Towards improved benefit sharing: approaches and processes for assessing and reflecting on the societal impact of biodiversity conservation

By

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JOHANNESBURG

Academic supervisor

Professor Wayne Twine

DECLARATION

I declare that this thesis is my own, unaided work. The work contained in this thesis was conducted as part of my employed work with South African National Parks. It is being submitted for the Degree of Doctor of Philosophy at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

25 May 2020

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ABSTRACT

Protected areas (PAs) must be relevant to broader society to be sustainable. Relevance (meaning and value) is based on vested interest grown through conservation-related benefit accrual that outweighs costs. The full suite of societal impacts of PAs is largely unknown, and there is no framework that accounts simultaneously for positive and negative impacts, both tangible and intangible. This limits the degree to which PA managers can understand (in order to adapt and improve) and report on their real value to society. This study develops a framework that (1) includes both ecosystem services and dis-services provided by protected areas, (2) provides a tool for reporting on benefit sharing to manage trade-offs, and (3) uses two case studies to test framework assumptions of the impact on human wellbeing and biodiversity conservation. The case studies assessed the social and economic impact of (a) resource harvesting (Mopane worm - *Imbrasia belina*) and (b) conservation-based employment through an Environmental Monitor (EM) programme, both in the context of the Kruger National Park (KNP), South Africa. The framework demonstrates the skewed nature of costs and benefits, highlighting that most beneficiaries are not those incurring the majority of the costs. Many local residents receive few benefits and incur significant costs. The Mopane worm case recorded both tangible and intangible benefits and costs associated with resource harvesting, highlighting new learning experiences and the creation of new social connections and relationships formed during project participation, as highly valued benefits. Respondents perceived their relationship with the park to be positive and expressed hope for building on this in the future. The EM study recorded both positive (cash, improved health, shelter, improved self-esteem, personal image) and negative (financial and opportunity costs, jealousies) impacts on multiple dimensions of wellbeing, noting significantly more positive impacts than negative at an individual, family and community scale. The EM study results suggest that conservation-based employees could play a role as conservation ambassadors outside of the workplace. This was attributed to the unique programme approach that focuses on learning opportunities, and suggests this has direct implications for conservation success globally as wildlife crime increases. The PhD study concludes that measuring both positive and negative impacts of benefit sharing projects and programmes on the multiple dimensions of human wellbeing is important, experiences that facilitate learning are seen as beneficial by participants and that the social capital built through meeting new people can have mutually beneficial outcomes both for conservation staff, neighbouring communities and conservation. The study developed and tested a framework that provides new insights into processes and

approaches leading to more effective benefit sharing, relevant to conservation areas around the globe that aim to implement benefit sharing projects and programmes that contribute positively to human wellbeing while also having positive impacts on conservation.

DEDICATION

This thesis is dedicated to my parents, Peter and Rosemary Rademan, for instilling in me a wonder for nature and a love of people.

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DISCLAIMER

The thesis contains three data chapters, all of which are written in journal article format and style, as they have been submitted to international journals for publication. As such, there is a certain amount of repetition of some sections. The language, spelling and referencing style of these chapters each reflects the style of the journal in which it is published, in press, or under review.

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CHAPTER 1

General introduction

1.1 RATIONALE FOR THE STUDY

The role of protected areas (PAs) has broadened over the last twelve decades, from the early focus almost exclusively on biodiversity preservation, to a growing emphasis on sustainable use and providing more societal benefits, especially to neighbours (Brockington 2002). With growing global populations and shrinking natural resources, PAs have become viewed as critical components of life support systems and as such are expected to contribute even more towards societal wellbeing than ever before (UNDP 2010). It has been shown that when people benefit from biodiversity, they are more likely to support it (Muchapondwa *et al.* 2009). However, those who do not benefit sufficiently feel either neutral or negative towards conservation, especially people who have experienced conservation-related costs such as human-wildlife conflict (Anthony 2007). Historically, the distribution and accrual of biodiversity benefits from protected areas has mostly been uneven, resulting in mixed feelings regarding PA value amongst society (particularly local communities living close to parks) (McCool 2012). Often, the beneficiaries (sometimes referred to as the "winners" such as tourists coming from areas distant to the PA or downstream beneficiaries of flood regulation services from PAs) do not incur any costs as a result of the existence of the parks, while local stakeholders often do (e.g. adjacent communities, possibly upstream, who are living with human-wildlife conflict). Not only is this unjust, but this can also cause negative perceptions of conservation among people living closest to or among wildlife (Anthony 2007).

Negative perceptions can fuel animosity and behaviour that is not in support of conservation, resulting in negative impacts both on people and nature (Swemmer et al. 2017). In the Kruger National Park (KNP) in South Africa, approximately 1.7 million people visit the park annually, with only a small fraction of these coming from areas adjacent to the park (Swemmer et al. 2017). Simultaneously, approximately 150 families living in close proximity to the park experience livelihood losses due to human-wildlife conflict each year (Swemmer et al. 2017). This threatens conservation sustainability at various levels. In trying to address this, many protected areas have embarked on processes aiming to enhance benefits as well as

restore access and ownership rights through the facilitation of more just and fair benefit distribution and accrual. Not only is fairer benefit sharing important for environmental justice, but the assumption is that it will impact positively on human wellbeing (tangible and intangible) which will in turn result in beneficiaries developing a vested interest in the conservation of biodiversity (Swemmer et al. 2017). In reality, these initiatives often have both positive and negative outcomes for both biodiversity and people, which means that PA managers are still grappling with challenges associated with managing the cost to benefit trade-offs among stakeholders and between stakeholders and the natural environment (Swemmer et al. 2015*).* A recent study explored the nature of cost and benefit trade-offs, defining costs and benefits as any interaction with the natural environment in and around protected areas that has either a positive or negative impact on well-being (Swemmer et al. 2015). The study goes on to further explore the concept of benefit sharing. Historically, the term benefit sharing has been used broadly in the context of people and conservation, but mostly in the context of bioprospecting, referring to genetic material (CBD 2011) which is not particularly relevant to the PA context. For the purpose of this study, we refer to benefit sharing in the context of PAs as, "*the process of making informed and fair trade-offs between social, economic and ecological costs and benefits within and between stakeholder groups, and between stakeholders and the natural environment, in a way that is satisfactory to most parties*" (Swemmer et al. 2015).

It is widely acknowledged that good governance, including effective monitoring and evaluation, contributes towards more effective management of benefit processes from PAs, by enabling PA managers to regularly adapt processes based on evidence (Ostrom 1990; Scheepers et al. 2011; Swemmer & Taljaard 2011; Wynberg and Hauk 2014; Swemmer et al. 2015). However, three significant challenges still exist for successful monitoring of benefit within the benefit sharing realm, most of which are rooted in the complex nature of the benefit sharing process (Swemmer et al. 2015) and all of which have received little academic attention in the published (and unpublished) literature:

1) Benefits from biodiversity are often referred to as ecosystem services (MEA 2004). However, this term and its application have received much critique in the past, mostly attributed to ethical and methodological problems associated with the commodification of nature (Schroter *et al.* 2014). Revamped definitions have come a long way and propose that ecosystem services are in fact what gives rise to the benefits, as opposed to being the benefits themselves (Hains-Young & Potschin 2012). Furthermore, ecosystem service models focus

mostly on biological criterion and do not necessarily cover the full suite of benefits that come from PAs such as employment, capacity building, and benefits associated with infrastructure and service delivery. Benefits from protected areas are diverse, varying in their type, nature, tangibility and value both within and between stakeholder groups, and often go hand in hand with costs. PAs that do report on benefits, do not do so as a whole, rather reporting separately on ecotourism (visitor numbers), employment, economic (Thomas *et al.* 2014) or social (Franks & Small 2016) impacts of parks. The lack of a **consolidated framework for clustering and assessing protected area benefits as a whole** regardless of scale, scope and beneficiary group means that very few (if any) comprehensive biodiversity conservation benefit audits exist. This results in a lack of understanding (and hence a lack of acknowledgement) of the role that PAs play in overall broader societal wellbeing. In a climate where PAs are expected to do more in terms of their societal contributions (UNDP 2010), this does not bode well for local and political support for biodiversity conservation at various scales. Furthermore, in some cases, the accrual of one type of benefit to one stakeholder group can result in a net loss to another group, but without a collective framework for mapping all benefits, these trade-offs and gaps in benefit and cost accrual are seldom acknowledged nor managed.

2) Broadly, the desired outcomes of sharing benefits from protected areas include environmental justice, contributing positively to human wellbeing, as well as building conservation support or constituency. However, very few protected areas can report on the degree to which these outcomes have been met through their beneficiation processes and a number of assumptions are made along the way. Not only are these difficult to measure (3 below), but the **links between benefit accrual and the net impact on human wellbeing and subsequent links to building vested interest in conservation, attitude, behaviour and support for conservation** are not well understood. Furthermore, the specific monitoring requirements that would enable PA managers to assess the above criterion have not been explored, resulting in a limited capacity to practice adaptive and reflective management.

