant implications (Capstick *et al*., 2015; Lee *et al*., 2015). Capstick *et a*l., (2015) assert that responses to climate change-related threats such as emissions reduction and adaptation, require some form of community involvement.

Additionally, public understanding of the causes of climate change-related threats is crucial in the formation of subsequent attitudes (Jang, 2013). Moreover, Crona *et al.* (2013) elude to the importance of gaining insight of public perceptions of climate change as these perceptions form part of the context in which mitigation projects are carried out. It becomes crucial for policy makers and researchers to understand these perceptions, as these perceptions can influence public support or resistance towards actions taken to address climate change-related threats (Crona *et al*., 2013; Lee *et al*., 2015). Similarly, understanding perceptions toward conservations practices and their ecological benefits can further guide conservation agencies towards creating and maintaining positives relations with adjacent communities (Hartter *et al*., 2014; Mutanga *et al*., 2015). In order to contribute to effective conservation policy, Amin *et al*

(2015) assert that there is a need to improve community knowledge of the importance of conservation practices and delivery of ecosystem services. Simultaneously, in improving the aforementioned knowledge, it ought to be noted that policy makers and researchers are only able to identify the benefits derived from ecosystems if they understand what local communities themselves perceive as benefits (Hartter *et al*., 2014). Climate change discourse has predominantly had a biophysical focus, and needs to incorporate a social science perspective to gain context specific understanding of threats and thus devise interventions that are specific to those communities. Therefore, the design of climate change adaptation and mitigation programmes need to be context specific, and unpack local community utilisation of ecosystem goods and services.

3.3. Climate change adaptation and mitigation

Climate change-related concerns pose threats to biodiversity by affecting ecosystem functioning and the species within the biophysical system (Belle *et al*., 2016; Poiani *et al*., 2011; van Wilgen *et al*., 2015). These effects range from shifts in species distribution, frequent occurrence of extreme events and alteration of environmental conditions (Pio *et al*., 2014; Poiani *et al*., 2011). These effects can also cause a shift in flowering plants and insect pollinators, resulting in an incompatibility between plant and pollinator species, ultimately resulting in an extinction of both species (Bellard *et al*., 2012). Climate-related impacts also alter the function and integrity of biomes, for example, the Millennium Ecosystem Assessment report predicts a 5-20% shift of the Earth's terrestrial ecosystems (Bellard *et al*., 2012). Pio *et al*. (2014) state that within southern Africa, native species richness is expected to reduce, while turnover rates are expected to increase as a result of climate change-related threats. van Wilgen *et al*. (2015) add that climate change-related threats are expected to cause a shift in species taxonomic groups, and describes biodiversity hotspots in South Africa as the most susceptible to these effects.

Strategies aimed at managing socio-ecological systems within the context of climate change generally focus on resistance, resilience and change (Lawler, 2009). Resistance focuses on the ability of a system to remain unchanged within the changing conditions of external factors, while resilience is concerned with the ability of a system to recuperate from stressors (Lawler, 2009). One of the determinants of socio-ecological vulnerability and adaptive capacity is poverty (Harlan and Ruddell, 2011; Laukkonen *et al*., 2009; Pettengell, 2010). This is due to their heavy reliance on climate sensitive resources which are crucial for sustaining their

livelihoods (Pettengell, 2010). The 2005 Millennium Ecosystem Assessment report estimates that 2.7 billion people, living under impoverished conditions, rely on natural resources for subsistence, sustenance and economic development purposes (Pettengell, 2010).

Furthermore, it is crucial to determine vulnerability by accounting for community socio-economic well-being, which is affected by increased climate change-related threats (Arthurson and Baum, 2015). These threats can further exacerbate vulnerabilities of community members and their households by reducing the capacity to respond to risk, thus requiring research to unpack household assets which can form part of designing climate-change adaptation initiatives (Shah *et al*., 2013). Paumgarten and Shackleton (2011) assert that examining socio-economic well-being allows for effective climate change policy design for both poverty alleviation and environmental protection. Also, it is necessary to place vulnerability within socio-economic contexts as the impacts are felt differently across these spatial and socio-economic gradients (Arthurson and Baum, 2015; Thorton *et al*., 2014).

The focus on vulnerability moves beyond income levels and incorporates broader socio-demographic characteristics. Additionally, this provides information for adaptation projects which are designed to respond to local community contexts in which households vary in their ability to engage in adaption projects (Arthurson and Baum, 2015; Haque *et al*., 2012). Adaptation strategies can involve the establishment of reserves, the restoration of ecosystems and biodiversity which has been degraded by anthropogenic land use, and programmes which monitor the socio-ecological responses to climate change (Mori *et al*., 2013). According to Mori *et al*. (2013), mitigation and adaptation appear as separate strategies aimed at addressing climate change-related concerns, however, it has been noted that these two strategies are complementary. It is argued that mitigation ought to embrace the long-term vision of adjusting communities to climate change effects, which is often the distinctive characteristic of adaptation (Baker *et al*., 2012; Mori *et al*., 2013).

The integration of both mitigation and adaptation may have the potential to produce new opportunities for natural resource management and biodiversity conservation (Nyong *et al*., 2007). In developing countries, climate change adaptation is regarded as a necessary strategy given that local communities have been struggling to address the challenges of climate variability (Lisa and Schipper, 2007). The IPCC Fourth Assessment Report has stressed the importance of adaptation, stating that it is a necessary measure to address the unavoidable warming which has been caused by increased emissions (Lisa and Schipper, 2007).

Consequently, adaptation has been promoted as a complimentary response to climate change mitigation (Lisa and Schipper, 2007).

In carrying out these programmes, local level government is considered the responsible and legitimate state organ to address such concerns at the local level (Baker *et al*., 2012; Harlan and Ruddell, 2011; Measham *et al*., 2011). Baker *et al.* (2012) assert that local governments play a crucial role in translating international and national programmes for implementation within their own jurisdictions. Additionally, Harlan and Ruddell (2011) state that climate change-related threats manifest within specific local circumstances which vary in socio-economic, ecological and political conditions. According to Measham *et al.* (2011), local municipalities and other NGOs have three critical duties to carry out in relation to climate change adaptation or mitigation:

- The need to structure local responses to impacts, given their spatial proximity to local communities,
- mediate between individual and collective responses in relation to the vulnerability of communities, and
- to govern the delivery and provision of resources necessary for the facilitation of adaptation and mitigation.

Among the various global initiatives aimed at mitigating climate change-related concerns is the United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (UN-REDD) (Blom *et al*., 2010). Other examples of global initiatives which emphasise on climate change mitigation and adaptation include the UNFCCC, the United Nations Environment Programme (UNEP) and IPCC (Vijaya-VenkataRaman *et al*., 2012). In conjunction, the above mentioned initiatives represent global efforts which seek to address the challenges presented by climate change, and the various strategies which can be adapted to local contexts. Similarly, the UN-REDD, or more commonly known as REDD+, is an overarching programme which seeks to reduce emissions from deforestation and forest degradation, while enhancing forest stocks in developing countries (Panfil and Harvey, 2015; Romijn *et al*., 2013; Thompson *et al*., 2011). The enhancement of these forest stocks involve forest regeneration and rehabilitation, reducing emissions and rates of degradation, and carbon uptake and removal (Thompson *et al*., 2011). The programme was established in 2008 as a means to support developing countries in their attempts to reduce

emissions and engage in forthcoming REDD+ projects (Blom *et al*., 2010; Romijn *et al*., 2013). Although the projects are centred on emissions reduction from deforestation and forest degradation, projects also incorporate aspects of conservation and sustainable management (Blom *et al*., 2010; Panfil and Harvey, 2015). In relation to governance, this represents a change of government and increase in different actors and structures in governance, taking into consideration how societies relate to forest conservation and management (Corbera and Schroeder, 2011).

The programme envisages meaningful stakeholder engagement with those who are directly reliant on forest goods and services for their livelihoods (Blom *et al*., 2010). The stakeholders include indigenous people and other affected communities whose socio-economic and cultural well-being is dependent on resources provided by forests (Blom *et al*., 2010; Groom and Palmer, 2012; Thompson *et al*., 2011). Such communities also play an important role in REDD+ as it is acknowledged that local communities have indigenous knowledge of and attachment to the forests (Blom *et al*., 2010). In relation to this study, indigenous knowledge can be a useful source of information to inform policy. Additionally, place attachment and changing one's surroundings will influence the identity or the attachment these communities. As such, it is important to gage these at the beginning to reduce potential negative influences or impacts on local communities. The programme proposes the involvement of stakeholders in various ways with regards to policy making:

- stakeholders need to be continuingly informed and updated about project goals and outcomes,
- there is a requirement for consultation with and invitation of all local stakeholders in both input and feedback of project outcomes,
- stakeholder views and concerns need to be incorporated in proposed project outcomes,
- all parties involved in collaborations and partnerships are seen as equals, and
- projects need to promote local community empowerment and consultative decision-making processes.   (Corbera and Schroder, 2011)

Among the goals of REDD+ initiatives include cost-effectiveness when it comes to the implementation of mitigation projects, support for biodiversity conservation and provision of environmental services, poverty reduction, and improvement in livelihoods (Kanawski *et al*., 2011). The REDD+ programme has however been criticised for its particular emphasis on

forest carbon which might undermine biodiversity conservation, considering that the forest envisioned by the programme makes no clear separation between natural forests and plantations (Kanawski *et al.*, 2011; Romijn *et al.*, 2013). The lack of separation between the two is crucial as plantations are monoculture, lower in diversity than natural forests, less resilient to climate change and lower on carbon stocks (Harvey *et al.*, 2010; Kanawski *et al.*, 2011). Similarly, Harvey *et al.* (2010) argue that funding may unduly be directed to plantations and jeopardise the funding needed for REDD+ initiatives aimed at natural forests. Although climate change adaptation and mitigation initiatives seek to address a biophysical phenomenon in the form of climate change, further research is needed to understand how these threats and responses manifest within the social context of communities, especially given the diversity within developing areas. Such insights can contribute to the design of initiatives that address climate change within complex and stressed socio-ecological systems.

3.4. Biodiversity and ecosystem services

According to the Millennium Ecosystem Assessment, ecosystem services (ES) are the benefits which people derive from ecosystems (Kumar and Kumar, 2008). These benefits include provisioning/production services (for example food and water), regulating services (such as flood control), cultural services (which include recreational and spiritual benefits) and supporting services (such as nutrient recycling), (Kumar and Kumar, 2008; Vo *et al.*, 2012). Crucial to this definition is that the ecosystem services must be directly and indirectly linked to actual use and human well-being which encompasses personal, social and economic well-being (Burkhard *et al.*, 2012; Vo *et al.*, 2012). Thus, ES may be considered as follows:

- Supporting services: These include process which are responsible for the production of ES and include soil formation and retention, photosynthesis and the production of oxygen, water cycling, and nutrient recycling.
- Provisioning services: These include the products obtained from ecosystems such as the production of food, fibre, timber and fresh water.
- Regulating services: These are the benefits derived from the regulation of ecosystem processes such as climate and flood regulation, and water quality control.
- Cultural services: These are benefits obtained from ecosystems such as recreational and aesthetic experiences, spiritual enrichment, aesthetic values and knowledge systems.

(Fu *et al.*, 2011; Jansson, 2013; Vo *et al* 2012).

Ecosystem services may be further categorised according to their material or non-material values (Vo *et al*., 2012). The material values provided by ES include provisioning, regulating and supporting services, while non-material values are linked to cultural services (Chan *et al*., 2012; Vo *et al*., 2012). The inclusion of non-material values is crucial as it provides a broader representation of the diverse benefits provided by nature, encompasses the perspectives of a variety of stakeholders, and promotes cultural sensitivity to biodiversity conservation (Chan *et al*., 2012). Conceptually, ecosystem services incorporate ecosystem organisation, structure and function which are directly or indirectly consumed and utilised by societies (Fisher *et al*., 2009). Research conducted to establish the demand placed on ecosystem services need to be context and site-specific and account for variations in which local community members utilise such services (Casado-Arzuaga *et al*., 2013).

These patterns of utilisation are influenced by geographic location, cultural norms and values (Casado-Arzuaga *et al*., 2013). Although communities may derive benefits from the singular ecosystem, individuals within the community have different needs and derive different benefits which may also conflict with other community members (Fisher *et al*., 2009). Understanding the various ways in which households and communities utilise their ecological resource base further enables environmental planning which can facilitate sustainable resource consumption within and around PAs (Thondhlana *et al*., 2012). Also, failure to account for the contribution of ecosystem services provides a skewed representation of livelihood portfolios, and results in inadequate baseline information for policy intervention (Angelsen *et al*., 2014).

The loss of biodiversity and the degradation of an ecosystem results in a reduction of goods and services suggesting that biodiversity plays an important role in the functioning of an ecosystem (Mertz *et al*., 2007). Such concern over the degradation of ecosystems has prompted global initiatives such as the Convention on Biological Diversity (CBD) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, which emphasise the need to protect and conserve biodiversity as a means to ensure the provisioning of ecosystem services (Bullock *et al*., 2011). Biodiversity not only plays a role in supporting ecosystem function, but also in ensuring that ecosystem services continue to support human well-being, health and livelihoods (Christie *et al*., 2012). However, these ES are under threat from population and economic growth, land-use change, and climate change related concerns (Christie *et al*., 2012).

Although commitments have been made through the CBD to reduce the rate of biodiversity loss both globally and nationally by 2010, this goal had not been attained (Christie *et al*., 2012). The impact of failing to meet such a goal has grave consequences for developing countries where most of the world's biodiversity is located, as communities within these countries have a higher dependence on the provisioning of ecosystem goods and services (Christie *et al*., 2012). More recently, the UN Sustainable Development Goals (SDGs) have stressed the importance of addressing challenges related to climate change and conservation which undermine the agenda of sustainable development. More specifically and closely related to this study, is the SDG-13 which seeks to address the impacts of climate change, and SDG-15 which addresses issues related to the protection, restoration and sustainable utilisation of ecosystems and prevention of biodiversity loss (Hawkes and Popkin, 2015; Kroll, 2015). Further research on biodiversity and ecosystem services needs to highlight the non-material utilisation and valuation within communities which can contribute to information necessary for developing suitable policy responses. It is crucial here to note that implementation of climate change mitigation initiatives such as the BLSCRP, particularly in South Africa, need to be understood within a context of conservation and human development imperatives. The following section describes the key thematic areas of conservation most relevant to this study and provides an overview of the conservation discourses and practices, stakeholder involvement/participation, and CBC initiatives.

3.5. Conservation

3.5.1. An overview of discourses and practices

In understanding conservation discourses and practices, it is necessary to place these discourses and practices within the establishment of protected areas (PAs). Protect areas are defined as a portion of land and/or sea which is specifically established to protect and maintain the biological diversity, natural and cultural resources of that area, and is managed through legal means (Boitani *et al*., 2008). The establishment of PAs is based on the International Union for Conservation of Nature (IUCN) which categories PAs in relation to their primary management objectives (Agrawal and Redford, 2009; Boitani *et al*., 2008). The categories are listed as follows:

- 1a) Strict nature reserves which are managed specifically for scientific purposes.
- 1b) Wilderness areas which are specifically managed for the protection of wilderness.

- 2) National parks which are managed for the purpose of ecosystem protection and recreational use.
- 3) Natural monuments which are managed for the conservation of target natural features.
- 4) Habitat/Species management area which focus on conservation through management interventions.
- 5) Protected landscape/seascape which are manage landscapes and seascapes for protection and recreation purposes.
- 6) Managed resource protected area, which are managed for the sustainable utilisation of natural ecosystems.

(Boitani *et al*., 2008; Dudley and Philips, 2006)

The classification of PAs range from PAs with strict restrictions on human use such a categories 1a and 1b, to PAs which permit the use of resources as part of its management plan such as category 5 and 6 (Agrawal and Redford, 2009; Boitani *et al*., 2008). Those PAs which fall under categories and 1 and 2 are the most common types of conservation areas, such as national parks, while more inclusive PAs are in the form of protected landscapes which allow the use of ecosystem services by local communities (Adams and Hutton, 2007).

Historically, a majority of national parks and protected areas within southern Africa adopted the Western preservationist conservation policy with a centralised management which led to the disruption of local community livelihoods, who were dependent on natural resources (Buscher and Whande, 2007; Miller *et al*., 2011). This approach to conservation was first implemented in North America where the first protected areas, namely the National Parks of Yosemite and Yellowstone were created (Benjaminsen and Svarstad, 2010; Miller *et al*., 2011). The creation of PAs was achieved through the use of military forms of management and eviction of indigenous communities, with the approach being transported and adopted in Africa (Benjaminsen and Svarstad, 2010; Kelly, 2011). The delineation of land portions for conservation purposes have also been associated with restricted access, displacement and the criminalisation of those with less economic and political power (Kelly, 2011; Miller *et al*., 2011).

It crucial to understand that such practices occurred during a colonial era which saw the African landscape as wilderness subject to the management of the colonial authorities, while understating the dependence of local communities on their environment (King, 2007). According to Gomez-Baggethun and Ruiz-Perez (2011), such ideas towards conservation stem from the western philosophy that perceives humans as being separate from nature, coupled with the view that conservation can only be achieved through the removal of local communities. As such, PA were presented as portions of land reserved for the ruling elite while forcibly removed communities were barred from entry and deprived of their means of subsistence (Benjaminsen and Svarstad, 2010; Kelly, 2011; King, 2007). Kelly (2011) asserts that during the colonisation of Africa, preservationist and scientific arguments were used as a pretext for the appropriation of land and imposition of conservation laws.

Particularly in South Africa, during the apartheid regime, national parks and PAs within the country also followed the fortress conservation policy, otherwise known as the fences and fines, and coercive conservation approaches (Watts and Faasen, 2009). In order to achieve conservation, fortress conservation policies sought to forcibly remove and exclude local rural communities within national park boundaries, barring communities from accessing resources within the protected areas (Buscher and Whande, 2007; Miller *et al*., 2011). This resulted in the displacement and removal of communities from these sites, and restricted access to natural resources which communities traditionally had access to. Thus bringing a disruption to their livelihoods (Buscher and Whande, 2007; Miller *et al*., 2011). Due to the hostility of conservation approaches adopted by PAs, many neighbouring communities showed no support for such conservation areas as the locals themselves were removed from their lands and denied access to natural resources (Watts and Faasen, 2009).

The protectionist and exclusionary approaches to PAs further adopted a philosophy which argued the incompatibility of ecosystem conservation and socio-economic development (Buscher and Dressler, 2007). The preservationist approach to conservation favours investments in the protection of ecosystems rather than investment is socio-economic development within communities (Sandker *et al*., 2009). This approach is often implemented at the expense of local community involvement which has contributed to conflict and lack of support for conservation measures (King, 2007; Sandker *et al*., 2009). In a study of South Africa's nature reserves in the Eastern Cape, Thondhlana and Cundill (2017) revealed that conflict existed between adjacent community members and 13 of the nature reserves included

in the study. Results indicated that amongst the sources of conflict was the restricted access to the nature reserves for community members to engage in livestock rearing and harvesting of resources (Thondhlana and Cunhill, 2017). According to Thondhlana and Cunhill (2017), these sources of conflict can undermine local support and acceptance of nature reserves within the province.

Arguments against the more inclusive forms of PAs state that conservation of biodiversity is a moral imperative and that natural ecosystems should be protected for their intrinsic value (Buscher and Dressler, 2007). These proponents view PAs as an option where biodiversity may be conserved, and ensuring minimal influence and disruption by human societies (Buscher and Dressler, 2007). Prior to the support for local community resource management, the scholarly debate supported the view that these communities were unable to self-organise effectively and thus, unable to manage resources (Cox *et al*., 2010). Therefore, the more appropriate management of natural resources was through imposed government management in communities or the establishment of privately owned and managed property (Cox *et al*., 2010). Furthermore, these approaches highlight that local communities are not necessarily guided by conservationist thoughts but rather seek to maximise utility from their resource base (Buscher and Dressler, 2007). Their utilitarian view of resources is based on individualistic gains as an attempt to deal with their state of poverty, and that conservation measures would require certain resources to be abandoned as part of livelihood strategies (Buscher and Dressler, 2007). Collectively, the afore-mentioned discourse of conservation highlights the strong preservationist and protectionist ideals which has historically dominated and influenced conservation practices. These ideals emphasised strict restrictions of human activities within the boundaries of PAs with the primary goal of preserving ecology.

However, there has been a shift in conservation discourse from the historical preservationist approach towards a social conservationist discourse which advocates conservation ideals of sustainable consumption of resources, and incorporating aspects of socio-economic development and social justice (Miller *et al*., 2011). Based on the Kinshasa Resolution for the Protection of Traditional Ways of Life, governments were urged to ensure that the establishment of PAs should not result in the displacement of communities, and should consider the needs of indigenous communities (Adams and Hutton, 2007). The more inclusive forms of PA management were often linked to ideas of bottom-up approaches, decentralisation of authority, governance, and local participation (Buscher and Dressler, 2007).

In the 1970s, the United Nations Educational, Scientific and Cultural Organisation (UNESCO) biosphere concept established the zoning of protected areas with the core considered to have high restrictions, while a buffer zone surrounding the core allowed for certain activities to take place (Adams and Hutton, 2007). The outcome has been a series of community-based conservation approaches which have sought to incorporate local community needs and interests, empower these communities, promote active participation in management, and improve socio-economic welfare (Vodouhe *et al*., 2010). In relation to South Africa, legislation provides an institutional framework to support participatory management. For example, the National Forestry Action Program and the National Forests Act of 1998, the Biodiversity and Protected Areas Act of 2003, and the White Paper for Sustainable Forestry Development in South Africa (Holmes-Watts and Watts, 2008). These have given rise to increased participation of all stakeholders in conservation practices within South Africa.

3.5.2. Stakeholder involvement/participation in conservation

Since the 1980 Brundtland report, stakeholder involvement has been strongly advocated for the management of natural resources, and is considered part of the prerequisites for achieving sustainable development (Young *et al*., 2013). The shift towards stakeholder participation has undergone various stages, beginning in the 1960s with efforts to raise awareness, the incorporation of local community perspectives for environmental planning and data collection in the 1970s, acknowledgment of indigenous knowledge in farming practices and participatory rural appraisal in the 1980s, and the merging of participatory and sustainable development-based approaches in the 1990s (Reed, 2010). Accordingly, global politics followed in line with these shifts and is evident in the following efforts to promote more inclusive environmental planning (Kothari *et al*., 2013). These international efforts for more inclusive forms of conservation and redress of past injustices included the 1972 Stockholm Conference on the Human Environment, 1980 World Conservation Strategy, and the 1992 Earth Summit which established the United Nations Convention on Biological Diversity (Martin *et al*., 2013).

Arguments which have been put forward in support of stakeholder involvement can be subdivided into three categories, namely, normative, substantive and instrumental (Young *et al*., 2013):

- Normative arguments - promotes stakeholder involvement as a means to strengthen democracy.

- Substantive arguments - highlights the benefits of stakeholder involvement such as adding knowledge and values into the decision-making processes.

- Instrumental arguments - highlighting stakeholder involvement as a tool that increases legitimacy and trust while decreasing the likelihood of intense conflict.

With reference to the substantive and normative arguments, stakeholder involvement enables for fair representation in environmental planning and management, and may aid in understanding the context of human behaviour within communities (Young *et al*., 2013). The establishment of PAs has been considered as one of the means to ensure decreased exploitation of the natural environment by maintaining and protecting biotopes within a given area (Amin *et al*., 2015; Vodouhe *et al*., 2010). However, it is also noted that these PAs ought to sustain the livelihoods of the interested and affected local communities (Vodouhe *et al*., 2010). In a survey, undertaken by the World Wildlife Fund for nature (WWF), of national parks and protected areas, criteria were formulated for how national parks could better manage themselves while contributing to the development of local communities (Vodouhe *et al*., 2010). Among the criteria, the survey identified that national parks need to be well funded, appropriately staffed, establish environmental education and community outreach programmes, and have efficient enforcement capacity (Watts and Faasen, 2009). According to Watts and Fassen (2009), the failure to achieve a good park-and-people relationship is one of the challenges which limit effective park management.

The management of protected areas had been predominantly a state centralised system with military forces deployed to protect the boarders and government receiving direct revenues derived from entrance fees (Vodouhe *et al*., 2010). As a result, this form of management has led to conflicts between conservation agencies and local communities, and negative stakeholder attitudes towards conservation and PAs (Vodouhe *et al*., 2010). Vodouhe *et al*. (2010) assert that conservation strategies that fail to include local communities in the planning and management are likely to fail. According to Reed (2008), participatory approaches were practiced within industrialised countries, however, it was within less developed countries that an action-oriented and site-specific approaches were developed and introduced.

In addition, it is recommended that levels of awareness around the importance of biodiversity and biodiversity protection needs to be improved among local communities, especially those

communities that are participating in conservation strategies (Lindemann-Matthies and Bose, 2008). This knowledge must specifically reflect on, for example, community perceptions of the actual number of species present in their surrounding ecology, as well as the associated threats that may arise from the extinction of such species (Lindemann-Matthies and Bose, 2008). In furthering our understanding of conservation discourses and practices, the following section provides an overview of community-based conservation practices.

3.5.3. Community-based conservation (CBC) practices

With the emergence of a new participatory-based paradigm for the establishment and management of PAs, approaches such as CBC became a more dominant form of ecosystem protection (Buscher and Dressler, 2007). Community-based conservation has been interpreted to involve the protection of biodiversity by building partnerships with local communities (Pretty *et al.*, 2009). Community-based conservation approaches further purport that local communities who show a dependence on natural resources have acquired knowledge of their surrounding ecology, which enables them to manage resources for sustaining livelihoods and conservation (Buscher and Dressler, 2007). The movement towards people-centred approaches and the integration of indigenous knowledge and practices in conservation strategies resulted in the establishment of specific programmes based on the inclusion of local communities in the protection and management of natural resources, as well as linking these management practices with local socio-economic development. Examples of these diverse approaches include community-based natural resources management (CBNRM), integrated conservation and development projects (ICDPs), and payment for ecosystem services (PES) (Ingram *et al.*, 2014; Suich, 2010; Waylen *et al.*, 2010). These approaches are discussed in detail below.

3.5.3.1. Community-based natural resource management (CBNRM)

Although the concept of CBNRM emerged in the 1980s, there was already the viewpoint that local communities were able to manage natural resources based on their indigenous knowledge (Blaikie, 2006). Community-based conservation programmes were developed as a response to the failure of top-down approaches, as well as the need for conservation to address socio-economic challenges (Suich, 2010). Other objectives includes the protection of the environment along with ensuring social justice (Gruber, 2010). This approach is also based on the shift in the roles of communities within conservation strategies and how they are viewed in terms of active stakeholders. For example, previous approaches considered local communities as an obstacle to conservation, however, current participatory approaches view local

community participation as a prerequisite for sustainable management (Gruber, 2010). Community-based natural resources management is considered a tool to improve the livelihoods of natural resource dependent communities, as well as promoting democratic processes in decision-making and ensuring the equitable distribution of benefits within the community (Saito-Jensen *et al*., 2010). Within developing countries, CBNRM projects are closely linked with livelihoods, the promotion of sustainable utilisation of natural resources, local economic development, poverty reduction, and market based conservation (Brunckhorst, 2010).

Within the CBNRM approach, a community is understood as a spatial unit and a social configuration with a set of shared customs (Blaike, 2006). Central to the definition of CBNRM is that management of natural resources ought to provide support for the long-term sustainability along with the extensive participation of local communities, and their involvement in decision-making (Gruber, 2010). Suich (2010) asserts that with the dual goal of biodiversity conservation and improvement of local livelihoods, the CBNRM approach argues that natural ecosystems can be sustainably management if there are appropriate incentives (Suich, 2010). In sub-Saharan Africa, CBNRM is often adopted as a means to address rural development and conservation (Nelson and Agrawal, 2008). The CBNRM approach represents the nexus where the community, government institutions, and private sector intersect (Blaikie, 2006). However, it needs to be noted that it is this intersection that results in contradictions between expected results and actual outcomes (Blaikie, 2006). The practice of CBNRM also advocates for the efficient utilisation and allocation of resources, application of locally adapted technology and indigenous technical knowledge (ITK) (Blaikie, 2006).

Among the institutional reforms sought by the approach is the decentralisation of authority, responsibilities and benefits associated with the management of natural resources (Nelson and Agrawal, 2008). This form of bottom-up approaches prescribed in CBRNM initiatives results in an increased cognisance by local communities of the benefits which could induce collective action (Nelson and Agrawal, 2008). The inability and reluctance to promote decentralisation has also been cited amongst the fundamental barriers to the success of CBNRM (Nelson and Agrawal, 2008). The devolution of authority is said to empower local communities in the management of local resources, and thus requires investment in capacity building, and establishment of local governance institutions (Fabricius and Collins, 2007). Additionally,

Nelson and Agrawal (2008) assert that with the absence of decentralisation, community involvement in CBNRM is seen as coercive practices of conservation.

Other reasons for the failure of CBNRM projects include the lack of understanding of the values local communities attach to their natural ecology, such as the social, market and non-market values (Gruber, 2010). The challenge of achieving successful CBNRM projects is that the communities which are often the site of such projects, are located in remote areas with limited capital and assets, thus making these projects vulnerable (Fabricius and Collins, 2007). It should also be noted that the communities in which these projects are undertaken are heterogeneous and display unique contexts in relation to access to power, cultural and social practices, socio-economic conditions and comprise of different classes, gender and social norms (Mensah, 2016; Saito-Jensen *et al*., 2010; Waylen *et al*., 2010). According to Mensah (2016), individuals within a lower socio-economic status group generally have less access to resources and support structures, which restricts their ability to engage in conservation initiatives. Therefore, it becomes crucial for initiatives such as the Reforestation programme, which targets the more vulnerable groups within communities, that participation and delivery of socio-economic benefits may not be attainable for the more vulnerable community members, thus requiring thought on how to remove barriers of participation for those in lower socio-economic status groups.

The design and implementation of CBNRM projects should coincide with the needs of local communities and promote social and ecological sustainability, while simultaneously increasing the capacity within communities (Brunckhorst, 2010). The CBNRM projects extend beyond passive conservation practices which include park outreach and environmental awareness campaigns (Child and Barnes, 2010). Instead, it seeks to distribute benefits, responsibility and authority from experts and bureaucratic institutions to communities who depend on their surrounding ecology (Child and Barnes, 2010). Additionally, CBNRM projects promote social capital within communities through the development of networks, and the promotion of norms and trust (Gruber, 2010).

However, this social capital may counter-act the progress made by projects, whereby certain networks can lead to the exclusion of other community members (Wagner and Fernandez-Gimenez, 2008). Threats to CBNRM include elite capture whereby the more privileged individuals within the community dominate the decision-making processes and increase their

own access to benefits, at the expense of the more marginalised members in the community (Saito-Jensen *et al*., 2010). For example, Silva and Motzer (2015) report that in the Uibasen Conservancy project , Namibia, high levels of community dissatisfaction was noted due to benefits being appropriated by an elite group within the community. It was also observed that this group not only appropriated benefits for themselves, but also purposively restricted potential inclusion of non-elite community members (Silva and Motzer, 2015).

3.5.3.2. Integrated conservation and development projects (ICDP)

Integrated conservation and development projects (ICDPs) were first developed in the 1980s as a means to address challenges of poverty and environmental degradation, purporting that local communities are more likely to engage in conservation practices provided that these practices provide socio-economic incentives (Baral *et al*., 2007). Integrated conservation and development projects are described as approaches to conserve natural resources within areas of high biodiversity, while attempting to link biodiversity conservation with socio-economic development (Garnett *et al*., 2007). The approach assumes that the establishment of biodiversity markets which provide benefits to community members can encourage the protection of a given resource (Garnett *et al*., 2007). A premise of ICDPs includes that communities ought to receive some form of compensation from the result of restrictions imposed on resources due to conservation measures (Dahlberg *et al*., 2009). Among the forms of compensation is the provision of alternative income sources which can reduce the dependence on restricted resources (Dahlberg *et al*., 2009).

Critiques of ICDPs often highlight that these projects focus more on socio-economic incentives rather than the objective of conserving ecosystems (Baral *et al*., 2007). These projects are deemed ineffective in promoting sustainable pro-environmental behaviours, with local communities initially engaging in such projects for socio-economic benefits rather than conservation outcomes (Baral *et al*., 2007). Integrated conservation and development projects are indirect forms of conservations as they provide socio-economic incentives as a means to encourage community engagement (Sandker *et al*., 2009). According to Sandker *et al*. (2009), ICDPSs have been criticised for overemphasising the socio-economic benefits and have been labelled as 'conservation by distraction'.

The success of these projects is limited by the inequitable distribution of socio-economic benefits (Baral *et al*., 2007; Stone and Nyaupane, 2014). Although benefits have been noted

and contributed to local livelihoods, there have been instances where benefits can result in increased community inequality and local conflict (Campbell *et al*., 2010; Stone and Nyaupane, 2014). Afenyo and Amuquando (2014) found that the infrastructural benefits generated from the Tafi Atome Monkey Sanctuary project, in a rural community in Ghana, were restricted to residents living in close proximity to the sanctuary. Inequitable distribution of benefits was largely attributed to the absence of suitable policies that regulated this process (Afenyo and Amuquando, 2014). Similar experiences are reported by Stone and Nyaupane (2014) in relation to the Nata Bird Sanctuary Trust (NBST) in Botswana. The authors (*ibid*), highlight the lack of equitable distribution of benefits as the main factor influencing community levels of satisfaction and participation. In this regard, it is crucial for initiatives such as the Reforestation programme to refrain from creating or reinforcing inequitable access to benefits within communities.

Such issues of inequitable distribution of benefits are further criticised as they are insufficient in providing enough incentives to outweigh the restrictions on natural resources (Sandker *et al*., 2009). Furthermore, Dahlberg *et al*. (2009) express concern over incentives attracting individuals to a given area which results in increased pressure on the ecosystem targeted for conservation. Among the challenges which obstruct win-win situations of ICDPs is the separation of poverty and conservation as potential outcomes of this strategy (Garnett *et al*., 2007). Other challenges in the integration of conservation and development is the divergence in that conservation measures often require strict restrictions and minimal utilisation of resources by local communities (Salafsky, 2011). However, these conservation measures require the support of local communities who are the users of resources (Salafsky, 2011).

