AN ASSESSMENT OF THE GIBA GORGE SPECIAL RATING AREA AS A BIODIVERSITY STEWARDSHIP PRACTICE

By

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ABSTRACT

Traditional conservation practices restricted resources to formally Protected Areas leaving biodiversity lying outside Protected Areas with minimal or no formal management. Increasing evidence of significant biodiversity lying outside Protected Areas, even in urban areas has necessitated innovative strategies for conserving biodiversity for human well-being. One such strategy is the use of a 'Special Rating Area' (SRA) legislative instrument to raise funds for managing biodiversity on privately owned properties through a pilot project in the Giba Gorge Environmental Precinct (GGEP). The aim of this study is to assess the Giga Gorge SRA as a biodiversity stewardship practice by understanding the processes of open space management and the impact it has had on local communities, ecosystems and adjacent property. The study was conducted involving the GGEP property owners and the Tshelimnyama community members (local community adjacent to the GGEP) comprising the traditional healers and general community members. The study is guided by the political ecology conceptual framework for understanding environmental issues in the GGEP and how socio-political processes at various scales have shaped the GGEP project. In addition, stakeholder theory provides a framework for exploring relationships among GGEP stakeholders and how their interests are managed. The study uses a sequential explanatory mixed methods approach in data collection and analysis. Analysis of data reveals improvement in the quality of ecosystems during the period 2010 to 2012. Secondly, findings reveal unsustainable natural resource uses such as recreational activities and medicinal plant harvesting. Thirdly, the study highlights negative stakeholder perceptions towards management activities resulting from communication breakdown. Fourthly, findings show that majority of the property owners did not find security concerns in the GGEP open space as factors that would restrict their interactions with the open space and other open space users. Lastly, the study reveals that the GGEP project had no impact on property value. This study recommends that the GGEP management develops and implements research based communication strategies for engaging stakeholders in the processes of managing the GGEP project.

PREFACE

The experimental work described in this thesis was carried out in the School of Agriculture, Earth and Environmental Sciences, University of KwaZulu-Natal, Westville campus, from July 2011 to December 2014, under the supervision of Dr. Fathima Ahmed and Professor Urmilla Bob.

This study represents original work by Chuma Banji Chinzila and has not otherwise been submitted in any form for any degree or diploma to any tertiary institution. Where use has been made of the work of others it is duly acknowledged in the text.

DECLARATION - PLAGIARISM

I, Chuma Banji Chinzila declare that:

1. The research reported in this thesis, except where otherwise indicated, is my original research.

2. This thesis has not been submitted for any degree or examination at any other university.

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

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   a. Their words have been re-written but the general information attributed to them has been referenced
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5. This thesis does not contain text, graphics or tables copied and pasted from the Internet, unless specifically acknowledged, and the source being detailed in the thesis and in the References sections.

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LIST OF ACRONYMS

AEO 2	Africa Environmental Outlook 2
BMA	Biodiversity Management Agreements
BRICS	Brazil, Russia, India, China, and South Africa
CBD	Convention on Biological Diversity
COP	Conference of the Parties
CPRE	Campaign to Protect Rural England
D'MOSS	Durban Metropolitan Open Space System
DEA	Department of Environmental Affairs
DEAT	Department of Environmental Affairs and Tourism
EASAC	European Academies Science Advisory Council
EPCPD	Environmental Planning and Climate Protection Department
GGEP	Giba Gorge Environmental Precinct
GIS	Geographical Information System
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
JMOSS	Johannesburg Metropolitan Open Space System
MEA	Millennium Ecosystem Assessment
MOSS	Metropolitan Open Space System
NEMA	National Environmental Management Act
NEMBA	National Environmental Management: Biodiversity Act
NEMPAA	National Environmental Management: Protected Areas Act
NGOs	Non-governmental organisations
PRA	Participatory Rural Appraisal
RDAP	Reaction, Defence, Accommodation, and Proaction
RDP	Reconstruction and Development Programme
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency Limited
SPSS	Statistical Package for Social Statistics
SRA	Special Rating Area
UK	United Kingdom
UNEP	United Nations Environmental Programme
UNFCC	United Nations Framework Convention on Climate Change
USA	United States of America
WCED	World Commission on Environment and Development

WESSA	Wildlife and Environment Society of South Africa
WoF	Working on Fire

CHAPTER ONE

INTRODUCTION

1.2 Preamble

The need to conserve is deeply rooted in the value attached to the natural environment; whether of intrinsic or instrumental value (Ladle *et al.*, 2011). As such, conservation values materialise through delineation of the natural environment to be conserved which gives rise to Protected Areas (Ladle *et al.*, 2011). Dudley (2008: i) defines Protected Areas as "a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values." Conservation through Protected Areas permits the resuscitation of biodiversity which then trickles down to well-functioning ecosystem processes giving rise to incessant supply of ecosystem services (Dudley *et al.*, 2014), with manifold benefits to people.

Protected Areas take many forms such as game reserves, national parks, nature parks, biosphere reserves, national monuments, conservation networks and protection areas all which vary according to land use, resource planning and management (Brockington *et al.*, 2008; Aubertin and Rodary, 2011). The International Union for the Conservation of Nature (IUCN) developed categories of Protected Areas recognised by the United Nations and nations throughout the world (Dudley, 2008). These categories have evolved since the late 18th century with the current categories being a product of the revisions made since 1960 (Brockington *et al.*, 2008). The IUCN categories integrate into conservation, human activities, provisions of multilateral international agreements and also take into consideration pursuits of other sectors of the economy (Aubertin and Rodary, 2011; Ladle *et al.*, 2011). Categorisation of Protected Areas was based on the purpose of establishment such as protection and conservation, restriction and restoration of species, habitats and landscapes (Brockington *et al.*, 2008). The IUCN categories include the following:

- Ia. Strict Nature Reserve;
- Ib. Wilderness Area;
- II National Park (ecosystem protection; protection of cultural values);
- III Natural Monument;
- IV Habitat/Species Management;
- V Protected Landscape/Seascape; and,

- VI Protected Area with sustainable use of natural resource

(Dudley 2008: 4).

Protected Areas are valued as a tool for managing and conserving biodiversity and by doing so sustain ecosystem services and cultural aspects of the natural environment (Lockwood *et al.*, 2012; Dudley *et al.*, 2014). Management of Protected Areas varies from purely government and community-based to partnerships between governments, non-governmental organisations (NGOs), private companies and communities (Dudley, 2008; Lockwood *et al.*, 2012). It must be noted however that, the act of earmarking biodiversity for protection does not in itself guarantee conservation and a rather deliberate move to conserve biodiversity is required to attain the desired outcomes (Lockwood *et al.*, 2012).

Protected Areas are the main tool and strategy for conserving biodiversity globally. However, researchers such as Mora and Sale (2011) demonstrate the continued loss of biodiversity managed through Protected Areas and other strategies. This is attributed to "budget constraints, conflicts with human development, and a growing human population that will increase not only the extent of anthropogenic stressors but the difficulty in successfully enforcing Protected Areas" (Mora and Sale, 2011: 251). Hamilton *et al*. (2013) assert that land use around Protected Areas constrain biodiversity conservation through alteration of ecological processes and movement of species. Additionally, implementation of Protected Areas may not be warranted as indicated by Gross (2012) who states that context is important in determining whether or not to implement Protected Areas because sometimes, small measures can be more effective than extensive ones. All in all, Protected Areas supplement conservation efforts outside Protected Areas as provided for by the Convention on Biological Diversity (CBD) (Dudley, 2008).

The main focus of this study is biodiversity management outside Protected Areas and in particular, the study assesses the Giba Gorge Special Rating Area (SRA) as a biodiversity stewardship practice. Biodiversity stewardship is defined as a strategy where landowners or users become guardians of their land including all the biodiversity and manage the land using sustainable use and management practices (South African National Biodiversity Institute-SANBI, 2009). The Giba Gorge SRA is an eThekwini Municipality pilot project in the Giba Gorge Environmental Precinct (GGEP) of Hillcrest area of Durban which started in 2009. It is a partnership between the Municipality and the GGEP property owners and is implemented using a legislative instrument called the Special Rating Area (SRA). A SRA has been developed and used in managing communities by providing extra services in addition to those provided by the Municipalities (Msunduzi Municipality, 2013). Extra services include security, cleansing services such as refuse collection, campaigns against crime, maintenance of infrastructure, upgrading the environment such as streets and social amenities (Lohrentz, 2010). In

general, the driver of this instrument in South Africa is to empower communities to take an active role in making their communities better and more secure in a crime-infested country (Lohrentz, 2010; Stellenbosch Municipality, 2014). However, in the GGEP, this legislative instrument was specifically adopted for managing biodiversity. Thus, the extra service sought by the GGEP community is biodiversity management; given the rich biodiversity in the Giba Gorge open space, the GGEP uses the SRA specifically to conserve the biodiversity by restoring the degraded ecosystems to their natural state (GGEP, 2011).

The eThekwini Municipality population is composed of 45% rural, 30% peri-urban and 25% urban inhabitants (eThekwini Municipality, 2013: 38). The GGEP lies at the fringe of urban area and at the forefront of traditional areas rendering it to be regarded as peri-urban (eThekwini Municipality, 2010a). The GGEP open space falls within the jurisdiction of the eThekwini Municipality and is managed using an urban spatial framework known as the Durban Metropolitan Open Space System (D'MOSS) (Environmental Planning and Climate Protection Department-EPCPD, 2010).

The study is guided by the political ecology approach, for example, as advocated by Forsyth (2013), in understanding the relationships among natural resource users, environmental problems and how decision-making processes at different scales affect natural resource management in the GGEP. In addition, the study adopts the stakeholder theory (Freeman, 1984), which forms the basis for conducting this study using a multi-stakeholder approach. Stakeholder theory provides a framework for identifying stakeholders which is crucial for this study. Overall, it provides a platform on which to engage the various stakeholders of the GGEP in this study.

The study assesses the processes of the GGEP project and perceptions of stakeholders on the GGEP project. This is crucial for understanding the aspects pertaining to the sustainability of the GGEP project. The study also seeks to understand how sustainable the various natural resource extraction practices in the GGEP area are and how these natural resource extraction processes affect the biodiversity of the GGEP open space. In view of this, the study explores the processes of biodiversity management in terms of the proposed SRA planning and management of the GGEP pilot project within the context of biodiversity stewardship.

The study further examines the benefits of the GGEP project to stakeholders as well as contestations which exist among stakeholders over natural resources. In addition, the study assesses the current uses of natural resources in the GGEP in relation to their rate of harvest. In order to do so, quantitative techniques (questionnaire survey for data and descriptive statistics for analysis) as well as qualitative techniques (interviews, focus group discussions, observations and document analysis for data collection and thematic analysis for data analysis) are used. The study incorporated Participatory

Rural Appraisal (PRA) techniques during focus group discussions to assess changes in natural resource abundance between the years 2010 and 2012. Additionally, the study utilises the proximate principle and change analysis to complement the perceptual analysis in determining the impact of the GGEP project on proximate property value and ecosystems.

1.2 Background

A SRA is a registered cooperative under Section 21 of the South African Company Act, which uses the provisions of Section 22 of the Municipal Property Rates Act to raise funds for the provision of additional services to properties within a precinct (eThekwini Municipality, 2011; eThekwini Municipality, 2012a). In order to provide additional services, community members of a proposed SRA are charged an additional rate to their property rates to raise funds for the provision of additional services (Republic of South Africa, 2005; Msunduzi Municipality, 2013). A group of property owners (pioneers) living within a precinct can initiate the establishment of a SRA by developing a proposal which includes budget, activities and timeframes of the proposed activities (City of Cape Town, 2009). Besides the proposal, pioneers provide a justification for the establishment of a SRA to other property owners living within the precinct through the management plan (Republic of South Africa, 2005; City of Cape Town, 2009; Schlemmer, 2011).

Before establishing a SRA, it is vital to know the size and extent of the proposed geographical area as well as the actual additional services to be implemented under the SRA project (Republic of South Africa, 2005; Stellenbosch Municipality, 2014). This means then that the geographical area in question and the additional services sought should be clearly defined within the management plan and understood by the community. Most importantly, the proposed rates should be sufficient to run the SRA project (Republic of South Africa, 2005; Msunduzi Municipality, 2013). Through consultations with other property owners, the pioneers seek consent through majority vote (66% of property owners living within the proposed SRA) to establish a SRA (Republic of South Africa, 2005; Schlemmer, 2011). In addition, the municipality and the SRA project pioneers make an undertaking to transfer funds raised under Section 22 of the Property Rates Act to the SRA according to the provisions of Section 67 of the Municipal Finance Management Act (eThekwini Municipality, 2011). Under the Municipal Property Act 6 of 2004, a municipality can establish a SRA if the business proposal falls within the Integrated Development Plan of the City in question (City of Cape Town, 2010). For a community to be a SRA it has to be composed of at least 200 properties or they must meet the required value of properties, which is determined by the city council (City of Cape Town, 2010).

Once the SRA is established, a committee should be elected to oversee the running of the activities as well as management of the finances generated (Republic of South Africa, 2005).

Various SRAs have been established in South Africa with more than 19 in Cape Town (City of Cape Town, 2009). Two SRAs have been established in Durban, that is, the GGEP SRA and the Umhlanga Urban Improvement Precinct (eThekwini Municipality, 2012b). All these SRAs with the exception of the GGEP were established to provide additional services as cleansing and security services (City of Cape Town, 2009; eThekwini Municipality, 2012b). Funding for the GGEP project, just like other SRAs, is sourced from additional rates and the Municipality (EPCPD, 2010a). Figure 1.1 depicts the sources of funding for the GGEP budget.

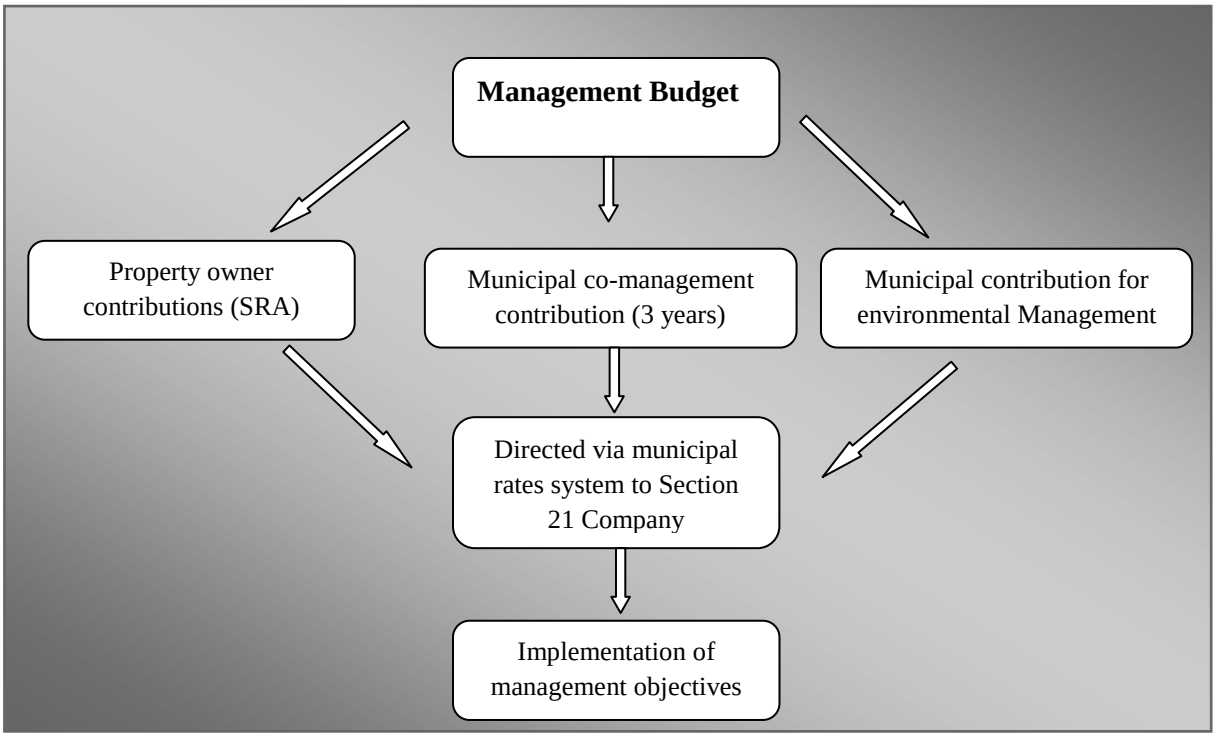


Figure 1.1: Funding for the GGEP management budget (Adapted from: EPCPD, 2010a: 9)

As shown in Figure 1.1, the sources of the GGEP project funding include property owner (SRA) contributions, eThekwini Municipality co-management contribution and eThekwini environmental management contributions (EPCPD, 2010a). Funding for the GGEP project is thus accessed through Section 67 of Municipal Finance Management Act and channelled to the Section 21 Company for implementation of the management plan (EPCPD, 2010a). A key aspect of the funding is that the eThekwini Municipality co-management contribution to the budget only lasts for a stipulated period of three years (EPCPD, 2010a). After the stipulated period of funding, the GGEP project is expected to be self-sustainable financially using the property owner contributions and other independently sourced funding (EPCPD, 2010a).

1.3 Rationale

The Millennium Ecosystem Assessment-MEA (2005) asserts that biodiversity conservation and management is critical in a world where degradation and the pressures on biodiversity are rising. Ecosystems contain diverse species which provide many services that are important for human well-being and as such, biodiversity is recognised as an important component of human well-being in all sectors of living (MEA, 2005; Costanza and Farley, 2007; Jones and Solomon, 2013). Researchers such as Costanza and Farley (2007) and Alves *et al.* (2013) recognise the need for integrative biodiversity conservation in recognition of the fact that human well-being is embedded in a complex web of interactions with various natural resources. Thus, integrative approaches to biodiversity management ensure sustainability of biodiversity and natural resources that are critical for continuous support of the activities on which human well-being is dependent (DEAT, 2006).

The DEAT (2006) reveals the following trends in South Africa's biodiversity conservation:

- Prior to 2004, more focus was on managing biodiversity in formally Protected Areas mostly in rural areas. This excluded critically important ecosystems in urban areas, which were not under legislative protection but provided multiple ecosystem services.

- Since 2004, various natural resource management strategies have emerged, largely presenting a departure from traditionally state managed to more integrated management strategies. Thus, the conservation model changed and is more inclusive as it provides incentives for conservation as well as instilling a sense of individual responsibility towards conservation. Conservation funding has since incorporated business principles, outsourcing and economic empowerment all in a bid to increase the size of Protected Areas and to include biodiversity in urban areas.

Initiatives such as biodiversity stewardships and the D'MOSS emerged and through such strategies 75 000 hectares of land (falling outside Protected Areas) is formally under conservation (Driver *et al.,* 2012: 59). This is in line with global trends in biodiversity management best practice, which focus on the involvement of communities and integration of indigenous knowledge in environmental management and conservation (Secretariat of the CBD, 2010; Dudley *et al.,* 2014). Effective natural resource management is impossible without the involvement of various stakeholders (Schwilch *et al.,* 2012). This is because of the many challenges faced in natural resource management strategies (such as conflict of interest) that do not integrate stakeholders in management (Adger *et al.,* 1998; Warner, 2007). For instance, degradation of an ecosystem may not necessarily be caused by factors within the ecosystem but the cause may be emanating outside the ecosystem. An integrated ecosystem approach is therefore important to resolving environmental issues as well as considering all possible threats to the ecosystem (Vallejo and Hauselmann, 2004). According to Redpath *et al.* (2013), conservation

conflicts result when parties disagree on management objectives with one party imposing their interests at the expense of other parties. This implies that integrating stakeholders in natural resource management achieves efficiency by reducing conflicts and increasing consultations in policy formulation and implementation, thereby achieving sustainable and capacity development (Vallejo and Hauselmann, 2004; Dickman, 2010; Redpath *et al.*, 2013).

1.3.1 Landscape context

The 20th century saw a significant rise in urbanisation not only in the developed world but also in the developing world, including sub-Saharan Africa (Ward *et al.*, 2009; Goddard *et al.*, 2010; Nagendra *et al.*, 2014). This rapid urbanisation meant increased land use change due to increased demand for natural resources, which negatively affected habitats through degradation (Wilby and Perry, 2006; Williams and Winfree, 2013) and pollution such as air pollution, water pollution, industrial pollution, traffic, vehicle-generated pollution, solid waste and carbon emission (Li and Yao, 2009). Transformation of urban spaces from the natural environment to more complex artificial environments (such as concrete environments), significantly affect availability of open spaces and ecosystems services required for human well-being (Ward *et al.*, 2009). However, research reveals that urban areas possess complex ecosystems with diverse species composition (Grobler *et al.*, 2002; McConnachie *et al.*, 2008; Aronson *et al.*, 2014). Within South Africa, urban areas possess natural and artificial open spaces which are designed to make urban spaces liveable places (Schopfer *et al.*, 2004; Rotenberg, 2008). Such urban open spaces include "formal parks, sports fields, agricultural fields, town squares, private gardens, road reserves, servitudes for services such as electricity transmission lines, and dams" (eThekwini Municipality, 2002: 6). Some of these urban open spaces provide a home to many indigenous animal and plant species (Goddard *et al.*, 2010).

Within the eThekwini Municipality, the D'MOSS is a management tool used for establishing and maintaining urban natural open spaces with conservation efforts directed at conserving high value ecosystems (EPCPD, 2011). The main purpose of integrating high value ecosystems within the D'MOSS is to secure ecosystem services for human well-being (EPCPD, 2011). Since 2010, conservation under the D'MOSS has become part of town planning and the conservation area has been increasing through re-zoning of land as conservation zone or environmental conservation reserves (EPCPD, 2011). In addition, the D'MOSS uses the following tools to secure high value ecosystems for conservation and the GGEP project falls within these environmental conservation tools:

- Non-user conservation servitudes: in some instances, the outcome of the development assessment process requires the registration of conservation servitude over that portion of the

application property that is within the D'MOSS (EPCPD, 2010: 12). Developers are thus required to register conservation servitude over the portion of the property which requires protection from development (EPCPD, 2010: 12). The area affected by the servitude remains in the ownership of the property owner and can be used for purposes that do not compromise the integrity of the natural environment (EPCPD, 2010: 12).

- Re-zoning: land in the city is zoned for a number of uses such as industrial, residential and agricultural. Historically, when demarcating areas of the eThekwini Municipal area into zones, environmental sustainability and resilience was not taken into account (EPCPD, 2010: 13). This has necessitated a re-zoning process in certain areas in order to better protect the globally significant biodiversity of Durban (Mittermeier *et al.,* 2004; EPCPD, 2010: 13; Perera *et al.,* 2011). Land can be re-zoned into conservation zone (applied to privately owned areas requiring permanent protection from development) and environmental conservation reserve (applied to land owned or intended to be owned by either the Municipality or Ezemvelo KwaZulu-Natal Wildlife for conservation purposes) (EPCPD, 2010: 13).

  Land Acquisition: in some restricted instances, threatened or important areas are protected through acquisition (EPCPD, 2010: 13). This is achieved by either purchasing the property from the owner at an agreed upon value or registering a conservation servitude on the property (EPCPD, 2010: 13).
- Nature reserve proclamation: this refers to establishing a protected area as per provision of the National Environmental Management Protected Areas Act-NEMPAA (EPCPD, 2011: 13). Proclamation of a Nature Reserve gives land a higher conservation status (EPCPD, 2011: 12).

The GGEP is rich in biodiversity; it contains endemic and threatened species and vulnerable ecosystems, and is home to a historical site. The combination of all the characteristics renders the GGEP a unique open space whose value is important for both current and future generations. The EPCPD (2010) asserts that the GGEP open space ecosystems are rich in biodiversity and history, and yet environmental problems threaten ecosystem sustainability. Further, the EPCPD (2010) states that the threats to the GGEP open space ecosystems include the existence of alien plants which, if not properly managed, may lead to the displacement of the natural habitats, unsustainable commercial medicinal plant extraction which can completely destroy the habitats if not controlled, soil erosion; pollution and sedimentation of rivers; unplanned fire regimes and hunting. The EPCPD (2010) ascribes proliferation of invasive alien species as the biggest threat to the GGEP ecosystems. In South Africa, it is estimated that invasive alien species cause about R6.5 billion loss of ecosystem services annually (Driver *et al.,* 2012: 3).

Similar to global trends, the GGEP is faced with ecosystem degradation and the D'MOSS (undated) highlights land use change as one of the causes. This is demonstrated by, Figure 1.2 and 1.3 which show changes in land use change at two different stages: in 1954 and 2008.

Figure 1.2: Aerial view of the GGEP area in 1954 (Source: D'MOSS, undated: 6)

Figure 1.3: Aerial view of the GGEP area in 2008 (Source: D'MOSS, undated: 6)

Figure 1.2 shows the undeveloped state of the GGEP area in 1954 while Figure 1.3 shows the developed state of the GGEP area in 2008. Land use activities, such as developments have transformed South Africa's landscapes owing to growing population resulting from liberalised movement in the post-apartheid South Africa, increasing poverty and unemployment, among others (Miraftab, 2007; South African National Biodiversity Institute-SANBI, 2013; Brown and Du Preez, 2014). This scenario reflects some underlying causes of ecosystem change in the GGEP and Durban as a whole and is revealed through unsustainable natural resource harvesting which is one of the major environmental problems of the GGEP (EPCPD, 2011).

The significance of this study is embedded in the intrinsic value of the study area as well as the funding model adopted for managing the GGEP open space. As established in the previous section, the SRA instrument ideally used in managing the social environment of communities was adopted in the GGEP for natural resource management. This presents a unique scenario in South Africa for natural resource management outside Protected Areas, which mandates that the various processes be documented for further research into the subject or informing replication of the project in other provinces in South Africa. This is in the wake of the need for government to collaborate with communities, businesses, and people in increasing resources required for biodiversity management (Department of Environmental Affairs and Tourism-DEAT, 2004). Therefore, the successes and challenges of the GGEP project are intended to be examined and documented through this study.

In relation to the GGEP project, the perceptual analysis is important in informing GGEP management decisions aimed at improving the management strategies currently undertaken. This study is critical to understanding how stakeholders perceive the GGEP project as this indicates the future of this project since its sustenance is dependent on the willingness of the property owners to support the project financially. Being the first biodiversity management project to utilise the SRA in South Africa, the study will provide knowledge on the various processes of managing a SRA in relation to biodiversity management.

1.4 Aim and objectives

The aim of this study is to assess the Giba Gorge SRA as a biodiversity stewardship practice. Thus, the study seeks to understand the impact of the GGEP project on local communities, ecosystems and adjacent property value.

The objectives provided direction in implementing the study. They informed the research instruments and analysis of data to provide relevant conclusions for this study. The following objectives were set:

- To ascertain the occurrence of changes in natural resource abundance during the period 2010 to 2012.
- To assess the current uses of natural resources in the GGEP in relation to the extent to which resources are extracted.
- To assess various stakeholders' perceptions towards the GGEP project.
- To ascertain the extent to which security measures affect the stakeholders' perceptions of the interactions with the community and the GGEP project.
- To determine the impact of the GGEP SRA on property values or surrounding development.

1.5 Chapter sequence

Chapter one provides the context for this study. It highlights the background to the study which was based on managing biodiversity outside Protected Areas in urban areas and the need to conserve natural ecosystems for a secure provision of ecosystem services within urban areas. In addition, the chapter rationalises this study within the context of fragmented ecosystems in urban areas, biodiversity stewardship and the biodiversity management challenges in GGEP. Further, the chapter provides the aim, objectives and the sequence of chapters.

Chapter two, the theoretical and conceptual framework provides constructs upon which this study is based. The study is underpinned by the political ecological approach in understanding the context within which natural resource management occurs. It highlights various discourses in natural resource management including power, gender, environmental ethics and scale on which social and environmental processes occur. The political ecological approach is operationalised through the stakeholder theory, which provides a platform for engaging multi-stakeholders in the study.

Chapter three reviews literature pertaining to this study. It contextualises the study within biodiversity, its importance and the threats within the South African and global context. The chapter also provides the local and international legislative framework underpinning biodiversity management. By doing so, it highlights the various institutions and strategies for the management of biodiversity in South Africa. Urban open spaces are discussed highlighting the purpose, benefits and threats to urban biodiversity management. Various studies conducted in South Africa and other parts of the world are discussed highlighting the processes in establishing open spaces, the impact on adjacent properties and stakeholder perceptions on open spaces.

Chapter four is the description of the research methodology and the study area. The first part of the chapter provides the geographical and environmental context in which the study was conducted. Maps and pictures are provided which show the scope of the study as well as the general overview of the natural resources under study. The second section of the chapter presents the research design of the study by detailing the various methods and instruments used to collect and analyse data. In addition, this section highlights the population and sub sample used in this study.

Chapter five presents the research findings and analyses of the findings. Data is presented and subsequently analysed according to themes guided by the research questions. This chapter highlights the main findings of the study, which are discussed and analysed within the context of the conceptual and theoretical framework underpinning the study. The results are also analysed in context of various other research findings. The main themes that are highlighted in this study include changes in natural resources during the period 2010 to 2012, current uses of natural resources, stakeholder perceptions towards the GGEP project, the impact of security measures on stakeholder perceptions and the impact of the GGEP project on property value or surrounding development.

Chapter six is the summary and conclusion chapter which highlights the general findings of this study. Further, conclusions are drawn in relation to the general objectives of this study. Lastly, the study uses the major findings of this study to make recommendations for the GGEP project, policy-makers and future research.

1.6 Conclusion

Human well-being is intricately dependent on biodiversity through various services that are critical to meeting the basic needs of life. Ecosystem services provide the basis of all development and thus provide a foundation upon which global economies are built. This implies that poor ecosystem health affects human well-being through disrupted economic activities and livelihoods. Consequently, it is critical to adopt sustainable conservation strategies to manage biodiversity not only in the rural but also in urban areas where ecosystem services are critical. Such conservation strategies should manage biodiversity wherever it exists in its natural form to maintain incessant supply of ecosystem services. Besides managing biodiversity outside Protected Areas, current practice in biodiversity stewardship strategies management incorporates all relevant stakeholders in management, empowers communities to manage biodiversity and act responsibly in decision-making processes for environmental sustainability. In addition, current practice in biodiversity stewardship strategies pools resources from the public and private sectors for biodiversity management. By doing so, government increases resources for biodiversity management and areal extent of ecosystems.

CHAPTER TWO

CONCEPTUAL AND THEORETICAL FRAMEWORK

2.1 Introduction

Ecosystems are important to all living organisms because they sustain life through the goods and services they provide, such as air purification, food, fuel wood and carbon sequestration (Jones and Solomon, 2013). Natural resource management is enabled by adopting appropriate legislation for implementing ecosystem management strategies. Participatory management presents complex processes and challenges, involving natural resource legislation, implementation and management strategies.

A political ecological approach as a conceptual framework facilitates an understanding of the forces influencing and shaping natural resource management. The political ecology approach is operationalised through stakeholder theory as a platform for engaging GGEP open space stakeholders. Thus, the stakeholder theory is used to understand the various relationships among the users of the GGEP open space and its ecosystems, using the multi-stakeholder approach. From the conceptual and theoretical framework, a methodology was derived which is presented in chapter four.

2.2 Political ecology approach

Forsyth's (2013: 3-4) review of the definition of the term political ecology reveals disparities in understanding and use of the term and some of the meanings include:

- Phenomenological interaction of biophysical processes, human needs, and wider political systems;
- Political activism in favour of deep green environmentalism and its critique of modernity and capitalism;
- Interconnectedness of political relations;
- Analysis of Marxist debates about materialism, justice and nature in capitalist societies, with the view of achieving a fairer distribution of rights and resources; and

- General terms to politics of environmental problems without specific discussion of 'ecology'.

However, Forsyth (2013) reiterates that a generally acceptable understanding of the term political ecology relates to social and political nature of the causes, state and management of environmental problems. As a field, political ecology embraces "place-based, often qualitative approaches that seek to understand the differentiation of resource access across different groups and individuals, and how variable access shapes their material engagement with the biophysical world" (Turner, 2013). Similarly, Peterson (2000: 324) defines political ecology as an "approach that combines the concerns of ecology and political economy to represent an ever-changing dynamic tension between ecological and human change, and between diverse groups within society at scales from the local individual to the earth as a whole." It integrates social sciences with natural sciences in understanding human-nature relationships (Peterson, 2000: 324). In its initial phase, political ecology focused on ecological conflicts emanating from risks such as pollution from industries (Forsyth, 2005). However, attention has shifted towards understanding not just risk but the nature of the risk and how powerful social actors influence ecology (Forsyth, 2003). According to Peterson (2000), the shift in focus came about from understanding that available natural resources determine the range of alternatives for their use and this will ultimately affect the politics and economics surrounding management of the natural resources.

The political ecology approach provides the key impetus in understanding the dynamics explored within interdisciplinary fields such as geography (Neumann, 2009). In this framework, injustices existing in natural resource management focus mainly on the poor and marginalised groups in society, exposing the relationship between environmental degradation and social inequality (Springate-Baginski and Blaikie, 2007; Maldivian, 2008). Turner (2013: 5) asserts that "political ecological analysis is generally motivated by normative commitments to social and environmental justice with a stronger human-centric orientation than is adopted by ecologists." Environmental justice is a major component of political ecology and it is expressed in two ways, justice in costs and benefits emanating from natural resource management and, representation in all decision-making processes for natural resource management (Blaikie, 2012). Political ecology also focuses on natural resource management politics which are characterised by knowledge and social justice and power imbalances in the interactions between vulnerable societies and environmental problems (Forsyth, 2008). In a broader sense, "political ecology addresses the conflicts and convergences between development, conservation, cultural survival, gender equality and political autonomy in a search for social, ecological and technological alternatives" (Rocheleau, 2008: 178).

Nature and society are inextricably related and the state of the environment or its nature is a result of interactions between political processes and dominant actors in society (Adams and Hutton, 2007;

Pincetl, 2012). For instance, a study by Lanckriet *et al.* (2014) reveals that environmental degradation north of the Ethiopian Highlands was a result of unfair land rights during feudal times which drove the poor farmers onto marginal land. Thus, political ecology, within the geography field, views environmental phenomena to be a consequence of socio-political processes acting at various spatial scales or contexts (Adams and Hutton, 2007). It "attempts to link an understanding of the logics, dynamics and patterns of economic change, the politics of environmental action and, ecological outcomes, a set of relationships fundamental to conservation" (Adams and Hutton, 2007: 149).

2.2.1 Political ecology discourses in natural resource conservation

Various political ecology discourses within natural resource conservation address issues of politics, social justice, democracy and conflicts revealed through interests, power and vulnerabilities of different social groups (Brown and Purcell, 2005; Blaikie, 2012; Forsyth, 2013). This section considers discourses of spatial scales at which social-environment interactions occur, power interplay among natural resource users and policy makers, conservation policy, gender and natural resource use and environmental ethics.

2.2.1.1 Discourses of spatial Scale

Political ecology highlights the relationships between social and environmental processes which occur at different spatial scales ranging from local to global (Mauro, 2009; Bixler, 2013; Forsyth, 2013). Neumann (2009) argues that scale is not a definite or fixed concept but varies depending on its social and context specific interpretation. In political ecology, scale discourses focus on how international and national policies affect natural resource management and social-environmental interactions such as access and use of natural resources and, involvement in decision-making and sustenance of livelihoods of local communities (Brown and Purcell, 2005). Scale in political ecology also pertains not only to policies but to interconnectedness of phenomena at a local, regional, national and global level (Thomas-Slayter *et al.,* 2013). Some researchers believe that the local scale is crucial to achieving desired outcomes (such as environmental sustainability, social justice and democracy) in natural resource management (Brown and Purcell, 2005). However, Brown and Purcell (2005: 608) argue that "the politics of scale literature offers the *a priori* conclusion that there is nothing inherent about scale; it does not allow for assumption that there is something intrinsically desirable about the local scale." Mauro (2009: 117) states:

> *The scale of analysis adopted in a research project may depend on the kind of question one wishes to answer, but ultimately larger-scale processes must be included to arrive at explanations that go beyond appeals to complexity or beyond eclecticism in the frameworks being combined.*

Because social-environmental relations are complicated, it is vital that any study thereof incorporate contributions to the phenomenon under study from all levels of scale (Neumann, 2009). Thus, this study incorporates the contribution of various policies, legislations and agreements that shape natural resource management in South Africa.

There are various interactions that exist across scales, which can take the form of international agreements (for instance, the CBD) or even governance at local organisations (Adger *et al.,* 2006). Such interactions are promoted as a means of achieving efficiency in resolving global environmental problems locally (Kolstad, 2014). For example, Community-Based Natural Resource Management systems provide formal and universal guidelines (in the case of international agreements) and recommendations viewed as best practice in natural resource management (Adger *et al.,* 2006). However, what determines the cross-scale interaction is power and how it is used (Adger *et al.,* 2006). While this study is undertaken at a local level, it does not obviate taking into consideration the impact of national and global-scale processes and power structures influencing the management of the GGEP open space. Various processes that affect natural resource management in the study area are considered and their implications to the GGEP project pursued.

2.2.1.2 Power discourses

Power plays an important role in shaping natural resource management through policy formulation, generation of scientific knowledge, access and use of natural resources (Blaikie, 2012; Pincetl, 2012; Bixler, 2013;). Roth (2015) asserts that political ecology perceives social, economic and political power as important factors in the relationship between humans and the environment. As demonstrated previously by Kimenyi *et al.* (2004), disparities exist among actors with various types and levels of power. In terms of natural resource access and use, differences are mainly determined by the various ways in which power is used in society (Turner, 2013). However, power is acquired in various ways by actors and/ or groups in society and can be acquired through election or appointment to positions of power (Celliers *et al.*, 2007). Peterson (2000) highlights three types of power functioning at different scales and they include overt, covert and structural. Overt power is a direct form of power which uses coercion, incentives or intimidation in decision-making processes. However, covert power deprives actors of opportunities to act through control of decision-making processes. Structural power relates to organisations' ability to control the number of issues which actors can make decisions on (Peterson, 2000). Celliers *et al.* (2007) describe structural power in terms of legislative, executive, moral and enforcement aspects. According to Celliers *et al*. (2007),

- Legislative power is that which enables an actor to participate in formulating rules and regulations. Organisations commissioned to participate in policy formulation and implementation (for instance, the SANBI), possess such power.

- Executive power is bestowed upon an organisation by government to make decisions, which affect all the people under the jurisdiction of that organisation.
- Moral power is vested in organisations that have moral obligations by virtue of their expertise and reputation to speak and act on an issue. Such an organisation is influential based on its moral authority, an example of which maybe a research institute.
- Enforcement power allows an actor to impose its decisions on members of their group or society in general, to be complied with. Examples of such organisations include environmental and wildlife authorities, and in a general sense, the police force.

Andrews and McCarthy (2014: 9) assert that "any adequate analysis of the operations of power must carefully and empirically trace how, where, and by whom power is used." Noteworthy is that people possessing power may not necessarily be decision-makers; rather, decision makers are usually influenced by external factors at various scales such as lobby groups and the media (Wangler *et al.,* 2013). A key aspect in exercising power is knowledge, without which there is no basis of negotiations amongst a group of actors with varying degrees of power (Adger *et al.*, 2006).

In the context of this study, power interplay within the GGEP is examined. The study focuses on the eThekwini Municipality's EPCPD which possess executive and enforcement power. It also examines power interplay among the GGEP open space stakeholders.

2.2.1.1 Conservation policy discourses

Conservationists' role in policy processes is to question "...who pays, who benefits, and who loses" from policies and to evaluate policies (Neumann, 2008: 729). Policy formulation processes involve making choices by weighing the various alternatives available based on costs and benefits and potential risks of the policy to society (Kimenyi *et al.*, 2004; Blaikie, 2012). According to Kimenyi *et al.* (2004), the purpose of the policy formulation process is to maximise social-welfare while ensuring availability of resources required for implementing policies despite disparities in agendas and bargaining power of participating parties. Disparities in agendas and bargaining power of parties involved in policy formulation cannot guarantee maximum social welfare rather they can benefit more powerful parties (Kimenyi *et al.*, 2004). For instance, governments' agenda in policy formulation may be to win the favour of voters for possible re-election and may in due course have to yield to the pressure from the media or lobby groups (Wangler *et al.*, 2013). Kimenyi *et al.* (2004) further state that the main concern with the process of policy formulation and the resultant policy is that policy affects the environment and humans, now and in the future. It is therefore essential to minimise politics in policy formulation by considering the environmental impacts of the policy (including the

plight of the vulnerable in society). Policy can also be used to impose unfair penalties on natural resource access offenders, a phenomenon which is common in developing countries where poor communities rely on the environment for their livelihoods (Forsyth, 2008). Such policy impositions characterised colonial and post-colonial natural resource management in most developing countries with the implication that poor communities lose their sources of livelihoods, which then exacerbates their poverty (Odera, 2004; Vaccaro *et al.*, 2013).

According to Forsyth (2008), political ecology enables the use of knowledge developed from environmental and social science in formulating socially just policies. However, it is not always possible to formulate socially just policies because formulation is usually informed by scientific knowledge obtained in various ways, some of which compromise the reliability of knowledge generated (Rocheleau, 2008; Blaikie, 2012). Blaikie (2008) asserts that one inherent problem in generating scientific knowledge is that funding organisations sometimes impose terms of conducting research, hence limiting researcher objectivity. Policies generated under such circumstances become biased and unjust, favouring those possessing power at the expense of vulnerable natural resources and people in society (Blaikie, 2008). In addition, sometimes, scientific knowledge is generated under commission, and this presents scientists with a problem of objectivity. Under such circumstances, the knowledge generated maybe used to implement the commissioners' agendas and not necessarily to address the initial problems identified (Blaikie, 2012). This concern is re-echoed by the Political Ecology Research Group (1979: 20, cited in Forsyth, 2003: 20):

> *Science is dialectical in nature, the results of research depend upon the assumptions of the researchers, which depend upon all manner of social factors specific to that researcher or research institutions. The ….situation where Government attempts to appoint 'impartial' assessors, in a quasi-legal framework, will in our view lead to the increasing dissatisfaction with the inquiry procedure.*

Adam and Hutton (2007) assert that the use of scientific research is not politically-neutral and as a result, it is important to understand the dynamics of politics, human action and how these affect the changes in natural resource use and control. It is therefore necessary to understand where power is vested and how it is used in order to further understand political dynamics in relation to conservation.

2.2.1.3 Gender discourses

Gender discourses are important in political ecology because they engender perceptions of natural resources and the livelihoods of local communities (Espinosa, 2010). In particular, Rocheleau *et al.* (2013) assert that gender discourses relate to gender divisions of knowledge and organisational affiliations, rights to natural resources and environmental quality. This is so because interests of men

and women in natural resources are different and are dependent on economic, cultural and ethnic contexts (Elmhirst and Resurreccion, 2008; Espinosa, 2010). Gender discourses examine constitutive power of genders at various scales (Elmhirst, 2011), that is, women and men do not both participate in natural resource policy formulation, access, harvest and use in the same way and for the same purposes. In addition, men and women have differentiated power relationships in natural resource use and management as a result of differences in food production and provision (Sunderland *et al.*, 2014). Gender is thus understood as a critical variable in shaping processes of ecological change, viable livelihoods and the prospects for sustainable development (Shackleton *et al.*, 2011). An example of differentiated gender roles in access and harvest of natural resources is that provided by Espinosa (2010) who states that women of the Amazon are traditionally not allowed to enter the forest or rivers and therefore they do not participate in hunting or fishing. This means that natural resource harvesting in that area of the Amazon is monopolised by men while women's roles are to manage the harvested resources and thus control when resources are harvested (Espinosa, 2010). Sunderland *et al.* (2014) highlight that men's access and use of natural resources is mainly towards economic gain while that of women is towards maintaining household food security. Shackleton *et al*. (2011) attributes such behavior to historical contexts of natural resource ownership, barriers to harvesting facilities and accessing markets.

Another aspect of gender discourses in conservation is a situation created by policy implementation programmes that are designed to curb environmental degradation but can instead result in gender-directed impacts and create inequalities among genders (Elmhirst and Resurreccion, 2008; Rocheleau *et al.*, 2013). Of concern to gender discourses are the processes of globalization, economic efficiency and rescaling of social production particularly those that perpetuate gendered production, reproduction and community management (Elmhirst and Resurreccion, 2008). For instance in Vietnam, gender bias in economic reform organisations has transformed resource access and control of the privatised coastal aquaculture (Elmhirst and Resurreccion, 2008). In this study, the gendered politics surrounding natural resource access, harvest and use is considered within the GGEP project.

2.2.1.4 Discourses of Environmental ethics

Social justice with respect to natural resource access and use is a moral and ethical issue, which is pursued in political ecology (Turner, 2004). Environmental ethics in political ecology pertain to inequalities among social actors and how inequalities affect access to natural resources (Jarosz, 2004). According to Cloke (2002, cited in Bryant and Jarosz, 2004: 807), in political ecology "the need for ethical reflection and action arises from the necessity to respond to significant intellectual and political changes in specific spaces and places overtime and a need to be accountable to self, for

others and responsible for near and distant spaces, places and environments." Bryant and Jarosz (2004) assert:

- Political ecology prioritises the rights of the poor whose livelihoods are dependent on the natural resources over those of the politically and economically powerful. Thus, people's survival needs are viewed to be more important than any conservation effort regardless of the fact that political ecology views vulnerable communities and environments as equal entities to be treated the same.

- The ethical stance of political ecology helps in avoiding prescribing policies that are not objective and promote unethical separation of people and the environment. Such ethical matters concern issues such as the de-humanisation of people accessing natural resources for their livelihoods by imposing harsher sentences on them. In addition, ethical concerns include addressing issues where decisions or policies are made to prioritise conservation over the need to earn a livelihood by local communities.

- Political ecology addresses moral and ethical issues on how conflicts are perceived and later used to formulate policies.

Morality and environmental ethics are critical to this study in light of the inequalities existing among the GGEP stakeholders. In this study, ethical issues surrounding access, harvest, and use of the GGEP open space resources by the stakeholders were considered. Thus, analysis highlighted inequalities among stakeholders and how they affected resource access and use. In addition, issues were also pursued in light of sustainability requirements for the GGEP resources.

2.2.2 Political ecology and conservation

Political ecology "offers productive possibilities for developing an understanding of political dimensions of conservation" (Adams and Hutton, 2007: 148). Such are discourses that focus on how environments are shaped by politics and in turn how societies are affected by changes in environments (Neumann, 2009; Vaccaro *et al.,* 2013). This section considers discourses in environmental conservation which include local people in management.

2.2.2.1 Paradigm shifts in environmental management

Vaccaro *et al.* (2013) describe the various paradigm shifts in environmental conservation starting with the introduction of public parks in the United States of America (USA). The end of the 19th century ushered in another form of environmental management characterised by exclusionary rights and control of natural resources through Protected Areas (Vaccaro *et al.,* 2013). However, in developing

countries, the fight for and later gain of independence brought about another paradigm shift from Protected Areas to participatory conservation (Argyrou, 2005; Adams and Hutton, 2007). Participatory approaches were emphasised through sustainable development in the 1980s and later on in the early 1990s through the CBD which provided for inclusion of local communities in managing and conserving natural resources while sharing the benefits arising thereof (Adams and Hutton, 2007; Vaccaro *et al.*, 2013). Thus, for all countries which ratified the CBD, the focus of conservation is community involvement in conservation through development (Jones, 2006). International organisations and governments focus their efforts (through grants, loans and political support, among others) on development projects that promote conservation and poverty alleviation (Jones, 2006).

At a national level, the key issues that the South African Government seeks to address include poverty alleviation, job creation, sustainable livelihoods, access to quality education, improved healthcare, social development, human settlement and, fighting crime and corruption, among others (Republic of South Africa, 2009; KwaZulu-Natal Legislature, 2011). These priorities provide direction to all government activities performed at national, provincial and local levels including decision-making and formulating rules and regulations in various sectors of the economy. For instance, in promoting conservation and healthy living, the eThekwini Municipality provides for the establishment and management of parks and open spaces through the D'MOSS. The study area (GGEP) falls within the jurisdiction of the D'MOSS and was established under a local government legislative instrument, the SRA (eThekwini Municipality, 2010). The conservation land falling under the D'MOSS is either a privately owned protected area or government owned protected area (EPCPD, 2010). However, the Giba Gorge is neither a privately owned protected area nor government owned protected area. It is a collection of government parcels and privately owned parcels of land that are collectively managed by a partnership between the private property owners and the Municipality (local government).

2.2.2.2 The politics in environmental conservation

Environmental discourses surrounding nature conservation and livelihoods have become prominent among researchers over the last few decades (Viccaro, 2013). These have been prompted by the increasing trend in unsustainable practices in natural resource management which manifest through capitalist behaviours controlling the world economies (Bob *et al.*, 2008). Such discourses are of fundamental importance as they deal with the question of actual survival of the poorest in society (Adams and Hutton, 2007). Environmental discourses pertain to the management systems adopted by governments to manage natural resources as well as the effects of resource harvesting on people living adjacent to or within those environments in question.

There are various environmental management systems practiced throughout the world, among which are the Protected Areas and Community-Based Natural Resource Management systems. As discussed previously, Protected Areas are an old resource management system which in developing countries has its roots in colonial management systems (Viccaro, 2013). The motivations of declaring and managing resources as Protected Areas include preserving biodiversity, maintaining hunting, protecting scenic beauty and sustainable extraction of natural resources (McDonald and Boucher, 2011), as well as maintaining the evolutionary potential through conservation of genetic diversity. Traditionally Protected Areas were characterised by exclusionary rights and local or indigenous communities were viewed as interference to sustainable management of resources (Gruber, 2010). New forms of Protected Areas emerged to include, public private partnerships, private and community managed Protected Areas (Dudley, 2008). These emerged as a result of growing awareness of human rights, acknowledgment of the role of humans in shaping the environment and the recognition of inefficiencies in implementing Protected Areas due to resistance from communities, among others (Lockwood, 2010; Viccaro, 2013). Despite that governments have devolved power, they still maintain control through funding which is given upon meeting government's objectives and performance requirements, among others (Lockwood, 2010). Such discourses provide a glimpse of the politics inherent in Protected Areas' conservation policy.

As an alternative to centralised management systems, Community-Based Natural Resource Management system emerged as a new paradigm in conservation that aimed to bring social equity in environmental conservation (Gruber, 2010; Viccaro, 2013). It was a move from exclusion to inclusion of all people with a stake in the resources managed (Adams and Hutton, 2007). Community-Based Natural Resource Management system recognised and integrated indigenous or local communities' natural resource use with conservation (Viccaro, 2013). Despite the milestone achievement of incorporating local communities in conservation, there are still many challenges that Community-Based Natural Resource Management system faces (Fabricius and Koch, 2004: Sebele, 2010). Fabricius and Koch (2004) assert that despite devolution of government power to manage natural resources, communities have not been empowered in decision-making. In addition, there is lack of respect for communities which is unlike the situation with private landowners. Despite this, Community-Based Natural Resource Management system has embraced local or indigenous communities, interactions between communities and management are minimal (Sebele, 2010). Further, Fabricius and Koch (2004) assert that donors and managers fail to recognise and understand the role of belief systems of the communities involved in management of natural resources.

This discussion has revealed paradigm shifts in conservation practice from Protected Areas to Community-Based Natural Resource Management and within Protected Areas, various forms have emerged. Evident is that environmental conservation practices are rid with challenges as revealed in

the discussion. Consequently, political ecology criticises all conservation strategies, which "restrict local rights and traditional resource users" (Clapp, 2004: 839). As highlighted in previous discussions in this chapter, political ecology discourses concern issues regarding rights, responsibilities, benefits and relationships in managing resources. The major concern around conservation efforts is the infringement of local people's rights by the state, NGOs and other powerful global actors through unfair policies and exclusion of local people from management (Clapp, 2004). In addition, politics in conservation dictate that most (if not all) threats to the environment are only addressed if they affect the most privileged or influential people in society (Forsyth, 2008). This study pursues some of the issues highlighted regarding conservation involving private landowners and adjacent communities.

2.2.3 Application of the political ecology approach

The political ecology approach can be applied in natural resource management to understand environmental problems (Forsyth, 2003; Vaccaro *et al.*, 2013). That is, the principles of the political ecology approach can be applied in conservation efforts to understand the underlying causes of environmental problems. Political ecology proposes that sustainable management of natural resources can be achieved through engendering equity and justice for all stakeholders (Blaikie, 2012). Thus, political ecology provides an opportunity to examine decision-making and how it is influenced by social, economic and political contexts at local, national and global scales (Bixler, 2013). In addition, it provides an opportunity to examine how the interplay of social, economic and political processes shapes the environment (Bixler, 2013).

Much of political ecology research has focussed on rural communities but that is not to imply that it can only be applied to such communities (Moffat and Finnis, 2005). Moffat and Finnis (2005) state that environmental conservation issues in political ecology can also be applied to urban and peri-urban environments, which are equally poor and vulnerable. This study was conducted in an urban-managed open space setting located in the peri-urban communities of the Hillcrest area of Durban.

In taking a holistic approach to identifying and managing natural resources, political ecology provides another angle through which analyses can be made to understand environmental problems. This study seeks to understand the environmental problems faced in the GGEP through the lens of the political ecological approach. In order to do so, the study examines the relationships that exist between humans and natural resources and in this study, it examines the relationships existing between the GGEP open space stakeholders as well as the various alliances that have emerged in trying to manage the resources of the GGEP. In addition, the relationships existing among stakeholders are also examined to understand the causes of the environmental problems observed in the GGEP. The study further uses the political ecology approach to understand the politics surrounding access and control of natural

resources in the GGEP open space. The balance of power or lack thereof among stakeholders is analysed with respect to sustainable management of the GGEP open space resources. Scale is useful in understanding the legislations and actors that affect natural resource management in the GGEP open space. Finally, gender discourses in natural resource management are used to understand the role of women in the use of natural resources in the GGEP. Thus, the relationships between women and access, harvest, gendered roles in management and use of GGEP resources are analysed.

2.2.4 Linking Political ecology to Stakeholder Theory

Balmford (2003: 435) asserts that "to be effective, conservation science must be interdisciplinary, must involve practitioners and stakeholders, and must be pragmatic whilst also being ambitious." This assertion is embedded within the political ecology approach as supported by Maldavin (2008) who states that political ecology provides an opportunity to engage in alliances with various groups of society in order to solve problems faced in society. However, it does not provide a framework for engaging such stakeholders in solving environmental issues and so the stakeholder theory was adopted for this study to compensate for this limitation. It provides a framework through which the political ecology approach can be operationalised. The stakeholder theory is discussed next.

2.3 Stakeholder theory

The stakeholder theory has developed since the first work by Freeman (1984) called strategic Management - a stakeholder approach. Various authors in the field have built on the work by Freeman (1984) and provide various arguments of what a stakeholder is not (Elms *et al.,* 2011). Authors such as Clarkson (1994 and 1995), Donaldson and Preston (1995) and Mitchell *et al.* (1997) are among the main contributors to the development of the stakeholder theory. Together with Freeman's (1984) work, Clarkson (1994 and 1995), Donaldson and Preston (1995) and Mitchell *et al.* (1997) have contributed to the development of the stakeholder theory on definition of a stakeholder, stakeholder identification and management. Thus, through a review of the work done in this field, it is evident that the definition of a stakeholder, the principles of stakeholder theory, stakeholder identification criteria and stakeholder management have remained basically the same to date. Many authors still refer to the definition by Freeman (1984), the stakeholder identification criteria (Mainardes *et al.,* 2011) and stakeholder management by Mitchell *et al.* (1997). As such, the discussion that follows on stakeholder theory contains references that are quite old but remain relevant today to the use of stakeholder theory.

2.3.1 Stakeholder theory in perspective

The stakeholder approach has its roots in the principles of 'corporate social responsibility' (Elms *et al.,* 2011). In the USA, stakeholder theory was first used in the field of business ethics and later in strategic management (Hansen and Bode, 2004). It was used in the same way in Germany where it had its roots in Systems Theory and Coalition Theory developed in the 1960s (Hansen and Bode, 2004). Freeman (1998: 174) whose definition holds till this day, states that stakeholders include "groups and individuals who benefit from or are harmed by, and whose rights are violated or respected by, corporate actions."

According to Freeman (2011), stakeholder theory relates to creating sustainable value of a business responsibly which is profitable and embedded in the structure of society. Stakeholder theory provides a new perspective of an organisation, which is, that an organisation goes beyond the shareholders and, should be viewed as a collection of various groups with diverse interests (Fontaine *et al.,* 2006). The theory also provides explanations for existing relationships within an organisation as well as providing guidelines for managing those relationships (Donaldson and Preston, 1995). In addition, stakeholder theory explains and guides the structure and operations of an organisation. Fundamentally, the theory is based upon an understanding that communities have stakes in an organisation and therefore the organisation has a duty to manage those interests (Branco and Rodrigues, 2007; Verbeke and Tung, 2013). This together with the definition forms the basis for stakeholder identification (Donaldson and Preston, 1995).

In natural resource management, the stakeholder theory,

> *…can help us to understand better the objectives and interests of the various stakeholders managing and using the environment, the trade-offs there may be between objectives, and the costs and benefits of change and intervention at both macro and micro levels. Incorporating these ideas into environmental planning can improve prediction of outcomes, reduce the risk of unforeseen resistance, and generally facilitate informed policy-making.*
> (Grimble *et al.,* 1995: 2)

The theory can be valuable for understanding the causes of conflicts (Stoll-Kleemann, 2009). Authors such as According to Castro and Nielson (2003), Yasmi *et al.* (2006) and Bob and Bronkhorst (2010) assert that conflict emerges when stakeholders have irreconcilable differences or incompatible interests, values, power, perceptions and goals. Furthermore, if unresolved or not managed, conflicts are likely to escalate and intensify. In as much as conflict constitutes natural social interactions, it has the potential to further complicate social interactions as well as prevent environmental destruction

(Stoll-Kleemann, 2009). Stakeholder theory thus provides a platform for engaging conflicting groups. Furthermore, Priscoli (1989, cited in Stoll-Kleemann, 2009: 155) asserts:

> *Ideally, stakeholder* [analysis] *would take into consideration the interdependency between stakeholders and the environment in which they interact, including the institutional frameworks, as characterised by rules and strategies that are embodied in regularised patterns of behaviour or procedures for conflict resolution.*

According to Tullberg (2013), the stakeholder theory addresses the issues of cooperation among an organisation's role players and averts conflict when eminent. Thus, acknowledgment of stakeholders by an organisation basically means that it is no longer only responsible for its shareholders' need for profit but the needs of its stakeholders too (Verbeke and Tung, 2013). In addition, acknowledging an organisation's stakeholders can be profitable to the organisation in the long run.

2.3.1 Principles of the stakeholder theory

Stakeholder theory is based on an assumption that values should be integrated into business and thus, proposes that ethics and economics are mutually inclusive in business (Freeman, 2011). Thus, the theory's main proposition is that an organisation's managers should incorporate morality into decision-making processes. Jones and Wicks (1999: 213) state that "a stakeholder theory without a moral grounding is incomplete and does not adhere to the principles of the theory." Stakeholder theory provides a framework which endeavours to link stakeholder management to growth or profitability of an organisation (Branco and Rodrigues, 2007; Verbeke and Tung, 2013). In stakeholder management, an organisation is viewed as a network of various cooperation of competitive self-serving interests which should be considered regardless of whether the interests of one stakeholder group conflicts with the agendas of other stakeholder groups (Donaldson and Preston, 1995). However, the satisfaction of one stakeholder group need not come at the expense of another and ought to be beneficial to all: this principle is referred to as balancing stakeholder interests (Reynolds *et al*., 2006). The philosophy behind stakeholder theory is voluntarism on the part of an organisation's management in considering and satisfying stakeholder needs (Freeman *et al.*, 2004). Consequently, the managers are, on moral grounds, expected to consider the possible effects of their decisions on an organisation's stakeholders.

Stakeholder theory presumes that when all stakeholder interests are managed properly, an organisation's investors benefit in the end (Verbeke and Tung, 2013). Hence, stakeholder management entails the consideration of legitimate interest of various stakeholders in all structures of an organisation such as policy formulation, decision-making and establishment of structures of an organisation (Donaldson and Preston, 1995; Mainardes *et al.*, 2011). This introduces an aspect of ethics and morality in decision-making which entails that managers should always assess how their

decisions can affect various stakeholder groups (Freeman, 2009). Thus, processes and strategies of how to meet stakeholder's needs should be developed. Other principles of stakeholder management include integration of all managers involved in stakeholder management; predicting stakeholder behaviour; provision of resources for stakeholder management; and, prioritising the needs of stakeholders in decision-making processes and not those of the organisation's managers (Freeman, 2004).

2.3.2 Criticism of the stakeholder theory

Since its conceptualisation by Edward Freeman in 1984, stakeholder theory has continuously been criticised, the first of which relates to the definition of a stakeholder (Orts and Struddler, 2009). Such criticisms have contributed to the further development of the stakeholder theory. Some of the criticisms that appear in the literature and have implications for this study are discussed next. Elms *et al.* (2011) criticise the stakeholder theory for being centred on business rather than society. To this Freeman (2011) states that business and society are inseparable and the distinctions are usually a result of the mind sets of managers (Freeman *et al.,* 2010). Further, Elms *et al* (2011) criticise stakeholder theory identification criterion to be too wide and thus can yield a lot of groups as stakeholders. Freeman (2011) states that the application of stakeholder theory should determine whether the identification criterion should narrow down or widen the identified stakeholders. Related to this criticism is the old critique of the definition of what a stakeholder is. According to Freeman (2011: 19), there is a call to "define stakeholder once and for all, and marry it to a theory of which groups are legitimate and which are always instrumental." Harrison *et al. (*2010) also assert that Freeman's (1984) identification criterion has been criticised by some authors (Donaldson and Preston, 1995; Mitchell *et al.,* 1997; Orts and Struddler, 2009) as being too broad and thus may include groups of people who would not gain from the organisation's success. According to Freeman (2011), development of a theory in that direction is unnecessary. This study uses Mitchell *et al*.'s (1997) model of stakeholder identification as discussed in the next section (2.3.3).

Further, the stakeholder identification model as proposed by Mitchell *et al.* (1997) was a great contribution to stakeholder theory, however, it was also criticised for only identifying an organisation's stakeholders and failing to pinpoint how an organisation addresses the needs of stakeholders with varying levels of salience (Jawahar and McLaughling, 2001). In addition, Mitchell and colleagues did not address the question of balancing the efforts in managing stakeholder claims, which is very important. Reynolds *et al.* (2006) cites practical examples of organisations that acted in balancing the efforts in managing stakeholder needs and concludes that the organisations' actions were beneficial to all stakeholders.

Another aspect of the definition of a stakeholder that comes under criticism is the failure to acknowledge 'non-human' and 'non-present' stakeholders (Orts and Struddler, 2002). That is, the theory does not provide principles of how managers should behave when dealing with non-human stakeholders as well as non-present stakeholders such as the natural environment or future generations, respectively. Gibson (2012) suggests that non-human or environmental stakeholders be considered in management using the concept of sustainability. This study presents one such scenario of non-human stakeholders (the GGEP open space) and non-present stakeholders (future inhabitants of the GGEP and surrounding areas) whose interests need consideration. The nature of the organisation under study is that it was established to protect and conserve the GGEP open space ecosystems. In this way, it is directly considering the needs of the non-human stakeholders as well as non-present stakeholders.