3) Human wellbeing comprises both hard (food, shelter money) and soft (psychological wellbeing, security) components. Due to the difficulty in measuring softer outcomes, most benefit audits focus on reporting on tangible **outputs** (e.g. number of participants) as opposed to qualitative **outcomes** (how the participants were affected). This is not only inaccurate (reporting variables do not reflect the objectives) but can also be misleading (e.g. in cases where softer negative outcomes may outweigh hard positive impacts. In these cases, the net

impact would be negative, but this would be missed if only the harder components were measured. This leads to tick-box reporting as well as performance goals (and hence performance) being driven by quantitative variables (e.g. x number of projects) as opposed to more representative outcomes (e.g. what, how many and to whom benefits were accrued). This, as well as the lack of a framework through which to assess benefits collectively (1 above), makes assessing **trade-offs** within and between stakeholder groups as well as between stakeholders and the natural environment difficult (Swemmer & Taljaard 2011; Swemmer *et al.* 2015). Furthermore, a lack of a deeper understanding of these processes and outcomes limits the effective identification of leverage points, a useful tool in a climate where high impact projects are needed but limited resources are available.

The KNP, a large and complex protected area in South Africa, experiences many of the above challenges. This is due to its history of protectionist conservation, political approaches to forced removals of people during the establishment and management of the KNP, restricted access to certain sectors of society, its world heritage status, and fame as a world renown tourist destination. As such, the KNP provides an ideal opportunity to investigate the above challenges. This study aimed to develop a consolidated framework to cluster protected area benefits and costs into logical themes for ease of reporting and assessing of the scale and scope of benefit and cost distribution and accrual from PAs. The study then set out to use a case study approach to test the framework. Case studies provide for a detailed investigation into specific issues, allowing researchers an opportunity to interpret complex concepts in an applied, simplified and practical way. Cases studies do, however, limit the applicability of broader concepts. To address this latter concern, this study used two very different case studies to (1) develop the concept of wellbeing, (2) explore the links between benefit accrual, net impact on human wellbeing, and conservation attitudes and behaviour. The first case study involved the harvesting of Mopane worms from the Kruger National Park and the second case assessed the impact of conservation-based employment through the Kruger-2-Canyon Biosphere Environmental Monitor (EM) programme. The study aims to contribute new knowledge in the form of the proposed process framework, the development of qualitative wellbeing indicators, the development of a methodology to compare cost benefit trade-offs and the role that more effective benefit sharing can play in conservation.

1.2 LITERATURE REVIEW

1.2.1 History of conservation and benefit sharing

The ‘‘fortress conservation efforts’’ characterising the history of many protected areas has resulted in mostly successful biodiversity preservation due to strict controls regarding rights to access land and to harvest resources from it (Carruthers 1995; Abbot & Mace 1999; Brockington 2002; Child 2004). In many cases this was accompanied by a focus on ecotourism including the re-creation of what was perceived as “pristine wilderness” in the absence of people (Adams & Hutton 2007). However, the past 30 years have seen an evolution of thinking more specifically in the Global South, towards an acknowledgement that protected areas cannot survive without the support of their neighbours (Pimbert & Pretty 1994; Hulme & Murphree 1999; Brockington 2004; Galvin & Haller 2008). It is also suggested this support could be nurtured by facilitating local access to conservation benefits (Hutton & Leader-Williams 2003; Muchapondwa *et al.* 2009). In so doing, conservation agencies are trying to be more inclusive of broader society with a focus on rural neighbours, and many examples of community-based conservation (CBC) are being tested and applied across the globe (Pimbert & Pretty 1997; Child 2004; Fabricius & Koch 2004). The Convention on Biological Diversity (CBD) was an early driver of this change through its three primary objectives of biodiversity conservation, sustainable use and fair and equitable benefit sharing (CBD 2011). Outcomes of CBC approaches have been mixed, with both winners and losers (Attwell & Cotterill 2000; Berkes 2004; Igoe 2006; Morgera *et al.* 2013). In South Africa, the South African National Parks (SANParks) regard benefit sharing as part of their mandate but also as a tool to build social relevance or acceptability among society, one of the key pillars of sustainability of the organisation (**Figure 1.1**). Due to the history of parks such as the KNP, benefit sharing is interpreted through the lens of environmental justice.

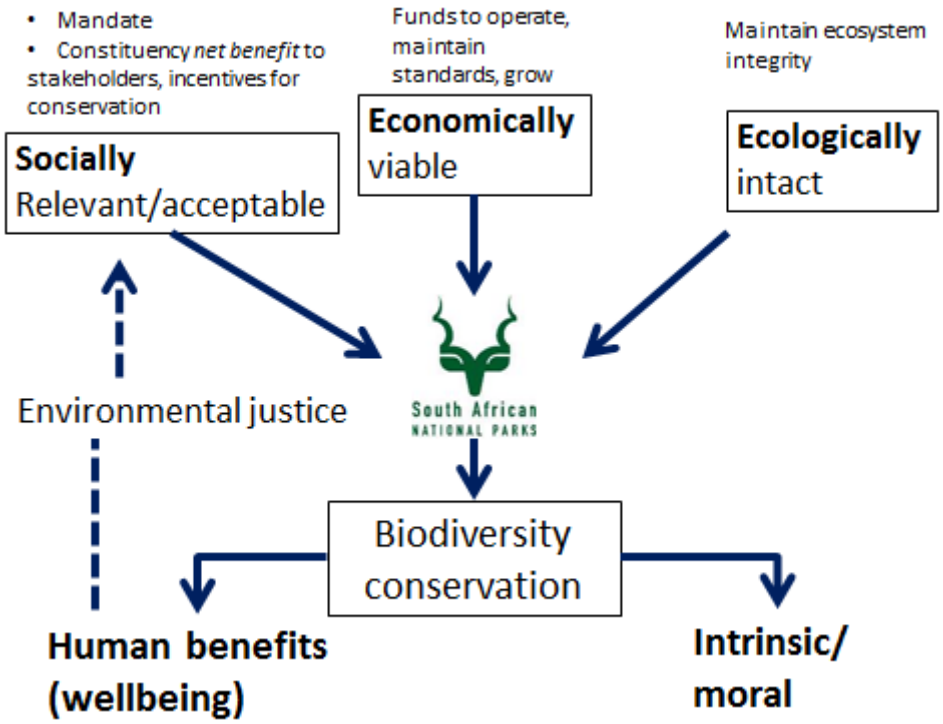

Figure 1.1 The role of biodiversity conservation and its sustainability in the context of South African National Parks (SANParks)

1.2.2 Benefit sharing and ecosystem services

Despite widespread use of the term ‘‘benefit sharing’’ internationally, there is no unified understanding of what it means to conservation and people (Schroeder 2007; McCool 2012; Nkhata *et al.* 2012). Recent attempts have been made to clarify the meaning (Wynberg and Hauk 2014), more specifically in the context of the conservation sector, specifically to address concerns regarding managing cost-benefit trade-off’s at various levels (Swemmer *et al.* 2015). In the protected area context, “benefit sharing” has been defined as “*the process of making informed and fair trade-offs between social, economic and ecological costs and benefits within and between stakeholder groups, and between stakeholders and the natural environment, in a way that is satisfactory to most parties*” (Swemmer et al. 2015).

A fault of many conservation-based benefit schemes is the failure to predict, mitigate, and adaptively manage unintended negative consequences from projects or management actions (Botha *et al.* 2007). Benefits that come from national parks can be direct or indirect (MEA 2004). Ecological benefits or ecosystem services are the direct positive benefits flowing from the natural environment within and around national parks as a result of ecosystem goods (food, fresh water, medicines, building material, and livestock fodder), and the associated

regulating (climate regulation, erosion regulation), supporting (waste treatment, pollination, and primary production), and cultural services (spiritual enrichment, aesthetic experience, ecotourism, heritage, and wilderness) (MEA 2004). Non-ecological benefits include benefits that accrue through processes such as employment and capacity building (Swemmer *et al.* 2015). Benefits vary in type (economic, social, ecological, cultural, and political), tangibility, significance, and value between stakeholder groups, but all benefits by definition play a role in improving people's wellbeing at various levels. People's preferences for benefits differ based on their needs, with some suggestions that a general desire to meet basic human needs (food, water, shelter) must be met before one would seek to meet more indirect (possibly intangible) needs (Maslow 1987).

1.2.3 Benefit sharing and wellbeing

In the context of conservation, benefit has been defined as any interaction with the natural environment in and around protected areas that has a positive impact on wellbeing (Swemmer et al. 2015). Wellbeing is hence a central concept in understanding benefit sharing. Wellbeing is subjective (based on personal perception) and multi-dimensional (Cella 1994) and can be defined either as hedonic (referring to happiness and pleasure in the absence of pain) or eudemonic (focusing on meaning and self-realisation involving the degree to which a person is fully functioning) (Ryan & Deci 2001). Wellbeing is broader than livelihoods, in that it includes intangible elements such as quality of life over and above the tangible components of food and income (Chambers 1995; Scoones 1998). Subjective (internal) wellbeing (SWB) is defined as a person's cognitive and affective evaluations of his or her life (Diener *et al.* 2002). *Cognitive* refers to a person's satisfaction with their life as a whole as well as in specific areas such as work and relationships. *Affective* refers to emotions, moods and feelings (Albuquerque 2016). Objective (external) wellbeing refers to material wellbeing or quality of life (e.g. income, living conditions and educational opportunities) (Alatartseva & Barysheva 2015). Collectively, wellbeing describes happiness, confidence, physical condition and general outlook on life, although the definition of wellbeing varies depending on its application (MEA 2004; Dodge *et al.* 2012). A common understanding of what wellbeing includes can be listed as follows (Botha *et al.* 2007):

1. Material wellbeing—such as livelihoods, shelter, food, water, building materials, money.
2. Physical wellbeing—such as health.
3. Social wellbeing—such as dignity, self-respect, good relations.