3.5.3.3. *Payment for ecosystem services (PES)*
Payment for ecosystem services (PES) are strategies which seek to generate economic benefits and incentives from biodiversity conservation, and is based on a voluntary transaction between a service provider and buyer of a particular ecosystem service (Gomez-Baggethun and Ruiz-Perez, 2011; Nelson *et al*., 2009). These payments may be monetary or come in the form of goods and services (Petheram and Campbell, 2010). The payments derived from such transactions are said to encourage pro-environmental behaviour as local communities attempt to improve the supply of the desired ecosystem services (Sommerville *et al*., 2010). The success of PES is also influenced by the social contexts in which they are implemented, thus requiring an analysis of community dynamics. Prior to implementation, Ghazoul *et al*. (2009), describe

these dynamics to be varying degrees of poverty, access to resources, local-level skills and knowledge.

Other conditions which are necessary for the success of PES is the equitable distribution of benefits and support from local community members (Bremer *et al*., 2014). To ensure PES approaches make a meaningful contribution to community livelihoods, it is argued that the most marginalised community members need to be the target of these services, as well as have the lowest opportunity costs, (for example, labour, time, infrastructure requirements for participation). (Bremer *et al*., 2014). In ensuring financial contributions to livelihoods, the programmes need to compensate local users to an extent that benefits outweigh non-participation (Jack *et al*., 2008). The most common financial structures in PES schemes are flat payments, (based on participants receiving similar financial payments), and discriminative payments, (based on participants receiving payments determined by their opportunity costs), (Chen *et al*., 2010). Although flat payments are perceived to be an equitable payment method of distributing benefits, discriminative payments are considered more effective in cases where community members do not have equal opportunity costs (Chen *et al*., 2010).

Bremer *et al*. (2014) express concern over these programmes as they can compound poverty, especially within the most marginalised households where payments do not exceed costs. Additionally, concerns have been raised in instances where resources are held as a collective, which presents challenges for the equitable distribution of costs and benefits among participants (Bremer *et al*., 2014). Given that not all community members have an equal dependence on their resource base, PES schemes may limit and disrupt resource access to those members who are unable to participate in schemes (Ghazoul *et al*., 2009).

Payments must also reflect on non-financial benefits, which aid in encouraging participation for those individuals where the cost of participation exceeds potential earnings (Bremer *et al*., 2014). The promotion of non-financial benefits may encourage moral and altruistic behaviour rather than behaviour determined by financial incentives (Muradian *et al*., 2013). Moral behaviour is beneficial in promoting community cohesion and organisation which guides the management of community resources (Muradian *et al*., 2013). Consequently, a shift away from sole financial incentives is necessary as poverty is not only considered or determined by income (Pascual *et al*., 2010). Other dimensions of poverty that ought to be considered include how

PES can contribute to the dignity of community members, as well as facilitate community empowerment (Pascual *et al*., 2010).

Ingram *et al*. (2014) argue that PES approaches are able to address challenges of poverty reduction within communities, especially in communities with limited employment, income and livelihood opportunities. These programmes provide new income opportunities by creating new markets to those communities located in isolated areas (Ingram *et al*., 2014). However, the success of PES schemes is also determined by the level of involvement of local communities in the design of these schemes (Petheram and Campbell, 2010). The lack of involvement can result in the design of inappropriate schemes which do not take into consideration local community dynamics and needs (Petheram and Campbell, 2010). The involvement of local communities further allows for the design of schemes which may produce various forms of payments which are socially desirable and acceptable (Adhikari and Boag, 2013). Such communication is crucial for the long-term sustainability for PES schemes in cases where there are monetary fluxes in payments (Adhikari and Boag, 2013). As such, implementation of, and engage in conservation practices in South Africa needs to take cognisance of historical exclusion of communities. Additionally, the various forms in which conservation is practiced needs to highlight how these communities can derive meaningful benefits from conservation practices, without adversely disrupting livelihood strategies.

It is argued that participation in conservation strategies is based on individual philosophies, cultural beliefs and norms and perceptions, and more recently with community-based initiatives the need for incentives. However, the manner in which individuals consume, utilise and construct nature influences their interaction with the environment. In this regard, conceptualisation and perceptions of climate change, biodiversity and conservation may also influence participation in community-based initiatives. As such, the following sections seeks to unpack perceptions related to this study.

3.6. Perceptions

Although it is vital for the general public to have scientific information regarding climate change for them to engage in mitigation practices, there is a need to understand attitudes, perceptions and beliefs related to climate change. Understanding these perceptions of climate change aid in unpacking whether communities perceive that they contribute to climate change or feel responsible for addressing the problem (Becken *et al*., 2013). These perceptions are

influenced by cultural factors such as past experiences and inherent knowledge, and determine how individuals respond to mitigation practices (Becken *et al.*, 2013). Such cultural dynamics can serve to be a social barrier to mitigation practices if they either ignored or underestimated (Becken *et al*., 2013). Exploring socio-cultural dimensions and subjective values linked to climate change are crucial as these often influence the manner in which individuals or groups of individuals respond to climate change mitigation programmes (Amundsen, 2015). Through these socio-cultural dimensions and subjective values, broader understanding is gained about socio-economic challenges faced within the communities, which shape risk priority (Amundsen, 2015). As mentioned earlier, this could serve as a barrier within the South African context given the impacts of apartheid and colonisation. Historic experiences of conservation, specifically the discrimination and restriction to land and other resources could influence participation in the Reforestation programme investigated as part of this study.

Attitudes of individuals also have a considerable influence on risk perception with those individuals with pro-environmental attitudes being more likely to support and engage in mitigation practices (Brody *et al*., 2008). It can be argued that those individuals who hold views and values that align with the protection of the natural environment will be more prone to support and engage in practices aimed at reducing the threat of climate related concerns (Raymond and Brown, 2011). The manner in which one perceives the functioning of ecology also determines the manner in which they respond to threats of climate change (Kennedy *et al*., 2009). Those individuals who view the natural environment as fragile rather than stable are more willing to adapt and change their behaviour and show support for practices aimed at mitigating the effects of climate change (Brody *et al*., 2008). The social networks within a given community can also influence support for mitigation practices. According to Brody *et al.* (2008), individuals who believe that they can reduce the effects of climate change and perceive the risk of climate change-related concerns more seriously, can influence others within their social networks and thus increase the overall likelihood of engagement in mitigation practices.

Exploring the way in which the public perceives risk is crucial for environmental planning and can help shape policy and management practices. The perception of risk is influenced by the level of understanding of the causes and effects of climate change, and the degree to which climate change is regarded as being a threat to their well-being (Wolf and Moser, 2011). The afore-mentioned, arguably influences the decisions, behaviour and willingness to engage in

and support climate change mitigation practices (Wolf and Moser, 2011). Unlike scientifically informed risk assessments, public perceptions are predominantly experimental and intuitive (Brody *et al*., 2008). Public perceptions rely less on quantitative mathematic metrics and rely more on qualitative experience (Brody *et al*., 2008). In this regard this study focuses on both quantitative and qualitative observations in relation to the factors that promote participation in the Reforestation programme.

Therefore, the analysis of the risk perception of climate change requires researchers to understand these perceptions in a social context with varying demographics and attitudes (Brody *et al*., 2008). The role of demographics has aided in comparing risk perceptions across different income and education groups. It has been found that those who belong to a higher socio-economic status perceive the threat of climate change less than individuals from lower socio-economic groups (Brody *et al*., 2008). Furthermore, those individuals who have acquired more knowledge about the causes and effects of climate change tend to have a lower risk perception, thus it can be argued that income and education have a negative correlation with climate change risk perceptions (Brody *et al*., 2008).

The manner in which communities respond to the threat of climate change is also determined by the way in which they perceive their environment has changed (Becken *et al*., 2013). Regardless of the scientific knowledge and projections which can be communicated to a certain population, it is the perceived risk of climate change that influences the behaviour and actions of individuals (Becken *et al*., 2013). Perception of risks is predominantly subjective and informed by personal experiences and observations of local climatic events (Becken *et al*., 2013). Thus, it can be argued that proximity plays an important role in determining how individuals and communities perceive risks of climate change (Becken *et al*., 2013). According to Whitmarsh (2008), communities in close proximity to their surrounding ecology are more likely to identify changes within their environment (Whitmarsh, 2008). For example, it has been argued that those communities who reside in close proximity to sources of air pollution shall portray higher levels of risk perception than those who reside further away from the source of pollution (Whitmarsh, 2008).

Based on the above, one may hypothesise that if communities are made aware of their vulnerability to changes in temperature and extreme climatic events, their level of risk perceptions is expected to rise (Brody *et al*., 2008). For example, risk perceptions are expected

to be higher in those communities located close to coastlines and floodplains, and may perceive the threat of increased precipitation more seriously (Brody *et al*., 2008). The uncertainty of an event or phenomenon also determines the likelihood of individuals supporting or engaging in mitigation practices, as it can determine the magnitude of risk (Etkin and Ho, 2007). Given that climate change occurs on a wider temporal scale, individuals' exhibit greater uncertainty resulting in a greater variety of risk perceptions (Etkin and Ho, 2007).

The ways in which individuals perceive nature's resilience also determines the perceived risk and willingness to adopt or adhere to certain environmental practices (Etkin and Ho, 2007). According to Etkin and Ho (2007), these perceptions of nature can be categorised as follows:

- There are those who perceive ecology as benign, viewing its function as stable and predictable with an abundance of unlimited resources,
- those that perceive ecology as ephemeral, where ecology is considered as unstable and fragile,
- those with the view that ecology is tolerant or perverse, which is a combination of the previous two perceptions, and
- those that view ecology as capricious, largely believing the functioning of ecology is unpredictable.

The knowledge held by the general public has been considered relatively low with regards to causal factors of climate change (Vignola *et al*., 2013). Although public campaigns have aimed at providing information about climate change, it is argued that individuals are sensitive to the information they receive, and to the person/organisation that provides this information (Vignola *et al*., 2013). In this regard, trust emerges as an important variable impacting behaviour. For example, it was revealed that trust in the source of information plays a role in individuals understanding and response to the threat of climate change (Brewer and Ley, 2013). Trust dimensions are a crucial contributor to the acceptance and credibility of scientific information, which can be utilised to shape attitudes, as well as support of environmental policies (Brewer and Ley, 2013). Furthermore, distrust has been recognised to constrain natural resources management, as the absences of trust limits cooperation with communities (Davenport *et al*., 2007). The lack of trust therefore, contributes to increased opposition against environmental organisations, as well as heighten scepticism (Davenport *et al*., 2007).

The values and risk perception of communities are of importance as these perceptions can create subjective social barriers to the implementation and engagement in climate change mitigation practices (Raymond and Brown, 2011). For example, what one community member perceives as a necessary mitigation practice, could be viewed as irrelevant by others (Raymond and Brown, 2011). These different perceptions may cause conflict within the community and between the implementing agent, thus hampering efforts to launch mitigation practices (Raymond and Brown, 2011). In relation to this study, peri-urban communities such as Buffelsdraai may perceive the need to address socio-economic ills such as poverty and unemployment rather than addressing environmental challenges such as climate change. In this regard, it is crucial to be cognisant of competing needs and challenges within a community, as these needs and challenges may be a barrier for climate change mitigation initiatives that are not framed within local community challenges.

Understanding public perceptions is valuable to environmental planners and policy makers as it widens the scope for providing alternatives within environmental protection practices (Tam and McDaniels, 2013). These perceptions held by individuals and communities can motivate or discourage the engagement in either conservation or climate change mitigation projects (Tam and McDaniels, 2013). Also, place attachment influences climate change mitigation as it can be utilised as a motivation for community engagement within such projects, drawing on communities' shared interest in maintaining or enhancing the state of their surrounding ecology (Amundsen, 2015). Within traditional African societies it is observed that these communities have a strong place attachment as a result of the structure of their livelihoods which include livestock rearing, subsistence agriculture, traditional medicine and rituals. Collectively, the afore-mentioned livelihood structures are related to specific elements of nature, thus requiring initiative such as the Reforestation programme to take cognisance of the way in which the transformation of the landscape can affect place attachment.

Additionally, the manner in which one conceptualises their natural ecology has been noted to be shaped by the way in which they see the world, and the subsequent impacts their actions might have on the surrounding ecology (Pretty *et al*., 2009). Early discussions on the way in which nature is perceived included Marxist concepts of nature which included:

- First nature which is perceived as nature pristine and not drastically altered by human activity (Dressler, 2011; Hughes, 2005).

- Second nature which refers to the production of nature as a commodity which is worked by humans and shaped by extraction and utilisation for commodity markets, with nature being assigned an exchange value (Dressler, 2011; Hughes, 2005). According to Hughes, second nature further includes the institutional, legal, economic and political processes which govern society. Castree (2010) further asserts that second nature is produced within and is a part of a global capitalist system.

- Third nature which includes the assigned abstract value to the natural environment which is influenced by the assumptions and representations of how nature should or ought to be (Dressler, 2011).

Buijs *et al*. (2008) state that biodiversity conceptualisation is also about how individuals interpret biodiversity not only through scientific knowledge, but through their experiences, emotions and day-to-day activities (Buijs *et al.*, 2008). By dealing with the subjective knowledge rather than scientific meaning of biodiversity, one is able to explore the social representations of biodiversity in individuals and communities (Buijs *et al.*, 2008). Collectively, social representation is shaped by values, practices and ideas that enable social groups to define these concepts or objects (Buijs *et al*., 2008). These social representations enable communities to communicate their understanding of their environment, and enable them to align their own knowledge and experiences to already existing scientific concepts such as biodiversity (Buijs *et al.*, 2008). Incorporating indigenous knowledge within research is seen as a step towards connecting scientific knowledge with cultural diversity which has an attachment to biodiversity through utilisation patterns, and cultural importance of various ecosystem goods (Bohensky and Maru, 2011; Kinzig and McShane, 2015). The interaction between biodiversity and society occurs within a context of diverse cultures, beliefs and values, livelihoods, languages and knowledge (Pretty *et al*., 2009).

Kinzig and McShane (2015), assert that sub-Saharan Africa is amongst the most culturally diverse regions, thus resulting in a wide range of utilisation and valuation of ecosystem goods which can inform conservation practices. It is also observed that environmental knowledge changes alongside ecosystem changes, with language being used to communicate the components of that ecosystem (Pretty *et al*., 2009). Furthermore, these knowledge systems provide information regarding the functioning of ecosystems, can contribute to environmental management practices, and facilitate improved communication between local communities and

various environmental protection agencies (Bohensky and Maru, 2011; Kinzig and McShane, 2015). This indigenous knowledge gained from culturally diverse communities can inform the Reforestation programme through languages used to relate to the environment and changes occurring within the environment, and build a narrative as to how and why local communities value and utilise ecosystem goods and services.

Given the complexity within various socio-ecological systems, it is argued that the understanding of these systems can be attained through the application of both scientific and indigenous knowledge (Bohensky and Maru, 2011). Thus, a loss in biodiversity equates to a loss of the words often used to describe the ecosystem component, as well as a change in the livelihood practices within affected communities (Pretty *et al*., 2009). This suggests that the loss of biodiversity is associated with several tangible and intangible losses that impact many aspects of livelihoods, particularly among the poor. Additionally, research shows that conceptualisation of biodiversity also informs attitudes towards the natural environment (Kelemen *et al*., 2011; Tam and McDaniels, 2013

The attitudes which human species have towards non-human species may be explained by affect and utility motivations (Martin-Lopez *et al*., 2007). More specifically, affect refers to the emotional responses towards species, while utility refers to the instrumental use of a species (Martin-Lopez *et al*., 2007). Whether attitudes held by humans towards non-species is determined by affect or utility, these attitudes are influenced by numerous variables. The Biophilia Hypothesis postulates that there is an inherent biological predisposition held by human species which attracts us to certain species (Martin-Lopez *et al*., 2007). Also, the physical and behavioural characteristic of species, where species more similar in physical appearance to humans are held more positively than those species which are less similar (Martin-Lopez *et al*., 2007). Other explanations which tend to influence the attitudes towards biodiversity are rooted within cultural and religious sects an individual ascribes to (Hope and Jones, 2014; Pretty *et al*., 2009). Religious faiths such as Christianity and Judaism are said to historically portray humans as having dominion over nature (Hope and Jones, 2014; Pretty *et al*., 2009). Alternatively, faiths such as Hinduism and Buddhism tend to promote the inter-relationship between humans and their natural ecology (Pretty *et al*., 2009). Similarly, Waylen *et al*. (2010), assert that culture in the form of customs and taboos have resulted in the demarcation of sacred groves which restrict the utilisation of specific resources, and can be incorporated in conservation initiatives to protect those resources of cultural importance.

It is also acknowledged that in addition to understanding perceptions and attitudes towards, the values individuals assign to their natural environment form a crucial part of unpacking perceptions towards ecology. Through the exploration of valuation, information can be gathered to understand why individuals opt for specific land use or development options which impact on their surrounding environment (Kelemen *et al*., 2011). The manner in which communities value biodiversity also aids in exploring how biodiversity contributes to their livelihoods, and improves awareness and increases importance of that surrounding ecology to that particular community (Kelemen *et al*., 2011). This cultural projection can be understood through the valuation of biodiversity, and is unpacked by individual perceptions towards the environment, as well as their environmental worldviews and belief systems (Braat and de Groot, 2012). For example, Hansla (2011) states Stern developed three types of value orientations which can aid in explaining environmental belief systems and behaviour. These three types of value orientations are egoistic, altruistic and bio-spheric values:

- Egoistic value orientations are characterised by individuals who seek to maximise outcomes,
- altruistic value orientations are reflected by an individual's concern of the well-being of others, and
- bio-spheric value orientations, embodied by the concern for non-human species and natural environment.   (Hansla, 2011).

Of the three values, bio-spheric orientations are seen to have a more positive correlation to pro-environmental behaviour and policy, while egoistic have a negative correlation (Hansla, 2011). According to de Groot and Steg (2008), individuals with a bio-spheric value orientation decide to engage in pro-environmental behaviour based on their perceived costs and benefits for the whole ecosystem. Individuals who display an egoistic value orientation base their decision on the perceived costs and benefits for themselves (de Groot and Steg, 2008; Hansla, 2011). In relation to this study, understanding value orientations within the Buffelsdraai community can provide insight into how to shape environmental awareness/education, especially for those individuals who need to be persuaded of the importance of supporting and engaging in pro-environmental behaviour and practices.

In relation to ecosystem goods and services, biodiversity valuation influences community utility/consumption of the former. Therefore, there is a need to quantify the flow of goods

which are harvested from the ecosystem (Hein *et al.*, 2006). For regulation services there is a need to quantify the impact of the particular service within and around the ecosystem (Hein *et al*., 2006). For example, the valuation of a hydrological service in a forest would comprise of assessing the impact the forest has on the water flow downstream (Hein *et al*., 2006). Determining the valuation of cultural services would depend on the community's conceptualisation of and interaction with the ecosystem and the benefits they derive from the ecosystem (Hein *et al*., 2006). Collectively, the valuation of ecosystem goods and services may be divided into three types; ecological, socio-cultural and economic value (de Groot, 2006). These three types of valuation are discussed below, beginning with ecological value.

According to Lead *et al*. (2010), the ecological value of an ecosystem is reflected by the interlinkages of ecological components within an ecosystem such as role of trees in preventing soil erosion. The ecological value of an ecosystem is further determined by the integrity of the regulation services and habitat functions provided by the ecosystem, as well as the complexity, rarity and diversity of the ecosystem (de Groot, 2006; Lead *et al*., 2010). Ecological valuations have been primarily utilised for biodiversity conservation and have promoted community, species and genetic measurement (Mertz *et al*., 2007). As a whole, ecological evaluation can contribute to decision-making and the creation of biological value indices, protected species lists, and species population modelling (Mertz *et al*., 2007).

The second type of ecosystem goods and services valuation are socio-cultural values, which include equity and perception, have been used to determine the importance of ecosystems functioning for the benefit of human welfare (de Groot, 2006). These values have aided in identifying and determining the importance of ecosystem functions in supporting mental and physical health, education, cultural identity and spirituality (de Groot, 2006; Gomez-Baggethun and Barton, 2013). By exploring socio-cultural values, it is possible to reveal the non-material benefits which ecosystems provide for social well-being (de Groot, 2006). These non-material material benefits may be encapsulated according to the Millennium Ecosystem Assessment cultural services which includes:

- Cultural diversity - the diversity of ecosystems contributes to the diversity of cultures.
- Spiritual services - the spiritual and religious value attached to ecosystems through religion.

- Traditional and formal knowledge systems - the appreciation of how ecosystems contribute and shape the knowledge systems within various cultures.

- Educational value - understanding that ecosystems contribute to formal and informal education.

- Inspiration - ecosystems are a source of inspiration for art, national symbols, and architecture.

- Aesthetic values - the perceived beauty of ecosystems.

- Cultural heritage value - the value assigned to ecosystems of historical or cultural significance.

- Recreation and ecotourism - the location and leisure time chosen to be spent based on the characteristic of an ecosystem. (Gee and Burkhard, 2010; MA, 2005).

Although there are existing categories to encapsulate socio-cultural valuation, it is increasingly difficult to determine this valuation as the spatial scale becomes larger, therefore it is often accepted that socio-cultural valuation is better understood at the local level (Kelemen *et al*., 2011). Furthermore, socio-cultural valuation of biodiversity results in more complex choices of utilisation which are often influenced by cultural and aesthetic values (Kelemen *et al*., 2011). Gomez- Baggethun and Barton (2013) assert that it becomes more challenging to determine socio-cultural values in communities which display high levels of social and cultural heterogeneity.

From the afore-mentioned valuation types, it is also pertinent to reflect on the economic valuation of ecosystem which is considered as the attempt to ascribe quantitative values of ecosystem goods and services (Kumar and Kumar, 2008). The economic valuation of biodiversity is often determined by the instrumental purpose that biodiversity fulfils and may be utilised for production and consumption (Kelemen *et al*., 2011). According to Pascual *et al*. (2010), the use of economic valuation can reflect the scarcity of available biodiversity and ecosystem services, equating the degradation of the environment as a cost to the general public and policy makers. Dikgang and Muchapondwa (2012) assert that through economic valuation, the financial benefits of conservation are thus highlighted and this may in turn be used to validate the funding of conservation programmes. Although economists may assign a monetary value to ES, it has to be noted that these valuations are influenced by the socio-economic context such as preferences and culture (Pascual *et al*., 2010).

Assessing the monetary value of ecosystem goods and services may aid in establishing the linkage between natural and human systems at both the micro and macro-level scale (Amirnejad *et al*., 2006). Within the micro-level scale, valuation can provide information about the structure and functioning of ecosystems which support human well-being (Amirnejad *et al*., 2006). At the macro-level, valuation can establish the various indicators for both human well-being and sustainability (Amirnejad *et al*., 2006). Whether biodiversity has an economic or socio-cultural valuation, both these valuations take into consideration the direct and indirect values that biodiversity offers which are described as the value determined by direct utilisation of biodiversity and the value based on potential options biodiversity can have a direct use, respectively (Kelemen *et al*., 2011). The framework adopted under the economic valuation of biodiversity is the total economic value (TEV) which is determined by the sum total of use and non-use value (Barbier *et al*., 2011; de Groot *et al*., 2010; Laurila-Pant *et al*., 2015). Use value refers to the direct consumptive and non-consumptive benefits derived from ES while non-use value encompasses the importance of ES, regardless of the use value (de Groot *et al*., 2010; Fisher and Christie, 2010).
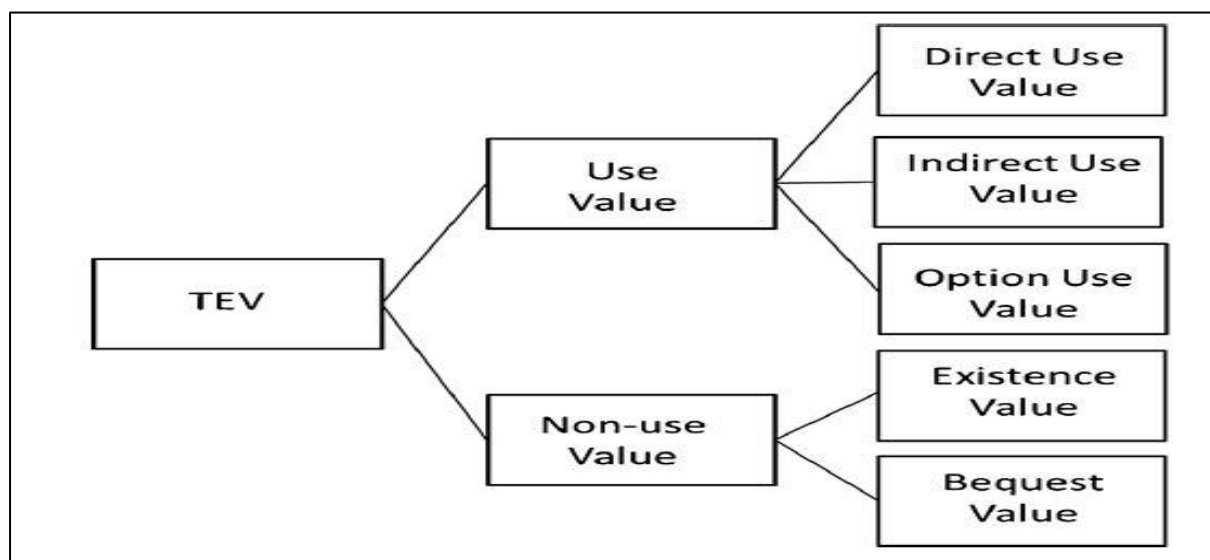
Figure 3.1: Total Economic Value (TEV) (Source: Laurila-Pant *et al.,* 2015: 3).

The use value can be further divided into direct use (typically reflected by provisioning and cultural services), indirect use (typically reflected in regulative and supportive services), and optional use (the option of utilising ES in the future) (Barbier *et al*., 2011; Laurila-Pant *et al*., 2015). In relation to non-use value, this is divided into bequest value (the preservation of ES for future generations), and existence value (ES that are not currently utilised, but necessary

for ES functioning) (Barbier *et al*., 2011; Fisher and Christie, 2010; Laurila-Pant *et al*., 2015). According to Brander *et al.* (2010), determining non-use value is particularly more challenging as these values are linked to moral and religious beliefs for which do not have existing markets. The advantages of exploring how a local community values biodiversity enables the researchers to learn from these communities on aspects relating to the local environment and the social dynamics which affect these environments (Christie *et al*., 2012).

The valuation of biodiversity is also an indication of the specific natural resources which these local communities utilise (Christie *et al*., 2012). Methods used to determine the value of the environment may be categorised as either revealed or stated preference (Amirnejad *et al*., 2006). Revealed preference methods are concerned with how an individual actually behaves, while stated preference methods are concerned with how an individual stipulates they would behave in a hypothetical situation (Amirnejad *et al*., 2006). Unfamiliarity with the various goods and services provided by an ecosystem can generate biases which often distort valuation results, namely information and methodological misspecification bias (Barkmann *et al*., 2008).

With regards to information bias, the more unfamiliar the individual is with the good or service under valuation, it is more likely that their response will be influenced by inaccurate information (Barkmann *et al*., 2008). In terms of methodological misspecification bias, regardless of being provided with accurate and precise information, there is a risk that an individual will not understand the information being provided to them (Barkmann *et al*., 2008). Thus, unfamiliarity may be a barrier to ecosystem valuation as individuals who are non-experts may have limited scientific knowledge and understanding of their ecosystem (Barkmann *et al*., 2008). Moreover, responses, perceptions and overall valuation of ecosystem goods and services are influenced by several behavioural factors (de Groot and Steg, 2010; Gifford *et al*., 2011; Rivis *et al*., 2009). These are discussed in detail below, specifically in relation to specific theories of environmental behaviour.

Individuals experience a certain level of difficulty in their ability to identify the causes of their behaviour (Gifford *et al*., 2011). In this regard, behavioural influences, specifically experiences and attitudes formed from such experiences, has been viewed as an emerging research agenda within the field (Halkos and Matsiori, 2015).Since the 1970s, theories and models have been proposed by environmental psychologists as a means to uncover the factors which determine environmental behaviour (Gifford *et al*., 2011; Halkos and Matsiori, 2015; Kennedy *et al*.,

2011). These factors which influence behaviour may be divided into three broad categories of influences. These include intrapersonal factors which include values, personality and motivations, and interpersonal influences such as social norms and social comparisons, and external influences such as punishment and rewards (Gifford *et al*., 2011).

It has been increasingly acknowledged that the loss of biodiversity has been aggravated by human activities and behaviour and as such, pro-environmental action has been considered essential to addressing such challenges (de Groot and Steg, 2010; Kennedy *et al*., 2011). Pro-environmental behaviour can be understood as actions which have a positive impact on the availability of resources or energy from the environment (de Groot and Steg, 2010). Furthermore, these actions can be understood in relation to the extent that behaviour positively alters the structure and dynamics of an ecosystem (de Groot and Steg, 2010). In order to encourage such pro-environmental actions, there needs to be an understanding of the factors which influence such behaviour (de Groot and Steg, 2010; Halkos and Matsiori, 2015). This study examines participation in reforestation/conservation programmes in relation to the following behavioural theories; theory of planned behaviour, value-belief-norms theory, and norm-activation model. These are discussed below.

The theory of planned behaviour (TPB) is a model which has been utilised to explain the determinants which guide an individual's behaviour (Duerden and Witt, 2010). According to the TPB, a specific behaviour is determined by that individual's intention to engage in that exact behaviour (Duerden and Witt, 2010). Their intention is influenced by the individual's attitude towards that behaviour, their perceived control over engaging in that behaviour and the subjective social norms associated with that behaviour (Rivis *et al*., 2009). The theory is considered most effective for understanding the processes that an individual undergoes from contemplating the behaviour, to implementing that behaviour (Duerden and Witt, 2010).

The TPB seeks to reveal the connections between attitudes and behaviour, arguing that pro-environmental behaviour is mostly influenced by behaviour-specific attitudes, rather than general environmental attitudes (Rivis *et al*., 2009). The TPB further states that it is behavioural intention that is the more suitable psychological determinant of behaviour, and that intention is influenced by three factors:

- An individual must have a positive attitude towards that pro-environmental behaviour, which is influenced by values and beliefs,

- an individual must believe that the behaviour is supported by social norms, and is consistent with group expectations, and

- an individual must believe that they have adequate control over the behaviour.

(Gifford *et al*., 2011).

The TPB suggests that the more the above factors are aligned with a pro-environmental action, the more likely an individual intends to and actually engages with pro-environmental behaviour (Gifford *et al*., 2011). In relation to this study, it is important to consider people's attitudes and perceptions of biodiversity as well as conservation, and to inform their participation in these programmes. Additionally, Hansla (2011) asserts that there is a need to understand individual's value and belief system as these further influence engagement in pro-environmental behaviour. Thus, these values and belief systems need to be unpacked to gain further understanding of the factors that influence participation in initiatives such as the Reforestation programme. In this regard, the value-belief-norms (VBN) theory, for example, can be used to understand how value orientations can influence behaviour.

According to the value-belief-norms (VBN) theory, behaviour is determined by an individual's personal norms, which are activated by the belief that environmental conditions shall threaten something valued by the individual, and the belief that the individual is able to take action to reduce that threat (Gifford *et al*., 2011). Combined, these two above mentioned beliefs are rooted in an individual's conceptions of human-environment interactions (Gifford *et al*., 2011). Human values are often used to explain pro-environmental behaviour as values are seen to influence attitudes and behaviours (de Groot and Steg, 2010). Additionally, de Groot and Steg (2010) state that a value may be understood as a guiding principle in an individual's social entity of life (de Groot and Steg, 2010). In relation to this study, the way in which individuals value their natural environment can inform initiatives such as the Reforestation programme and help shape community values to align them with climate change mitigation and conservation goals.

There are other behavioural theories, for example the norm-activation model (NAM) that is used to understand determinants of pro-socially driven behaviour (Bamberg and Moser, 2007). The norm-activation model has been applied within a context where environmental behaviour is primarily considered as pro-socially motivated activity (Bamberg and Moser, 2007). The

NAM argues that moral or personal norms are a direct determinant of pro-social behaviour (Bamberg and Moser, 2007). These moral norms are conceived as feelings of a strong moral obligation which individuals experience for engaging in pro-social behaviour (Bamberg and Moser, 2007). According to the NAM, an individual perceives the potential negative consequences to the environment, understands the consequences of action or inaction, and then weighs the associated costs or benefits of acting or not acting (Gifford *et al*., 2011).

The NAM was first conceptualised to explain an individual's moral decision making process, specifically their altruistic behaviour (Turaga *et al*., 2011). The main argument put forward is that pro-social behaviour is influenced when personal moral norms have been activated (Turaga *et al*., 2011). For this activation to occur, there are two necessary preconditions. First, an individual needs to be aware that their actions have consequences and impacts the well-being of others, and this is commonly referred to as awareness of consequences (AC) (de Groot and Steg, 2009). Second, an individual needs to feel personally responsible to take action, and this is known as ascription of responsibility (AR) (de Groot and Steg, 2009). However, the activation of moral norms may be neutralised by the individual denying the consequences of their actions, and refusing to accept their responsibility to take action (Turaga *et al*., 2011). The author acknowledges that within this study, specifically in relation to participation in conservation and reforestation programmes, attitudes and behavioural influences such as culture, may be important factors to consider.

It has been observed that communities living adjacent to areas designated for conservation are highly dependent on the natural resources for a variety of purposes such as fuel wood, water or food (Amin *et al*., 2015; Liu *et al*., 2010). In instances where conflict has arisen between adjacent communities and conservation agencies, the exclusion of community interests from decision-making regarding the planning and management of conservation areas have been noted as key determining factors (Buscher and Wolmer, 2007). Conflict also arises from the traditional practices of slash-and-burn which are adopted by communities for cultivation purposes, and have a negative impact on forest resources and species abundance (Liu *et al*., 2010). Additionally, Lui *et al*. (2010) assert that local attitudes often determine the environmental behaviour of communities, and are shaped by social context such as gender, age and level of education. Among the theories which have sought to explain the link between attitudes and behaviour is the theory of reasoned action (TRA) (Lepp and Holland, 2006). According to the TRA, behavioural intent influences behaviour, attitudes and subjective norms

influence behavioural intent, and these attitudes and norms are influenced by beliefs (Lepp and Holland, 2006). The belief system an individual ascribes to shapes their attitude and it has been realised that those with a bio-centric belief system have a positive attitude towards conservation practices in relation to those with an anthropocentric belief system (Lepp and Holland, 2006).