Furthermore, stakeholder theory has been criticised by Jensen (2001) who asserts that it provides loopholes for managers to start engaging in self-serving behaviour due to the many groups to whom they are responsible. Managers would do this as long as it would benefit at least one stakeholder group. Additionally, stakeholder theory provides more than one objective of an organisation (serving shareholders' need for profit and meeting the needs of an organisation's non-shareholding stakeholders), which in itself is problematic as there would be no clear foundation to evaluate performance of managers. Responding to this criticism, Phillips *et al.* (2003) state that it is not possible for managers under the stakeholder theory to engage in self-serving because the managers would be more accountable as they would be answerable to many stakeholders.

In the 1984 publication by Freeman, there is a presumption that the stakeholder theory had universal applicability (Hansen and Bode, 2004). According to Hansen and Bode (2004: 244), stakeholder theory was developed using studies conducted in the USA and was "fostered by American Pragmatism." Hanson and Bode (2004) state that,

- It is easier in the USA to relate business with ethics without government regulation because generally, business and ethics can be related to religious culture in particular the Christian principles upon which the nation was founded. Despite the presence of other religious groups, Christian principles are still upheld to an extent, that is, they also guide the constitution.

- The general principles of Christianity are based on biblical teachings of love for one's neighbour and translated in a business context it means ensuring your actions have minimum negative impact on your stakeholders. When translated into the stakeholder theory, it makes it easier for those upholding such principles to uphold the stakeholder theory.

- However in places like Germany, this relationship was not created and thus ethics are enforced in business through government regulations. Therefore, the theory could be universally applied if contextual differences in certain countries are acknowledged on the phenomena and theory level.

The African context can be compared to that of Germany where most of the time legislation is used to force organisations to adhere to the stakeholder theory. An example of such legislation is the Affirmative Action Policy in South Africa which is used to force organisations to consider the needs of racially disadvantaged stakeholders when employing persons (Pierce and Kendrick, 2005).

Various criticisms have emerged from the discussion and some of the criticisms stem from the early development years of the theory and still featured in the literature by 2011. Thus, the criticisms relate to the definition of stakeholder and identification of stakeholders. This study adopts stakeholder theory as a platform for engaging with the study's stakeholders. In order to do so, the study also adopts the stakeholder identification criterion by Mitchell *et al.* (1997). Secondly, the study averts the critique on Mitchell *et al.*'s (1997) criteria by adopting Clarkson's (1995) Reactive Defensive Accommodative Proactive (RDAP) model of stakeholder management. The researcher acknowledges that such dilemmas do occur and therefore managers have a responsibility to manage such situations before they happen.

2.3.3 Stakeholder identification

Stakeholder identification constitutes one of the important steps that have to be taken in the process of stakeholder engagement (Ayuso *et al.*, 2012). One may assume that stakeholders can be easily identified without the need for a scientific methodology but this is not so as some stakeholders may not be obvious. Regarding this issue, Reed *et al*. (2009: 1937) state:

> *Much of the stakeholder analysis literature has presumed that stakeholders are self-evident and self-construed, and has focused on categorising pre-identified stakeholders to understand their interests and relationships. However, before this can be done, it is necessary to identify who holds a stake in the phenomenon under investigation. This in itself necessitates a clear understanding of the issue under investigation so that the boundaries of the social and ecological phenomenon can be established.*

In identifying stakeholders, three attributes of stakeholders are examined which influence stakeholder actions or inactions and they include power, legitimacy and urgency. Power is the ability of those who possess it to bring about the outcomes they desire (Salancik and Pfeffer, 1974, cited in Mitchell *et al.*, 1997: 865). That is, power enables the possessor to impose its will upon others. Legitimacy, on the other hand, is "a generalised perception or assumption that the actions of an entity are desirable,

proper, or appropriate within some socially constructed system of norms, values, beliefs and definitions" (Suchman, 1995: 574). Lastly, urgency is the "degree to which stakeholder claims call for immediate attention" (Mitchell *et al.,* 1997: 867).

Possession of one, two or all of the three attributes determines the kind of stakeholders and how they behave. Thus, a combination of the attributes gives rise to different stakeholder classes and levels of salience (Mitchell *et al.*, 1997). Salience is regarded as the degree to which managers give priority to competing stakeholder claims (Mitchell *et al.*, 1997). Any entities that do not possess any of the three attributes have no salience and therefore are not considered stakeholders of the organisation (Mitchell *et al.*, 1997). Figure 2.1 is a diagrammatic representation of the stakeholder attributes which combine to form stakeholder classes to be discussed in the proceeding paragraphs.

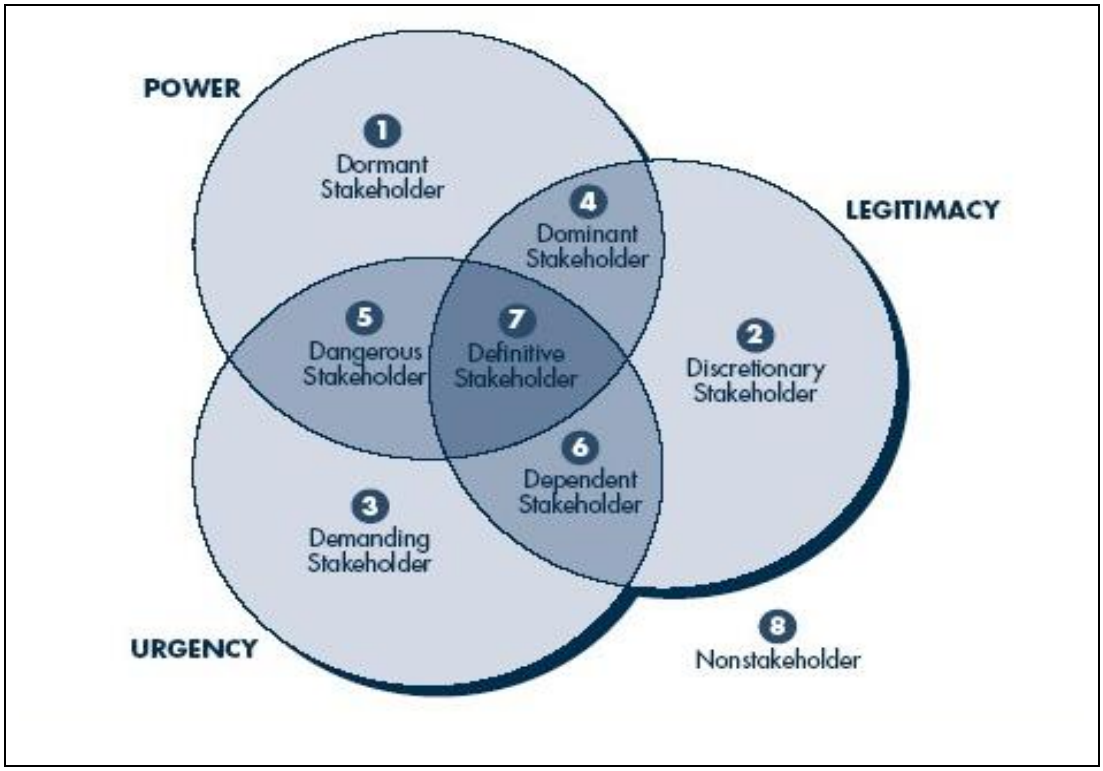


Figure 2.1: Venn diagram: combination of stakeholder attributes

Adapted from Mitchell *et al.* (1997: 874)

Latent stakeholder is a class of stakeholders, who possess only one of the three stakeholder attributes and therefore has low salience. From Figure 2.1 the numbers 1, 2 and 3 represent latent stakeholders. Within this class are dormant, discretionary and demanding stakeholder types. Dormant stakeholders possess power but their lack of legitimate relationship with an organisation and urgency in their claims makes them unable to use their power. Discretionary stakeholders possess legitimacy but without power and urgency in their claims, the managers do not engage in an active relationship with the stakeholders. Demanding stakeholders possess urgency, however, without power and legitimacy

they cannot coerce managers to attend to their claims. Such stakeholders are very demanding, they voice out their claims but cannot take action further than that.

Expectant stakeholder is a class which possesses two of the three stakeholder attributes represented by the intersections between two attributes represented by the numbers 4, 5 and 6 in Figure 2.1. This stakeholder class has moderate salience and is quite active and therefore attracts the attention of managers. The stakeholder types falling under this class include dominant, dependent and dangerous stakeholders. Dominant stakeholders possess power and legitimacy and with these two attributes, they attract the attention of the managers. This is because they have a well-established relationship with the organisation. Dependent stakeholders possess legitimacy and urgency but their lack of power makes them reliant on other entities possessing power to make their claims. Dangerous stakeholders possess power and urgency but because of the lack of legitimacy, their claims are always illegitimate. The combination of power and urgency in this type of stakeholders is very important because it enables the stakeholders to be coercive and violent.

Definitive stakeholder is a class, which possesses all the three attributes of stakeholders, that is, power, legitimacy and urgency, and has a high level of salience. In Figure 2.1, definitive stakeholders are represented by the number 7 which falls on the intersection of all the three attributes (power, legitimacy and urgency). With all three attributes present, managers are obliged to prioritise and attend to these stakeholders' claims.

2.3.4 Stakeholder management

Since an organisation is viewed as a group of people with diverse interests, an organisation then can be thought to be an entity which through its managers, manage the various interests of people (Fontaine *et al.*, 2006; Jiao, 2010). The managers protect stakeholders' rights and ensure profitability of the business for the sake of the shareholders (Fontaine *et al.*, 2006; Jiao, 2010; Ayuso *et al.*, 2012). Ayuso *et al.* (2012) reiterate that managers are agents of stakeholders and by doing so make sure that the interests of all stakeholders (including shareholders) are managed sustainably. Hornby (2010) defines shareholders as owners of shares in a company, that is, through shares they contribute capital to a business. Stakeholder management therefore concerns managing and balancing various stakeholder interests with the view that doing so enhances the benefits derived from a resource under management (Reynolds *et al.*, 2006; Banerjee and Bonnefous, 2011).

The first and important aspect of stakeholder management is communication (Phillips, 2004). It is frequent and constant communication with stakeholders which helps managers to avert conflict as well as ensure that the organisation meets the needs of its stakeholders (Phillips, 2004). Thus, through frequent communication managers receive feedback on how well the organisation is doing in meeting

stakeholder needs. In addition, De Nooy (2013) asserts that communication among stakeholders fosters achievement of natural resource management objectives because it improves agreement on facts and management goals. Consequently, communication should also allow stakeholders to make a contribution towards the running of the organisation (Phillips, 2004).

Since the success of an organisation hinges on effective communication among stakeholders, it is important to manage stakeholder needs (Tullberg, 2013). Thus, another aspect of stakeholder management is that managers should maintain a balance in meeting the needs of various stakeholders (Phillips, 2004; Reynolds *et al.,* 2006). This means that considerable resources must be invested in contributing to all stakeholder interests which maybe conflicting (Tullberg, 2013). However, this does not mean that all stakeholders must receive equal amount of attention or resources in meeting their needs. Rather, stakeholder needs should be met proportionate to their contribution to the organisation (Phillips, 2004). Jawahar and McLaughlin (2001) argue that a large share of resources should go to stakeholders who control or have power over an organisation's resources. In addition, allocation of resources to stakeholder management must be commensurate with the level of threat they pose to the survival of the organisation (Jawahar and McLaughlin, 2001). Thus, such stakeholders receive a bigger share of the resources when compared to stakeholders who do not control any of the organisation's resources.

It is believed that the ethics of business are lower than those of everyday life and some people believe that it should remain so (Phillips, 2004). However, the normative stakeholder theory introduces a moral aspect of considering high ethics in business (Phillips, 2004; Ayuso *et al.,* 2012). Thus, the theory requires that managers consider the interests of all its stakeholders in the management processes of the organisation (Freeman, 2009). To do so, managers need to adopt certain strategies for each of its stakeholders relative to stakeholder demands and importance (Ayuso *et al.,* 2012). Some of the strategies that could be adopted in managing stakeholder needs are discussed next.

2.3.4.1 Stakeholder management strategies

Various stakeholders have different interests and demands on an organisation, some of which can be conflicting and this demands that an organisation develops strategies for managing stakeholder needs (Ayuso *et al.,* 2012). Initially, Carroll (1979) and Wartick and Cochran (1985) proposed that whatever management strategies an organisation develops, it can be categorised into RDAP strategies. Working on the foundation set by these authors, Clarkson (1995) developed an RDAP scale of strategies to stakeholder management and the scale ranges from doing less than is required to doing more than is required as shown in Table 2.1. However, Jawahar and McLaughlin (2001) building on the work by Carroll (1979), Wartick and Cochran (1985) and Clarkson (1995) later proposed that the strategy taken by an organisation should depend on whether there is a threat to an organisation's survival or

not. If a threat exists, an organisation will adopt a risky strategy to address the needs of the stakeholder(s) posing the threat. In this instance, an organisation will satisfy the needs of the stakeholder(s) posing a threat while concomitantly refusing to satisfy the needs of stakeholder(s) not posing any threat to the organisation. Nevertheless, if a threat does not exist, then an organisation will adopt a strategy which will satisfy the needs of all stakeholders (Jawahar and McLaughlin, 2001).

Table 2.1: The RDAP Scale (Source: Clarkson, 1995: 109)

Rating	**Posture or Strategy**	**Performance**
1. Reactive	Deny responsibility	Doing less than is required
2. Defensive	Admit responsibility but fight it	Doing the least that is required
3. Accommodative	Accept responsibility	Doing all that is required
4. Proactive	Anticipate responsibility	Doing more than is required

Table 2.1 summarises the different strategies available to managers of an organisation in managing stakeholder needs. As shown in the Table 2.1, a reactive strategy is one where an organisation decides to refute any responsibility and thus does less than is required. A defensive strategy is one where an organisation acknowledges responsibility over stakeholder claims but does so with much resistance. In addressing stakeholder needs, managers only do the least required actions (Carroll, 1979; Clarkson, 1995). An accommodative strategy is one where an organisation accepts responsibility over stakeholder claims and in addressing the stakeholder needs, the managers go all the way in doing all that is required (Carroll, 1979; Clarkson, 1995). Thus, the organisation becomes accommodative of the stakeholder claims. Lastly, a proactive strategy is one where an organisation foresees the possible future responsibility. Thus, the managers actively engage the stakeholders in the organisation and do more than is required to meet stakeholder needs (Carroll, 1979; Clarkson, 1995). This strategy ensures that stakeholders are satisfied and thus averts possible problems in the future (Jawahar and McLaughlin, 2001).

At any given time, an organisation will adopt one or more of the four RDAP management strategies to deal with stakeholder claims (Jawahar and McLaughlin, 2001). For instance, an organisation's managers may adopt proaction or accommodation to meet the needs of stakeholders who pose a threat to the survival of an organisation. Thus, as stated previously, the management strategy adopted will depend on the type of stakeholders making claims. In identifying which management strategy is needed by stakeholders, Ayuso *et al.* (2012) classifies stakeholders into primary and secondary. An organisation's primary stakeholders are groups of people "that are essential for the business itself to exist and/ or have some kind of formal contract with the business (that is, shareholders, employees, customers, and suppliers)" (Ayuso *et al.,* 2012: 6). Such stakeholders would merit a proactive or accommodative strategy because they hold power to an organisation's critical resources or have power over operation licences such as government (Jawahar and McLaughlin, 2001). Therefore, an organisation's managers will allocate more resources towards managing stakeholders with more

power. Conversely, an organisation's managers could adopt a defensive or reactive strategy for secondary stakeholders (Jawahar and McLaughlin, 2001). Ayuso *et al.* (2012: 7) define secondary stakeholder group to include "social and political stakeholders that play a fundamental role in obtaining business credibility and acceptance of business activities (that is, NGOs, activists, communities, governments, media, and competitors)." In addition, non-human, non-present, peripheral (not readily identifiable) and environmental stakeholders are part of secondary stakeholders (Ayuso *et al.,* 2012). According to Verbeke and Tung (2013), stakeholder salience in stakeholder management changes as the organisation evolves from early stages of establishment to later stages of existence. This implies that the strategies adopted to manage stakeholders change throughout the lifecycle of an organisation.

2.3.5 Application of the stakeholder theory

According to Freeman (2004), the nature of stakeholder theory is descriptive, prescriptive (instrumental) and suggestive (normative). Descriptively, the stakeholder theory describes the relationships that exist, the behaviour of managers and what constitutes an organisation (Donaldson and Preston, 1995; Fontaine *et al.,* 2006; Freeman, 2009). Secondly, the theory is instrumental in that it provides a framework for managing stakeholders if efficiency in the organisation is to be achieved (Fontaine *et al.,* 2006; Branco and Rodrigues, 2007; Freeman, 2009). It prescribes how managers should behave towards stakeholders to yield certain results (Fontaine *et al.,* 2006; Branco and Rodrigues, 2007; Freeman, 2009). Thus, it links efficiency of an organisation in the market with stakeholder management by outlining important factors that need consideration to yield efficiency (Verbeke and Tung, 2013). Lastly, the stakeholder theory is normative because it suggests behaviour which when employed constitutes stakeholder management (Freeman, 2009). In this way, the theory takes a moral approach to management considering each stakeholder (group) important for attaining an organisation's goals (Freeman, 2009; Ayuso *et al.,* 2012). As stated by Donaldson and Preston (1995: 73) an organisation's stakeholders are "not a means to some other end, but have a right to be treated as an end in itself."

The stakeholder theory was initially developed for application in business management as evident from Freeman's (1984) work which has been adopted and applied in many organisations around the world (Freeman, 2004; Freeman, 2009). For instance, many American corporations adhere to the stakeholder theory in their design and operations. Corporations such as Google practice the stakeholder theory and as such, their success is based on the value placed on stakeholder relationships (Collins, 2001). However, Phillips *et al.* (2003) emphasise that the stakeholder theory is not limited to corporations or size of business but can be applied to smaller businesses, NGOs, government organisations, private businesses and partnerships.

According to Freeman (2004), the processes of stakeholder identification using the principle of 'who and what really counts' can also be applied and used in the field of environmental sciences. Stakeholder theory refers to non-human and non-present stakeholders who are important to an organisation's success (Orts and Struddler, 2002; Gibson, 2012) and Gibson (2012) recommends application of stakeholder theory to management of non-human and non-present stakeholders within the context of sustainability. In addition, Gibson (2012) proposes that sustainability should be used in considering the positive and negative effects of business practice on the environment rather than preservation. Further, some authors such as Grimble *et al.* (1995) have also indicated that the stakeholder theory can be applied in the field of environmental management. Other characteristics of natural resource management which warrant the application of the stakeholder theory, include "multiple uses and users of the resource; unclear or open access property rights; temporal trade-offs, the presence of externalities; and, imperfect markets" (Grimble and Wellard, 1997: 173).

De Nooy (2013: 44) asserts that "all stakeholders need to be equally involved in the management processes for effective natural resource management" while Grimble *et al.* (1995: 2) states:

> *The application and development of stakeholder analysis to address environmental management issues can be justified in two main ways: (a) the limitations and weaknesses of conventional methods used in policy and project assessment and design for dealing with stakeholder interests; and (b) its particular relevance to natural resource and environmental issues, as opposed to other issues.*

Researchers such as Buysse and Verbeke (2003), Reed (2008), De Nooy (2013), Lafreniere *et al.* (2013) and Verbeke and Tung (2013) all demonstrate the application of stakeholder theory in natural resource management. For instance, De Nooy (2013) applies stakeholder theory, to proving that the "effect of interpersonal communication on agreement among stakeholders in natural resource management depends on context: stakeholder group, overall network structure, and type of management system." Further, the stakeholder analysis is viewed as a better alternative for analysing costs and benefits of a policy, project or programme than other cost-benefit analysis tools as well as environmental economic techniques (Grimble *et al.,* 1995). It complements the conventional methods of cost-benefit analysis by analysing the more private costs and benefits incurred by stakeholders (Grimble *et al.,* 1995).

Guided by stakeholder theory, this study sought input from various stakeholders in assessing perceptions pertaining to the GGEP project. Thus, the stakeholder theory is critical in this study because it forms the framework for stakeholder identification and the principles and strategies for managing stakeholder interests. It also justifies the involvement of various groups of people who affect or are affected by the operations of the GGEP project. The whole study is designed around understanding stakeholder views on various selected issues such as the willingness of property owners

to pay an additional rate to their properties. Therefore, the study took a multi-stakeholder approach because there were many stakeholder groups whose inputs were vital for the success of this study. The multi-stakeholder approach provided a platform on which stakeholder groups' participation in the management of the GGEP project was assessed (Cummins, 2004). Thus, according to Cummins (2004), stakeholders participate through integration into governance structures or through participation in assessments such as in this study.

2.6 Conclusion

The political ecology approach is most appropriate to underpin this study because of its inherent characteristics. The various discourses in political ecology such as scale, conservation, gender, power, and environmental ethics are important in understanding the processes of natural resource management in the GGEP. Scale puts into perspective the levels at which actors relate to make decisions that affect natural resource management at a local level. Another aspect of political ecology discourses discussed is power. The focus was on how various actors acquire and exercise power and how the decisions made by such actors affect natural resource management. In addition, discourses in conservation policy pertain to the generation of scientific knowledge, agendas of commissioners of research as well as implementation of research based policies generated. Furthermore, gender discourses were examined with particular attention on the gendered roles in natural resource access and extraction. Another aspect examined is the gender involvement in natural resource harvesting as well as the power dynamics in control, access and use. Finally, context specific political ecology discourses in South Africa were discussed with respect to conservation strategies.

The stakeholder theory is used to operationalise the political ecology approach. There are various reasons why this theory is used in this study. Firstly, the theory acknowledges and identifies existing interested parties (stakeholders) in any organisation including those who are known to the organisation and those unknown to them. Thus, the theory provides a basis upon which all the interests (stakes) of the stakeholders are managed relative to the importance of each stakeholder. In addition, the stakeholder theory also suggests ways in which various stakes are managed in an organisation. This study fits in very well to the theory, as its main objective was to understand various stakeholder perceptions and how the stakeholders have contributed to the GGEP project. The study examined the perceptions of the property owners, eThekwini Municipality personnel, the personnel involved in managing the GGEP project, adjacent Tshelimnyama community members and commercial harvesters.

CHAPTER THREE

LITERATURE REVIEW

3.1 Introduction

South Africa's land share of the earth's surface (2%) cannot compare to that of its biodiversity which comprise "7.5% of the planet's plants, 5.8% of its mammals, 8% of its bird species, 4.6% of its reptiles and 5.5% of its insects" (DEAT, 2004: 45). As such, it is ranked third globally in terms of biodiversity, and together with 17 other countries form two-thirds of the earth's biodiversity (DEAT, 2004: 45). Authors such as Mittermeier *et al.* (2004), Kuntonen-van't Riet (2007) and Perera *et al.* (2011) assert that there are three biodiversity hotspots in South Africa which include the Cape Floral Kingdom, Succulent Karoo and the Maputaland-Pondoland-Albany centres of endemism. Furthermore, Kuntonen-van't Riet (2007: 3) states that "34% of terrestrial systems, 82% of river signatures, 65% of marine bio-zones and 8 estuarine types" are threatened. Driver *et al.* (2012: 2) highlight wetlands as the most endangered ecosystems with 48% of which is critically threatened while Fourie *et al.* (2014: 1) posit that the grassland biome is also threatened with 45% of which is transformed, degraded or invaded by alien species. The main pressure on biodiversity is water abstraction from rivers, habitat transformation through cultivation, urbanisation and resource extraction (Reyers *et al.*, 2007; Driver *et al.*, 2012).

Environmental problems such ecosystem degradation, species loss and habitat fragmentation are not only South Africa's problems but are global for which there are urgent calls for management solutions (Egoh *et al.*, 2010). As such, conservation has become vital for human well-being through maintenance of healthy ecosystems (Secretariat of the CBD, 2010). Despite this, traditional biodiversity conservation has mainly focussed on formally Protected Areas, with little effort to conserve biodiversity falling outside Protected Areas especially in urban areas (McDonald *et al.*, 2008; Cox and Underwood, 2011). Empirical evidence suggests the presence of environmentally important species and sites within urban ecosystems and areas outside Protected Areas, which warrant conservation (McConnachie *et al.*, 2008; Aronson *et al.*, 2014). Dikgang and Muchapondwa (2012) suggest an ecological linkage between biodiversity in Protected Areas and outside Protected Areas while Dudley (2008) considers Protected Areas as complementary to biodiversity falling outside Protected Areas. As such there is need to focus conservation efforts not only to biodiversity falling inside Protected Areas but also biodiversity outside Protected Areas.

There are various strategies throughout the world developed to manage ecosystems and to ensure the sustainability of ecosystem services (Barnaud and Antona, 2014). However, the management of ecosystems is not without challenges, the most important of which is managing stakeholders, usually with various and conflicting interests (Grimble and Wellard, 1997; Barnaud and Antona, 2014). Much research has been conducted and documented on the best ways in which ecosystems can be managed efficiently. Based on experience, institutions have also documented recommendations on the management of ecosystems to achieve equity and justice in accessing ecosystem services as well as in sharing the costs and benefits that emanate from use (Forsyth, 2008). This study examines the processes of ecosystem management outside Protected Areas, with a focus on the GGEP project.

This chapter starts by contextualising the study within sustainable development and then provides review of literature on ecosystem and biodiversity, the importance of ecosystems, threats to, and rehabilitation of ecosystems. Urban ecosystems are contextualised in terms of urban open spaces and the review examines open spaces from early development to the current issues affecting urban open space management. By doing so, this review discusses issues that affect ecosystem management such as drivers of change, externalities, contestations and impacts of ecosystem management on property value.

3.2 Sustainable development

The concept of sustainable development can traced from the late 1980s when the World Commission on Environment and Development (WCED) first defined sustainable development. In 1992, the United Nations provided a framework for environment and development through Agenda 21 and also persuaded global leaders to commit to sustainable development through ratifying the CBD (United Nations, 1992a). Since then, many authors have provided definitions which have evolved to include various meanings (Elliott, 2012). Nevertheless, the United Nations (1987: 43) defines sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own." Thus, the United Nations (1987) acknowledges that sustainable development imposes limits on development depending on the level of technological advancement, social organisation of the environment and the environment's capacity to assimilate the waste produced. According to Elliott (2012), sustainable development encompasses matters relating to poverty, environmental degradation and inequalities in access, use and cost-benefit sharing. Within natural resource management, sustainable development portrays the interconnectedness of the economy and society while providing insight into the limits within which economic pursuits can be achieved (Elliott, 2012). This concept was highlighted in Agenda 21 of the United Nations

Conference on Environment and Development which stipulates various constituents of sustainable development in natural resource management some of which include:

- It calls for conservation of biological diversity by engendering cooperation with local communities, government and NGOs, equitable cost-benefit sharing, integrating scientific research and indigenous knowledge in natural resource management, and development of appropriate biotechnology for conservation of biological diversity

- It acknowledges the need for integrating local communities in managing natural resources to eradicate poverty and the need for conserving the resources on which development is dependent as essential for sustainability. This calls for appropriate and integrated environmental policies to harness environmental conservation and poverty alleviation.

- It highlights the need for capacity building to engender experience and knowledge sharing locally, regionally and internationally.
  (United Nations, 1992a)

Ecosystems provide humanity with services which when used efficiently can provide humanity with all its needs for survival and prosperity (Africa Environmental Outlook-AEO 2, 2006). However, development pressure especially in urban areas has caused ecosystem degradation thereby affecting the ability of ecosystems to provide services (Seto *et al.*, 2012). Imeson (2012) asserts that restoration of the ecosystem goods and services is critical not only for sustainable development but for averting climate change. Sustainability concerns which the world is facing require international cooperation through collective responsibility to overcome (Roorda, 2012). As such, there has been a call since the early 1980s to change ecosystem consumption habits to those that are more sustainable in order to conserve global ecosystems (AEO 2, 2006). This change can only be effected through international collaboration which should bring about policy reformation to address the factors influencing the practice of sustainable development (AEO 2, 2006). However, Imeson (2012) cautions that adoption of policy is insufficient to achieve sustainable development but there is need for seriousness, effort and organisation in implementing policies.

Since the early 1990s there has been a renewed commitment by global leaders to transform development to that which is sustainable through international conventions and multilateral agreements (AEO 2, 2006). The adoption of the Millennium Development Goals at the Johannesburg World Summit on Sustainable Development in 2002 highlights the need for environmental sustainability in meeting the needs of the poor communities, among other things (Elliott, 2012; Benson, 2013). It is through multilateral agreements that sustainable development frameworks, strategies, and management systems are put forward (AEO 2, 2006). Within Africa, the African Union

unites nations in the commitment for sustainable socio-economic development through the organisation's Constitutive Act (AEO 2, 2006). African leaders commit through the national Acts to engage in sustainable development, to participate in globalisation through socio-economic activities while alleviating poverty (AEO 2, 2006).

Multilateral agreements such as the Kyoto Protocol bind global leaders to take action within regions and countries to adhere to the standards set for sustainable development (AEO 2, 2006). However, such actions have caused animosity among the world leaders because adhering to multilateral agreements is perceived as implying reduction in economic activities and prosperity (AEO 2, 2006; DEAT, 2006). The failure of global leaders to reach consensus during Conferences of Parties (COPs) of the United Nations Framework Convention on Climate Change; COP 17 held in Durban in 2011; COP 18 held in Qatar in 2012 and COP 19 held in Warsaw, Poland in 2013, is an indication of the extent to which global leaders can go to protect their economic development (Marcu, 2012; Khor, 2013). However, the call for sustainable development should not be viewed as a hindrance to economic prosperity; on the contrary, it should be viewed as a part of the process to economic development and prosperity (AEO 2, 2006). Whether it is at a global, regional or local scale development should harness "economic growth, social justice and equity, and environmental integrity" (AEO 2, 2006: 35).

3.2.1 International multilateral agreements

Conservation of biodiversity is governed by various multilateral international agreements that are binding to countries which ratified or acceded to the agreements. Within such countries, laws and policies are formulated with respect to binding multilateral international agreements. This section highlights the overarching legislative frameworks critical to biodiversity conservation globally and in South Africa.

South Africa, like many other global countries has ratified many international multilateral agreements with respect to conservation of biodiversity and combating factors which affect ecosystem health. These agreements include the CBD (ratified in 1995), the Kyoto Protocol (acceded in 2002) of the United Nations Framework Convention on Climate Change (UNFCC) (ratified in 1997), among others (as highlighted in Table 3.1). The provisions of the multilateral agreements relevant to this study are discussed in the proceeding sub-sections.

Table 3.1: International multilateral agreements ratified/acceded by South Africa
(Source: DEAT, 2006: 62; Kuntonen-van't Riet, 2007: 9-14)

International Multilateral Agreement	Ratified	Provisions
Convention on international trade in endangered species of wild fauna and Flora	1975	Provides for the protection of wildlife against international trade to prevent over exploitation and extinction
The Ramsar Convention on Wetlands of International Importance, especially as Waterfowl Habitat	1975	Provides a framework for conservation and sustainable use of wetlands
Bonn Convention on conservation of migratory species of wild animals	1991	Provides for conservation of migratory species
Basel Convention	1994	Provides a framework for protecting human beings and the environment against adverse effects of production, transporting, and dumping hazardous wastes
United Nations Convention to Combat Desertification	1997	Provides that member countries prepare and implement measures to combat land degradation
World Heritage Convention concerning the protection of the world cultural and natural heritage	1997	Provides a framework for protecting the world's natural and cultural heritage
UNFCC	1997	Provides a framework for collaborated international efforts to manage climate change
Kyoto Protocol of the UNFCC	2002	Provides emission targets for the reduction of greenhouse gas emission
Johannesburg Plan of Implementation	2002	Provides a framework for protecting and managing natural resource base for economic and social development
Cartagena Protocol on Biosafety	2003	Provides for protection of species against genetically modified species

The CBD was the first internationally binding agreement on conservation of biological diversity, initiated at the Rio Earth Summit held at Rio de Janeiro in 1992. This convention provides regulations on how to manage and maintain biological diversity in each of the states that ratified the convention. It is based on the principle:

> *States have the sovereign right to exploit their own resources in pursuant of their own environmental policies. In addition, they have the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other states or of areas beyond the limits of national jurisdiction.*
> (United Nations, 1992, Article 3: 4).

Primarily and relevant to this study, the United Nations (1992) states that the convention acknowledges that conservation of biodiversity is for the common good of humankind and, therefore, each member state has absolute rights to and responsibility for managing its own bio-resources. In

addition, it recognises the need to conserve indigenous biodiversity as well as reclamation of species within their natural habitats and/ or to their original state (*in situ* conservation). However, in situations where species are critically endangered and need reclamation, species can be conserved outside their natural habitats (*ex situ* conservation). Further, the convention recognises the relationship existing between nature and indigenous communities whose activities are highly dependent on biodiversity. Lastly, it recognises the need to establish cooperation in biodiversity conservation between nations, institutions, and organisations at local, regional and global scales.

Given the above, Article 6a: 5 provides that member states conserve biodiversity and uphold sustainable practices in the use of biodiversity through adoption of strategies, plans and programmes at regional, national and local scales. Such strategies, plans or programmes should be commensurate to the provisions and recommendations of the CBD. In addition, sustainable practices, which warrant conservation of biodiversity, should be incorporated into all sectors of the economy (Article 6b: 5). To this end, the state has the responsibility to recognise activities which threaten biodiversity or its use thereof through monitoring and creating databases for data emanating from the monitoring process (Article 7b-c: 5).

With regards to *in situ* conservation (relevant to this study), the CBD recommends managing bio-resources essential for conservation and sustainable use of biodiversity within their natural habitats (Article 8c: 6). In addition, Article 8d: 6 of the CBD endorses conservation of natural ecosystems through retention of sustainable number of species. This should be done by salvaging degraded ecosystems and endangered species, and, eliminating and preventing invasion of alien species using appropriate management strategies (Article 8f, h: 6). Such management strategies should allow for natural resource uses that do not interfere with conservation of biological diversity including sustainable development of land adjoining the ecosystems (Article 8j: 6).

Article 10a-b: 7 of the CBD, requires governments to integrate conservation of biodiversity, including sustainable use, in all sectorial decision-making in order to avert adverse impact on biodiversity. In addition, governments are urged to promote efforts from the private sector to develop appropriate strategies for sustainable management of biodiversity (Article 10e: 8). Article 12c: 8 highlights research as another important component of the CBD and, according to the provisions of the CBD, governments should support research, which adds to knowledge pertaining to conservation and sustainable use of biodiversity. Lastly, Article 13a: 8 compels governments to educate its citizens about conservation and sustainable use of biodiversity through media campaigns and integration into educational programmes. This can be done through partnerships with other member states or international organisations to develop awareness campaigns and educational programmes (Article 13b: 9).

Besides the CBD, there are many other international agreements that South Africa has ratified or acceded to that are relevant to environmental conservation as highlighted in Table 3.1. The provisions of the agreements outlined in Table 3.1 inform South African policy on environmental conservation (Kuntonen-van't Riet, 2007). Thus, the agreements' objectives are implemented at a local scale through legislations, with established institutions responsible for implementation of each aspect of the multilateral agreements. The following section highlights some of South Africa's legislation on biodiversity conservation.

3.2.2 South African legislative framework

The legislative framework that underpins ecosystem management in South Africa draws its concepts from the various multilateral international agreements ratified or acceded to. The CBD as well as other international multilateral agreements highlighted in Table 3.1 provides the basis for establishing environmental laws. Chapter two, Section 24 of the Constitution of South Africa provides for sustainable development which ensures economic advancement and conservation of biodiversity and for conservation, which reduces or eliminates degradation of the environment (Republic of South Africa, 1996). It is on this provision that promotion of human well-being, through urban open spaces is done.

The National Environmental Management Act (NEMA) (Act 107 of 1998) is national legislation that provides a framework for managing biodiversity in meeting the needs of all South Africans as provided for by the constitution (Republic of South Africa, 2009). It provides South African citizens the right to an environment that promotes well-being and therefore the state has the onus to ensure sustainable use of environmental resources in meeting the needs of its citizens (DEAT, 2004; Republic of South Africa, 1998). Further, the Republic of South Africa (2009) states that Section 25 of the NEMA provides for adherence to international multilateral agreements through establishment of necessary legislation to implement the requirement for environmental conservation. Above all, it recognises and provides that conservation requires an encompassing approach towards the management of biodiversity. Such an approach integrates governance of all organs and institutions of government in decision-making processes that take into consideration the potential impacts on the environment (Republic of South Africa, 2004). The NEMA is implemented through two legislations: the NEMPAA (Act 57 of 2003) and National Environmental Management: Biodiversity Act (NEMBA) (Act 10 of 2004).

The NEMPAA provides for the establishment of Protected Areas in order to integrate state and privately owned land into functional entities that promote human well-being through sustainable socio-economic development (Republic of South Africa, 2009). Reeves and Marom (2009) and Republic of South Africa (2009) state that the NEMPAA enables the establishment of Protected

Areas, nature reserves and national parks through land restrictions, formal declaration and management plans. Thus, this provides the basis for private landowners to engage in the biodiversity stewardship programme as a means of conserving biodiversity (Reeves and Marom, 2009; Republic of South Africa, 2009).

On the other hand, the NEMBA provides a framework for protecting biodiversity, sustainable use of indigenous biodiversity, equity in sharing benefits arising from use of biodiversity and the establishment of institutions for biodiversity management (Republic of South Africa, 2004). By doing so, it draws upon the principles of the CBD through implementation of the White Paper on the Conservation and Sustainable Use of South Africa's Biological Diversity (Republic of South Africa, 2004). Chapter three of the NEMA provides instruments for biodiversity planning and monitoring which include the National Biodiversity Framework and Biodiversity Management Agreements (BMA) (Republic of South Africa, 2004; 2009). The National Biodiversity Framework integrates conservation efforts of all stakeholders including government, NGOs, communities and landowners through a five-year framework (Republic of South Africa, 2009). Thus, the National Biodiversity Framework identifies the following as priorities in biodiversity conservation:

- *Integrate biodiversity considerations into fiscal policy through environmental fiscal reform, including the development of fiscal incentives for the conservation of biodiversity;*
- *Implement the National Protected Area Expansion Strategy (the National Protected Area Expansion Strategy sets protected area targets for South Africa, provides maps of focus areas for Protected Areas through acquisition of land, and contract agreements with private and communal landowners or users, developed through biodiversity stewardship programmes);*
- *Expansion, and makes recommendations on mechanisms for protected area expansion;*
- *Establish and strengthen provincial stewardship programmes;* and,
- *Strengthen programmes that support the informal conservation area system*

  (Republic of South Africa, 2009: 6)

According to Republic of South Africa (2009), BMAs fall within Protected Areas under the NEMPAA and are made between the Minister of Environmental Affairs and private landowners or organisations for the conservation of biodiversity. Thus, within the NEMPAA, BMAs form the Statutory Conservation Categories under which the biodiversity stewardship programme is implemented (Republic of South Africa, 2009). Figure 3.1 provides a summary of the legislative framework provisions for biodiversity conservation in South Africa.

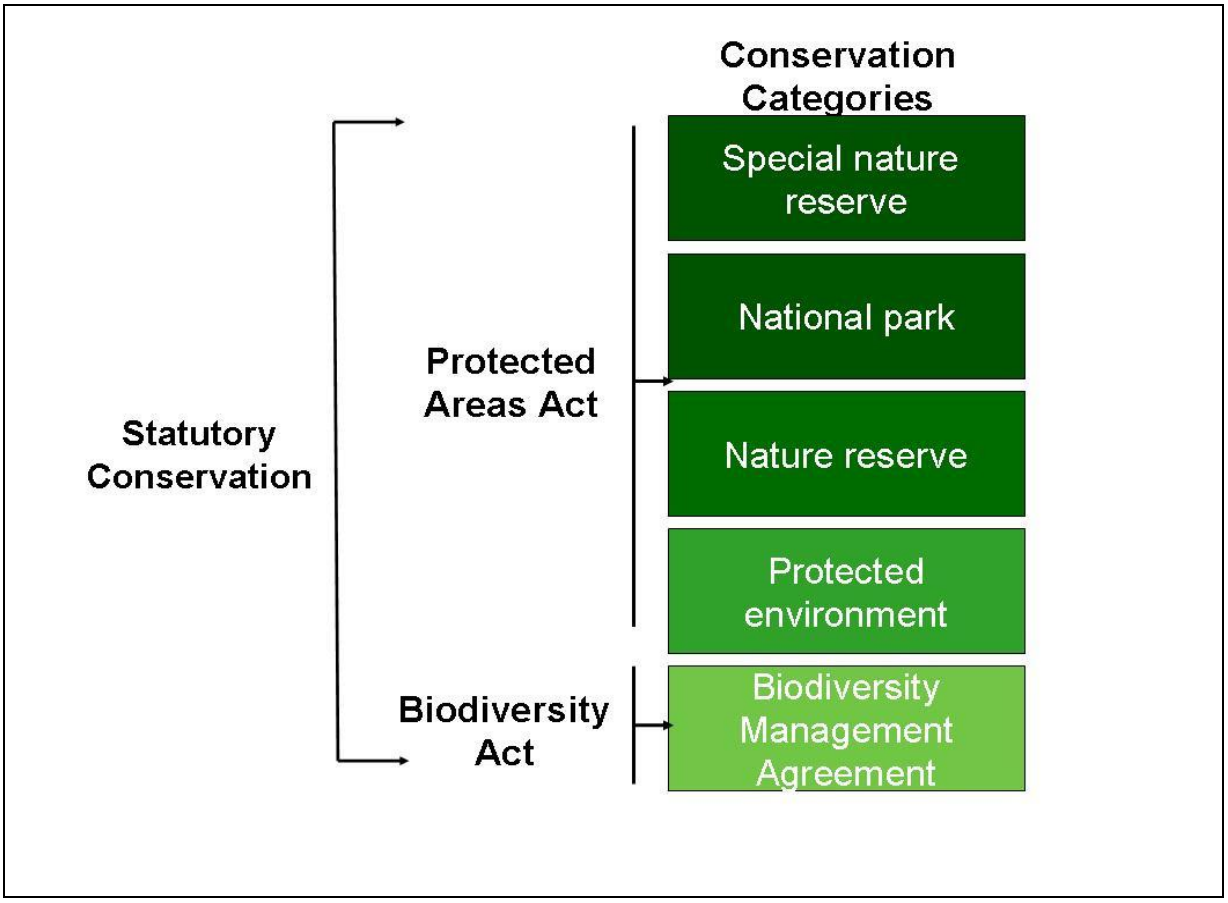


Figure 3.1: Conservation categories available in terms of the Protected Areas Act and the Biodiversity Act (Adapted: Republic of South Africa, 2009: 5)

The NEMBA provides for integration of all entities involved in biodiversity management in ensuring sustainability of environmental resources. This means that the sectors of the economy managed under various departments are guided by environmental principles embedded in their respective legislations. Table 3.2 provides a summary of the legislations and instruments underpinning management and conservation of environmental resources.

Table 3.2: Some of South Africa's biodiversity conservation related legislation and instruments (Source: DEAT, 2004; Republic of South Africa, 2005; Kuntonen-van't Riet, 2007: 9-14; eThekwini Municipality, 2010)

Legislation	Provisions
The National Water Act, 1998 (Act No. 36 of 1998)	Provides for conservation of water resources including equitable and sustainable use
National Forests Act, Act No. 84 of 1998	Provides a framework for sustainable management and development of forest resources
Development Facilitation Act, Act No. 67 of 1995	Provides a framework for implementing development projects
National Land Transport Transition Act, Act No. 22 of 2000	Provides a framework for the development of land and transport of the republic
World Heritage Convention Act, 1999 (Act No 49 of 1999)	Provides for protection and sustainable development within the bounds of world heritage sites
Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)	Provides for management of invasive alien species
National Biodiversity Framework	Provides a framework for biodiversity conservation through cooperation with various stakeholders
Environmental Impact Assessment Regulations	Provide a framework for investigating and reporting potential impacts of a development project
Land-Use Management Act	Provides a framework for land-use and equitable management
KwaZulu-Natal Planning and Development Act, Act No. 5 of 1998.	Provides a framework for planning and development within the province
Municipal Property Rates Act 2004	Provides a framework for levying land rates on properties and also provides for levying special rates for additional services
eThekwini Municipal Rates Policy	Provides a framework for levying rates within the eThekwini Municipality

As highlighted in Table 3.2, conservation of environmental resources is governed by various legislations. Each piece of legislation pertains to a specific part of the environment, for instance, the National Forests Act governs natural forests, woodlands and plantations (Republic of South Africa, 1998). However, Table 3.2 also highlights some legal instruments provided for by various legislations for conserving environmental resources such as the National Biodiversity Framework as provided for by the NEMA.

3.2.2.1 Biodiversity stewardship

The Department of Environmental Affairs (DEA) developed the biodiversity stewardship programme for managing biodiversity outside state-owned Protected Areas (Ferrar and Lötter, 2007). The aim was to increase the size of Protected Areas in a cost-effective manner for government (Driver *et al.*, 2012). Despite being a relatively new programme, Adams *et al.* (2012) assert that the biodiversity stewardship programme is progressively becoming common within the South African context of biodiversity conservation. The NEMA through NEMPAA and NEMBA provide legislative

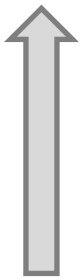
framework for establishing and implementing the biodiversity stewardship programme (Cadman *et al.*, 2010).

Biodiversity stewardship is a concept derived from the principle of stewardship, which refers to custodianship, guardianship, managing, overseeing and caring for property as well as people (Melatjie, undated). It refers to a management system in which the state entrusts the management of biodiversity to private and communal landowners (Melatjie, undated; Reeves and Marom, 2009). Driver *et al.* (2012: 5) assert that in a biodiversity stewardship programme "conservation authorities enter into contract agreements with landowners who retain title to the land and are recognised as the management authority of the protected area. Biodiversity stewardship ensures sustainable management of biodiversity for present and future generations by providing a legal framework for engaging landowners and users in conservation efforts with prospects of benefits (Reeves and Marom, 2009). Further Ferrar and Lötter (2007), state that biodiversity stewardship acknowledges landowners and users as stewards for land and biodiversity. Thus, the state "recognises the value of biodiversity on private land and the conservation role that private land owners can play in helping to meet provincial biodiversity targets" (Ferrar and Lötter, 2007: 4). In addition, private and communal landowners agree to manage biodiversity in order to secure sustainable supply of ecosystem services (SANBI, 2009). Biodiversity stewardship manages biodiversity to ensure ecosystem health, which in turn enhances community resilience and ability to adapt to climate change (Chapin III *et al.*, 2009). By doing so, conservation agencies achieve their objectives of conservation and expanding Protected Areas while the landowners accrue economic benefits and technical assistance in managing biodiversity (Ashwell *et al*., 2006; SANBI, 2013). Table 3.3 presents a summary of the principles of biodiversity stewardship, some of which have already been discussed.

Table 3.3: Principles of biodiversity stewardship (Adapted: Cadman *et al.*, 2010: 77)

Biodiversity is the bottom line	Decisions on conservation investment must be defensible and based on the biodiversity importance of the land (drawing on systematic biodiversity plans and science-based site assessments), not on ownership, political affiliation or economic status.
Site security	In order to maximise use of the state's limited resources and guarantee on-going conservation, land of high biodiversity importance must be secured through formal agreements and legal contracts. Every effort should be made to implement the most secure biodiversity stewardship category appropriate to the biodiversity importance of the site.
Voluntary commitment	Landowners or communities cannot be forced to enter into biodiversity stewardship agreements with a conservation authority; the decision to enter into the agreement must be voluntary, but may be based on extensive consultation and negotiation.
Landowner-focused extension	Proactive extension services are essential to secure buy-in from landowners, and biodiversity stewardship agreements must be backed up by resources and capacity to provide on-going extension support to inform and support landowners.
Acknowledging people's needs	Biodiversity stewardship can only be effective if the needs, motivations and expectations of those who own, live on and work on the land are clearly understood, and efforts are made to meet their needs.
Building co-operation	In landscape-scale conservation management, strong partnerships based on mutual trust are needed across property boundaries (for example, for clearing invasive alien plants or flood mitigation), involving the state, conservation authorities, NGOs, private and communal landowners.
Monitoring of implementation	On-going monitoring is important not only to determine the effectiveness of the programme in reaching set goals, but also to justify the resources used by conservation authorities for the programme, and to motivate for the provision of incentives.

According to Ferrar and Lötter (2007), landowners involved in biodiversity stewardship through nature reserves and Protected Areas benefit through rates remission. Thus, biodiversity stewardship provides "financial incentives for conservation on private lands" (Adams *et al.*, 2012: 44). Figure 3.2 provides an overview of the biodiversity stewardship model used in South Africa.

Type of agreement	Biodiversity stewardship category	Duration	
Statutory agreements (under the Protected Areas Act)	→ Nature Reserves	30+ years, preferably much longer	 **Biodiversity importance** **Benefits to Landowners** **Restrictions on land-use**
	→ Protected Environments	Minimum 30 years	
Statutory agreements (under the Biodiversity Act)	→ *Biodiversity Management Agreements	Minimum 5 years	
Formal agreements (under contract law)	→ Biodiversity Agreements	Minimum 5 years	
Informal, non-contractual agreements	→ Conservation Areas	No time specifies	

*****Although the Biodiversity Act makes provision for the establishment of BMAs for species or ecosystems of special concern, these have not yet been piloted.

Figure 3.2: Schematic representation of the biodiversity stewardship model being implemented in South Africa (Adapted: Cadman *et al.*, 2010: 71)

There are four categories of conservation through biodiversity stewardship and include nature reserves, protected environments, biodiversity management agreements, and conservation zones (Republic of South Africa, 2009). As depicted on Figure 3.2, biodiversity importance, benefits to landowners and restrictions on land-use increase from conservation zones to nature reserves (Cadman *et al.*, 2010). However, landowners have the liberty to choose which category to use and can move from one category to the other on the hierarchy depending on the value of biodiversity on land, land tenure and landowner willingness (Cadman *et al.*, 2010; Mpumalanga Tourism and Parks Agency, undated). Cadman *et al.* (2010) highlight 'conservation zone' as the lowest category and is adopted on land that has low biodiversity and by landowners not requiring legal commitment to conserve biodiversity. This category warrants low technical support from the respective conservation agency (Mpumalanga Tourism and Parks Agency, undated). Cadman *et al.* (2010) and Mpumalanga Tourism and Parks Agency (undated) contrast 'nature reserve' category from the 'conservation zone' as being a category adopted on land with high and critical biodiversity and because of this, conservation requires a high level of commitment through legally binding agreements. In addition, the 'nature reserve' category has the most restrictions on land-use, high incentives, and longest contract duration of at least 30 years (Republic of South Africa, 2009; Cadman *et al.*, 2010). Similarly, the 'protected environment' category has quite high conditions but are less than those required for the 'nature reserve' category. The 'protected environment', however, allows for various land-uses provided the land-uses are consistent with conservation of present biodiversity on the land (Mpumalanga Tourism

and Parks Agency, undated; Republic of South Africa, 2009; Cadman *et al.,* 2010). Mpumalanga Tourism and Parks Agency (undated) asserts that unlike the 'nature reserve' and 'protected environment' categories, the 'biodiversity agreement' category has lower contract duration of at least five years. The process of establishing a 'biodiversity agreement' is shorter and is provided for in the NEMBA, which makes it the easiest legally binding conservation category to establish (Cadman *et al.,* 2010). As highlighted by Cadman *et al.* (2010), the four categories of biodiversity stewardship discussed define the biodiversity model used in South Africa.

According to Cadman *et al.* (2010) biodiversity stewardship is a tool, within the National Protected Area Expansion Strategy, used to achieve increased Protected Areas thereby provides diversity of microhabitats and corridors for biodiversity migration. It is envisaged that such efforts will provide ecological sustainability, which in turn will provide capacity for climate change resilience and adaptation (Cadman *et al.,* 2010). So far, various biodiversity stewardship programmes have been implemented throughout South Africa through provincial conservation institutions and NGOs (Cadman *et al.,* 2010). By 2012, 24 contract Protected Areas were established nationally through the biodiversity stewardship programme which translated into 75 000 hectares of land with 360 000 hectares awaiting proclamation (Driver *et al.,* 2012: 5). As reported by the Climate Action Partnership (undated), Ezemvelo KwaZulu-Natal Wildlife had implemented more than 11 stewardship sites by 2011 in KwaZulu-Natal alone. The D'MOSS also acquires land and engages landowners in the conservation of biodiversity falling within their properties using the principles of biodiversity stewardship.

SANBI (2013) asserts that currently, the biodiversity stewardship programme has contributed significantly to achieving provincial protected area targets, which would not have been achieved through conventional Protected Areas alone. As such, the biodiversity stewardship programme has also influenced positively on community development and job creation (Cadman *et al.,* 2010). For instance, the Umgano community stewardship site in KwaZulu-Natal provides jobs and 'business creation' opportunities to community members. Nevertheless, the challenge remains that of insufficient personnel on the part of conservation institutions to manage biodiversity stewardship programme sites (Driver *et al.,* 2012).

3.2.2.2 Institutions for managing biodiversity

As evident from Table 3.2, there are a number of legislations established to manage the environmental resources of South Africa. The DEA (previously known as DEAT) is the main institution mandated to implement the provisions of the CBD through the constitution and environmental legislations (DEAT, 2005). However, as highlighted by the DEAT (2005), there are a number of departments that are tasked with sharing the responsibility of the DEA for each aspect of the environment it manages (such

as forests, water, air and land, among others). Besides the departments, there are "other public and private (civic) institutions at national, provincial and local level" mandated to manage the environment (DEAT, 2005: 11). Kuntonen-van't Riet (2007) and Driver *et al*. (2012) state that at national level, the South African National Biodiversity Institute (SANBI), is a national institute mandated to oversee the management of biodiversity, knowledge and information, and, research and development. However, at the local level, the mandate of SANBI is implemented through a number of programmes and conservation institutions and agencies (DEAT, 2005). For instance, in KwaZulu-Natal, Ezemvelo KwaZulu-Natal Wildlife has the mandate to manage biodiversity.

The DEA acknowledges the importance of partnering with the private sector, NGOs, businesses, civil society and scientists in managing biodiversity (DEAT, 2005). This is because local governments and municipalities are inadequately capacitated to manage biodiversity through their various management programmes (DEAT, 2005). There are well-established NGOs that engage in sustainable biodiversity management, for example, the Wildlife and Environment Society of South Africa (WESSA), which concentrates on the socio-environmental aspects of sustainable biodiversity management.

The Metropolitan Open Space System (MOSS) is a government programme which is part of the EPCPD within municipalities and in the eThekwini Municipality this programme is called the D'MOSS (eThekwini Municipality, 2010). Roberts and O'Donoghue (2013: 12) state that the "D'MOSS is the 95,000ha system designed to protect the city's globally significant biodiversity and ensure a sustainable supply of the related ecosystem services." According to the EPCPD (2011: 8), the D'MOSS "incorporates areas of high biodiversity value linked together in a viable network of open spaces" in the municipality. Within the eThekwini Municipality, the D'MOSS is not a zone rather it is a "layer used as a trigger in the case of a development application, informing stakeholders of the potential environmental sensitivity of a site" (EPCPD, 2011: 8). The EPCPD (2011) further asserts that an extensive investigation indicates the extent of a development's impact which determines whether a development is supported or not. Thus the D'MOSS provides an opportunity to manage biodiversity and especially endangered ecosystems and species to ensure sustainable supply of ecosystem services to the current and future Durban inhabitants (eThekwini Municipality, 2010). By doing so, the D'MOSS "ensures representation and persistence of the City's biodiversity resources" (Roberts and O'Donoghue, 2013: 12).

The EPCPD (2010a) asserts that current conservation efforts to manage biodiversity falling on private property have not been effective because initial land-use zoning did not incorporate environmental conservation principles. For this reason, part of the D'MOSS with important biodiversity falls on private property. Therefore, to provide effective conservation to sensitive biodiversity falling on private property, the D'MOSS uses other tools such as SRA which is used in the GGEP project,

controlled development layer and split-zoning of private properties (EPCPD, 2010b; EPCPD, 2010d; Roberts and O'Donoghue, 2013). This is also in line with the current global awakening of the importance of biodiversity in the face of climate change, which has necessitated re-zoning some areas of sensitive biodiversity to ensure sustainable development (EPCPD, 2010d). In 2009, the D'MOSS completed re-zoning the Hillcrest area where the GGEP is located and private properties with significant natural biodiversity were rezoned into 'conservation zones' to curb development and its impact on biodiversity (EPCPD, 2010b). According to the EPCPD (2010b: 13), the aim of re-zoning is "to protect both environmentally sensitive land and disturbed land providing ecosystem goods and services [and ensure that goods and services] provided by these natural systems are protected in the future." The implication of re-zoning is that some land owners lost part or all of their land to conservation depending on abundance of biodiversity on the property. However, the EPCPD states that re-zoning was "undertaken in a way that aims to have the minimum impact on existing development 'rights'" (EPCPD, 2010d: 13).

3.3 Urbanisation and its impacts on biodiversity

Urbanisation has been increasing rapidly over the past 50 years and is expected to continue increasing (Goddard *et al.*, 2010; United Nations Environmental Programme-UNEP, 2012; Burkle and Martone, 2014). Burkle *et al.* (2014: 25) state that there will be a 70% increase in urban population by 2050 while Fisk (2012: 1396) estimates that so far, the urban population has increased from 2 billion in 1992 to 3.5 billion in 2012. More specific, the number of cities increased from 5,161 to 7,935 in 2011 (Nagendra *et al.,* 2014: 305). Most of the urban growth is said to have happened in developing countries where it is estimated that by 2030, 80% of the population will be urban (Goddard *et al.,* 2010: 90). Future predictions of urban change indicate a 5 million increase in urban populations with urban area coverage increasing faster than population growth (Seto *et al.,* 2012: 16083). According to the DEAT (2006), more than half of the South African population is urban with migration contributing significantly to urbanisation. The major concern with urbanisation is the role it plays in driving environmental change both locally and globally (Goddard *et al.,* 2010; Seto *et al.,* 2012). For instance, in South Africa, urbanisation puts pressure on water and energy resources, land for sewage disposal and treatment and above all, biodiversity (DEAT, 2006). Empirical evidence suggests that urbanisation endangers "8% of terrestrial vertebrate species on the International Union for Conservation of Nature Red List" and it is expected that about 5% of ecosystems containing some of the endangered species will be lost (McDonald *et al.,* 2008: 1695).

Urbanisation poses a threat to habitats, biodiversity and ecosystem services provided by urban ecosystems (Aronson *et al.,* 2014; Nagendra *et al.,* 2014). In addition, Andersson (2006) and Goddard

et al. (2010) assert that urbanisation alters the environment by introducing impervious surfaces which change ecological, hydrological and atmospheric processes. Through energy and food consumption the urban populations have a higher ecological footprint when compared to their rural counterparts (UNEP, 2012). Andersson (2006) reiterates that emission of gaseous waste into the atmosphere alters chemical composition exacerbating the phenomenon of global warming. The impact of urbanisation, however, is mainly felt by poor populations living in peri-urban and rural areas due to their vulnerability (UNEP, 2012). All these aspects of urbanisation affect the sustainability and productivity of ecosystems.

As urban ecosystems are transformed into persistent infrastructure, a patchwork of green spaces is created which affects observed and expected extinction of species (Goddard *et al.,* 2010). Thus, with urbanisation and increased human activities, habitats are disturbed, fragmented, and are lost resulting in reduced species diversity. Williams and Winfree (2013: 10) assert that "habitat loss from urban development threatens native plant populations in many regions of the world, [and can result in] direct plant mortality." When compared to other forms of ecosystem transformation such as forest to agricultural land, urban transformation is less likely to be reverted to vegetated land because they are persistent and only more likely to grow (Mckinney, 2006).

Besides species extinction, Goddard *et al.* (2010) assert that urbanisation has caused a disconnection between urban inhabitants and the natural environment due to sparse natural environments. This is despite the growing attention natural environments such as open spaces are receiving, especially with respect to human health benefits (Irvine *et al.,* 2013). This disconnection has implications on the quality of life of people living in urban environments since the natural environment impacts on human well-being (Mitchell and Popham, 2008). Consequently, Mitchell and Popham (2008) assert that it is essential to maintain green natural open spaces within the urban environment to provide recreational facilities as well as ecosystem services. To this effect, cities have developed initiatives such as botanical gardens, parks and natural open spaces throughout the world to provide the urban environment with green spaces for human-nature interaction (Gross and Lane, 2007).

Rapid urbanisation causes an increase in exotic species diversity while indigenous species diversity decreases significantly (Mckinney, 2006). As such Mckinney (2008) states that the urban environment is characterised by fragmented indigenous species (which adapt to the urban environment) and a variety of exotic species. Aronson *et al.* (2014) assert that urbanisation instigates biodiversity loss and biotic homogenization. The authors demonstrate the impact of urbanisation by showing that bird and plant species have significantly declined in urban areas compared to populations outside urban areas. Similarly, a study by Ye *et al.* (2012) reveals that rapid urbanisation causes biotic homoginisation and reduces the abundance of indigenous species relative to exotic ones. More empirical evidence

suggests that urban environments lose species over a period of time. For instance, Mckinney (2006) highlights a study conducted in cities on various continents which reveals a maximum of about 44% of species loss over a period of between 50 and 150 years. Despite this evidence, the collage of exotic and indigenous species generally increases species diversity but due to decreased diversity of indigenous species it results in biotic homogenisation (Goddard *et al.,* 2010). Biotic homogenisation has implications for conservation of indigenous species because lack of knowledge of indigenous species on the part of the urban inhabitants would deter conservation efforts (Mckinney, 2006). Therefore, developing natural open spaces is critical to the conservation of species both within and outside the urban environment, a focus of this study.

3.3.1 Contextualising the South African urban environment and dependence on ecosystems

Ecosystems play an important role in the development of economies around the world through the provision of ecosystem goods and services (Jones and Solomon, 2013). South Africa's economy depends largely on natural resources and despite this, there is a lack of clear reporting on the actual value of services derived from ecosystems (DEAT, 2006). The DEAT (2006) also states that there is lack of reporting on the actual contribution of ecosystems to the economy, for instance, some nature-based sectors such as tourism provide estimates of their worth, while other sectors' contributions remain unknown.

Like many other global economies, South Africa has been a victim of ecosystem degradation. Being an emerging economy with high aspirations to own a large share of the global economy through its recently acquired membership to BRICS (Brazil, India, China, and South Africa), ecosystem transformation is expected (BRICS, 2012). As it is, South Africa's environment is under pressure from cultivation, mining, urban expansion, climate change, medicinal plant harvesting, invasive alien species, population growth, overexploitation of natural resources, governance and technological innovation (SANBI, 2013). Besides the pressure on ecosystems, South Africa faces a challenge of policy implementation and enforcement due to lack of institutional capacity (DEAT, 2006; Turpie and De Wet, 2008).

Coupled with the pressures on the environment, South Africa has a unique urban socio-economic and environmental landscape developed during the colonial and apartheid era through legislation such as the Native Land Act of 1913, the Prevention of Illegal Squatting Act No 52 of 1951, the Group Areas Act No 41 of 1950, and the Bantu Authorities Act No 68 of 1951 (Miraftab, 2007). These pieces of legislation ensured segregation of racial groups with the non-White racial groups receiving poor services and amenities, access to resources and the economic benefits from the use of such resources (Gordon *et al.*, 2007; Miraftab, 2007; Roberts and O'Donoghue, 2013).