4. Spiritual wellbeing.
5. Security.
6. Freedom of choice.

Although there are numerous nature-based benefits that impact positively on human wellbeing, one of the most sought after benefits in the context of many PAs that are located in areas of low economic potential, and high socio-economic demands is that of employment. Assessing the direct economic impact of employment including income, expenditure and savings has been the focus of wellbeing assessments in the conservation sector around the world (McKinnon et al. 2016). Research has shown that where employment has had a broadly positive impact on the eudemonic components of human wellbeing, there is enhanced efficiency and productivity in the workplace. This has subsequently led to an increase in contract-based performance at an individual and an organization level (Baptiste 2008). Effective employee engagement (through positive management relationships, support and a trusting environment) has been shown to further increase employee wellbeing and in so doing contribute towards increased workplace performance (Truss et al. 2013)

In the conservation context, environmental education is a tool that is often used to create awareness, build support and share benefits in the form of education and learning. However, the impact of environmental education is seldom conceptualised in the context of wellbeing, with the recording of outputs usually being inadequately limited to quantifiable indicators e.g. the number of participants (Swemmer and Taljaard 2011). The outcomes of such programmes are assumed to include a greater awareness of environmental issues as well as broader knowledge and capacity as a result of the learning experience but these softer outcomes are difficult to articulate and measure and as such are seldom reported on. Learning has been known to contribute positively to self-satisfaction and optimism, greater self-esteem, confidence and self-worth and to overall mental wellbeing (NHS 2019). Learning informally leads to higher wellbeing (Jenkins and Mostafa 2015), and learning amongst older adults promotes an active and engaged lifestyle (Merriam and Kee 2014). Social learning is learning by all stakeholders to manage the issues in which they have a stake (Ridder *et al.* 2005). Outcomes from social learning include knowledge, improved relationships and a change in values (Lumosi *et al.* 2019). Learning with others increases social capital by extending social networks and promoting shared norms and tolerance of others (Field 2009). Building social connections (and social cohesion) adds to psychological wellbeing of individuals and groups

(Narayan *et al*. 2000). Also broadly referred to as social capital, social bonds or connections are networks of relationships among people that enable society to function effectively and to access resources (Lin 2001). Social capital is understood to be either bonding (within homogenous groups) or bridging (between groups) (Smith 2000). Where social capital exists, the benefits can accrue at an individual or at a group level and it is assumed that the net benefits of working collectively would outweigh the costs (Villalonga-Olives and Kawachi 2015). Relationships, trust and reciprocity, key components of social capital, facilitate further cooperation and in so doing reduce transactional costs, enhance long term agreements and promoting collective action (Pretty and Smith 2004).

While benefits are the primary objective of benefit sharing projects, they often occur simultaneously to costs. In the broad context of impacts of conservation on human wellbeing, a cost is defined as any interaction with the natural environment in and around protected areas that has a negative impact on human wellbeing (Swemmer et al. 2015). People not connected to or benefitting sufficiently from conservation can feel neutral or negative towards it, especially people who have experienced conservation-related costs (Anthony 2007; Adams *et al.* 2010). In some cases, costs (some of which are intangible) can outweigh economic or financial benefits (Botha *et al.* 2007). Societal support for conservation is not only important from a political perspective, but it is widely believed that local support as a result of vested interest built through effective benefit sharing also has positive impacts on reducing poaching (Emslie & Brooks 2003) although there is little empirical evidence to support this. Nevertheless, the relatively recent increase in rhino poaching in southern Africa has seen an increased interest in understanding and enhancing the scale and scope of benefits that are accrued locally from protected areas (Biggs *et al.* 2013).

1.2.4 Monitoring and reporting on benefit sharing

Although PA managers acknowledge the need to benefit broader society, they are limited in the way that they report collectively on benefit distribution and accrual. Ecosystem services as a concept (MEA 2004) has been criticised in the past due to the tendency for ecosystem service assessments to focus inappropriately on financial value, and seldom acknowledging other benefits (Wegner & Pascual 2011; Schroter *et al*. 2014). Revised definitions propose that supporting or intermediate services (e.g. woodland habitat or net primary productivity) provide the foundation for final services (e.g. flood protection or harvestable products) from which benefits flow (e.g. contribution to human wellbeing) giving rise to the value of

biodiversity (Hains-Young & Potschin 2012). Conversely, other assessments prioritise ecotourism-related benefits (Muller 2007; Buckley 2009; Strickland-Munroe *et al.* 2010), benefits to local communities (Igoe 2006; Adams *et al.* 2004) or social impact (Fortin & Gagnon 1999; Franks & Small 2016) excluding other benefit accrual processes. Assessing the economic impact of protected areas is widespread (Saayman & Saayman 2006; Hubert 2008), but in most cases these processes focus on regional or national levels, excluding local impacts. Due to the economic focus, these largely ignore the multiple dimensions of additional social or non-economic benefits (Thomas *et al.* 2014).

Some human-nature frameworks acknowledge various processes along a causal chain for reporting on the state of the environment, including drivers, pressures, states, impacts and responses. However, the focus is on the environment and responses that occur as a result of negative impacts and there is little attention given to the impact on wellbeing as a result (e.g. the UNEP Driving-forces, Pressures, States, Impacts and Responses [DPSIR] framework) (Kristinsin 2004). Similarly, threat reduction assessment models (TRA) are developed to measure the impact of conservation related benefit projects on biodiversity by identifying and measuring threats as a proxy for biodiversity but these don't give much attention to how these threats impact on the multiple dimensions of human wellbeing specifically (Salafsky & Margoluis 1999). The sustainable livelihoods framework defines livelihoods in terms of access to natural, economic, human and social forms of capitals, including psychological dimensions but interpreting these through a commodity lens (Carney 2002; Scoones 1998). Co-management frameworks focus on governance and institutions specifically with regards to property rights but they do not always include tools for assessing the wellbeing impacts of co-management (Plummer and Fitzgibbon 2004). Tools for measuring or assessing social impact of protected areas, both in terms of wellbeing as well as conservation constituency are rare (West *et al.* 2006). As a result many softer outcomes are reported as quantitative outputs undervaluing the full impact as well as the costs (Swemmer & Taljaard 2011).

1.2.5 Resource use and adaptive management in protected areas

Natural resources have been and continue to be harvested from parks, both illegally and legally (Van Wilgen and Herbst 2017). Resource use within protected areas is controversial, mostly due to people's differing value systems and world views that influence how they perceive the associated rights, risks and opportunities of harvesting resources within parks (Chester 1996; Nie 2003). In South Africa, resource use in protected areas is guided by

international agreements (Dudley 2008; CBD 2011) and local policies and legislation (SA constitution 1996; NEMPAA 2003). Within SANParks, the delegated authority for managing national parks, sustainable resource use is defined as "*resource use that maintains the integrity of the ecosystem, is economically viable and is socially just and acceptable*" (SANParks 2018).

Previous work has highlighted the importance of relationship building to develop a shared vision for sustainable resource use, as well as the role of participant monitoring efforts in building ownership, but the same work highlights that capacity is needed for more effective implementation (Scheepers et al. 2011). Frameworks have attempted to outline how resource harvesting projects can be monitored within South African national parks to achieve multiple objectives of both use and conserving biodiversity in the context of strategic adaptive management. However they have focussed on monitoring the ecological impacts without explicitly including the multiple dimensions of human wellbeing (Roux et al. 2011; Scheepers et al. 2011; Swemmer *et al.* 2015; Vermeulen et al. 2019). Part of being able to detect and adapt to required change includes exploring and using leverage points, defined as places where a small change in one aspect can lead to a large change in several other aspects within a complex system (Meadows 1999).

1.2.6 Community perceptions of conservation around a large national park

It is assumed that conservation success is determined partly by having support from the people who live inside or in close proximity to parks (Bennet 2016; Agrawal and Gibson 1999). As such, local community perceptions of marine and terrestrial PAs around the world have received considerable research attention (Bennet and Dearden 2014; Vuola and Pyhala 2016). Some studies show that conservation-related benefits positively influenced perceptions of conservation (Snyman 2012). Others reported that despite the efforts that conservation agencies go to, to share benefits, communities still feel separated from parks, incurring negative impacts and having unmet expectations (Carruthers 1995; Strickland-Munro et al. 2010; Anthony 2007).