It has been argued that the reason behind the lack of support and engagement in environmental management practices by local community members is their failure to recognise the scientific and ecological importance in terms of conservation needs (Buijs *et al*., 2008). As such, Brody *et al.* (2008) argue that limited scientific knowledge, specifically related to ecology and conservation limits an individual's ability to fully appreciate the benefits which they derive from ecology and the subsequent conservation of said ecology. It is assumed that improving levels of awareness and informing attitudes of the general public on the scientific significance of biodiversity shall produce the desired results of increased public support and acceptance of conservation practices (Amin *et al*., 2015; Buijs *et al*., 2008). However, Kennedy *et al.* (2009), notes that it is also crucial for the dissemination of scientific knowledge and information to be tailored to specific audience contexts to affect behaviour.

This interpretation between the lack of knowledge and lack of engagement in conservation is criticised for it deals with the concept of biodiversity in isolation and only based on scientific knowledge (*Buijs et al*., 2008). Furthermore, this interpretation excludes traditional and indigenous knowledge which is accumulated across generations through narratives and observations (Pretty *et al*., 2009). These narratives and observations are formed as social memory which is continuingly being reshaped according to the changes to the ecosystem (Pretty *et al*., 2009). This knowledge can then be utilised to guide sustainable harvesting practices, and provide insight to ecosystem dynamics and interactions (Pretty *et al*., 2009). Arguably, the more this form of knowledge is ingrained in the culture of a community, the more likely the associated practices shall become the social-norm (Pretty *et al*., 2009).

The perceptions of PAs often influence the interactions between communities and conservation practices (Vodouhe *et al*., 2010). For this reason, understanding local perceptions regarding conservation helps in improving the relationship between PAs and communities (Hartter *et al*., 2014; Mutanga *et al*., 2015; Vodouhe *et al*., 2010). Factors which influence these perceptions include the awareness that the protected area exists, the history of protected area management, ethnicity, age, gender, as wells as income and education level (Hartter *et al*., 2014; Mutanga *et*

al., 2015). Overall, further generation of knowledge regarding perceptions to climate change, biodiversity, and conservation need the development of robust approaches which take into account the myriad factors which influence community perceptions.

3.7. Conclusion

The present chapter provided an overview of the relevant literature for the research study beginning with a review of the climate change discourse. Literature revealed an increase in the incorporation of social dimensions into an otherwise biophysical dominated climate change discourse. Subsequently, it was important for this study to include discussions revolving the vulnerability of local communities and how local level government authorities are the more appropriate government authorities in implementing climate change mitigation and adaption strategies. Given the contemporary environmental challenge of climate change-related concerns, it was important to review the various factors which influence community vulnerability and adaptive capacity. The review of literature within this study also reflected on the importance of biodiversity and highlighted the complex nature of human and ecological systems, which contributed to the overall understanding of socio-ecological systems. Additionally, the exclusionary principles of conservation practices were interrogated to shed light on past experiences. It was further realised that such exclusionary practices were later transformed into more inclusive forms of participation, which sought to promote aspects of sustainable development and community participation. This shift towards more inclusive forms of conservation has resulted in a myriad of community-based conservation projects which seek to achieve the dual goal of environmental protection and socio-economic development.

Having recognised the need to incorporate and understand a social dimension in climate change research and mitigation practice, this chapter presented discussions about the role of public perceptions. These discussions reflected on how public perceptions can influence the way in which individuals respond to climate change-related threats, with discussions on risk perceptions broadened the understanding of community perceptions, and the possible barriers such perceptions may cause in promoting community participation in projects aiming to mitigate the effects of climate change. Furthermore, it was recognised that unpacking public perceptions can aid in understanding how individuals view and conceptualise their natural environment, as well as reveal how their valuation can influence utilisation of the natural environment. It was also necessary to review existing theories on environmental behaviour to explain how individuals view their natural environment, as well as provide explanations on

what shapes and determines pro-environmental behaviour, which is arguably an important aspect of promoting community participation. More specifically, by unpacking the various theories on environmental, this enables the study to frame local community utilisation of ecosystem goods and services, as well as inform what could be the factors that influence community participation in the BLSCRP.

CHAPTER FOUR:
STUDY AREA AND METHODOLOGY

4.1. Introduction

This chapter lists the research methodology approach undertaken during the study of which a case study approach was used, specifically focusing on Buffelsdraai. The Buffelsdraai community was identified as a suitable location because of the flagship reforestation project which has been running for the past ten years. The first section will provide a description of and the context of the study area. Thereafter, a description and outline of the research methodology, research design, data collection techniques and tools utilised to obtain primary data, and the software used to capture and analyse the data is provided. The limitations and challenges experienced in conducting the study is also explored.

4.2. Description of study area

The eThekwinin Municipal Area (EMA), located in the province of KwaZulu-Natal, is under the local government authority of the eThekwini Municipality and extends over an estimated area of 229 193ha (Davids *et al*., 2016). Climatic conditions of the EMA have been described as subtropical to temperate at higher elevations, and characterised with high rainfall and temperature seasonality, and lower mean temperatures (Ground *et al*., 2016). At lower elevations, the EMA is described as subtropical to tropical, and characterised with lower rainfall and temperature seasonality, and higher mean temperatures (Ground *et al*., 2016). This combination of climatic conditions has resulted in a region that supports tropical, sub-tropical and temperate mist-belt species (Ground *et al*., 2016). Located within the EMA is the city of Durban which is considered as the third largest metropolitan areas in South Africa with an estimated size of 2300 km^2 and a population of over 3 million residents (Boon *et al*., 2016). The city is located within the MPA Region, which represents one of 35 global biodiversity hotspots (Boon *et al*., 2016). Among the threats to the city and EMA's environments are pollution, habitat destruction and alien invasive species (Davids *et al*., 2016).
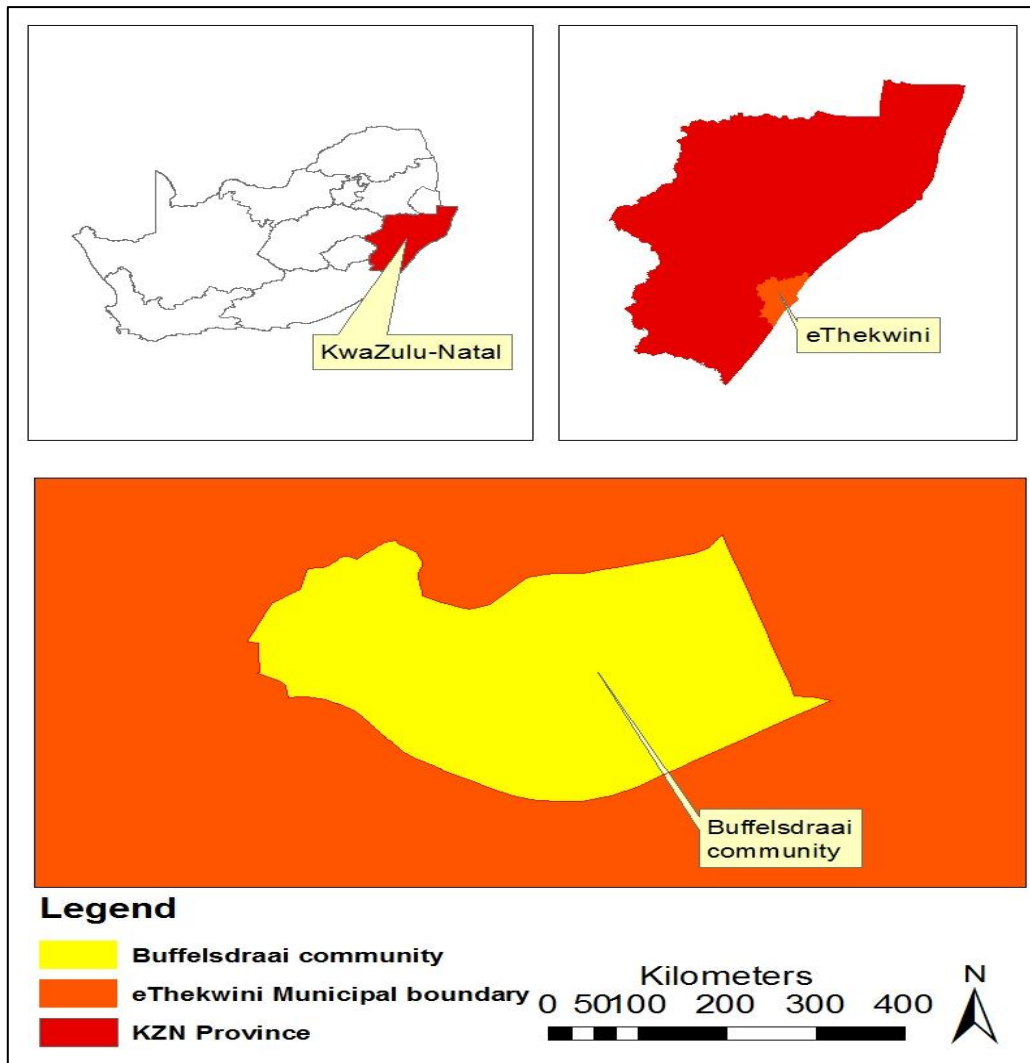
Figure 4.1. Location of study areas within eThekwini, KwaZulu-Natal (Author, 2017).

In comparison to other cities in the country, Durban has the highest proportion of residents living in poverty, and recorded an income inequality Gini Coefficient of 0.63 in the year 2012 (Boon *et al*., 2016). This ranking in the upper quantile indicates high levels of inequality. It has also been observed that city's legacy of apartheid has resulted in the most marginalised citizens residing in the municipality's fringe, which excludes these communities from economic and employment opportunities (Cartwright *et al*., 2013; Roberts and O'Donoghue, 2013). In relation to landscape, the larger proportion of Durban is comprised of rural and peri-urban land use characteristics and settlements (Boon *et al*., 2016). These rural and peri-urban areas make up two-thirds of the metropolitan area, and it is within these areas that communities rely on ecosystem services to meet their basic needs (Davids *et al*., 2016; Roberts and O'Donoghue, 2013). It can be observed that it is these areas which are more at risk to the effects of climate change related concerns (Roberst and O'Donoghue, 2013).

In response to the threats on the natural environment, the city has made efforts such as the Durban Metropolitan Open Space System (D'MOSS) which was established to protect the city's globally significant biodiversity and ensure the sustainability of the ecosystem service provision (Roberts *et al*., 2012). With specific reference to climate change-related threats, the city of Durban initiated the Municipal Climate Change Protection Programme (MCPP) in 2004 to address climate change related threats to its natural environment and affected development sectors (Cartwright et al., 2013; Roberts *et al*., 2012). The MCPP consists of several components namely; municipal adaptation, community-based adaptation, and urban management interventions to target climate change challenges (Roberts *et al*., 2012).

4.2.1. Buffelsdraai Landfill Site Community Reforestation Programme

The BLSCRP is considered one of the first of many reforestation projects anticipated by the eThekwini municipality which sought to establish and restore the indigenous forest in the buffer zone of the eThekwini municipality's Buffelsdraai Regional Landfill Site (Diga *et al*., 2016; Douwes *et al*., 2015). The main aim of the project is to offset the related carbon emissions of hosting the 2010 FIFA World Cup® (Douwes *et al*., 2015). The project is being carried out within the municipal owned buffer zone which is between the landfill site and adjacent communities (Greater Capital Report, 2011). The project was established in 2008 by the eThekwini municipality's Environmental Planning and Climate Protection Department (EPCPD) with WCT and DSW as key partners (Douwes *et al*., 2015). Key sources of funding for the project include the Danish International Development Agency (DANIDA) and the South African national government through its Green Fund (Douwes *et al*., 2015). In 2014, the BLSCRP received a Gold Standard by the Climate Community and Biodiversity Alliance (CCBA) (Douwes *et al*., 2015). The CCBA standards require forestry carbon projects, in the form of restoration, afforestation or reforestation, to ensure biodiversity benefits, and emphasise the importance of stakeholder consultation in such projects (Harvey *et al*., 2010).
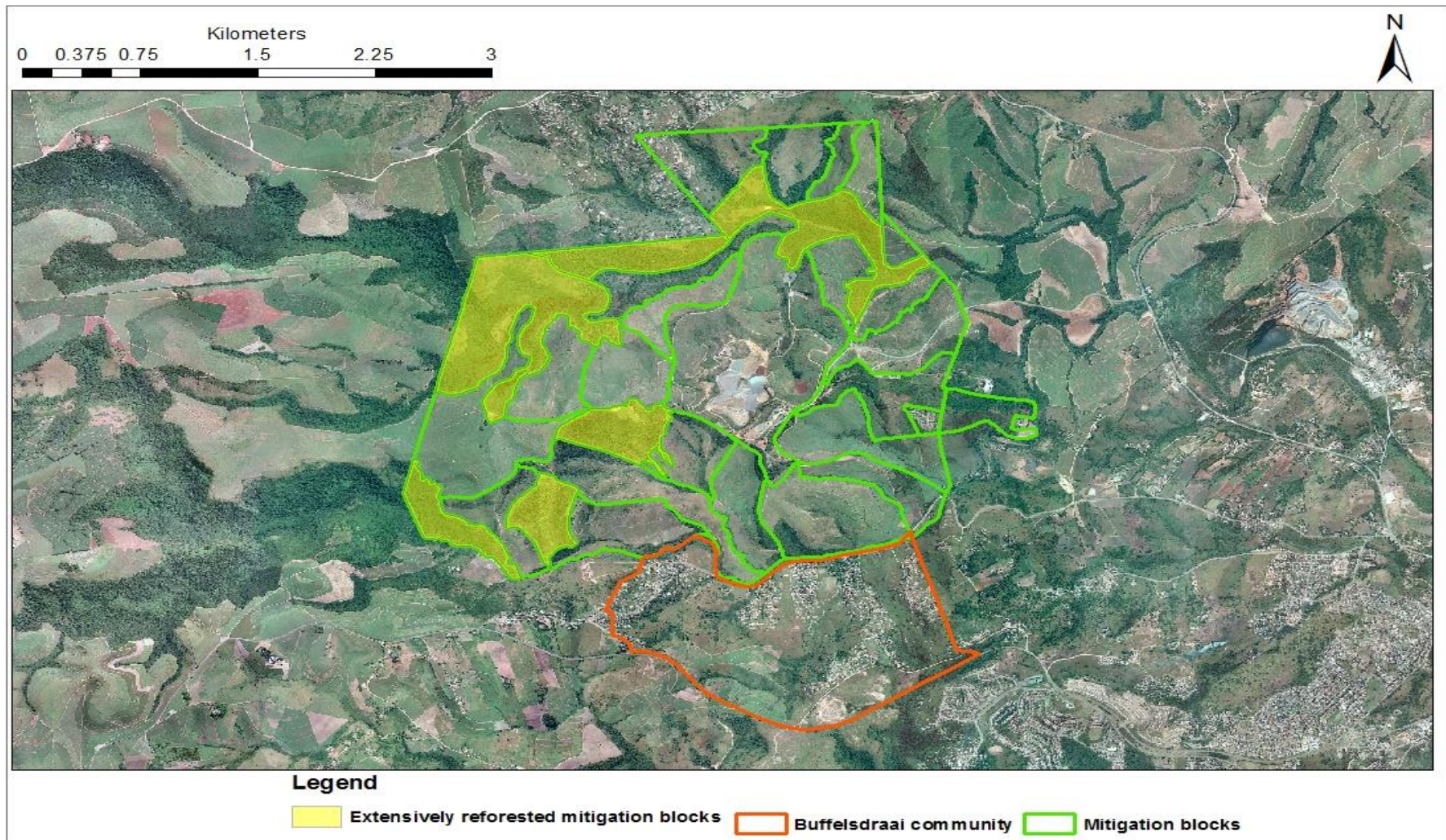
Figure 4.2. Location of Buffelsdraai community in Durban, eThekwini Municipality, KwaZulu-Natal (Author, 2017).

The estimated size of the buffer zone is 787ha with the active landfill zone occupying 100ha (Greater Capital Report, 2011). The tree seedlings are planted within the buffer zone which is separated into mitigation blocks where the reforestation occurs. In terms of ecological benefits, the restored forests are predicted to enhance biodiversity refugees and water quality, river flow regulation, flood mitigation, sediment control, and improve aesthetic appeal (Douwes *et al*., 2015). Furthermore, it was envisaged that the project would also enhance local community capacity and biodiversity adaptation to climate change-related concerns (Douwes *et al*., 2015). Local community members collect indigenous tree seeds which are grown in community household gardens, which are later collected and introduced to the buffer zone surrounding the landfill site (Douwes *et al*., 2015). The WCT is the assigned implementing agent of operations related to the tree growing and planting under its ITFL model (Greater Capital Report, 2011). Within this model, local community members, known as 'Tree-preneurs', grow indigenous tree seedlings in their respective household nurseries and once the trees have grown to a suitable height, community members are able to trade these trees for credit notes (Douwes *et al*., 2015). These credit notes are redeemable at 'tree stores' which have a prearrangement with WCT, and may be used to purchase groceries and building materials, while other households have been able to use incentives in assisting to pay for school fees and driving lessons (Douwes *et al*., 2015).

The tree-preneurs are members of local communities which include Buffelsdraai, Osindisweni and KwaMashu, with the majority of individuals involved in the project originating from the two former communities (Douwes *et al*., 2015). Community members are recruited by local facilitators within each respective community, and are trained in relation to the collection of seedlings and removal of alien invasive species (Douwes *et al*., 2015). As of 2015 the project has created an estimated 448 jobs, (43 full-time, 16 part-time, 389 temporary), in relation to tree planting and site preparation (for example, the removal of sugarcane and alien invasive plants), maintenance (for example, grass cutting and controlling alien invasive plants, and fire management) (Douwes *et al*., 2015).

Part of the project's social outreach is to increase local community capacity by providing understanding of ecosystem benefits, and building awareness of natural ecosystems (Douwes *et al*., 2015). Plans have been made to restore the ruins of former farmhouse located within the premises of the Buffelsdraai Landfill Site and establish this building as a Reforestation Hub which will become the administrative centre for the reforestation programme (Douwes *et al*.,

2015). The Reforestation Hub will also serve as a tool to promote environmental education and stewardship to enhance local climate change adaptation capacity, and innovative research (Douwes *et al*., 2015).

Approximately 90% of project beneficiaries from the three communities lived below South Africa' poverty line (Greater Capital Report, 2011). However, it should be noted that poverty indicators within South Africa have been criticised for not adequately representing local contexts (Munien, 2014). More specifically, current indicators are based on upper and lower limits which reflect averages rather than the majority. The Buffelsdraai community was noted to be and identified as one of the community with the lowest levels of formal education, income per household and food security, in comparison to Osindisweni and KwaMashu (Greater Capital Report, 2011). The realisation of the socio-economic context within these communities, the Reforestation project seeks to target the most vulnerable groups within the communities (Greater Capital Report, 2011).

4.3. Research methodology

A research methodology is a model which guides the way research is conducted within a paradigm, and establishes the set of rules and principles which form the foundation of a research inquiry (Wahyuni, 2012; Gelo *et al*., 2008). Additionally, the research methodology embodies the set of beliefs which further inform the researcher's observation, theory, hypothesis and the specific research methods undertaken in a research inquiry (Wahyuni, 2012; Gelo *et al*., 2008). Research methodologies are underpinned by philosophies such positivism, constructivism, or as in the case of this study, pragmatism that is the philosophical roots of mixed methodology research (Denscombe, 2008; Migiro and Magangi, 2011; Symonds and Gorard, 2010). According to Denscombe (2008), using a combination of quantitative research underpinned by positivist philosophy, and qualitative research underpinned by interpretivist and constructivist philosophies. The use of pragmatism as the philosophical foundation of research produces crucial outcomes permitting the researcher to synthesis approaches from various philosophies (Denscombe, 2008).

Furthermore, pragmatism allowed for the researcher to utilise both qualitative and quantitative research methods as a means to adequately address research findings (Denscombe, 2008). It is said that the pragmatism philosophy stresses the complexities of research, and asserts that a research design cannot be singularly determined by theory as suggested by deductive research,

or data driven as suggested by inductive research (Doyle *et al*., 2009; Wheeldon, 2010). Rather, pragmatism suggests abduction as a more flexible strategy to facilitate the process of alternating between an inductive and deductive approaches of inquiry (Doyle *et al*., 2009; Migiro and Magangi, 2011). Additionally, Wheeldon (2010) states that abduction permits the use of existing knowledge to produce research solutions while also allowing the amalgamation of several theories and approaches.

The mixed method approach can be defined as a research approach where data is collected and analysed using quantitative and qualitative techniques (Ostlund *et al*., 2011). According to Denscombe (2008), there are crucial aspects to a research enquiry which utilises a mixed methods approach, with the key characteristic being the incorporation of both qualitative and quantitative methods within the single research inquiry. Furthermore, there needs to be clarification on the sequence and priority of both the qualitative and quantitative aspects of data collection and the subsequent analysis of data (Denscombe, 2008). This approach to research draws on the strengths of both the quantitative and qualitative approaches (Ostlund *et al*., 2010). According to Castro *et al*. (2010), quantitative research allows for comparisons between groups of individuals through the use of statistical testing between variables. However, such abilities are hampered by the inability to grasp the contextual settings within a study area which is provided by qualitative techniques (Castro *et al*., 2010). Creswell *et al*. (2008) state that social phenomena are often complex and best understood through mixed methodologies. Ostlund *et al*. (2011) add that mixed methodologies were perceived as a means of converging both quantitative and qualitative methods in conducting research inquiries. The use of multiple methods can also aid in reducing the bias and shortcomings of using a singular method (Creswell *et al*., 2008).

Within the various typologies of mixed method designs, this study adopted a concurrent triangulation design which involves the collection of both quantitative and qualitative data during the same phase of data collection (Castro *et al*., 2010; Kroll and Neri, 2009). Triangulation is an approach that combines multiple theories, methods and data sources for the purpose of enhancing the validity of or expanding on research findings (Modell, 2009). Triangulation further enhances research findings as multiple theories can provide various perspectives to address the research inquiry and broaden complementary and competing arguments (Modell, 2009). In relation to data findings, triangulation permits the use of qualitative data to enrich trends and relationships observed in quantitative data (Modell, 2009).

This study was based on a cross-sectional analysis of community participation in the BLSCRP (Levin, 2006). Particularly for this study, interest was placed on capturing utilisation of ecosystem services, community participation, as well as local levels of awareness, perceptions, attitudes and knowledge towards concepts such as conservation, biodiversity and climate change. In relation to sampling, cross-sectional studies require the sample size to be drawn from the whole population, providing a large sample size which is representative (Levin, 2006).

4.3.1. Research design

A research design establishes a framework of strategies and methods that enable a researcher to scientifically address their stated research questions (Kroll and Neri, 2009). Gelo *et al*. (2008) add that a research design creates a structure from which philosophical foundations can be linked with methodological assumptions and research methods. The research design adopted in this study is based on a case study strategy, which is considered as an empirical enquiry to a research phenomenon within the context of real-life experience (Noor, 2008). A case study addresses questions of how and why things occur, and allows for the exploration of contextual realities and differences of intended and actual outcomes (Noor, 2008). These contextual realities are explored through the use of multiple information sources (Creswell *et al*., 2007). The aim of a case study is not to examine an entire population or organisation but rather provide focus on certain issues and features (Noor, 2008). The case selected may be groups of individuals or an activity, and the associated issue to be investigated (Creswell *et al*., 2007). There are three broad reasons for adopting a case study approach, these include:

- when the study seeks to address questions of 'why' and 'how',
- when a researcher cannot manipulate the behaviour of participants within the study, and
- when a researcher seeks to explore conditions within their occurring context. (Baxter and Jack, 2008).

4.4. Data acquisition and analysis

Based on the research methodology and design, the following section addresses the data collection tool utilised to collect primary data. In this regard, the chosen data collection tool was a questionnaire. The data obtained from the questionnaire was captured and analysed through the use of Statistical Package for the Social Sciences (SPSS) version 23.

4.4.1. Data collection tools

4.4.1.1. Questionnaire

The purpose of a survey is to extract quantitative descriptions and information of a set of characteristics about a population or sample group (Groves *et al*., 2009). For the purpose of this study, the survey instrument addressed specific elements such as socio-economic and demographic profiles to illustrate trends in the population, the status-quo in terms of poverty, economic activity, levels of education, and socio-economic vulnerability. In addition to coded closed-ended questions, included in the questionnaire were scales (for example, the Likert scale) which were used to quantify attitudes, abilities and opinions of community members (Meadow, 2003). More specifically, this scale was used to determine levels of agreement with statements regarding the perceived fragility/resilience of the natural surrounding environment, and satisfaction with the involvement, success and implementation of the BLSCRP. These scales sought to provide both an individual's psychological and physical function within their geographical location (Meadows, 2003). As a whole, the survey sought to account for an individual's belief, opinion, ideas and perceptions, and aid in the explanation of changes and comparisons within the community (Maree and Pietersen, 2007).

According to Creswell and Plano-Clark (2007), the incorporation of open-ended qualitative questions in data collection instrument validates the research as a quantitative data triangulation mixed methods design (Doyle *et al*., 2009). De Vos *et al.* (2002) note that qualitative research entails eliciting participant accounts of meaning, experience or perceptions; while quantitative research methods focus on deriving numerical data to describe variables and the relationship between the variables. While a structured survey was used as the data collection tool in this study, Lickert style questions were used to rate respondents' perceptions, level of participation in relation to specific practices and attitudes towards impacts. Furthermore, throughout the survey, open-ended questions are included to further probe responses that were quantitative in nature. This reveals that the study integrated qualitative dimensions within the survey tool used. The data collection teams also noted additional responses and comments that are integrated into discussion as respondents' 'voices' (actual extracts used).

The survey instrument used in this study consisted of open and closed ended questions, with the following thematic areas:

1. Socio-demographic profile of respondents.
2. Household demographics.

3. Biodiversity, conservation and climate change conceptualisation.
4. Ecosystem goods and services.
5. Buffelsdraai Landfill Site Community Reforestation Project.

These thematic areas were crucial for addressing the research questions as well as the objectives of this study. The first section was designed to extract the socio-demographic characteristics of individual respondents. Section two provided further insight to household livelihoods which enabled the study to comprehend the socio-economic context of the community. Section three aimed at revealing respondent's perceptions, levels of awareness and knowledge regarding key environmental concepts, as well as how respondents value and perceive their natural surroundings. Section four focused on extracting data regarding the way respondents utilised and benefited from various ecosystem goods and services, and highlighted the way in which the surrounding ecology supported livelihood activities. The fifth section consisted of questions focused on the awareness of and participation of respondents in the BLSCRP which was pertinent in informing the way in which community members are engaged in the BLSCRP, the type of benefits they derived, and the overall response towards the project.

While the study integrated qualitative dimensions, specifically in relation to the use of open-ended questions and noting additional comments by respondents, it is important to note that further research should include focus group discussions and key informant interviews. Focus group discussions will enable collective reflections on key issues and themes in relation to CBC programmes. The success of CBC programmes are linked directly to communities having a shared vision of what should be achieved. Key informant interviews would permit different perspectives and interests to be examined from different stakeholders.

4.4.2. Sampling framework
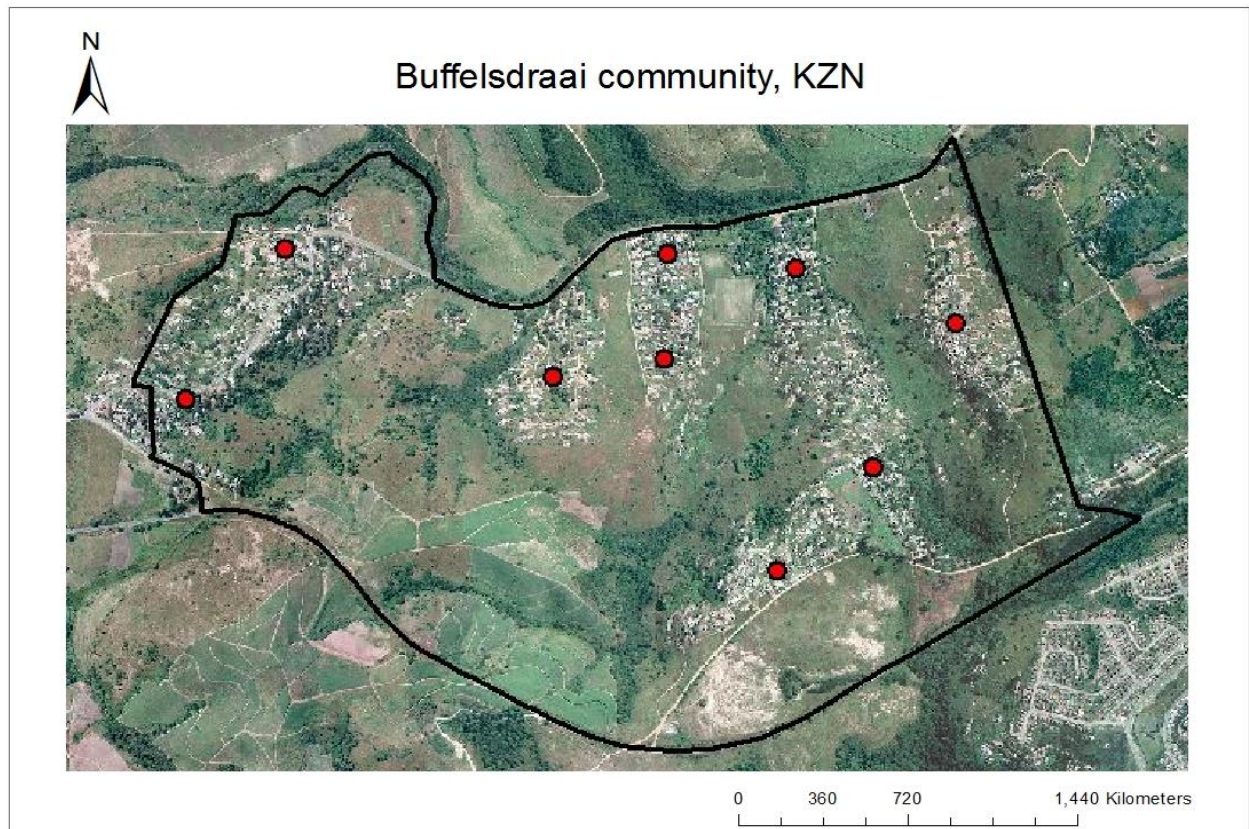
Figure 4.3: Sampling nodes within the Buffelsdraai community, KwaZulu-Natal (Source: Author)

A multi-stage sampling framework was adopted in this study which entailed the random selection of nodes. Thereafter the nearest 30 household were purposively selected based on road accessibility. During the first stage of the sampling, Hawth's Tools extension in ArcMap v 10.3 was used to generate 9 random nodes (Figure 4.3) which delineated the community based on settlement patterns and density of households. This was carried out to provide adequate representation of households, and reduced any bias in the selection process. The next stage of the sampling involved the purposive selection of 30 households, closest to the identified nodes, based on road accessibility. In instances where the chosen household was unwilling to participate or not unavailable for the interview, the nearest neighbour was then sampled. A total of 270 households were surveyed which was a statistically representative sample of the total of 840 households, at 95% level of confidence (Israel, 1992). Households were surveyed using face-to-face interviews. The data collection was conducted over a period of ten days with the aid of 7 field assistants who were conversant in IsiZulu and English for

ease of communication and translation. Prior to the commencement of data collection, field assistants were trained on how to conduct the face-to-face interviews and with a context for the questions posed.

4.4.3. Data analysis and evaluation

4.4.3.1. Statistical analysis

The data collected from the questionnaire was captured and analysed using the SPSS version 23. Open-ended questions and responses were further coded into themes which allowed for ease of comparison and data capturing. The data was also thematically analysed according to the three themes identified in the conceptual framework and literature. The results obtained from SPSS were also exported to Microsoft Excel for displaying the data in graphs, charts and tables. Descriptive and inferential statistical analyses were carried out, when data permitted. Given that data collected in the study was predominately categorical in nature, non-parametric tests such as Pearson's Chi-Square tests, Fischer's Exact Tests and the Likelihood Ratio were used.

4.4.3.2. Validity and Reliability

Prior to the commencement of data collection, the questionnaire was piloted to determine the accuracy of the survey instrument. The necessary amendments to the survey instrument were done and corrected for during a workshop and training of field-assistants. This training focused on gaining knowledge of difficult concepts related to climate change, biodiversity and conservation and ensured a uniform and correct approach to using suitable words/phrases in isiZulu.

4.5. Limitations and challenges

Research is considered to be a holistic process from the point of inception to data collection, description and analysis. Limitations encountered included the availability of data as the BLSCRP is a flagship project and not many scientific journals/publications were available to examine previous statistics on the performance of the project. Time and logistical difficulties especially during the data collection process, more specifically, it became difficult to gain access to community members, especially those who were employed or were away during data collection periods. During data collection, it became apparent that the project brought on some level of conflict between community, especially between community members that were involved in the project and those who were not involved. This created hostile environments

during certain days of data collection, which prolonged the sampling timeframe. However, this was rectified through explanations of the reasons and motivation behind the research study. During the piloting exercise, it emerged that there was a lack of suitable isiZulu words that allowed for the translation of scientific terminology. Consequently, fieldworkers were trained to ask/relate terms without providing definitions that could influence the respondent responses of local levels of awareness and knowledge of specific terms.

4.6. Conclusion

The chapter provided a description of the Buffelsdraai community and the chosen research methodology adopted, and data analysis. Limitations and challenges experienced with conducting the research study were also highlighted. Primary and secondary data used for this study is discussed in detail in the subsequent chapter.

CHAPTER FIVE:
RESULTS AND DISCUSSION

5.1. Introduction

This chapter provides a description and analyses of data obtained during this study. Data collected during the household surveys are discussed thematically and critically evaluated in relation to the literature and conceptual frameworks that guided this study. All data collected is discussed in relation to the following theme; socio-demographic profiles of respondents and households, conceptualisation and awareness of key concepts; use of ecosystem goods and services, and an overview of the Buffelsdraai Reforestation programme. The discussions provided also reflect on the broader aims and objectives that framed this study.

5.2. Socio-economic and demographic profile of respondents

Socio-demographic characteristics are considered vital in understanding contexts within which society is constructed and function (Amundsen, 2015; Brody *et al*., 2008). As described by many, reforestation programmes are aimed at providing support for ecosystem function and local livelihoods (Le *et al*., 2011; Lawlor *et al*., 2013; Locatelli *et al*., 2015). In this study, it was deemed important to examine socio-demographic characteristics because of the influences on livelihood practices, levels of awareness, and attitudes and perceptions.