Despite the efforts made by the post-apartheid government to address the inequalities, poverty persists with about 45.5% of the population living in poverty in 2011 (Statistics South Africa, 2014: 12). Statistics South Africa (2014: 32) further indicates that the highest percentage of poor people (26.3%) lived in KwaZulu-Natal in 2011. In addition, Durban is said to be the poorest metropolitan area with poverty levels estimated to be at 41.8% in 2009 (Roberts and O'Donoghue, 2013). Leibbrandt *et al.* (2010) states that during the period between 1993 and 2008, urban poverty increased despite that there was a small decrease in national poverty levels. Urban poverty level as at 2011 was estimated to be at 30.9% (Statistics South Africa, 2014: 33). The underlying cause of poverty in urban areas is unemployment exacerbated by rapid urbanisation and the backlog on government's part to provide services (Leon, 2007). Statistics South Africa (2014) shows a strong link between high intense levels of poverty and low or no education attained. Poor populations experience high unemployment due to lack of access to services such as education, consequently lacking skills demanded by the job market (DEAT, 2006).

Roberts and O'Donoghue (2013) assert that some of the peri-urban communities were previously rural communities that have now been integrated into the urban setting. Despite the integration into urban areas, inhabitants of peri-urban areas still lead traditional lifestyles and mainly depend on the natural environment for their livelihoods (Roberts and O'Donoghue, 2013). Thus, the urban peripherals provide livelihoods to many where they participate in the informal sector of the economy (DEAT, 2006). The poor in the periphery of urban areas turn to the natural environment through harvesting forest and non-forest products for sale or use in business ventures to earn a living:

> *The poor are able to survive in the urban areas, by learning to navigate these hidden and marginalised spaces, where undefined property rights and the lack of proper regulation leads to an increasing number of urban slums and a growing informal business sector. While this informality helps the poor survive, it also contributes to locking them into a cycle of poverty and to excluding them from the mainstream.*
> (Leon, 2007: 8)

The informality of the poor people's livelihoods makes the poor susceptible and vulnerable to diseases and or disasters associated with climate since they cannot pay for better services and environments (Roberts and O'Donoghue, 2013). In addition, Leon (2007: 8) asserts that the "informality and illegality" of their actions instigate land-use conflicts with either the state or private landowners. As part of this study, an analysis of contestations arising from access and use of the GGEP open space by various stakeholders (one of which is the proximate peri-urban Tshelimnyama community) is undertaken.

3.4 Ecosystems and livelihoods

Understanding ecosystems-their health, productivity, and degradation is achieved through examining the state of biodiversity (Pandolfi and Lovelock, 2014). Thus understanding ecosystems require defining biodiversity and its role in achieving human well-being. Lockwood *et al.* (2012: 12) define biodiversity as "the variety of all living things: the plants, fungi, animals and micro-organisms; the genetic information they contain; and, the ecosystems they form." Biodiverse ecosystems are healthy ecosystems and provide sufficient ecosystem services: healthy ecosystems refer to "dynamic complexes of plants, animals, micro-organisms and their non-living environment, of which humans are an integral part" (Secretariat of the CBD, 2010: 2). Díaz *et al.* (2006) further assert that ecosystem services pertain to any tangible and non-tangible gains from the ecosystems, which are highly associated with the presence of particular species within ecosystems. Some of the ecosystem services include:

> *...food, fodder, fibre, settlement, medicines, water, energy; oxygen production, air and water purification; climate regulation, carbon storage and local weather regulation; control of the impacts of weather; the regulation of disease-carrying organisms and decomposing of waste and detoxifying of pollution; the cycling of nutrients to support soil fertility and the pollination of crops and plants, and control of pests; and the provision of models to understand and address health issues... ecosystems also provide cultural, aesthetic, spiritual, recreational, and educational benefits, which are important for physical and mental health*
> **(**Secretariat of the CBD, 2010: 2).

Jones and Solomon (2013) assert that biodiversity is a reservoir of resources required for production of food, clothing, shelter and medicines, among others. As such, biodiversity and healthy ecosystems provide basis for development of operational humanity (Driver *et al.*, 2012). In addition, biodiversity and ecosystem services provide the basis on which all sectors of the economy are developed (Jones and Solomon, 2013). For instance, in South Africa, ecosystems "underpin the fishing industry, horticulture and agriculture, tourism, the film industry, commercial and non-commercial medicinal application of indigenous resources, water and sanitation, construction, and, the food industries" (DEAT, 2006: 108). The importance of biodiversity cannot be understated, for it provides livelihoods and the basic needs of life.

Collectively, ecosystem services contribute significantly to livelihoods and the absence of one or more eliminates the balance of service provisioning (Secretariat of the CBD, 2010; The Economics of Ecosystems and Biodiversity, 2010). However, according to the MEA (2005), changes in ecosystems can cause unexpected and sudden alterations to ecosystem services, which could have repercussions for all living organisms. Such changes can include disease emergence, abrupt alterations to water

quality, and shifts in regional climate for which management of ecosystems becomes critical to maintaining stability in ecosystem services provision (Burkle *et al.*, 2014).

As established, biodiversity is directly related to the provision of ecosystem services. This implies that a biodiverse ecosystem will provide better services, and, resiliency of ecosystems and human communities to disturbances, and, *vice versa* (Colding and Barthel, 2012). To achieve this, Mace *et al.* (2012) asserts that all constituents of ecosystems are important for producing goods and services. However, Díaz *et al.* (2006: 1300) state that some constituents of ecosystems are more critical than others, for instance, "functional composition-identity, abundance, and range of species traits" has adverse effects on the goods and services produced by ecosystems, while less common species will have less impact. It is therefore important to focus conservation efforts on maintaining the veracity of ecosystems through sustaining the structure, profusion, operative arrangement, and quantities of species in an ecosystem (Mace *et al.*, 2012). This would ensure well-functioning ecosystem processes giving rise to incessant supply of ecosystem services.

The MEA (2005) places ecosystem services as a central organising principle within the nexus of ecosystems, biodiversity and human well-being. For instance, the use of traditional medicines is dependent upon the presence of medicinal plants that are able to cure ailments suffered by the communities living proximate to an ecosystem. However, ecosystem goods and services are context specific, that is, each community has values and cultures on what they deem to be an ecosystem service (Díaz *et al.*, 2006; Mace *et al.*, 2012). Holistically, ecosystem services are express and non-express products of well-operating ecosystem processes (Díaz *et al.*, 2006).

3.4.1 Human well-being

Jones and Solomon (2013: 669) assert that "biodiversity is essential to the well-being of the planet and, in particular, for the human beings that live on it." Human well-being is experienced when there is provision of the basic needs of life such as shelter, security, food, water, energy, identity, health, freedom of choice and action (Díaz *et al.*, 2006; Secretariat of the CBD, 2010). According to Díaz *et al.* (2006: 1301), human well-being is influenced by "cultural, geographical, and historical context in which different human communities develop, and is determined by cultural, socio-economic processes and provision of ecosystem services." As established, human well-being is dependent on ecosystem services, however, mere abundance of an ecosystem service does not imply that it contributes significantly to human well-being; what matters is the demand placed on that service (MEA, 2005; Secretariat of the CBD, 2010). Thus, a decline in supply of a highly demanded service will have a substantial impact on human well-being when compared to an abundant less demanded service.

The Johnson *et al.* (2013) asserts that there is no comprehensive understanding as to how changes in ecosystem services affect human well-being. However, for the services that have been monitored, scientists demonstrate an intricate nonlinear relationship between biodiversity and ecosystems, and, human well-being as it involves processes which interact to produce a life support system for humankind (Secretariat of the CBD, 2010). According to Driver *et al.* (2012), well-managed ecosystems are able to reduce the impact of disasters and thus play an important role in mitigating disasters. Further, well-managed ecosystems adapt well to climate change through increased resilience to the impact of climate change on ecosystems and human communities (Intergovernmental Panel on Climate Change-IPCC, 2014).

Globally, ecosystems contribute significantly towards employment creation as well as the economic well-being through commercialisation of the goods and services produced (MEA, 2005; Jones and Solomon, 2013; SANBI, 2013). It must be noted, however, that disparities exist in the contribution of ecosystems to employment in developed and developing countries (MEA, 2005). In South Africa, ecosystems are important and their value is significant as exemplified in Table 3.4, which provides monetary values of open spaces in Durban alone.

Table 3.4: Value of open spaces in Durban (Adapted from: DEAT, 2006: 110)

Ecosystem	**Size (hectares)**	**Rand value (millions)**
Beaches and rock outcrops	1 039	30.2
Alien vegetation	3 787	24.8
Forest	10 581	195.3
Disturbed woodlands	2 823	29.5
Field crops	741	0.7
Dry valley thicket or broadleaved woodland	18 306	267.5
Grassland	2 828	6.8
Tree crops	14	0.2
Recreational	1 712	4.1
Utility	289	0.5
Wetland forest	201	33.7
Wetland (non-woody)	5 485	1 108.80
Near shore ocean (the ecosystem in the area of ocean just off the shore)	50 000	837.2
Water	3 093	428.8
Wooded grasslands	11 145	116.4
Settlements	865	6.4

As indicated in Table 3.4, the highly valued open space is the wetland (non-woody) valued at R1 108.80 billion followed by near shore ocean valued at R837.2 million. On the other hand, tree crops and utility open spaces have low values of R0.2 million and R0.5 million respectively.

In third world countries, human well-being is compromised by lack of basic needs of life such as food, shelter and clothing which is related to poor health of ecosystems (Benson, 2013). These aspects among others have become a priority for global leaders through the Millennium Development Goals (Elliott, 2012). The high rate of poverty exacerbated by a population lacking skills and high unemployment rate affects human well-being both in rural and urban areas (DEAT, 2006). These factors push populations in search for livelihoods into urban areas with the hope of employment. However, when urban areas cannot absorb immigrants into its structures, people turn to the natural environment for shelter, food, fuel and employment (DEAT, 2006). This usually causes conflicts as people encroach onto private or public land demarcated for environmental conservation (Leon, 2007).

3.5 Drivers of ecosystem change

Globally, threats to ecosystems are contextualised in terms of direct and indirect drivers of change. Direct and indirect drivers cause changes in ecosystem structure and composition: indirect drivers of change act on the direct drivers by changing the normal conditions under which ecosystems thrive (MEA, 2005). Consequently, the direct drivers affect ecosystems by changing composition and structure, which ultimately affects ecosystem goods and services.

3.5.1 Indirect drivers of change

Indirect drivers of change include globalisation, population growth and high per capita consumption; which is mainly determined by belief systems, scientific and technological change, culture and religion, and increased world trade (Namjam *et al.*, 2007; Secretariat of the CBD, 2010; Jean-Yves and Verdier, 2013). According to the Secretariat of the CBD (2010), population growth and high per capita consumption induce overexploitation through increased demand for ecosystem goods and services, and introduction of invasive alien species all of which are direct drivers of change. On the other hand, Jean-Yves and Verdier (2013) state that globalisation increases the ecological footprint globally through the demanded goods for human consumption. Namjam *et al.* (2007) assert that globalisation encompasses many other drivers of change. For instance, Meyfroidt *et al.* (2013: 438) states that "with the expansion of globalisation and urbanisation, the agents of deforestation have changed, in particular in Latin America and Southeast Asia." Nevertheless, the same indirect drivers of change can affect ecosystems positively, for instance, science and technological change can provide new methods of using ecosystem services efficiently and thus result in a decrease in overexploitation (Secretariat of the CBD, 2010).

Globalisation can be seen as a multi-faceted terminology which encompasses economic, social, technological, cultural political and technological changes affecting every nation (Stromquist and

Monkman, 2014). Despite its origins, the definition of the term 'globalisation' has evolved and the current understanding of the term is further from its original use (Held, 1999, cited in Lawal, 2006: 66; Namjam *et al.,* 2007). Since the 1980s, globalisation of transportation, information technology, and clean energy has transformed the urban landscape (Fisk, 2012). According to Lawal (2006), since the end of the cold war, global economies have been growing and getting closer to each other due to the need for trade in information, goods and services and, more importantly, natural resources. Globalisation can therefore be deemed to be the "internationalisation, liberalisation, universalisation, modernisation and deterritorialisation of cross-border relations, regulations, social structures and social spaces" (Namjam *et al.,* 2007: 5). It refers to interdependencies, integration, interactions and interconnections of world economies socially, politically, economically and technologically (Lawal, 2006; Martens and Raza, 2010). This relationship implies that what happens in one economy has a significant impact on the other world economies. According to Pierre (2013), the major influence that globalisation has had is on financial systems during financial crises. A good example is that of the USA's (and later the Euro Zone) 2008 economic recession (Verick and Islam, 2010; Martin, 2011). The recession, which started in the USA, escalated impacting the whole globe which is interlinked through money and commodity markets. Verick and Islam (2010) assert that globalisation permits movements across geographical boundaries, interactions between nations as well as transfer of information, natural resources and knowledge. Above all, in the context of environmentalism, globalisation has highlighted environmental problems facing the world today despite it being an instigator (Jean-Yves and Verdier, 2013). Thus, globalisation implies that environmental issues have no geographical boundaries and so global collaboration in managing global natural resources is viewed as the best practice (Namjam *et al.,* 2007).

There are many ways in which globalisation has been defined however, there still exist contentions as to what it really is and the exact positive and negative impacts on global economies (Dauvergne, 2005; Namjam *et al.,* 2007). Nevertheless, dynamics defining globalisation are understood to be composed of three main themes and they include governance, knowledge and economy (Lawal, 2006; Namjam *et al.,* 2007). Esty and Ivanova (2004) state that globalisation of governance targets elimination of geographical boundaries through liberalisation of laws and regulations in order to allow easy access to economic activities. Governance in a global world is shared and it is no longer reliant only on national-states but also on various global interest groups and other global states (Namjam *et al.,* 2007). Despite this assertion, Pierre (2013) states that globalisation still allows for significant autonomy in domestic governance, for instance in domestic reform, globalisation is only viewed as a facilitator of reform. Namjam *et al.* (2007) reiterate that it is because of globalised governance that global institutions and governance emerged and collaborations in managing environmental resources are made possible through multilateral agreements. This is because environmental resources are

global assets and quandaries are global, therefore the need to incorporate global participation (Namjam *et al.,* 2007). Ecosystems distribute their services globally unrestricted by geographical boundaries and in the same way, disturbance of ecosystems will affect all inhabitants of the globe (Namjam *et al.*, 2007). Thus, global governance through global institutions and regulations makes it easy to manage environmental resources (Namjam *et al.*, 2007). The Global Environmental Outlook 5-GEO5 (2012) highlights internationally agreed goals and themes on biodiversity and include: Convention on Biological Diversity (CBD 1992); Ramsar Convention on Wetlands (United Nations 1973); Millennium Summit (2000) Millennium Development Goal 7; and, Johannesburg Plan of Implementation (JPOI), among others.

According to Pierre (2013), globalisation has made the flow of information and knowledge easy while Muradian (2005) and Namjam *et al.* (2007) assert that globalisation has increased social interaction of nations through amalgamation of knowledge and this is expressed through the streaming of information, ideas, ethos and technology. With the growth in global shared knowledge and reduced time and space through which the exchange occurs, environmental management is enhanced (Muradian, 2005; Namjam *et al.*, 2007; Jean-Yves and Verdier, 2013). Rapid information flow makes it possible to organise global action and awareness on environmental issues while technological advancement and flow can be beneficial to finding efficient methods of natural resource use (Namjam *et al.,* 2007; Pierre, 2013). Concomitantly, technological advancement and flow can have adverse effects on the environment, that is, when technologies in question pertain to resource abstraction (Namjam *et al.,* 2007).

Pierre (2013) states that globalisation has contributed significantly towards economic growth. This implies that national economies become integrated into one global economy through trade, technology, investment and movement of capital and employment opportunities (Namjam *et al.*, 2007; Martens and Raza, 2010). This clearly implies many collaboration opportunities by national-states that are able to take advantage of globalisation (Namjam *et al.*, 2007). Global environmental collaboration can also benefit from increased income by channeling the resources towards environmental conservation (Esty and Ivanova, 2004; Muradian, 2005; Namjam *et al.*, 2007). Young *et al.* (2006) and Namjam *et al.* (2007) assert that the main concern with economic globalisation is the increase in consumption of natural resources which in conjunction with technological advancement would induce increased resource abstraction. In addition, increased resource abstraction can have negative ramifications on the sustainability of the environment in the long-term (Young *et al.*, 2006).

Economic globalisation has caused some concerns around the world such as “job losses due to offshoring, attacks on the unfair practices of foreign trading partners, and calls for protectionist trade policies” (Margalit, 2012: 484). In addition, Muradian (2005) asserts that globalisation provides

opportunities for economic integration and at the same time it breeds social inequality as is the experiences of some regions and countries such as Africa and North Korea. Countries like North Korea took advantage of the opportunities created by globalisation to create national wealth but by doing so created disparities between the rich and the poor, with the poor in the majority (Muradian, 2005). A study by Dreher and Gaston (2008) shows that globalisation has aggravated income inequality for Organisation of Economic Co-operation and Development countries. According to the MEA (2005), social inequalities drive the poor to rely on ecosystems for their livelihoods which can induce environmental problems due to unsustainable use practices. Besides localised consequences of globalisation, economies that fail to compete on the global markets are ostracised by the practices of globalisation (Muradian, 2005).

Jean-Yves (2014) asserts that globalisation emasculates environmental regulations due to the need to standardise policy globally thereby hindering the development of appropriate context sensitive environmental policy. In addition, globalisation has the potential of causing differences in environmental sustainability between hemispheres, from one region or country to another (Martens and Raza, 2010). Many multinational companies rely on the developing world to invest in agriculture, mining and other industries in order to produce goods for global markets (Nepstad *et al.,* 2006; Renaud, 2012). Africa and the Amazon are two of the other regions that bear the aspirations of multinational companies for achieving global food security, however, the need for agriculture produce has caused high rates of deforestation (Nepstad *et al.,* 2006; Renaud, 2012).

Globalisation has not just opened up economic opportunities but also the movement of goods from one hemisphere (region or country) to another (AEO 2, 2006; Pierre, 2013). Such movements of goods occur as trade, aid or simply food for those on transit (MEA, 2005). The AEO 2 (2006) cautions that the movement of goods can lead to introduction of alien species which may become invasive and destructive to the environment. Further, globalisation and the environment impact on one another, for instance, globalisation affects the state of ecosystems and their ability to produce services sustainably while ecosystems drive globalisation through the supply of ecosystem services on which economic activities are dependent (Namjam *et al.,* 2007). Martens and Raza (2008) assert that there is need for policy makers to constantly understand the changes occurring at various scales while globalisation should aid sustainable policy development which integrate social, economic and ecological aspects. In addition, it is important to understand and control the dynamics of globalisation if ecosystems are to be managed sustainably since globalisation will only flourish if ecosystems are managed sustainably (Namjam *et al.,* 2007). All in all, Jean-Yves and Verdier (2013: 116) state that "it's partly up to national political decision makers to take pro-environmental measures to prevent or repair the environmental damage arising, in part, from globalisation."

3.5.2 Direct drivers of change

On the other hand, direct drivers of change include overexploitation, land-use, climate change, species introduction, biodiversity loss and biogeochemical processes (Díaz *et al.*, 2006; Managi, 2013; Secretariat of the CBD, 2010; UNEP, 2012). Changes in ecosystems caused by one or all of the drivers of change induce change in ecosystem health and goods and services derived thereof (European Academies Science Advisory Council-EASAC, 2009; Lockwood *et al.*, 2012). In addition, one driver of change can be an instigator of other drivers, for instance, overexploitation can induce biodiversity loss and affect biodiversity distribution, abundance and composition (Pereira *et al.*, 2012).

3.5.2.1 Land-use change

According to DEAT (2006) and EASAC (2009), land-use change is caused by urbanisation, overexploitation, pollution and invasive alien species invasion all of which account for South Africa's major threats to ecosystems. Land-use change is triggered by various factors including globalisation and population growth (MEA, 2005, Meyfroidt *et al.*, 2013). According to Meyfroidt *et al.* (2013), local decisions on production are highly influenced by global demands for goods and services facilitated by the ease with which information, knowledge and capital flow across countries and continents. Thus, a globalised world has made it easy to produce and trade in products demanded by the growing global urban population (Lambin and Meyfroidt, 2011). Growing populations throughout the world induce land-use change. For instance, a twofold world population increase during the period 1960 to 2000 resulted in an increase in food production by about 160% (MEA, 2005: 39). The MEA (2005: 39) further indicates that over the same period the demand for wood by the paper industry tripled, water consumption increased twofold, while timber production increased by over 50%. In addition, fish production over the period 1970 to 2000 increased from 50 million tonnes to about 70 million tonnes. However, the last century has seen about 50 to 1000 times more extinction of species than any other period resulting from land-use change (EASAC, 2009). Single-handedly, land-use change threatens 11% loss of natural habitats by 2050, 40% of agricultural land could be converted to intensive cultivation land, and coral reefs could be lost by 2030 if the current rate of use remains unchanged (EASAC, 2009: 2).

The MEA (2005) asserts that there are certain land-use activities that demand alteration of ecosystems to produce more of one-ecosystem good or services such as food and timber production. This kind of alteration of ecosystem services results in changes in other ecosystem goods and services on which the desired service is dependent. For instance, food production will require clearing forests and fresh water for irrigation, both of which can cause poor water quality, species loss (and hence loss of forest

products) and increased release of carbon dioxide into the atmosphere (MEA, 2005). Beyond the immediate environment of production, loss of forest cover would result in the inability of the environment to attenuate floods downstream while the use of chemicals in the production process would affect the water quality through nutrient loading (MEA, 2005; Bastian *et al.,* 2012). Bastian *et al.* (2012) assert that the result would be a number of disasters which is an indicator that the ecosystem has lost it resilience. Thus, land-use change results in changes in the provision of ecosystem services (Lawler *et al.,* 2014).

Human activities are intricately related and together they interact and cause a multiplier effect in terms of the impacts they have on the environment (MEA, 2005) The dilemma faced by developing countries is maintaining a balance between ecosystem conservation and production to meet global production demands (Lambin and Meyfroidt, 2011). Lambin and Meyfroidt (2011: 3465) assert that the "challenge for developing countries confronts the force of economic globalisation, which seeks cropland that is shrinking in availability and triggers deforestation." If the rate of change of ecosystems remains unchecked, the ability of ecosystems to provide for current and future generations will be compromised (Secretariat of the CBD, 2010). This therefore highlights the need for land-use planners to incorporate conservation needs in planning, decision-making and most importantly in formulation and implementation of legislation (Bastian *et al.,* 2012). In addition, an understanding of instigators of land-use change and the role of policy in environmental sustainability will foster sustainable land-use (Lawler *et al.,* 2014).

3.5.2.2 Overexploitation

Overexploitation or unsustainable harvesting is one of the drivers of change of ecosystems and biodiversity, which affects all ecosystems; be it aquatic, forest, or grassland (Secretariat of the CBD, 2010). It is said that over-fishing is a cause for concern in marine ecosystems while unsustainable hunting for food, ornaments and medicines is a major concern for terrestrial ecosystems (Duraiappah *et al.,* 2005; Pereira *et al.,* 2012). Overexploitation is perpetuated by government and multinational companies and, individuals from poor communities relying on the natural environment for their livelihoods (Secretariat of the CBD, 2010; Meyfroidt *et al.,* 2013). The Secretariat of the CBD (2010) states that it is for this reason that management systems have been developed and are still being developed to manage ecosystems in such a way that they support poor adjacent communities.

Ecosystems play an important role in developing economies throughout the world. It is through natural resource exploitation that goods and services are produced for domestic and commercial consumption (UNEP, 2007; Secretariat of the CBD, 2010). However, the natural resources become overexploited when the rate of extraction or use exceeds the ability of ecosystems to regenerate and/or

recuperate. Nepstad *et al.* (2006) assert that the world contributes to overexploitation of natural resources through the demands placed on natural products such as timber, agriculture produce, medicinal plants and animal products. Currently, many African countries are faced with increasing poaching of wildlife for their horns, an act which is mainly induced by increasing international demand for trophy horns (Miliken and Shaw, 2012). Poaching of the rhino is threatening the white rhino with an annual loss rate at 532 in South Africa (Miliken and Shaw, 2012:11). Rhino poaching exemplifies how international demand for ecosystem services in collaboration with local populations seeking livelihoods can lead to loss of species. This is the case with plant species in South Africa, especially in the Cape Floristic Region and KwaZulu-Natal coastal belt of South Africa, where overexploitation of species is rampant (DEAT, 2006; Privett *et al.,* 2014).

The demand for water supplies has increased threefold since the 1960s while the supply thereof remains constant causing uncertainty over sustainability of fresh water use for future generations (2030 Water Resources Group 2009; United Nations Educational, Scientific and Cultural Organization, 2009). According to Masondo (2011), it was projected at the South African Water and Energy Forum held in Johannesburg South Africa that fresh water shortages would be felt as early as 2020 in South Africa. The looming water shortages in South Africa are mainly a result of increasing need which outstrips the ability to meet the needs (Masondo, 2011). The wetlands in Johannesburg have been purifying the region's water from mine and industrial pollutants (SANBI, 2013), however, it has come to light that the untreated acid mine water threatens the country's ability to provide clean water for human consumption (Gass, 2012). With pressures exerted on water sources, in addition to ongoing pollution, there is need to conserve and manage ecosystems that maintain clean water supplies (SANBI, 2013).

Biodiversity loss due to deforestation estimated to be 13 million hectares per year with South America and Africa being the most affected (Johnson *et al.,* 2013: 237). This is a major cause for concern globally and the major instigators are increasing demand for land to produce more food, timber and settlement (Lambin and Meyfroidt, 2011). Deforestation and habitat transformation pose a threat to habitats (which can lead to loss and extinction of many valuable plant species such as medicinal plants) and the traditions and culture of African societies which are intricately reliant on the natural environment **(**Okigbo *et al.,* 2008). In addition, Johnson *et al.* (2013) assert that the consequences of high rates of biodiversity loss on human well-being remain unknown. Nevertheless, the threat posed by deforestation calls for conservation of ecosystems through effective land-use planning and/ or zoning (Lambin and Meyfroidt, 2011).

Medicinal Plants

Medicinal plants are a socio-cultural heritage of Africa and have been used for hundreds of years in rural areas and later in urban areas as a source of primary health-care (Herndon *et al.,* 2009; Towns *et al.,* 2014). Semenya and Maroyi (2012) assert that medicinal plants provide the needed medicines in rural areas mainly administered by traditional healers, especially where health facilities are absent. To some people, medicinal plants provide first aid treatment while to others, it is the only health-care that they receive; for instance, in Ghana, more than half the child population suffering from malaria are treated with traditional medicines extracted from medicinal plants (Secretariat of the CBD, 2010). The medicinal industry in some of the African countries is said to be highly profitable and is estimated to be worth US$ 64 000 in Sierra Leone and US$ 7.8 million in Ghana (Van Andel *et al.,* 2012: 368; Jusu and Sanchez, 2013: 299). According to Driver *et al.* (2012: 14), about 2 000 plant species are used for medicinal purposes 82 of which are threatened of extinction in South Africa. Approximately 72% of the population in South Africa depends on traditional medicines (commonly known as *muthi*) for their primary health-care (Williams *et al.,* 2013: 23).

Over the years, developed countries have created a demand for herbal and traditional medicines and thus the emergence of pharmaceuticals developing herbal-based medicines and other products (Okigbo *et al.,* 2008). Singh *et al.* (2013) state that this resulted from the awakening and awareness of the potential harm conventional medicines can cause to the general human well-being. However, due to the high demand for medicinal plants, so much pressure has been exerted on the ecosystems such that most of the ecosystems are disintegrating (Lambert *et al.,* 2005; SANBI, 2013).

Medicinal plants are used for subsistent as well as commercial consumption (Kar and Jacobson, 2012; Vashist and Sharma, 2013). Van Andel *et al.* (2012: 368) assert that "medicinal plant markets not only provide a snapshot of a country's medicinal flora, they also reflect local health concerns and the importance of traditional medicine among its inhabitants." Medicinal plants support livelihoods of poor rural communities (Hicks *et al.,* 2014), for instance in South Africa, medicinal plants have been credited for their economic role in society especially that of providing healthcare to both urban and rural inhabitants (Williams *et al.,* 2013). According to SANBI (2013: 46), in 2007 the harvesting and trade of medicinal plants was valued at R2.9 billion. Another estimate of the medicinal plants industry is placed at R1 million per day and this value excludes dispensing fees (Phipson, 2012: 19). As a result, there is increasing pressure on medicinal plant stocks through over-harvesting which can be attributed to increased demand for herbal medicines resulting in increase in prices (Phipson, 2012). In addition, the high demand for herbal medicines has exerted a lot of pressure on the indigenous plant species due to overexploitation of wild populations, hence the need to use these resources sustainably (Okigbo *et al.,* 2008; Phipson, 2012). For instance, SANBI (2013: 46) estimates that 10% of the

traded medicinal plant species are threatened and this calls for urgent attention to achieve sustainability.

Hassan (2012) asserts that medicinal plants are important as they play a role in development of cultural traditions globally. In addition, medicinal plants are important as they contribute towards rehabilitation of degraded land through improving fertility of soils and control of erosion (Lambert *et al.,* 2005). Furthermore, medicinal plants contribute towards the diversity of ecosystems. Consequently, conservation of medicinal plants is critical to maintaining genetic and species diversity, cultural and traditional knowledge through research and documentation **(**Okigbo *et al.,* 2008; SANBI, 2013). Okigbo *et al.* (2008) and Jain *et al.* (2012) suggest that there are various medicinal plant conservation strategies and they include practices that promote conservation within natural habitats and outside their natural habitats. A management strategy for conserving medicinal plants outside their natural habitats is known as 'conservation through cultivation' or *ex-situ* conservation (Okigbo *et al.,* 2008; Jain *et al.,* 2012). Jain *et al.* (2012) assert that 'conservation through cultivation' is used to safeguard and propagate species that are threatened in their natural habitats. More effective ecosystem management practices are needed especially those which consider the community needs for medicinal plants and those of conserving biodiversity. This study seeks to identify practices utilised in the GGEP in ecosystem management, which includes management of medicinal plants.

3.5.2.3 Climate change

According to Hicks *et al.* (2014), climate change is predicted to be the principal biggest threat to ecosystem health. Climate change has caused a rise in sea level and temperatures with a rapid increase observed during the 1980s (Archer and Pierrehumbert, 2011). In addition, there are observed changes in precipitation, species' geographical ranges and intensity of natural disasters such as floods, wild fires and droughts (IPCC, 2014). According to the SANBI (2013) South Africa is also affected by climate change with the local trend generally following global climate change trends. Climate change is predicted to affect food production through destruction of rangelands by high temperatures, spread of pests, invasive species, natural disasters, and erratic precipitation (SANBI, 2013).

UNEP (2014), states that ecosystems provide many services one of which is the regulation of climate through carbon appropriation. Thus, alteration of ecosystems, for instance through conversion to agricultural land results in increased atmospheric carbon which contributes to global warming (Perrings, 2010). UNEP (2012) asserts that climate change is an important instigator of ecosystem degradation, however, Perrings (2010) states that fragmented or degraded ecosystems exacerbate climate change and the ability for species and humans to adapt to climate change. Further, climate

change affects the dispersal of species within a habitat and can affect species diversity within that habitat (Rosenzweig *et al.,* 2007). According to Perrings (2010: 1), climate change

> *…is affecting species distributions and abundance, the timing of reproduction in animals and plants, animal and bird migration patterns, and the frequency and severity of pest and disease outbreaks. Species are moving from lower to higher elevations and from lower to higher latitudes. Species that are unable to move are at risk. At the same time, changes in the world's biota from other causes are affecting the ability of ecosystems to adapt to climate change. The simplification of many ecosystems to make them more 'useful' to people reduces their flexibility. By eliminating species that are 'redundant' given current climatic conditions and current uses, we have reduced the capacity of many ecosystems to function if climatic conditions change.*

Thus, the effects of climate change such as changing temperatures, precipitation, availability of pathogens and competition with invasive alien species, among others, negatively affect ecosystems (Cahill *et al.,* 2012). Walther *et al.* (2009) and Perrings (2010) reiterate that increases in temperature that have been induced by climate change affect ecosystems by altering function, distribution, structure and composition of indigenous species. Climate change alters precipitation patterns, which in turn affects the availability of surface and ground water (IPCC, 2014). It affects seasons, intensity, and frequency of precipitation; and the same applies to temperatures (IPCC, 2014). Thus, a rise in temperature can cause harsh conditions for proliferation of certain species while the same effect may induce the proliferation of other species that require more sunlight to grow. Further, Walther *et al.* (2009) assert that climate change can induce vulnerability of habitats to invasions by alien species, which can overtake and completely change the habitat's biodiversity, and establish in the new habitat. Extreme climatic events induced by climate change make it possible and easy for species to be transferred into new habitats where they can become invasive or even overtake the whole habitat (Walther *et al.,* 2009).

Climate change predictions using 15 global circulation models reveal that by 2050 there will be transformation of biomes to varying degrees given different scenarios of low to high risk (Driver *et al.,* 2012). SANBI (2013) states that climate change models reveal the changes that could occur under rising temperature and increased precipitation. Such changes may directly result from climate change or from efforts to adapt to climate change, an example of which is the recent campaign to turn to biofuels which lead to an increase in demand for agricultural land (Wilson *et al.,* 2008; Bradley *et al.,* 2012). According to Driver *et al.* (2012), South African ecosystems will adapt to changes in climate given that the critical aspects of biomes responsible for maintaining resilience are not compromised. Some of the critical aspects of biomes that are important for climate change resilience include riparian

and coastal corridors, areas characterised by temperature, rainfall and altitudinal gradients, areas of high diversity and plant endemism, and refuge sites including south-facing slopes and kloofs (SANBI, 2013).

Resiliency and adaptation to climate change are important for survival of all species including humanity. Resilience is "defined not just according to how long it takes for the system to bounce back after a shock, but also how much disturbance it can take and remain within critical thresholds" (Davoudi, 2012: 300). Thus, the concept of resilience hinges on a state of equilibrium to which an ecosystem will revert or progress to. According to Burns *et al.* (2006), resilience concerns the propensity of ecosystems to resist stress without being converted into inferior or different systems producing different services and governed by different processes. Thus, "resilience provides the capacity to absorb shocks while maintaining function; when change occurs, resilience provides the components for renewal and reorganisation" (Berkes *et al.*, 2002, cited in Folke *et al.*, 2002: 13).

Resilience is determined by diversity of genes, species, functional groups of species, and, processes within the system (Drever *et al.*, 2006). Of these attributes, Thompson *et al.* (2009) assert that genetic diversity is the most important at various levels of species interaction. This is because it is the foundation upon which natural selection happens and it yields resilience of species within a given geographical location (Muller-Starck *et al.*, 2005). Thus, genetic diversity regulates the ability of species within a given geographical location to counter change, resist change or even compete with other species for survival (Pease *et al.*, 1989, Halpin, 1997, cited in Thompson *et al.*, 2009: 14). In addition, ecosystems depend on genetic diversity within species to survive drastic environmental change such as that induced by climate change and development (Thompson *et al.*, 2009). On the other hand, species diversity is important in producing long-term resilience in ecosystems as it determines processes important for genetic diversity and propagation of species (Thompson *et al.*, 2009). For instance, the process of predation on herbivores ensures that consumption of primary producers is checked to maintain primary productivity within ecosystems (Thompson, 2011).

Folke *et al.* (2002), state that within the socio-ecological context, resilience is defined in terms of the ability of ecosystems to remain unchanged with respect to composition, structure, identity and function, in the face of pressure. Davoudi (2012) also defines resilience to include the amount of pressure or disturbance that a system can take without changing the existing state of equilibrium. Therefore, resilience considers the extent to which pressure can be exerted on systems before changing the systems' state of equilibrium. In addition, resilience can also imply the ability of ecosystems to continuously change but remain within the same state of equilibrium (Folke *et al.*, 2010). This suggests that there are thresholds in ecosystems beyond which if pressure continues

mounting, the ecosystem changes the state of equilibrium (Figure 3.3 provides a graphical illustration of this concept) (Secretariat of the CBD, 2010).

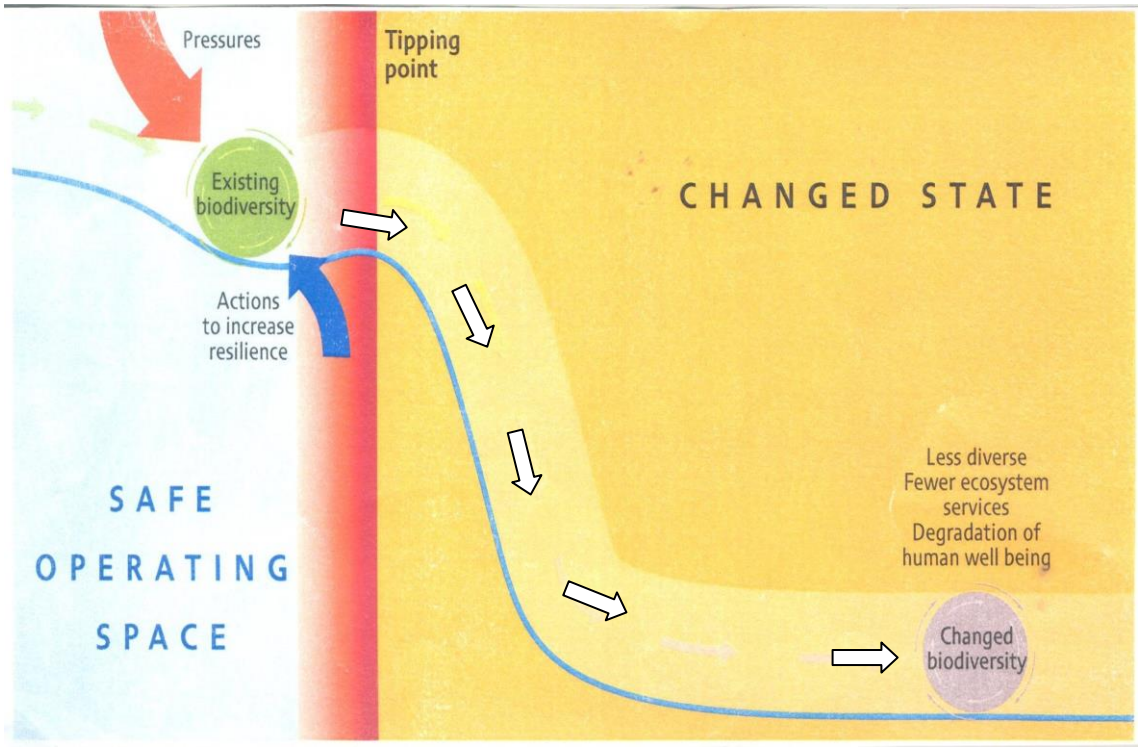


Figure 3.3: Illustration of resilience (Adapted: Secretariat of the CBD, 2010: 72)

According to Plagányi *et al.* (2014), thresholds within systems resulting from changes in the condition of ecosystems and how they are organised continue to perturb managers. This is because it is unknown where the thresholds lie or when they are reached, only consequences of exceeding thresholds are visible (Secretariat of the CBD, 2010). Exceeding thresholds implies that ecosystems move into a new state of equilibrium, for instance, Figure 3.3 indicates that a move from the 'safe operating space' to the 'changed state' (Secretariat of the CBD, 2010). However, "once an ecosystem moves into a new state it can be very difficult, if not impossible, to return it to its former state" (Secretariat of the CBD, 2010: 72). Therefore, "adaptive response to such changes, and planning for their occurrence, requires an understanding of the underlying drivers and system responses as well as appropriate monitoring" (Plagányi *et al.,* 2014).

According to Folke *et al.* (2010), change can occur within a system and that change can enhance the ability of the system to be resilient at a larger scale. Within the socio-ecological context, self-organisation is an important attribute of resilience without which learning and preparedness for change would be impossible (Folke *et al.,* 2006). Thus an ecosystem that can re-organise after

exposure to pressure provides an opportunity to study how ecosystems react to certain (amounts of) pressure. In this way, resilience can be viewed in terms of the ability for ecosystems to change thereby providing opportunities for learning, innovation and resolving socio-ecological challenges (Folke *et al.*, 2010; IPCC, 2014).

Climate change exerts pressure on ecosystems through changing environmental temperatures and precipitation patterns which reduce or eliminate habitats suitable for species survival (Morit and Agudo, 2013). Morit and Agudo (2013) assert that archaeological records indicate that species survived previous climate changes while future climatic predictions indicate significant changes and reduction in the size and location of biomes which will affect species composition. This therefore renders resilience important for adapting to climate change. Biodiversity at a genetic and species level enhances resilience and knowledge developed from studying ecosystem resilience is important for developing natural resource management strategies (adaptive management) that enhance biodiversity and reduce human vulnerability (Burns *et al.,* 2006: 381). According to the IPCC (2007), resilience is important mainly in regions where economies are dependent on primary production. This is because the ability of the natural environment to produce is compromised by the impact of climate change. Therefore, there is need to enhance resilience through conservation of ecosystems and the diversity of species and genes within these ecosystems (IPCC, 2007). Andersson (2006) recommends the use of resilience theory in urban land-use planning and management to achieve sustainability within urban spaces.

Drivers *et al.* (2012) assert that current practice in climate change mitigation uses ecosystem resilience to enhance adaptive capacity of communities. The focus of climate change adaptation efforts is on socio-economic, structural and technological enhancement (Campbell *et al.*, 2008; IPCC, 2014). However, it is increasingly accepted that the link between biodiversity and climate change should be incorporated into climate change adaptation planning (Thompson *et al.,* 2009). Thus, the focus has shifted from technology-based adaptation to ecosystem-based adaptation by "maintaining and restoring ecological infrastructure, which frequently has the added benefit of creating jobs and contributing to livelihoods" (Drivers *et al.,* 2012: 116). This therefore implies conserving natural ecosystems and rehabilitating degraded ecosystems to ensure that ecosystem function is not compromised (Drivers *et al.,* 2012). Further,

> *…ecosystems-based adaptation focuses on managing, conserving, and restoring ecosystems to buffer humans from the impacts of climate change. It combines socio-economic benefits, climate change adaptation, and biodiversity and ecosystem conservation, contributing to all three of these outcomes simultaneously.*
> (Drivers *et al.,* 2012: 117)

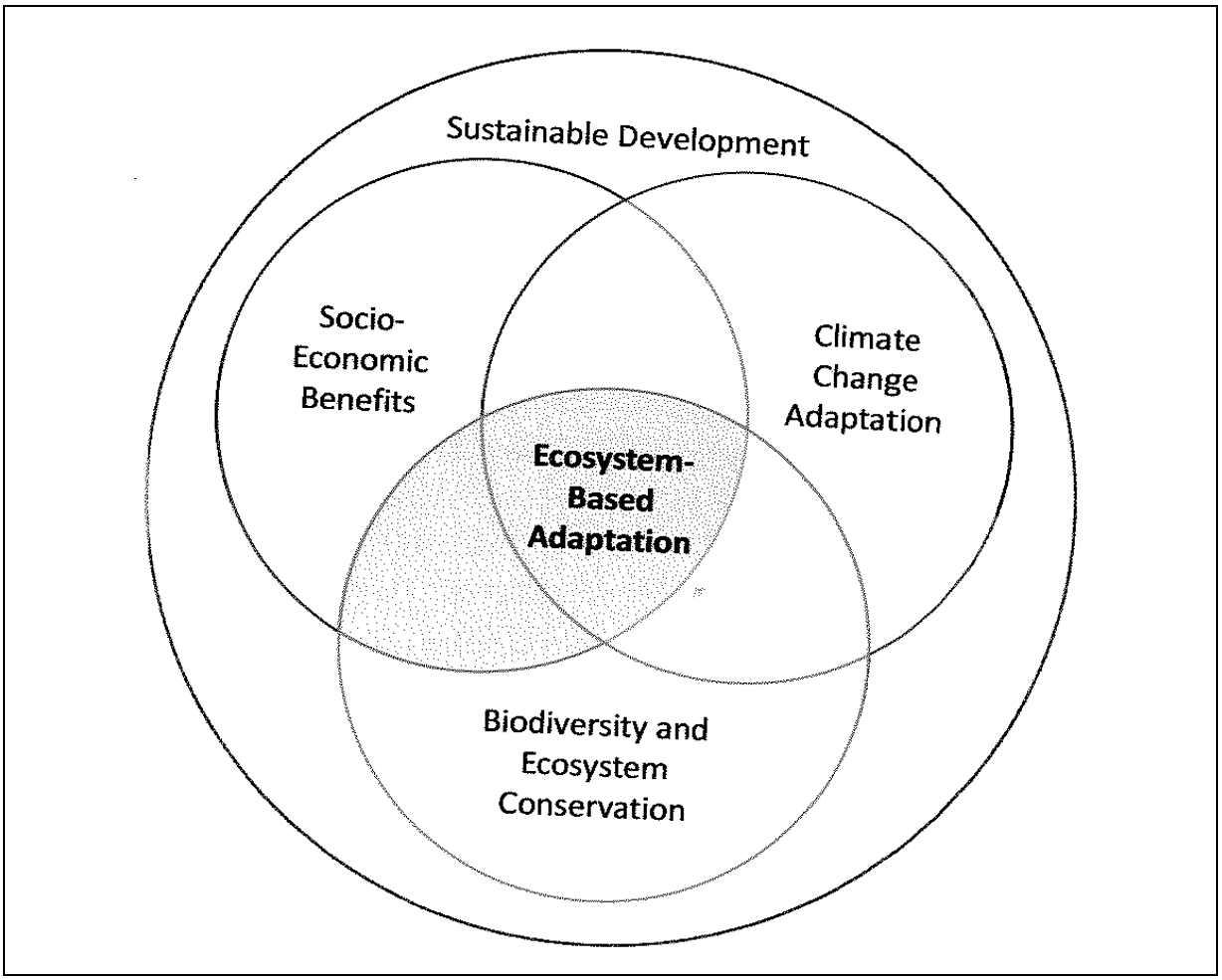


Figure 3.4: Concept of ecosystem-based adaptation
Adapted: Drivers *et al.* (2012: 117)

According to Perez *et al.* (2010: 14), "ecosystem-based adaptation is an approach that builds resilience and reduces the vulnerability of local communities to climate change." Figure 3.4 shows a representation of the concept of ecosystem-based adaptation. The three aspects (climate change adaptation, socio-economic benefits and, biodiversity and ecosystem conservation) depicted in Figure 3.4 can be prioritised to provide the most benefit to the target area or population (Drivers *et al.*, 2012). For instance, priorities in an urban environment would be to mitigate floods, through restricting ecosystem transformation in places such as estuaries, riparian corridors or coastal areas (IPCC, 2014). Prioritisation can be achieved through "landscape-scale analysis including mapping and analysis of features at the local scale" (Drivers *et al.*, 2012: 117). This is achieved through declaring Protected Areas, national reserves, and additional conservation zones, for instance through the D'MOSS in Durban. Thus, the GGEP is one of such areas earmarked for conservation using the D'MOSS to ensure ecosystems service supply and conservation of endangered species.

3.5.2.4 Nutrient loading, pollution and invasive alien species

Pollution and nutrient loading is yet another threat to ecosystems and biodiversity; it refers to the discharge of chemicals (liquid, solid or gas) into the atmosphere, on land or water (Secretariat of the CBD, 2010). For aquatic ecosystems, nutrient loading stands as the greatest threat to biodiversity and biogeochemical processes (Woodward *et al.,* 2012). SANBI (2013) asserts that the main contributors to pollution and nutrient loading are industries, sewage and agriculture activities through use of fossil fuels, nutrient-enrichers and pesticides. Most of these chemicals are detrimental to the environment and ecosystems directly or indirectly, for instance burning of fossil fuels releases greenhouse gases while nutrient-enrichers contain nitrogen which finds its way into areas where they were not intended to be (Secretariat of the CBD, 2010). According to United States Environmental Protection Agency (2007), nitrogen and phosphorus account for the two main pollutants, especially for aquatic ecosystems. Nutrients such as nitrogen in nutrient-poor habitats can induce rapid growth of some species at the expense of other not so responsive species which results in change in the composition of species (Secretariat of the CBD, 2010). Thus, nutrient loading can also induce or exacerbate proliferation of invasive alien species (Lambert *et al.,* 2014). Further, the Secretariat of the CBD (2010) states that surface run-off from agricultural land carries with it into water ecosystems agricultural chemicals and fertilizers which promote the growth of micro-organisms that compromise the quality of the water and thus the survival of species dependent on that water. Currently, nutrient loading has induced changes in species in some parts of the world such as the "grasslands across Europe and North America, and in southern China and parts of South and Southeast Asia" (Secretariat of the CBD, 2010: 59). Thus, nutrient loading is considered a driver of change in ecosystems as it can induce biodiversity loss and provide conditions conducive for alien species invasions (Secretariat of the CBD, 2010).

Pyˇsek and Richardson (2010) assert that alien invasions are a common phenomenon which affect majority of ecosystems. In addition, majority of food and other production are reliant on alien species (Pyˇsek and Richardson, 2010; SANBI, 2013; Simberloff *et al.,* 2013). However, the major concerns with alien species are the negative ramifications to the environment as well as human well-being especially when they are invasive (Pyˇsek and Richardson, 2010). An invasive alien species is defined as a species that "has been introduced into an area outside of its natural range, by intentional or unintentional human action, and once established in the new habitat, has spread in such a way that it threatens ecosystems, habitats or species with environmental or economic harm" (SANBI, 2013: 43). This implies that the species introduced must be successful in the new environment to the detriment of indigenous species.

Pyˇsek and Richardson (2010) assert that plants have been among the three major subjects of research over the years. Of all the floral invasive alien species, there are "751 species (434 trees and 317 shrubs) from 90 families" (Rejmanek and Richardson, 2013: 1093). Lambert *et al.* (2010) state that floral species are more successful in aquatic ecosystems among all invasive alien species. Freshwater ecosystems are the most vulnerable of all the ecosystems to invasive alien species which are mainly responsible for species loss (UNEP, 2012). In South Africa, all biomes have been invaded by alien species with the largest threat posed by terrestrial species which account for about 9 000 species (Irlich *et al.*, 2014: 1). As a result, more studies have been conducted on floral invasive alien species because they are a menace to the water supplies (SANBI, 2013). By 2010, floral invasive species had occupied about 20 million hectares of land (SANBI, 2013: 44).

As established previously, invasive alien species are introduced into ecosystems by different agents either intentionally or unintentionally. Regardless of the efforts and resources that have been invested to contain invasive alien species, the species remain a major socio-economic and ecological problem (Kriticos *et al.*, 2013). What makes the efforts to contain invasive alien species more difficult are the means by which they are introduced into ecosystems, for instance through natural phenomena such as cyclones with their associated water currents (AEO 2, 2006). An example of an invasive alien species introduced in this manner is demonia weed (*Parthenium hysterophorus*) which was introduced into Swaziland by a cyclone in 1984 and has ever since been invasive in agricultural land (AEO 2, 2006).

Introduction of invasive alien species is also facilitated by globalisation and humanitarian aid (UNEP, 2012). According to Hulme (2009), globalisation has played a major role in the introduction of invasive alien species, that is, the fact that people can travel all over the world easily means that transportation of alien species is also easy. In addition, globalisation has made trade possible and easier with countries around the world (Pierre, 2013). Through trade in various products, species have found their way into countries and habitats they had not inhabited before (Kriticos *et al.*, 2013). Humanitarian aid is also cited by the AEO 2 (2006) as another channel through which alien species are introduced and this is particularly true for third world countries and Africa which face many disasters such as droughts and famine. Some grains brought as food for people in need may find their way onto ecosystems either intentionally or accidentally and later become invasive once established (AEO 2, 2006).

Invasive alien species affect ecosystems ecologically and the impact can either be positive or negative (Schlaepfer *et al.*, 2011; Vila` *et al.*, 2011). Pyˇsek and Richardson (2010) assert that invasive alien species affect ecosystems by changing species composition of ecosystems and such change results in disruption of ecosystem services. Further, invasive alien species alter abundance, diversity and plant productivity of indigenous species (Vila` *et al.*, 2011; Pysˇek *et al.*, 2012). In addition, Schweiger *et*

al. (2010) state that invasive alien species interrupt processes such as pollination and dispersal while Vila` *et al.* (2011) assert that invasive alien species affect the functioning of ecosystems and transform habitats. Some invasive alien species affect biodiversity through toxins released into the ecosystem, predation and competition (Ficetola *et al.,* 2009). According to the AEO 2 (2006), the major concern with invasive alien species is that they increase vulnerability of communities, especially those directly dependent on the natural environment for their livelihoods. Thus, the destructive nature of invasive alien species can cause socio-economic problems such as food insecurity, land degradation (which affects agricultural activities) and threaten human settlement and health (AEO 2, 2006; Pyˇsek and Richardson, 2010). Of concern is that the impact of invasive alien species on ecosystem processes may only be visible after species have already been affected by the invasion (Vila` *et al.,* 2011).

In South Africa alone, invasive alien species pose a threat to biodiversity, increase biomass, challenge the ecological integrity of natural ecosystems, threaten water security and river flow, reduce the productive potential of land, degrade wetlands and estuaries, increase the intensity of fires and resulting erosion, and they affect trade relations (Preston and Williams, 2003; Chamier *et al.,* 2012). Management of invasive alien species should therefore focus on preventing invasions and controlling invasions in invaded areas (Ficetola *et al.,* 2009). This was first recommended by the CBD in 1992 prevention of invasion was seen to be the best way of managing invasive species. It is therefore important to adopt ecosystem management practices which can help in preventing new alien species invasions as well as manage existing invasive alien species.

3.5.3 Ecosystem restoration and rehabilitation

The earlier discussions on drivers of ecosystem change have highlighted that ecosystem degradation is increasing globally with increased demand for agricultural production and human settlement which over the years either have fragmented habitats or reduced productive capacity of land (Foundation for Ecological Security, 2008). In addition, climate change has also changed the conditions under which species thrive through temperature changes, extreme weather events exacerbating loss of species and further fragmentation of ecosystems (Walther *et al.,* 2009; Perrings, 2010; IPCC, 2014). This shows that climate change increases vulnerability of ecosystems to erosion, invasive species, pollution, species loss which in turn compromises ecosystem processes that maintain resilience to change (Drivers *et al.,* 2012). With increasing ecosystem fragmentation and degradation, more attention is increasingly paid to the practice of ecological restoration as championed by multilateral agreements such as the CBD (Benayas *et al.,* 2009). Thus, ecological restoration is viewed as an important aspect of climate change mitigation through enhancement of resilience of ecosystems (Benayas *et al.,* 2009; Vaughn *et al.,* 2010). In addition, within the context of global warming, ecological restoration forms

part of mitigation strategies that target at lowering atmospheric carbon through sequestration (Harris *et al.*, 2006).

The Society for Ecological Restoration International (2004: 3) defines ecological restoration as the "process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed." In addition, Dong *et al.* (2013: 64) states that ecological restoration is an "intentional activity that initiates or accelerates the recovery of an ecosystem with respect to its health, integrity and sustainability." It involves recovery of a disturbed ecosystem to what it was prior to the disturbance in terms of structure, function, processes, services and potential or to a different but ecologically functional state (Foundation for Ecological Security, 2008; Benayas *et al.*, 2009; Vaughn *et al.*, 2010). Thus, ecological restoration is "the process of assisting with the recovery of an ecosystem that has been degraded, damaged, or destroyed by re-establishing its structural characteristics, species composition and ecological processes" (Neal and Anderson, 2009: iv). Ecological restoration is achieved through restoration of species composition, ecosystem function, ecosystem stability and general landscape (Shackelford *et al.*, 2013). Noteworthy is that it is not always possible to restore some aspects (such as structure) of the ecosystems to original state (Foundation for Ecological Security, 2008). Consequently, ecological restoration can be achieved through restoration of ecosystem function by restoring "only certain attributes [of the ecosystem], rehabilitation or reclamation" (Foundation for Ecological Security, 2008: 6). Despite the assertion that restoration of structure and function is the most desirable; restoration of function is more favourable in terms of cost and time (Foundation for Ecological Security, 2008). Thus, initial efforts can be invested in restoring function with the aim that eventually the ecosystem through restored function will revert to the desired structure. According to Vaughn *et al.* (2010)

- The process of ecological restoration includes assessing the site, formulating project goals, removing sources of disturbance, restoring processes or disturbance cycles such as fire regimes, rehabilitating substrates such as soil and hydrology of the site, restoring vegetation through vegetation monitoring and maintenance.
- As a precursor to undertaking restoration projects, it is important to determine the state (structure and function) of the ecosystem necessitating restoration and usually historical structure and function become useful reference points. Thus, within the historical reference context, the actual time in history should provide the basis of ecosystem restoration in terms of desired structure and function of the ecosystem considering what is achievable in current climatic conditions.

Literature highlights that the kind of restoration activities a project adopts is dependent upon the objectives of the project (Benayas *et al.*, 2009; Vaughn *et al.*, 2010; Shackelford *et al.*, 2013). Thus, restoration activities may include revegetation, enhancement of an ecosystem (to suit particular

species), remediation (where one ecosystem is replaced with another) and mitigation (which is recovery of an endangered species or ecosystem) (Bakker and Scott, 2004; Benayas *et al.*, 2009; Vaughn *et al.*, 2010). In addition, Dong *et al.* (2012: 64) assert that the main environmental issues within a project site will also determine the restoration activities to be undertaken such as "erosion control, reforestation, re-introduction of …native species, removal of non-native species and weeds, re-vegetation of disturbed areas, daylighting streams, and habitat and range improvement for targeted species." Further, the Foundation for Ecological Security (2008) indicates that additional activities can include invasive pollution control, restoration of corridors, and fire management all designed to restore mineral cycle, water cycle, energy flow and succession.

Shackelford *et al.* (2013) assert that there are various objectives for undertaking restoration projects and the authors acknowledge the current need to develop restoration goals on ecosystem services and human well-being. Lambert *et al.* (2005) reiterate that rehabilitation of ecosystem strategies should endeavour to alleviate poverty in the communities in the proximity of the ecosystem or for communities whose livelihoods are dependent on the ecosystem. In addition, the Foundation for Ecological Security (2008) states that ecological restoration espouses the use of environmentally sustainable methods of restoring ecological processes within degraded ecosystems. Relevant to this study are the methods employed in eradicating environmental problems including invasive alien species, overexploitation of natural resources, soil erosion and pollution, and lack of fire management.

As established in this section on drivers of ecosystem change, ecosystem services degradation is caused by not only one but many forces some of which include climate change, biodiversity loss through overexploitation and land degradation. The implication of this is that all the forces underpinning ecosystem service degradation should be managed holistically to be able to revert ecosystem degradation (MEA, 2005; Quinn, 2012). According to the MEA (2005), the solution to solving these problems lies mainly in adjusting policies, institutions, governance, social behaviour factors, knowledge and practices.

3.6 Urban conservation

Urbanisation in developing countries has been increasing at a high rate primarily through in-migration of people from rural areas (UN-Habitat, 2006; Drakakis-Smith, 2012). Other factors contributing to rapid urbanisation stem from natural increase of *in situ* populations, the abolition of apartheid laws (in the case of South Africa) and the reclassification of rural areas as urban (Satterthwaite, 2007; Drakakis-Smith, 2012; Reed, 2013). According to Drakakis-Smith (2012), an increase in population pressure on natural resources in rural areas causes migration thereby contributing to urbanization.

Urbanisation however, exerts pressure on urban ecosystems and the services on which human well-being is dependent (Nagendra *et al.,* 2014). In addition, urban community practices such as gardening introduce alien species, which if invasive are responsible for loss of species (Celliers *et al.,* 2013). Rotenberg (2008) recommends preserving and maintaining green spaces in urban environments as a crucial aspect of fulfilling environmental quality goals and attaining a 'liveable' city - one that is environmentally, economically and socially sustainable.

Urban environments have been demonstrated to possess simple to complex ecosystems, for instance a study by Grobler *et al.* (2002) assessed the natural woodland vegetation and species richness of the urban open spaces in Gauteng province of South Africa. The findings reveal the presence of patches of undisturbed natural vegetation. Another study by McConnachie and Shackleton (2010) demonstrated the existence of significant biodiversity in nine small towns of South Africa. Besides this study, there are many more studies that provide evidence of rich biodiversity in urban settlements (Goodness and Anderson, 2013; Henry and Frascaria-Lacoste, 2012; Pauchard and Barbosa, 2013; McConnachie *et al.,* 2008). Researchers (Maller *et al.,* 2008; Verheij *et al.,* 2008; Roberts and O'Donoghue, 2013) in the field of conservation have stressed the importance of biodiversity in urban areas as being recreation, aesthetics, moral qualities and ecosystem services, among others. Despite this, human beings are generally disconnected from nature (Thomas, 2015).

Open spaces (areas occupied by natural or indigenous species) in urban areas play an important role in providing ecosystem services such as wind and noise filtering, microclimate stabilisation, mitigating the effect of climate change and storm water-flow, erosion control, habitat provision, water table enhancement, social and physiological relief from crowded, stressful urban lifestyles (Ward *et al.,* 2009: 49; O'Farrell *et al.,* 2012; Anderson *et al.,* 2014). Additionally, Kelly *et al.* (2005) and Natural England and Campaign to Protect Rural England-CPRE (2010) assert that open spaces are usually endowed with recreational facilities such as trails for nature walks, bird watching, fishing, canoeing, horse riding and biking; grasslands for picnics and relaxation. Open spaces also provide resources for educational purposes such as research, and learning about nature for children (O'Farrell *et al.,* 2012). Furthermore, open spaces in urban environments also provide many socio-economic needs and limits structural development like the London green belt which was developed to limit urban sprawl (Natural England and CPRE, 2010; Ernstson, 2013). Lastly, open spaces sustaining well-functioning ecosystems provide the urban environment with ecosystem goods and services such as air purification, local climate regulation, regulation of floods and diseases, among others (Thompson, 2011; Roberts and O'Donoghue, 2013; Pillay and Pahlad, 2014). Urban ecosystem dissipates to some extent, the effects of development such as ecosystem degradation which result from the pressures from developmental needs (Thompson, 2011). Economic benefits of open spaces cannot be understated: open spaces have a positive impact on surrounding development depending on how far it

lies from the open space (Conway *et al.,* 2010). Nevertheless, open spaces can also have negative externalities as asserted by Kelly *et al* (2005). The negative externalities associated with open spaces are discussed in the proceeding section.

3.6.1 Open spaces

The designing of landscapes can be traced from the medieval Greece and Roman empires and is linked to the English grand designs (Thompson, 2011). Crompton (2007) asserts that open spaces in urban areas have been in existence as early as the 1700s in the United Kingdom (UK) emanating from a long-standing English tradition to maintain parks for wild animals. Besides tradition, the royal family and wealthy people who occasionally permitted the public to use of open spaces developed some open spaces (Crompton, 2007). Some parks were developed in response to the unconducive living conditions during the industrial revolution (Ignatieva *et al.,* 2011; Thompson, 2011). Further, wealthy people in London also developed projects where esteemed properties were constructed around open spaces with a hope that the value of such properties would increase (Crompton, 2007). This became a novel model for development in industrial cities and led to the development of larger open spaces such as the Regent and Prince's park.

In the USA, the idea of parks can be traced as far back as the 1600s but it was only in the 1800s that an open space was developed inspired by European open spaces (Thompson, 2011). Table 3.5 provides more details on the progressive development of open spaces.