The KNP is a good case study of community perceptions, being a large, flagship national park with both local and international status. As a result, several studies have been done on community attitudes and perceptions towards the park over the past three decades (Els 1994; Carruthers 1995; Cock and Fig 2000; Mabunda 2004; Rademan 2004; Anthony 2007;

Strickland-Munro 2010; Greer 2014; Ndlovu 2015; Steenkamp 2016). The research outcomes are instructive in understanding the complexity of local perceptions of conservation in the South African context. Early studies suggested that people living next to the KNP placed a solely utilitarian value on wildlife (Els 1994). Carruthers (1995) noted that people placed their need for land and food above any aesthetic value and there were perceptions that SANParks had stolen land and resources, building resentment towards the fences that stood between people and wildlife (Cock and Fig 2000). Later studies suggest that communities living next to the KNP view the park positively due the benefits accrued, felt pride in the park and believed it should be protected (Mabunda 2004). In other cases, mixed feelings were reported, with positive sentiments associated with benefits accrued but negative feelings also recorded as a result of damaging impacts such as human-wildlife conflict (Anthony 2007). In other cases, positive feelings were associated with employment and added social capital linked to increased opportunities to meet new people as a result of the KNP as well as a sense of pride for the park, but at the same time a feeling of concern about remaining separate was noted (Strickland-Munro 2010). People living adjacent to the KNP have been found to value the aesthetic beauty of nature as the highest benefit of living adjacent to the park (Rademan 2004), while others recorded anger, marginalization and a perceived lack of access as dominating perceptions of the park (Greer 2014). Overwhelmingly positive sentiments towards the park and its value have also been recorded (Ndlovu 2015), contradicting other work that suggesting that more than half of respondents received no benefits from the park (Steenkamp 2016). Most of the above studies were done in different geographical areas around the KNP, by different researchers at a different time for varying purposes, highlighting the importance of assessing attitudes and perceptions in the context of who is involved and when, why and how the research is being done.

1.3 AIM, OBJECTIVES AND RESEARCH QUESTIONS

1.3.1 Aim

This thesis aims to contribute towards achieving improved benefit sharing outcomes from protected areas by developing more effective benefit sharing assessment and reflection approaches and processes.

1.3.2 Objectives

Objective 1: To develop and test a framework for obtaining a comprehensive and integrated inventory of direct benefits that accrue from protected areas, encompassing diverse benefit types, values and stakeholder groups.

- *Question 1.1:* What are the various types of benefits that accrue directly from the KNP to a diversity of stakeholders?
- *Question 1.2:* How can these benefits be clustered into a comprehensive benefit framework that enables a broad level but logical view of the suite of benefits that accrue from the KNP regardless of scale, benefit type and beneficiary?
- *Question 1.3:* Can this framework be used to conduct an inventory of benefits that accrue from the KNP, applying the inventory to the framework to assess benefit accrual across scales?
- *Question 1.4:* How can the framework and inventory be used to reflect on the processes and approaches to benefit sharing from the KNP?

Objective 2: To develop a process model that traces the cycle of cost and benefit distribution and accrual, starting from the biophysical template (natural environment), and leading to conservation-related attitudes and behaviour.

- *Question 2.1:* How can the benefit and cost inventory be used to explore and develop a process model that traces the pathway between the biophysical template, biodiversity related costs and benefits and conservation perceptions

Objective 3: To track the process from benefit distribution to predicted outcomes from resource harvesting from within the Kruger National Park (using the Mopane caterpillars project as a case study). This includes assessing objectives versus outcomes, trade-offs and testing the assumptions regarding impact of benefit distribution on human wellbeing and in so doing, on conservation.

- *Question 3.1:* To what degree has the harvesting of Mopane caterpillars from KNP impacted on human wellbeing at individual, family and community level?
- *Question 3.2:* To what degree has the harvesting of Mopane caterpillars from KNP had indirect conservation-related outcomes (i.e. as a result of relationships)

- *Question 3.3:* What trade-offs were experienced before, during and after the harvesting of Mopane caterpillars?
- *Question 3.4:* What factors have contributed to the success/failure of the Mopane caterpillar harvesting project achieving its objectives (human wellbeing and conservation)?

Objective 4: To track the process from benefit distribution to predicted outcomes as a result of conservation related employment (using the K2C EM programme as a case study). This includes assessing objectives versus outcomes, trade-offs and testing the assumptions regarding impact of benefit distribution on human-wellbeing and conservation constituency both for the EM project but also for the broader context of employment in and around the Kruger National Park.

- Question 4.1: To what degree has the K2C EM programme contributed to human wellbeing at an individual, family and community level?
- *Question 4.2:* Has the K2C EM programme had any conservation related outcomes, in terms of conservation constituency (support) and pro-conservation behaviour?
- *Question 4.3:* What cost to benefit trade-offs are experienced in the K2C EM programme?
- *Question 4.4:* What factors have contributed to the success/failure of the K2C EM programme achieving its objectives?

1.4 APPROACH OF THE STUDY

This study aims to address the knowledge gaps summarised in section 1.1 (rationale) in implementing (practice) and reflecting (theory) on benefit sharing from protected areas, by using the KNP as a case study to: (1) Develop a "cost/benefit audit framework" for reporting on the pattern of costs and benefits collectively, testing the first assumption that (i) protected areas impact a range of people in a variety of ways (**Figure 1.2**); (2) Propose a "benefit-to-outcome process model" that charts the process of benefit distribution, testing the second assumption that (ii) human wellbeing is the link between the biophysical template and society; (3) Assess two benefit sharing schemes in detail in order to track the process from benefit distribution to predicted outcomes. The first case study involves natural resource use from within the KNP (Mopane caterpillar harvesting), and the second involves employment

in the conservation sector (Environmental Monitor Programme). Objectives, impact on human wellbeing, conservation and trade-offs are explored throughout, while testing the remaining two assumptions in each case. These include: (iii) that benefit distribution processes result in an improvement of human wellbeing, and (iv) that an improvement in human wellbeing as a result of conservation-related benefits, results in positive conservation outcomes.

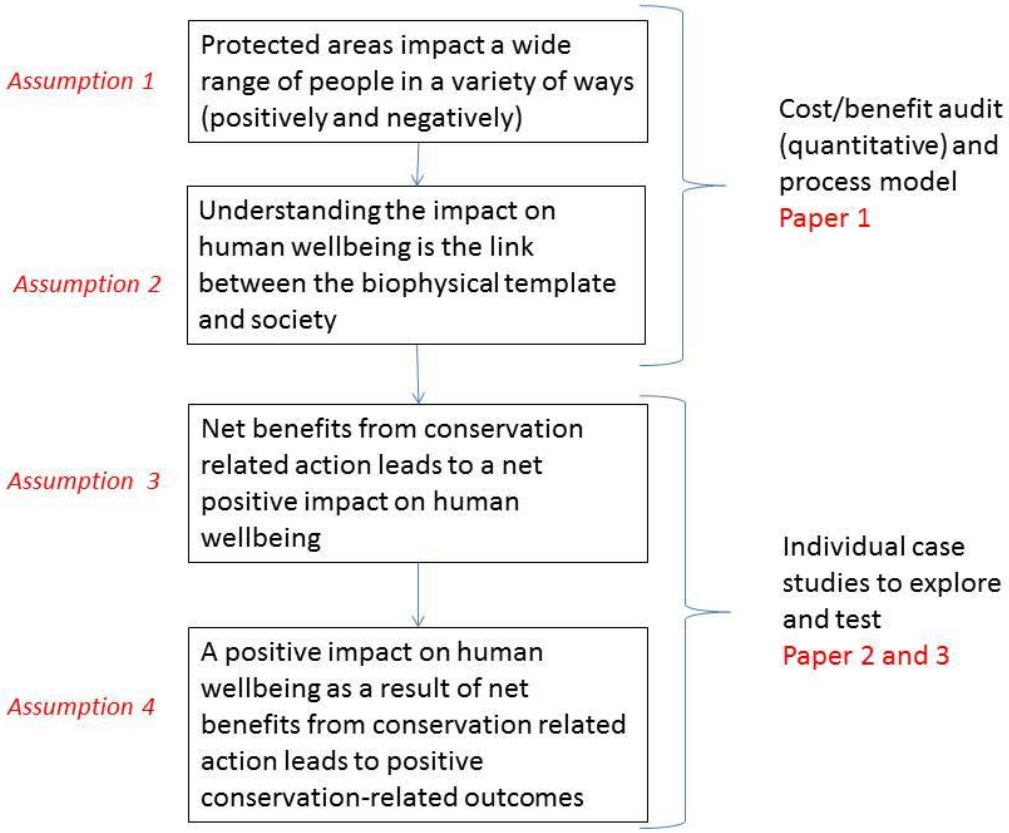

Figure 1.2 The conceptual framework for the PhD outlining assumptions in the context of benefit sharing from conservation areas and how each will be addressed through chapter/paper sections in the present study

This research used the KNP, South Africa as a case study. KNP is a globally important, iconic national park that is a world-renowned tourism destination. It has a large national and global economic impact and makes a significant contribution to conservation. The KNP abuts several different land use types including private and government conservation land, rural and urban towns and villages, agriculture and industry (Carruthers 2004; Saayman and Saayman 2006). However, KNP has a history of forced removals of people and policies that

restricted access to certain sectors of society. This provides a complex context posing new challenges to access and benefit sharing models and community based natural resource management. This is in the current climate of social, political, economic and ecological landscape challenges facing conservation. It is envisioned that through this study, scholars and practitioners will gain insights towards a better understanding of some of these challenges that face conservation agencies attempting to implement benefit sharing around the world.