Table 5.1: Respondent age category (n=270, in %)

Age cohorts	%
19-29	29
30-40	37
41-51	18
52-62	11
63-73	4
74-84	1
Average age	37.76

Results indicate that respondents' age ranged from 19 to 84 years with 37% belonging to the 30-40 year age cohort, and 29% being between the ages of 19 to 29 years (Table 5.1). Smaller proportions of respondents were between 41-51 years (18%) and 52-65 years (11%). A minority of respondents were between the ages of 63-73 years (4%) and older than 74 years (1%). Collectively, the results indicate most of the respondents are between the ages of 19-40, making up 66% of the sampled population. The range of the respondent ages is 19-84, with an

average age of 37.76 years. The results suggest that the population is a fairly youthful community.
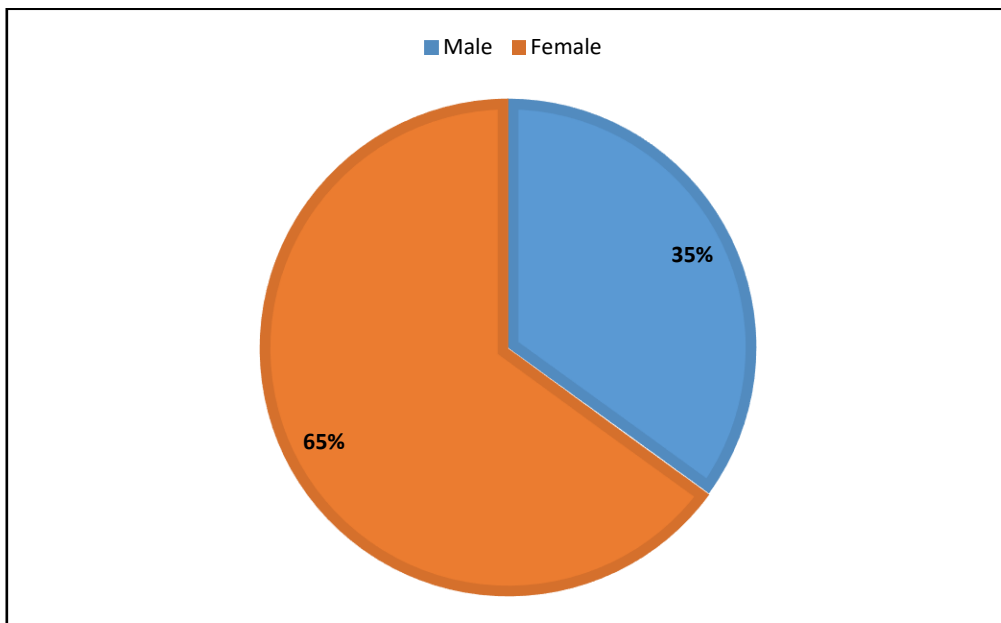
Figure 5.1: Respondent gender distribution (n=270, in %)

The majority of respondents were females (65%), with males comprising 35% of the sample population (Figure 5.1). The skewed gender distribution noted in the sample population, could be attributed to the sampling framework adopted in the administration of the surveys. The questionnaires were administered to an adult member of the household and males preferred not to participate in the study and opted for the one of the female head of household to respond to questions. Another factor contributing to the skewed distribution was that often upon arrival to the households, female respondents indicated that the males were not present due to employment commitments.

Table 5.2: Respondent employment status (n= 270, in %)

Employment status	%
Student	1
Medically boarded	1
Retired	4
Self-employed	6
Unemployed	61
Part-time employed	15
Employed	12

The majority of respondents indicated that they were unemployed (61%), with smaller proportions part-time employed (15%) and employed (12%), self-employed (6%), retired (4%), medically boarded (1%) and students (1%). Results suggest that level of unemployment within Buffelsdraai may be considerably higher than the provincial (33%) and national (29.8%) rates (SSA, 2011). Further inspection of data trends reveal that 68% of unemployed respondents were female, suggesting that females within the community may be experiencing higher levels of vulnerability compared to their male counterparts. These findings are once again considerably higher in comparison to the national unemployment rate of women (46%) within the country (SSA, 2011). The above results highlight a significantly high unemployment rate within the sampled population, indicating that employment opportunities remain highly limited for community members. Although employed respondents account for a collective 33% of the sampled population, almost half of these respondents have no form of secure full-time employed as 15% of respondents are employed part-time. Additionally, those who were retired, medically boarded and students add further to household dependency on those employed.
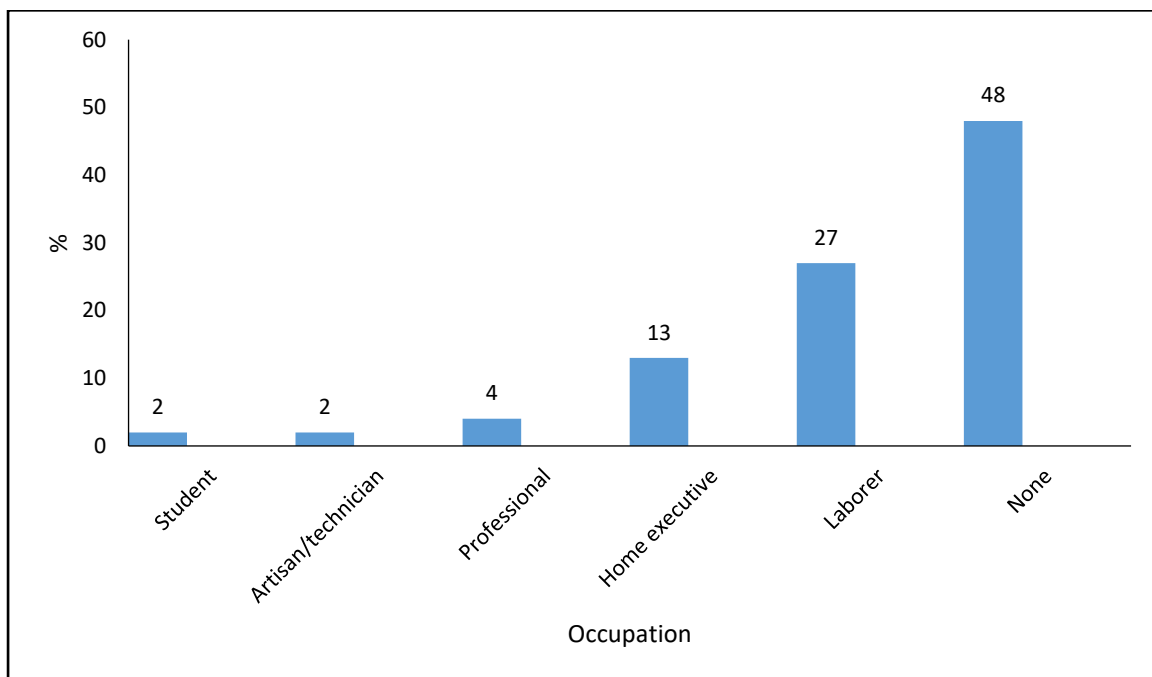
Figure 5.2: Respondent occupation (n=270, in %)

Results show that formal skills among respondents are limited (Figure 5.2). Within the sampled population, 48% of respondents indicated that they had no occupation, 27% were labourers, four percent with professional occupation, and two percent were artisans/technicians. Other respondents stated that they were home executives (13%), tasked mainly to tend to household

duties such as taking care of the elderly and children within their household. As such, levels of respondent employment are therefore unsurprising, given the limited levels of formal skills.

Table 5.3: Respondent level of education (n=270, in %)

Level of education	%
No formal	9
Partial primary	12
Primary completed	6
Partial secondary	40
Secondary completed	27
Certificate diploma	4
Undergraduate degree	0.4
Adult based education	2

The above table (Table 5.3), depicts the highest level of formal education attained within the sampled population, with nine percent of respondents stating that they had no formal education. A noticeable proportion of respondents (40%) stated they had not completed secondary schooling. Further discussions with respondents revealed that the reasons behind not completing their secondary schooling was that there were no financial resources which could enable them to continue with their education. Respondents who had completed their secondary schooling accounted for 27%, while 12% stated they obtained partial primary schooling. With regards to higher education and tertiary qualifications, 4% of respondents attained a certificate/diploma and 0.4% with undergraduate degree. The limited levels of education can arguably limit the ability of respondents to gain formal employment opportunities, and thus further compound unemployment within the community.

Table 5.4: Respondent monthly income (n=270, in %)

Monthly income range	%
None	47
≤R1 500	37
R1 501- 3 000	10
R3 001- 4 500	4
R4 501 – 6 000	2

A noteworthy portion of respondents (47%) stated that they do not receive any form of monthly income with 37% indicating a monthly of R1 500 or less. Four percent of respondents noted an income between R3 001 and R4 500, and 2% earned between R4 501- R6 000.

Table 5.5: Respondent access to credit (n=270, in %)

Access to credit	%
Yes	6
No	94

Moreover, the study found that 94% of respondents had no access to credit (Table 5.5). The low monthly income ranges are further exacerbated by the finding that vast majority of respondents had no access to credit, further limiting their financial assets.

Table 5.6: Cross tabulation: Respondent gender and employment status (n=270, in %)

Employment status (%)	Gender	
	Male	Female
Employed	20.2	8
Part-time employed	14.9	14.8
Unemployed	56.4	61.9
Self-employed	4.3	6.8
Retired	3.2	5.1
Medically boarded	1.1	1.1
Student	-	2.3

In further profiling the socio-demographic profile of the Buffelsdraai community, a cross tabulation between gender and employment status was conducted. The data revealed that 20.2% of males were employed and 8% of female respondents were employed. Additionally, almost equal proportions of males (14.8%) and females (14.9%) were part-time employed. Moreover, 56.4% of males and 61.9% of females were unemployed, with 4.3% of males and 6.8% of females being self-employed. Results also indicated 3.2% of males were retired, while 5.1% of females were retired. Equal proportion of both males and females (1.1%) were retired, and 2.3% of females were students. Collectively, the results indicate high levels of unemployment coupled with low skill levels and limited formal education. These socio-economic conditions are concerning and are indicative of the vulnerability context of respondents. More concerning is the gendered socio-economic vulnerability which highlights the limited opportunities for female respondents within the community.

5.3. Socio-economic and demographic profile of household members of the respondent

The section unpacks the socio-economic context of the Buffelsdraai community, aiming to unpack household dynamics of the respondents. Given that the research project adopted a case study approach, it was of the outmost importance to extract data that enables a broader

understanding of the community by unpacking household profiles of the respondents to understand individual and household level vulnerabilities. Thus, the survey probed respondents household characteristics in an attempt to provide a more robust understanding of vulnerability and socio-economic status. Respondents described gender distribution, age, levels of employment and education, and sources of income within their households.

Table 5.7: Respondents' household demographics (n=270)

Household demographics	%
Gender	
Male	48
Female	52
Age cohorts	
<10	26
11 to 20	21
21 to 30	21
31 to 40	17
41 to 50	9
51 to 60	4
61 to 70	2
>70	1

The results indicate that a noteworthy proportion of households (47%) had members younger than 18 years of age. In relation to household gender distribution, 48% of sampled household members were males, and 52% were females. With regards to age distribution, a majority of the sampled population (68%) are under the age of 30. A very low percentage of the population (3%) are over the age of 60, with the remaining population mostly ranging between 31 to 40 years of age. The results are indicative of a fairly youthful population.

Table 5.8: Respondents' household members involvement in social organisation and networks within the community (n=270, in %). Multiple responses permitted

Social organisation	%
None	39
Church/religious group	51
Stokvel	13
Workers union	4
Farmers organisation	1
Sports association	1

Most households (51%) indicated that either they or a member of their household were part of a church/religious group. Others noted were for organisations such as stokvels (13%) and workers unions (4%). Equal proportions of households (1%) stated that they had membership in farmers organisation and sports association. Thirty nine percent of respondents' household members were not part of any social organisations. Membership in such organisations may be considered to form part of household and individual social networks. According to Bodin and Crona (2009), social netwroks and organisations can also contribute to environmental regulation. These social networks have been noted to be useful in the absence of formal institutions to dissiminate information, increase community capacity, promote self-regulation, and mediate conflicts (Bodin and Crona, 2009). The above findings present an opportunity to utilise pre-existing social structures to enhance community partcipation and involvement in environmental management initiatives.

Table 5.9: Household employment status (n=270, in %)

Employment status	%
Children/students	41
Employed	16
Self-employed	3
Unemployed	35
Medically boarded	1
Pensioner/retired	4

Expanding further on respondent's household demographics, *Table 5.9* is a summary of the various employment status of individual household members. A noticeable proportion of respondents' household members (41%) suggested that they were either children or students, retired (4%) and medically boarded (1%) and thus could not be considered as economically active members of the household. Further inspection of respondents' household vulnerability indicates that 54.1% of responses on household members' employment status fall within the economical active categories (18-59 years of age). Additionally, 35% of the respondents had household members that were unemployed, which raises concern over the household security. Results indicate that 16% of respondents' household members were employed, while a smaller proportion of 3% were self-employed. These results suggest that unemployment is a critical concern for the Buffelsdraai community and highlights the need for interventions that target sustainable job creation. In comparison, 81% of respondents' household members can be considered economically inactive (children/students, medically boarded and pensioners/tired),

resulting in a dependency ratio of 1:4. This is concerning and suggests that households within Buffelsdraai experience high levels of vulnerability.

Table 5.10: Responses on sources of household income (n=270, in %). Multiple responses permitted

Sources of household income	%
Formal employment	62
Small business/informal trading	16
Sale of trees/seedlings	2
Sale of agricultural produce	1
Remittances	4
Old age pension	16
Child grant	62
Disability grant	6

Sixty two percent of the respondents suggest that households derived their incomes from formal employment, equal proportions of responses (16%) on households suggest that they obtain incomes from small business and old age pensions. Other responses noted disability grants (6%), remittances (4%), sale of tress/ seedlings (2%), and the sale of agricultural produce (1%) as sources of household income. These results show by respondents (84%) indicate that households relied on government aid (child grants, old age and disability pensions) as a source of monthly income. These results are disconcerting and highlights an unsustainable reliance on the state for livelihood support.

Social welfare grants are crucial for the considerably more vulnerable individuals within the household, with a quarter of the South Africa's population receiving these grants (Patel, 2012). Within the SL framework, a household's ability to engage in diverse activities is shaped by assets and capitals which are possessed within various household members (Babulo *et al*., 2008). The lack in various capitals is perceived to be a barrier as this restricts the ability of households to pursue and diversify their activities which contribute to livelihood strategies (Babulo *et al*., 2008).

Table 5.11: Responses on monthly household income (n=270). Multiple responses permitted

Source of income	Average amount (in Rands)
Formal employment	R1836.89
Small business/informal trading	R184.07
Sale of trees and seedlings	R27.41
Sale of agricultural produce	R6.04
Remittances	R26.30
Old age pension	R241.56
Child grant	R457.11
Disability grant	R76.15
Mean total	**R2855.53**

In terms of estimating average household monthly income, the data revealed that across the sampled households, the mean total monthly income was calculated to R2855.53. From the various sources of income, formal employment contributed the most with an average estimate of R1836.89, followed by small business/informal trading with an average estimate of R184.07. In total, state welfare such as pensions, child and disability grant, contributed a combined average income of R774.82. Other sources of household monthly income such as remittances averaged R26.30 with the sale of trees and seedlings equating to R184.07, and the sale of agricultural produce contributing an estimated R6.04. Estimating annual household income based on the above findings would equate to an average annual household income of R34 266. 36. In comparison, census data reveals the KZN average annual household income to be at R83 053 (SSA, 2011).

For instances where formal employment contributed to household income, 23% of respondents' household members stated that the monthly income range was between R3001 to R4500, and 22% indicated that the household receives less than R1500 from formal employment. In relation to the contribution of small business/informal trading, data indicates that for 84% of respondents' households, there was no form of small business or informal trading to supplement household monthly income. Of those households which did supplement their income from small business/informal trading, 13% of responses suggest household received less than R1500, and one percent between R1 5001 to R3 000. The above figures indicate that small business/informal trading is not a major contributor to monthly household income.

Other sources of household monthly income were included, however, these only contributed less than R1 500 to monthly income. These sources were the sale of trees and seedlings (2%), sale of agricultural produce (1%), and remittances (4%). Remittances are considered to contribute to private household welfare by providing financial capital which is often utilised to mediate challenges associated with poverty (Gupta *et al*., 2009). The source of remittances is commonly provided by household members who have a relatively higher economic status than their family to whom they transfer this capital to, and assist in supplementing costs associated with education and nutrition (Gupta *et al*., 2009).

With regards to those households which depended on state welfare as a source of household monthly income, 13% of respondents' households suggested that they received less than R1 500, and three percent between R1 501 to R3 000 from old age pensions. Child grants were another source of household monthly income with 60% of respondent households receiving less than R1 500, and two percent between R1 501 to R3 000. Lastly, five percent of respondents' households received less than R1 500, and one percent between R1 501 to R3 000 from disability grants.
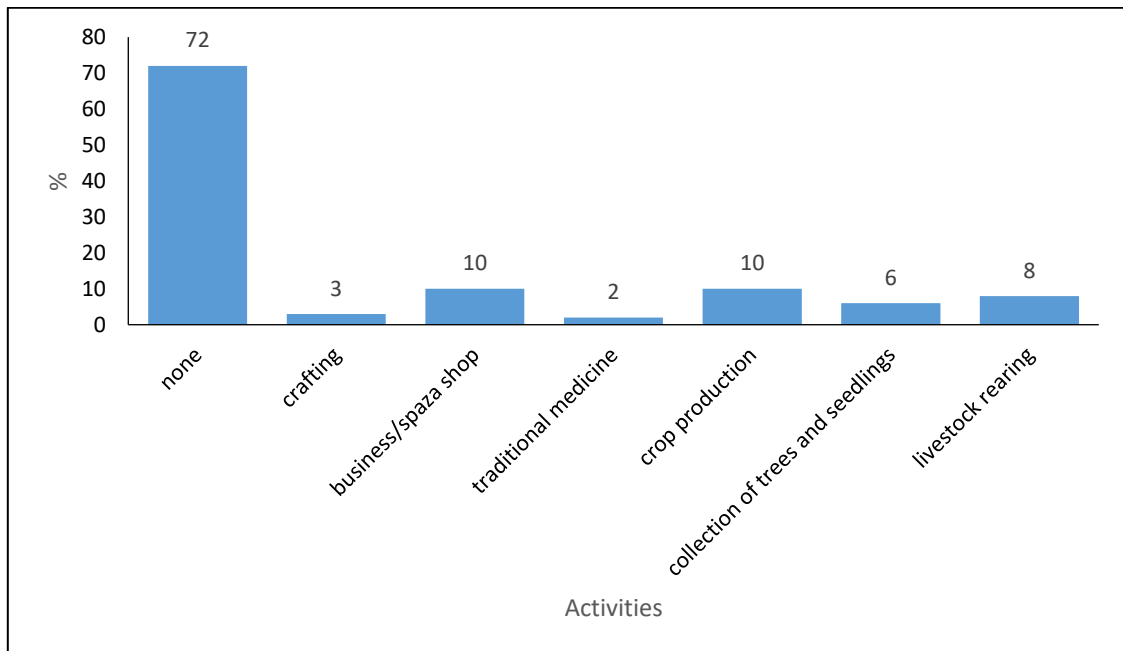
Figure 5.3: Activities taking place on property (n=270, in %). Multiple responses permitted

Households were requested to indicate whether there were any activities which were currently taking place on their property as a means of diversifying their livelihoods. Figure 5. 3 indicates that 72% of households did not engage in any activities on their property. Other households noted enagement in business/spaza shop (10%), crop production (10%), livestock rearing (8%), and collection of trees and seedlings (6%). During the surveying of household respondents, it became apparent that the lack of resources, finance and infrastructural support were the main reasons for the limited livelhiood strategies. One of the household respondents stated that:

"It is difficult for my family to engage in activities on our property because we have very small housing plots and as you can see, my house is built very close to my neighbour. Besides having no space to grow crops the community does not have reliable sources of water. I have to walk far to collect water from the communal tap and on many occasions, there is no water coming out of the taps and that limits the ability to irrigate any crops or vetegables that I could plant".(Respondent 2)

Engaging in agricultural activities has been noted to alleviate hunger and malnutrition through crop production, as well as substitute products purchased at market prices (Crush *et al*., 2011). Collectively, the engagement and diversification of household activities contributes to a households' ability to divise coping strategies in periods of exposed threats and shocks (Paumgarten and Shackleton, 2011). Therefore, it is argued that a lack of diversification of livelihood activties translate to increased vulnerability, and an inability to effectively manage household risks and threats (Paumgarten and Shackleton, 2011). In this regard, the limited diversification of livelihoods within the Buffelsdraai community further compounds the current state of community vulnerability. Such findings do however, give an indication in the gap that CBC initiatives can fill through its project design.

During the household surveys, physical household characteristics were noted. Sampled household respondents had a combination of formal (48%), tradiational (30%), and informal (22%) dwelling types (Table 5.12) . Formal dwellings were constructed with brick and cement; traditional dwellings were contructed from a mixture of mud, rocks, thatch and logs, and informal dwelling were commonly contructed from corigated iron and metal sheets, logs and pieces of wood.

Table 5.12: Distribution of household dwelling types (n=270, in %)

Dwelling type	%
Formal	48
Traditional	30
Informal	22

In comparison, the eThekwini municipality (79%), and KwaZulu-Natal province (71.6%) show signifcantly higher levels of formal housing compared to Buffelsdraai (SSA, 2011). Although the data indicates that close to half of the sampled housedholds were formal dwellings, it should be noted that these households were often in a delapidated condition. Also, the proportion of the sampled households residing in traditional dwelling types were higher than provincial (19%) and national (7.9%) figures (SSA, 2011). More concerning, 22% of the sampledpopulation resided in informal dwellings which is comparatively higher than provincial (8.3%) and national (13.6%) figures (SSA, 2011). According to Mafukidze and Hoosen (2009), challenges regarding housing within the country has been linked to backlogs stemming from the apartheid regime. Nonetheless, availability of adequate formal housing emerges a critical concern for the Buffelsdraai community.

In relation to household services and living conditions respondents described sources of energy, water and sanititation. Results indicate that 87% of households had access to electricity, however, 80% of households used fuelwood as well. The utilisation of biomass for meeting energy requirements is considered as health risk and contributes to numerous cases of respiratory disease, with the World Health Organisation (WHO) stating a significant proportion of premature deaths of children under the age of five years is attributed to indoor smoke inhalation (Kaygusuz, 2011). Other noticeable energy sources included candles (67%) and paraffin (44%), and 19% use gas. The above mentioned sources of energy were utilised for a combination of purposes such as cooking, lighting and heating. It should be noted that while modern electrcity was avaialble to households, many engaged in fuel-switching and utilised sources such as fuelwood, paraffin and candles. Given the limited household incomes, affordability of modern, safe and efficient energy sources may be a challenge within the community. Within sub-Saharan African communities, access to energy is crucial to agriculture, health and education, with literature supporting the viewpoint that increased access and energy consumption is amongst the determinants of socio-economic development and growth (Kahsai *et al*., 2012).

Additionally, majority of household respondents (66%) obtained their water from a communal tap or borehole (Table 5.13). Other households relied outside taps (36%), nearby river/ stream (7%), communal tank (4%) and piped water within the dwelling (5%) as their main sources of water. even though earlier results show that 48% of sampled household respondents used formal dwellings, only 5% had access to water within the dwelling. Limited access to safe and clean water for household use places immense restrictions on livelihood strategies and overall qaulity of life.

Table 5.13: Household water facility/supply (n=270, in %). Multiple responses permitted

Facility/supply	%
Piped water (inside dwelling)	5
Outside tap	36
Communal tap/borehole	66
Communal tank	4
Nearby river/stream	7

These results are in stark contrast to both provincial (40%) and national (46%) statistics (SSA, 2011). Comparing these results with Census data, an estimated 22% of households within KZN are reliant on communal taps, and nationally, there are 18% of households utilising communal taps as a source of water (SSA, 2011). Further discussions with household respondents reveal that limited access to water is further compounded by frustrations as communal taps experience occassional, and unscheduled cut-offs during the day which further limits access to piped water. Limited access to safe potable water in South African communities has been linked to the absence of infrastructure such as functional supply, as well as maintence of these supply systems (Karuaihe *et al*., 2014). The challenge of access to potable water is not only resticted to South Africa, as reports by organisations such as United Nations Children's Fund (UNICEF) and WHO indicated that 39% of the sub-Saharan population in 2010 had no access to improved water (Karuaihe *et al*., 2014).

The study also revealed the sanitation facilities which households where equiped with and utilised, with three percent stating that there wasn't any sanitation facility within the household. There were households equiped with a flush toilet, however these only accounted for six percent of the sampled households, which is drastically low given that 57% of households wtihin the country have flush toilets which are connected to a sewarage system (SSA, 2011).

The predominant access to household sanitation were pit latrines (75%) and households employing the bucket system (17%).

Table 5.14: Household sanitation type (n=270, in %). Multiple responses permitted

Sanitation type	%
None	3
Flush toilet	6
Pit latrine	75
Bucket system	17

These results arguably indicate the backlog of sanitation facilities within the community given that at the national scale, 28% of households have access to pit latrines, and two percent adopting the bucket system (SSA, 2011). The above findings highlight some of the many social challenges experienced within poor, peri-urban communities in South Africa.

With regards to the disposal of household waste, 70% of households had their removed by local municipalities. Also, data shows that the remaining households had their waste removed by local communtiy members (3%), burning (24%), and dumping in communal dump sites (18%). Those households which burnt their waste or disposed their waste in communal refuse dump stated that their households were located too far from the nearest collection point which was the Buffelsdraai road, and thus stated they had no access to muncipal waste removal services.

5.3.1. Needs and challenges at the household and community level

The households were requested to list the three major needs and challenges, in oder of priority. A wide variety of needs and challenges were mentioned, however, the results below highlight the most popular of these concerns (Table 5.15). Studies exploring the vulnerability in low and middle income countries have revealed the importance of considering underlying processes and determinants of urban vulnerability (Lankao and Qin, 2011). Amongst the findings is that understanding that the manner in which natural hazards interact with socio-economic factors influence the context of vulnerability, identify trends in social marginalisation, and reveal differences in household accessibility to necessary resources for adaptation (Lankao and Qin, 2011).

Table 5.15: Needs and challenges at the household level (n=270, in %).

Needs		Challenges	
	Rank		**Rank**
Housing	1	Unemployment	1
Employment	2	Water	2
Water	3	Food insecurity	3

Results indicate that, the three most important needs were housing, employment and water supply. Further discussions revealed that housing was ranked as a proirty because, at the time of the survey, the majority of repondents resided in traditional or informal dwelling structures. Those who resided in formal dwellings added that the conditions of these structure were also of poor quality. One respondent said:

"..the house is built with concrete and has a roof but most of the structure is falling apart. I cannot afford any materials to maintain the structure". (Respondent 15)

In relation to challenges experienced at the household level, the key challenges in rank of priority included unemployment, lack of access to reliable water supply, and food insecurity. Concerns over employment opportunities were unsurprising given the high levels of unempolyment among respondents and other household members, discussed earlier.

Table 5.16: Needs and challenges at the community level (n=270, in %).

Needs		Challenges	
	Rank		**Rank**
Housing	1	Crime	1
Clinics	2	Unemployment	2
Road works	3	Housing	3

At the community level, the highest ranked needs included the provision of adequate housing, establishment of clinics within the community and road works. The need for housing stems from previous responses of repondents' dissatifaction with their current living conditions, and this dissatisfaction was considered an important matter to address at both the household and community level. Lack of health care facilities such as clinics were advocated for as respondents perceived that the cost and effort of gaining access to healthcare were considerably high for those residing within the community:

"There are no clinics or hospitals in the community and when our childeren fall ill, a nearby clinic is only in Verulam. Its difficult to take our children there because the town is too far to walk to and the taxis that are available to transport us to the town are unaffordable, especially to those of us who do not have jobs" .(Respondent 41)

Other needs deemed to be pertinent included the provision and maintaince of road networks. This is further evidenced by:

"When there are heavy rains the roads are inaccessible for those of us who have cars. The roads become very muddy and my car struggles to get up the hill where I live. The lack of tarred roads also means that a lot of sand ends up being washed into some of the community members homes". (Respondent 69)

Based on results above, respondents and households within the Buffelsdraai community experience a variety of socio-economic challenges, mostly related to their basic needs. The date revealed high dependency and low income within households which can be attributed to earlier findings of the unemployment levels amongst respondents. The aforementioned household economic status is further compounded by the lack on livelihood diversification and a dependecny on state welfare. Furthermore, limited access to basic services such as water and sanitation and housing conditions reveal the marginalisation of the Buffelsdraai community, with needs and challenges identified by respondents unsurprisingly linked with employment and basic services.

5.4. Conceptualisation of key environmental concepts

The following section unpacks respondent conceptualisation of the three key and scientific concepts, namely conservation,biodiversity and climate change. The manner in which respondents conceptualise and relate to conservation reveals levels of awareness, understanding and use of indigenous terminologies to describe conservation practices which can influence the way in which such projects are implemented. With the increased realisation that conservation projects ought to involve local communities, there is a need to understand the attitudes and perceptions of local community members (Tomicevic *et al*., 2010).

Table 5.17: Respondents awareness of environmental concepts (n=270, in %)

	Climate change	Biodiversity	Conservation
Yes	51	20	28
No	49	80	72

In unpacking the conceptualisation of key environmental concepts, respondents were asked to state if they were aware of environmental concepts, specifically climate change, biodiversity and conservation. Less than half of the respondents (49%) were unaware of the concept climate change. Additionally, a large proportion of respondents (80%) were unaware of the term biodiversity. Moreover, a significant proportion (72%) of respondents were unaware of the term conservation. Further analysis of the data revealed that the awareness of climate change, conservation and biodiversity was significantly different when compared against levels of formal education, (Likelihood ratio test *p=0.001*). As such, it is observed that there are low levels of awareness of key environmental concepts amongst respondents.
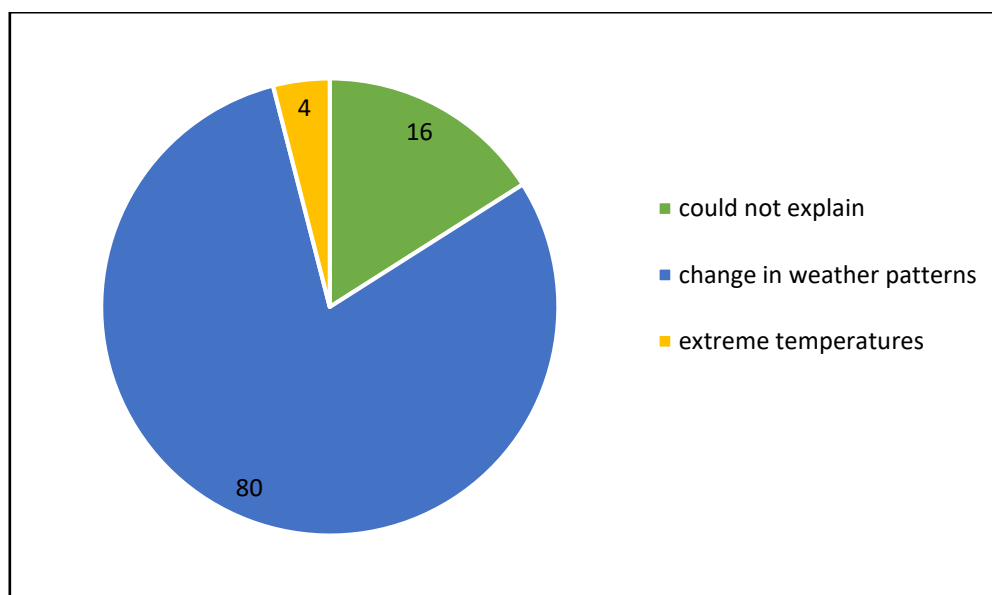
Figure 5.4: Respondents meaning of the term climate change (n= 137, in %)

A comparable proportion (51%) of respondents had stated that they were aware of the term climate change, and of those respondents, a significant proportion (80%) related the term to changes in weather patterns. A relatively low proportion (4%) of respondents related the term to extreme temperatures while 16% of respondents could not explain what the term meant.