Table 3.5: Development of open spaces (Source: Crompton, 2007: 2-4)

Period	Development
1850s	The proximate principle was spread to the USA where government officials took a step to engage in developing public open spaces believing that the developments were able to cover their own costs.
1873	The belief that open space development could cover their own cost of development was reinforced by a publication that provided evidence that open spaces had positive impact on adjacent properties (called the proximate principle). The evidence emanated from the experience from New York's Central Park. After the completion of Central Park in New York, USA, it was observed that the value of properties proximate to Central Park increased while the City of New York made profits from running the park.
1900s	There was conclusive evidence that well maintained parks and open spaces benefit adjacent properties. Despite such evidence, people remained cynical about the development of open spaces as they viewed the development to benefit the wealthy class only while the poorer working class had to meet the costs of maintenance. Such cynicisms characterised the open spaces in the UK especially that initially the open spaces were meant to service the wealthy class only.
1930s	The legitimacy of the proximate principle was questioned on the basis that the computational methods were simplistic at the time the principle was developed.
1970s	The proximate principle's validity was redeemed by using computational methods, which met the acceptable standards of social science research. In addition, new evidence of the proximate principle emerged which qualified the application of the principle to properties. According to the new evidence, the principle could only be applied to properties lying within 152.4 to 182.9 metres from the edge of the open space. Further, the type of open space determines how the impact varies with distance from the open space, that is, natural open spaces have more impact on property value than would a park that has a lot of recreational activities. In addition, a property positioned relative to the best view into the park will have more benefits than would another without the same view. It must be noted, however, that the proximate principle does not account for all the benefits of maintaining an open space.

One of the significant developments of the 20th century is the Garden City Movement in the UK and Russia, City Beautiful or Parkway movement in the USA and New Zealand (Ignatieva *et al.*, 2011). The Garden City movement was a "town-planning idea that sought to marry the best of town and country in new urban development" (Grant, 2014: 2394). As a result of the Garden City movement, urban areas became connected to rural areas and natural landscapes through the development of greenbelts (Ignatieva *et al.*, 2011).

Distribution of natural resources and their uses along socio-economic gradients in South Africa have mainly been influenced by the segregative apartheid laws in South Africa (Lube *et al.*, 2010). Studies have shown that distribution of open spaces and biodiversity still vary along cultural and socio-economic gradients (McConnachie *et al.*, 2008; Cilliers, 2010; Lube *et al.*, 2010; Nemudzudzanyi *et al*., 2010). Nevertheless, literature highlights the growing awareness and need for incorporating open spaces in urban planning. One such study was conducted in Durban by Pillay and Pahlad (2014) which highlights gender differences in the use of open space in residential areas. Another study is that

of Roberts *et al.* (2005) which highlights the link between ecosystem services and biodiversity conservation as espoused by the D'MOSS. In addition, a study was conducted in 10 small towns of the sub-topical thicket biome to compare availability of open spaces in high density and low-density suburbs. The study revealed that high-density poor suburbs have fewer public open spaces when compared to low density suburbs (McConnachie *et al.,* 2008; McConnachie and Shackleton, 2010). The study also compared the availability of open spaces in old suburbs (constructed more than 50 years ago) and the more recent Reconstruction and Development Programme (RDP) suburbs (constructed less than 15 years ago). The results revealed that the more recent RDP suburbs have even fewer open spaces than the older suburbs. This is despite the fact that it is becoming common knowledge that open spaces provide many beneficial services (McConnachie and Shackleton, 2010). Further, O'Farrell *et al.* (2012) explored the relationship between ecosystem services and biodiversity conservation in the Cape Town Municipal area. The study found that both regulatory and provisioning ecosystem services were severely affected by ecosystem transformation.

Several studies have been conducted mainly in the developed countries, which highlight a number of issues such as impacts of open spaces on adjacent property value, funding for open space developments and externalities of open space development. Empirical evidence suggests that well managed ecosystems can have a positive effect on the value of adjacent properties or developments (Kaufman and Cloutier, 2006; Sander and Polasky, 2009; Conway *et al.,* 2010). Such studies have been designed and conducted as an attempt at quantifying the benefits of conserving open spaces most of which had positive results. One such study is that conducted in England by Gibbons *et al.* (2014) which demonstrates a positive impact of open spaces such as green spaces, gardens and water bodies on adjacent property value. The study also shows that the impact reduces with increasing distance from the open space. Another study conducted in China shows a positive impact of open spaces on adjacent property value (Kong *et al.,* 2007). A similar study conducted by Sander and Polasky (2009) revealed that the value of residential properties increased with reduced proximity to the open space. Using empirical evidence which demonstrates positive impact of open spaces on adjacent properties, decision-makers undertake open space developments with the view that in the long run the cost of development will be offset (De Brun, 2007).

Many more studies have been conducted in and outside the USA to determine the impact of open spaces on property values most of which registered a positive impact on property values (Kelly *et al.,* 2005; Kong *et al.,* 2007; Gibbons *et al.,* 2014). However, some studies suggest that open spaces are associated with negative externalities (such as noise, vandalism, thefts and burglary, ambiguous landscapes and heavy traffic) all which cause a negative net impact on the value of proximate properties (Kelly *et al.,* 2005; Jorgensen *et al.,* 2007; Sander and Polasky, 2009; Jim and Chen, 2010). Besides negative externalities, the state of the open space can impact negatively on the proximate

property value. For instance, after the completion of the Regent's Park of London, it was noted that the cost of developing the park far exceeded the projected revenue (Crompton, 2007). However, over time, the value of the surrounding development increased significantly (Crompton, 2007). An explanation offered by the developers was that initially, the open space would have a negative or no impact on surrounding property value but eventually as the park became more beautiful it would impact positively (Crompton, 2007).

A review of literature has highlighted a lack of focus on ecological and socio-economic aspects of open spaces which are important especially in the African context (Lube *et al*., 2010). This is because most of the poor people in African communities rely on the natural environment for their livelihood and thus, their dependence may be, in some instances, in conflict with conservation efforts (Bob *et al*., 2014). Reliance on the natural environment and contestations that result from access and use of resources is an important aspect which this study aims to investigate among the GGEP stakeholders.

3.6.2 Management systems of open spaces

As demonstrated by studies conducted in South Africa and other parts of the world (Henry and Frascaria-Lacoste, 2012; Goodness and Anderson, 2013; Pauchard and Barbosa, 2013), urban areas contain biodiverse ecosystems, which warrant management considering the functions they play and if they are to continue providing services. The Johannesburg Metropolitan Open Space System (JMOSS) (2002: 6) defines open spaces as "any undeveloped vegetated land within and beyond the urban edge, belonging to any of the following six open space categories: ecological, social, institutional, heritage, agricultural and prospective (degraded land)."

- Ecological open spaces include natural areas rich in biodiversity and under conservation and, recreational areas such as parks, botanical gardens, water bodies, nature reserves among others.

- Agriculture open spaces refer to agriculture land;

- Institutional open spaces include public service facilities, health facilities and airports or airfields, among others;

- Heritage open spaces include national monuments, cemeteries and cultural sites, among others;

- Social open spaces include community centres, recreational areas and places of worship, among others; and,

- Prospective open spaces include mining areas and quarries, landfills and slime dumps, among others.

  (JMOSS, 2002: 6)

However, the D'MOSS categorises open spaces into two, that is, urban and natural open spaces. According to the Durban Metropolitan Council (1999: 66),

- Urban open spaces are the human made or legally designated places and areas within the Durban Metropolitan Area that are developed for community use. They include parks, sports fields, agricultural fields, streets, town squares, road reserves, servitudes for services such as electricity transmission line, dams and private gardens, among others; and,

- Natural open spaces are the remaining undisturbed natural and undeveloped areas within the Durban Metropolitan Area. They are the areas that contain the core terrestrial, freshwater, estuarine and marine ecosystems. These ecosystems include land cover types such as grasslands, forests, beaches, estuaries, rivers and wetlands, among others.

This study focuses on natural open spaces as defined by the D'MOSS. Important to note is that open spaces range from private to semi-public and public open spaces (Council for Scientific and Industrial Research, 2000). Within the management criteria of MOSS the categories private, semi-public, and public open spaces fall under either Protected Areas or non-Protected Areas (EPCPD, 2010b). The municipality or state entity (such as Ezemvelo Wildlife in KwaZulu-Natal) manages open spaces falling under Protected Areas (EPCPD, 2010b). Open spaces declared as nature reserves fall under state management, while the municipality manages those declared municipal nature reserves (EPCPD, 2010b). Management of such open spaces is on a full-time basis.

According to the eThekwini Municipality (2010) semi-public and public open spaces fall under non-Protected Areas and are managed on a full-time or part-time basis. Within the category non-Protected Areas are open spaces managed under formalised infrastructure on a full-time basis while those that are not under formalised infrastructure are managed on a part-time basis (EPCPD, 2010b). Open spaces managed on a full-time basis include municipal nature reserves (owned by the municipality), private nature reserves (owned by private entities), and municipal/private managed or SRAs (co-owned and managed by the municipality and private entities) (eThekwini Municipality, 2010; EPCPD, 2010b). On the other hand, open spaces managed on a part-time basis include:

- municipal managed (owned and managed by municipality);

- state managed (state owned but managed by NGOs or a state entity besides Ezemvelo Wildlife);
- private managed (owned and managed by private entity through a management contract);
- environmental conservation reserve (earmarked for conservation and managed by municipality); and
- Conservation zone (earmarked for conservation and privately owned and managed).

(EPCPD, 2010b; eThekwini Municipality, 2010)

Within the eThekwini Municipality, over 80% of open spaces remain unmanaged or un-zoned with only 12% of the D'MOSS under some form of management (eThekwini Municipality, 2010). This is a cause for concern, especially considering how extensive the threats to biodiversity are, not only in Durban but also globally. It is for this reason that initiatives such as the GGEP are necessary and important to conserve areas that fall outside Protected Areas but contain species and heritage sites of importance.

3.6.3 Management challenges in open spaces

According to Mammon (2005) and Shackleton *et al.* (2014), the post-apartheid South African government developed legislation to address the apartheid ills through legislation such as the Urban Development Framework, Growth Employment and Reconstruction programme and RDP. In as much as these pieces of legislation are meant to improve the lives of previously disadvantaged groups, implementation of the legislation raise environmental concerns. The need for government to provide housing for the ever-increasing number of people exerts pressure on the remaining open spaces to be converted into settlements (Mammon, 2005). For instance;

> *The Driftsands Nature Reserve, one of the few potential urban parks in Cape Town with high ecological and environmental asset value, is presently under threat of being developed for mass low-income housing despite attempts by the authorities to illicit a professional opinion on what portions of this Reserve can be developed without compromising its integrity.*
> (Mammon 2005: 9)

Given the urban landscape of South Africa, poverty and unemployment persist, exacerbated by high population growth to which Government is constantly under pressure to provide jobs through engagement in various project and investment opportunities (Marais, 2011; Roberts and O'Donoghue, 2013). In response to the challenges the people of South Africa face, there is increased emphasis for poverty alleviation and reducing unemployment and this is operationalised through Integrated

Development Plans at national, provincial and local levels (eThekwini Municipality, 2002; Roberts and O'Donoghue, 2013). Consequently, Natural England and CPRE (2010) assert that open spaces become target areas for expansion and development. This is not just a scenario unique to South Africa but is a global trend where city officials are in constant pressure to justify development of open spaces over business investment opportunities. A good example is that of England's green belt which despite having been established over six decades ago faces many challenges, one of which is population growth and the need for land to develop (Natural England and CPRE, 2010).

UNEP (2012) identifies funding as yet another challenge nations face with respect to implementing national conservation goals. Thus, obtaining new funding ventures, establishing and sustaining conservation efforts on open space and ensuring effective service delivery become challenges due to inadequate funding (Sheffield City Council, 2014). South Africa also faces challenges in funding conservation projects and as such funding models have been developed such as the use of the SRA in the GGEP project (Roberts *et al.*, 2012).

3.6.3.1 International funding models for open spaces

Crompton (2007) highlights four funding models, the earliest being used during the 18th century in the UK where open space development relied on private wealthy individuals and royal families to provide funds and resources. The second funding model was that of Prince's Park in London where properties adjacent to the park were charged an annual ground rent, which the Trust then used to maintain the park. Thirdly, some parks were funded by the local authorities, an example of which includes the Newsham, Stanley and Sefton Parks, which were developed by the Liverpool city council. Lastly, both in the UK and the USA, central government funded some parks, examples of which include Birkenhead and Central Park, respectively (Crompton, 2007). Dempsey and Burton (2012) reiterate that development of public open spaces is funded through public funds allocation by local government and public sector-led specific projects and initiatives. This model has been used to develop parks, for instance a municipality in Jefferson County of Wisconsin, USA passed legislation for establishing open spaces (Kelly *et al.*, 2005).

South Africa follows a similar funding model with local government providing all the funds for public open space development or part of the funds in developing private-public open spaces (eThekwini Municipality, 2010; Roberts *et al.*, 2012). In addition, Miraftab (2007: 604) asserts that as a result of insufficient financial resources, "local governments are encouraged to be entrepreneurial and improve local revenues by private sector participation and using market-based strategies." In addition, city or local government enter partnerships with private entities to manage open spaces and in such cases, both parties are responsible for funding the open space (eThekwini Municipality, 2010). A unique

model of funding is that used by the GGEP project, which is funded by individual property owners through additional rates levied on their properties (eThekwini Municipality, 2010; Roberts *et al.*, 2012). This is done under the provisions of the Municipal Property Rates Act of 2004 using the SRA instrument.

3.6.4 Perceptions on open spaces

As established earlier living adjacent to open spaces can be beneficial while at the same time detrimental due to the externalities associated with open spaces. Generally, open spaces are desirable amenities in the urban environment which not only provide recreation but also health and/ or psychological benefits (Active Living Research, 2010; Ward *et al.*, 2010; Irvine *et al*., 2013). Regardless of the externalities, people decide whether they want to use open spaces and whether they reside adjacent to or near an open space. Therefore, people's perceptions on open spaces are important to researchers, developers and planners because they define the value attached to open spaces (Ward *et al.*, 2010). This was echoed by Shivanand and Dragicevic (2005: 147) who state that "evidence from research in environmental psychology and landscape studies demonstrates that people's perceptions and attitudes are influential in land-use patterns and transformations."

Perceptions can be useful in determining the kind, size, and location of open spaces, as revealed in a study conducted by Eleishe (2000). The study reveals that the City of Al Ain residents aged between 20 and 40 years preferred open spaces offering many recreational activities to those that did not. Such open spaces provide families with many activities to engage in ranging from sporting, resting to walking (Eleishe, 2000). A study conducted by Ward *et al.* (2010: 54) shows that open space users preferred open space attributes such as "the diversity of natural scenes, functions, activities, flora and fauna, safety, accessibility and the overall aesthetic quality of urban green space." In addition, a study by Pillay and Pahlad (2014) reveals differences in the way open spaces are perceived and valued among the genders. The study shows that more males used open spaces within the proximity of their residences while fewer females did. The study further revealed that females were more aware of externalities such as quality and safety of the open space.

Perceptions on safety of open spaces seem to be a determinant on the use of open spaces as demonstrated by Pillay and Pahlad (2014). More studies show that negative externalities associated with open spaces are perceived negatively especially by people living adjacent to open spaces (Chiesura, 2004; Lemanski, 2004; Jorgensen *et al.*, 2007). If an open space is associated with negative externalities it becomes less desirable to use or to buy adjacent properties. Further, evidence suggests that value attached to open spaces can vary among people of different age groups owing to different activities engaged in on those open spaces (Chiesura, 2004). Among South African youth, perceptions

about open spaces can be influenced by socio-economic factors with perceptions varying depending on whether the youth were unemployed or students (Ward *et al.,* 2010). Lastly, for children, living adjacent to open spaces is associated with low levels of child obesity due to recreational and sports activities done in the open spaces (Active Living Research, 2010).

Such information on perceptions can be critical in developing open spaces, especially when incorporated into the planning process at an early stage (Ward *et al.,* 2010; Pillay and Pahlad, 2014). However, Shackleton *et al*. (2014: 501) reiterate that currently, there is disproportionate distribution of open spaces in urban areas despite that South Africa has "modern and sound national environmental policies and frameworks" for developing open spaces. This study examines the perceptions of GGEP property owners on the GGEP project.

3.6.5 Land-use conflicts

During the pre-industrial period, when urbanisation and consumption rates were still low, ecosystems were managed as common pool resources with very little intervention from governments (MEA, 2005). However, the Food and Agriculture Organisation (2008) asserts that since the industrial revolution there has been rising demand for land, minerals, and fossil fuels to meet the needs for settlement, food, clothing and energy, among others. Consequently, most of the ecosystems were transferred to private property thereby alienating communities previously dependent on the ecosystems without resources to use (MEA, 2005). The MEA (2005) and Peltonen and Sairinen (2010) assert that ecosystem change, which may result in ecosystem degradation, induced by one or more drivers of change profits one group over another. In most cases, the groups of people negatively affected by ecosystem change include children, women and, indigenous and poor communities (MEA, 2005). These groups lack the capacity to adapt to ecosystem changes due to lack of economic resources to find alternatives to the disturbed livelihoods (MEA, 2005).

For most Africans the natural environment is a source of livelihood and thus, availability of natural resources and sustainability is critical to their survival (Kok *et al.,* 2009). Power struggles over access and control of natural resources emanate from increasing demand for natural resources caused by growing global populations, ecosystem degradation and overexploitation (Díaz *et al.,* 2006). However, power struggles can exclude the 'weak' in society from accessing resources and have the potential of causing conflict (Díaz *et al.,* 2006; Kok *et al.,* 2009). The weak in society are the vulnerable and according to Bob *et al.* (2014), Africans make up the most of the vulnerable globally as a result of reliance on climate affected resources. Vulnerability is an underlying factor to natural resource conflicts and is caused by growing population, climate change with its associated impacts and scarcity of resources (Ahmed, 2010; Bob and Brankhorst, 2010).

Climate change is seen as exacerbating the socio-economic and political factors that cause conflict in communities (Bob *et al.,* 2014). Usually, conflict emanates from a clash of interest and value over use of natural resources among interest groups, whose actions affect the ability of other groups to use the resources (Castro and Nielson, 2003; Yasmi *et al.,* 2006; Bob and Brankhorst, 2010: 14). As such, climate and the environment have become important aspects for understanding the causes and possible solutions to conflict (Bob *et al.,* 2014; Kok *et al.,* 2009). However, researchers have shown that conflict can be caused by other factors such as ethnic rivalry (Buhaung, 2010; Sunga, 2011). Bob and Brankhorst (2010) highlight some of the types of conflicts to include, among others;

- Biodiversity conflicts which include natural resource management, biodiversity and conservation, rights over the use of biodiversity such as patents;
- Conflicts disproportionately affecting women, that is, conflicts that affect women more than males due to their vulnerability in society;
- Conflicts about air quality and noxious pollutants which relates to conflicts emanating from infringement of people's rights to live in a healthy environment;
- Land conflicts which arise from land-use contestations, scarcity of land and presence of key resources on land;
- Water conflicts which considers conflicts which may arise with the eminent shortages of water predicted to result from climate change; and,
- Climate change and environmental conflicts which considers conflicts emanating from the impact of climate change in relation to the socio-economic inequalities that may rise or are arising;

Land-use conflicts are particularly important because land harbours resources and conflicts over a given parcel of land can arise from conflicting use of resources such as biodiversity or the land itself (Kok *et al.,* 2009). This is reiterated by the DEAT (2005: 23):

> *Many important biodiversity areas overlap with areas of high population density, high agricultural potential, mineral deposits and scenic beauty important for tourism. This can lead to conflicts regarding decisions over land-use allocations and underscores the need for extensive consultation regarding land-use changes, and the need to set aside areas considered irreplaceable for biodiversity conservation and important for ecosystem services*.

Further, Vejre (2008) asserts that urban areas are characterised by various extensive land-use which transform urban ecosystems into semi-permanent constructed structures at the core, and limit growth within the urban bounds. Consequently, peri-urban areas become areas of resort for expansion of urban areas and for other activities such as conservation, agriculture and garbage dumping (Vejre, 2008; Arha *et al.,* 2014). The many demands placed on peri-urban areas and the global trends of urbanisation are realities that make peri-urban areas critical for environmental conservation and development (Ahra *et al.,* 2014). The many purposes peri-urban areas serve and general scarcity of land in urban areas become underlying factors for land-use conflicts in urban areas (Vejre, 2008; Kok *et al.*, 2009). Land scarcity can be contextualised in three ways: firstly, land becomes scarce because of demands for the resource. That is, the number of competing land-uses can exert a strain on land available to meet land-use needs which render land scarce (Percival and Homer-Dixon, 1998). In addition, Percival and Homer-Dixon (1998: 5) states that "population growth within a region or increased per capita consumption" can escalate demand for land resources. Secondly, land scarcity can result from unequal distribution among various economic or racial groups (Percival and Homer-Dixon, 1998). This situation in South Africa, as indicated earlier, was induced by colonial and apartheid laws that mainly restricted land ownership in urban areas to the white dominant class (at the time) (Gordon *et al.,* 2007). Despite the efforts by the post-apartheid government to redistribute land, Gordon *et al.* (2007) state that inequalities persist and a new form of capitalistic induced scarcity has emerged. Lastly, environmental problems that reduce the ability of a given piece of land to function optimally reduce the amount of productive land available for the various competing land-uses and can cause conflict (Percival and Homer-Dixon, 1998; Kok *et al.,* 2009). Such environmental problems include overexploitation, degradation, desertification, invasion by alien species and climate change (Kok *et al.,* 2009). As the laws of economics dictate that 'when supply is low, demand is high', this further induces scarcity (Franco, 2014). The three contexts of scarcity can act together in two forms: resource capture and ecological marginalisation.

> *Resource capture occurs when increased consumption of a resource combines with its degradation: powerful groups within society - anticipating future shortages - shift resource distribution in their favour, subjecting the remaining population to scarcity. Ecological marginalisation occurs when increased consumption of a resource combines with structural inequalities in distribution: denied access to enough of the resource, weaker groups migrate to ecologically fragile regions that subsequently become degraded.*
> (Percival and Homer-Dixon, 1998: 5)

Given the complexities associated with urban land-use and scarcity, Vejre (2008) states that urban areas require highly formalised and efficient land-use planning systems. Formalisation of land-use planning and management means that urban land-use is subject to various decision-making processes

and, as such, conflicts arising from discordant uses can be political (Von der Dunk *et al.,* 2011; Koubi *et al.,* 2013).

According to Gordon *et al.* (2007) land-use conflicts in urban areas are exacerbated by widespread poverty and lack of employment opportunities for most of the poor inhabitants of peri-urban areas. Because they have no resources to acquire their own land, these inhabitants invade private or restricted areas (land earmarked for other uses) mainly for settlement or earning a livelihood from the natural environment (DEAT, 2006; Gordon *et al.,* 2007). Thus land use conflicts are instigated by competing uses of resources in the peri-urban areas (Darly and Torre, 2013). On the other hand, land-use conflicts among stakeholders arise when there are negative externalities associated with the proposed land-use (Von der Dunk *et al.,* 2011). A study by Von der Dunk *et al.* (2011: 149) identified the types of land-use negative externalities which are usually the cause of conflict to include "noise pollution, visual blight, health hazard, nature conservation, preservation of the past, and changes to the neighbourhood." These externalities are interlinked through a 'causal-effect' relationship: one externality can lead to another; for example, nature conservation can lead to health related issues (Von der Dunk *et al.,* 2011).

Generally, conflicts reveal dysfunction of the socio-political and economic structures in society (Darly and Torre, 2013). Within the state of dysfunction, the actual issue causing disagreement but maybe hidden in secondary issues and this calls for careful examination of the issues causing conflict and further investigation of whether there are other underlying issues causing conflict (Von der Dunk *et al.,* 2011). For instance, stakeholders can complain of crime as a negative externality of developing a park when in actual sense they are contesting changes to the neighbourhood. Part of this study assesses contestations and possible conflicts arising in the GGEP project and the relationships existing between the GGEP management and property owners and, the GGEP management and the Tshelimnyama community.

Further, conflicts at a global, regional or local scale affect ecosystem health and degraded ecosystems cannot support development (AEO 2, 2006). In addition, Perry *et al.* (2010) assert that conflicts can cause degradation of the environment ultimately affecting the livelihoods of people dependent on the environment. At a global and regional scale conflicts take the form of political civil unrests and wars while at a local scale conflicts arise due to disputes arising from unequal distribution of resources (Bob *et al.,* 2014). Individuals, groups, or leaders dispute over control of resources while the underprivileged in society fight for their right to equality in accessing resources (Bob and Bronkhorst, 2010). Although widely perceived to be destructive and/ or a state to be avoided, conflict expressed non-violently is universal, and without conflict, societies would stagnate (Pillay, 2009; White *et al.,* 2009). Management of conflict therefore becomes necessary and important in reducing the negative

effects of conflict (White *et al.*, 2009). According to the AEO 2 (2006), conflict can be overcome by harnessing equity in natural resource allocation, social justice, involvement of society in policy development and promoting peace through tolerance of differences among people in society.

3.7 Conclusion

There are many issues to consider when undertaking ecosystem management. This chapter highlighted a lot of issues some of which pertain to the benefits of managing ecosystems. The importance of ecosystems set the foundation upon which other discussions ensue and this chapter established that overall, ecosystems are important for human well-being through provision of services. Ecosystem services are however disrupted through degradation of ecosystems caused by overexploitation, invasion by alien species, climate change, pollution and medicinal plant harvesting, among others. In order to manage and rehabilitate ecosystems, it is important to consider factors affecting ecosystem health holistically to ensure efficiency in management.

CHAPTER FOUR

STUDY AREA AND METHODOLOGY

4.1 Introduction

This chapter provides the context in which the study was conducted as well as the methodological approach adopted. The chapter begins by examining the study area highlighting the geographical location, the general features of the landscape and vegetation types, and the challenges faced by the entire open space. It also provides insight into the underlying socio-economic conditions in which this study was conducted. Secondly, the chapter outlines the methodology adopted for this study by highlighting the mixed method approach used, sample composition, and research instruments adopted. The methodology also highlights data analysis methods used in this study as well as the limitations of the study.

4.2 Background to the case study

Conservation efforts in the Giba Gorge can be traced as far back as the 1980s when the dream of some members of the Wildlife Society was realised (Keir, 1984). The dream was to create a greenbelt running from Maloti north of Durban, to Amanzimtoti in the south of Durban and Botha's Hill to the west (Davis, 1989). The aim was to conserve the green spaces of Durban, conscientise people about the importance of nature conservation while providing recreation through the trails created linking nature reserves. The first of such trails to be established was the Ingweni (which means place of the leopards, a name which emanated from the leopards that were usually seen in the area) which was developed through the efforts of community members, high school students and the Lion's Club (Davis, 1989). The Ingweni trail, fashioned in a shape of a horseshoe, runs around the Kloof, Gillits and Giba Gorge area linking major nature reserves (The Ingweni Trail, undated). It was a three-day experience of nature ranging from animals, plants, and water (lake, river and falls) (Van den Horst, 1993).

The trail system was a joint project in the D'MOSS run by the Wildlife Society and the Natal Town and Regional Planning Commission (Davis, 1989). The first Metropolitan Open Space (MOSS) plan mapped out in 1980 outlined the possible conservation areas in the Greater Durban Metropolitan area. By 1983, the MOSS plan was endorsed and launched by the Regional Planning Commission of Natal Town (Davis,

1989) and was later heralded as ‘one of the most impressive’ in the world (Daily News, 1989). The goal of MOSS was “to establish and maintain the most efficient open space trail system which [would] link established and potential conservation areas within Metropolitan Durban” (Natal and KwaZulu, undated: 200). Roberts and Diederichs (2002) states that the focus was mainly to develop a management plan for protecting biodiversity after realising the important role ecosystem goods and services played in the lives of municipal residents.

Since the launch of the MOSS plan in 1983, MOSS has grown from non-existence to an area of about 74 711 hectares by 2010 (EPCPD, 2010b: 9). This area encompasses a variety of habitats including forest, estuary, freshwater wetland, grassland, woodland, thicket, marine, rocky and field crops, artificial water bodies, recreational, settlement and tree crops (EPCPD, 2010b). Most of the area in the D’MOSS is important because of the various goods and services provided by the ecosystems (eThekwini Municipality, 2010). Some of the services include climate regulation, cultural and recreational opportunities, soil formation, erosion control, water supply and regulation, pollination, nutrient cycling and waste treatment (eThekwini Municipality, 2010). In addition, the D’MOSS plays an important role in reducing greenhouse gases, which contribute to climate change (eThekwini Municipality, 2010). The total value of all the services provided by the D’MOSS was valued in 2003 at R3.1 billion per year (eThekwini Municipality, 2010: 4).

4.3 Study area

The GGEP is managed by the eThekwini Municipality with the property owners of the GGEP. From amongst the property owners, a management committee is elected which oversees the day-to-day running of the GGEP activities. The eThekwini Municipality, the committee and the GGEP manager make up the GGEP management. Thus, together with the eThekwini Municipality personnel, the GGEP management plans activities to be done in the precinct, manage finances and implement the management plan. The management activities are based on the management objectives set out in the GGEP Management Plan and are highlighted as follows:

- To restore the ecologically degraded areas of the GGEP to a functional and indigenous state that benefits biodiversity in the area.
- To manage the natural habitats of the GGEP according to up-to-date conservation management best practice principles.

- To provide facilities, infrastructure and well trained personnel that accommodate a safe and meaningful experience to the visitors of the GGEP.
- To build a good relationship with all landowners within the GGEP through regular and effective communication.
- To identify negative impacts (e.g. pollution) to the aquatic environments of the GGEP, and to put measures in place to rectify these problems.
- To promote the involvement of educational institutions in the use of the GGEP for environmental education purposes

This study was designed around the natural resources of the GGEP open space. The ecosystem goods and services provided by the GGEP open space are experienced by not only the people living in the GGEP but even by those far away but near enough to be impacted by the health of the resource. However, the GGEP open space faces many challenges and threats to ecosystem health some of which if not addressed immediately will lead to extinction of indigenous species (GGEP, undated). The major challenge in the GGEP open space is to restore and maintain the open space ecosystem as indigenous ecosystems amid major contestations. The property owners' interest is to conserve the GGEP open space for its potential in recreation, research and ecosystem services such air purification services, among others (GGEP, undated). On the other hand, the local communities have interest in the GGEP open space resources mainly for economic purposes through trade and use of medicinal plants and animal extracts.

4.3.1 Location

The GGEP is located in Durban which lies in the KwaZulu-Natal province of South Africa. It is located in the Hillcrest area of Durban, about 30 kilometers from the Durban central business district. It falls within the eThekwini Municipality and the GGEP open space (Giba Gorge) is classified as a Metropolitan open space under the D'MOSS (GGEP, 2011). The total land area is approximately 354.1 hectares of which, 227.6 hectares is under conservation (GGEP, 2011: 8). Within the open space are various ecosystems including scarp forest, grasslands, rivers and wetlands, and cliffs. The location of the GGEP is shown in Figure 4.1.

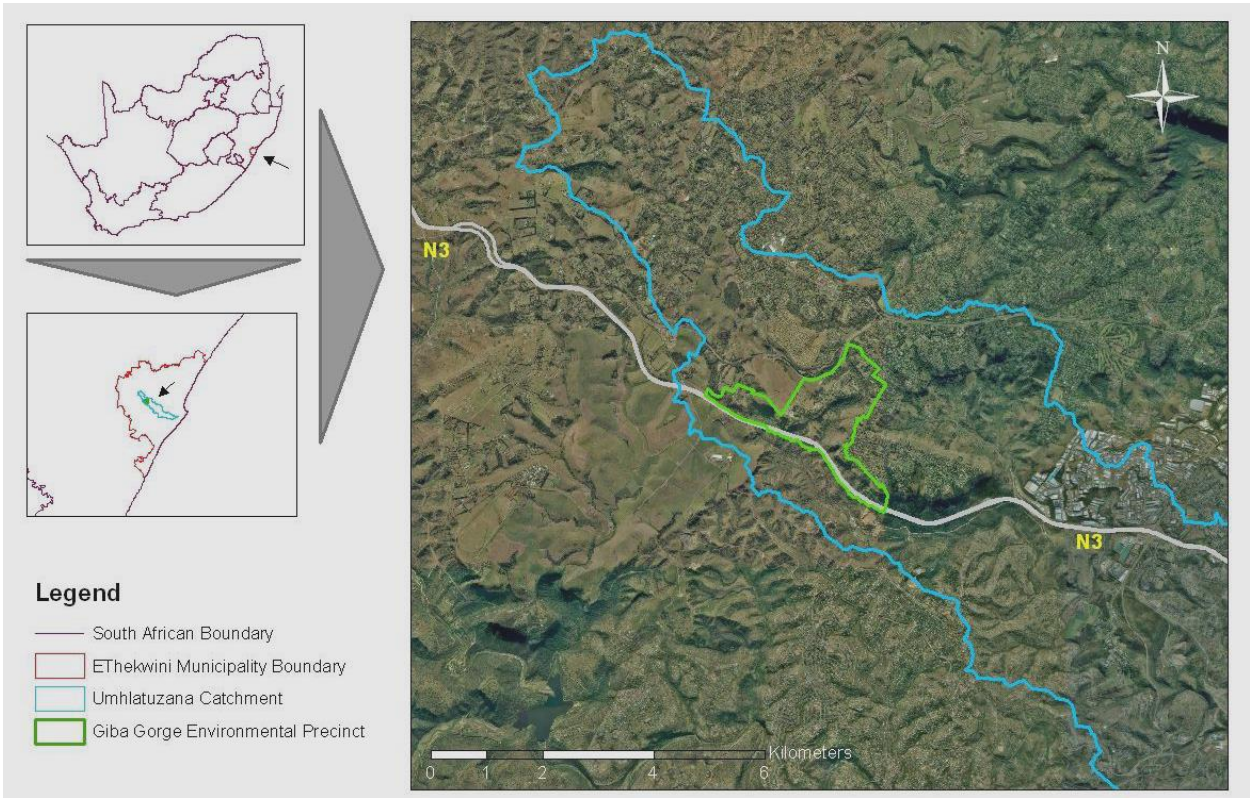


Figure 4.1: Location of the GGEP (Adapted: eThekwini Municipality, undated)

Figure 4.1 shows the GGEP as the area with a green boundary and the bottom insert represents the location of the Umhlatuzana Catchment area (within which the GGEP falls) in the eThekwini Municipality. Shown on Figure 4.1 also is the location of the eThekwini Municipality in South Africa as indicated on the top left insert. The following sections provide detailed view of the GGEP in terms of land ownership, ecosystems and species found in the GGEP open space.

4.3.2 Ownership

The GGEP open space is composed of land owned by various entities which include eThekwini Municipality, South African National Roads Agency Limited (SANRAL), Public works and private property owners. Figure 4.2 depicts the area coverage of various ownerships within the GGEP.

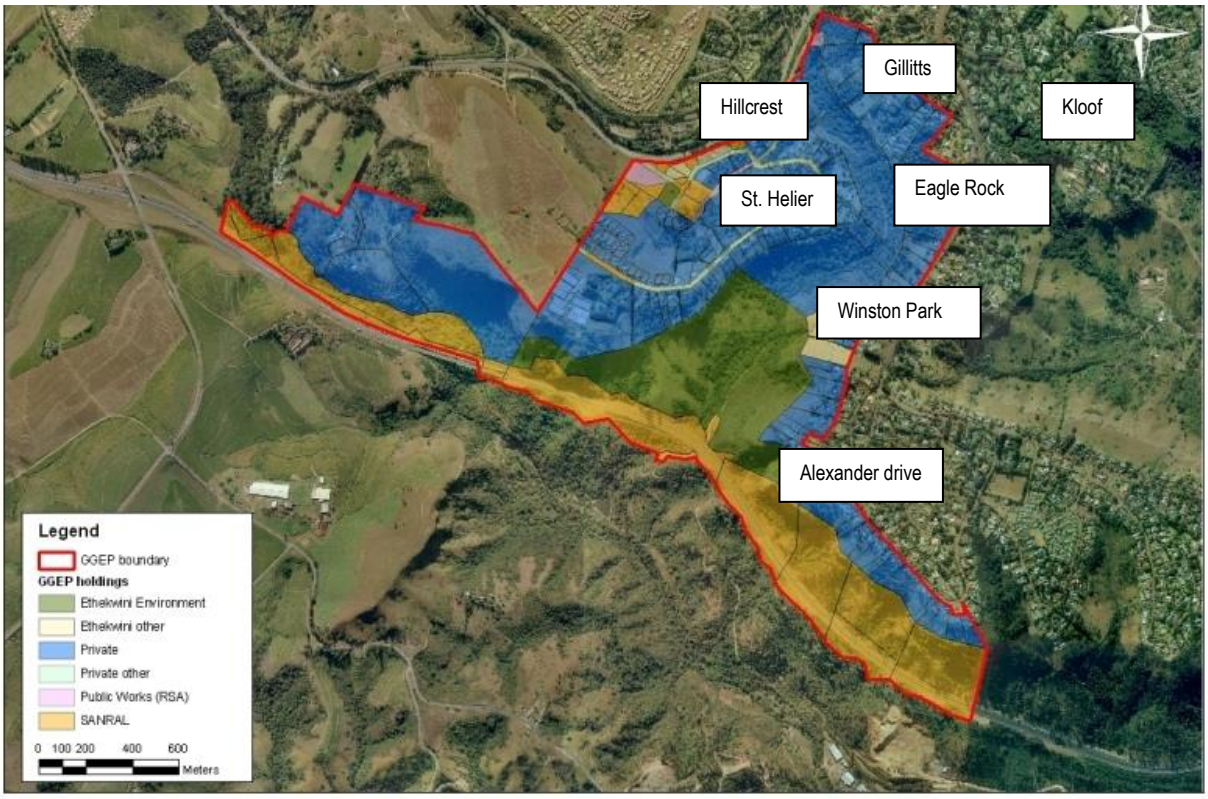


Figure 4.2: GGEP land ownerships (Adapted: GGEP management files, undated)

According to Figure 4.2, the largest parcel of land in the GGEP highlighted in blue and light-green falls under private ownership while a substantial parcel highlighted in amber, falls under the South African National Roads Agency Limited ownership. Further, the parcel highlighted in green and cream falls under eThekwini Municipality ownership while a small parcel highlighted in pink falls under Public Works ownership. The eThekwini Municipality and the GGEP property owners are the only two land owners in GGEP that are actively involved in managing the GGEP. However, each land owner is required to contribute towards managing the GGEP open space through the SRA provisions in the Municipal Property Rates Act 2004 (Republic of South Africa, 2005).

4.3.3 Physical environment

The main aspects that influence climate in Durban are latitude, distance from the ocean and altitude (Piesold *et al.*, 2011). Durban experiences a subtropical climate characterised by hot summers with a mean temperature of between 28 degrees Celsius in summer and 22 degrees Celsius in winter (Teixeira-Leite and Macfarlane, 2014: 13). In addition, the highest precipitation is recorded during the months of

November to March with an average annual precipitation rate of about 1000 millimeters (Diab *et al.,* 1991). Durban experiences humid conditions with humidity levels of up to 72% at the coast (Piesold *et al.,* 2011: 20).

The dominant geology of the GGEP is the sandstone overlaid by Megacrystic Biotite Granite with soils that are sandy and acidic in nature which mostly occur on plateaus and scarps (GGEP, 2011). However, the characteristic soils found in the forest are a mixture of sandstone, granite and alluvial deposits (GGEP, 2011). The main features characteristic of the GGEP include, "flat plateaus, adjacent scarps and steep incised gorges" (GGEP, 2011: 13).

4.3.4 Ecosystems

Ecosystem degradation is a global trend owing to increasing natural resource consumption needs (MEA, 2005; Secretariat of the CBD, 2010). The MEA (2005) and Managi (2013) highlight some of the threats to ecosystems globally most of which are human-induced and include land-use change, population growth, unsustainable natural resource harvest, alien species invasion, governance and climate change, among others. Land-use change has been the main instigator of the drastic ecosystem conversion in the GGEP in the past 50 years (D'MOSS, undated).

The GGEP is a diverse open space consisting of various ecosystems and species of varying importance (GGEP, undated). It is comprised of four ecosystems including grassland, forest, cliffs and, wetlands and rivers (EPCPD, 2010a). Biodiversity existing within the GGEP ecosystem is important for the services they provide to the GGEP community and the wider community of Durban (EPCPD, 2011). The services include provisioning such as building materials, regulatory such as climate regulation, cultural such as recreation, and supporting services such as soil formation (DEAT, 2006; EPCPD, 2011). Figure 4.3 provides an overview of the ecosystems within the GGEP open space.

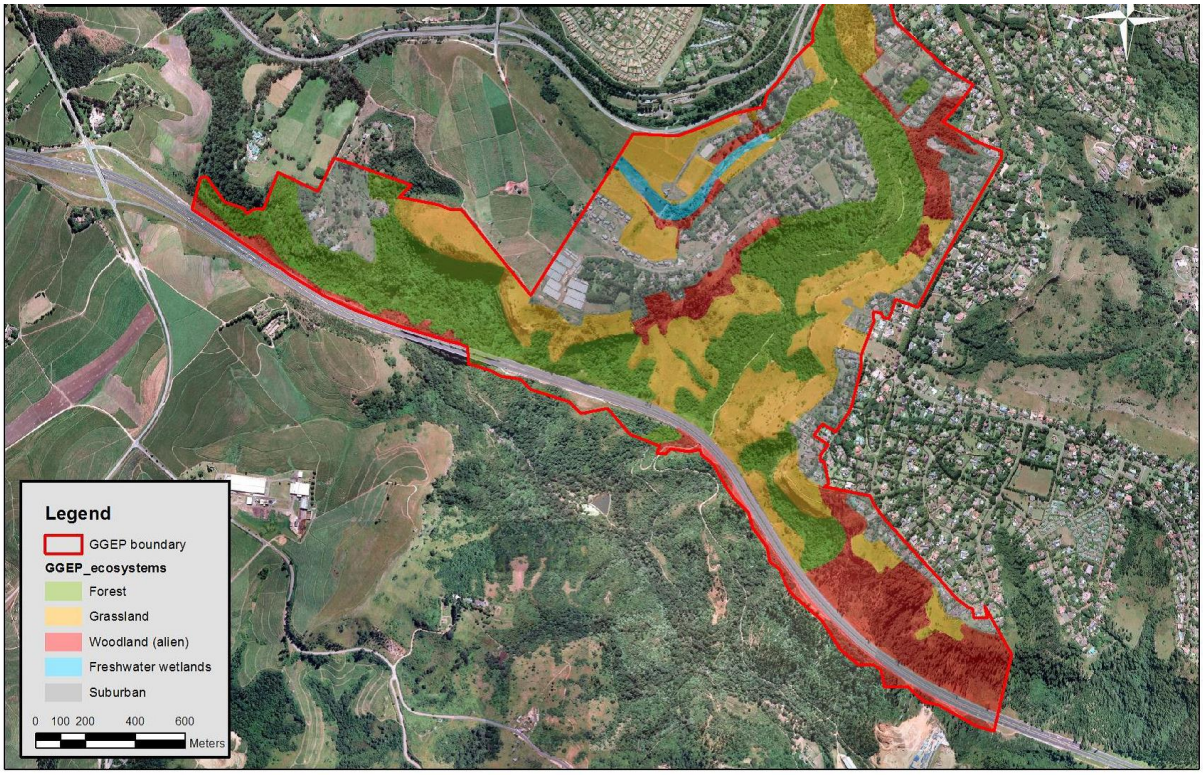


Figure 4.3: The GGEP open space ecosystems (Adapted: GGEP management files, undated)

Figure 4.3 shows the various ecosystems in the GGEP and the developed or suburban areas. The forest ecosystem is highlighted in green while the woodland is in red. Further, the grassland and the wetland ecosystems are highlighted in amber and blue, respectively. The remaining areas within the GGEP boundary (the areas bound within the red line) show the developed or suburban area.

4.3.4.1 Grassland ecosystem

The grassland type found in the GGEP open space is known as the KwaZulu-Natal sandstone sourveld (GGEP, undated). It is unique grassland characterised by acidic sandy soils formed by the weathering of sandstone rocks (GGEP, undated). The sandstone sourveld grasslands of the GGEP are unique to the coastal areas of KwaZulu-Natal where majority of this ecosystem has been transformed. This phenomenon reflects the state of the sandstone sourveld grasslands throughout the country where it is estimated that over 68% is transformed (GGEP, 2011: 14). Only 0.2% of this ecosystem falls under Protected Areas (GGEP, 2011: 14). Consequently, the SANBI declared the ecosystem ‘endangered’ while Ezemvelo KwaZulu-Natal declared it ‘critically endangered’ (GGEP, 2011). The grasslands support a

range of plant and animal life including birds, insects, small mammals, and a variety of grasses and flowering plants (GGEP, 2011). Some of the species in the grassland include striped caco (*Cacosternum striatum)* and spotted shovel-nosed frog (*Hemisus guttatus*). Figure 4.4 shows part of the KwaZulu-Natal sandstone sourveld.

Figure 4.4**:** GGEP open space sandstone sourveld grassland
(Adapted: GGEP Management files, undated)

The sandstone sourveld is a biodiverse grassland and its biodiversity is revealed in spring after flowers blossom and pollinators are abundant; a scenario which invites many predators and small insects (GGEP, undated). One of the important factors that influence this phenomena and which is responsible for the health of the grassland is fire. Fire is responsible for clearing off old dry grass to give way to new life; it also prevents invasion of non-herbaceous plants and by doing so, it maintains the whole life system of grasslands (EPCPD, 2010a). The main threats to the remaining part of this ecosystem include bush invasion, soil erosion, alien plant invasion and irregular fire regimes (EPCPD, 2010a). Being an endangered ecosystem, it is important that this ecosystem is conserved through introduction of sustainable management practices.

4.3.4.2 Scarp forest

The type of forest in the GGEP open space is known as scarp (as shown in Figure 4.5). This kind of forest usually occurs on rugged terrain, mountainous and coastal areas which are protected from fire (GGEP, undated). In the study area, the scarp forest is diverse in plant and animal species (D'MOSS, 2010). Some species found in the GGEP scarp forest are particularly unique to the scarp forest, some of which include: ruby-footed giant millipede (*Doratogonus rubipodus*), spotted ground-thrush (*Zoothera guttata*) and kloof frog (*Natalobatrachus bonebergi*) (GGEP, undated).

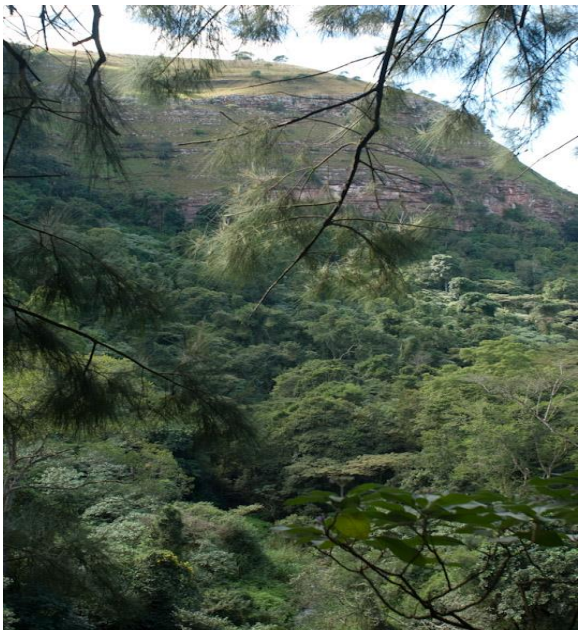


Figure 4.5**:** Scarp forest of the GGEP open space (Adapted: GGEP management files, undated)

The scarp forest is an endangered ecosystem and 20% (GGEP, undated) is protected by the National Forest Act of 1998 (D'MOSS, 2010). In addition, the GGEP open space is home to many animals and plant species some of which are unique to this place while others are simply endangered (EPCPD, 2010a). For instance, the African crown eagle whose populations are decreasing, nests in the scarp forest; the ruby-footed giant black millipede (*Doratogonus rubipodus*) is only found in the GGEP open space and Kranztkloof nature reserves; the spotted ground thrush (*Zoothera guttata*) lives only in the Eastern Cape forests and KwaZulu-Natal scarp forest; and the kloof frog (*Natalobatrachus bonebergi*) lives in streams of scarp forests (EPCPD, 2010a; GGEP, 2011). Scarp forests are also rich in variety of animal and plant species ranging from insects, small mammals to birds (GGEP, 2011).

The major threat to the scarp forest ecosystem is unsustainable resource extraction practices, especially for medicinal purposes, which makes the forest susceptible to invasion by alien species (GGEP, undated). Due to lack of knowledge on sustainable harvesting on the part of the harvesters, their practices are usually detrimental to the health of the plants and animals (GGEP, undated). This further disturbs the structure of the forest by opening up the canopy to sunlight which immediately results in proliferation of the understory (GGEP, undated). With presence of invasive alien species in the understory, the understory gets taken over by alien species which then threaten the survival of the poorly managed indigenous species. The importance of the structure of the scarp forest cannot be understated because it is critical to maintenance of indigenous species and the forest itself (GGEP, undated: 10).

4.3.4.3 Rivers and wetlands

The GGEP is a well-drained open space which is endowed with rivers and streams as well as many smaller drainage systems which all drain into the main rivers (GGEP, undated: 11). Rivers and wetlands make up 4.3% of the GGEP and occupy about 10 hectares of the total GGEP manageable area (GGEP, 2011: 16). The two main rivers in the GGEP are the Giba and Umhlatuzana rivers which both run through the GGEP open space. In addition to the rivers are smaller drainage systems like streams. Further, the rivers in the GGEP open space are replenished by seepage as well as ground water (GGEP, undated). The GGEP open space is also endowed with pools and waterfalls on the upper Umhlatuzana River (as shown in Figure 4.6).

Figure 4.6: Pools and waterfalls characteristic of the upper Umhlatuzana river
(Adapted: GGEP Management files, undated)

The GGEP open space wetlands are an important feature as they are rich in animal and plant species. They are important for the entire open space as they provide water and shelter to terrestrial animals as well as a habitat for hygrophilous plants (such as sedges and reeds) and animals (GGEP, undated; GGEP, 2011). In addition, the wetlands are rich in insects and frogs of which some were discovered in the Giba Gorge. It must be emphasised that the GGEP open space is home to more than 20 frog species and this is almost a quarter of all recorded species in South Africa (GGEP, undated). However, the rivers and wetland ecosystems are not without challenges to their health and sustainability. The major environmental threats include pollution, erosion and alien species invasion (GGEP, 2011).

4.3.4.4 Cliffs

Cliffs are special features as they occur in almost all ecosystems except rivers and wetlands (GGEP, 2011). The sandstone sourveld cliffs of the GGEP are very rich in animal and plant life, despite their harsh environmental conditions (GGEP, undated). In order to live in harsh conditions, animal and plant

species have had to adapt to surviving on rocky terrain which has very little water and nutrients. One such plant species is the blood lily (*Gladiolus cruentus*), a very rare species mainly occurring in Durban which has been declared 'critically endangered' by the SANBI (GGEP, undated). Figure 4.7 shows some plants that grow on cliffs, one of which is the red flowering plant called blood lily (*Gladiolus cruentus*).

Figure 4.7: Cliff Ecosystem with the blood lily (*Gladiolus cruentus*)
(Adapted: GGEP management files)

In addition to plant species, cliffs provide a home to many animal and bird species. Some of the animal species such as rock hyrax (*Procavia capensis*) find the cliffs a refuge against predators while others such as lanner falcons (*Falco biarmicus*) inhabit the cliffs seasonally (GGEP, undated: 12). However, the health of cliff ecosystems is threatened by illegal harvesting of ornamental plants, erosion and dumping of waste from the adjacent residential areas (GGEP, 2011). Proper management of these threats is critical to conserving the plant and animal species of cliff ecosystems.

4.3.5 Umhlatuzana rock shelter

Besides ecosystems, the GGEP has another aspect which renders the GGEP a unique open space: the uMhlatuzana rock shelter. This is a site of historical significance because artefacts dating as far back as 100 000 years were found on this site (GGEP, undated). Thus, the uMhlatuzana rock shelter provides evidence of early human inhabitation (of the Stone Age) and thus provides insight into the lifestyles of the inhabitants (GGEP, undated). It is a significant resource for educational purposes for the people of Durban, South African and the world at large, and provides tourism potential for Durban (EPCPD, 2010a). Figure 4.8 depicts the face of the uMhlatuzana rock shelter.

Figure 4.8: Umhlatuzana rock shelter (Adapted: EPCPD, 2010c)

According to Bastian *et al.* (2013), historical sites with their associated characteristics are important in the modern day society for their services. People attach value to historical sites through the various uses they put the sites to, such as museums, tourist destinations and properties (Australian Government, 2006). Thus, historical sites are important in many aspects including educational, use and cultural value (Australian Government, 2006). Knowledge obtained through the study of historical sites is important in providing comprehension of the socio-economic and sometimes political organisation of previous generations (Maskey *et al.*, 2007). In addition, historical sites can generate monetary value through direct use or can have considerable monetary implications to proximate properties (Australian Government,

2006). Other values of historical sites include linking current generations to previous ones, give a sense of identity, for education and research and, spiritual use (Australian Government, 2006). Consequently, conservation of historical sites is important for maintaining 'cultural capital' (Australian Government, 2006). That is, through conservation, historical sites are restored and maintained to prevent degradation and disappearance of these sites. Bastian *et al.* (2013) assert that there has been an increasing awareness for the need to conserve historical sites and this stems from their value to society.

4.3.6 Invasive alien species

Alien species invasion is a big concern in the GGEP open space, especially in the forest and grasslands (GGEP, undated). In the forest ecosystems, the main factor that triggers proliferation of invasive alien species is unsustainable harvesting of forest resources, in particular medicinal plant harvesting (GGEP, undated). Such disturbances to forest ecosystems can trigger proliferation of invasive alien species though invasions are not completely limited to disturbed forests (Martin *et al.*, 2008). With availability of seeds of both indigenous and invasive species, the forest floor soon gets a new spring of life. This means that invasive alien plants have to compete with indigenous plants but invasive alien species tend to outgrow the indigenous plants (GGEP, undated).

The alien species in the GGEP open space can be traced from various sources. The most common source is the households and these are responsible for most ornamental plants and fruits that have been found in the forest and grassland (WESSA, 2008). Another source of alien plant species are timber and other plantations and this source is responsible for introduction of most woody plant species such as gum trees (*Eucalyptus grandis*) (WESSA, 2008). However, any habitat can be thought of as a source of alien species because plant species behave differently when introduced in a foreign habitat due to changes in the conditions in which they grow in such as sunlight levels (WESSA, 2008).

Some of the key invasive species found in the GGEP include: ageratum (*Ageratum conyzoides),* American bramble *(Rubus cuneifolius),* black wattle *(Acacia meansii),* bugweed *(Solanum mauritianum),* camphor tree *(Cinnamomum camphora),* castor-oil plant *(Ricinus communis),* chromolaena *(Chromolaena odorata),* ginger lilies *(Hedychium spp.),* formosa lily (*Lilium formosanum),* lantana *(Lantana camera),* syringa *(Melia azedarach) and* guava *(Psidium guajava)* (GGEP, undated; WESSA, 2008).

4.3.7 Red data species

The GGEP has many species that have been red listed as near threatened, vulnerable, endangered and critically endangered by the SANBI. Table 4.1 provides an overview of some of the key species that have been red listed.

Table 4.1: Red Data species of the GGEP (Source: GGEP, 2011: 5)

Common Name	**Scientific Name**	**Status**
Wild begonia	*Begonia dregei*	Endangered
Beautiful brachystelma	*Brachystelma pulchellum*	Near-threatened
Imfingo	*Stangeria eriopus*	Vulnerable
Dwarf yellow grass aloe	*Aloe linearifolia*	Near-threatened
Natal lily	*Crinum moorei*	Vulnerable
Wild squill	*Merwilla plumbea*	Near-threatened
-	*Brachystelma gerrardii*	Endangered
Cape primrose	*Streptocarpus molweniensis*	Vulnerable
Swan orchid	*Cynorkis compacta*	Vulnerable
Blood lily	*Gladiolus cruentus*	Critically endangered
Kloof frog	*Natalobatrachus bonebergi*	Endangered
Plain stream frog	*Strongylopus wageri*	Near-threatened
Wooly-necked stork	*Ciconia episcopus*	Near-threatened
Martial eagle	*Polemaetus bellicosus*	Vulnerable
African crowned eagle	Stephanoaetus coronatus	Near-threatened
Lanner falcon	*Falco biarmicus*	Near-threatened
Black-winged lapwing	*Vanellus melanopterus*	Near-threatened
Bush blackcap	*Lioptilus nigricapillus*	Near-threatened
Spotted ground-thrush	*Zoothera guttata*	Endangered
Anchieta's pipistrelle	*Pipistrellus anchietae*	Near-threatened
Large-eared free-tailed bat	*Otomops martiensseni*	Vulnerable
Natal long-fingered bat	*Miniopterus natalensis*	Near-threatened
Blue duiker	*Philantomab monticola*	Vulnerable

The red list classification used in Table 4.1 provides a general overview of the status of some species of the GGEP. There are species that are threatened directly through unsustainable harvesting and they include the martial eagle (*Stephanoaetus coronatus*) and the African crowned eagle (*Polemaetus bellicosus*) which are hunted for medicinal purposes while the blue duiker is hunted for food (GGEP, undated). Other species targeted in medicinal plant harvesting are given in Table 4.2.

Table 4.2: Species targeted in medicinal plant harvesting

(Source: GGEP undated)

Common Name	**Scientific Name**
Wild Poplar	*Macaranga capenesis*
Tassel Berry	*Antidesma venosum*
Flat-crown	*Albizia adianthifolia*
Red Beech	*Protorhus longifolia*
Pambati-tree	*Anastrabe integerrima*
River Wild-quince	*Cryptocarya woodii*
Umdoni	*Syzigium cordatum*
Mitzeeri	*Bridelia micrantha*
Quinine Tree	*Rauvolfia caffra*
Magic Rope	*Oncinotis tenuiloba*
Camphor	*Cinnamomum camphora*
Silky oak	*Grevillea robusta*
Ironwood	*Casuarina equisetifolia*

On the other hand, some species are threatened indirectly through the destruction of their habitats. Such species include the kloof frogs (*Natalobatrachus bonebergi)* and plain stream frogs (*Strongylopus wageri*) which are threatened through destructive medicinal harvesting practices (GGEP, undated). It must be noted however that there are still many species whose red list data is unavailable because they are either being assessed or have not been assessed at all.

4.3.8 Social-economic status

The GGEP is composed of private property owners making up about 143 properties clustered into five suburbs and/ or estate, namely: Winston Park, St. Helier, Kirkman, Eagle Rock and Alexander Drive (GGEP, 2011). Most of the property owners have formal employment occupying middle and top management positions or running their own businesses (GGEP Contact List, 2011). Figure 4.9 shows the location of the GGEP relative to the Tshelimnyama community.

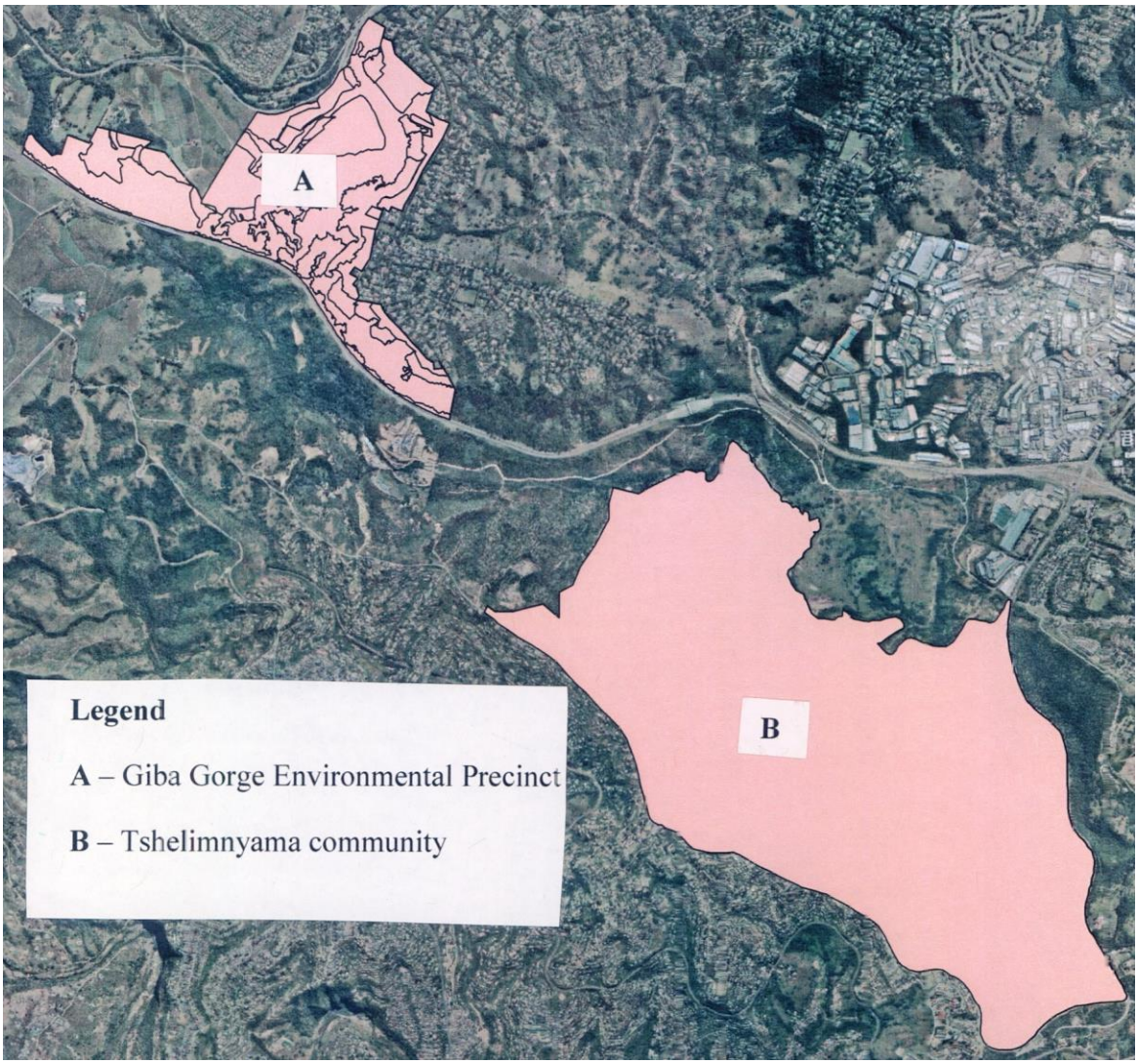


Figure 4.9: Location of the Tshelimnyama community relative to the Giba Gorge Environmental Precinct

Figure 4.9 shows the relative location of the Tshelimnyama community represented by the letter 'B' while the GGEP is represented by the letter 'A'. Figure 4.10 shows that the Tshelimnyama community lies downstream of the GGEP, an important aspect to consider when examining how ecological activities on the GGEP affects the Tshelimnyama community as is discussed next.

Figure 4.10: Tshelimnyama community downstream of the GGEP
(Adapted: GGEP management files, undated)

Down-stream of the GGEP is an informal settlement with 6121 households (Statistics South Africa, 2011) considered to be low income and is called Tshelimnyama (Figure 4.10). It has been classified as part of the 44% of households in the eThekwini Municipality that is poor with its residents earning less than R1 500 per month (Seppings, 2009: 11). This community benefits directly from extraction of GGEP open space resources. In addition, it also benefits indirectly form the conservation efforts through flood attenuation, water purification and other ecosystem services provided by the GGEP (GGEP, 2011).