The Mopane caterpillar project was chosen as a case study due to it being a relatively unique, pilot project with well-defined objectives, an interdisciplinary team of implementers and addresses a basic human need through the facilitation of access to a tangible resource. This pilot flagship project started in KNP in 2010, with the aim of promoting access for local communities, to natural resources within the park. By providing a detailed assessment of the impact of the project, this study aims to provide valuable monitoring outcomes. These enable both an adaptive approach to the management of the project as well as a well-grounded evaluation of outcomes towards wider roll out of resource use in SANParks, and other protected areas around the world. Although there is a large team of researchers and managers monitoring several aspects of the project (including assessing the direct ecological impacts of removing worms from the system), this study focussed on the social and economic impacts, and in so doing how these have impacted on conservation (by impacting conservation related attitudes, perceptions and behaviour).

The EM programme was chosen as a second case study specifically because it is vastly different to the Mopane caterpillar project, in that it operates outside of the KNP, in the broader conservation bioregion in which the KNP is embedded. The EM programme objectives include employment and environmental integrity protection. This project started in 2014 as an arm of the government Expanded Public Works Programme, and involves approximately 1,800 Environmental Monitor jobs in the country (of which 270 work in the Kruger to Canyon Biosphere). The EMs are employed on 3 year contracts, and are currently in their second phase of funding (year 4 - 6). Although the programme contributes many jobs, being a government intervention, it is reliant on government funding, the sustainability of which is uncertain. The objectives of the programme are to contribute to social and economic development as well as ecosystem integrity. The aim of the case study is to assess the project in terms of its social and economic impact at an individual, household and community level, as well as its impact on conservation through awareness and constituency building. Since it

started relatively recently, it provides an ideal opportunity to assess the impact of employment (as those employed had only recently been employed and would be able to relate to the period before and after employment relatively easily). Furthermore, because the group of EMs do similar work, the project provides an ideal opportunity to do an impact assessment on a large number of employees who are employed under very similar conditions – which makes data analysis and interpretation more credible and reliable.

1.5 ETHICAL CONSIDERATIONS

Due to the involvement of human subjects in this research, it is a requirement that the ethical approach be approved by the Wits Ethical Clearance Committee. Since the work was conducted in and around SANParks, and by a SANParks staff member, the SANParks Research Statement of Ethical Practice (SANParks 2008) is also of relevance. Some of the data was collected prior to getting clearance from the Wits committee, since it was collected as part of the researcher's normal job description, and was done prior to the researcher having chosen the PhD topic. However, the ethics approval was applied for in retrospect and approved by the Wits Human Research Ethics Committee (HREC) – certificate number H16/10/21. The research was conducted in a manner that was acceptable by the HREC including voluntary participation and anonymity. The researcher has a good understanding and acknowledgement of the importance of ethical research approaches and has been working in the field of social science research based from the Kruger National Park for almost 10 years. During this time, the researcher has been part of the development of the Guidelines for negotiating social research in communities living adjacent to Transboundary protected areas: Kruger National Park (TPARI 2009) as well as the SANParks Research Statement of Ethical Practice. In the case of data collection for the Mopane caterpillar project, many of the participants were elderly and illiterate; hence it was not appropriate to ask such participants to sign documents that they could not read themselves. These participants gave their consent verbally in a group setting with witnesses. In the case of the EM programme, the participants are all employees within the programme. The interviews were administered by medium level managers who know and engage with the participating EMs on a daily basis. Respondents were again told of the purpose of the research and that the data would be used in reports and publications. In both cases, respondents were free to answer questions that they were comfortable with, and skip any that they did not want to answer. Throughout this research, the researcher was aware that her position as a SANParks employee could have influenced

the way in which the research subjects interacted with her and responded to the questions posed, as well as the way in which the researcher interpreted and analysed the data. This could have resulted from possible perceptions of the research outcomes influencing access to resources or job security. This is a reality and could not be helped. However, the researcher did use ethical means to ensure confidentiality and honesty of data collection methods at all times. Furthermore, the researcher tried at all times to be neutral when analysing and interpreting findings, by using a second coder or data interpreter in some cases and reflecting throughout on positionality. Collaboration between PA staff and local communities in the manner outlined in this research contributed to social capital, an important component of wellbeing and conservation benefits and this was viewed as a positive tradeoff of the former concern.

1.6 THESIS STRUCTURE

The thesis is structured around three journal articles that are either published (Chapter 2), accepted for publication and undergoing copyediting (Chapter 3), or have been submitted and are under review (Chapter 4) (**Figure 1.3**). In the interests of uniformity and readability, the Microsoft Word version of each of the papers is presented as a data chapter, and the figures, tables and supplementary material from each journal article have thus been renumbered to reflect their position within each chapter of this thesis.

This introductory chapter sets the scene for the thesis, by providing the rationale for the study, a detailed literature review providing justification for the research aim and objectives. The basic approach is outlined, and the structure of the thesis is given, as well as a general description of the study area. The second chapter develops a framework and pathway that (1) includes both ecosystem services and dis-services provided by protected areas, and (2) provides a tool for protected area managers to report on benefit sharing as a whole towards managing cost-benefit trade-offs. The third and fourth chapters go on to test the framework and pathway by examining (1) a Mopane worm (*Imbrasia belina*) harvesting project in the KNP and (2) a conservation-based employment programme in the K2C biosphere, to test whether conservation related benefit sharing has a net positive impact on multiple dimensions of human wellbeing, and whether and to what degree sharing such benefits influences local perceptions of conservation, a requirement for the sustainability of protected areas across the globe.

In each of the afore mentioned studies, the main researcher is the primary author, and is responsible for the conceptual framing, research design, data collection and analysis and writing up of the studies for publication. However, for each study, a number of other people were also involved; in most cases these were managers working in the various projects in KNP. These co-workers mostly reflect having given support in either implementing the actual projects or in collecting data for the research, and have been included as co-authors on the papers, along with my supervisor, Prof. Wayne Twine.

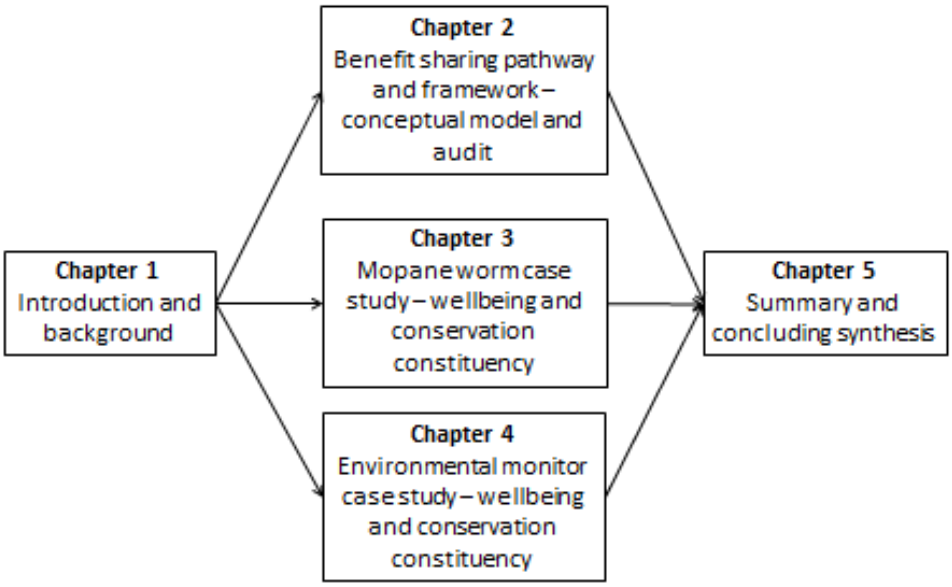

Figure 1.3 Thesis structure showing the connection between the various chapters

1.7 STUDY AREA

The Kruger National Park is situated in the Lowveld of South Africa, spanning the two provinces of Mpumalanga and Limpopo (**Figure 1.4**). Although having earlier predecessors, the park was officially proclaimed in 1926, from which time it has been perceived in a duel light (Carruthers 1995). On the one hand, the KNP is seen globally as a powerful symbol of conservation success, yet on the other hand it is also perceived to be a symbol of segregation, inequality and injustice to many living in close proximity to the park (Carruthers 1995). The history of forced removals of people from the interior of the park, to outside the borders in the early years as well as restricted access policies that only allowed entrance and use of facilities by certain sectors of society have fuelled the latter. However, South African

democracy in 1994 facilitated several processes of change in the context of transformation (Swemmer and Taljaard 2011). With an annual rainfall between 400 mm and 750 mm, the 20 000 km^2 KNP is classed as semi-arid to arid wooded savanna vegetation, home to a large diversity of plants and animals that attracts over 1.8 million tourists annually from around the world, resulting in a large regional economic impact (Saayman and Saayman 2006). The South African component of the 1,073 km perimeter of the KNP abuts seven South African municipalities covering land uses that include private and government conservation land, rural and urban towns, villages, agriculture and industry, and including about 2 million people. Much of this land is of low agricultural potential (Lahiff and Cousins 2009) typified by high regional unemployment rates with residents being largely dependent on natural resources, subsistence agriculture and social grants (Statistics SA 2015). The KNP employs over 3,000 people, and implements numerous projects and programmes aimed at benefitting local communities (Swemmer *et al.* 2017). However, the majority of neighbours do not visit the park nor do they receive any direct benefits from the park its self. The Kruger to Canyons is a UNESCO registered biosphere reserve under the Man and the biosphere (MaB) programme with the KNP as its core conservation area, aiming to promote the conservation of biodiversity and its sustainable use (K2C 2013).