With regards to how often respondents have heard of the term, 47% stated often, 27% very often and 26% seldom hearing of the term. Ambiguities regarding the definition of climate change ought to be addressed for those outside the scientific community, as this enables public understanding for policy and legal frameworks implemented to address climate related challenges (Brace and Geoghegan, 2010). Interestingly, respondents' understanding is closely aligned with the scientific concept of climate change as revealed by their interpretations that climate change is linked with alterations in weather conditions and patterns.
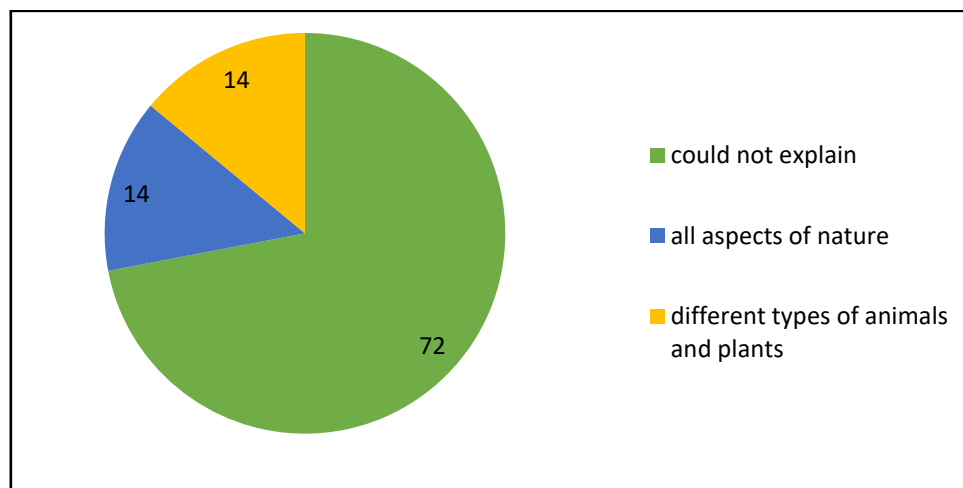
Figure 5.5: Respondents meaning of the term biodiversity (n=54, in %)

In relation to biodiversity, 72% of these respondents could not provide an explanation of the term (Figure 5.5). The minority of these respondensts (14%) stated that biodiversity refers to the different types of animals and trees, with an equal proportion of respondents (14%) stated that the term relates to all apects of nature. Although a minority, respondents' understanding of the concept is associated with concepts of biodiversity. Of particular concern however, is the majority of respondents who are unable to provide an understanding of the concept biodiversity. Coupled with the overall low levels of awarness of the concept, it is apparent that there is a gap in knowledge which needs to be addressed witin the community.
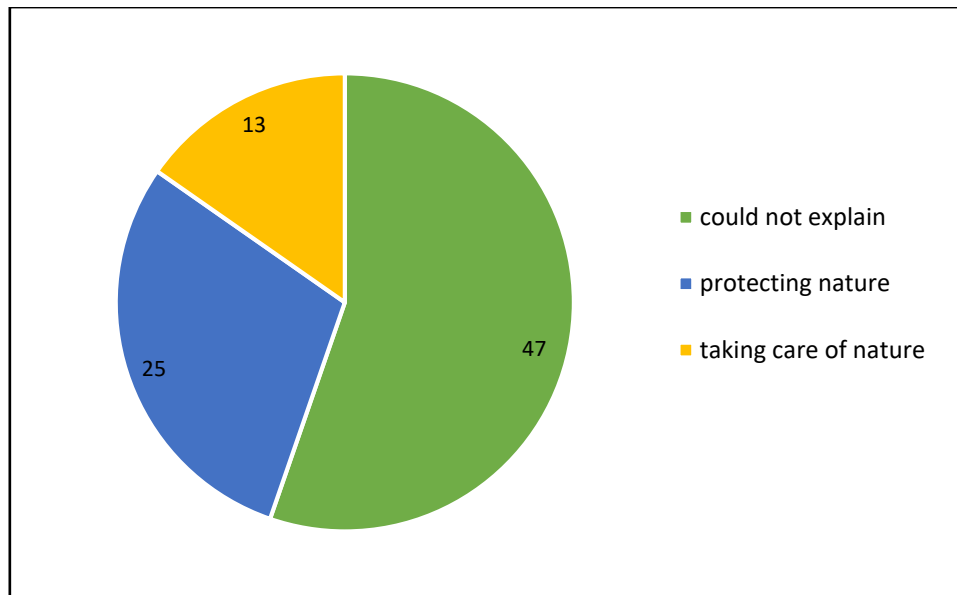
Figure 5.6: Respondents meaning of the term conservation (n=76, in %)

Most of these respondents could not provide an exact definition of the concept conservation (47%), while the remainder stated that conservation was the process of protecting (25%) and taking care of nature (13%). As observed with other concepts probed in this study, respondents' understanding is closely aligned with core of conservation practices. However, the majority of respondents were unable to explain what the concept is, despite indicating their awareness of the term. The inability of respondents to explain their understanding of the concept of biodiversity is an important finding, and suggests that exposure to scientific concepts may not necessarily equate to awareness. An outcome of community-based initiatives, such as the Buffelsdraai reforestation project should thus focus on targeting specific gaps in knowledge as revealed in this study.

The study probed for alternative indigenous terminologies which respondents related to the term climate change, with 30% (*n=137*), of respondents stating they could not provide an indigenous term for climate change. However, a comparable proportion (50%) provided phrases such as *ukushintsha kwesimo sezulu, ukuguquka kwezulu* (16%), and *amazing okushisa* (4%). These isiZulu alternatives relate climate change to changes in weather conditions as well as temperature. Thus, there is a close relation of indigenous terminology used within the community, and the various impacts of climate change. Language is a crucial tool which is often utilised to anchor unfamiliar concepts such as climate change into already existing knowledge and linguistic constructs (Whitmarsh *et al*., 2011). The use of the phrases above

can assist in making scientific knowledge more digestible, especially when encouraging community participation and sensitisation.

Similarly, respondents were asked if they were aware of a local/indigenous term which can be used as an alternative to the word of biodiversity, or implied and had the same meaning as the term biodiversity. The two most commonly used isiZulu words were *imvelo* (17%), and *indalo* (13%) (*n=54*). Documenting local indigenous knowledge not only results in the establishment of communication between local communities and environmental protection agents, but also allows for scientific studies to be embedded within realities of the communities they engage with (Brook and McLachlan, 2008).

Respondents also provided indigenous terminologies which are associated with the term conservation. The commonly used indigenous terminologies were *ukunakekela kwemvelo*, and *ukuvikela kwemvelo*. Other less know and utilised terminologies included *ukugcinwa kwemvelo*, *ukulondoloza kwemvelo*, and *ukongiwa kwemvelo*. These indigenous terminologies can be closely related to the term conservation, as the English translations are associated with the protection and preservation of nature. Indigenous knowledge has been recognised as a complimentary tool for biodiversity conservation and enshrined in international policy frameworks such as the UNCBD (Charnley *et al*., 2007). According to the UNCBD (cited in Charnely *et al*., 2007: 16), indigenous knowledge and practices which are related to the conservation of biodiversity need to be respected, preserved and applied. The use of indigenous terminology in community-based initiatives could allow for improved communication between stakeholders and facilitate easier uptake of scientific terminology. Studies show that language may also be a barrier for communication in community-based projects, and could restrict consultation and participation.

Table 5.18: Sources of information for environmental concepts (in %). Multiple responses permitted

	Climate change	Biodiversity	Conservation
Information source	**n= 137**	**n=54**	**n=76**
TV	45	37	36
Radio	56	37	33
Newspaper	19	15	17
School	51	46	55
Wildlands	10	9	14
Municipality	4	4	5
Friends/family	12	6	16
Pamphlets/brochures	2	-	1

The most common sources of information respondents had heard or read about the term climate change were mainly radio (56%), school (51%), and television (45%), while other noted sources included newspapers, friends/family (12%) and Wildlands representatives (10%). The least common sources included pamphlets/brochures (2%) and municipal representatives (4%. Although it is recognised that information sources can contribute to increased awareness and the dissemination of knowledge, there are limitations to how these sources can influence attitudes and behaviour (Lorenzoni and Hulme, 2009). Instead, emphasis should be given to the sources of information and the manner in which individuals are able to engage with this information (Lorenzoni and Hulme, 2009). Collectively, the data reveals that mass media such as television, radio and newspapers are the most common and dominant information platforms. Mass media shapes public conceptualisation of climate change and although these sources are able to increase understanding, there is also the possibility of mass media perpetuating misconceptions (Vainio and Paloniemi, 2011). It is crucial that when identifying suitable platforms to disseminate knowledge within the community, CBC initiatives should not only use popular platforms such as televisions and radio, but also incorporate sources of information which provide an opportunity for community members to critical engage with the information.

This study further identified the most common sources of information from which respondents had read or heard of the term biodiversity. Schools (46%), television (37%) and radio (37%) were the most popular platforms indentified by respondents. Other noticeable sources included newspapers (15%), NGOs (9%), municipal respresentaives (4%), and friends and family (6%). Identifying sources of information enables conservation authorities to target multiple channels as a means of communication, consultation, and dessimination of information (Witzling *et al*., 2015). The use of multiple information platforms can improve the flow of information to local

communities, especially when communicating aspects related to environmental awareness, and undersatnding individual-level impacts of environmental change. Respondents elaborated on their main sources of information for the term conservation. The most common source of information were schools (55%), television (36%), and radio (33%). Smaller groups cited is newspapers (17%), family and friends (16%), Wildlands Conservation Trust representatives (14%), the eThekwini Municipality (5%), and pamphlets/brochures (1%). Understanding main sources of information are key in identifying suitable platforms for the dissemination of information in future projects.

5.4.2. Perceptions towards biodiversity protection and conservation

Respondents shared their perceptions of who should be responsible for the maintenance, protection and conservation of biodiversity and the natural environment (Figure 5.7). The majority of the respondents (66%) stated that the eThekwini municipality should be the responsible agent to address such issues, with respondents arguing that since the municipality is charged with the delivery of social services, it should therefore also assume responsibility to addressing environmental challenges. Respondents also perceived the municipality to be closer to the community than national government and therefore more aware of the social challenges experienced by local communities.
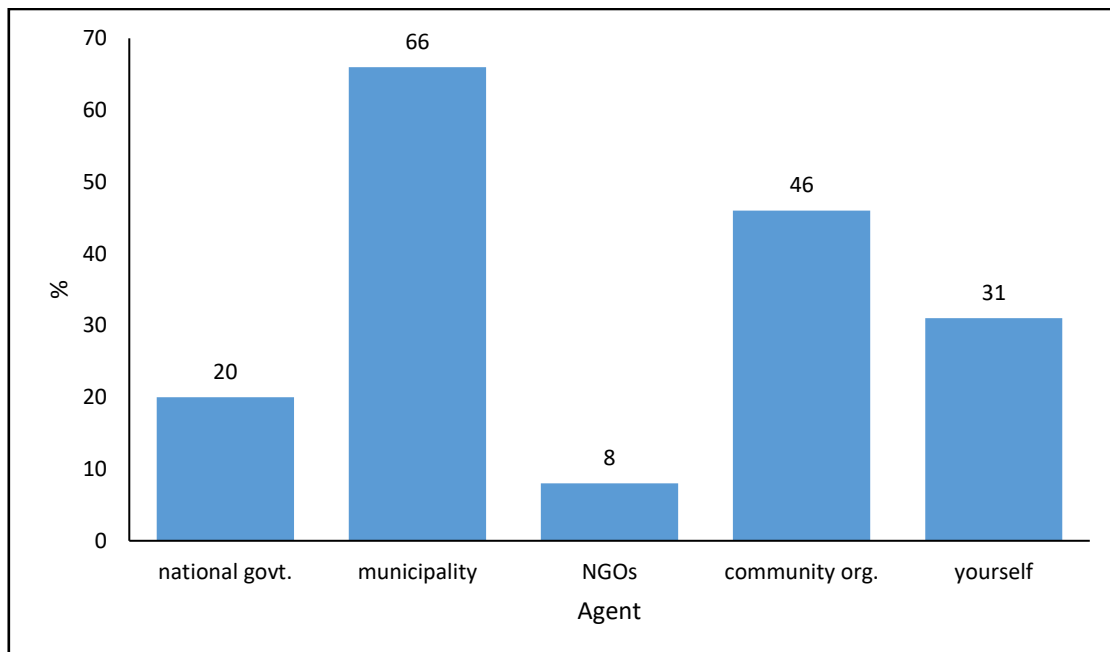
Figure 5.7: Perceptions of who should be responsible for biodiversity protection and conservation (n=270, in %). Multiple responses permitted

Although the global trend of neo-liberalisation has resulted in the reduced involvement of state authorities in environmental protection, they are still considered a crucial agent (Reed and Bruyneel, 2010). Other agencies identified included community organisations (46%). Some respondents shared that community-based organisations are better equipped with addressing these challenges due to their understanding and experiences of the local socio-economic dynamics. Although there were clear preferences for addressing environmental challenges, a noticeable proportion (31%) of respondents felt that they themselves are responsible for addressing environmental challenges. Respondents explained that as community members, it is their responsibility to address challenges within the areas they reside in. Other respondents had also stated that they would rather assume personal responsibility rather than being dependent on other agencies:

".. a community organisation should be responsible to address environmental challenges because to a certain level, we as community members should play a role in solving our own problems and issues. We cannot always expect the municipality or national government to solve all our problems. But our ability to solve environmental issues also depends on how much support we receive from the municipality and government as I believe we lack the necessary knowledge and skills to help ourselves". (Respondent 134)

Additionally, another respondent stated:

"It think it is very important for individuals to take on the responsibility to address issues that affect them. As the head of my household, my duty is to solve the challenges faced by my family, and that also means that as a member of this community, it is also my duty to address environmental challenges as these can cause other issues for my family. There are some challenges in life that cannot be solved for me, so that means the responsibility passes down to me as an individual". (Respondent 204)

As indicated the responses above, respondents revealed their willingness to be part of a solution to environmental issues within their community. This suggests potential for community-involvement in environmental management strategies. Within developing countries, there has been an increased trend of community-based organisations (CBOs) facilitating environmental management initiatives (Tukahirwa *et al*., 2010). In their capacity, CBOs may develop

partnerships with governments or private sector actors, supplement government activities, as well replace the traditional functioning of government structures (Tukahirwa *et al*., 2010).
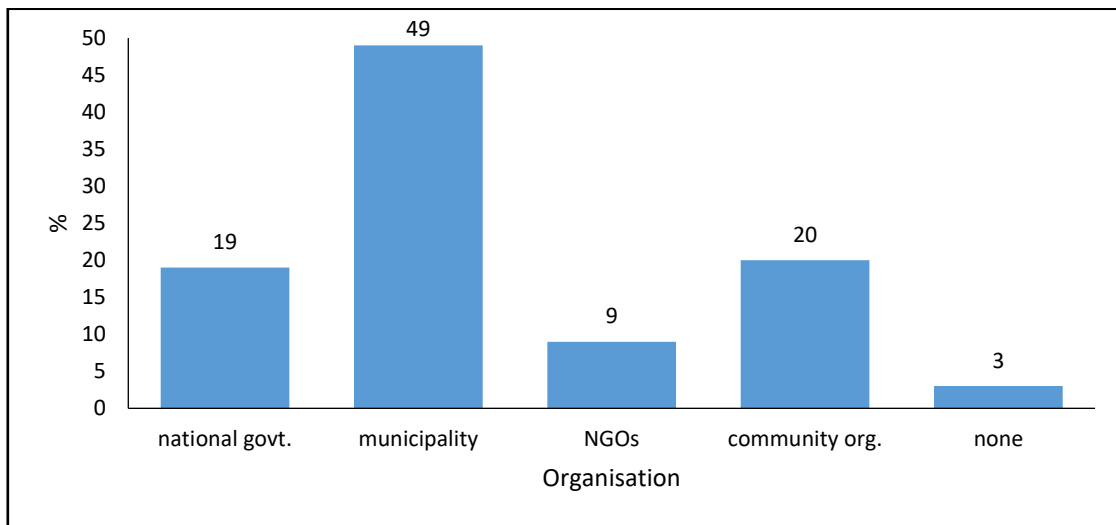
Figure 5.8: Respondents perceived trust in organisations (n=270, in %)

According to Winter and Cvetkovich (2010), the trust that the public has in various natural resource management organisations can influence engagement in conservation and shape environmental behaviour. In this regard, forty nine percent of respondents indicated that the eThekwini municipality is the organisation they trust the most, 20% trusted community organisations, 19% trusted national government, and three percent trusted neither of the organisations. The reasons provided in discussions with respondents of their trust in the municipality were closely linked to similar arguments made by respondents as to why the municipality should be the responsible agency to address environmental challenges. Trust was built on the municipality being responsible for service delivery and having prior experience in addressing other social challenges within the community. Other organisations listed included community organisations (20%), national government (19%) and non-government organisations (9%). The data revealed that there was a statistical difference between respondents perceived responsibility for organisations to protect and conserve biodiversity, and the level of trust in national government (Likelihood ratio test, *p=0.001*), the municipality (Likelihood ration test, *p=0.001*), and community organisations (Pearson chi-square test *p=0.001*).

It is argued that insider-outsider dynamics have a significant impact on relations with local communities, as well as the processes of consultation. Similar to earlier assertions, it is evident

that some respondents displayed more trust in stakeholders that could identify with and/ or understand their lived experiences and local socio-economic contexts.

"I would trust a community organisation because it would be formed by people from the community who I share a common problem and goal with. If there was an issue of pollution in the river, I believe that a community organisation would react quicker as all of us in the organisation would work very hard to solve the problem since it affects most of us". (Respondent 118)

It is also interesting to note that NGOs were the least trusted organisation amongst respondents. For example, one of the respondents stated that:

"I wouldn't trust an organisation from outside the community because these NGOs come here and think they are smarter than us, yet they have no understanding of the community dynamics and challenges we face". (Respondent 150)

Further arguments stated that external organisations were 'outsiders' to the community and were not knowledgeable of community dynamics, and would impose their authority rather than establish a partnership with the community. Such perceptions of outsider/insider dynamics thus warrant careful consideration when identifying collaborative partnerships in launching CBC initiatives.

Table 5.19: Respondents elaboration for the need of conservation (n=261, in %)

Reasons for conservation	%
Provisioning of goods and services	69
Aesthetic value	3
Ecosystem integrity and functioning	20
Knowledge and use for future generations	8

In an attempt to understand community level perceptions, the survey probed respondent perceptions of the need for conservation. Results show that the majority (96%) felt that conservation was necessary. The reasons for this are listed in Table 5.19, above. Most respondents (69%) stated that conservation was necessary to ensure the provisioning of ecosystem goods and services. Smaller proportions of respondents highlighted ecosystem

integrity and function (20%), use for future generations (8%), and aesthetic value (3%) as the main reasons for conservation. One respondent elaborated:

"If we as community members don't protect the resources we depend on; we are at risk of losing the environment that provides for our families" (Respondent 207)

Although respondents displayed limited awareness of scientific concepts such as biodiversity and conservation, there were still positive responses towards the need to conserve the surrounding biodiversity which can be built upon by conservation authorities as a means to motivate and communicate the desired outcomes and associated trade-offs of conservation projects (Imran *et al*., 2014). It's necessary to highlight that respondents acknowledged species co-dependence within natural systems, and more importantly, a loss of environmental resources will influence their well-being. These respondents eluded to the assumption that without conservation, biodiversity would decrease and result in a collapse of certain ecosystem functions, and reduce ecosystem integrity. Such responses concur with the fact that ecosystems produce functions that are independent of human benefit (Daniel *et al*., 2012). Although respondents displayed limited awareness of the concepts, they did recognise the uses of environmental components and the need for conservation and biodiversity. More importantly, respondents understood the linkages within ecological systems and that their livelihoods are depended on environmental goods and services.

Table 5.20: Respondent elaboration against the need for conservation (n=9, in %)

Reasons	%
too much has already been lost	11
not too important for livelihood	45
fear it will restrict use of resources	22
dealing with poverty is more important	22

Respondents that did not recognise a need for conservation also shared their reasons (Table 5.20). Forty five percent of these respondents stated that conservation was not linked to their livelihood and therefore did not see the need for it. Equal proportions (22%) stated that conservation will restrict access to resources, and they are dealing with more important social challenges, such as poverty therefore did not recognise the need for conservation. While a smaller percentage (11%) stated that there was no point in conservation because the environment has already been significantly damaged. As depicted in the results above, the

need to address socio-economic challenges may overpower conservation, especially within poor and low-income communities. One respondent shared:

"There are far more important issues that need to be addressed in our community than to protect animals and trees. We are faced with issues of poverty on a daily basis and government funds should be directed towards communities like ours rather than the protection of the environment" (Respondent 178)
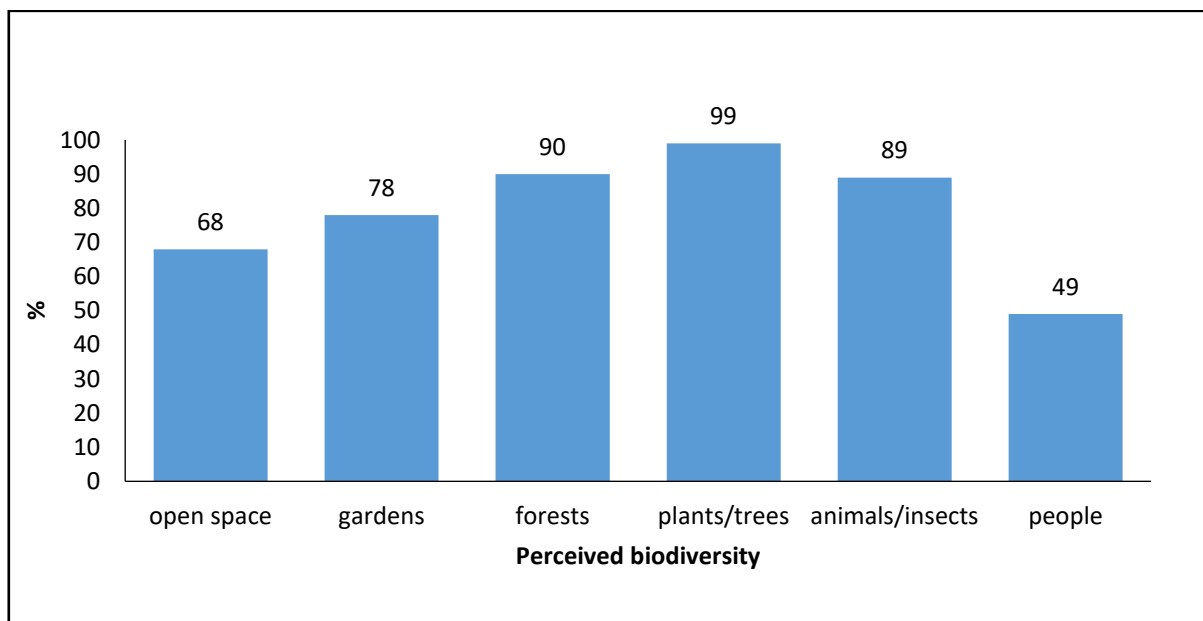
Figure 5.9: Respondents perception of biodiversity within their surrounding area (n=270, in %). Multiple responses permitted

As part of providing understanding of how individuals conceptualise their natural surroundings, respondents were asked to identify aspects within their surrounding area which they perceived to be a part of biodiversity (Figure 5.9). Almost all the respondents (99%) had identified plants and/ or trees as part of biodiversity, followed by forests (90%), and animals and/ or insects (89%). Household gardens (78%) and general open spaces (68%) within the community were also considered to be a part of biodiversity, as well as 49% of respondents perceiving people living within the community as part of biodiversity. These perceptions align with the scientific definitions and concepts related to biodiversity. Once again, even with limited awareness of the scientific term, most respondents were able accurately conceptualise different aspects of biodiversity in their descriptions. This shows that respondents did show some understanding of the concept.

5.4.2.1. Respondents evaluation of the natural environment

The following examines respondents' rank of importance of spaces within their community that they perceived as part of nature. Other aspects explored were the value respondents placed on the natural environment, including but not limited to aesthetic, economic, cultural and subsistence values.
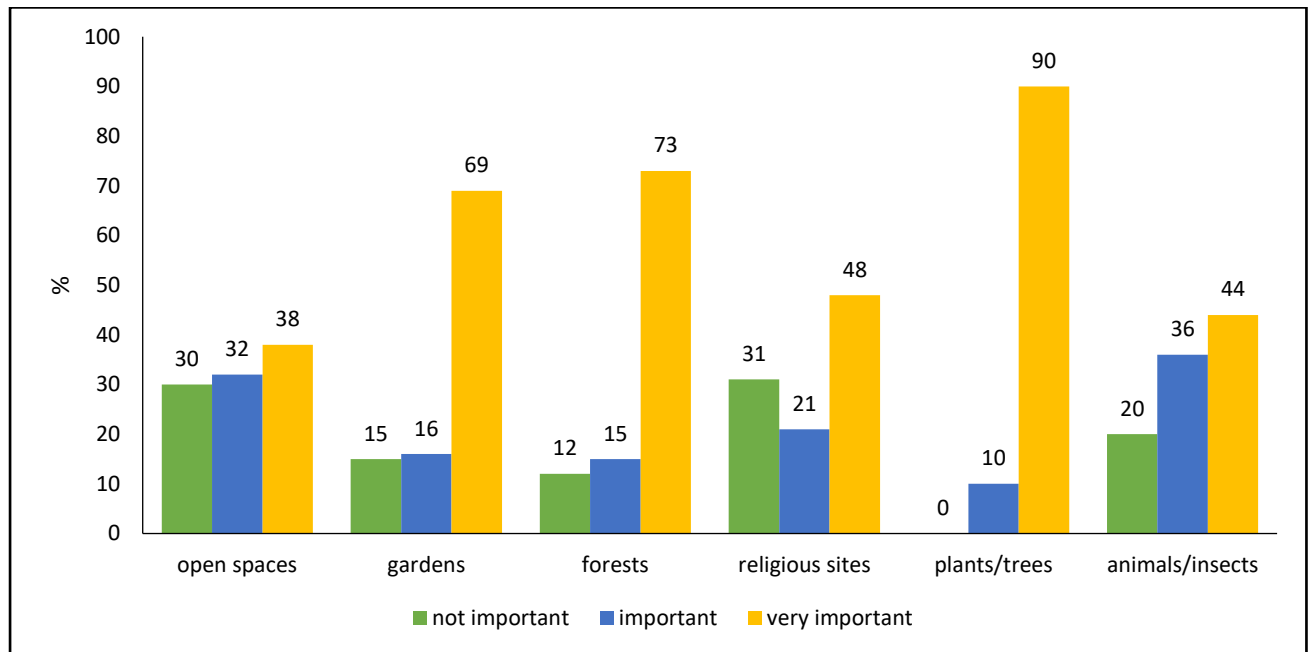
Figure 5.10: Respondent ranking of the importance of green spaces in their surrounding (n=270, in %)

Thirty percent of respondents stated that they do not consider open spaces to be an important aspect of the natural environment. Almost equal proportions of respondents indicated that open spaces were important (32%) and not important (30%), while other respondents noted that open spaces were very important (38%) components of nature. One respondent shared:

"The open space of land surrounding the community is not important for me because it is currently vacant and produces no benefit for myself or the community. I would like to see the land be converted for agricultural purposes so that community members have the opportunity to have land to grow crops which we could sell or use for subsistence purposes." (Respondent 182)

It can be argued that the value, as perceived by local communities, of natural spaces is based on utility. More importantly, as reflected above, individual subsistence needs and utility of

natural spaces may overpower perceived ecological importance. This is concerning as it could be a barrier to the acceptance and support of CBC initiatives which restrict community utilisation of the natural environment. Additionally, it suggests that projects such as the Buffelsdraai project need to convey the importance of restoring the natural landscape surrounding the community, and link the contribution of ecological resilience to the provisioning of ecosystem goods and services for household livelihoods

The majority of respondents (69%), considered their gardens to be a very important aspect of nature, while 16% perceived it to be important, and 15% considered gardens to be unimportant. The proportion of respondents who perceived gardens to be very important cited that their gardens provide both tangible and intangible benefits. For example:

"My garden is very important because I can plant and grow vegetables that we can eat and this reduces the costs of having to spend money buying vegetables at supermarkets that are expensive. Besides my garden providing me with food, it is also fulfilling to have plants in my garden that help make my surrounding environment more appealing since the community as a whole lacks beautiful spaces." (Respondent 212)

Evidently, the value respondents associated with gardens was influenced by utility, and aesthetic appeal. Other aspects of nature which were ranked include forests, with 73% of respondents stating the forest as very important, 15% perceiving the forest as important and 12% indicating the forest as not important:
"The forest provides fuelwood which we use for cooking and heating and it is where we can also get trees which we use as materials for building our houses." (Respondent 225)

As noted earlier, respondents have assigned a utilitarian-based evaluation to forests which has influence their rank of importance. Although forests are considered highly important, respondent perceptions are influenced by extraction and utilisation, rather than the ecological functions that forests provide. This finding indicates the challenges faced for CBC initiatives where conservation objectives are in conflict with local community utilisation of ecosystem goods.

Religious sites within the community were also included as part of the rank of importance of nature, with 48% of respondents stating their natural surroundings are very important for

religious practices while 21% deemed these spaces important and 31% considering that religious sites are not an important part of nature in the community. A considerably large proportion (90%) of respondents perceived plants and trees as very important aspects of nature and 10% deeming them as only important. The data reveals substantially high levels of importance on plants and trees as respondents indicated a variety of benefits they derive directly and indirectly:

"Plants and trees are very important for myself and my family because we obtain edible fruits that grow on trees. Also, we are fully aware that it is the trees and plants that provide us with clean air that we breathe and without them, we believe we wouldn't be alive as all humans need air to be alive." (Respondent 235).

It has been noted that trees fulfil a wide range of tangible benefits such as nutrition and income, as well as intangible benefits associated with culture and spirituality (Shackleton *et al.*, 2008). A study by Davenport *et al.* (2011) found that within three towns in South Africa, an estimated 70% of households harvested tree products for use value (Kaoma and Shackleton, 2014). Lastly, animals/ insects were also considered in the rank of importance, and the data revealed that 44% of respondents believed animals and insects to be very important, 36% perceiving them to be important and 20% perceiving no importance of animals and insects as part of nature in the community.
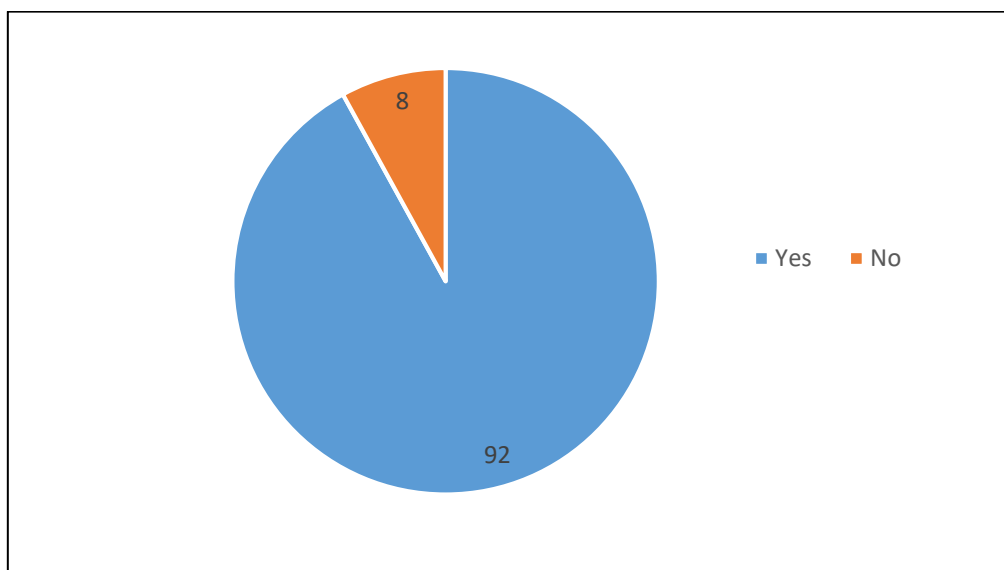
Figure 5.11: Respondents perception on the importance of Biodiversity (n=270)

This study also attempted to determine respondents' perception on the importance of having many different types of plants and animals within their environment, and a vast majority of respondents (92%) stated that it was important to have many different types of plants and animals. This finding indicates a positive sign that respondents are aware of the importance of biodiversity. The reasons for the associated importance are listed in Table 5.21.

Table 5.21: Respondents elaboration on the importance of different types of plants and animals (n=252, in %)

Reasons	%
Source of subsistence	50
Aesthetic contribution	8
Future generations	3
Sustaining ecosystem functions	39

Fifty percent of respondents stated that having many different types of plants and animals was important as these serve as a source of subsistence for their livelihoods. Thirty-nine percent of respondents stated that having many different types of plants and animals was important to sustain ecosystem functioning, as they perceived an absence of a variety of plants and animals would disrupt the balance of their natural environment. It's important to note that these reasons were not linked with direct human consumption or utilisation. Rather, respondents perceived that their natural environment consisted of networks in which animals and plants depend on one another, and that an increased diversity of plants and animals contributes to ecosystem functioning:

"I believe that it doesn't take a person to be highly educated to know that there is a link between plants and animals. As humans we depend on plants and animals for our survival, so to do plants and animals depend on one another to survive. These plants and animals contribute to a functioning environment and I believe anyone can tell you that if there is less of something in any kind of system, that system will not function properly. So the more there are different types of plants and animals in our environment, the better for the environment to keep functioning." (Respondent 193)

Other reasons for the importance of having different types of plants and animals included an increase in diversity could contribute to the improved aesthetic appeal (8%) and use for future generations (3%). These elaborations included the need for future generations to also have an opportunity to share in the value and knowledge of the environment:

"I remember that when I was a child, my father would show me and tell me about the different types of plants and animals that we would see. From that experience, I was able to have more knowledge about my surrounding environment and I would like to pass on that knowledge to my children so that they also have the opportunity to learn about the environment". (Respondent 21).

The aforementioned is important as it reveals the cultural values that respondents associate with nature. Additionally, the need to conserve nature for future generations can be fostered in CBC initiatives which seek to ensure the long-term support of project benefits that may not necessarily be attained by the current generation. Moreover, such findings indicate an opportunity for initiatives such as the Buffelsdraai project to build on intangible benefits of the project.

Conversely, for those respondents (*n=18*) who did not consider having many different types of plants and animals in their environment as important, 77% stated that not all types of plants and animals are necessary or directly linked with their livelihoods. Rather, respondents argued that it's more important to have those animal and plant species which have a direct link with livelihood benefits:

"It is difficult to state the importance of anything if it does not affect your livelihood. Not all animals and plants provide me with something that I need. For example, snakes are not important to me because I receive no benefit from them. I think it is only important to have different types of plant and animals that we can use to support or improve our quality of life. For example, it would be better to have different types of plants that can grow fruit for us to eat rather than saying that all plants are important". (Respondent 27).

Seventeen percent of these respondents considered that having a diversity of animal and plant species would result in an increased abundance of species which would occupy a larger habitat area. The resultant effect, according to the respondents, would be less land available for housing or agricultural produce, thus directly conflicting with their livelihoods:

"The problem with having different types of plants and animals is that at some point these plants and animals will expand and occupy more land. Eventually we will be told as a

community that certain parts of land are restricted for our use because there is a need to protect them. Currently, we can already see that across the road from the community, where the Wildlands people are growing a forest. I believe that some portions of land should be made available for us as a community to grow crops and help with the poverty we are experiencing. Probably at some point in the future, there will be less and less land available for the community to use and make our current state of poverty worse." (Respondent 12).