4.4 Research methodology

The research methodology is informed by the research questions and the key question asked in this study is: can a SRA legislative instrument foster effective ecosystem management outside Protected Areas? Further sub-questions that are asked include the following:

- What are the perceptions of stakeholders on changes in natural resources over the years past in the GGEP area? What changes have occurred in the GGEP between 2010 and 2012?

- What are the current uses of natural resources in the GGEP?

- What are the stakeholders' perceptions towards the GGEP project?
- To what extent do security measures affect the stakeholders' perceptions of the interactions with the community and the GGEP project?
- What is the impact of the GGEP SRA on property values or surrounding development?

To answer the given research questions, a mixed method research design was adopted for this study using a case study approach. Both qualitative and quantitative research methods were utilised in data collection and analysis. Data was collected using questionnaires, key informant interviews, observations and focus group discussions as primary data sources. Secondary data sources included Tax Valuation Roll documents, aerial photographs and reports. The data analysis tools used include the Statistical Package for Social Statistics (SPSS), Geographical Information System (GIS) and thematic analysis.

4.4.1 Research design

This study takes a case study approach of research within the mixed methods design. According to Remenyi (2012), a case study is "an empirical enquiry that investigates a contemporary phenomenon within its real life context, when the boundaries between phenomenon and context are not clearly evident, and in which multiple sources of evidence are used." A case study engages the researcher in an in-depth understanding of a given scenario in order to understand real world phenomenon (Yin, 2012). As such, a case study approach provides detailed information required to understand a phenomenon when compared to other methods. In addition, a case study allows for integration of multiple data collection methods which at the end give a complete understanding of a given phenomenon (Denscombe, 2007; Curry *et al.,* 2009). More importantly, this research is based on a case study because it was conducted in the GGEP where the eThekwini Municipality is piloting a conservation management project using the SRA as a legislative instrument.

Leech and Ownwuegbuzie (2009: 265) state that "mixed methods research represents research that involves collecting, analysing, and interpreting quantitative and qualitative data in a single study or in a series of studies that investigate the same underlying phenomenon." In addition, Creswell *et al.* (2004: 212) describe mixed methods research as a study which "involves the collection or analysis of both quantitative and/ or qualitative data in a single study in which the data are collected concurrently or sequentially, are given a priority, and involve the integration of the data at one or more stages in the process of research". It is apparent that when using a mixed methods approach both quantitative and qualitative techniques are integrated in a single study in the data collection and analysis (Gaber and

Overacker, 2012; Heyvaert *et al.,* 2013). The mixed methods approach to research thus provides a flexible way to obtain information and by mixing the methods, best results for the research questions are obtained through triangulation (Johnson and Ownwuegbuzie, 2004; Denscombe, 2007).

Several authors advocate that quantitative and qualitative research should not be combined into one study because of the different philosophies underlying each technique on how knowledge should be obtained (Teedlie and Tashakkori, 2009). The advocates of quantitative research argue that knowledge and the process of acquiring it should be objective and therefore the researcher should be detached from the objects under study (Johnson and Ownwuegbuzie, 2004; Wahyuni, 2012; Harrison III, 2013). On the other hand, the advocates of qualitative research believe that knowledge cannot be objective and therefore in order to acquire it, the researcher should be involved in the process in order to understand the context under which knowledge is gathered (Johnson and Ownwuegbuzie, 2004; Wahyuni, 2012; Harrison III, 2013).

Researchers such as Leech and Ownwuegbuzie (2009), Teedlie and Tashakkori (2009) and Rubin and Babbie (2013) view mixed methods as a new and third paradigm, which should not be seen as replacing quantitative and qualitative research paradigms. Thus, the mixed methods research approach bridges the gap between quantitative and qualitative research paradigms by maximising the strengths and minimising the weaknesses inherent within each (Johnson *et al.,* 2007). However, Onwuegbuzie and Collins (2007) state that mixed methods approaches can have problems of representation, integration and legitimation. Researchers such as Onwuegbuzie and Collins (2007) and Cameron (2011) have expressed concern over the use of a mixed methods approach to research such as paradigms, pragmatism, praxis, proficiency, philosophical, representation, legitimation, integration, cultural, psychological (cognitive) and practical, among others. However, Mingers (2001) states that the concerns and criticism are not insurmountable. Therefore, in taking a mixed methods approach, the researcher needs to find a way of overcoming the criticism by:

- Having sufficient understanding of the philosophical bases of research to determine if and how apparent paradigmatic differences in approach might influence their work and be resolved
- Being familiar with key literature and debates in mixed methods, and with exemplars of a variety of mixed methods approaches to research; learn to take risks, but also to justify choices made.
- Being able to determine the appropriateness of a selected method(s), based on the question(s) being asked (be question-driven in their choice of methods), and be able to determine whether mixing methods provides a cost-effective advantage over use of a single method; have knowledge of the variety, rules and implications of different sampling methods, and of alternative approaches

to dealing with ‘error’ or deviance from the norm; be prepared to recognise and admit what is not known, and seek advice; develop skills in working collaboratively with researchers using different approaches or methods.

- Having well developed skills in carrying out research using at least one major methodological approach, but also a comprehensive understanding of a range of approaches and methods (if they did not already), particularly to understand the principles underlying those methods; have an ability to interpret data meaningfully, and to ask questions of the data, rather than to simply follow a formula; know and understand how software can be used to assist analysis tasks.
  (Cameron, 2011: 96)

4.4.1.1 Rationale for combining qualitative and quantitative research techniques

According to Venkatesh *et al.* (2013), a researcher can undertake to use a mixed methods approach if doing so will help in answering the research problem. In addition, a mixed methods approach can be adopted “without much consideration of paradigmatic or cultural incommensurability if the researcher is able to overcome the cognitive and practical barriers associated with conducting mixed methods research” (Venkatesh *et al.*, 2013: 2). The rationale for combining quantitative and qualitative techniques in one study is that on their own, the techniques are inadequate and therefore may not provide enough information to answer the research questions (Ivankova *et al.*, 2006). That is, quantitative methods cannot provide rich information required to understand a phenomenon while the actual meaning can be lost when summarising data and knowledge generated can be too general or abstract to be applied to local situations, context or individuals (Johnson and Onwuegbuzie, 2004). On the other hand, qualitative methods cannot generalise findings while analyses can be time consuming and findings are rid with personal biases and idiosyncrasies (Anderson, 2010; Johnson and Onwuegbuzie, 2004). Therefore, the inadequacies of one method are overcome by another method’s strengths, for instance, quantitative methods summarises data for generalisations but in doing so some meaning maybe be lost. To overcome this, qualitative methods provide rich detailed data which help explain the generalised information from quantitative methods.

Researchers (Johnson and Turner, 2003; Johnson and Onwuegbuzie, 2004) argue that taking a mixed methods approach to research yields greater benefits considering the strengths that each technique possesses. Thus, a mixed methods approach ensures that the information obtained is both valid and reliable (Gaber and Overacker, 2012; Mayoh and Onwuegbuzie, 2013). According to Hanson *et al.* (2005), the mixed methods approach is very useful because by integrating quantitative and qualitative techniques, information from one technique can be used to complement, develop, initiate and expand on information from other techniques. The complementary aspect in a mixed methods approach ensures that

a researcher is able to pursue different aspects of the research, clarify issues, seek in-depth understanding and even follow-up on issues arising (Bryman, 2006; Gaber and Overacker, 2012). Qualitative techniques can be used to elicit information to be used to explain quantitative information (Hanson *et al*., 2005). The expansion aspect in a mixed methods approach can also ensure that a researcher is able to use quantitative and qualitative techniques based on their strengths to pursue different aspects of the phenomenon under study (Bryman, 2006; Gaber and Overacker, 2012; Mayoh and Onwuegbuzie, 2013). Finally, combining quantitative and qualitative techniques ensures that the weaknesses that each technique possesses are minimised (Bryman, 2006).

4.4.1.2 Mixed methods sequential explanatory design

Implementation of the mixed methods approach can be done in two ways: sequentially or concurrently (Curry *et al.*, 2013). Mixed methods sequential design is sub-divided into explanatory, exploratory and transformative methods while mixed methods concurrent design is sub-divided into triangulation, nested and transformative methods (Hanson *et al*., 2005). The main differences between sequential and concurrent designs are (a) the implementation sequence and (b) the importance attached to each technique (Hanson *et al*., 2005). In addition, the timing of data collection using each technique determines the type of mixed methods approach (Harrison III, 2013). The decision of which technique takes precedence should be made before data collection or during the course of data collection (Ivankova *et al*., 2006). In addition, the researcher also has to decide when to integrate the quantitative and qualitative techniques. In mixed methods sequential explanatory design, quantitative data is collected first while qualitative data is collected and analysed last (Ivankova *et al*., 2006; Curry *et al.*, 2013; Harrison III, 2013). This study adopts a mixed method sequential explanatory design where priority is given to quantitative techniques and therefore quantitative data was collected first.

4.4.4 Population and sample

As a starting point of this study, there was a need to identify the relevant stakeholders for the GGEP and this study. In order to do this, the stakeholder identification criteria as established by Mitchell *et al.*, (1997), specifically that relating to power, legitimacy and urgency; was adopted and used. Table 4.3 shows the stakeholder identification criterion used for this study.

Table 4.3: Stakeholder identification criteria (Source: Mitchell *et al.*, 1997: 874)

Stakeholder attributes	Questions used to identify stakeholders
Power	Whatever group it is, is it able to make demands over the GGEP open space? Does it have the right to make any demands relating to issues of the GGEP open space?
Legitimacy	Does the group have any recognised or formal relationship with the GGEP project? If they access the GGEP open space, are the group's actions desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs and definitions?
Urgency	Can a group make any claims regarding the GGEP open space resources which need immediate attention?

People with access to the GGEP open space and interests were put through a stakeholder identification process to determine whether they were stakeholders to be considered in this study or not. The questions in Table 4.3 were used to check which stakeholder groups possessed which attributes and the resultant Table (Appendix 4) highlighted the attributes each stakeholder group possessed. The results of the identification process were important in determining which stakeholder groups were to be targeted for each research question. After the identification was done, the following were identified to be important stakeholders for this study and for the GGEP open space:

- Definitive: included the eThekwini Municipality (the EPCPD personnel, and the GGEP manager and field workers) and the GGEP property owners residing in St. Heliers, Winston Park, Kirkman, Eagle Rock and Alexander Drive.

- Dependent: The Tshelimnyama community members included registered traditional healers (traditional healers formally registered with the Tshelimnyama traditional healers' association) and general community members (non-traditional healers).

- Discretionary stakeholders: commercial harvesters are people who harvest medicinal plant and animal products on a large-scale to supply traditional healers within Durban or beyond. Despite that this group did not participate in the study, they are an important stakeholder group which formed significant part of the discussion.

This study's population included 143 households of property owners residing in the GGEP and 6121 households of Tshelimnyama community members. All GGEP households were targeted in the census while a purposive sample was selected and used from the Tshelimnyama community. Purposive sampling is a qualitative sampling technique which does not use probability in selecting objects to make up the

sample (Tashakkori and Teddlie, 2003). Thus, the researcher selects the sample based on which people or objects will provide the most information or details for the research (Petty *et al.,* 2012). When conducting purposive sampling, the researcher is not interested in the bulk of data to be collected or the quantity of the source of information, but the main focus is on the degree to which the gathered information answers the research questions (Polkinghorne, 2005). According to Teddlie and Yu (2009), there are four types of purposive sampling strategies and they include sampling to achieve representativeness or comparability, sampling special or unique cases, sequential sampling and using combinations of purposive sampling strategies. This study adopted sampling to achieve representativeness or comparability and within this strategy, the researcher used maximum variation sampling a method which is used when the researcher is seeking to cover a wide range of views from different target groups (Teddlie and Yu, 2009). Thus, the researcher was seeking information from the various stakeholders which was then compared in data analysis.

4.4.5 Implementation of the research design

The research design was underpinned by the following research techniques: questionnaire survey, focus group discussions, key informant interviews, observations and document analysis. In order to collect the necessary data for this study, the mentioned techniques were used in two phases: the first was the quantitative data collection and the second was qualitative phase. These two phases were implemented giving priority to the quantitative data over qualitative. Figure 4.11 provides a summary of the implementation of the data collection process and techniques used.

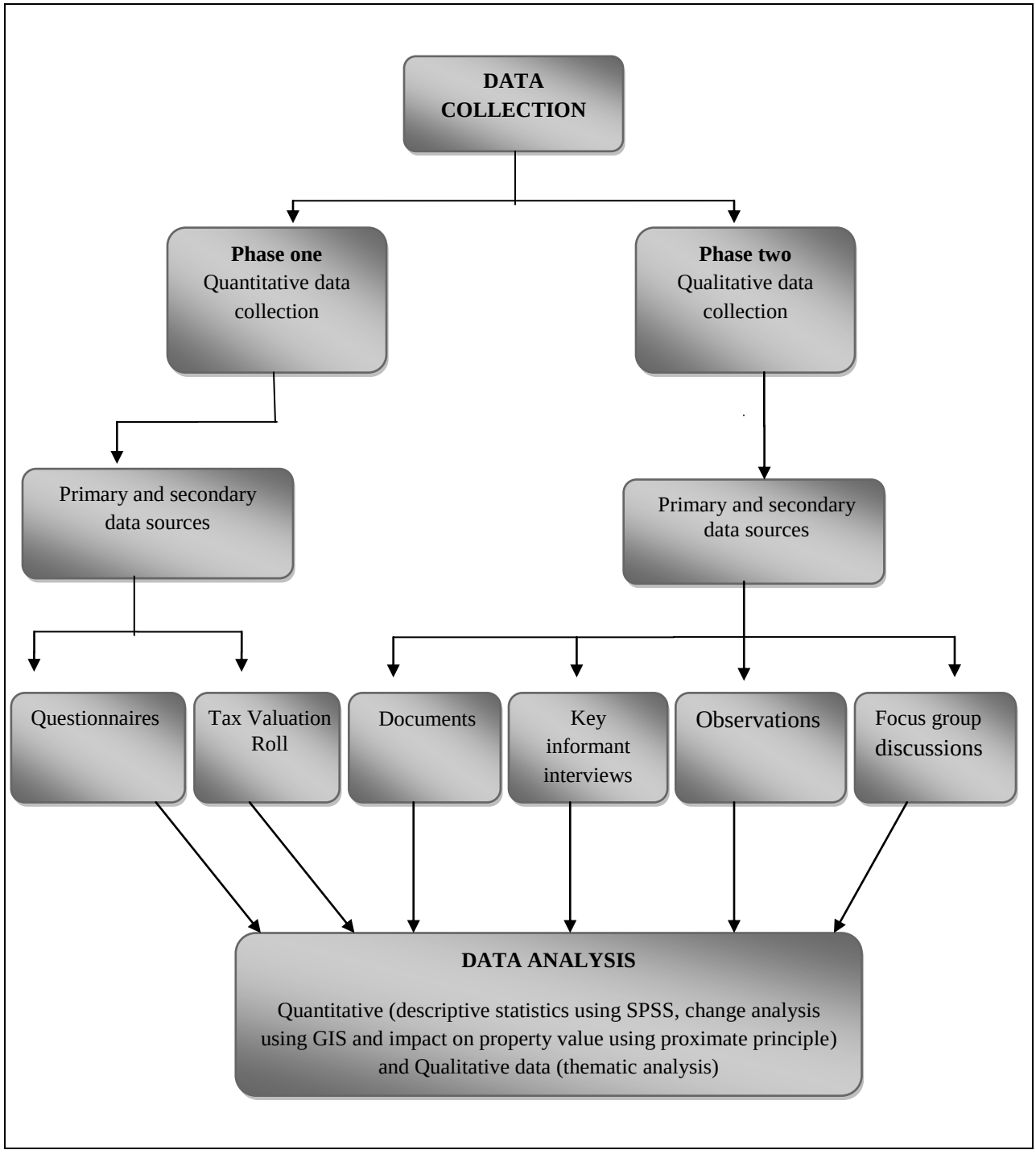


Figure 4.11: Summary of data collection process and techniques used in the study

4.4.5 Phase 1: Quantitative techniques in data collection

Quantitative data was given first priority over qualitative and was targeted at the GGEP property owners because of the purpose of the research which was mainly to inform the decision-making process of the future of the GGEP project. This study targeted all the GGEP property owners through a census. A census is defined as "… an attempt to collect data from every member of the population being studied rather than choosing a sample" (Harding, 2006: 26). The census employed the questionnaire (provided in Appendix 1) to elicit quantitative data on stakeholder perceptions of the changes in natural resources between 2010 and 2012. It was also used to elicit data on the current uses of natural resources in the GGEP area, stakeholder contestations over natural resources, and stakeholder perception towards the GGEP project. In addition, the Tax Valuation Roll was collected from the eThekwini Municipality which provided the value of each property in the GGEP area.

4.4.6 Phase 2: Qualitative techniques

Qualitative data was collected to complement Quantitative data, after the implementation of the property owner questionnaire survey providing rich detailed data. Thus, qualitative techniques (four focus group discussions, 10 key stakeholder interviews, observations and document analysis) were used to explore further the same issues that were addressed by the quantitative technique. Participatory approaches were integrated into focus group discussions to aid in collecting geographical information.

Participatory approach to research is an approach where the local people, as subjects of the research, are recognised as having the knowledge being sought after through their experiences and therefore they are empowered to share that knowledge with the researcher (Bennett and Roberts, 2004; Abdullah *et al.*, 2012). Thus, by acknowledging that people with experiences of the phenomenon under study possess the knowledge, the researcher is able to effectively collect the data which is the 'reality' as constructed by the locals. The local people are therefore viewed as the owners of knowledge and so the researcher through facilitation enables them to share it (Abdullah *et al.*, 2012). In addition, the researcher can use PRA techniques such as mapping in trying to understand "boundaries, nature and scope potential research projects" (Krishnaswamy, 2004: 7). PRA is a research method where a researcher facilitates the local community in sharing information and by doing so the community engages with the researcher in collecting, presenting data as well as analysis (Bhandari, 2003; Abdullah *et al.*, 2012). In this study, PRA technique of mental maps was integrated into focus group discussions to understand the changes that have occurred in natural resources (vegetation and animal life) of the GGEP open space for the years between 2010 and 2012. Mental maps are maps printed on paper on which participants in focus group discussions

can write geographical information desired by the researcher (Gaillard *et al.,* 2013). Thus for this study, the researcher printed a map outline of the GGEP on an A3 size paper. Using the A3 map outline, the stakeholders indicated on the map which natural resource areas they thought had changed and the reasons for the changes were captured.

DeWalt and DeWalt (2011: 1) define an observation as a "method where a researcher takes part in the daily activities, rituals, interactions, and events of a group of people as one of the means of learning the explicit and tacit aspects of their life routines and their culture." An observation can be formal where the researcher uses a guide as an instrument or informal where the researcher becomes the instrument (Petty *et al.,* 2012). In this study, observations were used to elicit data on the current state and uses of natural resources in the GGEP area using the researcher as an instrument. Observations were also carried out to determine some of the natural resource contestations.

According to Petty *et al.* (2012: 381), document analysis entails the review of "written documents that may take the form of textbooks, articles, notes, minutes of meetings, archives but may also include photographs, drawings, pictures, television programmes." It is the review of documents with the intention to extract desired facts or information (Owen, 2013). Some documents maybe relevant as part of data needed to answer a research problem and in this study, document analysis was done to collect data used in quantitative and qualitative analyses. Thus, secondary data collected included the aerial photographs, GGEP management activity log-book and the GGEP property owner contact list. The aerial photographs were used in quantitative data analysis in determining changes in the GGEP open space resources. The GGEP management activity log-book was used to extract qualitative data incorporated into analysis of changes in the GGEP open space resources while the GGEP contact list was used in administering the questionnaire to all GGEP property owners.

Determining the impact of the GGEP project on the open space ecosystems was important because it has implications on stakeholder interest in supporting the GGEP project now and in the future. GIS was used together with aerial photographs to calculate the area of the GGEP open space which had undergone changes over the period 2010 to 2012. According to Folger (2009: 1), GIS is a "computer system capable of capturing, storing, analysing, and displaying geographically referenced information. Thus, GIS enables the researcher to create interactive queries, analyse spatial information, edit data, maps and present the results of all these operations in real time" (Schatz *et al.,* 2013: 25). Benedikt *et al*. (2002: 152) assert that GIS uses "…digital data layers, elevation models, satellite images, expert systems and related open source information for planning, detection, evaluation and decision-making." Thus, this technique uses digital

maps or images to display large amounts of data in general (such as economic, geographic or political data).

Petty *et al.* (2012) assert that a focus group discussion involves a group of about six to ten homogenous or heterogeneous people brought together to discuss a particular topic under the facilitation of the researcher. A focus group can be useful in soliciting various perceptions about a research topic from a given sample (Petty *et al.*, 2012). In this study, focus group discussions were conducted with the Tshelimnyama community to understand natural resource harvest practices used by the traditional healers and non-traditional healers. In addition, a focus group discussion was conducted with the GGEP property owners to solicit more details on issues arising from the questionnaire survey.

Semi structured interview allows the researcher to use open-ended questions for the purpose of soliciting in depth and instinctive responses from the interviewee (Gilbert, 2008; Ryan *et al.*, 2009). According to Galletta (2013: 24), a semi structured interview "is sufficiently structured to address specific topics related to the phenomenon of study, while leaving space for participants to offer new meanings to the study focus." In this study, semi structured interviews with key informants were conducted to follow up on issues arising from the questionnaire survey, focus group discussions and observations of the state of natural resources in the GGEP open space. The following highlights the issues probed from each group of informants,

- The GGEP property owners provided insight into ecosystem changes in the GGEP open space before and after the start of the GGEP project, split-zoning, SRA rates, and natural resource use and contestations;

- The eThekwini Municipality personnel provided information on the GGEP open space, land ownership, split-zoning, GGEP project and funding for the GGEP project;

- The Real Estate Agents provided background information on property value trends before and after the 2008 global recession, and behaviour of property buyers and sellers in GGEP;

- The GGEP project manager provided insight into the ecosystem management practices in the GGEP;

- Tshelimnyama traditional healers' leaders provided insight into the natural resource harvesting practices used by Tshelimnyama traditional healers; and,

- Silverglen personnel (education officer) provided information on the education programmes initiated by the eThekwini Municipality in helping to curb unsustainable harvesting of natural resources for medicinal purposes.

Table 4.4 highlights the research methods and techniques employed in this study. It also provides insight into stakeholder groups targeted by each technique and the numbers of stakeholders that participated. The composition of the key informant interviews in this study is also highlighted in Table 4.4.

Table 4.4: Research techniques, methods, and research areas

Instrument	Key Research area	Method	Stakeholder group and number targeted	Appendices
Questionnaire	Changes in resource abundance, perceptions of stakeholders	Perceptual analysis	150 property owners however only 75 responded	1
Focus group discussion (size eight participants)	current uses of resources	Perceptual analysis, Focus group discussion guide and Participatory approaches of mental mapping	Three focus group discussions Tshelimnyama community members traditional healers One focus group discussion with Tshelimnyama general community members One focus group discussion with GGEP property owners	2
Key informant interviews	Follow up on issues arising from other instruments	Semi structured interview guide	Three property owners, One eThekwini Municipality personnel, Two Real Estate Agents, One GGEP project manager Two Tshelimnyama traditional healers' leaders One Silverglen personnel (education officer)	3
Observations	Current uses of natural resources	Three field resource observations 22 February 2011 18 November 2012 11 December 2012	GGEP open space	Not applicable
Document analysis	Impact of the GGEP project on property value	Proximate premium analysis	GGEP properties	Not applicable
	GGEP management activities	Calculating the area of changes within the GGEP open space	GGEP open space	

4.4.6 Primary data analysis

The quantitative data analysis was done using SPSS 21.0. Thus, the data was inputted into spreadsheets using codes which were compiled during the construction of the questionnaire. The data was later cleaned using SPSS to check for repetitions and other errors. It was also cleaned by going through all the categories of variables to ensure that all the codes were correct. The data was then analysed using descriptive statistics generating frequency tables, graphs and charts. The resulting data was discussed thematically.

Qualitative data was analysed using thematic analysis. Thematic analysis is defined by Braun and Clarke (2006: 79) as "a method for identifying, analysing and reporting patterns within data [while] describing various aspects of the research topic [and] describing [the] data set in rich detail." Guest *et al.* (2012) reiterate that thematic analysis looks for ideas implied or explicitly expressed in the data. The data emanating can then be presented in rich narratives or can be displayed graphically to show relationships between variables (Guest *et al.,* 2012). In this study, thematic analysis was used to gather all the data collected using qualitative techniques as well as in merging qualitative and quantitative data. After transcribing the focus group discussions and interviews, the data was read through in trying to identify the major themes emerging from the data. The themes identified in relation to the set objectives of the study are shown in Table 4.5.

Table 4.5: Themes emerging from qualitative data in relation to the set objectives

Objectives	Themes
To ascertain the occurrence of changes in natural resource abundance during the period 2010 to 2012.	Management activities
To assess the current uses of natural resources in the GGEP in relation to the extent to which resources are extracted.	Natural resource use
To assess various stakeholders' perceptions towards the GGEP project.	Funding for the GGEP project Communication
To ascertain the extent to which security measures affect the stakeholders' perceptions of the interactions with the community and the GGEP project.	Natural resource use and access contestations Natural resource harvest practices Environmental education and awareness
To determine the impact of the GGEP SRA on property values or surrounding development.	Natural resource use

Once the themes were identified, the researcher then grouped the bulk of the data under each of the relevant themes developed. The data was analysed to check for trends or patterns and also to bring

coherence of ideas in answering the research questions. It was at this point that the qualitative and quantitative data was merged and further analysis conducted with reference to the literature.

4.4.7 Secondary data analysis

Analysis of secondary data was conducted using change analysis of aerial photographs and proximate premium analysis which utilised the Tax Valuation Roll data. The aim was to understand the changes that have occurred in the GGEP open space ecosystems since the GGEP project started implementing management activities in 2010. In addition, proximate premium analysis was conducted to understand the economic impact of the GGEP on proximate properties.

4.4.7.1 Change analysis methodology

According to Garzon-Lopez *et al.* (2013: 308), remote sensing techniques "....offer potential alternatives for mapping species distributions over large areas." One of such remote sensing techniques is aerial photo interpretation. Aerial photographs are an important resource that has long been used and are still used in environmental management to detect change in land use and land cover (Roxburgh, 2008; Morgan *et al.*, 2010; Bartholomeus and Kooistra, 2012). The use of aerial photographs in remote sensing is becoming valuable in environmental change studies due to their high level of spatial and radiometric resolution (Gienko *et al.*, 2008; Morgan *et al.*, 2010). Thus, the high resolution images provided by aerial photographs enable researchers to identify objects; land use/land cover either at a small or large-scale and availability of images for long periods of time (Roxburgh, 2008; Morgan *et al.*, 2010). As such, aerial photographs are a valuable source of data for conducting change analysis or time series analysis (Gienko *et al.*, 2008; Roxburgh, 2008). In order to conduct change analysis, two main methods are employed (Gienko *et al.*, 2008: 53),

i. Inherent use of the primary image data (mostly for visual detection of changes) such as pseudo-colour composites, dynamic toggling, basic computer-assisted methods such as image subtraction and differencing.
ii. Use of derived products for advanced quantitative change analysis GIS-based vector analysis of digitised time series imagery and comparison of results of automated image classification either in raster or vector form.

However, the most common method for detecting environmental change quantitatively is the use of "GIS-based vector analysis of digitised time series of imagery" (Gienko *et al.*, 2008: 54-55). This study adopted

the GIS-based vector analysis of digitised time series of imagery to map out and quantify the changes that occurred in the GGEP since the implementation of the GGEP project in 2010 to 2012. Thus, two aerial photographs for the year 2010 and 2012 were used. The rationale for using these two reference years is that 2010 is the start year for implementation of restorative activities while 2012 was supposed to be the last year for the pilot phase of the GGEP project. Since the end of the pilot phase should have culminated in a referendum by all property owners to decide whether the project would continue beyond the pilot phase or not, it was expected by eThekwini Municipality and the management team that activities conducted between 2010 and 2012 would be sufficient to convince property owners to vote in favour of continuing with the project.

Thus, two geo-referenced digital colour aerial photographs were obtained from eThekwini Municipality's EPCPD for the years 2010 and 2012. The images were projected using the Universal Transverse Mercator and taken at a scale of 1:469 503. The following steps were followed:

i. Since digital aerial photographs were used, the various land use/land cover were mapped out within the GGEP for each photograph. Various land use/land cover polygons representing the different classes of land use/land cover were mapped out. The land use/land cover classification used was adopted from the eThekwini Municipality classification system used for the GGEP as shown in Table 4.6. This classification system was used for easy comparisons in data analysis of data computed using GIS change analysis and secondary data compiled by the GGEP management.

Table 4.6: Land use/land cover Classification for the GGEP
(Adapted: GGEP Management Activities Maps, 2010)

No.	**Land-Uses/Land-Cover**	**Description according to mapping criteria**
1	Suburb	Built up residential area including utilities and facilities such as schools
2	Forest	Trees with touching canopies
3	Grassland	Areas without trees
4	Woodland	Trees with canopies that do not touch mostly composed of gum (*Eucalyptus species)*
5	Wetland	Water bodies including marshlands/swampy areas

ii. The resultant land use/land cover maps (from 2010 and 2012 photographs) were used to calculate the area of each polygon.

iii. The land use/land cover classes were aggregated to get the total area for each class and two tables were generated for each aerial photograph.

iv. The total area of each class was compared for each aerial photograph to assess the change.

GIS maps were generated for the years 2010 and 2012 in order to obtain visual impressions of the ecosystem units mapped in the aerial photograph analysis. The maps depicted the changes computed in hectares for each ecosystem thus visually conveying the changes in the GGEP open space observed for the period 2010 to 2012.

4.4.7.2 Property value analysis: proximate premium analysis

This study employed the proximate principle proposed by Crompton (2004: 9) as described in Tables 4.7 and 4.8. As stated previously, the Tax Valuation Roll provided the main data required for analysis while Crompton's (2004) proximate principle method provided the open space quality scale to use in the analysis.

Table 4.7: Open space quality scale for determining proximate premiums
(Adapted: Crompton, 2004: 9)

Open space Quality	Description of open space	Rating (%)
Unusual Excellence	A signature open space; exceptionally attractive; natural resource based; distinctive landscaping and/or topography; often mentioned in sales advertisements for nearby properties; well maintained; genuine ambiance; engenders a high level of community pride and "passionate attachment."	15
Above Average	Natural resource based; has charm and dignity; regarded with affection by the local community; pleasant, well maintained.	10
Average	Rather nondescript; not really "noticed" by the local community; adequately maintained; no distinguishing features.	5

The percentages given in Table 4.7 rates the type of open space based on its quality as per description of open space given. Thus, rating the open space quality is the first step towards computing the value of properties attributable to the open space. After determining the quality of the open space, the researcher followed the procedure for computing the property value attributable to the GGEP open space provided in Table 4.8.

Table 4.8: Steps in calculating an estimate of the impact of open spaces on the property tax base (Adapted from Crompton, 2004: 9)

Number	Steps
1	Identify and grade the open space quality on the five point scale shown in Table 4.3.
2	Draw a 3 block or 152 metres travel radius around the open space, which was classified in the three highest quality categories.
3	Aggregate the assessed value of all single-family homes within each of the three block (152 metres) radii, using data from the local tax assessor's office.
4	Apply the percentage premiums suggested above (15%, 10% or 5%) to the aggregate value calculated in step 3.
5	Aggregate the premium calculated in step 4. This figure represents an estimate of the overall change in property value attributable to the open space examined.
6	Multiply the aggregated premiums calculated in stage 5 by local property tax rates imposed by all taxing entities to estimate the total positive impact of parks on the property tax base.
7	Compare the aggregated premium calculated in stage 6 to: • The annual debt charges incurred in the acquisition and development of those parks and open spaces; and • The annual cost of maintaining those parks and open spaces.

The proximate principle methodology for determining the value of properties attributable to an open space as proposed by Crompton (2004) provides an easy way when compared to the hedonic methods. This is because the hedonic methods require "considerable skill in computer mapping and the use of statistical techniques, and it is time consuming" (Crompton, 2004: 19). Despite that the proximate principle only provides a rough estimate of the actual impact, it is a good method to use in communities requiring an understanding of the impact of an open space on property value (Crompton, 2004).

4.4.8 Integration

This refers to the stage at which the quantitative and qualitative techniques are merged in order to answer the research questions (Ivankova *et al*., 2006). The researcher can choose to integrate the research techniques at the beginning of the research or during data analysis (Tashakkori and Teddlie, 2003). In this study, quantitative and qualitative data were merged during data analysis using the thematic analysis. Thus, this study utilised focus group discussions, key informant interviews, observations and document analysis as qualitative techniques. The data yielded by qualitative techniques was merged with the quantitative data from questionnaires, GIS analysis of aerial photographs and proximate premium analysis. Qualitative data complemented quantitative data analysis by providing detail and in-depth understanding of computed data.

4.5 Limitations of the study

The main limitations of the study pertain to hurdles encountered in data collection for all identified stakeholders which include the GGEP property owners, Tshelimnyama community members and commercial harvesters. The questionnaire survey was designed to solicit responses from the entire population of property owners in the GGEP, however, attempts to get responses from everyone failed. The first attempt used posting system by leaving questionnaires in each residential post box of the property owners but there was no response from everyone. This is despite that before the questionnaires were posted, an announcement in the GGEP newsletter was made introducing the researcher and indicating that the questionnaires would be posted. The second attempt was sending the questionnaires through email and this method yielded only 18 responses out of the 143 targeted property owners. The third attempt yielded nine responses through administering the questionnaire telephonically while the last telephonic attempt used a research assistant of a different race and it yielded 48 responses. Altogether, a total of 75 responses were obtained which were analysed for this study. Table 4.9 gives an overview of the reasons given by the property owners for not participating in the questionnaire survey

Table 4.9: Reasons given for not participating in the questionnaire survey

Reasons given	Number of property owners
Not available or too busy	34
Unwell	2
Do not live on the property	14
Wrong number	11
On holiday	2
Only speaks Afrikaans	1
Not interested	4

All the property owners were called telephonically and those that did not participate gave various reasons given in Table 4.9 including unavailability, illness, while others were not interested in participating in the study. Further, getting focus group discussion participants was also difficult as initially planned. A focus group discussion was planned for each residential area but only one materialized which was made up of participants from all the residential areas.

In the case of the Tshelimnyama community, traditional healers were skeptical of being part of this study indicating that previous researchers obtained valuable information about medicines and practices of

traditional healers which they used to make money for themselves. Some traditional healers indicated that they would not give any information out because the researcher would be better off than the traditional healer after obtaining the degree for which the information was solicited. As a result of the screening process involved in getting participants through the traditional healers' association, data collection was delayed by four months.

The researcher also tried to solicit responses from commercial harvesters but efforts to secure interviews with this stakeholder group proved futile since traditional healers could not provide the identity of the commercial harvesters. A follow up was made to the Berea market to try and find the people who supply medicines but the traders at the market mentioned that the suppliers come randomly and at early hours of the day for short periods of time. Due to dwindling resources and security concerns in trying to acquire responses from this stakeholder group, the researcher did not pursue this stakeholder group further.

4.6 Conclusion

The GGEP pilot project is an effort by the eThekwini Municipality to encourage ecosystem based biodiversity conservation falling outside Protected Areas in urban areas. In the GGEP project, this is done by accentuating the importance of the ecosystem services and the aesthetic value of the resources found in the GGEP open space. The Municipality is also promoting the importance of some of the resources in the GGEP open space such as endangered species and the Umhlatuzana Rock Shelter as a historical site. Education and awareness programmes are also used in surrounding schools to promote further use and conservation by the local communities. The combination of biodiversity and history of the GGEP open space is what makes the GGEP open space a unique resource warranting conservation. The GGEP open space has potential for future resources in research, education, and human well-being. However, unsustainable resource extraction practices, erosion and invasive alien species are threating the GGEP open space resources of degradation. As seen on the red list data, numerous species are threatened with extinction if the current threats are not addressed. It is envisaged therefore that this study will also contribute to the conservation efforts currently being undertaken by highlighting the state of the GGEP resources before and after the start of the project, natural resource contestations and the perceptions of the stakeholders towards the project.

The main stakeholders that this study focuses on include the property owners, eThekwini Municipality, the Tshelimnyama community members and commercial harvesters. Using the research strategies outlined in this chapter, the researcher was able to collect the required data to answer the main research

questions of the study. Despite the challenges faced during the course of the study, the data collected was adequate to complete the study as well as produce conclusive evidence and recommendations.

CHAPTER FIVE

DATA PRESENTATION AND ANALYSIS

5.1 Introduction

This chapter explores the processes of the GGEP project elaborated through its management practices implemented in the GGEP open space. The chapter presents findings obtained from a questionnaire survey (GGEP property owners), key informant interviews with eThekwini Municipality personnel, property owners and members of the GGEP project management, GGEP project manager, estate agents, Silverglen education officer (Silverglen is an eThekwini Municipality open space and centre which specialises in education and awareness on cultivation of medicinal plants), GGEP education programme manager, and the leaders of Pinetown and Tshelimnyama Traditional Healers' Associations. In addition, findings from focus group discussions with GGEP property owners and Tshelimnyama community members are presented. The presentation and analyses of the findings are done within the context of the political ecology and stakeholder approaches.

Guided by the stakeholder theory, the chapter is divided into three sections: stakeholder identification; biographical information which is further divided into the Tshelimnyama community members and GGEP property owners; and, stakeholder management which is composed of the following sub-headings:

- Changes in natural resources during the period 2010 to 2012
- Current uses of natural resources
- Stakeholder perceptions towards the GGEP project
- The impact of GGEP security measures on stakeholder perceptions
- The impact of the GGEP project on property value or surrounding development

The stakeholder identification section presents and analyses findings from the GGEP stakeholder identification which was conducted to identify relevant stakeholders to use in this study. This provided a foundation for understanding GGEP open space management practices. Further, the biographical

information presents and analyses the general profiles of the stakeholders used in this study. Lastly, the stakeholder management presents and analyses findings based on the themes listed above, which were guided by the research objectives and questions.

5.2 Stakeholder identification

In this section, stakeholder attributes proposed by Mitchell *et al.* (1997: 874) provide a basis for stakeholder identification. Using the stakeholder attributes of power, legitimacy and urgency the following stakeholder groups can be identified:

- Latent stakeholder: dormant, discretionary, and demanding stakeholder
- Expectant stakeholder: dominant, dependent and dangerous stakeholders
- Definitive stakeholder

For the purpose of this study, a matrix was developed in identifying stakeholders as shown in Appendix 4. Various stakeholders were identified, however, for the purpose of this study, only stakeholders whose actions could affect management of the GGEP open space and whose actions call for immediate attention were considered. The results of the stakeholder identification are presented in Table 5.1.

Table 5.1: Stakeholder groups of the GGEP identified for this study

Stakeholders identified	Stakeholder type
GGEP property owners eThekwini Municipality	Definitive
Tshelimnyama community	Dependent
Commercial harvesters	Discretionary

Table 5.1 highlights the stakeholders identified for this study. Three stakeholders groups used in this study include definitive stakeholders composed of the GGEP property owners and the eThekwini Municipality, dependent stakeholders composed of the Tshelimnyama community members, and discretionary stakeholders composed of the commercial harvesters. The eThekwini Municipality and the GGEP property owners manage the GGEP open space through provision of technical and financial resources. The eThekwini Municipality owns land in the GGEP open space while the property owners own homes (some of the property owners also own land in the GGEP open space). As explained in the

conceptual and theoretical framework underpinning this study, Mitchell *et al.* (1997) argue that definitive stakeholders show all characteristics of power, legitimacy and urgency. In this study, the GGEP property owners and eThekwini Municipality have power and a legitimate claim on the GGEP by virtue of their legal ownership and management role. This therefore makes any claim concerning the open space urgent. On the other hand, the dependent stakeholders (Tshelimnyama community composed of traditional healers and general community members) have no power to impose their actions on the open space natural resources. However, by virtue of proximity to the open space, they have a legitimate claim in accessing the GGEP open space and therefore their actions can call for urgent attention. Lastly, discretionary stakeholders (the commercial harvesters) have no power to impose their actions on the open space and lack urgency in their claim over the GGEP open space. However, they have a legitimate claim on the GGEP open space by virtue of their need to earn a livelihood. Thus, this chapter's data presentation and analysis focusses on the eThekwini Municipality, GGEP property owners, Tshelimnyama community and commercial harvesters.

5.3 Demographic information

This section starts by describing the characteristics of the two communities sampled for this study: the Tshelimnyama community and the GGEP property owners. The orientation of much of the discussions in this study is towards the GGEP property owners as the definitive stakeholders of the GGEP project since this group is involved in managing the GGEP open space. Thus, the GGEP property owners' interactions with the GGEP open space, Tshelimnyama community and commercial harvesters, is important in understanding natural resource management practices in GGEP open space.

5.3.1 Tshelimnyama community members

This section presents the Tshelimnyama community participants' demographic profile. It focuses on organisation of the traditional healers as well as their profile in terms of gender, age, race, level of education attained and income. These aspects are important in understanding natural resource harvesting practices and dependencies among the Tshelimnyama community.

5.3.1.1 Organisation of the traditional healers

Findings from focus group discussions with the Tshelimnyama traditional healers are required to organise into associations and register within their areas of residence. For instance, the Tshelimnyama traditional

healers register under Tshelimnyama community at a local level and fall under the Pinetown Association regionally. According to findings from a key informant interview with the leader of traditional healers, the Department of Health requires that traditional healers be registered with their regional association so that the practices of traditional healers can complement the practices of the Department of Health. This was highlighted in the following statement:

> *What happened is that Zweli Mkhize* [Premier of KwaZulu-Natal Province until August 2013] *became involved with izangoma as a parliamentarian to bring traditional healers together with people like Manto Shabalala Msimang* [former Health Minister] *from the Department of Health to say let's work together in fighting diseases such as TB* [Tuberculosis] *and HIV/AIDs* [Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome] *because it's one thing that a person will take ARVS* [antiretroviral] *and on the other side isangoma will say that that person needs to phalaza* [vomit] *which removes the pills from the system of a sick person hence that person will not get better*.
>
> (Traditional healer leader 1)

By being a member of the Association, traditional healers are able to receive training on various issues some of which are highlighted in the following statement:

> *….in fact we have collaborated with the Department of Education that teaches izangoma to read and write. If isangoma sees that this person has TB or Jaundice for instance, and because they have been taught diseases symptoms, they will refer those people to the clinic*.
>
> (Traditional healer leader 1)

As indicated in the statement quoted previously, the Traditional Healers' Association is an important platform for engaging traditional healers in various discourses such as health and literacy. The same platform has potential to be used in environmental discourses such as sustainable harvesting practices as well as *in situ* and *ex situ* conservation. It was through the Association, particularly the Pinetown Association, that part of this study was made possible. The Association controls information sharing, especially from their side, and therefore researchers are expected to get explicit permission (after a screening process) to interact with the traditional healers.

5.3.1.2 Gender

The Tshelimnyama community sample provided information to understand the processes of natural resource access and use in the GGEP open space. The gender composition of the sample is presented in Table 5.2.

Table 5.2: Gender composition of the Tshelimnyama sample participated in interviews and focus group discussions (n=39)

Tshelimnyama community sample composition	**Gender composition**			
	Male		Female	
	Number	%	Number	%
Traditional healers (*izangoma*)	2	6.2	30	93.8
*General community members	7	100	0	0.0

*Tshelimnyama community members not practicing traditional healing or any other form of healing relevant to this study

The majority of the traditional healers were female (93.8%) with only 6.2% male. However, the gender composition of the non-traditional healers was all male. Noteworthy is that the gender composition of the traditional healers is not reflective of the gender composition of the group within this community as the sample was selected conveniently, that is, only traditional healers who volunteered participated and in this case, the female gender was more responsive to the call for participation. However, an interview with one of the traditional healers' leaders revealed that generally traditional healers (*izangoma*) are female while most males are *izinyanga* as captured in the following statement:

> *…there are few male izangoma, what happens is that most males are izinyanga*. (Traditional healer leader 1)

The interview further revealed that the difference between *izangoma* (*isangoma* - singular) and *izinyanga (inyanga* - singular*)* is that *izangoma* are born with the ability to communicate with ancestors and thus can consult with ancestors on any misfortune such as illness. On the other hand, *izinyanga* are trained to know medicines for various ailments and thus are specialised in medicines. One of the key informants indicated that traditionally, people would consult with *izangoma* who would then be referred to *izinyanga* for medicines, but these roles have been blurred such that *izangoma* can consult and provide medicines. However, *izinyanga* cannot consult or communicate with ancestors. These findings are supported by Devenish (2006), who further states that *izangoma* are diviners while *izinyanga* are herbalists. The participants of this study were all *izangoma* though not purposively selected.

5.3.1.3 Age

The age composition of the participants varied between 31 to 65 years with an average of 50 years. Figure 5.1 presents the age composition of the participants.

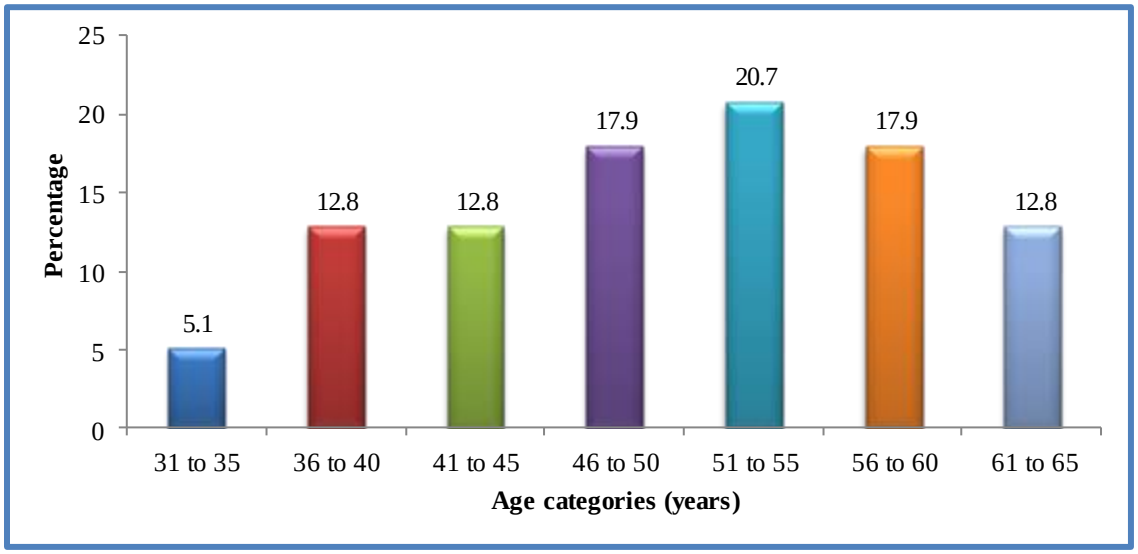


Figure 5.1: Age composition of the Tshelimnyama community participants

A comparatively high percentage of the participants (20.7%) were in the age group 51 to 55 years followed by the age groups 56 to 60 and 46 to 50 years which made up 17.9% of the participants each. Further, the age groups 36 to 40, 41 to 45 and 61 to 65 years all made up 12.8% of the participants each. The lowest percentage of participants (5.1%) was in the age group 30 to 35years. These findings do not reflect age composition of the traditional healers in Tshelimnyama. As indicated previously, not all traditional healers are registered with the Pinetown organisation and additionally, participation was entirely voluntary.

5.3.1.4 Race

All the Tshelimnyama participants were Black. This is reflective of the race composition of the Tshelimnyama community inhabitants currently and historically. Findings obtained through interviews with traditional healers reveal that the Tshelimnyama traditional healers have lived in the community with their parents for many years. This finding is consistent with the Pinetown Museum records which indicate that Black communities have occupied Tshelimnyama since the pre-colonial period (Ross, 1995) while the eThekwini Municipality (1992:1) indicates that 69% of inhabitants of Tshelimnyama were born there.

5.3.1.5 Level of education

The levels of education attained by the Tshelimnyama community members are presented in Figure 5.2.

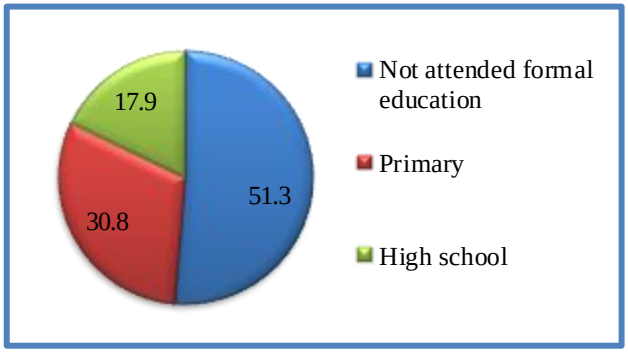


Figure 5.2: Level of education attained

The majority of the participants (51.3%) did not have any formal education while 30.8% of the participants indicated that they attended primary education. The lowest percentage of participants (17.9%) completed high school education. Previously presented findings on organisation of the Tshelimnyama traditional healers highlight that literacy is a concern among Tshelimnyama traditional healers. These findings reflect more of the situation among Tshelimnyama traditional healers as highlighted in a previous quote stating that the Department of Education has collaborated with the Traditional Healers' Association in teaching the members how to read and write. Education is important in comprehending and acting towards managing environmental problems (Shobeiri *et al.*, 2006; Uzunbolyu *et al.*, 2009; Chen *et al.*, 2011). The lack thereof has implications for conservation efforts directed towards groups of people with little or no formal education.

5.3.1.6 Income

All the participants in the focus group discussions and interviews indicated that traditional healing was their main source of income. However, they could not provide an amount as to how much they make monthly because their income was based on whether they had or did not have patients during a month.

> *Sometimes you find that you don't make any money in a month because there is no one coming for consultations…but other times you find one or more people come. So I can't say how much money I get every month because it is not the same you see.*
> (Traditional healer 7)

Nevertheless, it was revealed that there are traditional healers who have formal jobs, but such traditional healers rarely or never attend the meetings as highlighted by one of the participants:

> *....some are working and you find that those who are working come to register and never really attend the meetings because when we are meeting they are at work.*
> (Traditional healer leader 1)

Since the findings highlight that there are traditional healers who are employed, the fact that the participants of this study were not employed and had no stable income is not reflective of the employment and income status of the traditional healers in Tshelimnyama. Considering that the traditional healers' income was erratic, the researcher probed how they survived without reliable income. To this end, all the traditional healers (32) indicated that at least one member of their household was a recipient of a social grant or was employed.

> *I depend on my late son's two children's social grants and my other son also gives me a small amount of money on some month-ends. Apart from that I do not work; my ancestors have kept me away from working. The only way that I make financial gain for myself is through being isangoma. I tried to get an elderly grant but they chased me away.*
> (Traditional healer 2)

Traditional healing activities are important for income generation for the participants. The income generated is used to meet the household needs and in times when income generated is inadequate to meet the needs, family members' income sustain the households. This finding is supported by Statistics South Africa (2014) which asserts that social grants have become a major source of livelihood in South Africa.

5.3.2 GGEP property owners

The following section examines the GGEP respondents' demographic characteristics and focuses on place of residence, gender, age, race, level of education attained, occupation, level of income, length of stay in the GGEP and the respondents' awareness of the GGEP project. The biographical information provides background information for understanding various aspects of the analysis in this chapter.

5.3.2.1 Gender

The gender composition of the respondents is depicted in Figure 5.3. However, it was not a requirement for this study to target the given genders in Figure 5.3 but the aim was to solicit views from a representative of each property regardless of gender.

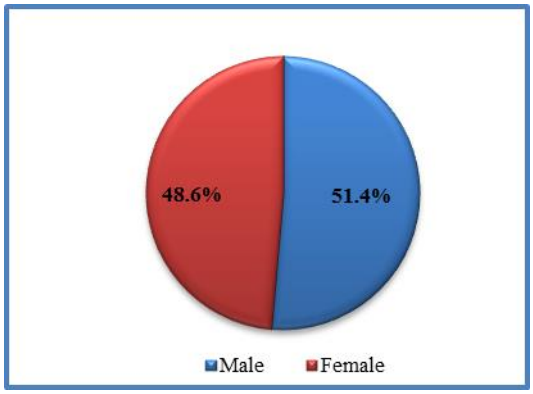


Figure 5.3: Gender composition of the GGEP respondents (n = 75)

Figure 5.3 shows that slightly more than half of respondents were males (51.4%) while slightly less than half were females (48.6%). However, these findings do not reflect the ownership of the property since in a family, a property could be co-owned; consequently any adult living in a property could have responded. However, findings from the focus group discussion revealed that nine out of ten property owners serving on the GGEP management committee were male. The observed high number of males in the GGEP management team can be related to the general trend globally of more males taking up decision-making positions (Helfat *et al.*, 2006; Burke, 2009; Davidson and Burke, 2011).

5.3.2.2 Age

The age distribution of the GGEP respondents is indicated in Figure 5.4. The figure shows that the respondents' ages varied between 21 and 83 years with an average age of 52 years.

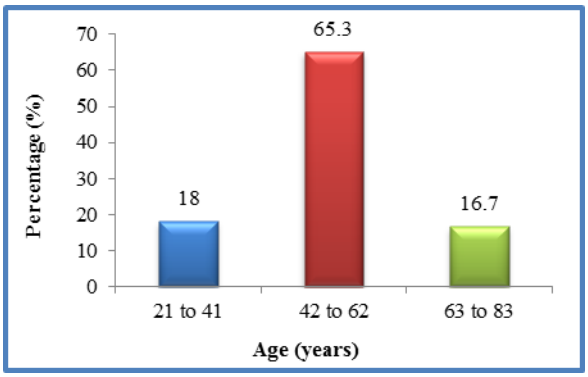


Figure 5.4: Age of respondents (n = 75)

The majority of the respondents (65.3%) were aged between 42 and 62 years. Furthermore, 18% of the respondents were aged between 21 and 41 years, and 16.7% between 63 and 83 years. Findings from an interview with a key informant working as an estate agent in the GGEP revealed that people looking to buy property in the GGEP are families with adults between the ages of 30 to 60 years. This trend can be associated with the lifestyles of people within the age group of 30 and 60 years since they are mostly working, starting up families or have families and thus would want to raise their children in a neighbourhood with 'good' amenities such as open spaces. According to the estate agent, the age group 30 to 60 years is also concerned about environmental issues and thus appreciate a 'country-look' within urban spaces. This result is consistent with Mendoza's (2006) study which revealed that younger people below 63 years tend to participate more in environmental programmes. Nordlund *et al.* (2010) also assert that people who grew up during times when environmental issues were prominent are more likely to participate in environmental programmes or act environmentally responsible. On the other hand, the current study through GGEP focus group discussions and key informant interviews found that the age group 63 to 83 years may not actively show environmental concern due to old age and lack of disposable income as most of them would be retired. This is evident from the finding that 75% of respondents who stated that they were retired were in the age group 63 to 83 years. Contrary to this study's findings, De Pelsmacker *et al.* (2006), Sudbury and Simcock (2010) and Riley *et al.* (2012) demonstrate that people older than 50 years had more disposable income, were more environmentally conscious and acted environmentally responsible. This result has implications in the development and tailoring of conservation strategies such as conservation projects, education, awareness and managing stakeholder groups of various ages.

5.3.2.3 Race

The GGEP respondents comprised 98.6% White and 1.4% Black. The racial composition of the GGEP respondents is supported by Boersema (2011) who asserts that post-apartheid, there has been an increasing trend for White South Africans to live in security estates and enclosed communities. Thus, the high percentage of White respondents could be attributed to the high number of white residents in selected peri-urban areas. Researchers have cited various reasons for the high number of White residents living in peri-urban, secure and enclosed communities. For instance, Boersema (2011) cites fear of crime, white racism and privilege as probable reasons. On the other hand, Landman (2004) and Besteman (2008) cite good financial investment, proximity to nature, sense of community, social control and identity, and integration of living and well-being through sports facilities and nature conservancies as other reasons. In terms of natural resource use, the development of security estates or enclosed communities excludes non-

residents from benefiting from use of natural resources such as open spaces. This is supported by Lemanski (2004) who asserts that security or enclosed estates can lead to social exclusion and in the case of natural resource access and use, estates exclude the public from accessing and using open spaces. This has implications in fostering human well-being of the people without access to such open spaces.

5.3.2.4 Level of education attained

All the GGEP respondents indicated having attained some form of education. However, the levels of education attained varied as depicted in Figure 5.5.

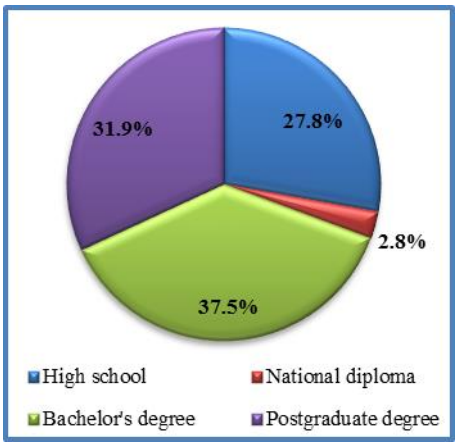


Figure 5.5: Level of education attained (n = 75)

The highest percentage of respondents (37.5%) had attained a bachelor's degree while the lowest percentage (2.8%) had attained a national diploma. Further, 31.9% of the respondents attained a postgraduate degree while 27.8% completed high school. These results reveal that all the respondents had attained a high school qualification with the majority having attained tertiary education. This finding can be viewed as a positive factor for conservation efforts in the GGEP project since research shows that the level of education attained, among other social factors, is important to environmental conservation as highlighted in studies such as Knight *et al.* (2010), Moon *et al.* (2012) and Raymond and Brown (2010). Education exposes people to environmental knowledge and therefore more educated people are more likely to participate in environmental programmes as they develop a sense of responsibility towards the environment (Marquart-Pyatt, 2008; Chen *et al.*, 2011). This finding therefore has implications on conservation efforts involving groups with different levels of education attained.

5.3.2.5 Occupation and Income group

This part of biographical information presents and analyses findings on the GGEP respondents' occupation and income group. Table 5.3 presents the occupation and income groups of the respondents.

Table 5.3: Occupation and Income Group of the GGEP respondents (n = 75)
mean income = R 416 666.7

Occupation	Percentage		Income Group	Percentage
Doctor	1.4		Below 100 000	1.3
Student	1.4		100 000 to 200 000	5.3
Book Keeper	2.8		200 000 to 300 000	2.7
Self-employed	5.6		300 000 to 400 000	13.3
IT Specialist	1.4		400 000 to 500 000	12.0
Supply Chain Director	1.4		500 000 and above	21.3
Black Economic Empowerment Consultant	1.4		No response	44.1
Financial Manager	1.4		**Total**	**100.0**
Architect	1.4			
Retired/Pensioner	5.6			
Accountant	1.4			
Financial Advisor	1.4			
Engineer	4.2			
Consultant Agronomist	1.4			
Investment Manager	1.4			
Estate Agent	2.8			
Not employed	1.4			
No response	62.2			
Total	**100**			

There was a low response rate especially for occupation with 62.2% of the respondents choosing not to respond. In addition, 44.1% of respondents chose not to provide their level of income. In keeping with research ethics, the researcher did not insist for a response since the respondents indicated that they felt that their occupation and income were confidential information. Thus, the following discussion is based on the GGEP respondents who provided their occupation (37.8%) and income group (55.9%).

The highest percentage (5.6%) represents self-employed respondents while retirees and/ or pensioners also made up 5.6% of the respondents. In addition, 4.2% accounted for engineers while estate agents and book-keepers made up 2.8% each. A number of occupations made up the least composition of the respondents of 1.4% each and include doctor, student, information technology specialist, supply chain director, Black Economic Empowerment consultant, financial manager, architect, accountant, financial advisor, consultant agronomist and investment manager. Another 1.4% respondent was unemployed. It is evident from Table 5.3 that among those who provided their occupation most were professionals which is also evident from the educational level attained in Figure 5.5.

With respect to income, the highest percentage of respondents (21.3%) was found in the income group earning R500 000 and above per annum while 13.3% accounts for the income group earning between R300 000 to R400 000. In addition, the income group earning between R400 000 to R500 000 made up 12% of the respondents while 5.3% was made up of the income group earning R100 000 to R200 000. The lowest percentage (1.3%) was that of the income group earning R100 000 and below per annum. The range of the income group is R500 000 while the mean is R243 056.

Despite the low response on occupation and income, these aspects are important in fostering conservation as demonstrated by a study conducted by Chen *et al.* (2011) who found that people get more exposed to environmental values through their employment. Level of income is also seen as an important factor in pro-environmental behaviour in the sense that environmental concerns may be seen as luxuries which people with high levels of income are able to engage in (Marquart-Pyatt, 2008; Franzen and Meyer, 2010; Chen *et al.*, 2011; Pampel and Hunter, 2012). The occupation or levels of income together with education levels attained are important in conservation programmes and in particular, the GGEP project. Thus, the implication of this extends to management of stakeholders with varying levels of income.

5.3.2.6 Place of residence and length of stay in the GGEP

Findings from the focus group discussion with the property owners and key informant interview with eThekwini Municipality personnel revealed that the GGEP open space is surrounded by various suburbs, however, only properties sharing a boundary with the GGEP open space make up the GGEP project. The place of residence of the respondents is presented in Figure 5.6.

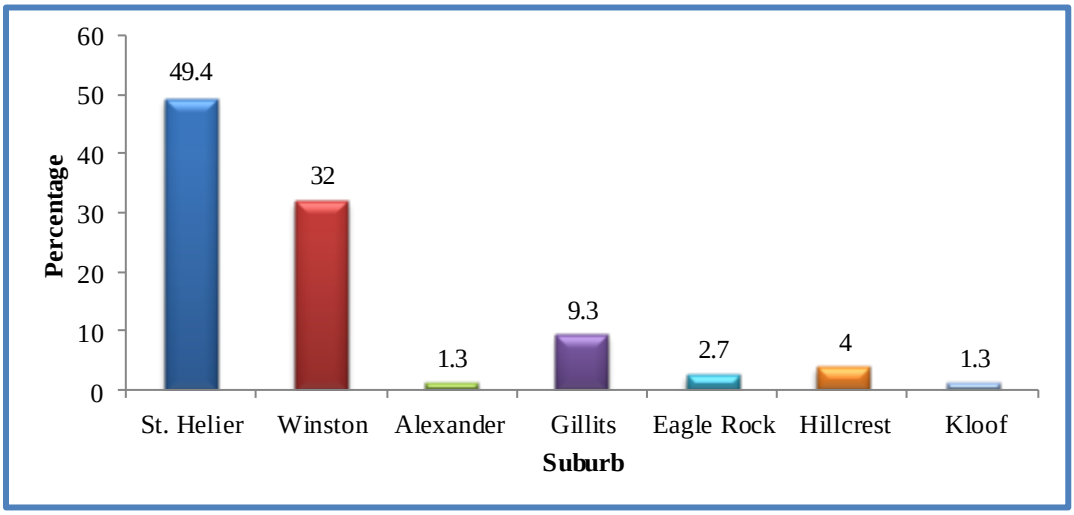


Figure 5.6: Respondents' place of residence

Figure 5.6 shows that the highest percentage (49.4%) of respondents resided in St. Helier followed by 32% of respondents who resided in Winston and 9.3% in Gillits. Four percent of the respondents resided in Hillcrest, 2.7% in Eagle Rock while 1.3% resided in Alexander and another 1.3% in Kloof.