Figure 1.4 Geographical location of the study area in the context of South Africa (Map courtesy of Encyclopaedia Britannica, 1013)

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CHAPTER 2

Tracing the cost benefit pathway of protected areas: a case study of the Kruger National Park, South Africa

2.1 ABSTRACT

The sustainability of protected areas is dependent on societal support. Protected area relevance (meaning and value) to society is based on vested interest grown through conservation-related benefit accrual that outweighs costs. Protected areas generally do not report on their total societal impact in part due to a lack of an appropriate framework that accounts simultaneously for positive and negative, tangible and intangible components. We develop a framework and pathway that (1) includes ecosystem services and dis-services provided by protected areas, and (2) provides a tool for protected area managers to report on benefit sharing as a whole towards managing cost-benefit trade-offs. Ecosystem services and products from Kruger National Park were classified into themes, followed by a quantitative inventory of cost/benefit processes for the KNP. We demonstrate the skewed nature of costs versus benefits, with most beneficiaries living far from the park. Most local residents receive few benefits and are often recipients of costs. The framework highlights the need to understand the impact of benefit sharing on human wellbeing; the lack of an understanding of the outputs and outcomes from direct ecosystem service flows from parks; and the need for an understanding of the links between benefit accrual and conservation-related outcomes.

Citation (Appendix 2.9.1)

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Author contributions

- Swemmer – 80% (conducted the research, wrote the manuscript);
- Mmethi - 10% (assisted with conceptual framework and data collection);
- Twine - 10% (supervisor, conceptual inputs, reviewed the manuscript).

2.2 INTRODUCTION

Protected areas are established and maintained across the world for various reasons, including for their ecological, cultural, social and/or economic values. However, the purpose of many protected areas has evolved with time, and in cases where these areas were originally set up primarily for biodiversity conservation (Brockington 2002), recent expectations are for these areas to provide more direct benefits and fewer costs to society than they have before (UNDP 2010). The Convention of Biological Diversity (CBD) was an early driver of this change, promoting sustainable use and benefit sharing (CBD 2011). Benefits are impacts that make a positive contribution to human wellbeing. They are diverse in type, nature, tangibility and value and often go hand in hand with costs, conservation-related impacts that have a negative impact on human wellbeing (Swemmer *et al.* 2015). The sustainability of protected areas is dependent on societal support at various levels, but being relevant (having positive meaning and value) locally is required for building vested interest through conservation-related benefit accrual that outweighs costs, most of which are felt locally (Pimbert & Pretty 1994; Hutton & Leader-Williams 2003; CBD 2011; Swemmer *et al.* 2016). Understanding perceptions of conservation and the drivers for these among stakeholder groups promotes effective implementation of benefit sharing, although this understanding is inadequate for most protected areas globally (Guerbois *et al.* 2023; Bragagnolo *et al.* 2016).

Sectors of society that benefit from conservation usually support it (Muchapondwa *et al.* 2009) but differences in socio-cultural preferences for biodiversity benefits requires context-appropriate approaches for ensuring relevance (Martin-Lopez *et al.* 2012). Those not benefitting sufficiently feel either neutral or negative towards it, especially people who have experienced conservation-related costs (Anthony 2007). Understanding these tradeoffs between costs and benefits at various levels can contribute towards more effective sharing of benefits from conservation (Swemmer *et al.* 2015). It is widely believed that local support built through effective benefit sharing will have positive impacts on reducing poaching (Biggs *et al.* 2013). The recent increase in rhino and elephant poaching in southern Africa (Lunstrum 2014) not only threatens individual species and impacts negatively on local communities (Greer 2014) but also places the economic viability of protected areas at risk through predicted losses related to reduced tourism visitation (Naidoo *et al.* 2016). As such, there has been an increased interest in understanding the scale and scope of benefits and costs that are accrued locally (Emslie & Brooks 2003; Biggs *et al.* 2016).

Despite the need for protected areas to benefit broader society, defining and reporting on these benefits and costs remains challenging. Reporting on protected area benefits is variable across the globe, with the aim of the assessment dictating the tools that are used giving rise to both opportunities and risks (Dudley, Stolton & Kettunen 2013). In many cases, costs are down-played or ignored. Generally, studies focus on a specific set of stakeholders (Franks & Small 2016), at a particular scale (Dudley & Stolton 2009) or on specific benefits that have indicators that are easy to measure or compare (TEEB 2010). Assessing the economic impact of parks is widespread (Saayman & Saayman 2006; Hubert 2008), with such assessments focusing on regional or national levels, rarely including local impacts, often not accounting for the multiple-dimensions of social (non-economic) costs and benefits and often facing methodological challenges (Daniel *et al.* 2010; de Groot *et al.* 2010; Chan & Rucklehaus 2010; Thomas *et al.* 2014).

Ecosystem services are referred to as the goods from nature that benefit humans, and traditionally include provisioning, regulating, supporting and cultural service categories (MEA 2004). However, this concept has received much critique, mostly attributed to ethical concerns with the commodification of nature and methodological challenges in assigning legitimate financial values to intangible benefits of biodiversity (Schroter *et al*. 2014). Most ecosystem service audits focus on natural capital, excluding benefits such as employment and capacity building and not taking costs into account. Other assessments focus on ecotourism-related benefits or cultural services (Muller 2007; Buckley 2009; Strickland-Munroe *et al.* 2010; Daniel *et al.* 2012; Hernandes-Morcilloa et al. 2013), benefits to local communities (Igoe 2006; Adams *et al.* 2004; Waylen *et al.* 2010) or social impact (Fortin & Gagnon 1999; Franks & Small 2016) not accounting for the collective contribution of all ecosystem services. Revised definitions for ecosystem services propose that supporting or intermediate services (e.g. woodland habitat or net primary productivity) provide the foundation for final services (e.g. flood protection or harvestable products) from which benefits flow (e.g. contribution to human wellbeing) giving rise to the value of biodiversity (Haines-Young & Potschin 2012). However, these classification systems focus on the services, not the products that are derived from the services, nor the actual benefit (Haines-Young & Potschin 2012). In some cases, costs (some of which are intangible) can outweigh the economic or financial benefits (Botha *et al.* 2004) with the accrual of one type of benefit to one stakeholder group resulting in a net loss to another group. Without a collective framework for mapping ecosystem services and dis-services (the ecosystem products that result in societal costs),

their associated products and the subsequent benefits and costs that accrue, the role that protected areas play in societal wellbeing is undermined, and the tradeoffs and gaps in benefit and cost accrual are seldom acknowledged and almost never managed for.

Our study aimed to use societal benefit and cost data collected from the Kruger National Park (KNP) to explore the concept of ecosystem services and disservices in the context of protected areas. In so doing, we develop a holistic framework for conducting a quantitative inventory of the suite of ecosystem services and disservices flowing from protected areas, and the associated products, costs and benefits that are derived from them. We use our inventory to compare the scale of ecosystem products, benefits and costs that flow to stakeholders and to reflect on what this means for protected area conservation going forward. Having been developed in KNP, one of the largest and most complex protected areas in the world, we believe that the lessons learnt in this study will contribute to the global discourse on ecosystem services, and will be useful to managers of other protected areas wishing to reflect on the collective social relevance of their parks and to market their societal contributions at various scales towards building conservation constituency.

2.3 MATERIALS AND METHODS

2.3.1 Study Area

The KNP comprises 20 000 km^2 of relatively intact conservation land, described as semi-arid to arid wooded savanna with an annual rainfall ranging between 400mm and 600mm. The park is home to many mammal, bird, reptile, fish, amphibian and plant species (Du Toit *et al.* 2003). The KNP is a world-renowned tourism destination with approximately 1.6 million visitors annually (SANParks 2014). It is a globally important, iconic national park with world heritage site status and a significantly large regional economic impact (Saayman & Saayman 2006). Despite the conservation successes of KNP, the early establishment of the Park involved forced removals of people from within the KNP boundaries, supported by policies that restricted access to certain sectors of society (Carruthers 1995). This was at a time when the South African *apartheid* government was moving thousands of people into culturally homogenous "Bantustan" homeland areas, some of which bordered the KNP. Currently, approximately 2 million people reside in the 7 South African municipalities bordering KNP, many of whom rely on subsistence agriculture and social grants due to high regional unemployment rates (municipal level unemployment rates range from 28.1% to 52.1%) (Stats

SA 2015). The area is typified by low agricultural potential (Lahiff & Cousins 2009) and employment within KNP is very sought after. The 1073 km of KNP periphery abuts private and government conservation land, rural and urban towns and villages, agriculture and industry – the diversity of which would be hard to meet anywhere else in the world. Together with the rich history of the park, this provides a complex context which poses new challenges to access and benefit sharing models and community based natural resource management (**Figure 2.1**).