The aforementioned shows that nature is also perceived as a competitor for space. Such perceptions can be linked to earlier findings which revealed the socio-economic vulnerability of community members and households. Moreover, this suggests that is becomes increasingly challenging to promote conservation within communities that are faced with issues related to poverty, as socio-economic development remains the main priority amongst community members. This may further limit the acceptance and support of initiatives such as the Buffelsdraai project, and eludes to the need to raise awareness amongst community members that environmental degradation influences their well-being by reducing the availability of ecosystem goods.
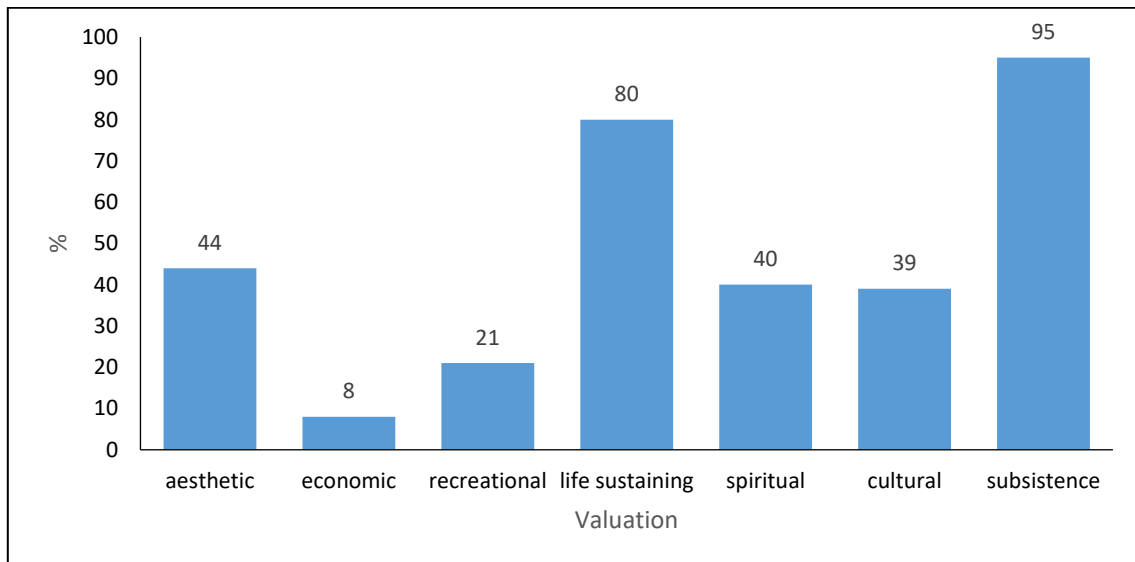
Figure 5.12: Respondents valuation of the natural environment (n=270, in %) Multiple responses permitted

Valuation of biodiversity is determined by the utilitarian function drawn from the natural environment which provides a benefit to the livelihood of individuals (Braat and de Groot, 2012). Examining the manner in which individuals value their surrounding ecology serves as

a tool to provide a cultural projection of the environment which is influenced by social-ecological interactions (Braat and de Groot, 2012). As such, it was necessary to determine respondents' perception of values provided by the natural environment at the individual level. The results indicate that 95% of respondents identify subsistence value in their natural environment. Other noticeable results were 80% of respondents indicating a life sustaining value in which the natural environment produces and renews air, water and soil. These findings build on earlier assertions which indicated a strong utilitarian evaluation on the surrounding natural environment. This suggests that natural capital contributes significantly to community livelihoods, and that community members are highly dependent on their natural environment. Additionally, the life-sustaining value that respondents have indicated presents a foundation on which the Buffelsdraai project can build campaigns to increase environmental awareness within the community.

A comparable proportion (44%) derived an aesthetic value, with 39% of respondents having recognised cultural value in the natural environment. Furthermore, 40% of respondents expressed a spiritual valuation of their natural environment, which was described as a sacred and religious site. The links between spiritual valuation of resources, and their subsequent management has been highlighted at an international scale including the IUCN group on Cultural and Spiritual Values, as well as the WWF program on Faith and Conservation (Cox *et al*., 2013). Evidence of the link between spirituality and resource management was noted through a study of 32 cases across Africa, Asia, Oceania, North America and Australia, which indicated that resources managed through a form of religious governance, had lower rates of degradation compared to those resources excluded from religious governance (Cox *et al*., 2013). Additionally, aesthetic and spiritual values have collectively been noted to influence greater motivation for engaging in environmental protection by creating a sense of stewardship (Novacek, 2008). As noted early, cultural valuation of the natural environment should form part of CBC initiatives as it can promote the intangible benefits that natural environment provides, and can contribute to increasing community support in projects such as the Buffelsdraai reforestation project, especially when financial incentives are limited.

A noticeably low proportion (8%) of respondents stated an economic value to the natural environment. Further discussion, alluded that the natural environment served as a source where respondents derive products for sale and traditional medicine, such as wood and certain plant and grass species. Respondents indicated that the lack of perceived economic value was due to

an absence of markets in which ecological goods could be sold, and the abundance of these goods:

"Our natural environment does not produce goods which we can sell outside or within the community. For example, the available plants and fruits are not in such abundance that they can be harvested and sold." (Respondent 12)

The lack of a perceived economic valuation and absence of a market to sell goods presents a challenge for CBC projects which seek to alleviate poverty and promote local economic development through market based conservation. With particular reference to the Buffelsdraai reforestation project, there is a need to consider broadening the channels for Tree-prenuers which can permit the sale of trees to markets beyond the current project scope.

Lastly, 21% of respondents associated the natural environment with recreational value. However, even though respondents indicated recreational value, there was a perceived dissatisfaction with these facilities:

"We do appreciate that there is a portion in the community where there are things like swings for the children to play on, but you can see for yourself that the level of quality is very low when you compare them to the parks provided for children living in the suburbs. I myself play soccer by the field but the soccer pitch is not being taken care of properly by the municipality. The goal posts have no nets, and the grass is not really suitable to play matches. There are times when we play games against other teams but we do not get enough people to come and watch these games because there isn't any shelter and stands for people to sit and watch." (Respondent 120).

5.4.2.2. Perceived threats to biodiversity
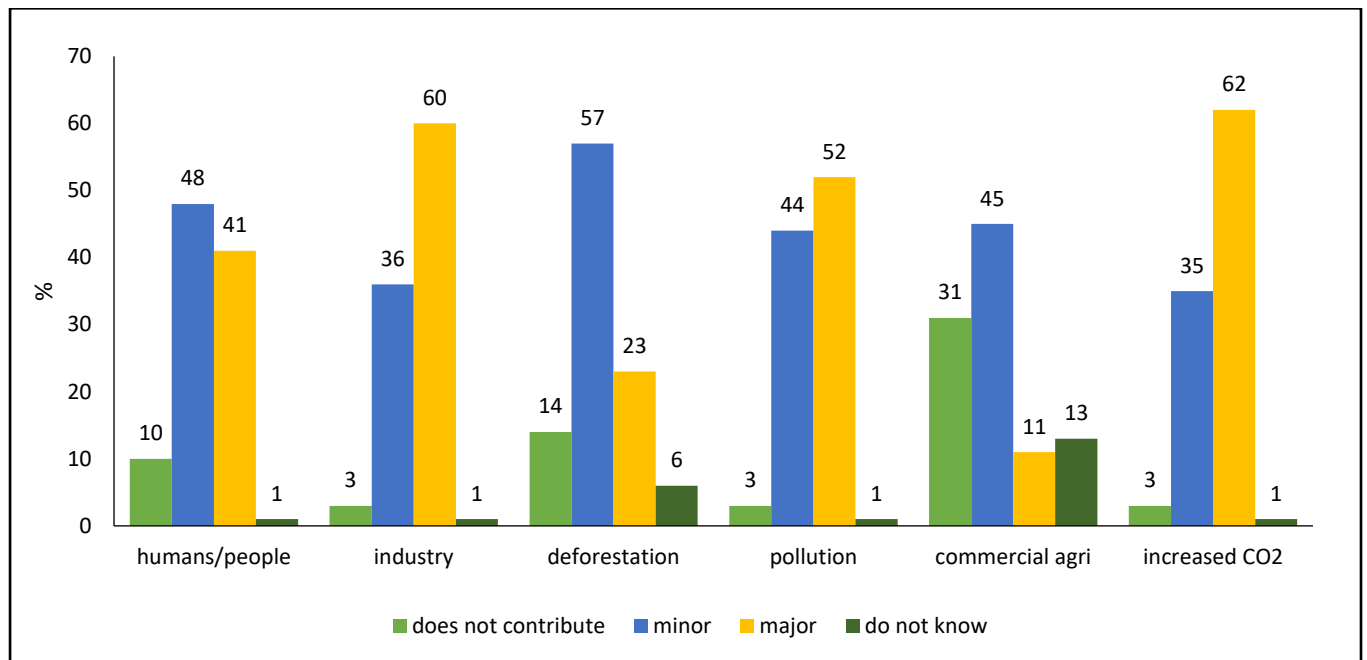
Figure 5.13: Respondents perceptions of the contributors to biodiversity loss (n=270, in %)

Additionally, the study explored respondents' perception to the extent in which various factors contribute to the loss of biodiversity. Forty-seven percent of respondent perceived humans as a major contributor, 45% stated a minor contribution, and seven percent suggested that humans do not contribute to the loss of biodiversity, and one percent were unable to indicate the role of humans in biodiversity loss. Moreover, 40% of respondents identified industry as a major contributor, while smaller percentages felt that industries were either minor contributors (43%), or did not contribute (9%) to loss of biodiversity.

With regards to deforestation, 57% of respondents believed that deforestation was a major contributor to the loss of biodiversity, 38% perceived a minor contribution, three percent stated that deforestation is not a contributor to the loss of biodiversity, and one percent were unable to establish a link between deforestation and biodiversity loss. Amongst the other activities rated, 51% of respondents indicated that pollution was a major contributor to the loss of biodiversity, 46% indicating a minor contribution, three percent stating that pollution is not a contributor, and one percent unable to indicate their perception of the link between deforestation and biodiversity loss.

Focusing on commercial agricultural practices, a noticeable proportion of respondents (29%) indicated that these practices do not contribute to the loss of biodiversity, with a relatively low proportion (11%) of respondents who perceived the same practices as a major contributor to the loss of biodiversity. Furthermore, a majority of respondents (57%) stated that commercial agricultural practices are a minor contributor to the loss of biodiversity and three percent of respondents were unable to determine the link between commercial agricultural practices and the loss of biodiversity. Lastly, the study probed the perception of the extent to which increased carbon emissions are a contributor to the loss of biodiversity. In this regard, 40% of respondents deemed increased carbon emissions as a major contributor, 46% perceived a minor contribution, six percent suggested that these emissions do not contribute to the loss of biodiversity and eight percent were unable to perceive a link between increased carbon emissions and biodiversity loss.

The results from *Figure 5.13* indicate that respondents perceived the above-mentioned factors as major contributors to the loss of biodiversity, with the only exception being commercial agricultural practices. A relatively low proportion of respondents were unable to conceptualise threats to biodiversity. Evidently, even with a limited understanding of the scientific term, respondents were able conceptualise biodiversity as well as the major threats. More specifically, the larger proportion of respondents could identify activities such as pollution, industry and increased CO_2 as the major contributors to the loss of biodiversity. However, the majority of respondents perceived deforestation as a minor threat to biodiversity. Although respondents had earlier indicated high importance on plants/trees and forests, it is concerning that deforestation was perceived as a minor threat.

Table 5.22: Respondents perception of the impact on the loss of the natural environment (n=270, in %)

	None	Positive	Negative
Individual level	5	4	91
Community level	10	4	86

Respondents were also requested to indicate their perceived impact regarding the loss of the natural environment, at an individual and community level. With regards to the loss of the natural environment at the individual and personal level, a vast majority of respondents (91%) stated that the impact would be negative, with only four percent of respondents perceiving a

positive impact, and five percent suggesting that there would be no impact due to the loss of the natural environment. At the community level, 86% of respondents deemed there would be a negative impact, four percent of respondents stated a positive impact of the loss of the natural environment and ten percent perceiving that the loss of the natural environment would have no impact at all. The perception of shared risks and threats are important as these influence and support community responses to environmental interventions, especially when there is a lack of scientific certainty within communities regarding risks (Raymond and Brown, 2011). According to McCright (2010), women generally express greater concern in comparison to men, as women are considered to link environmental concern with other health and safety risks they are exposed to. In contrast, this study found no statistical difference between respondents' gender and their perceived impact of the loss of the natural environment at a personal (Likelihood ratio, *p=0.552*) and community level (Likelihood ratio, *p=0.947*).

5.4.2.3. Respondents' observations of changes to biodiversity
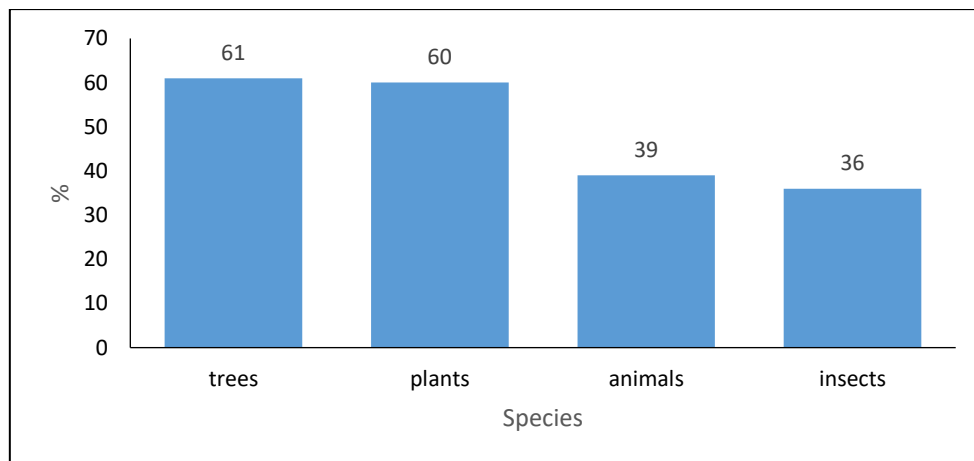
Figure 5.14: Respondents observed changes within their surrounding area (n=270, in %) Multiple responses permitted

This study further probed respondents' perceived changes within their surrounding area, focusing on observed changes to tree, plant, animal and insect species. From their observations, the majority of respondents observed changes in tree (61%) and plant (60%) populations, while lower proportions of respondents noticed changes in animal (39%) and insect populations (36%). Although the study did not find a statistically significant relationship between respondents' level of education and observed changes in their surrounding natural environment, it ought to be noted that such observed changes are arguably influenced by respondents' understanding of their natural surroundings, which, in this case, is linked to indigenous knowledge systems rather than a consequence of formal education. Indigenous

knowledge can aid in exploring the various changes in local scale climate patterns, especially in those communities where scientific model projections have not yet measured or recorded climate change disturbances (Alexander *et al*., 2011). The contribution of indigenous knowledge to understanding climate change is not necessarily about explaining or providing scientific descriptions, but rather about highlighting key trends of change, and the indicators of such change (Berkes, 2009). The knowledge about these trends and indicators is informed by observations made by individuals and the processing of this information (Berkes, 2009).
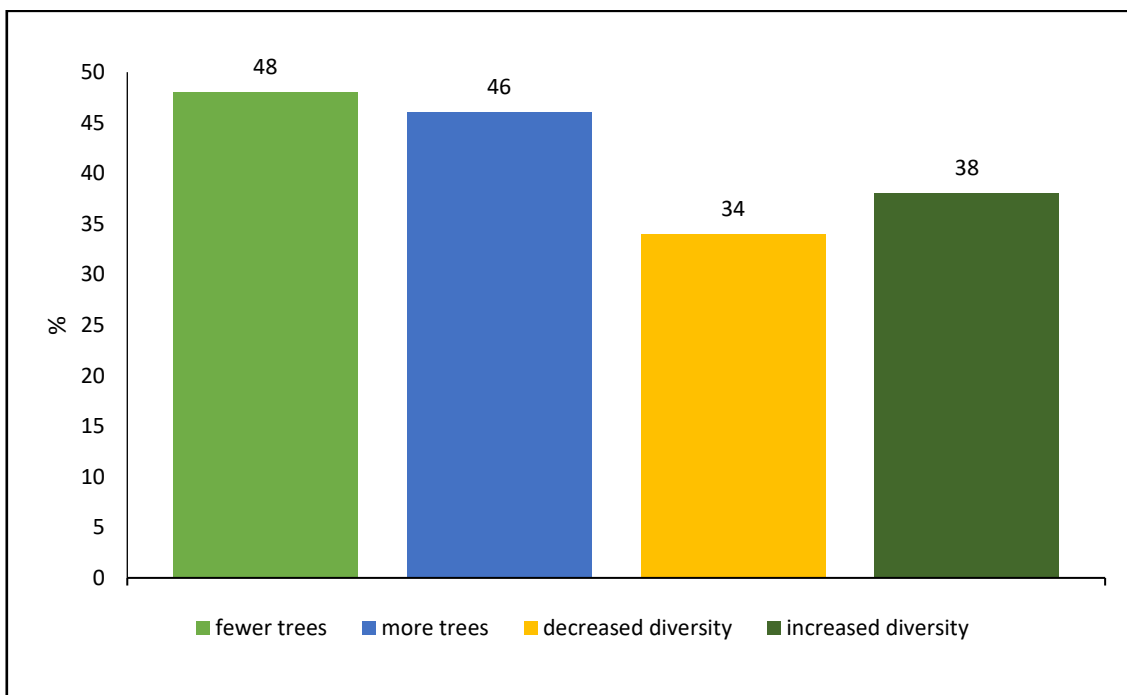
Figure 5.15: Perceived changes in tree species (n= 164, in %). Multiple responses permitted

These aspects were examined in more detail, with respondents describing the changes to their natural surroundings (Figure 5.15). In relation to trees, 48% of respondents noticed fewer trees (48%), and 46% noticed more trees within the community. The before mentioned results suggest that there were slightly higher proportions of respondents observed an increased abundance in trees. In relations to diversity, 34% of respondents stated there has been a decrease in tree diversity, while 38% observed an increase in tree diversity. These findings indicate that higher proportions of respondents perceived an increase in tree species diversity.
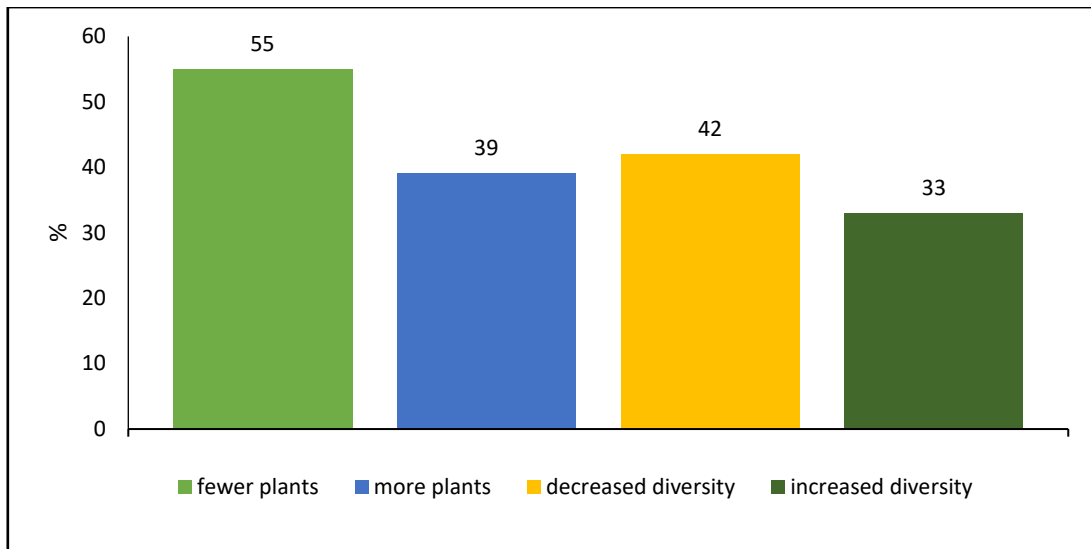
Figure 5.16: Perceived changes in plant species (n=161, in %). Multiple responses permitted

Focusing on observed changes to plant species, a relative majority (55%) of respondents had observed that there were fewer plant species in their surroundings, and a lower proportion (39%) stated they had observed more plants than before. Thus, based on respondents' perceived changes, there appears to have been a decrease in abundance of plant species. With regards to the diversity of plant species, 42% of respondents observed a decrease in diversity, and 33% observed an increase in the diversity of plants. In summary, respondents have mostly observed a decrease in the abundance and diversity of plants within their surrounding area.
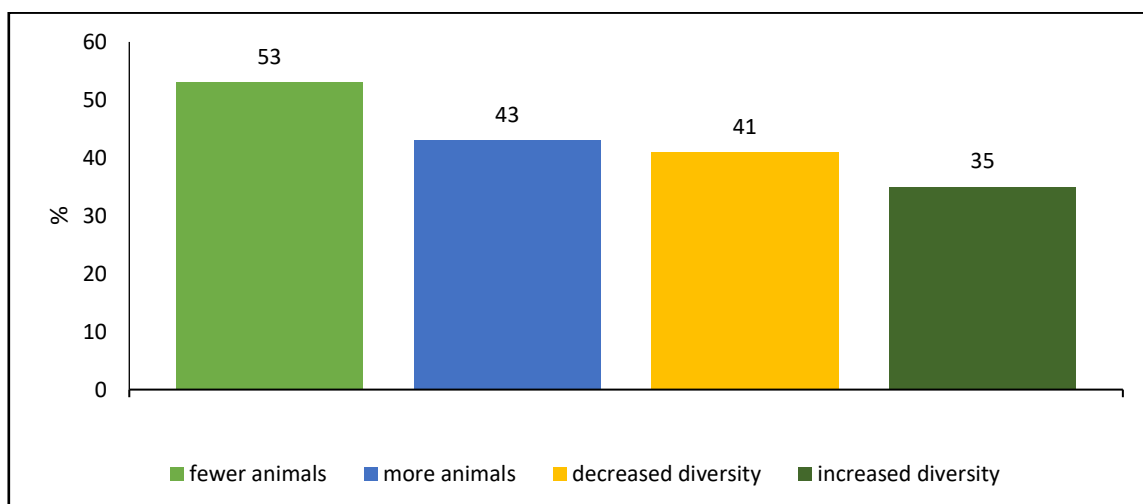
Figure 5.17: Perceived changes in animal species (n= 106, in %). Multiple responses permitted

Moreover, respondents observed changes in animal species within their surrounding area with a majority (53%) of respondents claiming that they observed fewer animal species than before, and a lesser proportion (43%) stated that there are more animal species than before. These results indicate that overall, a majority of respondents have observed a decrease in animal abundance. With regards to the diversity of animal species, 41% of respondents observed a decrease in diversity, with 35% of respondents observing an increase in diversity. A study by Gandiwa (2012) revealed the difficulties associated with determining whether local community perceptions of species abundance correlates with ecological surveys. The study revealed mixed results, which were attributed to limited environmental awareness, and human-wildlife interaction (Gandiwa, 2012).
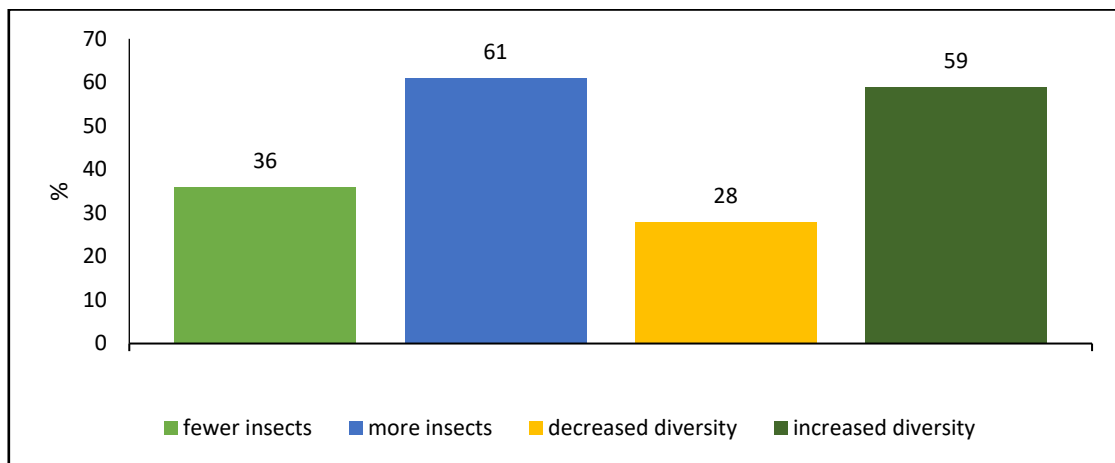
Figure 5.18: Perceived changes in insect species (n=97, in %) Multiple responses permitted

Focusing on observed changes to insect species, a majority (61%) of respondents have observed more insects than before, with a relative minority (36%) stated that there were fewer insects within the surrounding area. Similarly, a majority of respondents (59%) have observed an increase in diversity while 28% of respondents stated a decrease in diversity. These results thus indicate a perceived increase in both insect abundance and diversity. Attention to how local communities perceive changes in their environments forms part of literature which has seen increased focus on perceptions which incorporate how the public recognises and understands climate change, as public perceptions have been recognised to be among the constraints to socio-political responses to addressing the climate change (Crona *et al*., 2013). A study by Dallimer *et al* (2012) sought to determine the perceived abundance and variety of birds, butterflies and plants, in comparison to biological survey data. The results indicated that there is a possibility that perceived species richness may not be associated with actual species

richness. The reason provided was that participants perceived more species richness due to increased tree cover, however, based on the biological survey the study found that there was a negative relationship between actual plant species richness and tree cover (Dallimer *et al*., 2012).

5.4.2.4. Contributing factors to climate change

According to Whitmarsh (2008), the general public needs to be informed about the factors contributing to climate change to ensure democratic participation and informed decision-making. The importance of informed public participation is also stressed in Article 6 of the UNFCCC which addresses among other aspects, education, awareness, and access to information for promoting increased stakeholder involvement in the development and implementation of climate change policies (Whitmarsh, 2008). Therefore, it was deemed necessary to examine respondent awareness and perceptions of climate change.
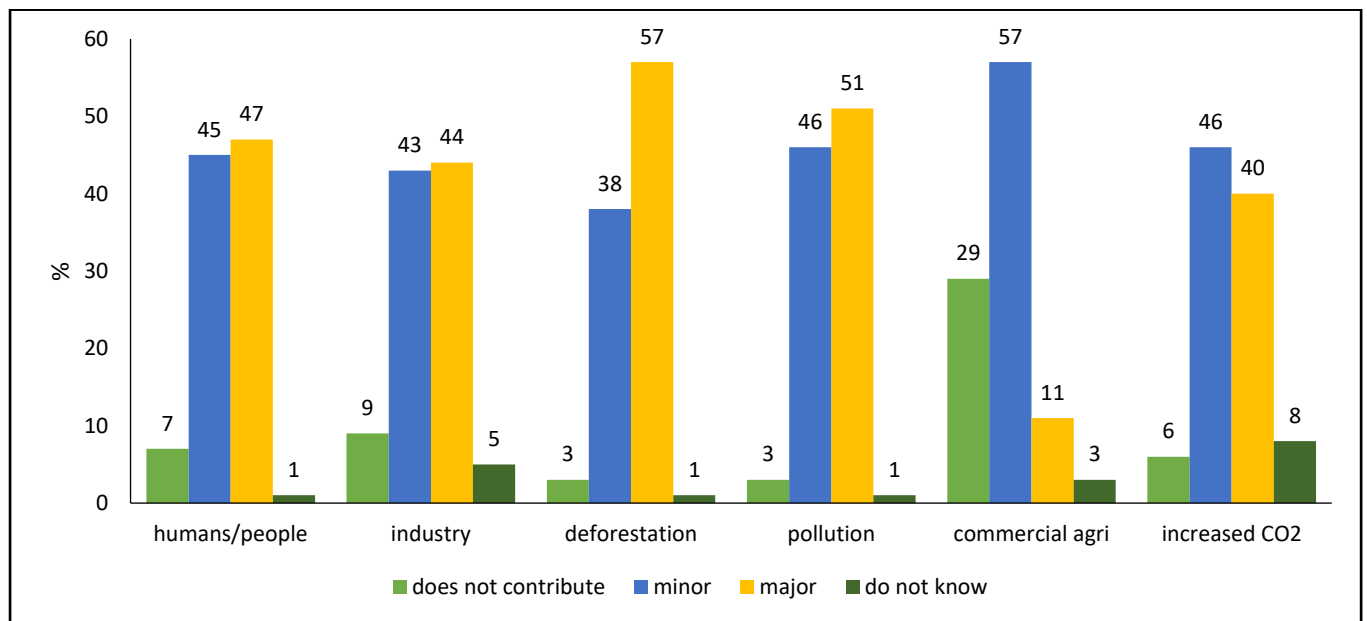
Figure 5.19: Respondents understanding of the contributors to climate change (n=270, in %)

Forty one percent of respondents indicated that humans/people are major contributors to climate change, while a larger proportion (48%) perceived humans/people as minor contributors. Relatively few respondents (10%) perceived that humans/people do not contribute to climate change while one percent of respondents indicated that they did not know the role that humans/people had towards climate change. The majority of respondents (60%)

identified industrial activities as a major contributor, 36% stated minor contributor, and three percent felt that industry does not contribute to climate change. Focusing on the contribution of deforestation to the effects of climate change, 23% of respondents perceived a major contribution while a majority of respondents (57%) perceived a minor contribution. A lower proportion of respondents (14%) indicated that deforestation does not contribute to climate change and 6% of respondents were unable to establish a link between deforestation and climate change.

A majority (52%) of respondents had indicated that pollution is a major contributor to climate change, 44% perceiving a minor contribution, and three percent suggested that pollution does not contribute to climate change, and one percent stating that they did not know whether or not pollution contributes to climate change. Eleven percent of respondents indicated that commercial agricultural practices were a major contributor to climate change. A noticeable proportion (31%) of respondents indicated that commercial agricultural practices do not contribute to climate change, and 13% of respondents stating that they did not have the knowledge to determine what contribution commercial agricultural practices may have towards climate change. Probing perceptions of the extent to which increased carbon emissions contribute to climate change, a majority of respondents (62%) identified carbon emissions as a major contributor to climate change.

Overall, respondents indicated that activities linked to deforestations, pollution, industry and commercial agriculture are major contributors to climate change. This reveals that respondent perceptions are closely linked to literature which has also highlighted the significant contribution of these activities. However, there is concern that the larger proportions of respondents perceived commercial agricultural practices and increased CO_2 as minor contributors to climate change. These findings indicate that CBC initiatives such as the Buffelsdraai reforestation project need to design environmental awareness campaigns that not only inform communities, but also address misconception of environmental challenges such as climate change.

Table 5.23: Perception of environment (n=270, in %)

Perception	%
Humans are part of nature	40
Humans are separate from nature, but equal	6
Humans are separate from nature, but superior	13
Humans are users of nature	32
Humans are custodians of nature	9

In an attempt to examine environmental attitudes and perceptions more closely, respondents were asked to indicate which of the statements provided, best described their perception of the environment, to probe their worldviews towards nature. Respondents were asked to indicate which of the above statements in Table 5.23 best described their perception of the environment. A relative majority of respondents (40%) perceived humans are a part of nature, with 32% of respondents stating that humans are users of nature, with relatively few perceiving humans are custodians of nature. There were respondents who perceived themselves to be separate from nature but varied in the relationship. The respondents are divided into those who see humans as separate from nature but equal (6%), and those who see humans as separate from nature, but superior (13%). The above results on the perception of the environment provide a brief insight to respondents' environmental orientations, which can be categorised into three categories, namely:

- Egoistic – Individuals perceive themselves superior to the environment, with their self-interest prioritised over the environment.
- Socio-altruistic – Individuals perceive the importance of the environment, however the protection of nature is seen as a means to ensure their own self-interest.
- Eco-centric – Individuals perceive the importance of the environment for its own sake and place an intrinsic value on nature.   (Imran *et al.*, 2014).

From the aforementioned, the majority of respondents can be classified as socio-altruistic. This builds on earlier findings in this study which highlighted respondent's subsistence and utilitarian valuation, and dependence on their natural environment. Although respondents agreed on the importance of biodiversity and the need for conservation, the natural environment has been perceived to be linked to the utilisation of ecosystem goods.

5.4.2.5. New Ecological Paradigm (NEP) scale

The New Ecological Paradigm scale has been utilised to measure the relationship between humans and the environment, and their subsequent environmental attitudes (Hawcroft and Milfont, 2010). Based on the original 12-item NEP scale, the shortened 6-item scale takes into account aspects regarding the balance of nature, limitations to growth, and human's right to rule over nature (Hawcroft and Milfont, 2010). As such, Table 5.24 is a summary of respondents' level of agreement with statements related to similar statements which have been adopted from the NEP scale. This was relevant for the study as part of examining community perceptions and attitudes which can be used to provide context of individual worldviews which have been noted to influence support and engagement in pro-environmental activities.

Table 5.24: Level of agreement with statements relating to the NEP scale (n = 270, in %)
(1-Strongly disagree, 2-Disagree, 3-Neutral, 4- Agree, 5-Strongly agree)

Statements	1	2	3	4	5
The balance of nature is very delicate and easily upset	14	10	23	37	14
Changing the environment for human use seldom causes serious problems	5	30	16	27	22
Plants and animals exist primarily to be used by humans	1	10	8	46	35
The Earth we live on has a limited amount of resources	3	10	16	49	23
Humans were meant to rule over the rest of nature	4	14	10	43	29
There are limits to economic growth	2	12	26	24	36

Respondents agreements with the various NEP statements were summarised into Figure 5.20 which is a representation of the categories in which respondents can be considered, based on the NEP scale. Depending on the respondents' level of agreement to the six statements, their score is added up, with a possible range of scores from 6 to 30.
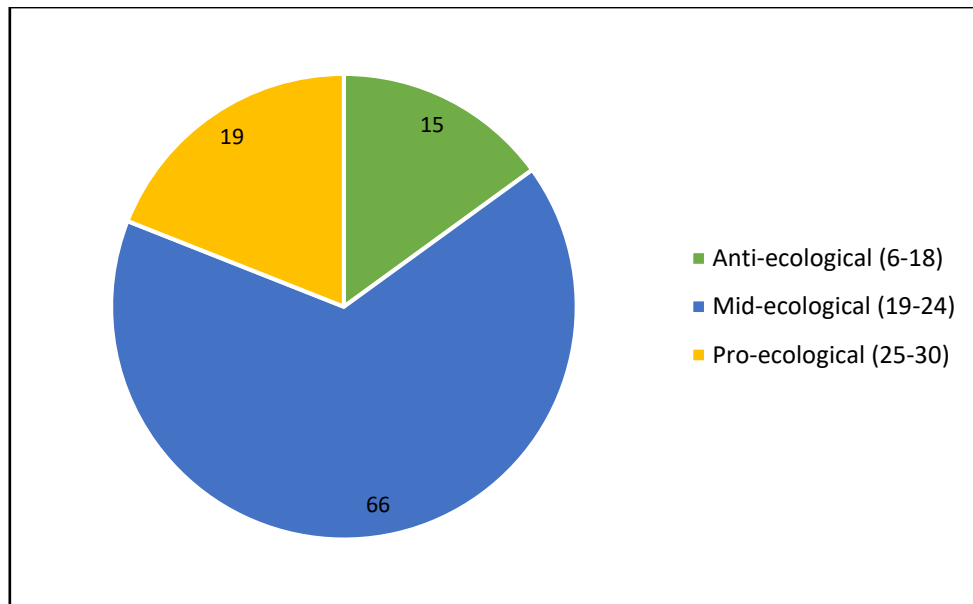
Figure 5.20: Respondents NEP scale scores (n=270, in %)

Respondents with a score between 6 and 18 are considered as anti-ecological individuals. Those respondents who score between 19 and 24 are considered as mid-ecological individuals. The final category includes respondents who score between 25 and 30, and are considered pro-ecological. The results from the respondents sampled indicated that a majority of respondents (66%) scored between 19 and 24, and therefore classified as individuals that are mid-ecological. Relatively smaller proportions are anti-ecological (15%), and 19% of respondents are pro-ecological.