In addition to place of residence, the respondents were asked to state the length of stay in the GGEP. Figure 5.7 shows the length of stay in the GGEP of the respondents.

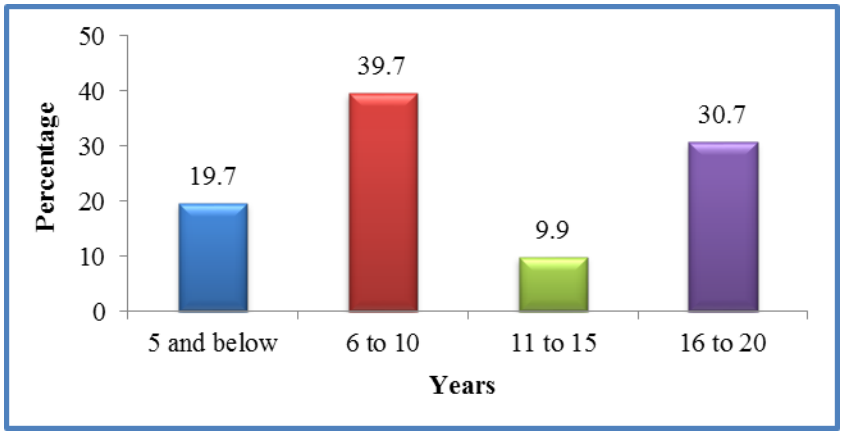


Figure 5.7: Length of stay in the GGEP of the respondents

The highest number of respondents (39.7%) has lived in the GGEP for 6 to 10 years followed by 30.7% of the respondents who have lived in the GGEP for 16 to 20 years. In addition, 19.7% of the respondents have lived in the GGEP for 5 years and below while 9.9% has lived in the GGEP for 11 to 15 years.

The place of residence and length of residence are important aspects for understanding perceptions of the GGEP property owners. Thus, analyses are made in section 5.4.1 under changes in natural resources in the period 2010 to 2012 and also in section 5.4.4.2 under natural resource management contestations in the GGEP project.

5.3.2.7 Stakeholders' understanding of the GGEP project

All the GGEP respondents stated that they were aware of the GGEP project. In addition, key informant interviews with the GGEP management revealed that consultations with property owners were held prior to formation of the GGEP project. This is more so in light of the additional SRA tax that is levied on property owners for management of the GGEP. This indicates that at least the respondents had knowledge about the GGEP project, a finding consistent with provisions of the Municipal Property Rates Act 2004 for establishing a SRA (Republic of South Africa, 2005). Thus, it can be deduced that initial preparations for establishing the GGEP SRA included consultations with the property owners to gain majority support

for the project. As evident from the GGEP focus group discussion findings, not all property owners were in favour of the GGEP project. This aspect of supporting the GGEP project is further discussed in terms of future sustainability of the project in section 5.4.4 under perceptions of stakeholders.

The findings from focus group discussions with the Tshelimnyama community revealed that all the participants had no knowledge of the GGEP project but were aware of the prohibitions on natural resource access and extraction. One of the traditional healers had the following to say about the GGEP:

> *Well they hinder access to the place, and this sometimes makes us cross as traditional healers because we are unable to collect the muthi that we need even if it is close by in the Gorge*.
> (Traditional healer 6)

Despite the Tshelimnyama community's interest in the GGEP open space resources, they were not aware of the biodiversity conservation project in the GGEP. There was no formal communication established between the Tshelimnyama community and the GGEP property owners since the project started. Communication and contact between the Tshelimnyama community and the GGEP property owners only occurred when the Tshelimnyama community members were caught harvesting natural resources in the GGEP open space (the aspect of communication is discussed further in section 5.4.4 under stakeholder perceptions). Lemanski (2004) supports this finding and asserts that exclusive residential areas have the potential to limit non-residents access and use of open spaces. This has implications for communities that are dependent on the restricted open space resources and in turn, management of the GGEP open space.

5.4 Stakeholder Management

Stakeholder management concerns managing and balancing various stakeholder interests with the view that doing so enhances the benefits derived from a resource under management (Reynolds *et al.*, 2006; Banerjee and Bonnefous, 2011). This section therefore examines the processes of natural resource and stakeholder management in the GGEP project by first providing context to the changes in ecosystems since the implementation of the GGEP Management Plan in 2010. The section further examines how stakeholder interests in the GGEP open space are managed with the focus being on changes in ecosystems, impact of the project and perceptions of the GGEP property owners on the GGEP project.

5.4.1 Changes in natural resource base in the period 2010 to 2012

The GGEP project is of significant importance to the eThekwini Municipality, the GGEP property owners and to the country at large as it is the first project to use the SRA in biodiversity conservation. The eThekwini Municipality and the GGEP management anticipate a positive impact as it would validate the project to the funders, especially going beyond the pilot phase of the project. This section examines how the activities implemented to manage environmental problems in the GGEP open space have affected abundance and quality of natural resources since 2010. The findings were solicited through primary and secondary data sources. Primary data sources used include questionnaire surveys with GGEP property owners, focus group discussions with GGEP property owners and Tshelimnyama community members, field observations, and key informant interviews with estate agents, eThekwini Municipality and Silverglen staff. GIS change analysis was conducted using aerial photographs, while the property value analysis (proximate premium analysis) was conducted using GGEP management activity records and eThekwini Municipality Tax Valuation Roll.

The GGEP open space has several ecosystems as highlighted in chapter three. These ecosystems are inhabited by various plant and animal species whose composition and abundance has undergone transformation over the past decade. Of significance to this study is the transformation that occurred after the implementation of the GGEP Management Plan in 2010. As stated previously, the Tshelimnyama community members had no knowledge of the GGEP project and as such could not be asked about the changes in natural resources between 2010 and 2012. However, focus group discussions and interviews with Tshelimnyama community members did reveal that some of the medicinal plants that they once used can no longer be found in the GGEP area. This is further discussed under natural resource management contestations in section 5.4.4.2. The GGEP property owners' perceptions therefore are the basis on which this analysis is made.

Findings from the questionnaire survey and the focus group discussion with the GGEP property owners reveal that the majority of the GGEP property owners (98%) were aware of the changes that have occurred in the GGEP open space before and after the GGEP project was implemented. The respondents were therefore asked to indicate how they came to know about the state of the GGEP open space. The results are presented in Table 5.4.

Table 5.4: Basis of their knowledge on the state of the GGEP open space (n=75)

Basis of knowledge	Yes	No
I visit the forest and grasslands	65.3	34.7
I am able to see the state or changes in the forest and grassland from my property	50.5	49.5
I just heard from other property owners	13.3	86.7
I am part of the GGEP management	12.0	88.0
I heard from other property owners who visit the forest and grasslands	9.3	90.7

The highest percentage of the respondents (65.3%) indicated that they are aware of the changes because they visit the forest and grasslands and 50.5% stated that they are able to see the state of the forest and grasslands from their properties. In addition, 13.3% of the respondents stated that they heard from other property owners while 12% stated that they were part of the GGEP management. Lastly, 9.3% of the property owners stated that they heard from property owners who visit the forest and grasslands. It is interesting to note that the majority of the respondents (65% who visit the open space, 50.5% who are able to see the open space from their properties and 12% who are part of the GGEP management team) base their knowledge on physical evidence. These findings have implications for analyses that follow.

Table 5.5 depicts the perceptions of the GGEP respondents on the state of the GGEP ecosystems before the project started.

Table 5.5: Perceptions of the state of the GGEP ecosystems before the GGEP project started (n = 75)

Comment	Before the project started (Percentage)	After the project started (Percentage)
Animals (birds, mammals) and plant life (trees in the forest, grass in grasslands) both abundant	58.3	69.4
Animals (birds, mammals) abundant while plant life (trees in the forest, grass in grasslands) scarce	5.6	19.4
Animals (birds, mammals) scarce while plant life (trees in the forest, grass in grasslands) abundant	20.8	0
Animals (birds, mammals) and plant life (trees in the forest, grass in grasslands) both scarce	12.5	11.2
Not sure	2.8	0
Total	**100**	**100**

Results from the questionnaire survey show that the majority of the respondents (58.3%) reported that animal and plant life were abundant before the GGEP project started. However, 69.4% of the respondents revealed that animal and plant life are abundant after the GGEP project started. In addition, 20.8% reported that animal life was scarce while plant life was abundant. None of the respondents indicated that

animal life is scarce while plant life is abundant after the GGEP project started. Further, 12.5% of the respondents reported that animal and plant life were both scarce while 11.2% indicated that both animal and plant life are scarce after the GGEP project started. Additionally, 5.6% stated that animal life was abundant while plant life was scarce. Similarly, 19.4% of the respondents stated that animal life is abundant while plant life is scarce after the GGEP project started. Lastly, 2.8% were not sure of the state of the GGEP open space ecosystems before the project started.

The following are some of the comments made in the questionnaire survey regarding the state of the GGEP open space ecosystems before the project started:

> *There were lots of aliens and bird life was scarce.*
> (Property owner 1)
>
> *The forest was full of invasive aliens and less birds and mammals*.
> (Property owner 2)
>
> *Animals and birds were abundant and there were too many trees including indigenous trees but not enough grassland*.
> (Property owner 3)
>
> *There were abundant orchids, blue duiker, hyrax, streptocarpus and bush babies*.
> (Property owner 4)
>
> *There was a lot of poaching and aliens before the project started*.
> (Property owner 5)

Findings from the GGEP questionnaire survey reveal that animal life was abundant and the following were highlighted as animal species that inhabited the GGEP open space before the project started (the names used are captured as given by the respondents): leguans-commonly referred to as Nile monitor and will be referred to as such in this study (*Varanus niloticus*), otters (*Lutrinae*), duikers (*Cephalophinae*), eagles (*Stephanoaetus coronatus*), bush babies (*Otolemur crassicaudatus*), bush pigs (*Potamochoerus larvatus*), hyraxes (*Procavia capensis)* and caterpillars (*Larva*), among others.

However, findings from the questionnaire survey and a key informant interview with a member of the GGEP management also reveal that during the last decade there have been many hunting incidences and medicinal plant harvesting incidences perpetrated by non-GGEP residents. Focus group discussions with the Tshelimnyama community members indicated that hunting is an old practice which some members of

the community have and still engage in both for food and medicinal purposes solicited from the GGEP open space, among other sources (further discussion on natural resources harvesting is done in section 5.4.1 on contextualising changes in natural resource abundance). This is consistent with Meyfroidt *et al.* (2013) who cite unsustainable natural resource harvesting by poor communities as one of causes of ecosystem change.

Besides hunting, findings from the questionnaire survey and the focus group discussion with the GGEP property owners reveal that there were developments in the GGEP before the project started and were a contributor to the decline in biodiversity. Figure 5.8 shows one of the contested developments in the GGEP.

Figure 5.8: Toyota Dealership development (Source: Field photographs)

During the last decade, the GGEP has seen a lot of development which transformed the natural environment into built up areas. Some of the property owners had the following to say regarding developments within the GGEP:

> *Much of the pristine grassland in St. Helier Road has been destroyed due to property development which has taken place on these grasslands, such as Eagle Rock and various complexes that have popped up in the last 10 years*.
> (Property owner 3)

> *Estate building has eliminated springbuck and bird life*.
> (Property owner 6)

> *There has been a lot of development…my view is obstructed by the new buildings*.

(Property owner 10)

It is interesting to note that one of the new developments in the GGEP is in Eagle Rock, an estate from which some of the respondents of this study reside. Field observations revealed a number of new developments such as residential and business properties within the period 2010 to 2012. One of the properties visited during a field observation was subdivided into three parcels, two of which were in the process of being sold. Another development was the Toyota dealership (shown in Figure 5.8) which was highly contested by the GGEP management team and property owners. Despite having failed to stop the development, the GGEP property owners managed to get the developers to provide resources for managing the remaining ecosystems located close to the development. This is yet another driver of ecosystem change, a finding supported by Goddard *et al.* (2010) who assert that development of persistent structures can cause loss and/ or extinction of species. The increasing development pressure is also consistent with global urbanisation trends and that of post-apartheid South Africa characterised by liberalised movement of people placing high demands on land for settlement and production (Leon, 2007; Reed, 2013; Nagendra *et al.,* 2014). Furthermore, development pressure also results from the need for job creation to offset high unemployment rates and translates into favourable policies on developments for businesses such as that observed in the GGEP. However, development policies that fail to consider the environment are retrogressive to the conservation of biodiversity. The Development Bank of South Africa (2011) supports this and further states that lack of political will, especially at the local level, makes it difficult to develop policies and allocate resources towards eco-friendly developments. This has implications for decision-makers in transforming policies that support biodiversity conservation.

The findings presented in Table 5.5 indicate that majority of the respondents believe that there are changes that have occurred in the GGEP open space compared to the state before the project started. The observed changes are discussed together with the findings presented in Table 5.6 on the current quality of the GGEP open space ecosystems. However, some respondents indicated that the state of the ecosystems is the same before and after the GGEP project started. The main reason given for no change observed in the GGEP after the project had started is that no rehabilitative activities had been done on ecosystems adjacent to their properties. Personnel from the management team indicated during a key informant interview that reports on management activities implemented on various sites of the GGEP are given in the quarterly issue of the GGEP newsletter. In addition to the newsletter is the GGEP website where management activities implemented are reported. With these mentioned media available for accessing information on management activities implemented, it can be deduced that the respondents do not have access to such media either unknowingly or by choice. The issues about perceived changes in the GGEP

and communication are further discussed under natural resource management contestation in the GGEP (section 5.4.4.2).

Further, the study sought to understand the perceived current quality of the GGEP ecosystems. Table 5.6 shows the GGEP respondents' views on the quality of the GGEP ecosystems after the implementation of the project in 2010.

Table 5.6: Perceptions on current quality of the GGEP ecosystems (n = 75)

Comment	Percentage
The forest and grasslands are in a better state than they were before the GGEP project started	86.1
The forest is in a better state while the grasslands have not changed since the GGEP project started	1.4
The forest has not changed since the GGEP project started while the grasslands are in a better state	4.2
Some areas of forest and grasslands are better while others are worse	1.4
The forest and grasslands have not changed since the GGEP project started	6.9
Total	**100**

In reference to quality, findings from the questionnaire survey indicate that the majority of the respondents (86.1%) stated that the GGEP ecosystems are in a better state than they were before the project started. In addition, 6.9% of the respondents revealed that the quality of the forest and grassland has not changed since the project started while 4.2% indicated that the quality of forests has not changed since the project started whereas grassland quality has changed. Further, 1.4% of respondents revealed that the quality of the forests has improved but that of grasslands has not. Another 1.4% of respondents indicated that some areas of the forest and grasslands are better while others are worse in terms of quality.

As presented previously, some of the GGEP respondents (6.9%) reported that there was no improvement in the quality of the forests and grasslands. Some of the respondents had the following to say:

> *Depends on which part you are living in*.
> (Property owner 3)

> *There is a great deal of alien invaders in the property adjacent to us that have popped up since the developer cleared the natural bush to create platforms for a house. The management objectives have not materialised and the vegetation has not regenerated but the invaders have*.
> (Property owner 5)

> *Improvement is only in certain areas*.

(Property owner 10)

As evident from the quotations given, the reasons cited for perceived lack of improvement in the quality of forest and grassland is that the GGEP management team has not implemented any or much of the rehabilitation activities in areas where the respondents live.

As depicted in Table 5.6, the majority of the GGEP respondents (86.1%) indicated a positive change in the quality of the GGEP open space ecosystems. Some of the property owners stated that,

Quality-wise, the GGEP ecosystems are in a better state than they were before the project started.
(Property owner 8)

...eradication of alien plants has already had a positive and noticeable impact on the local flora and restricting vehicular access to the gorge has like-wise impacted positively on both local fauna and flora.
(Property Owner 12)

Currently, the quality has improved and efforts are visible of the GGEP activities.
(Property owner 15)

The most amazing improvement is in the grassland but the forest has also shown improvement.
(Property owner 20)

In addition to the comments given, one of the property owners provided the pictures shown in Figure 5.9 as evidence of the improved quality of the GGEP open space ecosystems.

Figure 5.9: *Francolinus* (Source: William, 2011, pers. comm.)

The francolin (*Francolinus*) pictures (Figure 5.9) were captured on the property owner's yard and this was what the property owner had to say about the birds:

> *We have been here 10 years and this is the first time we have had francolin on our property - so that is a good sign!*
> (Property owner 12)

Evidence of animal life in the GGEP open space was seen from the presence of animal dung in the forest and Nile monitor (*Varanus niloticus*) as shown in Figure 10.

Figure 5.10: (a) Bush pig (*Potamochoerus larvatus*) dung (b) Nile monitor (*Varanus niloticus*)
(Source: Field photographs)

The presence of animal dung in the forests indicates that there are animals living in the forest, and particularly, the field workers indicated having seen bush pigs in the forest during one of their patrols. The same can be said of birds that are seen on properties. This indicates an improvement in the state of the bird and animal habitats, an assertion supported by Noss *et al.* (1997: 2) who state that "sufficient quality and quantity of habitat" is required to maintain species within an environment. In addition, The Foundation for Ecological Security (2008) asserts that indicators of stable ecosystems after rehabilitative activities include species abundance and diversity, presence of indigenous species and presence of past animal and plant species. Thus, the fact that the sightings of birds and animals are perceived to have increased, means that the living conditions (habitat quality and quantity) are conducive for the birds and animals in the GGEP open space.

In order to understand the actual land use and land cover changes that have occurred since the GGEP project started implementing management activities, a change analysis for the period 2010 to 2012 was conducted. Figure 5.11 visually illustrates the changes that have occurred in the GGEP open space land use and land cover between 2010 and 2012.

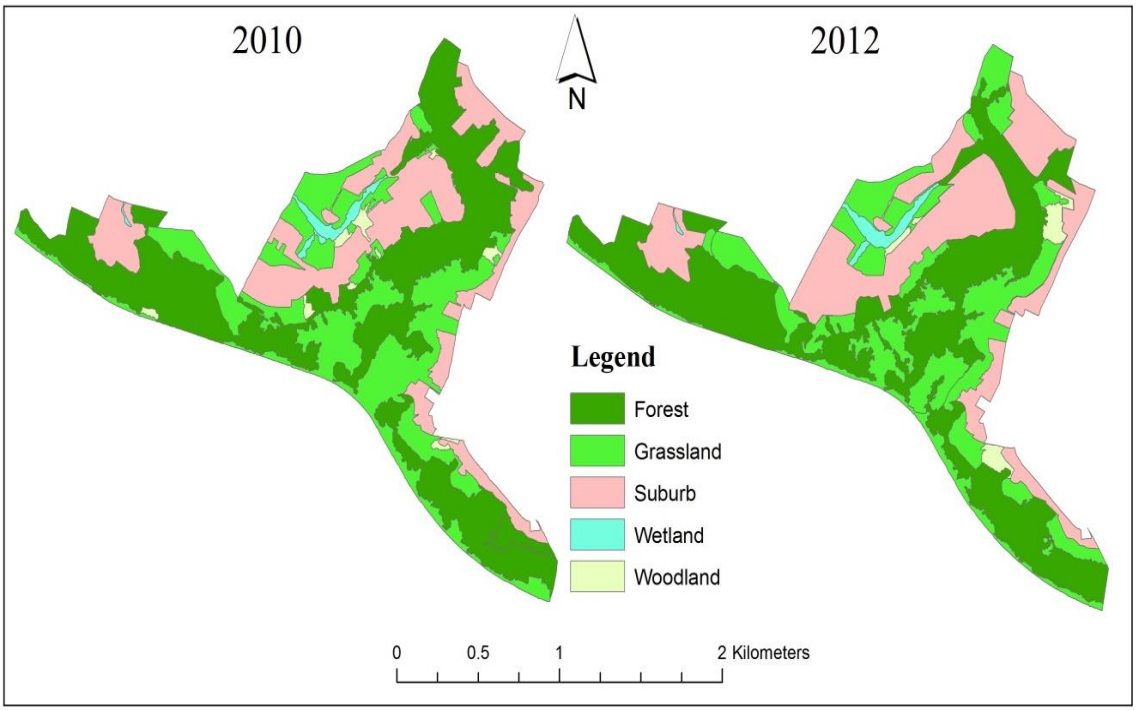


Figure 5.11: GGEP land use/land cover changes between 2010 and 2012

The areal changes highlighted in Figures 5.11 are tabulated in Table 5.7.

Table 5.7: Changes in land use/land cover of the GGEP open space

	Land use/land cover	**2010 Sum Area (hectares)**	**2012 Sum Area (hectares)**	**Change between 2012 and 2010 (hectares)**
0	Forest	133.81	127.5087	-6.3013
1	Grassland	85.99786	93.0062	7.00834
2	Suburb	74.865	86.4554	11.5904
3	Woodland	3.9973	5.4533	1.456
4	Wetland	4.2307	4.6467	0.416

GIS change analysis of aerial photographs revealed that the forest area reduced during the period 2010 to 2012 by 6.3013 hectares while the grassland area increased by 7.00834 hectares. Furthermore, the woodland and wetland areas increased by 1.456 hectares and 0.416 hectares, respectively. The increase in wetland area could have resulted from the clearing of invasive alien species. According to the findings obtained through the focus group discussion with GGEP property owners and the management activity

records, the wetland area is one of the management units where alien species were cleared. This implies that clearing of invasive alien species had a positive effect on the reclamation of part of the wetland area. The findings presented are consistent with the GGEP management's assertion that between 2010 and 2012, rehabilitative activities were implemented on the open space ecosystems as depicted on Figure 5.12

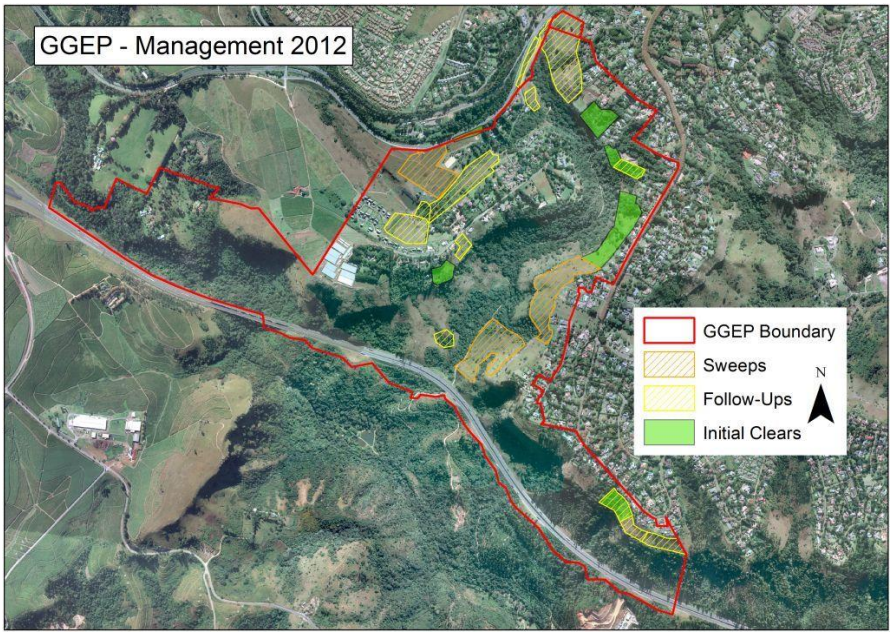
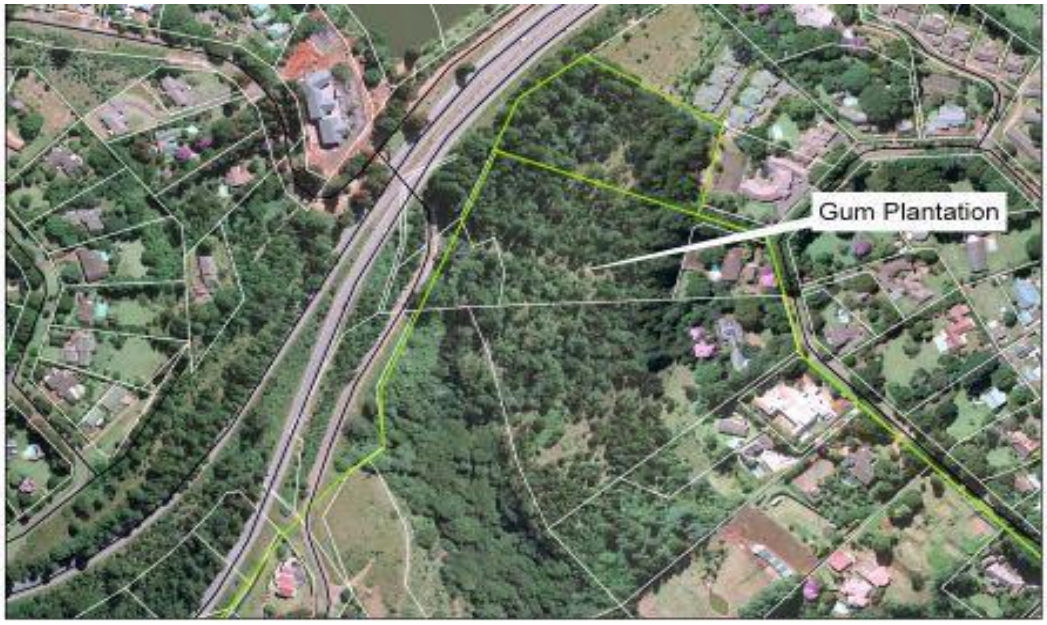


Figure 5.12: GGEP Management Activities (Adapted: GGEP management activity records)

Figure 5.12 shows the different levels of rehabilitation activities implemented in the GGEP open space. Initial clears are the first rehabilitative activities implemented on the open space and constitute the bulk of the alien species clearing. Follow-ups are implemented following initial clears to suppress alien species regeneration. Lastly, sweeps are continuous long-term rehabilitative activities implemented after follow-ups to suppress any alien species. Thus, the initial clears, follow-ups and sweeps depicted in Figure 5.12 demonstrate the activities implemented in the GGEP open space as indicated by the GGEP management.

For the purpose of this analysis, the impact of the implemented management activities in the GGEP between 2010 and 2012 were grouped into two categories, namely, complete transformation and partial transformation. Complete transformation represents the management areas that were transformed from one kind of ecosystem to the other such as woodland to grassland. Partial transformation represents management areas where ecosystems were not transformed to another kind of ecosystem but the state of the ecosystem was improved.

Further analysis of aerial photographs using GIS revealed that an area of about seven hectares had been transformed completely from forest and woodland to grassland. The transformation resulted from alien species clearing of mainly gum trees (*Eucalyptus grandis*) in areas that initially were grasslands but later became completely invaded by alien species. Figure 5.13 gives a close-up aerial representation of one of the completely transformed management areas that was transformed from gum tree (*Eucalyptus grandis*) woodland to grassland ecosystem.



(a) Before 2010

(b) After 2012

Figure 5.13: Alien clearing in the GGEP open space Sandstone Sourveld grasslands
(Source: GGEP management activity records)

Figure 5.13 depicts transformation of woodland into grassland. Figure 5.13(a) depicts an area infested with gum trees (*Eucalyptus grandis*) in 2010 depicted as gum plantation. On the other hand Figure 5.13(b) depicts the same area in Figure 5.13(a) that was transformed into grassland in 2012.

Further analysis revealed that a total area of about 23.2244 hectares was partially transformed during the period 2010 to 2012. The partial transformation also resulted from alien species clearing from grasslands that were partially invaded with ginger lilies (*Hedychium)* and lantana (*Lantana camara*), among others (chapter four outlined the main invasive species in the GGEP). Both the complete and partial transformations observed in the GGEP open space are consistent with the mental map sketched during the focus group discussion with the GGEP property owners indicating ecosystem changes in the GGEP open space (see Figure 5.14). Clearing of the invaded areas meant that some of the areas that had been classified as forest in 2010 are now classified as grassland. Further, the increase in the woodland area was also a result of the change from forest due to invasive alien clearing.

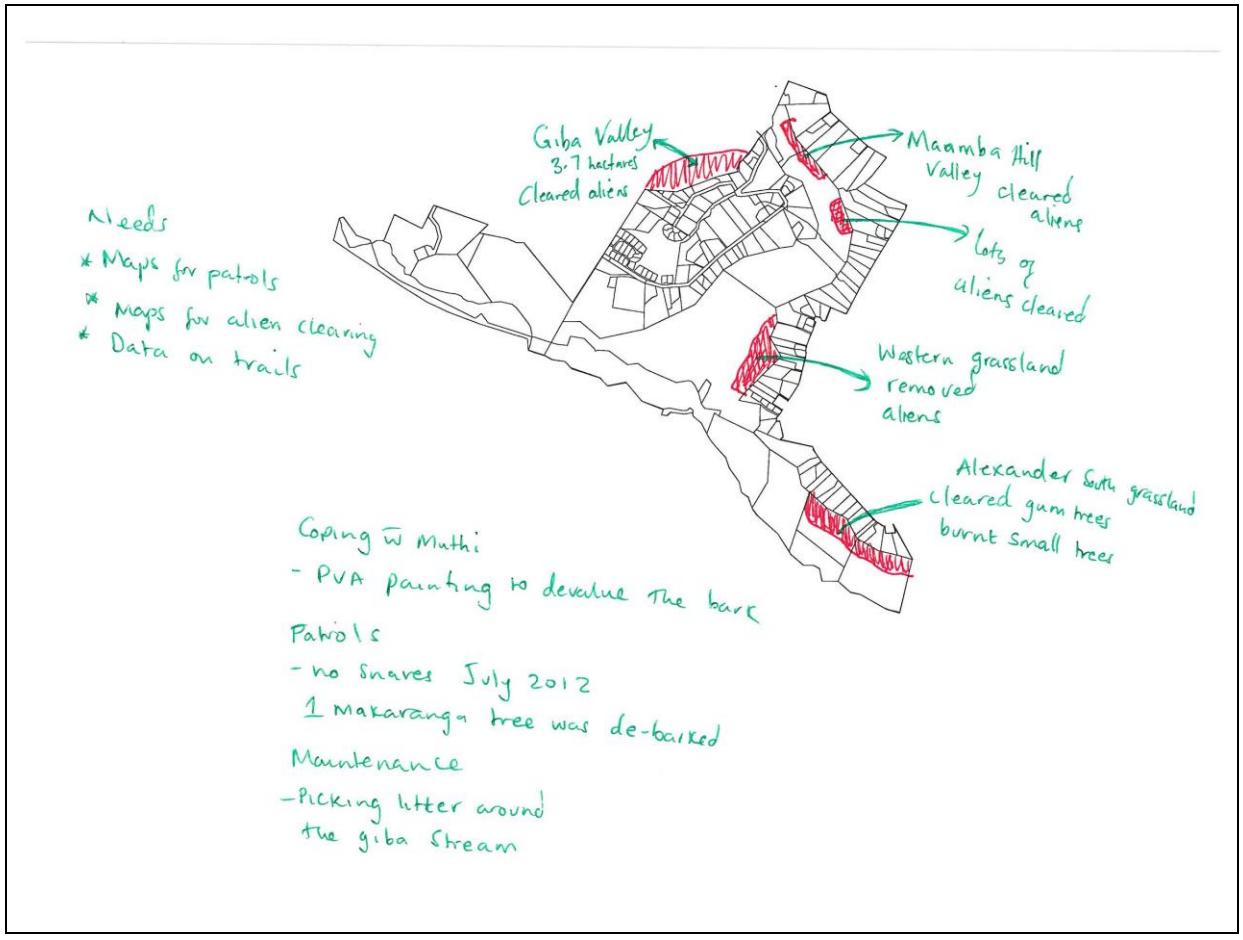


Figure 5.14: GGEP mental map (Source: GGEP focus group discussions)

Figure 5.11 also reveals changes in land use over the period 2010 to 2012, with the suburb area increasing by 11.5904 hectares. The changes are attributable to the residential and business developments between 2010 and 2012 as previously discussed. In addition, the increase also resulted from clearing of alien

species of gum (*Eucalyptus grandis*) and other invasive species which resulted in exposure of part of the suburban areas with distinct boundaries. It needs to be noted that this data was generated using aerial photographs which only exhibit visual aspects of the area under study. Thus, since parts of the suburban area were covered with gum trees (*Eucalyptus grandis*) in the 2010 aerial photograph, they were classified as woodland or forest but after alien species clearing in the 2012 aerial photograph, the suburban area was reclassified as suburb due to the exposed surface and boundaries. Findings from the focus group discussion with GGEP property owners also indicated that much of the suburban area had alien species invasions which management started clearing.

One of the objectives of the GGEP project is to restore degraded ecosystems to their indigenous state and to this end, the GGEP management team structured activities to eradicate invasive alien species. Despite some respondents' perceptions that the state of ecosystems has not changed since the project started, GIS analysis shows the contrary. The implication is that management activities have facilitated positive change to the state of ecosystems: grasslands and forest, especially the grasslands, where bloom of life has been observed (see Figure 5.15).

Figure 5.15: GGEP - St. Heliers' rehabilitated grasslands and spring of life on rehabilitated grassland (Source: Field observation pictures and EPCPD)

The findings presented reveal various changes to the GGEP open space ecosystems which are in keeping with the project's objectives of ecosystem rehabilitation as outlined in the management plan. By doing so, the project adheres to the principles of biodiversity conservation recommended by the CBD on a global scale and the DEA locally (Chapin III *et al.,* 2009). This is within the context that South African grasslands are threatened ecosystems and specifically the KwaZulu-Natal sandstone sourveld grasslands (Mucina and Rutherford, 2006; Reyers *et al.,* 2007; Fourie *et al.,* 2014). Within the GGEP open space ecosystems there are some species whose range is small and are threatened. Such species include the giant black millipede (*Doratogonus rubipodus*), spotted ground-thrush (*Zoothera guttata*), and kloof frog (*Natalobatrachus bonebergi*) (detailed description of the species range is provided in chapter four). Given

the pressures from urbanisation, development and the dwindling natural resource corridors, species rehabilitation with the aim of restoration is important in urban areas falling outside Protected Areas where rich biodiversity exists (Aronson *et al.*, 2014). An increase in the grassland area by 8.14% means a positive change towards reclaiming the GGEP sandstone sourveld most of which is invaded by gum trees (*Eucalyptus grandis*). Thus, this study's results have implications for the threatened sandstone sourveld grassland ecosystem and endangered Scarp forest of the GGEP.

This section highlighted changes in the GGEP open space most of which are positive actions towards reclamation, restoration and rehabilitation of the GGEP open space ecosystems. These changes, however, do not underscore the environmental problems faced by the GGEP such as unsustainable use of the open space. The following section highlights some of the problems that persist despite the changes that have been registered in the ecosystems.

5.4.2 Contextualising changes in natural resource abundance

A review of the literature in chapter three reveals various global pressures exerted on indigenous ecosystems including development and climate change. At a local scale, pressures on indigenous ecosystems follow the global trend but localised pressures exist too. The GGEP is one of the many open spaces pressurised by demand for natural resources. The major environmental problems include commercial natural resource harvesting for medicinal purposes, invasive alien species, soil erosion, pollution, sedimentation of rivers and unplanned fire regimes. This section examines how the GGEP project manages the said environmental problems to yield the changes observed during the period 2010 to 2012. It analyses the activities implemented since the project started in 2010 in relation to sustainable and best practices. As such, this section provides context for understanding changes in natural resource abundance and quality in the GGEP open space between the period 2010 and 2012.

5.4.2.1 Natural Resource harvesting

All the GGEP respondents in the questionnaire survey indicated that they do not harvest any animal or plant products from the GGEP open space. However, they indicated that there are people from outside the GGEP who harvest plant and animal products for medicinal purposes. Findings from the focus group discussion with the Tshelimnyama traditional healers reveal that all Tshelimnyama traditional healers harvest natural resources from the GGEP open space mainly for medicinal purpose. One of the traditional healers stated:

> *Yes we do get muthi…oh maybe I should not answer on behalf of everyone. I do get muthi from Giba Gorge*.
> (Traditional healer 6)

However, eight traditional healers indicated that the GGEP open space was not their only source of medicinal plants as highlighted below by one of the respondents:

> *I get my muthi from Swayimane most of the time. But if it's urgent I get muthi in the forest that side* (pointing towards the side of Giba Gorge) *and also from Berea in town*.
> (Traditional healer 7)

Results from the interviews and focus group discussions conducted with the Tshelimnyama community members also reveal that the traditional healers in the community use commercial harvesters to acquire medicinal plants and animal products during times when they cannot go into the forest because of commitments, illness or unavailability of medicinal plants. The following were some of the comments made about using commercial harvesters:

> *I used to get muthi for myself but due to illness I usually ask some people to get it for me*.
> (Traditional healer 2)

> *It depends, sometimes I get my own muthi and sometimes I also buy my own muthi or send people. Since we do not get all types of muthi in urban areas, sometime we have to get them from the rural areas, so there are people that go for me to collect those muthi items*.
> (Traditional Healer 4)

> *It depends, there is muthi that one cannot find here* (referring to Tshelimnyama and surrounding areas) *because this place does not have much forest or vegetation hence I often have to go to town and place an order with people that specialise in selling muthi in Durban close to Berea train Station*.
> (Traditional healer 7)

Commercial harvesters were cited as another group that harvests natural resources in bulk for trading within and outside Durban. Commercial harvesters are an elusive GGEP stakeholder group, which is said to use destructive harvesting practices and whose origin is unknown. However, when probed as to whether they knew where the commercial harvesters obtain their medicinal products, the participants

stated that they did not know. However, they indicated that commercial harvesters supply the Durban market traditional medicine traders and any other interested individual traditional healers in Durban.

Furthermore, findings from the focus group discussions with Tshelimnyama general community members reveal that there are community members who go into the GGEP open space to collect medicinal plants and animal products, hunt animals for food, collect wood for heating and fencing their gardens. This was reiterated by general community members who stated:

> *Yes, yes, I know there are izangoma who get muthi from there*.
> (General community member 1)

> *He is right, I have also seen them going over to the forest*.
> (General community member 2)

> *Well for us as black people, the only thing you would find is people using the forest to collect wood, collect muthi like the izinyanga and izangoma*.
> (General community member 3)

During focus group discussions, all the Tshelimnyama community traditional healers indicated that they use animal and plant products for their medicines such as animal fat, skin, hooves, plant roots, bark, stems and leaves. Figure 5.16 shows storage containers for plants and animal parts used for medicinal purposes inside one of the traditional healer's consultation room.

Figure 5.16: Containers of traditional medicines inside a traditional healer's consultation room (Source: Field photographs)

In combating the practice of natural resource harvesting for medicinal purpose, the GGEP has implemented painting of tree trunks to render the bark unusable for medicines. However, considering the various tree parts demanded for medicinal plant harvesting (roots, leaves and branches) tree trunk painting does not address the problem of medicinal plant harvesting. Thus, even with painted tree trunks, the health of plants and the forest can still be compromised through harvesting roots, leaves and branches except for large trees whose leaves and branches are difficult to access. Jusu and Sanchez (2013) assert that harvesting roots, wood or bark can be fatal to the targeted species. In addition, literature shows that harvesting techniques employed when obtaining medicines from plants and animals, among other things, can cause decline or near-extinction of species (Jusu and Sanchez, 2013; Augustino *et al.*, 2014). Furthermore, Flory and Clay (2010) assert that unsustainable harvesting of plant parts compromises the structure of the forest ecosystem by exposing the forest floor to sunlight which in turn makes the forest vulnerable to alien species invasion. Tree trunk painting is therefore a temporal distraction to harvesters from harvesting tree bark but does not effectively protect the entire plant from harvesters.

Besides tree trunk painting, the GGEP field workers conduct patrols in the GGEP open space once a week. The patrols are intended to identify unsustainable practices such as animal trapping and also to catch offenders who are prosecuted when caught. However, for patrolling to be effective in such a large open space, it would require full-time patrolling because harvesters conduct their activities any day of the week and anytime of the day. Without full-time patrols, harvesters would still get an opportunity to hunt. For instance, during a patrol (and field observation) on the 15 of February 2011, it was discovered that commercial harvesters had invaded one large area of the forest and about 41 trees were de-barked and cut as shown in Figure 5.17 (GGEP, undated). Another large scale harvesting incidence was reported in April 2013 where 26 indigenous trees were de-barked. This is an indication that despite conducting patrols on a weekly basis, commercial harvesters still access and harvest the GGEP open space natural resources.

Figure 5.17: Destructive medicinal plant harvesting (Source: Field photographs)

Figure 5.17 highlights some of the destructive harvesting practices used when extracting plant products for medicinal purposes and include de-barking, digging for roots or removal of root bark and cutting off portions of plant stems. Harvesting and hunting for medicinal plants is prohibited in formally managed open spaces and given the urban context where open spaces are scarce and formally managed, it leaves traditional healers without wild grounds to obtain the needed resources for their practice. This can be a negative externality of conserving biodiversity, an assertion consistent with Bob (2010) who states that, given South Africa's historical context of prohibitive laws during the apartheid regime, restrictions on harvesting medicinal plants may be viewed as measures to suppress traditional healers' prosperity. Chapter two, section 27 of the South African constitution and the Bill of Rights provide for sustainable use of natural resources in promoting equitable economic and social development (Jonsson, 2011). This has implications for environmental policy and decision-makers.

Findings from a key informant interview with the traditional healers' leader and education officer at Silverglen in Chatsworth reveal that the eThekwini Municipality implements and promotes the cultivation of medicinal plants by individual traditional healers. The Tshelimnyama traditional healers have from time to time undergone training on sustainable use, harvest and cultivation of medicinal plants. Five of the Tshelimnyama community traditional healers indicated during focus group discussions that they cultivate some medicinal plants not only in Tshelimnyama but in their villages. One of the participants highlighted this by saying:

> *Yes I do. I also have my own muthi that I planted at home. When I phone them at home I even ask them to irrigate it for me so that it will not die. Even when I am here too, I plant muthi although sometimes it gets eaten by goats because of lack of grazing land around here I guess*.
> (Traditional Healer 1)

Despite the expressed willingness to cultivate medicinal plants, the interview revealed that traditional healers have reservations on cultivating some medicinal plants due to the belief that the plants can be harmful to people as highlighted in the following statement:

> *Not all muthi is planted at home…there is muthi that one cannot plant at home because it is known to attract bad spirits and all these commotions can make people in the family sick or be possessed by bad spirits. Sometimes it happens that when you mix muthi it does something good to your body or heals people but when the stem is there growing in your yard it will cause trouble for you and your family*.
> (Traditional healers' leader 1)

The findings presented have highlighted the use of *ex situ* conservation practices. A successful story of *ex situ* conservation of medicinal plants in Umlazi Durban is used to motivate traditional healers from all provinces of South Africa to cultivate medicinal plants. This is consistent with the CBD recommendations for *ex situ* conservation and authors such as Mander *et al.* (1996) and Okigbo *et al.* (2008) who highlight the need for 'conservation through cultivation', which implies cultivating medicinal plants to supply the traditional medicine industry. The call to *ex situ* conservation by Government authorities is consistent with trends in developing countries, for instance, in India where medicinal plant cultivation is also used to enhance livelihoods of poor communities (Sati, 2013). This is in view of growing demand from global markets for herbal products, rising pressure for urbanisation, agriculture and settlement and the impact of climate change which have all contributed to significant reduction of natural habitats and species (Prasad, 2009). Thus, cultivation of medicinal plants is viewed as a measure to relieve the remaining wild lands off the pressures thereby facilitating proliferation of medicinal plants (Amuyoyegbe *et al.*, 2012). Medicinal plant cultivation is also an important strategy which governments in developing countries, where the use and extraction of medicinal plants is rife, are embarking on. However, as demonstrated in this study, traditional healing is surrounded by beliefs on the use and cultivation which would render *ex-situ* cultivation problematic.

Unsustainable natural resource harvesting for medicinal purposes was seen as a threat to ecosystem health as early as 1946 (Williams *et al.*, 2013). It is not only a problem in GGEP but also in many open spaces

such as the eThekwini Municipality's Silverglen Nature Reserve in Chatsworth Durban. Thus, unsustainable natural resource harvesting in the GGEP is only an example of the extent of the problem both at the provincial and national scales. This finding is supported by the Williams *et al.* (2013) who highlight commercial overharvesting of natural resources as one of the causes of biodiversity loss in South Africa. The Silverglen Nature Reserve, for example, offers education programmes on sustainable harvesting and propagation of medicinal plants, however, the programmes remain voluntary. The finding highlights a lack of effective legislative framework and programmes to address hunting and plant harvesting for medicinal purposes not only in the GGEP open space but in South Africa as a whole.

Findings from the Tshelimnyama focus group discussions also revealed that the traditional healers practice traditional harvesting methods. The Tshelimnyama traditional healers demonstrated their knowledge of sustainable harvesting practices, for instance, one traditional healer indicated that he learnt from his grandfather that a tree cannot be de-barked when the sun is up but one must wait until late afternoon. When shown the pictures in Figure 17 all the traditional healers expressed their shock on the harvesting methods used and some of the comments expressed regarding traditional harvesting methods and the methods used on the pictures include:

> *This is not how one should get muthi (pointing a picture in which a tree trunk has been pealed a long way from the top down towards the very low level of the tree near the surface). A correct way of get muthi in a tree like this is pealing a small amount of tree trunk on the side where the sun set and then after that take a wet soil or mud and smear the part that you pealed so that the tree will not try out and die.*
> (Traditional healer 1)

> *The law does not allow this. Some of the trees have been totally damaged, the stems are cut and the trees are de-barked in an incorrect manner. The trees will not grow back again, and we will not be able to find muthi again in the bush if people destroy trees or the forest like this. In order for a tree to grow, it must have its bark restored and roots to be covered in soil. The other picture shows animal traps in the forest, so this is not allowed.*
> (Traditional healer 3)

> *Well, in order to collect muthi and use the forest appropriately, you need the knowledge of how to cut the trees: my grandfather taught me about these cultural practices. The tree should be de-barked in an area of the trunk facing sunset, and it must also be covered with mud in the de-barked area to allow it to reabsorb the water when the rain comes. The roots should not be totally cut off,*

> *but one should cut one or two roots, and then cover it with soil so that the tree can grow again. This will keep the tree to grow and you will be able to find the tree when you come to harvest again.* (Traditional healer 5)

The Tshelimnyama traditional healers indicated that they practice the traditional knowledge they have about harvesting natural resources. This shows that traditional healers are concerned about sustainability of the wildlands that provide them with the medicinal products. Unlike in the GGEP project, studies such as Bohensky and Maru (2011) and Hill *et al.* (2012) highlight that sustainable environmental management is moving towards integrating indigenous ecological knowledge with western science. Schlosberg (2013) demonstrates the move towards sustainable relationships between humans and the environment. This has implications for the GGEP project and biodiversity conservation in South Africa.

5.4.2.2 Invasive Alien Species

Findings from the questionnaire survey, secondary sources and the focus group discussion with the GGEP property owners reveal that alien species invasion is yet another environmental problem in the GGEP and chapter four provides a detailed account of the invasive alien species of the GGEP. The major concern with invasive alien species in the GGEP is that the endangered sandstone sourveld grassland was invaded by alien species, which transformed the grassland into gum tree (*Eucalyptus grandis*) woodland (as shown in Figure 5.13). In addition, the forest was also invaded by alien species and this is of concern given that the GGEP project aims to manage the open space as an indigenous resource. In the GGEP, combating invasive alien species is a collaborative work between the GGEP management team and the high altitude Working on Fire team; a team of wild land fire fighters under a government funded programme. According to the findings from a key informant interview with eThekwini Municipality personnel, the GGEP management team is responsible for most of the invasive alien clearing while the high attitude Working on Fire team is responsible for clearing invasive alien species on cliffs.

Results from the focus group discussion with the GGEP property owners and the key informant interview with eThekwini Municipality personnel revealed that the GGEP management team uses an integrated approach of invasive alien species clearing in the forest and grassland ecosystems. They combine chemical and mechanical control methods (hand pulling, de-barking, slashing and herbicides application) to clear invasive alien species. According to the GGEP management, there are various methods employed in clearing invasive alien species and the methods used depend on the extent of invasion, size of plants and location within the open space. The first category of invasive alien species clearing methods is mechanical control and within the GGEP open space hand-pulling, slashing (as shown in Figure 5.18) and

ring-barking are used. Small invasive alien plants are cleared through hand pulling as much as possible while large plants that cannot be hand-pulled are de-barked by stripping the trunk to expose the sapwood. The major concern with this method is that cutting down big trees on slopes or cliffs can potentially cause soil erosion if not properly managed.

Figure 5.18: GGEP management team slashing invasive alien species
(Source: GGEP Management activity records)

Considering the size of the GGEP, extent of alien species invasion and the size of the management team, hand pulling is not an effective or sustainable way of managing invasive alien species. This is because, to eradicate invasive alien species, there is need to conduct repeated follow-up activities which would demand a bigger workforce to be done on a large scale. However, a team of nine working on about 227.6 hectares of land mainly invaded by alien species would not manage to cover a considerable area successfully. This is consistent with Moran and Hoffmann (2012) and Van Wilgen and Richardson (2014) who assert that mechanical control is labour intensive and costly, especially when invasion is extensive and the area in question is large. This then demands a more intensive method of clearing invasive alien species and for the GGEP, chemical control is used.

According to the findings from a key informant interview with eThekwini Municipality personnel, the management team uses chemical control through the use of herbicides that target specific plant species. This method is used as a measure of last resort considering how harmful the herbicides can be on the

environment in case of an accident or rain after application. In a conservation zone such as the GGEP, use of herbicides has to be done with the strictest care as it can defeat the purpose of conservation if handling of herbicides and equipment is not properly done. For instance, the GGEP manager and one of the property owners in the management team indicated that prior to the formation of the GGEP, a team that was working on clearing invasive alien species spilt herbicides in the GGEP open space and as the herbicides ran downhill, they destroyed all the plants in their path. To date, the impact of that spillage is still visible as there is little vegetation when compared to the surrounding vegetation. Thus the use of herbicides should be a short-term control method to be implemented by highly skilled people due to high risk on the environment and human health, rendering chemical control unsustainable (Van Wilgen, 2001; Van Wilgen and Richardson, 2014). Figure 5.19 shows an example of chemical control method used on tree stumps in the GGEP.

Figure 5.19: Alien clearing using herbicides on cut stumps
(Source: GGEP management activity records)

An integrated approach to clearing invasive alien species (where mechanical control is complemented by the used of biological and/ or chemical control) is especially suited to the GGEP. This is because the invasive alien species have reached the exponential stage of invasion and mechanical control cannot achieve containment alone (Van Wilgen *et al.,* 2001; Van Wilgen and Richardson, 2014). The use of mechanical and chemical control on invasive alien species that have reached an advanced stage of growth and occupying large areas can be unsustainable (Moran and Hoffmann, 2012; Van Wilgen and

Richardson, 2014). The famous quote by Benjamin Franklin (1735, cited in Kiel, 2011: 791), "prevention is better than cure" can be applied to invasive alien species management. That is, it is imperative to prevent alien species invasions through legislations that limit movement of exotic species. However, in cases where invasions occur, sustainable methods should be used to eradicate the species. Ficetola *et al.* (2007) support this by stating that the CBD and the Global Strategy of the Global Invasive Species Programme recommend developing strategies for preventing alien species invasions and managing invaded ecosystems. However, strategies for preventing and managing invasive alien species need not exacerbate the impact of invasive alien species by damaging desired species. As such, a sustainable and more cost-effective method of invasive alien species control is 'biological control', which utilises organisms that are natural predators to control the invasive alien species (Klein, 2011; Moran and Hoffmann, 2012; Van Wilgen and Richardson, 2014). However, interviews with the GGEP management team did not reveal any use of this method in the GGEP open space. These findings have implications for the GGEP project in the future.

Further, findings from key informant interviews with the GGEP project manager and eThekwini Municipality personnel reveal that clearing invasive alien species yields lots of wood which has to be ferried and disposed off from the GGEP open space. The alien species that are cleared are usually cut into smaller logs which are ferried to a designated area (see Figure 5.20) where GGEP residents can collect for their use.

Figure 5.20: GGEP designated area for logs (Source: Field photographs)

In addition, findings from a key informant interview with the eThekwini Municipality personnel reveal that a Tshelimnyama community member started a business using the wood from invasive alien species clearing. The Tshelimnyama community member chops and collects wood from the GGEP open space which he supplies to garages. The eThekwini Municipality personnel highlighted this by stating:

> *A Tshelimnyama community member started a small business…he approached us if he could take some of the wood we are cutting and actually he helps us because to move big pieces of wood is a mission…he does not have transport most of the time but he has a small team of three to four people and they have chain-saws...so they chop off the firewood and they sell it to the garages…it is good that we can help him because he also helps us.*
> (eThekwini Municipality personnel)

Trading in wood, an opportunity that arose from clearing invasive alien species from the GGEP is an activity which has produced temporal economic benefits to a few Tshelimnyama community members. However, this business is not sustainable as it is reliant on alien species clearing which implies that at one

point there will not be enough wood to sustain the business. Van Wigen and Richardson (2014) caution against the use of alien species products as it can create a dependence on the species.

Several studies recommend providing social and economic incentives as alternative livelihoods to poor communities dependent on natural resources for their livelihoods (Egoh *et al.*, 2010; Thondhlana *et al.*, 2012). This is in view of the fact that natural resources are a primary source of livelihood and in order to promote conservation of natural resources for healthy ecosystems, there should be strategies that incorporate conservation and sustenance of livelihoods. However, in the case of the Tshelimnyama community, the GGEP project through the eThekwini Municipality has not designed deliberate strategies to create alternative livelihoods such as job creation for the adjacent community. Rather, the field workers are employed by the eThekwini Municipality and the Working on Fire programme regardless of whether they are Tshelimnyama community members or not. Besides, the main focus of the GGEP project is restoration of the GGEP open space as an indigenous open space as enshrined in the management plan. Thus the management plan does not explicitly provide for alternative livelihoods, job creation for the adjacent poor community or any other economic benefits. The management plan, however, provides for social benefits for any persons interested in non-extractive, educational or recreational natural resource use. The findings discussed highlight the lack of Tshelimnyama community involvement in the GGEP project which has implications in relation to the management of the GGEP open space ecosystems. A further discussion on Tshelimnyama community involvement in the GGEP project is undertaken in section 5.4.4 on stakeholder perceptions.

5.4.2.3 Soil erosion

Soil erosion is another environmental concern in the GGEP associated with sedimentation of rivers. The key informant interviews with eThekwini Municipality personnel and the GGEP project manager reveal that within the GGEP open space, the problem areas for soil erosion are slopes, trails and roads with concern being erosion resulting from alien species clearing, cycling on trails and runoff. Field observations revealed the presence of contours for both trails and slopes or cliffs, especially in areas that are cleared of invasive alien species. In addition, on trails, logs are used on the edge of each contour (as shown in Figure 5.21) to slow down runoff while on cliffs and slopes, contours are created and brush is packed along the contours to slow down run-off on surfaces cleared of alien species. Furthermore, key informant interviews with the GGEP manager and the focus group discussion with property owners reveal that another soil erosion preventive measure implemented in the GGEP is prohibiting cycling on walking trails, as doing so would loosen soil particles. Thus, trails in the GGEP are designated for each purpose,

for instance, mountain bikers and horse riders use the main servitude running through the GGEP open space while walking trails are also demarcated.

(a)Contouring and reinforcing using logs on trails

(b) Contouring along a slope

Figure 5.21: Erosion control contours on trails and slopes of the GGEP open space
(Source: GGEP management activity records)

The key informant interviews with eThekwini Municipality personnel and the GGEP manager also revealed that soil erosion is a major environmental concern because it does not only degrade land but also causes sedimentation of water bodies. Within the GGEP are rivers and wetlands that are vulnerable to

sedimentation given the steep and hilly landscape of the GGEP open space. Horse riding, cycling along trails and invasive alien species clearing undertaken in the open space can cause erosion and sedimentation of rivers and wetlands. Bosworth (2007) and Kidd *et al*. (2014) demonstrate that trail-based recreational activities such as hiking, cycling and horse riding can significantly cause soil erosion and sedimentation of rivers or wetlands. This is because the said activities damage surrounding vegetation, compact soil and loosen soil, which if left unmanaged, can find its way into the rivers and wetlands through surface runoff (Olive and Marion 2009; Kidd *et al.,* 2014). Soil erosion compromises grassland and forest ecosystems through loss of nutrient rich soil that supports a variety of life and the result would be further erosion through runoff due to reduced ability of the lower soil layer to infiltrate water (Meng, 2006). Similarly, in rivers and wetlands, sediments deprive aquatic animal and plant life of the needed environment (such as sunlight, air and clean water) for its survival (Arp and Simmons, 2012). The effects of soil erosion on ecosystems are also supported by Philor (2011) and therefore restrictions and measures to prevent soil erosion in the GGEP are warranted currently and in the future.

5.4.2.4 Pollution

The key informant interviews with a GGEP property owner (also GGEP management team member), GGEP project manager and eThekwini Municipality personnel revealed that the main sources of pollution in the GGEP are littering by GGEP open space users, sewage as well as garden and household refuse dumping into the GGEP open space. Plastic litter was seen in the forest during a field observation as can be seen in Figure 5.22. In addition, findings from a focus group discussion with the property owners revealed that litter is also present in the streams that run through the open space. (For this study specific types of pollution comprise sewage, garden and household refuse, plastic litter-hereinafter referred to as pollution, for this study).

Figure 5.22: Litter seen in the GGEP open space (Source: Field photographs)

Commenting on the observed litter, one of the property owners made the following observation:

> *Litter is so much…we usually see the field workers picking up litter and sometimes the Scouts volunteer to pick up litter*.
> (Property owner 10)

Further, key informant interviews with the GGEP project manager and a member of the management team reveal that the sources of littering in the GGEP open space are linked to both the recreational and extractive users of the GGEP open space. The findings also reveal that the GGEP reminds all users not to litter in the open space through the use of billboards placed at each of the entrances into the GGEP open space. Despite this action, litter persists. Plastic litter is associated with environmental health risks both to humans and terrestrial and aquatic life (Ryan *et al.*, 2009; Mupindu and Mangizvo, 2012). In addition, aesthetically, plastic litter is unpleasant both for terrestrial and aquatic ecosystems and for this and other reasons, litter has become a global concern (United Nations Development Programme, 2011; Mupindu and Mangizvo, 2012).

Findings from the focus group discussion with the GGEP property owners, key informant interviews with the GGEP project manager and a member of the management team reveal that sewage emanates from

leaking septic tanks built near the edge of the cliffs while garden and household refuse emanate from some homes adjacent to the GGEP open space. The problem with sewage disposal into the GGEP open space is an addition of nutrients into the ecosystems, which can either induce or inhibit growth of some species at the expense of others. SANBI (2013) cites sewage as one of the water pollutants which affect water quality in South Africa. Nutrient loading is a threat to biodiversity and biogeochemical processes (Woodward *et al.*, 2012) and in nutrient poor habitats it can induce rapid growth of species, consequently affecting species composition and ecosystem productivity (Secretariat of the CBD, 2010). This is especially true for alien species, which by nature are invasive in certain environments but given additional nutrients could exacerbate the problem. On the other hand, pollution can be toxic to animal and plant species, as well as humans (Secretariat of the CBD, 2010). For instance, during a field observation patrol, it was observed that a hydrophilic plant (as identified by local biologist McInnes, 2011) at the bank of a stream within the GGEP forest had wilted (as shown in Figure 5.23) while other species in the on higher ground had not exhibited similar problems. This was especially so for plants of the same species lying on higher ground away from the stream. Since the plant was rooted in the stream and was in the interior of the forest, away from interference by people as there were no established trails at the time, it was assumed that the plant species dried up because of water poisoning. Thus, the cause of wilting could have been chemicals from sewage seepage or other chemicals that may have been disposed into the stream from households.

Figure 5.23: Wilting hydrophilic plant in the GGEP forest as identified by local biologist McInnes (2011) (Source: Field photographs)

Results from the focus group discussion with the GGEP management team reveal that people living adjacent to the GGEP open space dump garden and construction refuse over their fences into the GGEP open space. This is despite awareness and education information that is published on the GGEP website regarding dumping and pollution. On instances where dumping has been detected and the perpetrator identified, the GGEP management conducts individual visits to the perpetrators to explain the essence of the GGEP project and the implications of dumping on conservation efforts in the open space. According to the GGEP management, the perpetrators are usually unaware of the environmental implications of dumping but are cooperative once aware. In a place where conservation of biodiversity is a priority, it is expected that environmental awareness would be a priority as conservation cannot be achieved by management alone but requires community participation if the project is to succeed. This is supported by researchers such as Worster (1973), Miller and Hobbs (2002) and Mupindu and Mangizvo (2012), who recognise the importance of environmental awareness, especially in the urban context where pollution is a challenge. The implication would then be that the GGEP management should view the GGEP community members as partners in conservation not only financially but also through capacity building. As supported by the United Nations (1992) and Ashwell *et al.* (2006) through Agenda 21 and the Constitution of South Africa, the findings highlight the need for community empowerment to make environmentally sound

decisions in natural resource access and use. This is also in view of the fact that twenty years post CBD, the subject of environmental conservation and sustainability is not clearly understood despite the commitments that the government made by ratifying the CBD.

5.4.2.5 Unplanned fire regime

Results from the focus group discussion with property owners reveal that the GGEP open space has experienced unplanned wild fires which not only affected grasslands but part of the forest ecosystem too. Some of the wild fires encountered in the GGEP started from properties that had not implemented planned burning. There are some property owners who neither give access to their properties for planned burning nor manage the grasslands on their properties. Despite the wild fires experienced in the GGEP open space, the GGEP management team implements planned bush burning, with the help of the Working on Fire management team shown in Figure 5.24.

Figure 5.24: The Working on Fire team burning bushes in the GGEP open space
(Source: GGEP management activity records)

Findings from a key informant interview with the GGEP project manager further revealed that regular burning of grasslands is practiced in the GGEP open space. The GGEP project manager revealed that they practiced burning because it is beneficial to the GGEP ecosystems for maintaining biodiversity and as a measure of controlling alien species invasions. In addition, the GGEP manager stated that if grass is left for a long time without burning, a layer of grass debris piles up and when the fire breaks out it has enough fuel to destroy the roots and seeds that are buried in the ground. This finding is consistent with Strickland and Edwards (2012) and Boakye *et al.* (2013), who suggest that wild fires make regeneration of plants

impossible and thus cause degradation and loss of fire intolerant species. Andersen *et al.* (2012) show that animal species react differently to fire; some species are intolerant to frequent fires while others proliferate. However, burning is deemed valuable to ecosystems as it maintains timeous succession, provides foraging and food for animals, and the burnt debris provides nutrients to the plants in a given ecosystem (Strickland and Edwards, 2012).

In contextualising the changes in natural resources abundance, this section has highlighted some of the activities that the GGEP management team implements to rehabilitate the GGEP open space ecosystems. Efforts to manage the environmental problems are evident as seen from the previous section but challenges in dealing with the highlighted problems persist. Issues that affect the restorative activities that the GGEP management implements in the open space ecosystems have also been highlighted revealing various stakeholders playing a part in improving or exacerbating the problems. Perceptions of the GGEP stakeholders (relevant to this study) are discussed in relation to the issues on management and use of the GGEP open space in section 5.4.4 on stakeholder perceptions.

5.4.3 Current uses of natural resources

Managing ecosystems through conservation enhances human well-being through enhanced ecosystem health. The Constitution of South Africa provides for conservation of environmental resources and exploitation of such resources to enhance the well-being of its citizenry: human well-being is at the core of conservation in South Africa (Republic of South Africa, 1996). Biodiversity conservation projects such as the GGEP provide an opportunity to conserve indigenous biodiversity to enhance human well-being through ecosystem services.