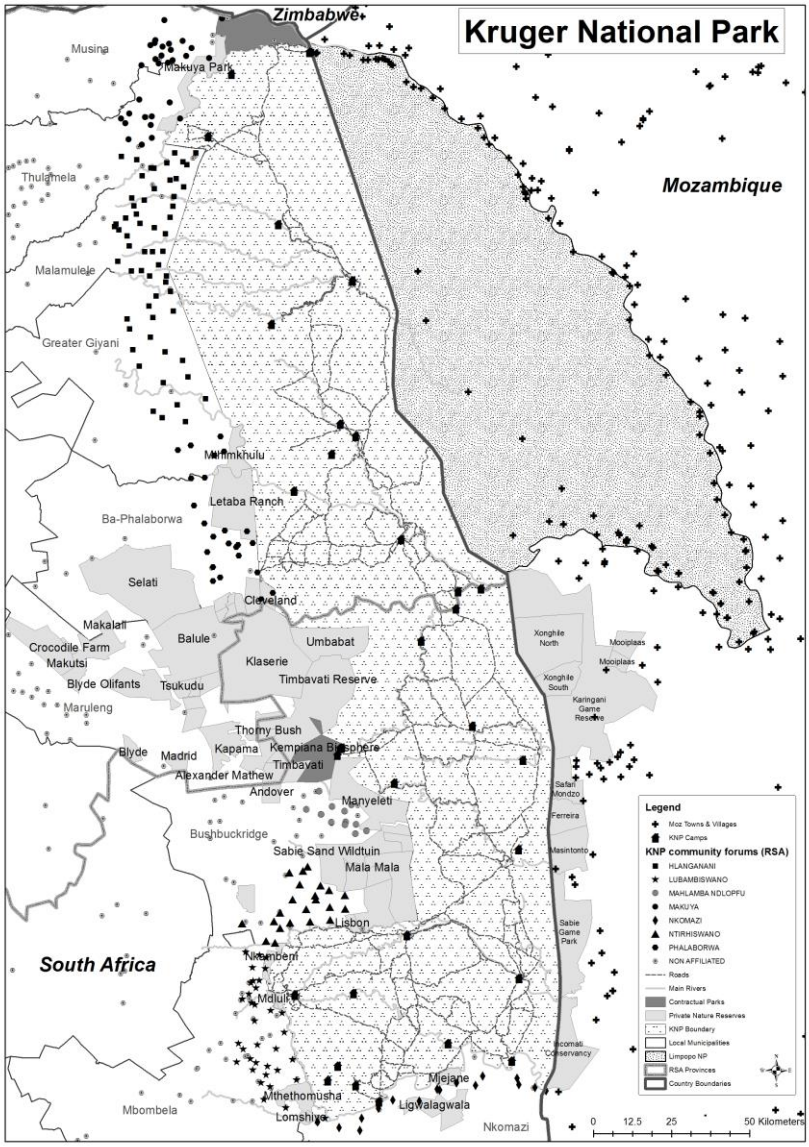

Figure 2.1 The Kruger National Park in an international context showing neighbouring villages and towns, district municipalities and provinces as well as conservation neighbours (KNP GIS Office 2017)

2.3.2 Data collection methods

Unstructured interviews were held in November 2014 with four high level managers from various departments in KNP (stakeholder relationships; community beneficiation and facilitation; tourism and public relations; research) to discuss (1) expectations regarding the development of a benefits framework and (2) to get ideas about the spatial and temporal scale and scope of the subsequent KNP benefit inventory process and (3) to begin drafting a benefits inventory list. Following from these interviews, a management meeting constituting an expert workshop was held (23 November 2014) with 11 middle to senior level SANParks managers working in KNP to further build on the KNP benefit inventory process. A minimum of one representative was chosen from each relevant department based on their expertise and knowledge on conservation related benefit distribution and accrual. Representatives included individuals from veterinary services, game capture and sales (1), stakeholder relationships (2), community beneficiation and facilitation (4), research (2), and tourism and public relations (1). During the workshop, participant's knowledge, opinions and perceptions on the range of tangible and intangible benefits accrued at various levels from KNP were captured using participatory methods (round-robin idea generation and informal plenary discussions) building on the list of benefits that was generated from inputs received during the first round of informal interviews. These ideas were charted directly onto a mindmap that was projected onto a screen (iMindMap7 2014). Once participants were satisfied that all initiatives were recorded, similar types (ie. those with aligned objectives and outcomes based on expert opinion) were grouped together building a hierarchical set of benefit themes and sub-themes (e.g. thatch harvesting and medicinal plant donations were clustered together under natural resource products).

The themes and sub-themes were further refined by looking critically at each theme in terms of the type of benefits accrued and whether the known output was an ecosystem service (ecosystem output effecting human wellbeing), an ecosystem product (as derived from an ecosystem service) or an ecosystem benefit or cost (realized impact on human wellbeing) (**Appendix 2.9.2)**. This was done in alignment with existing frameworks (MEA 2004; Haines-Young & Potschin 2012).

The following definitions were used, modified from those proposed by Haines-Young & Potschin (2012) in order to accommodate costs:

- *Supporting services:* The basic services provided by the environment that do not directly impact human wellbeing but enable the flow of final services
- *Final ecosystem dis/services:* Final ecosystem outputs (patterns and processes) that directly affect human wellbeing either positively or negatively
- *Ecosystem products:* Derived from final ecosystem dis/services, exposure to which has a direct positive or negative impact on human wellbeing. Products are also often called "goods", but the latter can be misleading as it implies that the impact is only positive.
- *Ecosystem costs/benefits:* Direct impacts (changes) to any or multiple elements of human wellbeing (tangible or intangible) realized through exposure to ecosystem products.

Each component identified through the consultative process was classified as either a "supporting service", "final ecosystem dis/service", or "ecosystem product". There was some debate around whether certain programmes were services or products from ecosystem services, especially for some of the cultural related outcomes. In alignment with Haines-Young & Potschin (2012) we chose to define *cultural services* as the environmental "space" or "setting" provided by the ecosystem which allows for cultural processes such as ecotourism, environmental education and research to take place.

The resulting framework was used to guide a quantitative inventory of services, products, costs and benefits flowing from the KNP. This involved a series of consecutive, one-on-one, informal interviews with SANParks staff to collect relevant data. Data were qualitative (mostly ecosystems services) and quantitative (ecosystem products) with sources including both published and grey literature (e.g. monthly, quarterly and annual reports). Data in hard copy was captured electronically, with various levels of data formatting conducted prior to analysis. Data variations in spatial and temporal scale are noted in the results. For categories where no KNP specific data were available (particularly in the case of specific ecosystem service outputs related to disease, vegetation, pollination and alien invasive species) published literature from elsewhere were used to illustrate certain points. Due to the multiple perspectives present at the meeting and the purposely participatory, non-prescriptive methods we used in collecting the data, data describes either ecosystem services, ecosystem products

or the impact of products on human wellbeing. Where data were available, benefits were expressed quantitatively, such as relative numbers of beneficiaries benefiting from different types of services and products. Due to the magnitude and complexity of understanding and plotting secondary "downstream" benefits, this inventory prioritized primary ecosystem services and products only (those that result directly from management actions within the KNP boundaries).

2.4 RESULTS

2.4.1 A cost/benefit pathway framework

Our framing of supporting services (habitat, primary production, biomass, pollination, soil formation, waste treatment, nutrient cycling and erosion control) and two of the final ecosystem services (provisioning and regulating) remained as outlined in most ecosystem service literature (MEA 2004; Haines-Young & Potschin 2012) (**Figure 2.2**). However, our framework included dis-services (e.g. human-wildlife conflict in the form of disease and predation) and followed the suggestion of Haines-Young & Potschin (2012) in terms of the definition of cultural services being the site or setting from which cultural products (e.g. tourism) are derived. Most projects, programmes and management actions identified through our consultation process were classified as ecosystem products under the sub-headings of: natural (provisioning and regulating), cultural, employment and business opportunities, infrastructure/service support products and products associated with managing relationships and restoring rights. It was acknowledged that these products then give rise to either costs or benefits in the form of tangible and intangible wellbeing impacts. It is further highlighted that these costs and benefits then give rise to value/relevance/meaning (or lack of value) of conservation and subsequent pro (or anti) conservation behavior.