5.5. Utilisation of ecosystem goods and services

As highlighted in the Millennium Ecosystem Assessment, different ecosystem goods and services serve a variety of purposes which contribute to aspects of human welfare (Daw *et al*., 2011). A vast majority of respondents (99%) stated that they utilised ecosystem goods and services within the community. The study found that according to Fisher's Exact Test, there was no statically significant difference between respondents' gender (*p=0.301*), and their utilisation of ecosystem goods and services. Furthermore, according to the Likelihood ratio test, there was no statistical difference (*p=0.748*), between respondents' level of income and their utilisation of ecosystem goods and services thus, neither gender nor income was influenced the use of ecosystem goods and services, in this study.
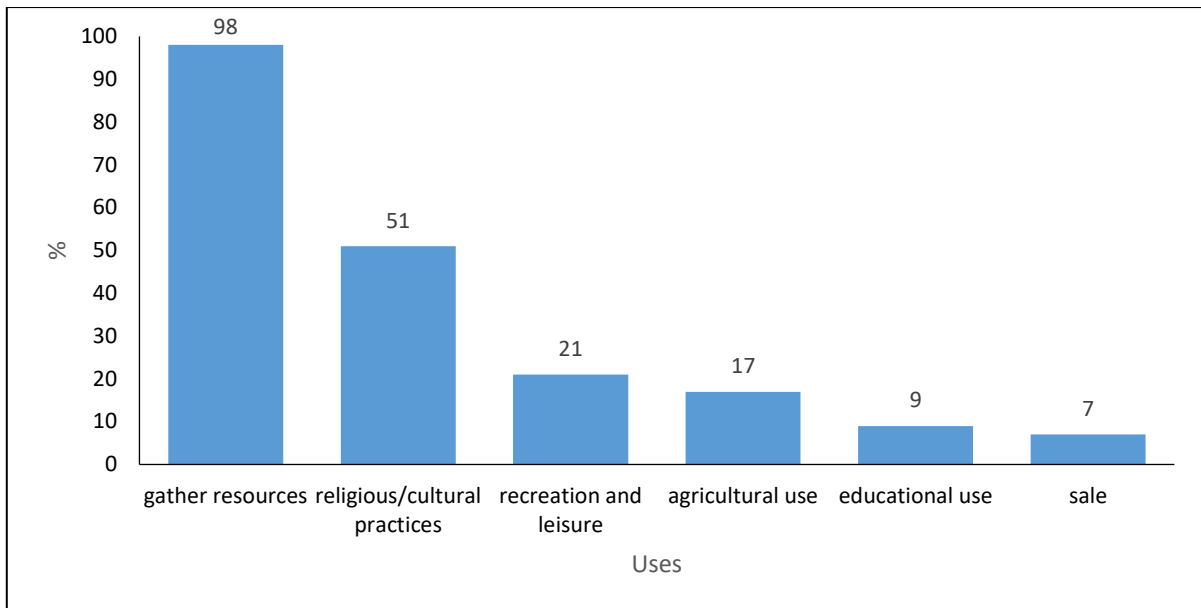
Figure 5.21: Respondents' use of ecosystem goods and services (n=266, in %)

Specific uses are listed in Figure 5.21. Evidently, all respondents that utilised their surrounding environment, did so for subsistence purposes. The majority of respondents (98%) used their surrounding natural environment to gather resources for household use. The least cited purposes included sale (7%) and educational use (9%), while other more noticeable purposes were for religious/cultural purposes (51%), recreation and leisure (21%), and agricultural use (17%). The benefits and uses derived from ecosystem goods and services have been found to support consumption, mediate livelihood shocks and threats, and enable households to accumulate assets as a means to mitigate poverty (Angelsen *et al*., 2014). Also, the collection and use of resources is significant for diversifying household livelihoods as marginalised communities show a greater reliance on ecosystem goods (Thondhlana *et al*., 2012). Although there was a predominantly direct and material use of ecosystem goods and services, there were other intangible uses observed. This indicates the variety of benefits derived from nature.

5.5.1. Uses of ecosystem goods

The study examined the various ecosystem goods which are utilised by respondents, with 85% respondents stating water as the most utilised good. Other goods included fuelwood (84%), sand (68%), fruits (67%), edible plants (57%), and stones (53%). Relatively equal proportions of respondents utilised medicinal plants (26%), clay (28%), thatch (21%), animals (11%) and logs (29%). These goods satisfied various livelihood benefits with goods such as water, fruits and edible plants utilised for personal consumption and other goods such as sand, logs, clay

and thatch being utilised for household structures. The extensive utilisation of fuelwood and water can be linked to earlier findings which indicated the lack of basic services such as water, and reliance on fuelwood as a source of energy. Overall, the various ecosystem goods utilised appear to be extracted and used to substitute for the lack of available resources.
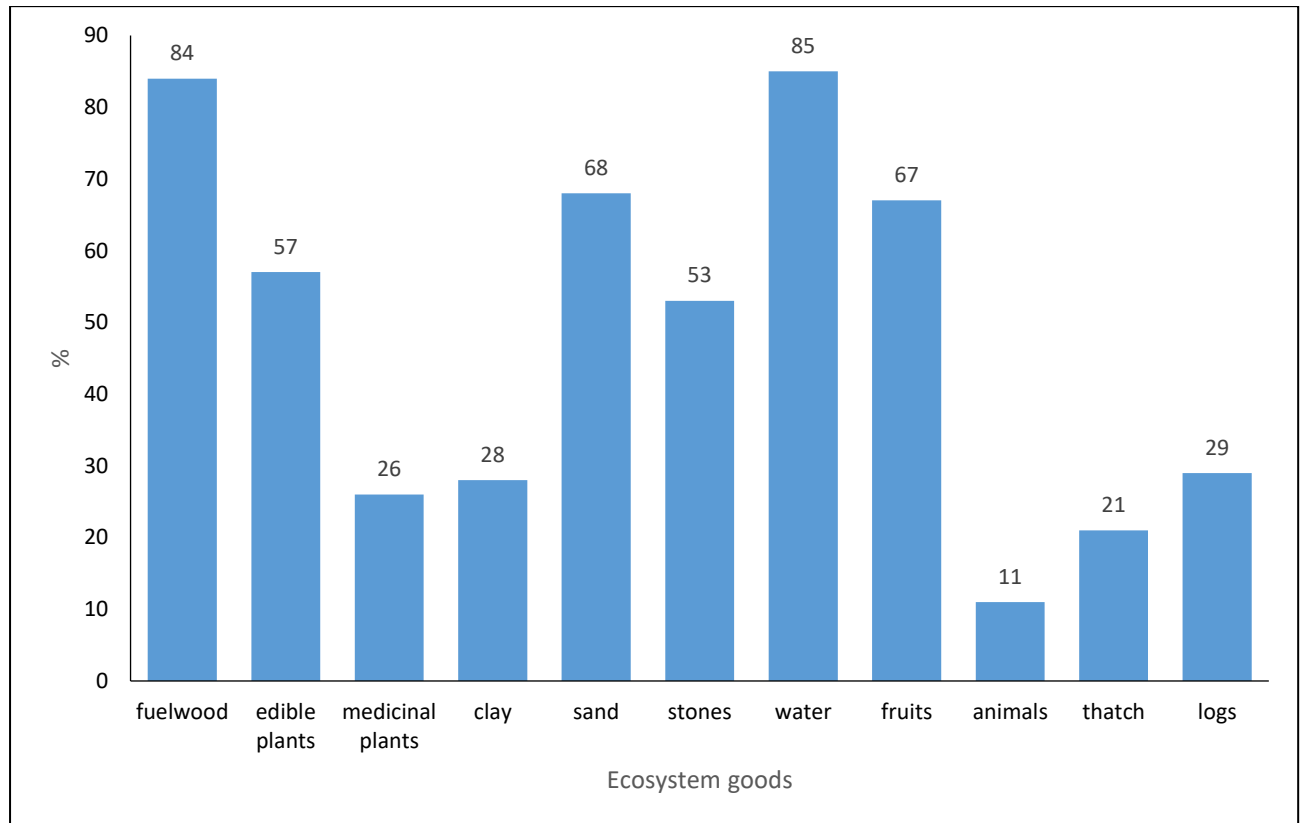
Figure 5.22: Respondents utilisation of ecosystem goods (n=266, in %). Multiple responses permitted

Within the southern African context, the dependence and utilisation of fruits is increasingly crucial for communities during periods of famine (Kalaba *et al*., 2009). Fruits may be consumed as part of a nutritional dietary profile, or be sold in markets as an income generating source (Kalaba *et al*., 2009). The consumption of edible plants has been noted to be influenced by its relative ease of accessibility and its inexpensive cost, especially for low income households (Lewu and Mavengahama, 2010). These plants further contribute to nutritional dietary intake, food security and may be utilised as part of treatments for illnesses (Lewu and Mavengahama, 2010). Similarly, in the South African context, fuelwood constitutes a source of energy, with studies in the Eastern Cape indicating that fuelwood was commonly the primary source for energy (Kaoma and Shackleton, 2014). In South Africa, despite efforts to increase

access to electricity, communities are still dependent on biomass as an energy source (Wessels *et al.*, 2013). The continued dependence on fuelwood has been driven by the costs associated with purchasing electricity and modern appliances (Wessels *et al.*, 2013).

These results support findings from research within South African villages which have indicated that a high proportion of households utilise at least one ecosystem good provided by their ecological base (Paumgarten and Shackelton, 2011). The evidence of the variety and dependence on ecosystem goods is particularly relevant for environmental policy as these findings enable the identification of those resources which are most likely to affect livelihoods as a result of reduced availability (Paumgarten and Shackleton, 2011).

Table 5.25: Respondents frequency of utilisation of ecosystem goods (in %). Multiple responses permitted.

Ecosystem goods	Population	Frequency of use			
		Daily	**Weekly**	**Monthly**	**Seasonally**
Fuelwood	**84**	23	33	28	16
Edible plants	**57**	14	30	11	45
Medicinal plants	**26**	7	7	35	51
Clay	**28**	0	3	14	83
Sand	**68**	2	3	21	74
Stones	**53**	1	3	23	73
Water	**85**	75	18	4	3
Fruits	**67**	16	28	6	50
Animals	**11**	20	27	20	33
Thatch	**21**	4	0	30	66
Logs	**29**	6	22	25	47

In relation to frequency of use, results show that fuelwood was used daily (23%), weekly (33%), monthly (28%), and seasonally (16%). The increased reliance on wood as a source of energy suggests that respondents may be categorised as energy poor. The use of the ecosystem as a supply of water, (75% of respondents on a daily basis), raises concern over the availability of adequate water to meet basic human needs. Additionally, respondents indicated that ecosystem goods that can be consumed, such as fruits, edible and medicinal plants were mainly extracted seasonally. This suggested that respondents did not rely heavily on these goods as part of their dietary intake. It is also unsurprising that these goods were not frequently extracted as their availability is determined by seasonality. Moreover, ecosystem goods such as logs, thatch, clay, sand and stones were not frequently extracted as these goods were mainly used for construction of dwellings.

With regards to fuelwood, respondents mainly utilised the good weekly, and water was mainly utilised daily. The data indicates that most of these goods, except for fuelwood and water, were mainly utilised seasonally. The variation in utilisation has been noted to depend on aspects such as accessibility to resources bases, as well as household contexts (Daw *et al*., 2011). The results purport findings from literature which have highlighted the dependence of low income communities on their natural resource base for subsistence purposes (Boafa *et al*., 2014).

In terms of sale purpose, fuelwood, clay, stones, water, animals and logs were not used for sale purposes, indicating that very few respondents derived products of monetary value from their surrounding resource base. The goods which were for sale purpose included medicinal plants (13%), thatch (5%), edible plants (3%), sand (1%), and fruits (1%). Estimating the contribution of natural resources to household sustainability forms part of an assessment of livelihood portfolios, as well as the effects of natural resource degradation on household welfare (Angelsen *et al*., 2014). The gathering of resources from surrounding ecological bases has proven to satisfy subsistence needs within households as well as act as sale products, in local markets, to supplement income (Shackleton *et al*., 2008).

Table 5.26: Ecosystem goods utilised for sale purposes (n=18, in %)

Ecosystem good	%	Average monthly price (in Rands)
Edible plants	22	R325
Medicinal plants	50	R544
Sand	6	R800
Fruits	11	R475
Thatch	17	R527

The results indicate that for 22% of these respondents, edible plants are a sold for an average monthly price of R325. A comparable proportion (50%) stated the sale medicinal plants, harvested from their surroundings, generates an average monthly income of R544. Other sale products included thatch of which 17% of respondents receive an average monthly income of R527, and 11% of respondents who sell fruits for an average monthly income of R475. Although a small proportion (6%) of respondents derive a sale value from sand, this resulted in respondents receiving an average monthly income of R800. The sale of goods is considered to be important, especially for vulnerable and marginalised community members (Shackleton *et al*., 2008). Similar research on the incomes derived from natural products in South Africa

has indicated that although the financial returns on the sale of natural products are considered modest, these products remain a safety-net for households (Shackleton *et al*., 2008).

5.5.2. Uses of ecosystem services
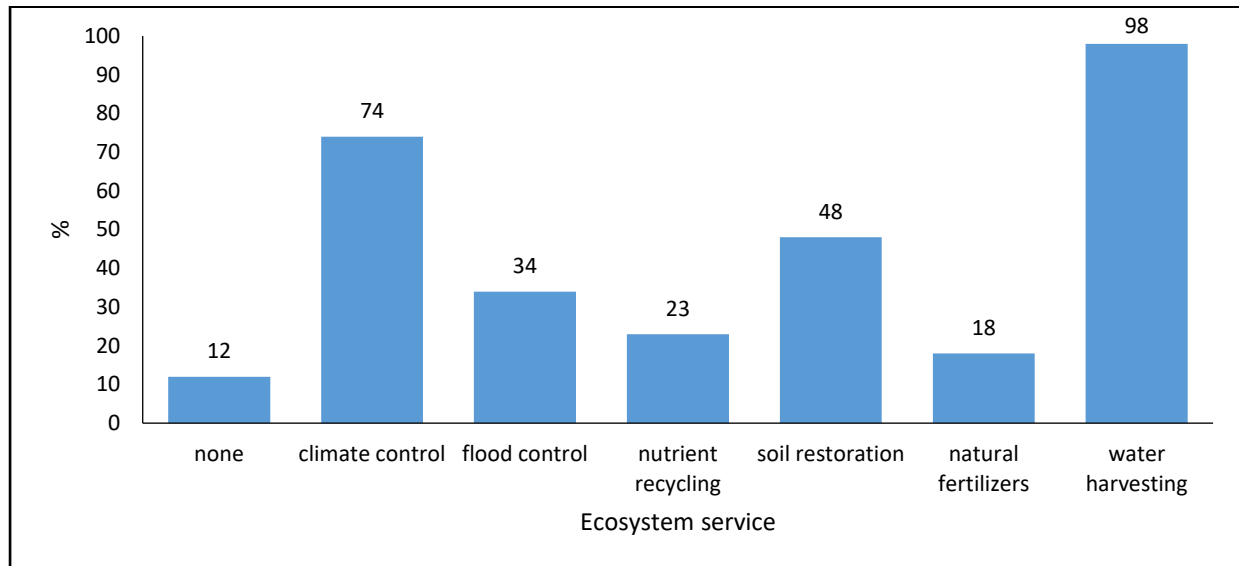
Figure 5.23: Respondents utilisation of ecosystem services (n=270, in %) Multiple responses permitted

The study also highlighted the various ecosystem services which respondents perceived their environment provided for them. The vast majority of respondents were able to indicate various ecosystem services provided by their environment. These findings are similar to those from a study by Martin-Lopez *et al.* (2012) in which majority of the sampled population were able to recognise that ecosystems provided services. According to Martin-Lopez *et al.* (2012), the increased ability to conceptualise services provided by ecosystems was influenced by formal education and gender (Martin-Lopez *et al*., 2012). Pearson's Chi-Square test was conducted to determine validity of such findings as suggested by literature. The Pearson chi-square test revealed that within the sampled population, there was no statistical difference between respondents' conceptualisation of ecosystem services and respondents' gender or level of formal education.

The majority of respondents (98%) perceived that the natural environment provided provisioning services such as water harvesting. Additionally, 74% of respondents perceived regulatory services such as climate control as a service provided to them by the natural

environment. This finding contrasts with research which has found that climate regulation has often been cited as an ecosystem service which has not been perceived as providing a benefit to human well-being (Fisher *et al.*, 2009). Other services respondents perceived their environment provided were regulatory services such as soil restoration (48%), flood control (34%) and nutrient recycling (23%), with few respondents (18%) stating natural fertilizers as part of the services provided by the natural environment. These finding indicate the respondents were able to identify the various services provided by the natural environment, and highlight that individuals within the community are identifying numerous benefits provided by nature. Additionally, this reveals that community members view their natural environment as a system and understand that within this system, the natural environment has a larger role to play

5.6. Buffelsdraai Landfill Site Community Reforestation Programme

The following section describes respondent perceptions and responses to the BLSCRP as well as highlights household benefits derived from the project. Individual participation is also explored providing a brief assessment of the contribution of the project to individual livelihoods, and the participant perceptions of the project itself.

5.6.1. Participation in BLSCRP

Table 5.27: Duration of involvement in project (n=44, in %)

Duration	%
<12 months	11
1-2 years	25
3-4 years	25
5-7 years	39

Results indicate that 16% of respondents were involved in the reforestation project. The majority of these participants (80%) were Tree-prenuers. Those respondents involved in the project specified the duration of the participation (Table 5.27). Results show that 39% of respondents were involved in the project for the past five to seven years. An equal proportion of respondents (25%) were active participants for a period of one to two years, and three to four years. Relatively few respondents (11%) indicated that they have been involved for less than twelve months. In this regard, it is evident that the project has had a positive impact in its ability to retain participants which contributes to the development of these participants. However, what is of concern is the smaller proportion of respondents who have been involved

in the project for two years and less. This indicates that the project has not been able to recruit new participants, and limits the potential of the project to deliver benefits across the community.

Table 5.28: Incomed derived from project participation (n=44, in %)

Income range	%
None	40
<R1000	18
R1001-2000	23
R2001-3000	13
R3001-4000	4
R4001-5000	2

Forty percent of respondents stated that they were yet to receive income for their participation. It ought to be noted that not all respondents received a direct monetary income for their involvement. Respondents also received food vouchers and credit notes as a substitute for monetary compensation, these are listed in Table 5.28. Eighteen percent of respondents received less than R1000, 23% of respondents received between R1001-R2000, and 13% received between R2001-R3000. Smaller proportions of respondents received between R3001-R4000 (4%), and R4001-R5000 (2%). It needs to be noted that the above income was based on what respondents had received through their entire duration of participation in the project. These findings raise concern that there is a noticeable proportion of project participants who are yet to receive benefits from their participation in the study, which compromises the intended outcome of the project to improve the livelihoods of the most vulnerable community members.
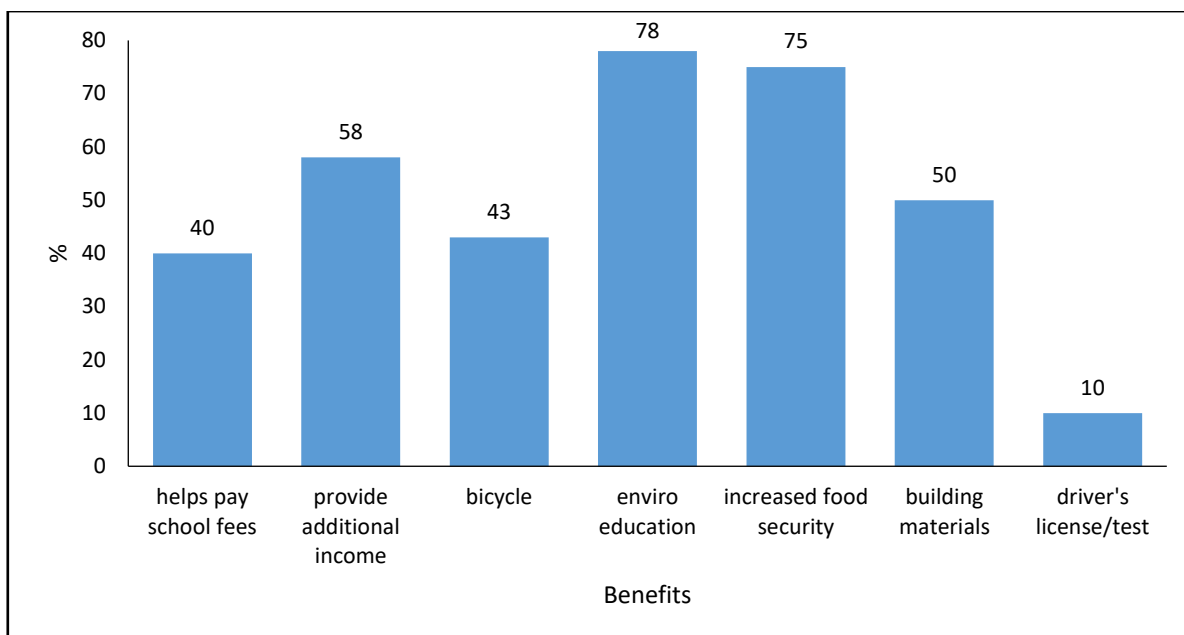
Figure 5.24: Benefits received from project (n=44, in %) Multiple responses permitted

In further determining the project's contribution to individual livelihoods, a vast majority of participants (78%) stated that their involvement resulted in increased awareness of the natural environment. Seventy five percent of respondents participating in the project, highlighted benefits such as increased food security within their household. A noticeable proportion of these respondents (58%) mentioned that their involvement resulted in additional income, thus, supplementing household livelihood strategies, and 40% of participants indicated that income derived from the project facilitated the payment of school fees for household members. Half of the respondents participating in the project have received building materials, and 43% of these respondents stated that they received bicycles. Fewer respondents (10%) mentioned that they have used their financial income from the project to pay for either a driver's license or test.
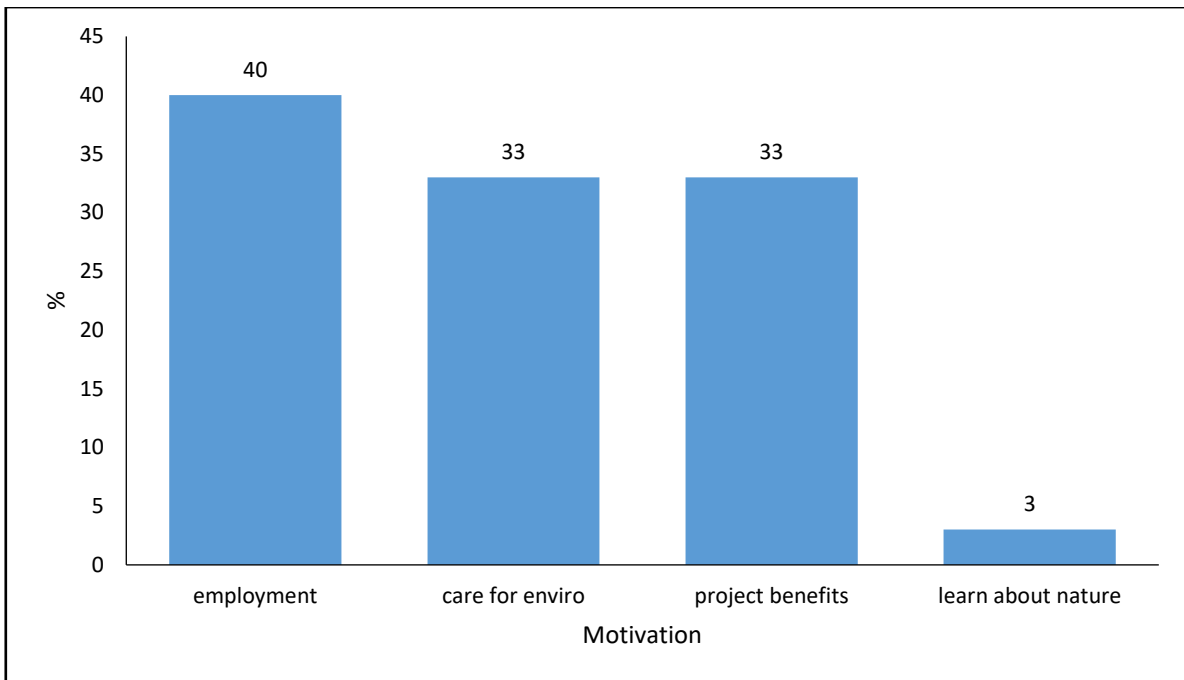
Figure 5.25: Motivation for participation (n=44, in %)

Participants were requested to elaborate on the reasons for their involvement in the community reforestation project, (Figure 5.25). According to 40% of respondents, the possibility of employment was their main reason for their involvement in the project. Also, 33% of respondents had stated that their motivation for participation was the prospect of receiving the variety of project benefits, such as infrastructural resources and food vouchers. An equal proportion of participants (33%) said their main motivation was for their concern and/ or care for the environment. A small proportion of participants (3%) indicated that their involvement was motivated to gain more knowledge and learn about nature. Collectively, the results indicate that participants were mainly motivated by the prospect of receiving tangible benefits from the project. In relation to sustaining long-term in low income communities, tangible benefits may be an incentive for participation, but other intangible benefits, such as education should also be part of the project outcomes (DeCaro and Stokes, 2008). A study of the Gambia Protected Areas Complex conservation project revealed that 76% of local stakeholders continued to engage in conservation, despite financial incentives having been ceased (DeCaro and Stokes, 1446: 2008). This was attributed to the project incorporating benefits that extended beyond tangible benefits and linked the project with inculcating conservation ideals within project participants.

Table 5.29: Impacts of the resfoestatuion project on respondents environmetal awarness (n=44, in %). Multiple responses permitted

Affected views	%
No effect	8
More aware about the environment	90
More aware of climate change	53
More knowledgeable about the environment	85

A vast majority of respondents involved in the project (90%) stated that their participation in the project made them more aware about the environment, with 85% stating that they gained more knowledge about the environment. A comparable proportion (53%) said that their involvement has made them more aware of issues and challenges related to climate change. Overall, these results show that the reforestation project has contributed to participants' environmental knowledge and responsibility.

5.6.2. Community perceptions of BLSCRP

A noteworthy proportion of respondents (80%) were aware of the community reforestation project. However, despite the high levels of awareness, the majority of respondents (64%) had stated that they were not part of the design and implementation stages of the project. Studies regarding public perceptions of nature conservation have indicated that negative perceptions held by communities was influenced by the absence of local involvement in the inception phase of the protected area (Imran *et al*., 2014).

Table 5.30: Respondents awareness of reforestation project objectives (n=134, Multiple responses permitted)

Project objectives	%
Offset carbon emissions	16
Increase local climate adaptation capacity	12
Replanting of forest habitat	66
Improvement of ecosystem services	36
Provide employment	81

The study found that the more well know objectives by respondents included the project seeking to provide employment (81%) for community members (Table 5.30). In terms of the project objectives that seek to address environmental challenges, 66% of respondents were aware of the objective to replant the forest habitat, 36% of respondents were aware of the objective to improve ecosystem services, 16% aware of the objective to offset carbon

emissions, and 12% aware of the objective to increase local climate adaptation capacity. The importance of public support for conservation efforts has been sighted as a contributory factor for successful conservation practices (Booth *et al.*, 2009). This support cannot be gained if project objectives are unknown, misunderstood and not accepted by communities (Booth *et al.*, 2009). Overall, there appears to be lower levels of knowledge regarding the objectives of the Reforestation project, thus limiting the understanding of environmental goals set out by the project.

The data revealed that a noticeable proportion (38%) of respondents believed the community reforestation caused conflict within the community. Respondents were further probed and asked to specify what the main drivers of conflict were. From these respondents (*n=82*), 49% of respondents stated that conflict was due to the inequitable nature in which community members could participate in the project. These respondents shared that the project focused on a specific region within the community, more specifically households in closer proximity to the landfill site were targeted:

"Those of us here up the hill of the community and do not reside nearby the landfill site are not given the opportunity to get involved in the project. If you go to the houses at the bottom near the main road, you will see that most of the households down there are growing trees because all the attention is on them and not on us" (Respondent 159)

Respondents further elaborated that the project remains exclusive to those households who were involved in the initial launch of the project, and is not inclusive of households who want to be added into the project. Respondents further stated that project participation ought to be rotated as a means to unsure that those who have not been given an opportunity to be current participants, may at a later stage be involved:

"Wildlands or the municipality have to consider giving other parts of the community an opportunity to get involved in the project. They have been focusing on the one part of the community for too long. It would be better to have periods where one section of the community is given an opportunity and once people there have started growing trees, then move on to another section and so on" (Respondent 178)

This rotation of participation would ensure that benefits derived from the project are spread out within the community, and would result in less frustration and resentment within the community. It has been noted that projects which adopt a benefit-sharing approach often cause unintended consequences and therefore do not accomplish the desired effect of promoting positive perceptions towards the project (Kideghesho *et al*., 2007). It is crucial for CBC initiative such as the Buffelsdraai reforestation project to be cognisant of the manner in which benefits are distributed within the communities, and address matters of perceived unfairness which cause undermine the success of the project.

Other respondents (44%), highlighted bias and corruption regarding employment and participation opportunities to be the drivers of conflict within the community. These respondents explained that there is a widespread perception within the community that WCT representatives only recruit members within the community, of which they have a personal relationship with. One respondent further stated that when more community members are recruited into the project, these individuals are either friends or family:

"What I have seen for myself and heard from other community members is that if you are not friends or family of those people who work for Wildlands you won't be involved in the project. It's those corrupt people from Wildlands that live in the community that decide who gets involved in the project and it is wrong of them to only choose their friends and family, and exclude the rest of us" (Respondent 214)

Evidently, some respondents held negative perceptions of the processes in which community members were chosen to be part of the project. An overall negative perception of fairness is concerning as such perceptions undermine the success of incentives based projects, regardless of whether a project produces net benefits (Sommerville *et al*., 2010). These perceptions of unfairness at an individual level can further contribute to negative perceptions at the community level which may affect community participation, and reduce project objectives linked to enhancing socio-economic development (Sommerville *et al*., 2010).

Other respondents (5%), stated that conflict was also due to some of the seedlings being rejected. Another respondent shared that there was a lack of communication from WCT in relation to the seedling species that were required:

"We are frustrated and angry because when we put our trees out on the road to be collected we are told that our trees will not be taken because they are longer the type of trees they require and that it's another type of tree which is being collected. A lot of our time and effort goes into growing these trees and its upsetting that I only got told afterwards that my trees are not needed." (Respondent 156)

Transparent and continuous communication and stakeholder involvement is described to be the cornerstone of successful CBC initiatives (Corbera and Schroder, 2011; Young *et al*., 2013). More specifically, there is a need to continuously inform participants within the Buffelsdraai reforestation project regarding changes that directly influence their participation in the project to ensure that participants can maximise the project benefits.

Lastly, a small proportion (2%) of respondents highlighted theft of trees as cause of conflict. A respondent shared:

"I work very hard to grow as many trees as possible but then as time goes by, I have noticed that some of the trees in my yard have disappeared over night. Then all of a sudden, I see a neighbour has a few number of trees that have already grown to the size necessary for exchange, even though they have never attempted to grow trees before" (Respondent 44)

These findings indicate that theft of trees within the community limits participants' return on investment in the form of resources and time spent of collecting seeds and growing trees. Additionally, theft of tress should be matter that needs to be addressed within the Buffelsdraai project as this undermines the success of project participants, and could contribute to increased conflict within the community.

Projects which aim to integrate conservation and development often provide benefits to adjacent local communities as a means to create positive attitudes and perceptions towards conservation initiatives (Ezebilo and Mattson, 2010). Conservation projects that seek to incorporate sustainable development and management have to consider the social, economic and environmental dimensions such as promoting dignified standards of life, employment opportunities, and motivate the importance of utilising environmental goods within ecological limits (Ezebilo and Mattson, 2010). Respondents explained their perceptions of whether the

reforestation programme achieved the intended household outcomes, regardless of their involvement in the project (Figure 5.24).
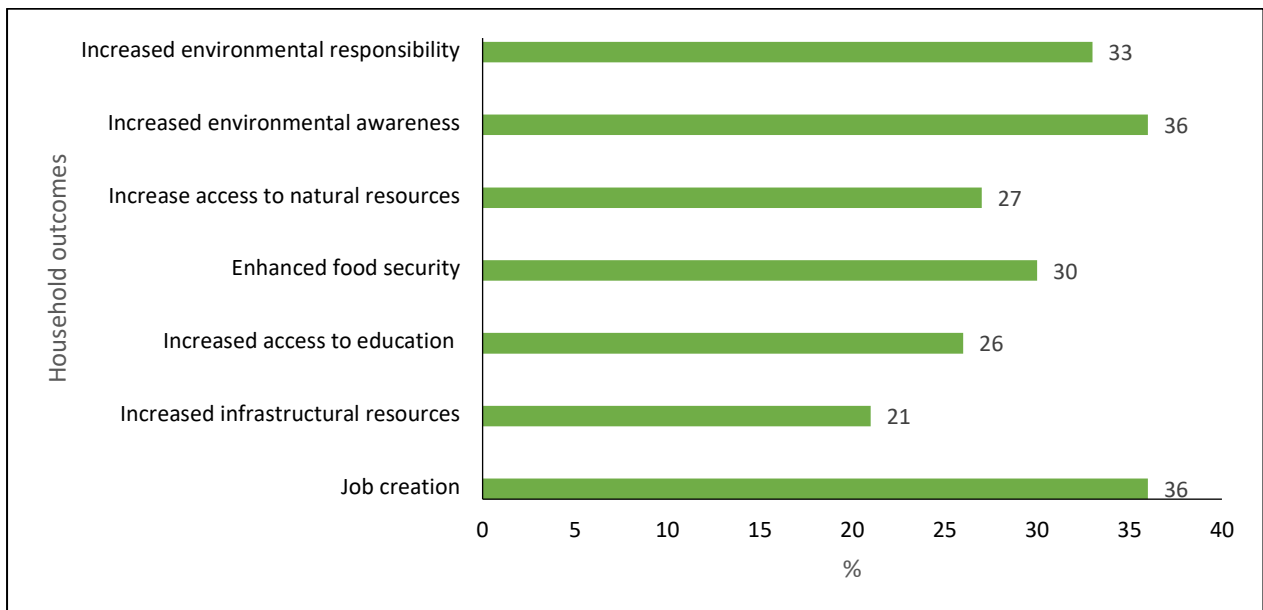
Figure 5.26: Household outcomes from the project (n=270, in %)

Thirty six percent of respondents stated that the reforestation project created employment for a member within their household. Furthermore, 30% of respondents stated that the project has enhanced household food security, while other respondents stated that the project resulted in an increased access to infrastructural (21%), and natural resources (27%). Other benefits cited by respondents included improvement in household food security (26%), levels of environmental awareness and knowledge (36%), increased responsibility for environmental well-being (33%), and increased access to education (26%). These findings indicate that the project has produced tangible and intangible benefits for community members. However, there still remains limited employment opportunities created by the project. Given the socio-economic and demographic profile of the Buffelsdraai community, it is necessary for the project to expand employment opportunities.