Findings from the questionnaire survey reveal that 75.9% of the GGEP respondents visit the open space while 24.1% do not. Figure 5.25 indicates the frequency with which GGEP residents visit the GGEP open space.

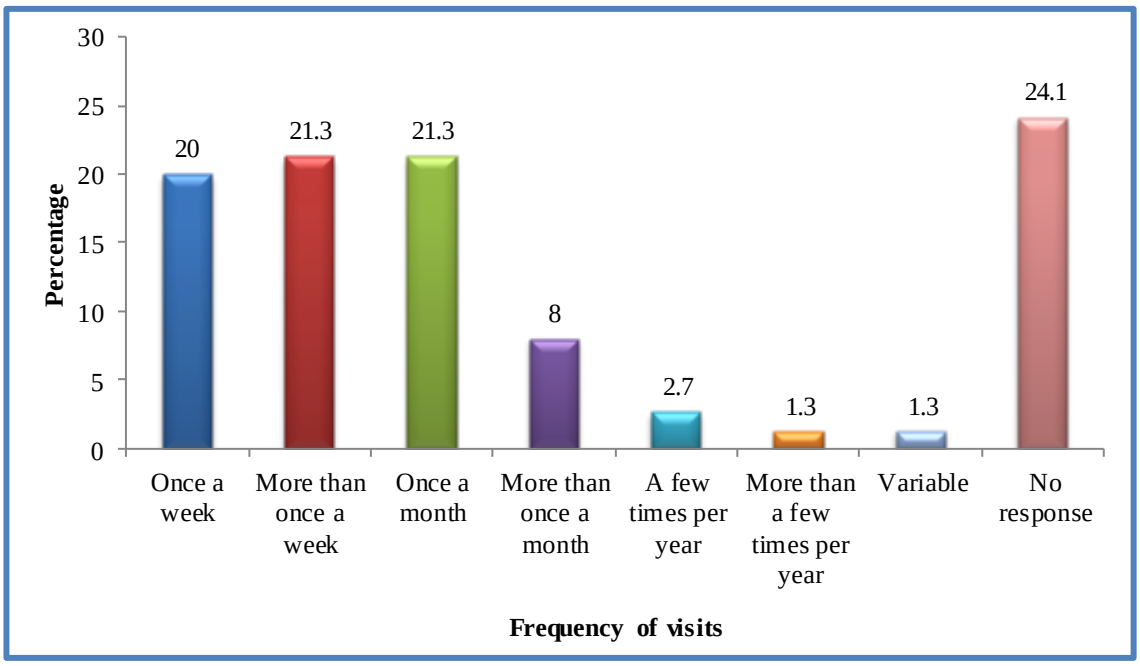


Figure 5.25: Frequency with which GGEP residents visit the GGEP open space (n = 75)

Of those that visit the GGEP open space, 21.3% of the respondents visit once a month, another 21.3% more than once a week and 20% once a week. In addition, 8% of the respondents visit the open space more than once a month while 2.7% indicated visiting the open space a few times in a year. Further, 1.3% of the respondents indicated visiting the GGEP open space more than a few times a year and another 1.3% indicated that their visits to the open space were variable. There was 24.1% no response which represents the respondents who did not visit the open space.

Findings from the questionnaire survey and the focus group discussion with GGEP property owners reveal that the GGEP open space provides various opportunities for GGEP residents and non-residents to engage in. Table 5.8 ranks the activities performed by the GGEP residents in the open space according to the frequency (expressed as percentages) with which each activity was mentioned in the questionnaire survey.

Table 5.8: Activities residents participated in (n = 75)

Activity	Responses (in percentage)		
	Yes	**No**	**No response**
Taking a walk	61.3	14.6	24.1
Mountain biking	27.9	48.0	24.1
Bird watching	9.2	66.7	24.1
Horse riding	8.0	67.9	24.1
Gathering/harvesting forest products	0	75.9	24.1

The majority of respondents (61.3%) cited walking as an activity done by GGEP residents within the open space. The GGEP open space has streams and waterfalls, forests, animals, and the uMhlatuzana rock shelter, which all provide recreation and educational experience. Some of the respondents (27.9%) cited mountain biking as an activity performed in the GGEP open space and this is attributable to the undulating landscape within which the GGEP lies. The road in the GGEP open space serves as the only route for cyclers since the trails are restricted to walkers as a soil erosion preventive measure. Figure 5.26 provides a summary of the routes taken by mountain bikers.

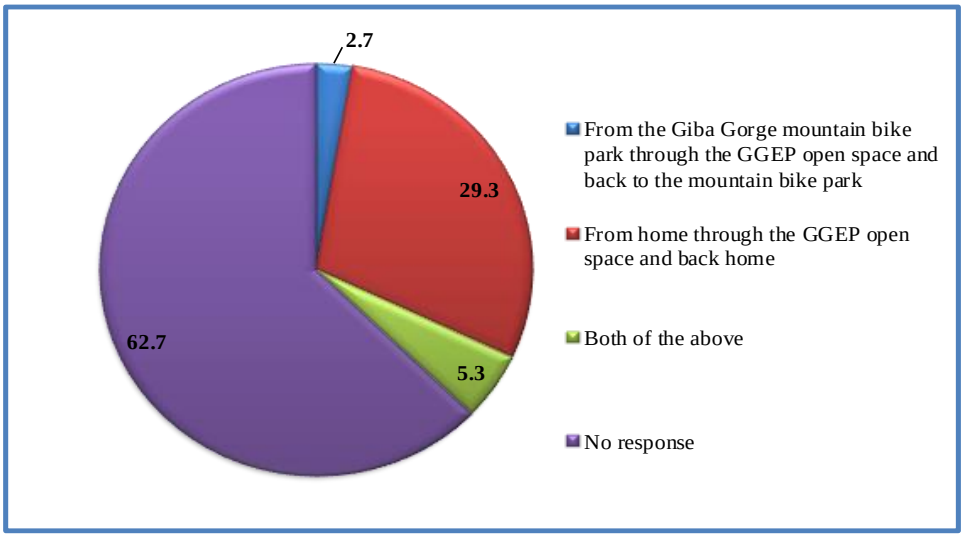


Figure 5.26: Routes taken by mountain bikers (n = 27)

As depicted in Figure 5.26, a high percentage of the GGEP respondents interviewed (29.3%) predominantly use only the GGEP open space for cycling while 5.3% use both the Giba Gorge mountain bike park and the GGEP open space. However, 2.7% use the Giba Gorge mountain bike park (which shares a boundary with the GGEP open space) through the GGEP open space and back to the bike park. In addition, 62.7% of the respondents did not respond and represent respondents who do not engage in cycling.

Table 5.8 shows that 9.2% of the GGEP respondents engage in bird watching. As presented in chapter four, the GGEP open space has various species among which are birds and these provide an opportunity for bird watching. Further, though not a commonly cited activity, horse riding is performed in the open space as indicated by 8% of the respondents. The 'no response' (24.1%) represents the respondents who stated that they do not visit the GGEP open space.

In addition to the activities presented in Table 5.8, the findings from the focus group discussion with property owners reveal that the GGEP residents enjoy the scenery of the open space landscape from their properties (see Figure 5.27).

Figure 5.27: A view into the GGEP open space taken from one of the properties
(Source: Field photographs)

Four property owners indicated that they are able to see birds and animals that wander onto their properties without having to visit the GGEP open space. One of the property owners had the following to say regarding animal life in the GGEP open space:

> *I can hear the birds and animals at night and I also see them.*
> (Property owner 12)

Besides the GGEP residents using the open space, 69% of the GGEP respondents indicated that non-GGEP residents use the GGEP open space as well. The non-GGEP resident open space users are presented in Figure 5.28.

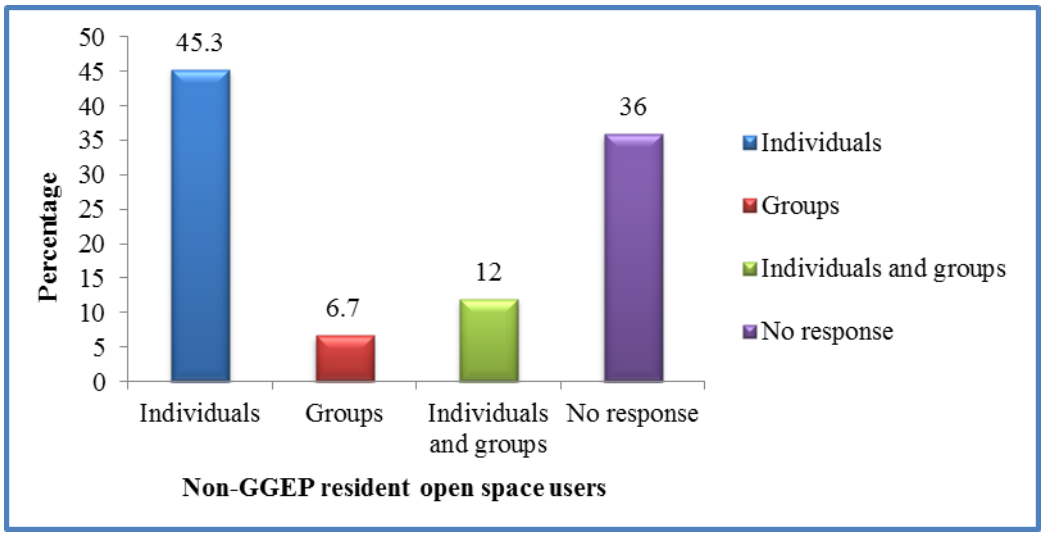


Figure 5.28: Non-GGEP resident open space users (n = 75)

The highest percentage of respondents (45.3%) indicated that among the non-GGEP resident open space users the majority are individuals. Findings from the focus group discussion with the GGEP property owners revealed that individuals who visit the GGEP open space include researchers, cyclists, horse riders and residents of nearby settlements and suburbs. In addition, 12% of the respondents stated that individuals and groups are among the non-GGEP resident open space users. Further, 6.7% of the respondents indicated that there are groups of non-GGEP resident open space users. The focus group discussion with the GGEP property owners revealed that groups that visit the GGEP open space include Scouts, Society for the Blind and schoolchildren. However, 36% of the respondents did not respond and represent the respondents who did not know the type of people who visit the GGEP open space.

As diverse as the said groups and individual are, so are the activities they engage in when they visit the GGEP open space as presented in Table 5.9. The activities are ranked in percentages according to the frequency with which each activity was mentioned in the questionnaire survey.

Table 5.9: Activities performed by non-GGEP resident open space users (n = 51)

Activity	Yes	No	No response
Mountain biking	60.0	10.7	29.3
Walking	37.3	33.4	29.3
Bird watching	14.7	56.0	29.3
Horse riding	13.3	57.4	29.3
Collecting animal and plant products	2.7	68.0	29.3
Camping	1.3	69.4	29.3

According to the GGEP respondents, non-GGEP resident open space users engage in mountain biking as indicated by 60% of the respondents, walking as cited by 37.3% of the respondents, bird watching cited by 14.7% of the respondents, horse riding cited by 13.3% of the respondents, collecting animal and plant products cited by 2.7% of the respondents and camping which was cited by 1.3% of the respondents. As presented, a high percentage of respondents (60%) cited mountain biking as a common activity which non-GGEP resident open space users also engage in. Adjacent to the GGEP open space is the Giba Gorge mountain bike park which has a similar landscape to the GGEP open space. Some people cycle from the mountain bike park through the GGEP open space and back to the mountain bike park. However, to use the mountain bike park resource people are charged a membership or entrance fee which some people find too high to pay. As a result, the GGEP open space is an alternative for people who want to cycle but cannot afford the charges at the mountain bike park. Access into the GGEP open space is unrestricted to both GGEP and non-GGEP resident open space users provided the users respect the integrity of the resource.

The GGEP property owners indicated that there are also individuals who visit the open space to collect animal and plant products for medicinal purposes. As established previously, findings from the focus group discussions with the Tshelimnyama community members indicated that they collect plant and animal parts or products for medicinal purposes. The Tshelimnyama community members also collect firewood, logs for construction, fruit and hunt animals for food. Findings also revealed that there are commercial harvesters who visit the GGEP open space to collect animal and plant products for medicinal use. However, collection of animal and plant products from the GGEP open space is illegal because it does not fall within the GGEP management plan and land use zonation of the area. Results from the key informant interview with the eThekwini Municipality personnel reveal that the GGEP was zoned as a ‘conservation area’ with provisions for recreational use and restrictions on harvesting or hunting any plants or animal products.

Recreation is cited as one aspect associated with living near open spaces (Jim and Chen, 2010; Gibbons *et al.*, 2014; Pillay and Pahlad, 2014). A study by O’Brien *et al.* (2014) highlights natural open spaces as good facility for the disabled to interact with nature and aesthetic value of natural open spaces in contributing to the well-being of users. The findings identified Society for the Blind as one group of the non-GGEP residents who use the open space for nature-walks and listening to birds. In an urban environment characterised by scanty nature where inhabitants have to travel to find open spaces, living within the proximity of a natural environment enhances human well-being (O’Brien *et al.*, 2014; Jim and Chen, 2006).

It has been demonstrated that the GGEP open space provides an opportunity to engage in various activities for GGEP and non-GGEP residents through recreational activities such as mountain biking, horse riding, trail walking and bird watching and camping. This chapter also highlights some of the environmental problems that are actively being addressed in the GGEP. In addition to the environmental problems are recreational activities which can cause adverse impacts on the environment. The discussion on 'contextualising changes in natural resource abundance' highlighted that trail-based recreational activities including walking on trails or hiking, horse riding and cycling can cause soil erosion and sedimentation of rivers and this is supported by Kidd *et al.* (2014) and Olive and Marion (2009). Secondary data sources reveal that the trail used in the annual Compendium Mountain Bike Derby passes through the GGEP open space and this race hosts about 1000 riders. Besides the once off events are the everyday mountain bikers who use the GGEP open space trails. Of concern is cycling in the GGEP open space because the findings reveal that because of the entrance fee charged at the adjacent mountain bike park, cyclists who cannot afford to pay prefer to use the GGEP open space. This means that if there are many people who cannot afford to pay, more cyclists will use the GGEP open space. This maybe the case already as one of the property owners made the following observation:

> *Inconsiderate bicycle riders, too many of them!*
> (Property owner 3)

Furthermore, Barros *et al.* (2013) demonstrate that trails can reduce the number and diversity of species through erosion while Kissling *et al.* (2009), Lucas-Borja *et al.* (2011) and Pickering *et al.* (2010) highlight other impacts to include soil compaction, hydrology, chemical and microbiological properties and soil loss. These findings have implications for the management of recreational activities in the GGEP open space.

5.4.3.1 Prospects of allowing non-GGEP residents into the open space

As established earlier in this study, access into the GGEP open space is unrestricted to both GGEP residents and non-residents. However, visitors into the open space are expected to abide by the regulations provided at the entrance of the open space and the integrity of the open space as a conservation area. Given the above, findings from the questionnaire survey conducted with the GGEP property owners indicate that there are prospects for allowing non-GGEP residents to use the GGEP open space. Table 5.10 summarises and ranks in percentage the prospects of allowing non-GGEP residents access to the GGEP open space as indicated by the GGEP respondents.

Table 5.10: Prospects of allowing non-GGEP residents into the GGEP open space (n = 75)

Prospect	Yes	No	No response
Education and awareness	76.0	21.3	2.7
Security measure	44.0	53.3	2.7
Volunteers and allies	36.0	61.3	2.7
View nature	25.3	72.0	2.7

According to 76% of the GGEP respondents, allowing non-GGEP residents into the open space provides an opportunity for environmental education and awareness. Findings from the focus group discussion revealed that the GGEP management runs an education programme for children and youth from schools in Durban including youth groups such as scouts. These groups engage in nature walks-an opportunity to learn about endemic and threatened species within their habitats. The education programme manager indicated during a key informant interview that the aim of engaging children in nature walks is to provide children an experience with the natural environment through educational programmes that instil environmental consciousness. Besides the education programme, results from a key informant interview with the eThekwini Municipality personnel and secondary data sources revealed that the GGEP open space provides resources for education and research. For instance, the GGEP is home to the African crown eagle, which currently is a subject of a research project on conservation of the species. The project investigates why the crown eagle populations in the D'MOSS area are stable whereas trends show that their population is decreasing in Africa. Since the GGEP is home to the crown eagle, one of the sample nests included in the study is situated within the open space. These findings demonstrate that biodiversity conservation can be beneficial to a wider community other than the immediate community. Miller and Hobbs (2002) support the finding and assert that through education and research open spaces make it possible to develop knowledge important for conservation of the natural environment. Pillay and Pahlad (2014) also cite education as an important aspect associated with open spaces while O'Farrell *et al.* (2012) state that open spaces provide a learning opportunity for children. The need for environmental awareness for sustainability has been emphasised since the 1970s (Shobeiri *et al.,* 2006) and later in 1992 at the WCED where the importance of education and awareness as an ideal strategy for biodiversity conservation and environmental sustainability was reiterated (United Nations, 1992). The Secretariat of the CBD (2012), advocates that nations use capacity development, awareness and environmental education in ensuring sustainability of environmental resources. In support of the findings, Handy (2001) and Chandel and Kumar (2014) assert that education and awareness enables the public to become more environmentally conscious and thus act more responsibly when using the natural environment.

Further, Table 5.10 shows that 44% of the respondents indicated that allowing non-GGEP residents into the open space acts as a security measure by increasing surveillance. This aspect of the findings is discussed further in section 5.4.5. Besides security prospects, findings from the questionnaire survey reveal that 36% of the respondents indicated that allowing non-GGEP residents into the open space provides the property owners with possible volunteers to help with activities in the open space and allies in an event where lobbying is required for the cause of the GGEP open space. That is, the more the people enjoying the benefits of the GGEP project, the more people would be willing to lobby for the cause of conserving the GGEP open space. This is consistent with Miller and Hobbs' (2002) assertion that when people have a good relationship with nature, they are more likely to support its conservation because of a better understanding of the ecology of nature. Similarly, Vinay (2014) acknowledges that when people are connected to the environment, they will act to conserve it. In addition, Sodhi *et al.* (2010) acknowledge that support from local communities can be crucial for conserving biodiversity. On the other hand, Epstein (2015) acknowledges NGOs and state agencies as important partners in conservation through funding, social capital and capacity building, and for mobilising society towards conservation activities.

Table 5.10 also shows 25.3% of the respondents agreed with that, allowing non-GGEP residents into the GGEP open space permits more people to view nature. The setup of the GGEP open space in an urban environment means that people can access and use the natural environment without leaving the urban setting. Thus, people can engage in activities which otherwise would not be possible in an urban environment such as bird watching, trail walking and camping. This finding is consistent with other studies (Koplan *et al.,* 2005; Gordon-Larsen *et al.,* 2006; Active Living Research, 2010; ; Natural England and CPRE, 2010; O'Brien *et al.,* 2014) which highlight the benefits of conserving biodiversity in urban environments. O'Brien *et al.* (2014) highlights natural open space recreational activities which people engage in mentioning trail walking and hiking as common activities.

The discussion on prospects of allowing non-GGEP residents to access and use the GGEP open space demonstrates how widespread the prospects are. Highlighting the prospects of open spaces through education and awareness campaigns allows people to understand the importance of conserving open spaces. Thus the implication would be increased public concern for conservation of open spaces which becomes a resource for environmental lobbying not only for a specific open space but all global open spaces (Sodhi *et al.,* 2010). Researchers such as Handy (2001) demonstrate that government authorities usually heed to pressure exerted by the public domain including NGOs, therefore securing partners for environmental lobbying and advocacy becomes critical. In a place where development pressure is high such as the GGEP, lobbying and advocacy is an important aspect of conservation programmes, hence the

need for partners. Further, the discussion on prospects of allowing non-GGEP residents to access and use the GGEP open space demonstrates how the benefits of maintaining an open space can go beyond the proximity of the open space. That is, open space users travel long distances to use the open space amenities such as mountain biking, trail walking and research within the GGEP open space. This has implications in planning and development of public natural open spaces in Durban and South Africa.

5.4.4 Stakeholders' perceptions of the GGEP project

This section examines the perceptions of the GGEP respondents on various aspects of the GGEP project including communication, natural resource management contestations, funding and general perceptions on the GGEP project as a whole.

5.4.4.1 Communication

Biodiversity management is moving towards forming partnerships with communities which have a stake in the resource under management either actively or through environmental education and awareness, for instance, through the biodiversity stewardship programme in South Africa (Cadman *et al.*, 2010). Communication with stakeholders is an important aspect of stakeholder management which is mainly dependent on stakeholder salience as reiterated by Jawahar and McLaughling (2001) and De Nooy (2013) (elaborated in chapter two). The findings presented examine perceptions of communication within the GGEP project and with the GGEP's various stakeholders, which affects the activities of the GGEP project. Thus, the focus is on communication among GGEP property owners and with the identified stakeholders.

Communication of the GGEP management with its dependent and discretionary stakeholders

As established at the beginning of this chapter, there are three stakeholder groups associated with the GGEP project: the GGEP property owners (definitive), the Tshelimnyama community (dependent stakeholders) and the commercial harvesters (discretionary stakeholders). Findings from the focus group discussions with GGEP property owners and key informant interviews with the leaders of Tshelimnyama traditional healers, GGEP property owners and eThekwini Municipality personnel reveal that the Tshelimnyama community and commercial harvesters have not been engaged within the GGEP project. That is, the GGEP management has made no attempts to involve the Tshelimnyama and commercial harvesters in the GGEP project despite the stakeholders being active users of the GGEP open space. Previous discussions on contextualising changes in natural resource abundance revealed that the

Tshelimnyama community members and commercial harvesters extract natural resources from the GGEP open space. The existing relationship between the GGEP open space and the two stakeholder groups warrants that communication be established in order to find ways of supporting the stakeholders' livelihoods while conserving the GGEP open space biodiversity. This is consistent with Freeman *et al.* (2004), Phillip (2004), Rowlinson and Cheung (2008), Ackermann and Eden (2011), and De Nooy (2013) who reiterate the need to establish communication with groups of people whose actions affect management of a resource. De Nooy (2013) asserts that communication among stakeholders fosters achievement of natural resource management objectives. In addition, the GGEP management has not adopted an effective management strategy to actively manage the dependent and discretionary stakeholders. Stakeholder management requires that an appropriate and effective management strategy be adopted in managing stakeholders and such a strategy would determine the level of management engagement with a stakeholder group (Jawahar and McLaughlin, 2001; Bakens *et al.,* 2005; Young, 2006; Ayuso *et al.,* 2012). However, the management strategies adopted only discourage destructive harvesting through painting of tree barks and patrolling the GGEP open space which, given the size of the open space, would not be effective. On the other hand, the GGEP management team cannot choose to ignore its stakeholders because doing so would be counterproductive to conservation efforts of the GGEP project. That is, when the stakeholders harvest the GGEP natural resources independently, their actions can lead to degradation of the open space ecosystems as in the case of the 'tragedy of the commons'. The results of such actions have been highlighted under contextualising changes in natural resource abundance in section 5.4.1.1. The findings discussed therefore have an implication for the management of dependent and discretionary stakeholders for the health of the GGEP open space ecosystems.

Communication of the GGEP management with its definitive stakeholders: GGEP property owners

Unlike the dependent and discretionary stakeholders, the GGEP project partnership (eThekwini Municipality and property owners) is a formal establishment that is expected to have established channels of effective communication. This is in line with the GGEP management objective set out in the management plan which is "to build a good relationship with all landowners within the GGEP through regular and effective communication" (GGEP, 2011: 9). Results from secondary data sources (GGEP management activity records), focus group discussions (with GGEP property owners) and a key informant interview (eThekwini Municipality personnel) reveal that there are channels of communication established for disseminating information pertaining to the GGEP project. Results from the focus group discussion with property owners reveal some of the available channels of communication as highlighted:

> *First, at the beginning we advertised and the billboard was at the end of St. Helier road and the residents have access to information. And then moving onto the website we have the history of the place, why the GGEP was created and the management plan on the website and it's all you need to know about the gorge. And then obviously we put our numbers on the website for anyone who has questions. I get a lot of calls. And then if there is anything else we deal with it individually. We have individuals who come to us to ask like Phoebe* (pseudonym) *here and we explain to them how the gorge was formed so everyone has access to information. All our plans are on the website. But you as a property owner have to take the initiative to come to us and ask.*
> (Property owner 1)

Thus, the quotation highlights that the GGEP project's channels of communication include a billboard placed at the entrance of the GGEP and the website. In addition, findings from the focus group discussion with the GGEP property owners and secondary data sources reveal that the GGEP has a bi-monthly newsletter. According to the GGEP management, the billboard provides a summary of what the GGEP is all about, announcements and it also provides contact details and the website of the GGEP. The newsletter features articles on various activities related to the GGEP open space and provides a summary of management achievements and targets following the achievements. The website outlines the GGEP project in detail providing the management plan, ecosystems, environmental problems and management, planned management activities and achievements, among others. Despite availability of information on the website, billboard and newsletter regarding activities conducted in the GGEP, findings from the questionnaire survey reveal that some of the GGEP respondents are unaware of the rehabilitative activities that have been implemented in the GGEP open space (highlighted in section 5.4.1). Two of the property owners stated,

> *What they say they will do is not happening in practice.*
> (Property owner 9)

> *We are paying but don't know why we are paying or what they are using the money for…they need better control and we need them to report back.*
> (Property owner 7)

Results from the focus group discussion with the GGEP property owners reveal that management has made efforts to communicate the management activities using different communication strategies. This suggests two issues: either the use of newsletters, billboards or website as strategies of communication is ineffective in transmitting information to all property owners or the messages communicated in the said

media are insufficient. Communication planning requires that the development of communication strategies be research based to identify the most appropriate channels of communication and messages for the target audience, among other things (Fleet, 2008; Cornelissen, 2014). Thus, it is also important to understand what messages the target audience wants to hear and how they want to hear it; this would result in the implementation of effective communication strategies.

Further, results from the focus group discussion with the GGEP management and key informant interviews with the eThekwini Municipality personnel revealed that the GGEP management team meets quarterly to discuss management of the GGEP open space and any other issues arising. The GGEP management considers these meetings an open forum for any property owner seeking to know more about the activities in the GGEP open space. However, results also show that most property owners are not aware that they can attend committee meetings and are also unaware of when and where the meetings are to be held. As a result, property owners do not attend these meetings and those who have attended did so by invitation. For such property owners, the meetings are a platform to address any queries they have regarding the GGEP project and especially the management activities, which are a cause of discontentment among property owners. For instance, during one of the meetings the researcher attended, a property owner was invited to the meeting because of the problems she had with field workers clearing invasive alien species on her property. For her, the meeting served as an opportunity to discuss her concerns with the management team. This kind of communication is reactive to stakeholder needs rather than proactive. It would be expected that the committee become proactive in inviting property owners to attend the quarterly management meetings. Communication between management and property owners as definitive stakeholders should be prioritised since property owners provide resources for managing the open space and therefore should be given feedback on management activities. This is consistent with the provisions of stakeholder management where stakeholders with high salience are prioritised in management (Jawahar and McLaughlin, 2001; Ackermann and Eden, 2011; Tullberg, 2013).

Results from the key informant interviews with the eThekwini Municipality personnel and the GGEP project manager revealed that since the GGEP project started implementing the management plan in 2010, no general meeting with all the property owners was held. However, at the outset, a general meeting was planned for December 2012 which would mark the end of the pilot phase of the project. The December 2012 meeting would also provide an opportunity for property owners to vote in favour of or otherwise, for the continuation of the project beyond the pilot phase. Results from a key informant interview with eThekwini Municipality personnel reveal that the first Annual General Meeting was held on 10 December 2012 where all property owners were invited to attend. Poor attendance at this meeting

was attributed to the fact that it was raining on the day. In addition, the vote which was supposed to be cast to decide the future of the GGEP was postponed because the Municipality decided to continue co-funding the GGEP project for three more years.

Evident from the discussion on communication is the lack of communication between the GGEP management and, the Tshelimnyama community members and commercial harvesters. The discussion also reveals the lack of effective communication between the GGEP management and the GGEP property owners. Among GGEP property owners, various communication channels were established, though their effectiveness in this context is questionable. Researchers such as Karlsen (2008), Olander and Landin (2008), Lloyd and Boyd (2011) and De Nooy (2013) reiterate the importance of communication as it engenders good relationships, determines how successful a relationship can be and is a foundation of stakeholder management. In addition, Lloyd and Boyd (2011) suggest that within natural resource management, communication is important among stakeholders in achieving management goals. As demonstrated in the findings, communication would allow for sharing of management experiences and ideas to improve management practices. The OSPAR Commission (2008) and De Nooy (2013) support this finding and reiterates that doing so would allow for stakeholder input in management which would in turn give stakeholders a sense of inclusiveness in management processes. Further, the discussion has demonstrated that effective communication channels can be an important tool in averting discontentment. This is consistent with the aspect of stakeholder management which requires that management communicates effectively with stakeholders and in doing so listens and acts on stakeholder views (Ipsos MORI, 2009; De Nooy, 2013). The findings discussed have implications on the GGEP management strategies, communication channels adopted for various stakeholders, achievement of objectives and overall success of the project.

5.4.4.2 Natural resource management contestations in the GGEP

This study identified various issues, which are sources of discontentment within the GGEP, that is, among property owners, between the GGEP property owners and Tshelimnyama community members, and between the GGEP property owners and commercial harvesters. This section discusses the identified sources of discontentment and the measures implemented to address the discontentment.

Contestations between management and GGEP property owners

The study through the questionnaire survey reveals that 11.1% of the GGEP respondents indicated that they would not support the GGEP project beyond the pilot phase. Commenting on long-term support of the GGEP, one of the property owners stated:

> *I have asked many times for a list of who voted for the project last time, I am still waiting. I will go to court if this happens again. Voting by placing my open vote in someone's house letter box is not my way of a fair vote*.
> (Property owner 5)

Some of the respondents stated that the project is unnecessary in some parts of the GGEP and therefore should only be funded by people owning land in the GGEP open space. Two other property owners gave the following reasons for their unwillingness to continue supporting the GGEP project in the long run:

> *The project is driven by a few with private motives, who own land in the gorge*. *I will not fund private land.*
> (Property owner 3)

> *This is really a good project for the St Helier's valley. Extending it along the N3 properties in Alexander drive is simply trying to gather more funding and I will not pay for this once the initial scope of the project is completed*.
> (Property owner 6)

Findings from the field observations on the GGEP open space reveal that the GGEP management had implemented many activities on invasive alien species clearing in St. Helier's valley when compared to majority of the GGEP open space. It can be deduced then that sentiments such as the one made by 'property owner 3' and 'property owner 6' may have emanated from the fact that the GGEP management team has not managed to clear invasive alien species in all parts of the GGEP open space. Having one area of the GGEP open space improving in quality while others are not is a cause of discontentment among the property owners as it makes some property owners to question the motive for soliciting funds from property owners. The perception of some property owners was that funds were mainly used on land owned by a few property owners in the open space where rehabilitation activities were implemented. This speaks directly to intangible benefits and/ or the long-term nature of conservation benefits from the GGEP project, which makes supporting the GGEP project seem cumbersome for some property owners. Concerning this, Moon *et al.* (2012: 292) state that "conservation policies that maintain or improve

landholders' personal circumstances and that promote pro-environmental norms may result in increased participation and thereby conservation outcomes." In addition, Epstein (2015) asserts that long term benefits of conservation are a condition for pro-environmental behaviour. The implications of the findings extend to management of the property owners' needs for tangible benefits which affects the state of the GGEP open space.

Perceptions of property owners on management activities

As presented previously, 86.1% of the GGEP respondents indicated that the GGEP ecosystems were in a better state than they were before the project started. In addition, change analysis for the period 2010 to 2012 reveals changes in the ecosystems, in particular a 6.3013 hectares reduction of the forest ecosystem. Findings from the questionnaire survey and focus group discussion with the GGEP respondents reveal that some of the property owners have a different idea of what kind of management activities should be implemented specifically concerning invasive alien species clearing. One of the comments from the questionnaire survey related to the state of biodiversity as follows:

> *Trees are cut and animals are no longer in the forest. Forest fencing is causing animals not to go in the forest*.
> (Property owner 40)

According the GGEP management, the GGEP open space is fenced off to keep out intruders. However, as indicated by property owner 40, fencing restricts movement of animals in and out of the open space. Further, two other comments were made in relation to the function of invasive alien species in the GGEP and are as follows:

> *…they cut trees exposing properties without wind breaks*.
> (Property owner 10)

> *Cutting trees also increases the noise from the M13 high way*.
> (Property owner 11)

As evident from the quotations given and the data from the focus group discussion with property owners, some property owners had concerns regarding invasive alien species clearing because the species were seen in the same light as indigenous species. Such property owners valued invasive alien species as plants and for their function as wind breaks or aesthetic reasons but did not understand the implication of invasive alien species proliferation in an indigenous open space. In addition, the alien species that had

grown in the GGEP over the years provided a shield against noise pollution from the N3 and M13 highway, acted as windbreaks and provided a sense of security to households. Thus, some property owners tended to oppose clearing invasive alien species because doing so would remove wind and noise breakers thus increasing noise pollution from the M13 highway. Nevertheless, findings from the key informant interview with the eThekwini Municipality personnel reveal that the cleared areas cannot be reforested with indigenous tree species because the purpose for clearing invasive alien species was to rehabilitate and restore the grassland ecosystem. Despite this, the eThekwini Municipality personnel indicated that the management team plants indigenous tree species on the edge of the grasslands for the purpose of wind and noise breaks.

The results presented reveal that another cause of discontentment among the GGEP property owners was different value systems with regards to invasive alien species in the GGEP open space. Miller and Hobbs (2007: 387) support this result and reiterate that it is a common phenomenon that non-scientists may value invasive species for the "natural or aesthetic qualities" without considering the ecological significance of the species. In addition, Gobster and Hull (2000) and Miller and Hobbs (2007) propose that social constraints emanate from unexpected negative sentiments from stakeholders caused by conflicting values between managers and stakeholders (in this case the property owners). McGregor *et al.* (2014) also suggest that perceptions of the public about invasive alien species may not be commensurate to that of ecosystem managers. As such, Estévez *et al.* (2014) reiterate that differences in value systems and perceptions on invasive alien species between stakeholders and management can lead to conflict. Despite the highlighted discontentment, the decision of what should constitute an indigenous open space lies with the municipal personnel who are mandated by the DEA to implement the decisions to eliminate invasive alien species. It is immaterial whether or not alien species provide benefits to residences within the GGEP because the species in question are categorised as destructive to indigenous species. This scenario presents a case of power interplay among stakeholders and in this case executive power vested in municipal personnel managing the GGEP (Gobster, 2000; Celliers *et al.,* 2007). That is, despite resistance and displeasure to clear invasive alien species, the municipal personnel act authoritatively in the interest of 'silent stakeholders', in this case the GGEP open space ecosystems. The results discussed have ramifications for management of property owners' needs and the health of the GGEP open space ecosystems.

The discussion on contestations between management and GGEP property owners indicates that the nature of discontentment between the management team and the GGEP property owners results from lack of timeous communication of decisions and management plans and effective communication strategy.

Despite the channels of communication availed to property owners, there is still lack of necessary information on the GGEP project. Again, communication has been highlighted as an important aspect of a project because it determines the success of the project through stakeholder acceptance. This is supported by Miller and Hobbs (2007: 387) who state that "successful habitat restoration must be predicated on communication of project goals and underlying rationale, as well as open dialogue to gauge public understanding and acceptance." In addition, Epstein (2015) states that a change of perceptions on net benefits of conservation can be achieved through educating natural resource users. The findings on contestations between management and GGEP property owners therefore have implications on the GGEP management's strategies to make stakeholders understand the processes of GGEP management. It also has implications on GGEP management's strategy to foster acceptance of the project and activities implemented.

GGEP versus commercial harvesters and the Tshelimnyama community

The study through focus group discussions with the GGEP property owners highlight two stakeholder groups that access the GGEP open space to extract natural resources, namely, the commercial harvesters and Tshelimnyama traditional healers. Further, the study through focus group discussions with GGEP property owners, key informant interviews with eThekwini Municipality personnel and Tshelimnyama traditional healers reveals that commercial harvesters solicit medicinal plants in the GGEP open space to supply traditional healers and traditional medicine traders within and outside Durban in places such as Johannesburg. That is, traditional healers who cannot access forests to harvest the needed natural resources for their practice enlist the help of commercial harvesters who act as wholesalers for the required natural resources. Thus, the main cause of discontentment among property owners is the very nature of commercial harvesters' occupation, which compromises ecosystem integrity in the GGEP open space. Harvesting of natural resources in bulk and the practices employed by commercial harvesters can result in long-term depletion of the GGEP open space of its resources. For instance, harvesting tree bark for medicinal purposes on a commercial basis leaves many trees de-barked, an act that is detrimental to plants. Thus, commercial harvesters' activities in the GGEP open space are destructive to the forest due to unsustainable harvest practices used when collecting plant products.

Findings from the questionnaire survey indicate that 81.5% of the GGEP respondents had a stable income earning over R100 000 per annum. Similarly, the eThekwini Municipality (2010: 26) indicates that 50% of households living in the Hillcrest area earn between R76 801 and R614 400 per annum. However, focus group discussions and key informant interviews with traditional healers revealed that traditional

healers had no formal employment and income generated from traditional healing consultations was important for sustaining their livelihoods. Findings also show that because income from traditional healing activities is unreliable, some traditional healers depended on social grants to supplement income while others enlist help from relatives who they live with, for sustenance. The socio-economic conditions of the Tshelimnyama traditional healers are reflective of the living conditions of the poor within Durban and South Africa, which are characterised by high levels of poverty and unstable income (Marx and Charlton, 2003; Roberts and O'Donoghue, 2013). The lack of stable income and poverty within the Tshelimnyama community is an underlying factor for dependence on the natural environment to supplement livelihoods. This notion is consistent with the MEA's (2005) assertion that most poor communities rely on the natural environment for their livelihoods as people resort to the natural environment to supplement their meagre income either by obtaining resources to use domestically or for commercial purposes.

Evident from the study is a wide disparity of livelihoods with property owners mainly in formal employment or retired while the Tshelimnyama community members mainly depend on the natural environment for their livelihoods. The said disparity gives rise to diverse interests and contestations for resources in the GGEP open space. That is, the interests of the GGEP property owners are far apart from those of the Tshelimnyama community members as depicted in Table 5.11.

Table 5.11: Stakeholder interests in the Giba Gorge

<table>
<tr><th>GGEP partnership (eThekwini Municipality and
Giba Gorge property owner) interests</th><th colspan="2">Tshelimnyama community (traditional healers and general community members) interests</th></tr>
<tr><td rowspan="2">Aesthetic value</td><td rowspan="2">Resources for medicines</td><td>Plant: tree bark, leaves, roots</td></tr>
<tr><td>Animal: skin, hooves, talons, tarsus oil/fat</td></tr>
<tr><td>Improve quality of life for property owners</td><td colspan="2">Building (logs)</td></tr>
<tr><td>Precinct has the potential of increasing the value of property</td><td colspan="2">Fuel (wood)</td></tr>
<tr><td>Conserving endangered species and historical site</td><td colspan="2">Food (fruits and meat)</td></tr>
<tr><td>Conserving the natural environment</td><td colspan="2"></td></tr>
</table>

As indicated in Table 5.11, stakeholder interests are different and there is not a single interest that is common to both groups. Previous examination of the current uses of the GGEP open space revealed that all GGEP respondents did not harvest any resources from the GGEP open space. On the other hand, findings from focus group discussions and interviews with the Tshelimnyama community (both traditional healers and general community members) revealed that Tshelimnyama community members

access the GGEP open space to hunt animals and harvest medicinal plants. In addition, some of the Tshelimnyama traditional healers and general community members stated:

> *…children go there to get mangoes and other fruits but people from our community go there to get things like wood to make fire or tree trunk to build or make roofs for their houses*.
> (General community member 4)

> *I use the forest for muthi to heal people. I also use the forest to get wood to make fire for making traditional beer when there is a traditional ceremony*.
> (Traditional healer 8)

> *…the most important thing that I use the forest for is muthi…oh! And wood for boiling or cooking muthi because electricity is very expensive.*
> (Traditional healer 3)

> *…..at home my children have even asked me to contribute money to buy electricity because they say muthi consumes too much electricity like cooking samp which they have long agreed that we need to use firewood to cook it with.*
> (Traditional healer 4)

As indicated previously, the major concern with harvesting resources from the GGEP open space is that the practice goes against the purpose of establishing the GGEP project. The GGEP management plan specifies a number of activities that are prohibited, one of which is harvesting of natural resources because harvesting natural resources is counterproductive to sustainable management of ecosystems as stipulated in objectives one and two of the GGEP management plan. The GGEP open space is a relatively small resource that cannot sustainably support uncontrolled harvesting of plant and animal products as demonstrated by the observed loss of species from the open space before the GGEP project started. This is because the number of people wanting to harvest resources from Tshelimnyama is unknown but the impacts of such harvest have demonstrated to be destructive. Focus group discussions with traditional healers revealed that there are more than 32 registered traditional healers in Tshelimnyama and, in addition, there are also many unregistered traditional healers. All these traditional healers depend on the immediate natural environment to provide resources for their practice and as indicated during focus group discussions, the GGEP open space is one of the nearest sources.

Regardless of whether natural resource harvesting is commercial or domestic, the main concern with harvesting natural resources for medicinal purposes is whether maintenance of ecosystem health is

possible while allowing proliferation of harvesting in the GGEP. This concern resonates with the principle of ecosystem resilience which asserts that stressors induce change on ecosystems but the ability of the ecosystems to retain its integrity depends on, among other things, the extent of the stress inflicted within a given time period (Hulme, 2003; Folke *et al.,* 2010; Tylianakis and Coux, 2014). The nexus between natural resource harvesting for livelihoods and conservation brings out moral issues among environmental discourses, especially in political ecology. The moral question to ask is: which takes precedence, livelihoods or ecosystem health? Unlike the case with the GGEP project, Bryant and Jarosz (2004), Blaikie (2012) and Turner (2013) promote social and environmental justice, with a human bias, in natural resource management. That is, in the context of the GGEP project, the needs of GGEP property owners should not take precedence over those of the Tshelimnyama community. However, biodiversity conservation is also critical, especially amid rising pressures to develop and urbanise. Bryant and Jarosz (2004) support this by stating that environmental ethics in political ecology consider the environment and poor communities 'equals' and require equal treatment. That is, livelihoods should be enhanced through ecosystem health.

In addition, the urban spatial context within which the GGEP open space is placed (where ecosystems are continuously fragmented and lost to development) and the significance of species within the open space demand that conservation be prioritised. It is for this reason that the D'MOSS classified the GGEP area as a conservation zone. What makes this discourse interesting is that ownership of the GGEP open space is shared between private and public land as demonstrated in chapter four: the property owners, eThekwini Municipality and SANRAL own land in the GGEP open space. Under private property ownership, the property owner would reserve the right to access private property. However, the merger among the GGEP property (the property owners, eThekwini Municipality and SANRAL) has resulted prohibitions on extractive use of natural resources. Thus, controlling access to the GGEP open space is based on conservation practice, that is, non-extractive natural resource use. All things considered, livelihoods are as important as ecosystem conservation in urban areas and this is supported by Driver *et al.* (2012) who assert that all economic, social or ecological decision-making should consider conservation needs as well as livelihoods of poor communities at all scales. This has implications for policy and decision-makers nationally and locally, especially considering the nature of traditional healers' livelihoods, the high rate of urban poverty, unemployment and on the other hand, the pressures on ecosystems.

5.4.4.3 Perceptions on funding for the GGEP project

The GGEP property owners' perceptions on the future of the GGEP are important in ascertaining how much support the GGEP project has considering that it has been running for more than two years. Understanding property owners' perceptions would provide needed information to the GGEP management in adjusting the project activities to the benefit of all property owners and other stakeholders. This is also in view of the fact that funding for the GGEP project will be the responsibility of property owners beyond the pilot phase of the project.

As presented previously, findings from the questionnaire survey reveal that the majority of the GGEP respondents (88.9%) were willing to continue supporting the project financially beyond the pilot phase of the GGEP project. A minority of 11.1% was unwilling to continue funding the project stating that the (SRA) rate charged on their properties was too much to pay, among other reasons discussed previously. Given the above, the study further sought to understand the property owners' willingness to continue funding the GGEP project and how much they were willing to pay. The results are presented in Table 5.12.

Table 5.12: Amount that the respondents are willing to contribute towards the GGEP project (n = 75)

Amount (R) per month	Percentage
100	5.5
150	1.4
200	4.2
500	2.7
Any amount	22.2
0.02% of property value	1.4
Current amount (0.0504% of property value)	22.2
Slightly more than the current amount	2.7
Unsure	4.2
Less than the current amount	1.4
No response	32.1
Total	**100**

As indicated in Table 5.12, the highest percentage of respondents (22.2%) indicated willingness to pay any amount and another 22.2% indicated willingness to continue paying the current amount. Furthermore, 5.5% indicated willingness to pay R100, 4.2% of the respondents stated R200 and another 4.2% were unsure about how much they would be willing to pay towards funding for the GGEP project. Table 5.12 also shows that 32.1% of the respondents did not respond and this percentage may represent both the

respondents who were unwilling to continue funding the GGEP project and those who were willing but did not want to indicate how much they were willing to pay.

A cross examination of income and willingness to support the GGEP project beyond the pilot phase revealed that one out of the eight respondents (12.5%) who were unwilling to continue funding the GGEP project was a pensioner. The remaining seven respondents (87.5%) were employed earning between R100 000 and R500 000 or more per annum. The implication of this finding is that the GGEP respondents' unwillingness to continue funding the GGEP project beyond the pilot phase may not be attributable to financial incapability but maybe due to other factors highlighted in the following statements:

> *There is still a lot that needs to be done and with the rates and taxes burden on a dwindling tax payer, a lot of people are already stretched*.
> (Property owner 10)

> *I cannot support the project, not in its present form. Long-term support will be subject to the desired outcomes being maintained.*
> (Property owner 28)

> *Financial obligation in the long-term might become too much. I am not willing to contribute financially. In terms of contributing to the GGEP I would like to see an exchange of energy rather than an exchange in money, like assisting with clearing of aliens, so basically exchange in physical man power is best suited for me and my partner*.
> (Property owner 33)

> *It should not be funded by a few who live nearby, but can be used by all and not driven by a few with private motives, who own land in the gorge, I will not fund private land*.
> (Property owner 45)

The quoted statements reveal that some property owners were not willing to continue funding the GGEP project because of perceived long-term financial burden from the additional tax (SRA), intangible or unrealised benefits of the project and perceived purpose of establishing the GGEP project.

The GGEP project is composed of property owners with various motivations for funding the project, which to some extent are revealed in the GGEP respondents' willingness to continue funding the project. This illustrates the politics involved in managing the GGEP open space. How the GGEP management and property owners manage these politics would ultimately affect the integrity of the GGEP open space since property owners provide funding for rehabilitating the GGEP open space ecosystems. This finding is

consistent with Adams and Hutton's (2007) assertion that socio-political processes shape the environment. Knight *et al.* (2010: 1348) also state that "the effectiveness of conservation actions implemented through conservation-planning initiatives is a function of the human and social dimensions of social-ecological systems, such as stakeholders' willingness and capacity to participate." Within the context of conservation projects, social interactions of definitive stakeholders will influence the success of the project through withheld support. Thus, definitive stakeholders' continued funding depends on whether they have accepted the GGEP project and the perceived returns on their investment. In support, Miller and Hobbs (2007: 386) reiterate that "funding levels may depend on public acceptance of a project, whereas the degree to which the public embraces the restoration is likely to be a function of the ratio between costs and perceived benefits." A study by Moon and Cocklin (2011) demonstrates that property owners are motivated to participate in environmental conservation by the "level of formal biodiversity protection offered by the programme, potential changes to their property rights, personal benefits of participation, and the programme objectives."

According to the findings from key informant interview with eThekwini Municipality personnel and GGEP management, the GGEP project will eventually have to be self-sufficient without the eThekwini Municipality grant. This action will increase the property owners' responsibility to fund the project and the management team recognises the need to find additional means of funding for the GGEP project. Findings from the focus group discussion with property owners reveal that the GGEP management is actively engaged in soliciting funding from donors as well as trying to establish fundraising ventures. However, at the time of data collection, no external funding was raised. This finding demonstrates that funding for open spaces and management of ecosystems is a challenge and as the literature demonstrates (Miraftab, 2007; Halme *et al.*, 2013), it is not only a challenge for the GGEP open space but is a global phenomenon. It is for this reason that the proximate principle has received much attention within open space discourses and provides the basis for the establishment of parks and open spaces in the Western world and Europe (Crompton, 2007; De Brun, 2007). The findings on funding for the GGEP project have implications on future funding of the GGEP project and in turn, on the health of the GGEP ecosystems.

5.4.4.4 Perceptions on desirability of the GGEP

In this study, desirability of the GGEP refers to the appeal of the area for settlement given the present open space management project. The aim is to understand whether the GGEP project influences people's decisions to buy property in the GGEP area. In order to do so, it is necessary to ascertain how the GGEP property owners and estate agents perceived GGEP property prices in comparison to those in surrounding

suburbs. Again, only the perceptions of GGEP respondents and not Tshelimnyama community members are sought because property owners reside in the GGEP and hence would provide the needed information for the study. Table 5.13 depicts property owner's perceptions on the comparative value of the GGEP properties to those of surrounding suburbs. Seeking insight into the comparative value of GGEP properties to those of surrounding suburbs outside the GGEP area provides a background understanding of people's motivation when buying property in the GGEP.

Table 5.13: Comparative value of GGEP property value (n = 75)

Comment	Percentage
The GGEP properties always were of high value compared to properties in the surrounding suburbs	41.7
The GGEP properties always were of the same value compared to properties in the surrounding suburbs	40.3
Not sure	18
Total	**100**

Results from the questionnaire survey depicted in Table 5.13 reveal that 41.7% of the GGEP respondents believed that the value of properties in the GGEP was higher than that of surrounding suburbs before the project started. In addition, 40.3% of the respondents indicated that value of properties in the GGEP was of the same value as those in the surrounding suburbs. Lastly, 18% of the respondents were not sure how GGEP property value compared to those of surrounding suburbs before the GGEP project began. However, results from key informant interviews with estate agents reveal that property prices in the GGEP were the same value as properties from surrounding suburbs. GGEP property owners' perceptions on the comparative value of the GGEP properties have implications on the GGEP project since some property owners anticipate an increase in the GGEP property value and desirability of the area for settlement.

Further, results from key informant interviews with estate agents revealed that since the start of the recession, property prices and sales have dropped significantly causing 'cost' to be the main determinant for comparing properties in different suburbs. For instance, if a property in one suburb with a conservancy costs more than the same kind of property in another suburb without a conservancy, buyers would opt for the cheaper option over the environmental attributes of a more expensive property. Thus, people wanting to buy properties would compare prices of properties in the GGEP to those outside the GGEP before considering other attributes of properties. Despite this, estate agents indicated that prospective buyers of properties in the GGEP were aware of the GGEP project and specifically asked for properties overlooking the GGEP open space. One of the estate agents asserted that the scenery of undulating landscape of forest and grassland as well as the bird and animal life make people want to buy properties in the GGEP area.

Thus, even though cost was an important factor when considering buying property in the GGEP, some people still sought to buy properties overlooking the GGEP open space. This indicates that the GGEP's natural environment has had an impact on the desirability of the area for settlement. International literature supports this result by showing that properties in the proximity of open spaces attract positive premiums and therefore would be a good investment for developers as people are prepared to pay more to live in such an area (Crompton, 2007; Cornway *et al.,* 2010; City of Phoenix, 2012; Cilliers *et al.,* 2013; Gobbons *et al.,* 2014). It is such decision-making behaviour that has influenced the development of open spaces in Europe and the USA since costs of developing and maintaining open spaces would be offset in the long run through tax revenues (Crompton, 2004; Cornway *et al.,* 2010; Gobbons *et al.,* 2014;). However, Cilliers *et al.* (2013) assert that in South Africa, there is lack of evidence to show that people are willing to pay more for properties closer to open spaces. This result therefore has an implication for the GGEP project and on planning for urban open spaces in South Africa.

The fact that people are buying property in the GGEP area implies that residents of the GGEP area are selling properties, which begs the question of why properties are being sold? Estate agents elucidated during key informant interviews that families selling properties in the GGEP do so because they want to downsize due to old age and reduced family size. In addition, other families sell properties due to subdivision of the properties to raise money, while transfers to work in other cities or countries and death of the estate owner are some of the reasons cited for selling properties in the GGEP. The GGEP project, however, was not cited as a cause for selling property except where a property is declared as an environmental conservation reserve in which case the Municipality becomes the buyer. This may imply that the GGEP area is still desirable to property owners who have owned property prior to the GGEP project because of many benefits associated with living in the proximity of an open space.

The study further sought to understand the GGEP property owners' perceptions on the benefits of maintaining the GGEP project. Table 5.14 summarises and ranks in percentage the benefits of maintaining the GGEP project as perceived by the GGEP property owners.

Table 5.14: Benefits of maintaining the GGEP project (n = 75)

Benefits	**Responses in percentage**	
	Yes	**No**
Conserve natural environment	82.7	17.3
Aesthetic value	70.7	29.3
Quality of life	54.7	45.3
Conserve endangered species/historical sites	50.0	50.0
Positive impact on property value	28.0	72.0

As shown in Table 5.14, the GGEP respondents were aware of some of the benefits of maintaining the GGEP project. The majority of respondents (82.7%) cited conserving the natural environment as a benefit of maintaining the GGEP open space while 70.7% cited aesthetic value. In addition, 54.7% of the respondents cited 'improving the quality of life of the GGEP residents' and 50% cited 'conserving endangered species and the historical site' as benefits of maintaining the GGEP open space. Lastly, 28% of the respondents cited the expected 'positive impact of the GGEP open space on property value'. These findings are supported by Jim and Chen (2010) who highlight aesthetic value and improvement of the quality of life for residents as benefits of living close to open spaces. Gibbons *et al.* (2014) also cite aesthetic value while Pillay and Pahlad (2014) cite aesthetic value and relaxation as benefits of living close to open spaces. It is important for property owners to understand the benefits associated with conserving biodiversity as this can add value to the project as a whole. Understanding the benefits of conserving biodiversity in the GGEP would help the property owners comprehend the activities, costs and efforts put in managing the GGEP ecosystems. This is consistent with Miller and Hobbs' (2007) assertion that understanding the rationale of conservation projects can garner support and acceptance of the project, which is required for successful ecosystem rehabilitation.

Findings from focus group discussions with the GGEP property owners, the narratives from the questionnaire survey and secondary data highlight the benefits of maintaining the GGEP open space to include air purification and regulating rainwater flow within the open space and into the lower catchment area in which part of the Tshelimnyama community lies. McConnell and Walls (2005), the Secretariat of the CBD (2010) and Drivers *et al.* (2012) also highlight the benefits of healthy ecosystems as purification of water and air, regulating water flow and control of impacts of weather. Overall, the GGEP open space ecosystem services impact positively on human well-being through provisioning and regulatory services. This is consistent with Roberts and O'Donoghue (2013) who highlight the importance of conserving biodiversity within the City of Durban for human well-being and climate change mitigation and adaptation.

Another aspect of benefits of the GGEP open space which literature from the developed world does not highlight is provision of natural resources to poor communities dependent on the natural environment for their livelihoods. Thus, though termed 'illegal', the GGEP open space provides the Tshelimnyama community with medicines, food, fuel and building materials which enhance the Tshelimnyama community members' livelihoods. Roberts and O'Donoghue (2013) assert that one of the benefits of conserving biodiversity in Durban is sustaining livelihoods of poor communities. This aspect of biodiversity conservation is not highlighted in open space literature developed in first world countries.

However, authors such as Prasad (2009) and Sati (2013) reveal that governments and researchers in developing countries have recognised the contribution of the natural environment to livelihoods in rural and peri-urban areas. Jim and Chen (2006) assert that the benefits of open spaces can be used to justify funding for open space management as well as to understand the monetary contribution of open spaces to the economy. The findings on benefits of conserving the GGEP biodiversity have implications for stakeholder management in the GGEP project and biodiversity conservation projects locally and in South Africa. In addition, the findings have implications for future research and theory development as these drive best practice in biodiversity management.

In addition to benefits of maintaining the GGEP project, the study sought to understand the perceived disadvantages of maintaining the GGEP project. The results are presented in Table 5.15.

Table 5.15: Disadvantages of maintaining the GGEP project

Responses	Yes	No	No response
Financial obligation too much	20.0	76.0	4.0
Management obligation too much	2.7	93.3	4.0
Too many restrictions	1.3	94.7	4.0
Cutting trees	1.3	94.7	4.0
None	73.3	22.7	4.0

Table 5.15 shows that 20% of the respondents indicated that the financial obligation from the project was too much while 2.7% of the respondents stated that the management obligation was too much. Further, one respondent (1.3%) indicated that there were too many restrictions associated with the project while another one (1.3%) cited cutting trees as a disadvantage of maintaining the GGEP project. The majority of the respondents (73.3%) indicated that there were no disadvantages associated with maintaining the GGEP project.

This chapter has highlighted various causes of discontentment among some of the respondents and some of the causes are highlighted again in Table 5.15 as disadvantages of maintaining the GGEP project. Funding for the GGEP seems to be a cause for concern as discussed previously. Despite the highlighted disadvantages, a high percentage of the respondents (73.3%) did not see any disadvantages and this leads to the need to understand the general perceptions of property owners on the future of the project. Figure 5.29 indicates the perception of property owners on the GGEP with respect to continuation beyond the pilot phase.

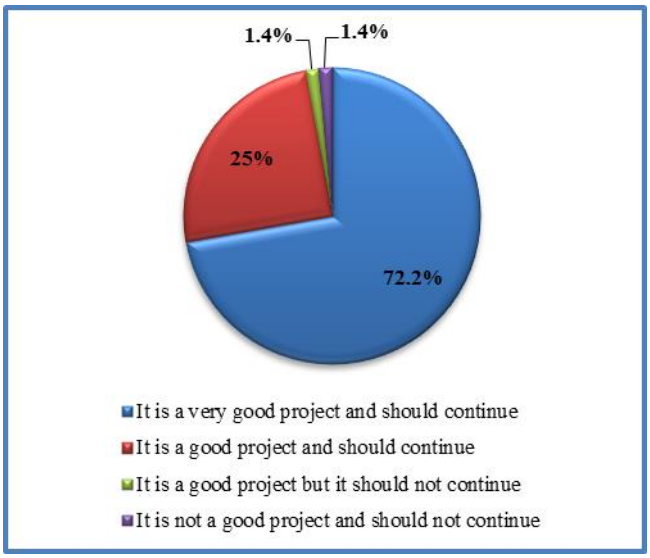


Figure 5.29: Perception of property owners on the GGEP and continuity beyond the pilot phase (n = 75)

The majority of the GGEP respondents (72.2%) felt that the GGEP project is very good and should continue beyond the pilot phase with 25% feeling that the GGEP project is a good project and should continue. However, one respondent (1.4%) felt that the project is good but should not continue while another one (1.4%) felt that it is not a good project and therefore should not continue.

The large support for the continuation of the project beyond the pilot phase (97.2%) indicates that property owners appreciate the open space with its associated benefits such as those highlighted previously in this section. As indicated by an estate agent during a key informant interview, open spaces such as the GGEP are a good amenity in an urban environment and are appreciated and used for recreational activities and also for health benefits associated with living in the proximity of nature. For such reasons, the GGEP open space is appreciated and supported. It is important to reiterate, however, that earlier findings indicate that not all respondents are willing to contribute the same level or any funding for the project. This has implications on planning for the future of the GGEP in relation to funding and all other findings in this study.

5.4.5 The impact of security measures on stakeholder perceptions

According to 44% of the GGEP respondents, allowing non-GGEP residents into the open space acts as a security measure. Despite this, findings from the questionnaire survey also reveal that 16.7% of the GGEP

respondents indicated that they do not visit the GGEP open space. The reasons cited for not visiting the open space relate to security concerns, some of which are highlighted in the following statements:

> *People coming to collect medicinal plants are usually armed and they wouldn't hesitate to use their weapons*.
> (Property owner 13)

> *I used to go in the forest but in the last 2 years (between 2009 and 2011) have not because of the gum trees that grew and I would not feel safe walking there*.
> (Property owner 14)

> *I don't go in the gorge because I feel unsafe; some people were mugged in the biking park, robbed of their bikes and personal items.*
> (Property owner 16)

In addition, focus group discussions with the Tshelimnyama general community members revealed that Tshelimnyama community members were also cautious of going into the GGEP open space because of stories they have heard about other people who use the open space for taking drugs. The Tshelimnyama general community members also indicated that such people have been perpetrators of criminal activities in the Giba Gorge mountain bike park where they steal bicycles and other personal effects. These sentiments are highlighted the following statements:

> *There are thieves who steal bicycles from those riding bicycles.*
> (General community member 1)

> *I heard that there are people who go to the forest with guns, and that is why white people are scared.*
> (General community member 2)

> *Eish! You see, there are wunga smokers in the forest and those guys are violent.*
> (General community member 3)

Reports of such criminal encounters in the adjacent Giba Gorge mountain bike park was cited by one property owner as a reason for not using the open space. Furthermore, during one of the patrols in the forest (field observation), the GGEP management team expressed concern about approaching natural resource harvesters because they usually carry firearms which they would use during a confrontational situation.

Results from the questionnaire survey also reveal that the grasslands were infested with invasive alien plants which had rendered the GGEP open space ecosystems 'unhealthy'. According to the GGEP respondents, invasive alien plants also made accessibility into the forest very difficult because before the start of the project there were no formal trails established in the forest. This made it difficult to see other people moving around in the open space and as such made people fear being attacked. However, as presented previously, between the years 2010 and 2012 two trails were established in the GGEP open space and more are still being developed.

The finding on the need to have people moving around in the GGEP open space is consistent with the principles of formal surveillance or visibility as a situational crime prevention strategy whose aim is reducing opportunities to commit crime (Clarke, 1997; Drugs and Crime Prevention Committee, 2013). The rationale behind this view is that having many people moving around in the GGEP open space would discourage criminal activities. The respondents' concern regarding proliferation of invasive alien species as a deterrent to accessing the open space is also another factor which encourages crime. This is according to Clarke (1995) and the Drugs and Crime Prevention Committee (2013) who cite environmental design as a crime prevention strategy while the National Crime Prevention Centre (2000) asserts that environmental decay and degradation is a factor instigating fear among public space users while providing opportunities for crime perpetrators.

Despite the security concerns expressed, the GGEP management team has not recorded any criminal activities in the GGEP open space since the project started. This could be owing to the patrols, which the management team conducts on a weekly basis as well as the presence of people engaging in various activities such as cycling and bird watching. Security concerns in the GGEP open space and the fear of crime is a negative externality associated with the GGEP open space. This finding is consistent with Kelly *et al.* (2005) who indicate that open spaces can be associated with negative externalities such as crime. This is especially true for open spaces with more closed ecosystems such as forests, which can be a hiding place for crime perpetrators. Pillay and Pahlad (2014) also state that the use of an open space is determined by safety concerns. Security concerns in the GGEP open space are also reflective of the situation in South Africa as evident from crime statistics which indicate that crime in South Africa is among the highest in the world despite the recorded decrease for the period 2011/2012 (Department of Police, 2012). Thus, the high incidence of crime makes people live in fear of victimisation which is manifested as insecurity to enter deserted areas that are seen as potential areas for crime such as forests. This finding has implications on security planning for the GGEP open space.

5.4.6 Impact of the GGEP project on property values or surrounding development

One of the anticipated impacts of the GGEP project is an increase in GGEP property value. An increase in property value would provide impetus for the continuation of the GGEP project beyond the pilot phase. Therefore, assessing the impact of the GGEP project on property value becomes necessary. Table 5.16 depicts the GGEP respondents' perceptions on the impact of the GGEP project on property value.

Table 5.16: Impact of the GGEP project on property value (n =75)

Impact	Percentage
The project has caused an increase in property value	43.1
The project has caused a decrease in property value	1.4
There has been no impact on property value	43.1
The project has not yet had an impact on property value	4.2
Not sure whether the project has had an impact on property value	8.2
Total	**100**

As indicated in Table 5.16, 43.1% of the respondents stated that the GGEP project has caused an increase in property value and another 43.1% of the respondents indicated that the project has had no impact on property value. In addition, 4.2% of the respondents believed that the GGEP project had not yet had an impact on property value while one respondent (1.4%) believed that the GGEP project had caused a decrease in property value. Lastly, 8.2% of respondents were not sure whether the project had an impact on property value.

Findings from key informant interviews with estate agents working within the GGEP revealed that the onset of the 2008/2009 recession caused property prices and sales to drop significantly. The estate agents stated that during the period of the recession, property sales were slower than any time before 2008 and property prices had to be reduced significantly to make a sale. This is consistent with assertion by the eThekwini Municipality (2010: 33) that "the global recession and the related credit crunch have had a negative impact on property related investment." Like other global economies currently, the South African economy is recovering from the recession but property sales have not recovered yet including residential properties as attested by the estate agents. This finding is consistent with global trends which show that the recession had significant impact on many sectors of economies in Europe and the USA and was the worst since the great depression (Campos *et al.,* 2010; Chernick *et al.,* 2011; Goodman and Mance, 2011). Thus, the time during which the GGEP project was implemented (2010) was a difficult time period economically to expect a positive impact on property value.

As shown in Table 5.16, one respondent (1.4%) felt that the GGEP project caused a decline in property value due to the split-zoning of the GGEP properties. Besides this, eight property owners made comments regarding concerns over the possible impact of split-zoning and SRA tax on their property value. Some of the comments made include,

> *The municipal rezoning of properties in the precinct could be a negative for developers.*
> (Property owner 17)

> *Compulsory add on rates have a negative effect on property values*.
> (Property owner 18)

> *The split-zoning is something that puts potential buyers off the area, as does the encumbrance of the extra rates.*
> (Property owner 19)

> *Division of land (split-zoning) is also problematic*.
> (Property owner 20)

> *Cannot subdivide the property and so I am paying high rates and the land can't be developed*.
> (Property owner 21)

Findings from the focus group discussion with property owners, secondary data sources and key informant interviews with eThekwini Municipality personnel, estate agents and a property owner reveal that initially, split-zoning of GGEP properties had caused insecurities among property owners who thought that they would lose rights to parcels of their properties falling under the 'conservation zone'. This is because the declaration of part of a property as 'conservation zone' implies that, among other things, part of the property cannot be developed but only used for conservation purposes. Declaration of part of their property as a 'conservation zone' implied forgoing profits they would have made from selling part of their property, that is, for property owners who bought large properties with the hope of sub-dividing into smaller parcels of land. In addition, if properties with a 'conservation zone' were to be resold, the selling price would be much less than the price at which the property was bought (that is, if the property was bought before split-zoning was effected). This is because part of the property is 'unusable' in terms of development or any other use not compatible with conservation practice.

Findings further reveal that properties are also declared 'environmental conservation reserves' in instances where large parts of a property contain significant biodiversity. This implies that the whole

property would have to be sold as conservation land. It is interesting to note the precedence with which conservation takes over development; a scenario that is rare in urban environments where developments are dominant, especially given that conservation is mainly on private property. Thus, declaration of properties with significant biodiversity for conservation as environmental conservation reserves and further acquisition indicates the importance of conserving biodiversity within areas that the D'MOSS has earmarked for conservation.

Driver *et al.* (2012) state that the eThekwini Municipality is one of the municipalities which is actively involved in ensuring sustainable development to secure and maintain a network of natural biodiversity. The findings presented are also consistent with trends in the USA and UK, where governments and NGOs have recognised the pressure development exerts on the natural environment and have therefore developed strategies to conserve urban natural environments (McConnell and Walls, 2005; Natural England and CPRE, 2010). However, as demonstrated in the findings, the split-zoning has stirred negative sentiments, especially for property owners who had business intentions when acquiring property in the GGEP. Moon and Cocklin (2011) state that limits to future development and land use option is one of the common barriers to participation in conservation programmes. This has implications for biodiversity conservation in the GGEP project and urban areas in general.

A further analysis of the proximate impact of the GGEP open space on property value was conducted using Crompton's (2004: 9) proximate principle. The computation of the actual impact of the GGEP open space using the proximate principle is provided in Appendix 5 and the results are presented in Table 5.17.

Table 5.17: Actual impact of GGEP open space (n = 143)*

<table>
<tr><th colspan="2">Aspects of the computation</th><th colspan="2">Value (R)</th></tr>
<tr><td colspan="2">Estimate of overall change in property value attributable to the open space</td><td colspan="2">34 838 850</td></tr>
<tr><td rowspan="2">Estimate of total positive impact of the open space on property tax base</td><td>Property tax 0.914% of overall change in property value</td><td>34 838 850</td><td rowspan="2">335 985.8694</td></tr>
<tr><td>SRA tax 0.0504% of overall change in property value</td><td>318 427.089</td></tr>
<tr><td colspan="2">Annual cost of maintaining the open space (2011/2012)</td><td colspan="2">361 929.2**</td></tr>
<tr><td colspan="2">Open space property value premium per annum</td><td colspan="2">-25 943.3306</td></tr>
</table>

* The total number of GGEP property owners as per eThekwini Municipality contact list

**Source: GGEP, 2011

Computation of the total positive impact of the GGEP open space on property tax base yielded R335 985.8694 as shown in Table 5.17. Comparing the total positive impact of the open space on property tax

base (R335 985.8694) to the annual cost of maintaining the open space yields a negative open space property value premium of R25 943.3306 as shown in Table 5.17. The open space property value premium indicates the value property owners attach to the services derived from the GGEP open space (Kroeger, 2008). The open space property value premium obtained depicts that the GGEP project has had a negative impact on the tax base (tax base being the GGEP properties). This is despite overwhelming international literature providing evidence indicating that open spaces can have positive impact on proximate property value (Crompton, 2004; Kroeger, 2008; City of Phoenix, 2012; Zhang *et al.*, 2012; Gibbons *et al.*, 2014;). As indicated by the GGEP respondents, the lack of positive impact of the open space on tax base value can be attributed to the 2008/2009 recession that according to estate agents caused a reduction in market value of properties. In addition, the negative open space value premium could be indicative of the initial investment stage in which the project is in. That is, the infancy stage in which the project is in means that a lot of investments in terms of funds and labour have to be made to rehabilitate the open space. This is supported by literature which indicates that initially an open space can have a negative or no impact on the tax base but eventually would increase the tax base value as the open space develops (Crompton, 2007). As it is, the GGEP project is still in the early stages of restoring the GGEP open space to an indigenous state. As indicated by GGEP respondents and estate agents, it is expected that property value will increase with improved state of ecosystems and aesthetics. Nevertheless, Cilliers *et al.* (2013) indicates that for studies conducted in South Africa, the impact of open space on property value was negative in some areas. These findings have implications on the future financial planning of the GGEP project.

5.5 Conclusion

This chapter through analysis of data obtained from questionnaires, interviews, focus group discussions, observations and secondary data sources revealed the processes of natural resource and stakeholder management in the GGEP, and implications of the findings to the GGEP project. The stakeholder identification process revealed that the eThekwini Municipality and the GGEP property owners are the definitive stakeholders; the Tshelimnyama community are the dependent stakeholders while the commercial harvesters are the discretionary stakeholders. Through analysis of the stakeholder interactions with each other and the GGEP open space, the chapter highlighted how each of the interaction impacted on biodiversity and its management. The chapter also highlighted implications of the processes of stakeholder and natural resource management both for the GGEP and biodiversity conservation in

general. A summary of the findings of this chapter is presented in chapter six and appropriate recommendations are given.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

The SRA as a funding model is the basis upon which the GGEP project was established within the context of the South African biodiversity stewardship 'non-contractual agreements' with property owners. The model which the GGEP follows relates to conservation of biodiversity outside Protected Areas, in this case, management of biodiversity of significant importance occurring on private properties in the GGEP. The project receives technical and financial support from eThekwini Municipality's EPCPD. The funding responsibility is shared among property owners in the precinct through the SRA rate levied on each property and is complemented by a grant from the eThekwini Municipality.

The focus of this study was to understand the processes of biodiversity management in the GGEP project considering that it is the first biodiversity conservation project to use the SRA funding model in South Africa. In undertaking the study, the political ecology approach provided a framework for understanding processes and relations among stakeholders. This is because political ecology generally proposes that the environment is shaped by socio-political processes occurring at various spatial contexts. Thus, political ecology examines relationships among natural resource users and how those relationships affect the management and sustainability of natural resources. The political ecology approach guided the study in understanding the environmental problems in the GGEP and how socio-political processes at various scales have shaped the GGEP project. Complementing the political ecology approach was the stakeholder theory which provided a framework for exploring relationships among actors with various interests in the GGEP open space and how interests are managed. The main stakeholders in the GGEP were identified and included eThekwini Municipality personnel, GGEP property owners, the Tshelimnyama community members (comprising traditional healers and general community members) and commercial harvesters.

This chapter presents a summary and conclusion of this study by first contextualising the study within the SRA legislative instrument and biodiversity stewardship practice. It also contextualises the study within the conceptual and theoretical framework highlighting how the political ecology approach and stakeholder theory guided this study. In addition, a reflection on the theory and conceptual framework used is provided which highlights some of the gaps identified. Further, the chapter presents a summary of

the key findings in relation to the aim and objectives of the study. Based on the key findings of the study, recommendations are given for the GGEP project and management of open spaces in South Africa. Lastly, the chapter presents concluding remarks.

6.2 Reflections on the theory or conceptual framework

As indicated previously, the political ecology approach and stakeholder theory were used to conduct and understand various aspects of this study. The political ecology approach was useful in this study as it provided concepts for understanding natural resource use among stakeholders of varying economic status and levels of power, that is, the GGEP property owners' need to use the open space resources for aesthetic value and recreation and, the Tshelimnyama community and commercial harvesters' need to use the open space resources to earn a livelihood. The conceptual framework also provided an understanding of how natural resources are shaped by relationships among users, in this case, the GGEP property owners, the Tshelimnyama community and commercial harvesters.

The stakeholder theory on the other hand provided a framework for identifying important stakeholders for this study and provided a platform for engaging the various stakeholders identified. By doing so, the theoretical framework complemented the political ecology approach by providing a structure for stakeholder management within the context of natural resource management. Thus, the principles of stakeholder management such as communication and stakeholder management strategies provided the basis for analysing natural resource management in the GGEP open space.

Further development in the political ecology approach could incorporate discourses of urban poor communities living in the peripherals. This is in view of the overwhelming political ecology discourses on rural poor communities with respect to natural resource use and management. However, as exemplified by this study, urban poor communities living in the peripherals are also dependent on the natural environment for their livelihoods. Additionally, urban poor communities face many other challenges unique to the urban context such as unemployment, overcrowding, disease as well as poor water and sanitation which can affect human-nature relationships and interactions (Du Plessis, 2006). More issues relate to poor housing and sanitary facilities and, living in disaster prone areas (Gilbert, 2014). The mentioned challenges faced by the poor have received global attention and form an integral part of the Millennium Development Goals. The World Summit on Sustainable Development acknowledged the poor, their living conditions and the need to eradicate poverty with its associated ills. In translating global commitments on poverty locally, conservation programmes are leaning towards

sustaining livelihoods of poor communities while conserving biodiversity through biodiversity stewardship (Cadman *et al.*, 2010). As such, urban poor communities are equally important in the human-nature nexus and warrant equal attention.

6.3 Summary of key findings in relation to the aim and objectives of the study

The aim of this study is to assess the Giba Gorge Special Rating Area as a biodiversity stewardship practice. Thus, the study seeks to understand the impact of the GGEP project on local communities, ecosystems and adjacent property value. To achieve this, the following objectives guided the study:

- to ascertain the occurrence of changes in natural resource abundance during the period 2010 to 2012;
- to assess the current uses of natural resources in the GGEP in relation to the extent to which resources are extracted for the future sustainability;
- to assess various stakeholders' perceptions towards the GGEP project;
- to ascertain the extent to which security measures affect the stakeholders' perceptions of the interactions with the community and the GGEP project; and
- To determine the impacts of the GGEP SRA on property values or surrounding development.

6.3.1 Changes in natural resource during the period 2010 to 2012

The study used a questionnaire survey and focus group discussion with the GGEP property owners, field observations and secondary sources (GIS images and GGEP management activities maps) to elicit data on changes in natural resources in the GGEP open space. The aim was to understand the changes in natural resource abundance and quality that have occurred following the implementation of the GGEP management plan in 2010. This is with reference to the purpose of establishing the GGEP project, which is ecosystem rehabilitation and management in view of the various environmental problems including invasive alien species, soil erosion, unsustainable natural resource harvesting, unplanned fire regimes and pollution. Most significant is rehabilitation and conservation of the endangered sandstone sourveld grassland most of which was transformed into woodlands through alien species invasion. Findings from GIS change analysis of aerial photographs depict changes in the GGEP open space ecosystems in two

ways: abundance and quality. Clearing of invasive alien species has resulted in loss of vegetation in grassland and forest ecosystems thus reducing abundance of vegetation. The implication of the reduction in abundance of vegetation in grassland and forest ecosystems is improved quality of the ecosystems, particularly the grassland. Grassland and forest ecosystem rehabilitation has yielded positive results with grasslands showing bloom of new plant and animal species and forests improving in structure as an indigenous ecosystem. Findings also reveal the presence of animal life that had previously disappeared from the open space such as birds (*Francolinus)* and bush pigs *(Potamochoerus larvatus)*. The Foundation for Ecological Security (2008) asserts that indicators of stable ecosystems after rehabilitative activities include species abundance and diversity, presence of indigenous species and presence of past animal and plant species.

6.3.2 Current uses of natural resources in the GGEP in relation to the extent to which resources are extracted

The study elicited data on this aspect through a questionnaire survey and focus group discussions with GGEP property owners and the Tshelimnyama community members and, field observations in the GGEP open space. The aim was to assess current uses of natural resources in the GGEP in relation to the extent to which resources are extracted within the context of sustainability. The study reveals extractive and non-extractive uses of the GGEP open space resources some of which are potentially unsustainable while others are currently unsustainable. The GGEP residents and non-GGEP residents use the GGEP open space resources for recreation such as horse riding, mountain biking, walking and bird watching. The said recreational uses of the GGEP open space are consistent with open space uses highlight by Kelly *et al.* (2005), Natural England and CPRE (2010), O'Brien *et al*. (2014) and Pillay and Pahlad (2014). In addition, the GGEP open space provides resources for education through an education programme mainly for children run by the GGEP management team. As evident from a project on the African crown eagle, the GGEP open space also provides resources for research. This finding is consistent with Miller and Hobbs (2002) who acknowledge the role open spaces play in providing resources for research while Pillay and Pahlad (2014) assert that open spaces are an important resource for education. Recreational activities have the potential to cause or exacerbate environmental problems such as pollution, soil erosion and sedimentation (Olive and Marion, 2009; Kidd *et al.,* 2014). Therefore, unrestricted use of the GGEP open space for recreational activities is unsustainable, especially considering that the GGEP shares a boundary with a recreational park, the Giba Gorge mountain bike park, whose users have access to the GGEP open space.

The study further reveals the existence of natural resource harvesting most of which is for medicinal purposes while harvesting also occurs for food, heating and building. Roberts and O'Donoghue (2013) acknowledge that the natural environment plays a huge role in sustaining livelihoods for poor communities in Durban. The stakeholders identified to be involved in natural resource harvesting include the Tshelimnyama community members and commercial harvesters. Of concern is that natural resource harvesting is not consistent with the GGEP management plan and the D'MOSS classification of the GGEP as conservation zone. This practice is unsustainable as is evident from the findings that natural resource harvesting practiced in the GGEP is destructive to ecosystems mainly because of the harvesting methods utilised such as de-barking, cutting off portions of plant stems, hunting and the demand placed on the ecosystems. The results presented highlight a possible compromise between ecosystem resilience and community needs as asserted by Folke *et al.* (2010). However, Blaikie (2012), Bryant and Jarosz (2004) and Turner (2013) equate community needs to environmental needs and thus these two aspects require equal treatment.

6.3.2.1 Management of natural resource in the GGEP

The major threats on biodiversity in the GGEP open space were identified to include natural resource harvesting, hunting, invasive alien species, soil erosion, pollution, sedimentation of rivers, and unplanned fire regimes. This study reveals various methods of managing the GGEP environmental problems which includes controlling invasive alien species as well as preventing and reducing soil erosion, sedimentation of rivers, pollution and wild fires. The management of invasive alien species using mechanical and chemical methods in the GGEP is unsustainable due to the level of invasion in the open space. Further, the management of natural resource harvesting is unsustainable because the methods used do not deal with the problem of harvesting but only acts as a temporal distraction to harvesters. Similarly, patrolling the GGEP open space and painting tree trunks do not stop harvesters but may reduce the number of targeted species or plant parts harvested. Attempts to curb natural resource harvesting reflect lack of knowledge on the significance of conservation legislations on the part of the harvesters (Semenya and Potgieter, 2014).

The study also revealed that the main challenge with the fight against natural resource harvesting for medicinal purpose is the lack of accessible resources to traditional healers, consequently, traditional healers enlist the help of commercial harvesters. However, there is no evidence suggesting that commercial harvesters understand sustainable harvesting of resources or biodiversity conservation while traditional healers demonstrated an understanding of environmental sustainability. At national and regional levels, there are efforts to develop sustainable practices to curb the unsustainable natural resource

harvesting for medicinal purposes, particularly 'conservation through cultivation', education and awareness. 'Conservation through cultivation' is a challenge because it only addresses the need for plant-based medicines but as evident from this study, animal body parts are also used as medicines by traditional healers. Secondly, 'conservation through cultivation' requires land on which cultivation of medicinal plants can be done but traditional healers may not have access to land. The efforts demonstrate how discourses at various scales shape the environment (Neumann, 2009; Bixler, 2013). Beside the said challenges are myths surrounding cultivation of medicinal plants as exemplified in the findings which may dissuade traditional healers from cultivating within their living environment.

6.3.3 Stakeholders' perceptions towards the GGEP project

Data on stakeholder perceptions towards the GGEP project was collected using a questionnaire survey with GGEP property owners, field observations and focus group discussions with GGEP property owners and the Tshelimnyama community members. The aim was to understand perceptions of definitive (GGEP property owners) and, where applicable, dependent (Tshelimnyama community members) stakeholders on natural resource use, funding and general support for the GGEP project beyond the pilot phase. These aspects are important in planning and implementing the GGEP management activities in the pilot phase of the project and beyond. This study reveals various perceptions on management of the GGEP open space which were categorised into natural resource management contestations, funding and the GGEP project in general.

The findings reveal that contestations between the GGEP management and GGEP property owners resulted from the intangible benefits or the long-term nature of conservation benefits from the GGEP project and nature of management activities implemented. Some of the respondents viewed lack of benefits (in terms of improvements in the quality of ecosystems) in areas adjacent to their properties as mismanagement of funds, that is, using funds to rehabilitate one area of the open space at the expense of other areas. Miller and Hobbs (2007) assert that positive perceptions of rehabilitation activities are dependent on the ratio between the cost of rehabilitation and perceived benefits. In addition, property owners are motivated to participate in conservation programmes through implementation of policies that yield personal benefits, among other things (Moon *et al.,* 2012). Further, some property owners were opposed to some of the rehabilitative activities implemented in the GGEP open space. In particular, alien species clearing on grasslands was negatively received because of the associated negative externalities such as lack of noise break from the M13 highway as well as wind breaks. Estévez *et al.* (2014) reiterate that differences in value systems and perceptions on invasive alien species can instigate conflict among

managers and stakeholders. Miller and Hobbs (2007) term such contestations as social constraints of conservation which emanate from conflicting values between managers and stakeholders.

The findings also reveal that the underlying issue behind the discontentments between the GGEP management and the property owners in the GGEP project is poor communication. The nature of disagreements and negative perceptions revealed are all cases of lack of information relating to the GGEP project and management activities. This is despite the provisions of stakeholder management which require that communication with stakeholders with high salience be prioritised (Jawahar and McLaughlin, 2001; Ackermann and Eden, 2011). Despite management's efforts to communicate the management activities, property owners remain unaware of the implemented management activities. What is not apparent is whether property owners lack interest to access information or whether it is problematic channels of communication used that cause the communication breakdown. Nevertheless, existing discontentment can be overcome through communicating the desired information using the right channels of communication. Lloyd and Boyd (2011) support this finding and assert that communication engenders good relationships and is the basis of effective stakeholder management.

The study also revealed natural resource management contestations between the GGEP property owners as well as the Tshelimnyama community members and commercial harvesters. Natural resource harvesting by the Tshelimnyama community members and commercial harvesters conflicted with the GGEP project's goal of conservation. The use of the GGEP open space resources by the Tshelimnyama community members and commercial harvesters differs from that of the GGEP property owners. The Tshelimnyama community members and commercial harvesters use the GGEP open space resources to earn a living (that is, traditional healers and commercial harvesters) and also to meet household needs (that is, Tshelimnyama community members) while the GGEP property owners use the open space resources for recreational purposes. Such disparities in natural resource use among stakeholders can result in conflict. Kok *et al.* (2009), Von der Dunk *et al.* (2011) and Koubi *et al.* (2013) assert that incompatible interests can cause conflicts among stakeholders. Bryant and Jarosz (2004) assert that priority should be given to communities who are dependent on the natural environment rather than the needs of the economically and politically powerful communities.

Concerning funding, this study reveals that the majority of the respondents were willing to support the project financially beyond the pilot phase with the minority showing lack of willingness to support the project beyond the pilot phase. In addition, the minority of respondents interviewed indicated willingness to pay any amount necessary towards funding for the GGEP project beyond the pilot phase. However, the

majority of the respondents interviewed expressed reservations in terms of the threshold of the amount to be paid towards funding for the GGEP project. Miller and Hobbs (2007) assert that project acceptance determines the level of funding by stakeholders while Adams and Hutton (2007) demonstrate how such socio-political processes shape the environment. In addition, stakeholder willingness and capacity to participate determines the level of success of conservation efforts (Knight *et al.,* 2010).

The perceptual analysis of the GGEP project in general revealed that the majority of the property owners interviewed indicated that it is a good project and therefore should continue beyond the pilot phase. A minority of the respondents indicated that the project should not continue regardless of whether it is good or not.

6.3.4 The extent to which security measures affect the stakeholders' perceptions of the interactions with the community and the GGEP project

Data for this aspect of the study was collected using a questionnaire survey with GGEP property owners, focus group discussions with property owners and the Tshelimnyama community members. The aim was to understand property owners' perceptions of the GGEP open space security and how perceptions affect property owners' interactions with the community and open space. In this regard, findings reveal that security is a major concern to all users and property owners' security concerns determine interactions with the community and the GGEP open space. However, the minority of the respondents interviewed did not use the GGEP open space due to security concerns, a finding consistent with Kelly *et al.* (2005) who cite crime as a negative externality of open spaces. Pillay and Pahlad (2014) also state that security concerns determine use of open spaces. The majority of respondents who use the GGEP open space perceive allowing non-GGEP residents to use the GGEP open space as a security measure as this increases surveillance in the open space. Having more people moving around in the open space would reduce opportunities for people to commit crime (Drugs and Crime Prevention Committee, 2013).

6.3.5 Impact of the GGEP SRA on property values or surrounding development

The tax valuation roll provided data for analysing the impact of the GGEP project on property value. The aim was to quantify the impact of the GGEP project on developments and properties adjacent to the GGEP open space, and the impact of the open space on desirability of the GGEP for settlement. The analysis was based on the proximate principle which suggests that open space development affects the value of adjacent developments depending on the quality and negative externalities of a given open space. The study revealed that the GGEP open space has caused a negative impact on the tax base with an open

space property value premium of minus R25 943.33. Crompton (2007) justifies a negative property value premium as being a normal phase of a project in its initial stages of establishment. Despite the negative impact on tax base, the study shows that property buyers prefer properties overlooking the GGEP open space, thus indicating a positive impact on the desirability of the GGEP.

6.3.6 Recommendations

This study highlights the processes of natural resource management in the GGEP open space with respect to stakeholder interactions including the GGEP open space as a silent stakeholder. In understanding the processes of natural resource management in the GGEP, the study in chapter five further highlights gaps in stakeholder management and takes note of relevant recommendations forwarded. Based on the identified gaps and noted recommendations, this section provides a detailed discussion of the recommendations on the management of the GGEP open space ecosystems, recreational activities, natural resource harvesting, natural resource management contestations among property owners, security in the GGEP open space, environmental education and awareness, development of open spaces in South Africa and the future of the GGEP project.

6.3.6.1 Management of the GGEP open space ecosystems

The findings on invasive alien species management have shown that clearing of invasive alien species has resulted in the rehabilitation of the GGEP ecosystems using integrated methods. It is recommended that the GGEP management introduce natural alien species predators which will control the proliferation of invasive alien species. This is in view of the fact that the chemical and mechanical control methods used are unsustainable and therefore adoption of biological control methods would be sustainable in the long run and will reduce negative environmental impacts.

6.3.6.2 Recreational activities

This study highlighted that recreational activities can have adverse impacts on the environment and Barros *et al.* (2013) state that there is need to limit the spread of trails in the open space for regulated recreational activities. It is therefore recommended that access and use of the GGEP open space for recreational activities be restricted and strictly regulated in order to control soil erosion and loss of species. This is within the context of the main objective of establishing the GGEP open space, which is for conservation, especially in light of the endangered species and ecosystems within the open space.

6.3.6.3 Natural resource harvesting

The study revealed perceptions of the GGEP respondents on unsustainable natural resource harvesting and among the identified harvesters are the Tshelimnyama community and the commercial harvesters. This introduced a conflict of interest among the stakeholders with the Tshelimnyama and commercial harvesters extracting the open space resources while the GGEP advocating non-extractive use. However, sustaining livelihoods is as important as ecosystem conservation in urban areas and this is supported by Driver *et al.* (2012) who assert that all economic, social or ecological decision-making should consider conservation needs as well as livelihoods of poor communities at all scales (regional and local). Therefore, in order to achieve biodiversity conservation and ecosystem health in the GGEP, there is an immediate need to curb unsustainable natural resource harvesting in the GGEP open space. In order to do so, it is important to heed the recommendations of the CBD (United Nations, 1992) which reiterates that conservation efforts should go beyond prohibitive laws by using economic and social incentives which would effectively discourage unsustainable and illegal harvesting. In this case, there is need to provide economic or social incentives to the Tshelimnyama community members and commercial harvesters that would make illegal harvesting less profitable. Based on the findings of this study, it is recommended that within the GGEP, there is need for GGEP project management to establish communication with the Tshelimnyama community in order to find ways of engaging them in the project as an important stakeholder group. Engaging the Tshelimnyama community in the GGEP project would mean finding ecologically sustainable practices of supporting their livelihoods and dependence on the natural environment. That is, there would be a need for mechanisms to control natural resource harvesting through capacity development, integration of the Tshelimnyama community's indigenous knowledge on sustainable harvesting with the GGEP management practices, and education and awareness of all stakeholders. This would call for participation of other stakeholders such as researchers to develop strategies where traditional healers can harvest resources sustainably and the GGEP open space ecosystems can be conserved.

It is also recommended that government acquire land in various regions and local areas where harvesting of natural resources for medicinal plants is pronounced to establish wild lands for *in situ* conservation of medicinal plants. *In situ* conservation is suggested since findings reveal that traditional healers have reservation of cultivating medicinal plants within their living environments. *In situ* conservation would then serve the purpose of supplying traditional healers and traders with the needed medicinal resources. The acquired land would then be managed by local herbalists (*izinyanga*) under the biodiversity stewardship programme in order to provide technical support (education on sustainable management of

biodiversity including harvesting) required for sustainable management of resources within wild lands. Thus, resources within these wild lands would be replenished through cultivation while non-destructive harvesting practices would ensure regeneration of plants. Such wild lands would provide both plant and animal products required by the traditional medicine industry and by doing so, the wild lands would cover the running costs and cost of acquiring land eventually. Establishing wild lands would eliminate the need for commercial harvesters because of permitted and easy access to medicinal resources.

Branding is a concept which has been used in programmes such as Fairtrade, organic foods and marine fish industries (Davenport and Low, 2011; World Fairtrade Organisation, 2011). What is concerning with natural resource harvesting is the destructive nature of the practices which have the potential of inducing species loss and ecosystem degradation. With respect to natural resource harvesting, branding would mean formalising the industry so that medicinal resources are packaged and branded to ensure traceability. Thus, through education and awareness campaigns with traditional healers and traders, branding can help in promoting sustainable practices in harvesting of plant and animal resources. This would eliminate the need for commercial harvesters and create jobs through cultivation, harvesting, processing, packaging and distribution. Branding would be complementary to wild lands which would act as sustainable sources of the resources to be branded.

6.3.6.4 Natural resource management contestations among property owners

Stakeholder management hinges on deliberate effective communication with key stakeholders and thus requires that effective communication channels be established (Jawahar and McLaughlin, 2001; Ackermann and Eden, 2011). As demonstrated by the findings, the current channels of communication in the GGEP project are ineffective. There is need for the management team to develop effective channels to communicate management activities and engage with property owners on various issues arising. This can have a significant effect on property owner perceptions on the GGEP project, in particular management activities and expenditure. Such communication channels should be research-based to find appropriate channels for the GGEP property owners. That is, there is need to conduct comprehensive research into the kind of communication channels property owners prefer and messages they want to hear. This study has identified some of the messages property owners want to hear. It is envisaged that improved communication on management activities will foster better project acceptance by the property owners.

This study revealed differences in value systems towards invasive alien species between the GGEP respondents and management. There is need for management to communicate management objectives to the property owners so that there can be mutual understanding of the management activities implemented.

This calls for understanding and acceptance on the part of GGEP property owners knowing that the actions of management in conserving the GGEP are informed by legislation and best practices. Cadman *et al.* (2010: 77) assert that "strong partnerships based on mutual trust are needed across property boundaries (for example, for clearing invasive alien plants or flood mitigation), involving the state, conservation authorities, NGOs, private and communal landowners." Mutual trust among stakeholders however, is earned through open and constant communication about project objectives and details about implementation of the objectives.

6.3.6.5 Security in the GGEP open space

Findings reveal that the GGEP relies on visibility of open space users for security and patrols that are conducted once a week by the field workers. It is recommended that the GGEP management plan for formal security such as securing the services of the police or any other formally trained security team. This is in view of the findings which reveal that there are armed open space users in the GGEP.

6.3.6.6 Environmental education and awareness

This study has demonstrated that conservation and sustainability is not common knowledge to natural resource users and the public. As the CBD and South African constitution recommend (Republic of South Africa, 1996; Secretariat of the CBD, 2012), there is continuous need for awareness campaigns and education regarding conservation and environmental sustainability. Within the GGEP, there is need to sensitise the community regarding the handling and disposal of garden refuse which is a source of invasive species. In addition, there is a need to educate the GGEP property owners regarding the processes of conservation in the open space and implications of those processes on the open space ecosystems.

Further, environmental conservation and sustainability is dependent on the decisions that the public makes and what informs their decisions on natural resource use. It is therefore important to reiterate the need to develop capacity in environmental conservation and sustainability in various communities through education and awareness campaigns. Such education and awareness campaigns should be tailored to address each community's needs such as how a community uses natural resources and the source of livelihoods. Education and awareness should also take into consideration socio-economic characteristics of the communities such as age, education level attained and income levels. This would promote responsible decision-making in natural resource use and in supporting conservation of biodiversity, especially within the context of rapid urbanisation and development.

6.3.6.7 Development of open spaces in South Africa

Given the benefits of conserving biodiversity highlighted in chapter five, there is need to develop more public natural open spaces in Durban and South Africa. This study has demonstrated that open space users are diverse and many; the activities engaged in are diverse too. However, given the high rate of poverty, unemployment and increasing cost of living; people are always looking for affordable recreational areas in terms of distance travelled and the cost of using the open space. Thus, providing easy access and less costly open spaces in residential areas would be beneficial in enhancing human well-being. In addition, such open spaces should not be developed in enclosed estates which restrict access to residents only. Since literature (Crompton, 2007; Zhang *et al.*, 2012; Gibbons *et al.*, 2014) demonstrates that in the long run open space development is profitable as it can meet the cost of development and raise the value of adjacent properties, the proximate principle can also be adopted in funding for natural open spaces in South Africa.

The review of literature in chapter three demonstrated that there are few studies in developing countries focusing on open spaces and their value to local communities. Researchers such as the Prasad (2009) and Sati (2013) reveal that governments and researchers are beginning to recognise the importance of natural open spaces to livelihoods in peri-urban and urban areas. It is therefore recommended that more research be conducted on the nature of open spaces in developing countries as well as the role open spaces play in sustaining livelihoods and contestations among open space users. Such research would inform decision-makers on the kind of open spaces to develop for various communities.

6.3.6.8 Future of the GGEP project

The findings indicate that some respondents have reservations on the amount of money they are willing to pay for funding the project despite that they feel the project should continue. This suggests that the project should continue but be externally funded and reduced reliance on the property owners. Thus the GGEP management should find ways of funding the GGEP, especially beyond the pilot phase when the eThekwini Municipality grant will be withdrawn.

The finding on positive support for the GGEP open space has an implication on planning for the future of the GGEP in relation to biodiversity conservation, rehabilitation as well as financing. Being the first biodiversity conservation project in South Africa that uses the SRA instrument in biodiversity management, it is necessary that periodical research be conducted to ascertain natural resource changes occurring in the GGEP. Such research should focus on the actual changes in ecosystem quality and the

determinants of the pace at which ecosystem change occurs. Overtime, such research would provide an understanding of the processes of ecosystem management outside Protected Areas and thus, contribute towards development of natural resource management strategies, especially in relation to stakeholder management and funding.

6.4 Concluding remarks

This study endeavoured to understand the processes of natural resource management in the GGEP project with respect to the SRA legislative instrument used to raise funds for managing the GGEP open space. This is within the context of dwindling government resources to effectively manage and conserve biodiversity in the face of climate change, urbanisation and overharvesting of natural resources, among others. This study shows that the SRA instrument can be used to raise funds for biodiversity conservation outside Protected Areas provided that a deliberate strategy for stakeholder management is developed. Most important for management are the definitive stakeholders as this group's support is critical for the survival of biodiversity management projects. Findings also demonstrate the willingness of community members to participate in biodiversity conservation not only through effort but also in providing the main resources for biodiversity management. Such attitudes coupled with strategic stakeholder management would provide a basis for developing open spaces outside Protected Areas and management of existing ones.

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APPENDICES

Appendix 1: GGEP property owners' questionnaire

Faculty of Science and Agriculture

PhD Degree Research Questionnaire

Dear Respondent,

My Name is Chuma Banji Chinzila, a student at the University of KwaZulu-Natal pursuing Doctorate degree in Environmental Science. I am conducting research as fulfillment of the Doctor of Philosophy degree titled: ***An assessment of the Giba Gorge Special Rating Area as a biodiversity stewardship practice*.** The results of this study will be useful to the eThekwini Municipality, Department of Environmental Planning and Climate Protection in understanding community perceptions of the Giba Gorge Environmental Precinct project and thus the future of the said project.

Your participation in this research will contribute greatly towards input into deciding the future of the Giba Gorge Environmental Precinct project (GGEP), and will therefore be appreciated. However, your willingness to participate in this research should be entirely voluntary. All responses will be treated with the strictest confidence and no names will be used in this study. In answering this questionnaire, please tick (√) on the appropriate answer and provide detail where possible.

Sincerely,

Chuma Banji Chinzila

Section A: Community background

1. Gender: 1). male 2). Female

2. Race: 1). White 2). Black 3). Coloured 4). Indian

3. Age:

1). 20yrs and below 2). 21- 41yrs 3). 42-62yrs 4). 63- 83yrs 5). 84yrs and above

4. Level of education:

1). High school 2). Tertiary-Bachelors 3). Tertiary - postgraduate

5. Occupation: ……

6. Income group:

1). Below R100 000 per annum
2). 100 000 -200 000 per annum
3). 200 000- 300 000 per annum
4). 300 000- 400 000 per annum
5). 400 000- 500 000 per annum
6). 500 000 and above per annum

7. Suburb: 1). St. Helier 2). Winston 3). Kirkman 5). Eagle Rock 4). Alexander Drive

8. How long have you lived in the Giba Gorge area?

1). 5 yrs. and below 2). 6 to 10 yrs. 3). 11 to 15 yrs. 4). 16 to 20 yrs. 5). 20 yrs. and above

9. Are you aware of the project currently being piloted in the Giba Gorge by the eThekwini Municipality and the Giba Gorge property owners?

1). Yes 2). No

Section B: Perception of stakeholders of the changes in natural resources over the years past in the Giba Gorge area

10. In terms of abundance what was the state of animal and plant life in the precinct before the project started?

1). Animal (Birds, mammals) and plant life (trees in the forest, grass in grasslands) were both abundant.

2). Animal life (Birds, mammals) was abundant while plant life (trees in the forest, grass in grasslands) was scarce.

3). Animal life (Birds, mammals) was scarce while plant life (trees in the forest, grass in grasslands) was abundant.

4). Animal (Birds, mammals) and plant life (trees in the forest, grass in grasslands) were both scarce.

5). Are there any comments that you would like to make regarding the state of animal and plant life in the Giba Gorge **before** the project started?

……

11. In terms of abundance what is the **current** state of animal and plant life in the Giba Gorge?

1). Animal (Birds, mammals) and plant life (trees in the forest, grass in grasslands) are both abundant.

2). Animal life (Birds, mammals) is abundant while plant life (trees in the forest, grass in grasslands) is scarce.

3). Animal life (Birds, mammals) is scarce while plant life (trees in the forest, grass in grasslands) is abundant.

4). Animal (Birds, mammals) and plant life (trees in the forest, grass in grasslands) are both scarce.

5). Are there any comments that you would like to make regarding the **current state** of animal and plant life in the precinct? ……

12. In terms of **quality** what is the state of the Giba Gorge (forest and grasslands)?

1). the forest and grasslands are in a better state than they were before the project started

2). the forest is in a better state while the grassland has not changed since the project started

3). the forest has not changed since the project started while the grassland is in a better state

4). the forest and grassland have not changed since the project started

5). Do you have any comment? ……

13. How did you become aware of the state of plants and animals or the changes in plant and animal life, forest and grassland of the Giba Gorge?

1). I visit the forest and the grasslands

2). I heard from other property owners who visit the forest and grasslands

3). I just heard from other property owners

4). I am able to view/see the state or changes in the forest and grassland from my property

5). others, specify ……..

Section C: Current uses of natural resources in the Giba gorge

14. Do you visit the Giba Gorge forest and grasslands? 1). Yes 2). No

15. If yes, how often do you visit?

1). Once a week

2). More than once a week

3). Once a month

4). More than once per month

5). others, specify

…….

16. What activities do you do when you go to the forest and grasslands?

1).Taking a walk

2). Horse riding

3). Mountain biking

4). Bird watching

5). Gathering/harvesting forest products

6). others, specify ……..

17. If you go to the forest and grasslands to collect products, specify which products you collect

1). Plant products such as……..

2). Animal products such as ……..

18. If you go mountain biking, where do you actually do it?

1). from the biking park through the forest/grasslands and back to the biking park

2). from home through the forest/grasslands and back home

3). others, specify…….

19. Do you know of people living outside the Giba Gorge Environmental Precinct area who enter/use the Giba Gorge forest and grasslands? 1). Yes 2). No

20. If yes, who are they? 1). Individuals 2). Groups 3). Organisations

21. What do they do when they come to the forest and grasslands?

1). Walking through

2). Mountain biking

3). Bird watching

4). Horse riding,

5). Collecting animal and plant products

6). others, specify……

22. What are the advantages of allowing people to access the forest and grasslands? (Please tick (√) all applicable options)

1).Allowing access to the precinct acts as a security measure

2). Allowing access to the precinct provides an opportunity for environmental education and awareness

3). Allowing access to the precinct gives the property owners more allies to lobby for the cause of the precinct

4). Allowing access to the precinct provides more volunteers to help out in the precinct activities whenever they needed

5). other, specify…….....

Section D: Stakeholder perception of the impact of the GGEP project on property value

23. When compared to property values of surrounding similar suburbs, what were the approximate values of the Giba Gorge properties before the project started?

1). The Giba Gorge properties always were of **high** value compared to properties in the surrounding suburbs

2). The Giba Gorge properties always were of **low** value compared to properties in the surrounding suburbs

3). The Giba Gorge properties always were of the **same** value compared to properties in the surrounding suburbs

4). Are there any comments that you would like to make regarding these property values?.....

24. Has the project made a difference to property values?

1). the project has caused an increase in property value

2). the project has caused a decrease in property value

3). There has been no impact on property value

4). Are there any comments that you would like to make regarding these property values?.....

25. What are the benefits of maintaining the Giba Gorge project?

1). Aesthetic value (bird watching, nature walk)
2). Improve the quality of life for the property owners
3). the precinct can have a positive impact on property value
4). the precinct helps to conserve some of the endangered species of the world as well as historical sites
5). the precinct helps conserve the natural environment
6). other, specify……..

26. What are the disadvantages of maintaining the Giba Gorge project?

1). Too many restrictions on the use of the precinct's resources
2). the management obligation is too much
3). the financial obligation is too much
4). other, specify…….

Section E: Stakeholder perceptions towards the project?

27. How do you feel about the project?

1). It is a **very good** project and should continue

2). It is a **good** project and should continue

3). It is a **good** project but it should not continue

4). It is **not a good** project and should not continue

5). Are there any comments that you would like to make regarding your perceptions of the project?.....

28. Would you support the project in the long run (i.e. beyond the pilot phase of the project)?

1). Yes 2). No

29. Are you willing to support the project financially in the long-term (i.e. beyond the pilot phase of the project)?

1). Yes 2). No

30. If yes, up to how much would you be willing to contribute towards the project monthly? ……

31. If you feel the project <u>should not</u> continue, give reasons for your answer……

Thank you for your participation!

Appendix 2: Focus group discussions

A. GGEP property owner

Date: …….

Name of Moderator: …….

Name of Note Taker: …….

Gender of Group: (circle one): All Female All Male

Start time: …….. End time: …….

Persons in group at start: ……..

Persons in group at end: …….

We certify that we have read and discussed the consent procedures on the following page with the group and continued only on consent by all members.

Signed by leader: ……. Date: ……..

Welcome remarks and informed consent

Welcome and thank you for coming to this focus group discussion. My name is …….. and I am from ……... Assisting me is ……. who will be taking notes on the discussion. I am a student at the University of KwaZulu-Natal, Durban, South Africa. I am collecting primary data for my Doctorate research on *Assessment of the Giba Gorge Special Rating Area as a biodiversity practice*.

We will talk about topics regarding natural resource use particularly forest use including the benefits to property owners of managing the GGEP, who uses the GGEP and what activities have been implemented in the GGEP.
If some of the topics are difficult for you to discuss, you have the right to not participate or to skip any issues that you do not want to discuss without any negative consequences.
We will also using maps for mapping changes in natural resources in the Giba Gorge forest and grasslands. Your participation is voluntary and there is no penalty for refusing to take part.
Before we begin, let me share some ground rules.

- All information shared here is confidential. Please do not share any of the information you hear today from each other with anyone outside this group.

- When you are talking about specific events or people in your community, it is important that you do not say their name. We want to be very careful to protect their identity and your identity. We will use each other's names during the session, but no names will be used in any of the reports we write using the information you share with us. No one will be able to link your name back to what you said.
- It is best if we have only one person speaking at a time. Try to speak up so that you are heard and we do not miss any of your comments.
- When responding to questions please leave enough time for the other group members to also share their thoughts. Please feel free to speak openly.
- There is no right or wrong responses.
- You will not receive any benefits in form of money or otherwise by participating in the discussion. Therefore, your participation should be totally voluntary without expecting anything in return.

Does anyone have any questions?

If you think of any questions in the future, feel free to contact the Primary Investigator ……., whose contact information is on this sheet.

Do you agree to participate in the discussion? If not then please feel free to leave.

Questions

1. What was the purpose of developing the Giba Gorge project? ……
2. How did the management committee engage the property owners to make them understand the project? In addition, later on how have they continued to engage property owners to make them understand the management activities? ……..
3. How are property owners supposed to benefit from the project? ……..
4. What are the current benefits of the project to the ordinary property owner?.....
5. What are the benefits of maintaining the Giba Gorge as GGEP for the paying property owners)?.....
6. What strategies did you develop to address the fact that other communities (for example, Tshelimnyama) rely on the ecosystems for their livelihood? ……...
7. Which stakeholders use the GGEP? ……..
8. How are the stakeholders mentioned in Q.7 involved in the management of the GGEP? …….

Mind mapping - Use a map of the GGEP for questions 9 to 10:

9. Identify on the map, which is eThekwini municipality land, private property and that which belongs to the Department of Road and Traffic …….

10. Since the start of the GGEP project, what activities have been done on the ecosystems in line with the project's vision? …….

Thank you for your time and participation!

B. Tshelimnyama community focus group discussion guide

Community: ……

Date: ……..

Name of Moderator: ……

Name of Note Taker: ……..

Gender of Group: (circle one): All Female All Male

Start time: ……. End time: ……

Persons in group at start:……

Persons in group at end: ……..

We certify that we have read and discussed the consent procedures on the following page with the group and continued only on consent by all members.

Signed by leader: …… Date: ……

Welcome Remarks and Informed Consent

Welcome and thank you for coming to this focus group discussion. My name is ……. and I am from …….. Assisting me is …….. who will be taking notes on the discussion. I am a student at the University of KwaZulu-Natal, Durban, South Africa. I am collecting primary data for my Doctorate research on *Assessment of the Giba Gorge Special Rating Area as a biodiversity stewards practice*.

We will talk about topics regarding natural resource use particularly forest use including where you get your forest products in this case *muthi*, priorities on forest use, as well as knowledge on sustainable harvest of *muthi*.
If some of the topics are difficult for you to discuss you have the right to not participate or to skip any issues that you do not want to discuss without any negative consequences.
We will also be using pictures about the forest resources. Your participation is voluntary and there is no penalty for refusing to take part.

Before we begin, let me share some ground rules.

- All information shared here is confidential. Please do not share any of the information you hear today from each other with anyone outside this group.
- When you are talking about specific events or people in your community, it is important that you do not say their name. We want to be very careful to protect their identity and your identity. We will use each other's names during the session, but no names will be used in any of the reports we write using the information you share with us. No one will be able to link your name back to what you said.
- It is best if we have only one person speaking at a time. Try to speak up so that you are heard and we do not miss any of your comments.
- When responding to questions please leave enough time for the other group members to also share their thoughts. Please feel free to speak openly.
- There is no right or wrong responses.
- You will not receive any benefits in form of money or otherwise by participating in the discussion. Therefore, your participation should be totally voluntary without expecting anything in return.

Does anyone have any questions?

If you think of any questions in the future, feel free to contact the Primary Investigator, …….. whose contact information is on this sheet.

Do you agree to participate in the discussion? If not then please feel free to leave.

Questions

1. Do you as *isangoma* collect your own *muthi* or do you have people who collect it for you?.....
2. What kind of things do you get from the forest to use as *muthi*?
   a) Tree bark
   b) Roots
   c) Leaves
   d) Tree stem
   e) Animals….specify which parts of animals
   f) Birds….specify which part of birds
   g) Others……
   ……
3. Why do you think the forest is important?
   a) ……
   b) ……

c) ……

d) ……

4. Forest Use Priority (Please Rank the forest use)
   - Food: hunting for food/gathering plants for food
   - Muthi: hunting for *muthi*/gathering for *muthi*
   - Building: timber/logs for construction of shelter
   - Fuel: wood for firewood
5. Where do you get your *muthi*? ……
6. Do you have permission to enter into the forest to get *muthi*? ……
7. Are there people from this community who obtain forest illegally from the forest? ……. If yes, what kind of people are they (*izangoma* or people in general)?.....
8. What kind of forest products do they get?.....
9. Are there people who collect *muthi* even if they are not *izangoma* for their use?
   ……..
10. Show them the pictures and get their reactions) what can they say about what they see?
    ……..
11. What is your knowledge on sustainable harvesting of *muthi*-explain? ……..
12. Do you have any traditional practices that helped you or your ancestors to sustain the forest?
    ……
13. If yes, what kind of practices are they (describe it) ……..
14. Do you use this traditional knowledge? ……
15. If no why don't you use this traditional knowledge? ……..

Appendix 3: Key informant interview guides

A. eThekwini Municipality Personnel

1. Would you briefly explain how the first general meeting went in terms of attendance, issue arising, main agenda
2. What are you doing about endangered species?
3. Is there any deliberate programme or activities aimed at protecting them to ensure their proliferation?
4. How was the Giba Gorge project formed? Did the property owners have to vote in support of the project?
5. How was the idea of conservation sold to property owners? Where there consultations like meetings with them, or how was it done?
6. During the focus group discussion in the last committee meeting I attended, it was mentioned that property owners are free to attend the committee meetings, but are they aware of this?
7. Are invitations sent and open to everyone each time the meetings are scheduled, or how are they notified?
8. Is there any reason why a lot of work/activities (alien clearing) are concentrated on the St. Heliers side or are they?
9. Is the umhlatuzana rock shelter a national heritage site? What status has it been given?

B. Estate Agents

1. Do you work in private practice?
2. So how is the business doing now?
3. What kinds of people want to buy into this area?
4. Are they aware of the project?
5. Have you been selling properties within the Giba Gorge?
6. Does the Giba Gorge project affect their properties or have you met anyone who has not been able to sell their property?
7. How do the prices compare to those outside the Giba Gorge?
8. So do you think the project has had an impact on property prices?
9. Do you think the project will have a positive impact on property value?
10. But is it because of the recession or has it been like that?
11. Do you think the project would have had any impact on property prices had it not been for the recession?
12. Do you know of any other conservancy like the Giba Gorge and would you relate the price of the Giba Gorge to the other conservancy's to the property prices?
13. I have heard about the split-zoning, how does it affect people wanting to buy property in the Giba Gorge area?
14. How are the property owners in the Giba Gorge affected by the split-zoning?
15. When considering the quality of the Giba Gorge, how does it affect potential property buyers' choices to buy in the Giba Gorge area?

C. GGEP Manager

1. How long have you been working with the project?
2. Have you ever heard of anyone who has been attacked in the Giba Gorge forest and grasslands since the project started?
3. How many were you in your team when the project started?
4. How many are you in your team?
5. Where there any existing trails in Giba Gorge forest and grasslands before the project started?
6. When did you start making trails in the Giba Gorge forest and grasslands? How do you manage erosion on cliffs? When clearing alien species? On trails? What do you call the work you do on trails to present erosion?
7. Where does the sewage that goes into the Giba gorge forest and grasslands come from?
8. What are you doing about endangered species? Is there any deliberate programme or activities aimed at protecting them to ensure their proliferation?
9. What kind of people engage in bird watching?
10. Does the blind people's association use the Giba Gorge forest and grasslands?
11. Why do you conduct patrols in the Giba Gorge forest and grasslands?
12. How often do you patrol the Giba Gorge forest and grasslands?
13. Have you ever caught any people harvesting *muthi*?
14. What do you do with the offenders when you catch them?
15. What do you do to prevent soil erosion (on trails, on cliffs or slopes)?
16. What are some of the things considered pollutants?
17. It came to my attention that there are people who dump in the Giba Gorge forest and grasslands, who are these people? What do they dump? Where do they dump?
18. What do you do to prevent pollution?
19. How often do you conduct bush burning? Where exactly is burning implemented (forest, grasslands or where)?
20. Tell me about the property owners who do not want to allow bush burning
21. Would you show me the area where herbicides were spilt which destroyed plants on its way?
22. Which trails do horse riders follow (walking trails or cycling trails?)

D. Traditional healers' leaders

1. What is the difference between registered and unregistered *izangoma* because we find that those that are not registered turn to shy away or refuse to participate in the study thinking that they might be arrested while those that are registered seem not to have a problem. Could you explain on that?
2. There is *isangoma* that said he is not an *inyanga* (traditional healer) he just has a gift to defend bad spirits, would you explain the difference between an *isangoma* and *inyanga*?
3. The one thing that I noticed was that most *izangoma* are women, is that the case with all your members?
4. Why they are some *izangoma* not registered?
5. Do *izangoma* have other jobs or businesses or any way of earning income?
6. Where do *izangoma* get *muthi* from?
7. Have you discussed the issue of getting *muthi*, as an association?
8. Are there people who practice cultivation of *muthi* and do you encourage cultivation?
9. Do the ancestors tell you where get *muthi*?
10. Do your members go to Silver Glen in Chatsworth?
11. Do you have any contacts for the commercial harvesters?
12. Are the people that sell at the market responsible for collecting *muthi* from the forests?

E. Thank you for your time!

F. Silverglen education officer

1. What is the mandate of Silverglen?
2. Which departments or institutions are involved in this establishment?
3. What role does each of these departments or institutions play?
4. Does Silverglen work with *izangoma* and/ or *izinyanga*?
5. What programmes do you have for *izangoma* and/ or *izinyanga*?
6. What kind of education programmes you give to *izangoma* and/ or *izinyanga*?
7. Do you invite *izangoma* and/ or *izinyanga* or do they come on their own?
8. How do you work with *izangoma* and/ or *izinyanga*?
9. Are you aware of any myths about cultivating *muthi* within the living environment or homesteads? If yes, how are you addressing such myths?
10. Do you provide *muthi* to *izangoma* and/ or *izinyanga*? If yes, do you provide for commercial harvesters only for individual *izangoma* and/ or *izinyanga*?

Thank you for your participation!

Appendix 4: Stakeholder identification

Power is the ability of those who possess it to bring about the outcomes they desire. Whatever group it is, is it able to make demands over the GGEP project? Do they have the right to make any demands relating to issues of the GGEP Project?

Legitimacy on the other hand is "a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions". Does a group have any recognized or formal relationship with the GGEP project? If they access the gorge, did they get express permission to do so?

Urgency is the "degree to which stakeholder claims call for immediate attention. Can a group make any claims regarding the GGEP project which need immediate attention?

Tick (√) in the appropriate box: Remember that some groups have more than one attribute, for instance, the Municipality has power, legitimacy and urgency.

Group	**Stakeholder attributes**			**Reasons**
	Power	**Legitimacy**	**Urgency**	
St Helier	X	X	X	Paying contributor with voting ability, part of precinct, prioritized in terms of urgency
Winstone Park	X	X	X	Paying contributor with voting ability, part of precinct, prioritized in terms of urgency
Kirkman	X	X	X	Paying contributor with voting ability, part of precinct, prioritized in terms of urgency
Eagle Rock	X	X	X	Paying contributor with voting ability, part of precinct, prioritized in terms of urgency
Alexander Drive	X	X	X	Paying contributor with voting ability, part of precinct, prioritized in terms of urgency
Tshelimnyama	X		X	Indirect access to natural resources, can have significant impact on management objectives
Commercial harvesters			X	Indirect access to natural resources, can have significant impact on management objectives
Society for the blind		X		Passive use of area but would be concerned about bad management practices.
Scouts		X		Passive use of area but would be concerned about bad management practices.

Rate payers association		X	X	Watchdog role but can rally support quickly.
Wildlife Association		X	X	Watchdog role but can rally support quickly.
Keep Hillcrest beautiful		X	X	Watchdog role but can rally support quickly.
Municipality	X	X	X	Paying contributor and regulatory authority.
Ezemvelo KwaZulu-Natal Wildlife	X	X		Mandated authority for protection of biodiversity, large area to enforce makes it difficult to control all areas.

Appendix 5: Proximate premium analysis

Estimation of the proximate impact of the GGEP open space on property tax base				
Property No.	**Property Value (VA4 Values) (R)**	**Overall change in property value (@ 15% Unusual Excellence) (R)**	**Applying Property Tax Rate of 0.914% on the overall change in property value (R)**	**Applying Special Rating Area tax of 0.0504% on the overall change in property value (R)**
1	1 620 000	243000	2221.02	122.472
2	9 000	1350	12.339	0.6804
3	2 800 000	420000	3838.8	211.68
4	1 400 000	210000	1919.4	105.84
5	2 500 000	375000	3427.5	189
6	1 800 000	270000	2467.8	136.08
7	1 440 000	216000	1974.24	108.864
8	1 960 000	294000	2687.16	148.176
9	1 280 000	192000	1754.88	96.768
10	1 930 000	289500	2646.03	145.908
11	3 050 000	457500	4181.55	230.58
12	1 800 000	270000	2467.8	136.08
13	390 000	58500	534.69	29.484
14	1 760 000	264000	2412.96	133.056
15	250 000	37500	342.75	18.9
16	850 000	127500	1165.35	64.26
17	1 170 000	175500	1604.07	88.452
18	1 350 000	205500	1878.27	103.572
19	1 660 000	249000	2275.86	125.496
20	1 180 000	177000	1617.78	89.208
21	1 540 000	231000	2111.34	116.424
22	2 100 000	315000	2879.1	158.76
23	1 300 000	195000	1782.3	98.28
24	1 390 000	208500	1905.69	105.084
25	1 120 000	168000	1535.52	84.672
26	2 250 000	337500	3084.75	170.1
27	1 350 000	202500	1850.85	102.06
28	1 120 000	168000	1535.52	84.672
29	1 410 000	211500	1933.11	106.596
30	1 120 000	168000	1535.52	84.672
31	1 780 000	267000	2440.38	134.568
32	1 080 000	162000	1480.68	81.648
33	800 000	120000	1096.8	60.48
34	2 150 000	322500	2947.65	162.54
35	600 000	90000	822.6	45.36
36	1 440 000	216000	1974.24	108.864

37	800 000	120000	1096.8	60.48
38	1 280 000	192000	1754.88	96.768
39	1 440 000	216000	1974.24	108.864
40	1 170 000	175500	1604.07	88.452
41	1 410 000	211500	1933.11	106.596
42	1 120 000	168000	1535.52	84.672
43	1 220 000	183000	1672.62	92.232
44	580 000	87000	795.18	43.848
45	2 100 000	315000	2879.1	158.76
46	2 250 000	337500	3084.75	170.1
47	1 170 000	175500	1604.07	88.452
48	2 500 000	375000	3427.5	189
49	3 300 000	495000	4524.3	249.48
50	3 100 000	465000	4250.1	234.36
51	1 720 000	258000	2358.12	130.032
52	1 760 000	264000	2412.96	133.056
53	2 600 000	390000	3564.6	196.56
54	3 450 000	517500	4729.95	260.82
55	1 710 000	256500	2344.41	129.276
56	2 200 000	330000	3016.2	166.32
57	3 050 000	457500	4181.55	230.58
58	2 000 000	300000	2742	151.2
59	2 450 000	367500	3358.95	185.22
60	1 890 000	283500	2591.19	142.884
61	3 250 000	487500	4455.75	245.7
62	1 930 000	289500	2646.03	145.908
63	1 710 000	256500	2344.41	129.276
64	2 550 000	382500	3496.05	192.78
65	2 050 000	307500	2810.55	154.98
66	2 700 000	405000	3701.7	204.12
67	1 500 000	225000	2056.5	113.4
68	500 000	75000	685.5	37.8
69	1 840 000	276000	2522.64	139.104
70	1 080 000	162000	1480.68	81.648
71	1 840 000	276000	2522.64	139.104
72	2 050 000	307500	2810.55	154.98
73	2 000 000	300000	2742	151.2
74	1 260 000	189000	1727.46	95.256
75	950 000	142500	1302.45	71.82
76	1 710 000	256500	2344.41	129.276
77	1 760 000	264000	2412.96	133.056
78	1 600 000	240000	2193.6	120.96
79	2 300 000	345000	3153.3	173.88
80	1 620 000	243000	2221.02	122.472

81	1 400 000	210000	1919.4	105.84
82	1 280 000	192000	1754.88	96.768
83	1 660 000	249000	2275.86	125.496
84	1 410 000	211500	1933.11	106.596
85	1 020 000	153000	1398.42	77.112
86	2 200 000	330000	3016.2	166.32
87	1 750 000	262500	2399.25	132.3
88	1 650 000	247500	2262.15	124.74
89	2 500 000	375000	3427.5	189
90	1 440 000	216000	1974.24	108.864
91	2 000 000	300000	2742	151.2
92	1 600 000	240000	2193.6	120.96
93	1 710 000	256500	2344.41	129.276
94	1 930 000	289500	2646.03	145.908
95	3 000 000	450000	4113	226.8
96	1 710 000	256500	2344.41	129.276
97	1 640 000	246000	2248.44	123.984
98	1 480 000	222000	2029.08	111.888
99	3 000 000	450000	4113	226.8
100	710 000	106500	973.41	53.676
101	1 190 000	178500	1631.49	89.964
102	1 500 000	225000	2056.5	113.4
103	1 770 000	265500	2426.67	133.812
104	1 540 000	231000	2111.34	116.424
105	1 270 000	190500	1741.17	96.012
106	1 700 000	255000	2330.7	128.52
107	1 340 000	201000	1837.14	101.304
108	1 120 000	168000	1535.52	84.672
109	2 500 000	375000	3427.5	189
110	2 000 000	300000	2742	151.2
111	240 000	36000	329.04	18.144
112	1 620 000	243000	2221.02	122.472
113	250 000	37500	342.75	18.9
114	1 600 000	240000	2193.6	120.96
115	450 000	67500	616.95	34.02
116	1 890 000	283500	2591.19	142.884
117	1 890 000	283500	2591.19	142.884
118	1 890 000	283500	2591.19	142.884
119	1 350 000	202500	1850.85	102.06
120	1 540 000	231000	2111.34	116.424
121	1 610 000	241500	2207.31	121.716
122	1 790 000	268500	2454.09	135.324
123	1 590 000	238500	2179.89	120.204
124	1 800 000	270000	2467.8	136.08

125	1 530 000	229500	2097.63	115.668
126	1 730 000	259500	2371.83	130.788
127	1 700 000	255000	2330.7	128.52
128	1 980 000	297000	2714.58	149.688
129	2 150 000	322500	2947.65	162.54
130	520 000	78000	712.92	39.312
131	1 890 000	283500	2591.19	142.884
132	400 000	60000	548.4	30.24
133	1 260 000	189000	1727.46	95.256
134	1 650 000	247500	2262.15	124.74
135	2 350 000	352500	3221.85	177.66
136	220 000	33000	301.62	16.632
137	620 000	93000	850.02	46.872
138	700 000	105000	959.7	52.92
139	1 170 000	175500	1604.07	88.452
140	520 000	78000	712.92	39.312
141	1 000 000	150000	1371	75.6
142	2 950 000	442500	4044.45	223.02
143	2 150 000	322500	2947.65	162.54
Total	**232239000**	**34838850**	**318427.089**	**17558.7804**