Restoration projects are often criticised for focusing on the achievement of project objectives which may not necessarily be tailored to socio-economic contexts of adjacent communities, which limits the ability to deliver the desired social benefits (Iftekhar and Takama, 2008). These benefits are unattained as there may be a lack of recognition of social values and needs, which further warrants the notion that local attitudes towards restoration projects are a

cornerstone for successful community- based management (Iftekhar and Takama, 2008). These results show that the reforestation project did influence the local community in a positive manner, however, a relative minority of respondents could identify with these benefits. More importantly, a major concern permeating these findings is that the benefits of the reforestation are perceived to be inequitably distributed among a minority within the community. Collectively, the results indicate that in terms of achieving both tangible and intangible benefits within the community, the reforestation project has been unable to positively influence the majority of individuals. Specifically, the lack of educational value attained by respondents is a concern as protected areas are said to be a crucial component for disseminating information on the importance of protecting the natural environment (Booth *et al.*, 2009).

Table 5.31: Level of satisfaction with achievement of outcomes within households (in %)

Indicator	n	Extremely dissatisfied	Dissatisfied	Satisfied	Extremely satisfied
		%			
Job creation	96	20	23	17	40
Increased access to infrastructure resources	57	12	14	28	46
Increased access to education	72	10	14	18	58
Enhanced food security	85	11	20	18	51
Increase access and use of natural resources	73	10	14	18	58
Increase level of environmental awareness/education	97	10	9	14	67
Increased responsibility to environmental wellbeing	92	11	11	14	64

The results indicated that 57% of respondents were satisfied with job creation within the household, while 43% of respondents stated that they were dissatisfied with the job creation from the project. A small proportion of respondents (20%) stated that the reforestation project increased access to infrastructural resources such as solar panels, Jo-Jo water tanks and cement, indicative of low outcome results. However, these respondents did reveal a significant level of satisfaction (74%). In terms of involvement in reforestation project enabling the support of increased access to education, a significant majority of these respondents indicated high levels of satisfaction (76%) with the manner in which project involvement has aided in the ability to supplement finances towards school fees. These respondents had stated that through household

members being involved in the project, there has been an increased affordability to pay for school fees and costs such as transportation for children to attend school.

The results also indicate high levels of satisfaction with the ability of the project to contribute to enhanced food security with 76% of households satisfied as the food vouchers received from the project have contributed towards food security. Households that received benefits from the project further indicated their high levels of satisfaction with regards to increased access and use of natural resources as 58% of households were extremely satisfied, and 18% satisfied. Similarly, there were higher levels of satisfaction with the project as household respondents stated that their involvement has resulted in increased environmental awareness/education, and responsibility to environmental wellbeing.

The study revealed that individual participation in the Buffelsdraai reforestation project is very limited. However, there were positive signs that the project has been able to retain participants, produce a variety of benefits for those involved in the project, and increase environmental awareness amongst respondents. It is noteworthy though, that the project has not been able to expand and recruit new participants, which limits the ability of project benefits to permeates within the community. Coupled with limited participation were the findings that there was a noticeable proportion of respondents who were yet to receive income from participation in the project. Additionally, for those who did receive income from the project, this income has not made substantial impact in improving the socio-economic status of project participants. Moreover, respondents indicated that their motivation to participate in the project were mainly for socio-economic incentives. At the community level, the project is considerably well-know. Unfortunately, there were low levels of awareness of the project objectives. It was further revealed that few households have attained benefits from the project, which can be linked to earlier findings of limited participation in the project. It is worth mentioning that for those households that have attained project benefits, there were high level of satisfaction with these benefits. It was also revealed that the project has caused conflict within the community, with the cause of this conflict linked to the perceived unfairness in the recruitment of project participants.

5.7. Conclusion

Amongst the findings was the realisation of the vulnerability context of community members evident in low levels of formal education, employment opportunities and challenges related to

basic services. Furthermore, the study found low levels of awareness regarding key environmental concepts. However, these low levels of awareness did not prevent community members in conceptualising concepts such as conservation, biodiversity and climate change. Community members displayed an array of valuations towards their natural environment which were aligned to direct use value. There was further evidence of the dependence on the surrounding ecological resource base which was predominantly for subsistence purposes. The data further revealed limited participation in the BLSCRP, coupled with low levels of awareness of project objectives, and low proportions on households attaining socio-economic benefits from the project.

CHAPTER SIX:
CONCLUSSION AND RECOMMENDATIONS

6.1. Introduction

This chapter provides the summary of key findings emanating from this study as well as recommendations and concluding remarks. The key findings and recommendations presented below are discussed in relation to the objectives, aim and research questions that framed the current study. The combination of qualitative and quantitative research methodologies allowed for the identification of key trends as well as a narrative that attempt to unpack these patterns.

6.2. Summary of key research findings

The summaries provided below are discussed in relation to the key concepts discussed in the multiple conceptual frameworks that guided this study and thematic areas listed in the survey instrument. The findings also reflect on the aim, objectives and research questions that were identified during the initial stages of this research, and listed in chapter one and four respectively.

6.2.1 Socio-demographic profile of respondents and the Buffelsdraai community

The study found that Buffelsdraai is a vulnerable community. This was evident in the high levels of unemployment, low levels of formal education and skills. Additionally, is was observed that the community faces a myriad of challenges linked to basic services such as water, sanitation, housing, energy, infrastructure, and health facilities. Moreover, households displayed limited diversification in livelihood portfolios as seen through the high dependence on state welfare, and lack of engagement in alternative income generating activities.

From a sustainable livelihoods perspective, community members within Buffelsdraai have limited attainment of financial, human, and physical capital. However, households revealed positive signs of social capital as observed in membership in social organisations such as church/religious groups and stokvels. These findings indicate that within the Buffelsdraai community, there is a need to address diverse socio-economic challenges which presents difficulties for CBC initiatives to deliver on socio-economic benefits that address poverty within the community.

6.2.2. Levels of awareness, knowledge, and conceptualisation of scientific concepts among local communities

The study found that there were substantially low levels of awareness of scientific terms such as conservation, biodiversity and climate change. This study showed that levels of formal education significantly influenced awareness of scientific concepts. Despite limited levels of awareness of scientific concepts, respondents displayed high levels of environmental knowledge, evidenced in their descriptions of changes within their natural surroundings over the last ten years. Furthermore, respondent conceptualisations of biodiversity and their natural environment is indicative of their understanding of how these aspects function as a system. For example, respondents were able to identify productive and regulative ecosystem goods and services. Additionally, respondents' descriptions were closely related to the scientific concepts addressed in this study.

Moreover, in understanding respondents' knowledge of and perceived threats to biodiversity, the study found that the majority of respondents perceived humans/people, deforestation and commercial agricultural practices as minor contributors to the loss of biodiversity. It was also revealed that the majority of respondents perceived industrial activities, pollution and increased carbon emissions as major contributors to the loss of biodiversity. The study found that there was no statistical difference between respondents' level of formal education, and the extent to which the above discussed activities were contributors to the loss of biodiversity. Similarly, in terms of knowledge of activities which contribute to climate change, the majority of respondents perceived commercial agricultural practices and increased carbon emissions as minor contributors towards climate change. With regards to humans/people, industrial activities, deforestation, and pollution, the majority of respondents perceived these activities as major contributors to climate change. The study found no statistical significance between respondents' level of formal education and their perceptions of the extent to which various activities contributed to climate change.

These perceptions reinforce the assertions that despite limited awareness of scientific concepts, respondents did display an understanding of environmental changes and the main contributing factors. However, there is still the need to address perceptions of commercial agricultural practices, increased carbon emissions, and deforestation and the impact of these activities on the natural environment. Therefore, this study establishes that language may be a fundamental barrier in unpacking local levels of awareness and environmental knowledge. Within the

context of CBC's and more specifically the Buffelsdraai reforestation programme, integrating local skills, experiences and knowledge may be a more suitable and inclusive technique that allows for a more detailed understanding of local environmental systems.

Additionally, there is a growing debate on the use of indigenous terminology in environmental education and conservation initiatives (Pretty *et al*., 2009). The use of indigenous terms may facilitate improved communication and dissemination of information across stakeholder groups, specifically in CBC initiatives which bring together stakeholders from diverse backgrounds. This study identified local indigenous terminology for the term conservation which included *ukunakekela imvelo*, *ukuvikela kwemvelo*, *ukugcinwa kwemvelo* and *ukongiwa kwemvelo*. Additionally, local indigenous terminology for biodiversity included *imvelo* and *indalo*. In relation to climate change, the study identified local indigenous terminology which included *ukushintsha kwesimo sezulu* and *ukuguquka kwezulu*. These terms could be integrated in future communication with the Buffelsdraai community or used in similar projects across South Africa in an attempt to lessen the gap between scientific and indigenous environmental terminology. More importantly, this study showed that respondents obtained their information on environmental issues from sources such as television, radio and newspapers.

6.2.3 Respondent environmental attitudes, beliefs and behaviours
In terms of perceived valuation, the majority of community members placed a subsistence and life sustaining value to their natural environment, with low proportions of respondents perceiving an economic valuation. Additionally, there were intangible values assigned to the natural environment such as aesthetic, spiritual and cultural valuation. This supports the assertion that local African communities such as Buffelsdraai derive a myriad of benefits from their natural environment which contributes to human well-being. Overall, the study found that respondents' valuation can be largely categorised as socio-cultural.

Moreover, the study found that community members understood the importance of having different types of plants and animals in their natural environment. Respondents did realise the need for conservation and protection of biodiversity. Furthermore, community members described the need for conservation based on sustaining ecosystem functions which revealed their understanding of how their natural environment functions as a system, with the loss of one component having an impact on the system as a whole. Additionally, respondents displayed the understanding that conservation of biodiversity does have impact on their well-being and

can ensure the provisioning of goods and services that contribute to their subsistence. Moreover, respondents were able to identify that the loss of biodiversity would have a negative impact to them personally, and the community as a whole. These findings are crucial for CBC initiatives such as the BLSCRP as it reveals an already existing understanding within the community on the importance of biodiversity and conservation, which can be strengthened upon.

In relation to responsibility of addressing environmental challenges, respondents perceived the municipality to be the most responsible organisation for addressing challenges related to biodiversity and the natural environment. Amongst the various organisation which community members would put their trust in, the municipality was perceived to be the most trusted organisation, while NGOs received the lowest levels of trust amongst community members. The perception of the eThekwini municipality being perceived as the most responsible organisation to address challenges related to biodiversity and the natural environment can be attributed to role and responsibility of the municipality in delivering basic services within the community. The NGO sector received the lowest levels of trust as such organisations were perceived as outsiders with a lack of understanding of local community dynamics. This requires for CBC initiatives such as the BLSCRP to take into consideration the different institutions which form part of the collaboration in such projects.

This study examined community conceptualisation and participation through various behavioural theories. In relation to the VBN theory, respondent perceptions revealed that a change in their environmental conditions such as the loss of biodiversity would have a negative impact on their well-being. In this regard, it would be expected that community member beliefs should result in the support and engagement in pro-environmental behaviour such as the BLSCRP. In relation to the NAM, of the two preconditions necessary for engagement in pro-environmental behaviour, community members were aware that their actions have an impact on their well-being thus meeting the first precondition of awareness of consequences. However, the second precondition of ascription of responsibility was not observed as the majority of community members perceived the eThekwini municipality, rather than themselves, as responsible for addressing challenges related to biodiversity and the natural environment. Additionally, the TRA suggest that individuals with a bio-centric belief system would display a higher likelihood to support conservation. In this regard, most community members revealed a socio-altruistic belief system by displaying an understanding on the importance on the

environment, but linked to their own self-interest as well. Moreover, through the NEP scale, the study found that most community members scores would categories them as mid-ecological.

6.2.4. Socio-ecological linkages and use of ecosystem goods and services

The study also examined the dependence and utilisation of ecosystem goods and services through a SES framework to encapsulate the various socio-ecological linkages within the Buffelsdraai community. Results show found strong human-nature interactions within the community, which were evident in diverse consumption and extraction patterns. As the SES framework requires the understanding of utilisation within a social and geographical context, it was found that the vast majority of respondents utilise and depend on various ecosystem goods and services provided within their community, indicating a strong reliance on ecosystem goods and service. The utilisation by respondents was mostly for subsistence, household purposes and the gathering of resources. The data also revealed that there was no statistical difference between respondents' gender and income, and their subsequent utilisation of ecosystem goods and services. This is in contrast to some studies that show a gendered reliance on ecosystem goods and services (Corbera *et al*., 2007; Daw *et al*., 2016; Lynch *et al*., 2014; Wieland *et al*., 2016). This study further showed that water, fuelwood, fruits, sand and edible plants were the most utilised ecosystem goods. Additionally, these goods were used frequently by respondents which is unsurprising given the level of socio-economic vulnerability displayed by households.

Overall, the various ecosystem goods served a subsistence purpose, with substantially low proportions of respondents that stated a derived economic value of these goods. Those ecosystem goods from which respondents derived an economic/sale value included edible and medicinal plants, sand, fruits and thatch. In relation to ecosystem services which respondents perceived to be provided by their natural environment, water harvesting and climate regulation were the most cited services. In relation to a sustainable livelihoods approach, community members have a heavy reliance on the available natural capital. This is particularly concerning as climate-change related threats can further increase community vulnerability by disrupting ecosystem functioning which would ultimately effect local community natural capital. Additionally, the strong reliance on natural capital within the Buffelsdraai community needs to be taken into consideration as CBC initiatives should avoid restricting access to the natural environment which is crucial for supporting community livelihoods.

6.2.5. Community participation in the Buffelsdraai reforestation programme

Evidently, the programme did provide benefits to local community members, even though these were limited to a small group of households within the community. The most cited benefits included job creation, increased level of environmental awareness/education, and increased responsibility to environmental wellbeing. For those respondents who cited a household benefit gained, there were high levels of satisfaction with such benefits. The larger proportion of respondents had stated that they had been actively involved in the BLSCRP project for between five to seven years. In terms of monetary benefits, most participants estimated a total benefit between R1 000–R2 000 for the duration of their involvement in the BLSCR programme. In relation to individual benefits, the most cited benefits included education about the natural environment, increased food security, supplementing of income, and building materials. Through discussions with participant respondents, it was revealed that the main source of motivation for participation was for employment opportunities. In terms of affected views as a result of participation in the project, the majority of respondents stated that they have become more caring and knowledgeable about the environment.

At the community level, the data revealed substantially high levels of awareness of the BLSCRP, indicative of the popularity of the project. However, a third of respondents had stated that there was a lack of consultation regarding the establishment of the BLSCRP. Furthermore, the study revealed that the majority of respondents were unaware of any project objectives. Those who were aware of the various project objectives mostly cited project objective such as the creation of employment opportunities, and the replanting of the forest habitat. Although not a vast majority, there were respondents had stated that the BLSCRP had caused conflict within the community. Through discussions with community members, the causes of community conflict revolved around issues such as restricted and unequal opportunities for participation, as well as nepotism and corruption regarding the selection of community members who are involved in the project.

6.2.6. Impacts of the Buffelsdraai community reforestation programme

The BLSCRP, through the conversion of sugarcane to increase in indigenous tree species, has been crucial in increasing environmental benefits by increasing biodiversity within the region as evident in the increase in tree and bird species. Additionally, the reforested area is expected to make considerable contributions towards the sequestration of carbon emissions. Moreover,

the cumulative effect of the BLSCRP shall enhance ecological resilience, improve water quality, river flow regulation, sediment control and flood mitigation (Douwes *et al.*, 2015).

In linking the ecological impacts with socio-economic benefits, it has been observed that the BLSCRP has produced both tangible and intangible benefits within the community. However, the study found that the benefits derived through participation in the project have remained limited to a select few of community members. This finding indicates that the BLSCRP needs to address such issues to ensure a more substantial socio-economic impact within the community. As stated earlier, there is a need to design incentives programmes that are suited to addressing specific needs and challenges within the Buffelsdraai community.

6.3. Recommendations

6.3.1 Community-based conservation within low income communities

In delivering project benefits there is the need to recognise the vulnerability context of households within the community to design an incentive system which tailors to the overall development of the community. Although individual participation in the BLSCRP produces benefits such as the credit notes which may be redeemable for certain goods and expenses, these benefits only contribute to the socio-economic development of individuals and not the community as a whole. Although the BLSCRP seeks to target the most vulnerable and poor groups within the community, focusing on incentives at the individual scale can contribute to increasing inequality amongst the most vulnerable groups in the community. As the study has found, there are multiple socio-economic challenges and needs which go beyond employment opportunities. Thus, it is necessary to build incentives based on the collective challenges and needs faced by community members.

6.3.2 Environmental awareness and education

A key recommendation emanating from this study is that community-based conservation projects should emphasise both exposure and understanding of scientific concepts among local communities within which they are implemented. These outcomes ought to be included in the project design, in an attempt to bridge the gap between scientific and indigenous knowledge systems, as possible tangible project outcomes. Furthermore, it was identified that the most common source of information was mass media. Given that such sources of information are a one-way platform of information, community members are arguably unable to interact and gain clarification on such concepts. This was evident in the finding that although there were

respondents who were aware of the term biodiversity, there were instances where respondents were unable to provide their understanding of the various concepts.

Such findings indicate that hearing of the word such as biodiversity does not necessarily result in increased understanding of the concept. Therefore, there is a need to establish interactive information platforms that allow community members to develop understanding and bridge the gap that can lead to increased understanding of key environmental concepts related to conservation, biodiversity and climate change. The establishment of such structures for the dissemination of information can also contribute to increased awareness and understanding of project objectives given that community members are not fully informed of project objectives. As the study found various local indigenous terminologies used to describe key environmental concepts, these can be used for current and future CBCs to contribute to communication and information sharing related to these projects.

6.3.3 Community participation and consultation

In attempting to mediate the trade-offs between the attainment of environmental and social development goals, there is a need to spread socio-economic benefits generated by the BLSCRP project. The study found that community members perceived the BLSCRP to be only focused on a specific portion of the Buffelsdraai community. This was evident in low proportions of community members stating that the BLSCRP has provided development goals at the household level. Among the suggested recommendations to address the broadening of development goals is the need to promote the inclusion of community members who have not been provided the opportunity to participate in the BLSCRP. In accordance to community members' perception of restricted participation, the BLSCRP needs to rotate the participation of households across the community as a means to ensure equal opportunities and mediate animosity towards one another.

Although it is recognised that WCT has employed individuals from the community to recruit community members to participation in the BLSCRP, there is a further need to establish a committee to oversee the recruitment of community members. Through discussions with community members, it was revealed that there is a perception of elite capture within the community whereby WCT recruiters have displayed bias in the recruitment of community members. In instances such as these where the recruitment of community members appears to be biased, there is arguably a need to address matters of transparency regarding opportunities

for participation. The establishment of a committee to oversee the recruitment process can be considered as a step towards the decentralisation of power from a select few individuals, towards a more democratic process of inclusion whereby community members themselves may deliberate about how the recruitment process is implemented, and improve on the relationship between the Buffelsdraai community and the eThekwini–WCT collaboration. This also can contribute towards building trust between community members and WCT, increase transparency of decision-making process related to the BLSCRP, and also lessen conflict within the community regarding the perceived nepotism in the recruitment of community members.

6.4. Concluding remarks

This study examined conceptualisation, participation and perceptions and through the research process, there are crucial aspects for future research to take into consideration. In relation to capturing the socio-economic profile of communities, there is a need to conduct a census of community households as these households display heterogeneous capabilities and vulnerabilities. As such, a census of the population can capture and highlight a wider scope of community dynamics which can provide baseline information that contribute towards to a design of a CBC initiative that encompasses the majority of community members, and also contribute towards the monitoring of project benefits across the community. It has been realised through the study that SES are complex interactions between human and ecological systems, thus the conservation and management of these systems are inherently multidimensional. The research study has been able to contribute to further understanding of community dynamics, needs and challenges and overall vulnerability context of the Buffelsdraai community. Such understanding is crucial for conservation and climate change mitigation practices as it provides a platform to design and implement programmes which are context specific. The experiences and perceptions of respondents surveyed in this this study can also be used to inform future CBC's envisaged for low income communities.

This study asserts that awareness of scientific concepts should not be used as an isolate measure of local knowledge. It is important to unpack conceptualisation and understanding in a more systematic manner. The findings of this study suggest that language can often manifest as a barrier in the research process. In this regard, the use of quantitative tools such as surveys, alone, may not provide the researcher with the depth of information to meaningfully understand a phenomenon. Despite the lack of formal scientific education, community members did

display an ability to conceptualise environmental concepts and align their conceptualisation with the ideals of environmental protection.

In relation to building on understanding of ecosystem services and the benefits derived by resource dependent communities, the research study has revealed the multiple goods and services which support community livelihoods. These ecosystem services were identified to be crucial for subsistence purposes with patterns of requiring the need to raise awareness around issues of environmental sustainability. The findings from the study further support the shared opinion that ecosystems support and protect communities in the African context, more specifically among low-income and/ or poor communities.

With emphasis on the BLSCRP, levels of community participation were considerably low, which raises concern over community engagement, level of participation and representation. Although there have been benefits generated by the project, these benefits are restricted to a relatively small proportion of the community. Such findings allude to potential conflict situations and warrants a closer inspection on how the project is performing in relation to meeting the intended community-based rationale. A major critique of CBC initiatives is that they face the risk of catering to a minority rather than the intended majority. This study showed that community involvement in the BLSCR programme is limited which has resulted in conflict. Conservation authorities and municipal partners need to improve on local participation and involvement to remedy the already volatile situation. Mediating the conflict and tension that the project has caused is also crucial for the long-term community support and trust, with such matters of conflict undermining the overall success of the BLSCRP. In this regard, a political ecology perspective reveals that for CBC implemented with the context such as Buffelsdraai can provide benefits for local community members. However, such projects need to be regulated in relation to who are the targeted beneficiaries of the project, how are benefits distributed. Additionally, there is a need for improved transparency. Moreover, there is need to monitor and constantly evaluate the project, with the Buffelsdraai community being the flagship for the BLSCRP from which lessons can be learned for future projects under similar socio-economic contexts.

Additionally, research into conceptualisation and perceptions of community members needs to explore perceptions beyond awareness of concepts. As evidenced in this study, it was revealed that community members understood ecological processes and the factors that contribute to

these processes, despite being unaware of scientific terminologies. This suggests that research focused exclusively on levels of awareness shall not encapsulate local levels of knowledge. Given the aforementioned, it is crucial to unpack conceptualisation of environmental concepts which allows for conservation projects to build on existing community knowledge.

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APPENDIX A:

HOUSEHOLD QUESTIONNAIRE

Good day, I am undertaking a survey of the reforestation programme and biodiversity on behalf of a student, Mr Sizwe Nkambule for his MSc degree at the University of KwaZulu-Natal. May I ask you a few questions

in this regard? Your answers will be treated confidentially and anonymously. If at any time during the interview you feel you do not wish to continue, please feel free to do so. Thank you for agreeing to be interviewed.

SECTION A: SOCIO-DEMOGRAPHIC PROFILE OF RESPONDENTS

A1. What is your age (in years)?   _____   A2. What is your sex? (Note: Do not ask)

1.Male	2.Female

A3. What is your employment status?

1.Employed	2. Part-time employed	2.Unemployed	3.Self-employed	4.Retired	5. Medically boarded	6.Student	7.Other(specify)

A4. What is your current occupation?

1.Laborer/unskilled	2.Sales/marketing	3.Administrator/manager	4.Businessperson	5.Professional	6.Artisan/technician	7.Manufacturing	8.Housewife	9.Student
10.Other(specify)								

A5. What is your highest level of formal educational attained?

1.No formal education	2.Partial primary	3.Primary completed	4.Partial secondary	5.Secondary completed	6.Certificate/Diploma	7.Undergraduate degree
8.Postgraduate degree	9.Adult Based Education (ABED)		10. Other (specify)			

A6. Do you have access to credit?

1.Yes	2.No

A7. What is your monthly income (in Rands)?

0.None	1.<R1500	2.R1501-3000	3.R3001-4500	4.R4501-6000	5.R6001-7500	6.R7501-9000	7.R9001->10500	8. >15001 (specify)

SECTION B: HOUSEHOLD DEMOGRAPHICS

B1. How many members of the household are male and female?

1. Male		2. Female	

B2. What are the ages of the members of the household?

1.<10		2.11-20		3.21-30		4.31-40		5.41-50		6.51-60		7.61-70		8.>70	

B3 What is the employment status of the household members?

1.Not applicable (children or student)	2.Employed	3.Self-employed	4.Unemployed	5.Medically-bordered	6.Retired/ pensioner	7.Other (specify)

B4. What are the sources of the total household monthly income (in Rands)? (Multiple responses permitted)

1.Formal employment	2.Small business/ informal trading	3.Sale of trees/ seedlings	4.Sale of agricultural produce	5.Remittances	6.Old age pension	7.Child grant	8.Disability grant	9. Other (specify)
TOTAL								

B5. What type of dwelling do you currently live in?

1. Formal brick	2. Traditional	3. Informal	4. Other (specify)

B6. What activities take place on the property currently? (Multiple responses permitted)

0.None	1.Crafting	2. Business/Spaza shop	3.Traditional medicine	4.Crop production	5.Collection of trees and seedlings	6.Livestock rearing

B7. What type/s of energy sources does the household have access to? (Multiple responses permitted)

1. Electricity	2. Fuelwood	3. Gas	4. Paraffin	5. Candles	6.Other (specify)

B8. What type of water facility/ supply does the household have access to? (Multiple responses permitted)

1. Piped water (inside dwelling)	2. Outside tap	3. Communal tap/ borehole	4. Communal tank	5. Collected from nearby river/ stream	6. Other (specify)

B9. What type of sanitation does the household have? (Multiple responses)

0.None	1.Flush toilet	2.Pit latrine	3. Bucket system	5.Other (specify)

B10. What are the various ways in which you dispose of domestic household waste?(Multiple responses permitted)

1.Removed by local authorities	2. Burn it	3.Communal refuse dump	4.Other (specify)

B11.Which of the following social organisation do you or a member of your household belong to? (Multiple responses permitted)

0.None	1.Church/religious group	2. Stokvel	3. Workers union	4.Farmers organisation	5. Other (Specify)

B12. Please indicate three major needs and challenges faced at the household and community level. (In order of priority).

Needs		Challenges	
Household level	Community level	Household level	Community level
1.	1.	1.	1.
2.	2.	2.	2.
3.	3.	3.	3.

SECTION C: BIODIVERSITY, CONSERVATION AND CLIMATE CHANGE CONCEPTUALISATION

C1. Please complete the following table:

	Biodiversity	Conservation	Climate change
1.Have you heard of the following concept?	Yes　　　No	Yes　　　No	Yes　　　No
2.What is your understanding of the term			
4. Where did you get this information from?			
5. If there is an isiZulu or isiXhosa word/s (specify)			

3. Frequency
1. Seldom
2. Often
3. Very often

4. Source of information
1. Television
2. Radio
3. Newspaper
4. School
5. Wildlands
6. Municipality
7. Friends/family
8. Pamphlets/brochures

C2. What do you consider to be part of biodiversity in your community?(Multiple responses permitted- ask for each)

1. Open space	2. Gardens	3. Forests	4.Plants/Trees	5.Animals/insects	6. People	7. Other (specify)

C3.Have you observed any changes in relation to the following in your surrounding area? (Please specify)

	1.Yes 2.No	1. There are fewer than there used to be	2.There are more than there used to be	3. Decrease in diversity	4. Increase in diversity
1. Tress					
2. Plants					
3. Animals					
4. Insects					

CODES

C4. Please rank the following according to what you consider to be an important part of nature in your community.

1.Open space		2.Gardens		3.Forests		4.Religious sites		5.Plants/trees		6.Animals/insects	

0=Not important
1=Slightly important
2=Important
3=Moderately important
4=Very important

C5.Is it important to have many different types of plants and animals in your environment? Please elaborate

Yes	
No	

Note: **Biodiversity** is the variety of different types of plants/trees and animals. **Climate change** is the change in weather conditions over a long period of time.

C6. Please rate the extent to which the following contribute to climate change and loss of biodiversity.

Contributors	Biodiversity	Climate change
1. Humans/ people		
2. Industry		
3.Deforestation		
4.Pollution		
5.Commercial agricultural practices		
6.Increased carbon emissions		

Scale
1= Does not contribute
2= Minimum
3= Minor
4= Intermediate
5= Major

C7. Who do you think should be responsible for addressing issues/challenges related to biodiversity and the natural environment? (Multiple responses permitted)

1.National government	2.Municipality	3.Private organisation (NGOs)	4.Community organisations	5.Yourself

C8. Which of the following organisations would you put your trust in providing you information?

1.National government	2.Municipality	3.Private organisation (NGOs)	4.Community organisations	5.None

C9. Please rate your level of agreement with the following statements (1=strongly disagree, 2= Disagree, 3=Neutral, 4=Agree; 5=strongly agree)

	1	2	3	4	5
1. The balance of nature is very delicate and easily upset					
2. Changing the environment for human use seldom causes serious problems					
3.Plants and animals exist primarily to be used by humans					
4.The Earth we live on has a limited amount of resources					
5.Humans were meant to rule over the rest of nature					
6. There are limits to economic growth					

C10.Do you think there is a need to conserve biodiversity? Please elaborate.

Yes	
No	

SECTION D: ECOSYSTEM GOODS AND SERVICES

D1. Do you use any ecosystem goods and services?

1.Yes	2.No

D1.2. If yes, what are the main purposes? (Multiple responses permitted- ask for each)

1.Gather resources	2.Religous/cultural practices	3.Recreation and leisure	4.Agricultural use	5. Educational use	6. Sale	7. Household	8. Subsistence

D2. Which of the following do you collect from your surrounding natural environment? (Not domestic purposes, eg household gardens)

Goods	1=Yes 2= No	Frequency (1=Daily; 2= Weekly; 3=Monthly; 4=Seasonally)	Purpose (1-subsistence, 2= Sale)	Amount (per month in Rands)
1.Fuelwood				
2.Edible plants				
3.Medicinal plants				
4.Clay				
5.Sand				
6.Stones				
7.Water				
8.Fruits				
9.Animals				
10.Thatch				
11.Logs				
12.Other				

D3. What services does the natural environment provide for you? (Multiple responses permitted-ask for each)

0.None	1.Climate control, e.g. shade	2.Flood control	3. Nutrient recycling	4.Soil restoration	5.Natural fertilisers	6.Water harvesting	7.Other (specify)

D4. Which of the following best describes your perception of the environment? (Choose only **ONE**)

1.Humans are part of nature	2.Humans are separate from nature, but equal	3.Humans are separate from nature, but superior	4.Humans are users of nature	5.Humans are custodians of nature

D5. With regards to the natural environment, please indicate which of the following values it fulfils in you personally? (Multiple responses permitted- ask for each)

1.Aesthetic value- I appreciate it for its beauty and scenery	2.Economic value- I derive products for sale e.g. wood, traditional medicine	3.Recreational value- It provides me with a place for outdoor activities
4.Life sustaining value- it is a place that produces, renews air, water and soil for me	5.Spiritual value- it is a sacred and religious place for me	6.Cultural value- I use it for rituals and to pass down knowledge
7.Subsistence value-it provides me with food and supplies to sustain my life e.g. food		

D6.Please describe the impact of the following.

	1- None	2-Positive	3-Negative
1. The loss of the natural environment on me personally.			
2. The loss of the natural environment the community.			

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SECTION E: BUFFELSDRAAI LANDFILL SITE COMMUNITY REFORESTATION PROJECT

E1. Are you aware of the community reforestation project?

1.Yes	2.No

Note: The Municipality & Wildlands Conservation Trust initiated a reforestation project which aimed to offset carbon emissions as a result of the 2010 FIFA World Cup, through a series of local natural habitat restoration projects using a buffer zone of the Buffelsdraai Regional Landfill Site. This includes programmes such as the 'Tree-preneurs', who set up small indigenous tree nurseries at their homes and trade seedlings for goods and services.

E2. Are you a part of the community reforestation project? (If No, skip to E8)

1.Yes	2.No

E2.1. If yes, how long have you been involved in the community reforestation project?_____

E3. Please specify your role in the community reforestation project?

_____

E4. How much financial income do you receive from your employment? _____

E5. What motivated you to be a part of the community reforestation project?_____

E6. What type of benefits do you receive from the community reforestation project? (Multiple responses permitted)

0.None	1. Helps pay school fees	2. Provides additional income	3. Bicycle	4. Education about the natural environment	5. Increased food security	6.Building materials	7. Driver's license/test	8.Solar panel
9.Other (specify)								

E7. Please indicate how your involvement in the community project has affected your views towards the natural environment. (Multiple responses permitted-ask about each)

1.No effect	2. More caring about the environment	3.More aware of climate change	4.Provided more knowledge about the environment

E8. Please indicate whether the reforestation project has achieved the following outcomes within your household? (Please use the scale provided)

Indicator	1. Response (1=Yes; 2=No)	Rating									
		1	2	3	4	5	6	7	8	9	10
1.Job creation											
2. Increased access to infrastructure resources (solar panels, Jo-Jo water tanks, cement etc.)											
3.Increased access to education											
4.Enhanced food security											
5.Increase access and use of natural resources											
6.Increase level of environmental awareness/education											
7.Increased responsibility to environmental wellbeing											

E9. Are you aware of any project objective, please specify (Multiple responses permitted)

0.None	1. Offset carbon emissions	2.Increase local climate adaptation capacity	3.Replanting of forest habitat	4.Improvement of ecosystem services	5.Provide employment

Thank you for your time. Have a good day.