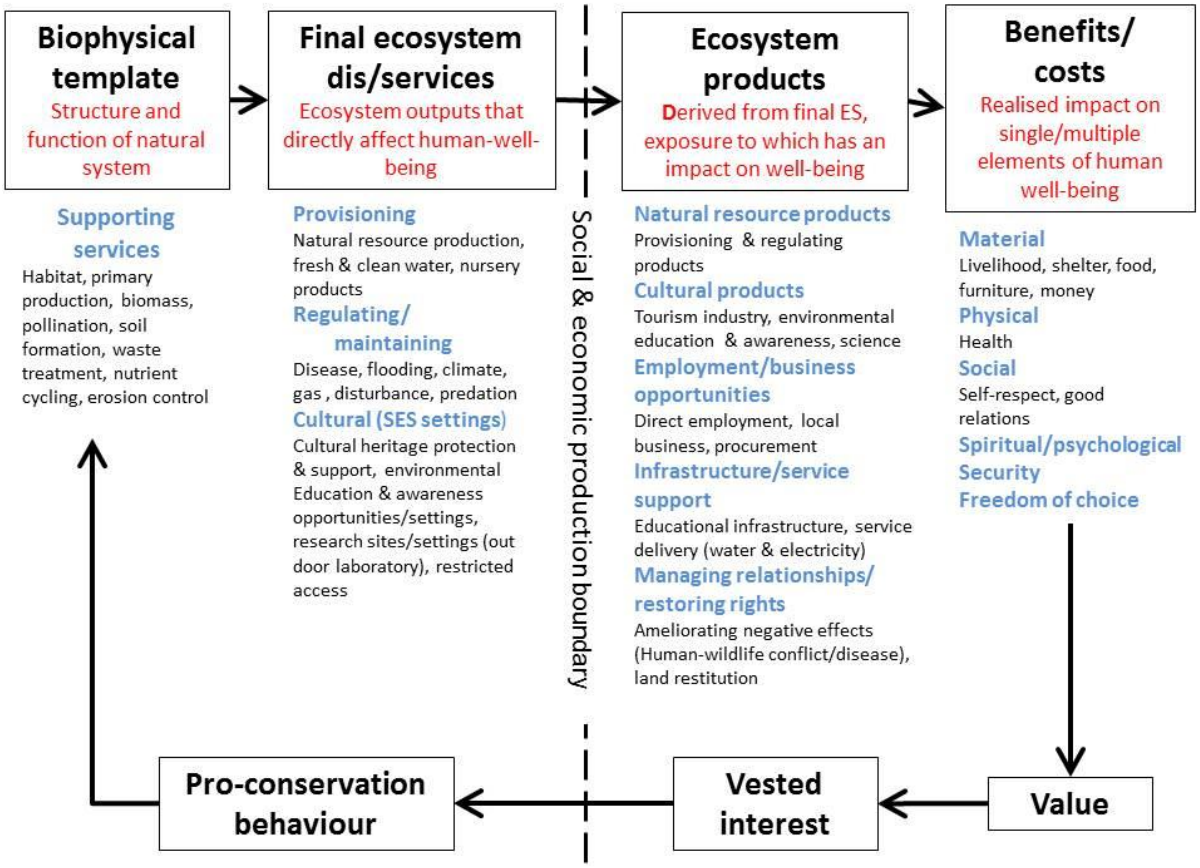

Figure 2.2 Cost/benefit pathway framework demonstrating ecosystem dis/services and ecosystem products that flow from the Kruger National Park biophysical template

2.4.2 A cost/benefit pathway inventory

2.4.2.2 Provisioning services through extractive resource use with local community benefits

Relatively recently, SANParks formalized their efforts to facilitate small scale extractive resource use from parks in the form of the SANParks Resource Use Policy (SANParks 2010). The policy makes allowance for the sustainable use of renewable and non-renewable resources for the purpose of managing biodiversity and sharing socio-economic benefits from harvesting resources within national parks. Several provisioning ecosystem services emanating from within the KNP provide opportunities for such legal sustainable resource harvesting of products (**Table 2.1**).

Table 2.1 Quantitative summary of selected provisioning ecosystem services and products emanating from within the Kruger National Park, South Africa (ZAR = South African Rand; at the time of submission of this article USD $1 = R13.55)

Variable	Context	Data
Mopane worm harvesting	Number of participants (2 seasons)	200
	Number of participating villages (2 seasons)	12
	Volume of worms collected	4300 litres
Thatch harvesting	Number of participants annually	30
	Number of thatch bundles harvested annually	Between 22 792 and 70 747
Medicinal plants	Number of workshops (2010, 2014, 2015)	8
	Number of Traditional Healers engaged directly (2010, 2014, 2015)	160
	Number of villages participating	25
	Approximate number of *Warburgia salutaris* saplings distributed	1000
Tree and plant donations	ZAR value of donations to local schools	R22 250
	ZAR value of donations to community groups	R9 665

2.4.2.2 Provisioning, regulating, maintaining and supporting services and products

Disease regulation by natural systems contributes both societal benefits and costs also occur at the human-wildlife interface. Adjacent to the KNP these costs are mostly to communal livestock farmers in the form of clinical disease impacts as well as associated live animal and meat trade restrictions. Foot and Mouth Disease (FMD) maintained by the African buffalo reduces the economic value of the 70 000 head of cattle that occur within the FMD buffer zone next to KNP (NDA 2016). Buffalo in KNP are also maintenance hosts for bovine tuberculosis (*Mycobacterium bovis)*, a cattle-introduced disease which has spilt back into cattle in the communal lands adjacent to the KNP (Masoke *et al.* 2015). Other potentially hazardous zoonotic diseases include Anaplasmosis (*Anaplasma maginale)*, Corridor Disease *(Theileria parva)* and Heartwater *(Ehrlichia ruminantium).*

Rivers passing through KNP provide water for downstream uses while supporting a resilient aquatic ecosystem both up and downstream that supports resource harvesting (eg fishing) and

small scale crop production. Intact riparian zones in KNP contribute to water quality through assimilation of pollutants and carbon sequestration. KNP also plays an important role in implementing the ecological reserve (ER) in rivers passing through the park, a mandatory requirement under the South African National Water Act (Act 36 of 1998) that ensures the provision of ecosystem goods and services (such as flood regulation) by sustaining a viable amount of water of acceptable quality in the rivers of South Africa. KNP rivers support the tourism experience, an important cultural benefit of the park as well as providing a valuable learning environment for research and policy.

Vegetation in KNP counters increased levels of atmospheric carbon dioxide by building it into plant tissue and releasing oxygen. An average mature tree can absorb carbon dioxide at the rate of 24 kg a year and release 130 kg of oxygen (Nowak *et al.* 2007). This is a considerable contribution considering the 2 million ha of KNP which ranges in woody cover from between 0 and 60% (Buchini *et al.* 2009). Vegetation in and around KNP buffers impacts from nitrogen deposition (from Industry on the South African Highveld) (Scholes *et al.* 2003), playing a critical role in soil formation (Bardgett 2005), soil stabilization and nutrient cycling (Treydte *et al.* 2007; Treydte *et al.* 2009), slowing down erosion and siltation of rivers and dams, sustaining healthy ecosystems through photosynthesis and nutrient uptakes, providing food for the thousands of herbivores in the park, providing food, medicine and a source of income for neighbouring communities and providing a habitat supporting function for fauna and flora including a wide range of vertebrates and invertebrates that serve as pollinators for plants (Costanza *et al.* 2007). Vegetation in KNP contributes cultural services in the form of tourism, culture, science and education, with 15% of the papers on research within and around KNP published between 2003 and 2013, having focussed on vegetation related research (Smit *et al.* this issue).

Fire is one of the key drivers in maintaining savanna landscape integrity in KNP, supporting the maintenance of other ecosystem services including provisioning services such as wood and thatching grass. Fire is a tool for reducing grass biomass inside the park preventing fires from moving into adjacent areas, as well as reducing fire risk to tourism infrastructure. Fire maintains the tree-grass balance in the KNP, reduces bush encroachment and increases forage quality and quantity. In so doing, fire supports both biodiversity and the cultural services associated with the tourism experience of the park.

Invasive Alien Species (IAS) are often widespread, dense monocultures which displace native species and transform landscapes posing a threat to ecosystem services. The KNP boundary acts as a filter to alien plants, and where there is more than 90% natural vegetation within a 5km radius of the park, alien plants are significantly less likely to invade (Foxcroft *et al*. 2011; Jarošík *et al.* 2011). Maintaining KNP clear of IAS at the smaller scale allows for collection of resources from within the park such as thatching grass. Trees that have escaped cultivation and invaded large catchment areas such as that of the Sabie river (23% invaded in 2002) impact on water resources through a loss of surface water run-off reducing river flow (9.4% less in Sabie river as a result of catchment invasions). This impacts on timing and extent of flooding and quality of water purification processes (Le Maitre *et al.* 2002). IAS contribute changes to nutrient cycling and ecosystem dynamics (Ehrenfeld 2011), alter net primary productivity and nitrogen availability (Ehrenfeld 2003). Much needed economic and social benefits are provided through employment aimed at the control of invasive plants in and around KNP and as a critical role player with capacity and power, KNP provides support for IAS decision makers at both local and regional levels.

2.4.2.3 Cultural services and products

The tourism industry

The ecosystem service for which KNP is most famous is the cultural service associated with the tourism experience. Having dramatically increased in numbers since the first 27 recreational visitors who entered KNP in 1927, the park currently receives approximately 1.6 million visitors through its gates annually. This is due to in part the diversity of tourism experiences offered through both accommodation and activities in the KNP (**Table 2.2**). As an additional cultural service, KNP provides support for Traditional Leadership in the form of both free (including 4 family or council members) and facilitated access into the park, as well as in the form of monetary (Approximately R40 000 per year) and in some cases natural resource (wood/meat) donations for traditional events (*Ummemo*).

Table 2.2 Quantitative summary of the scale and scope of selected cultural services from the Kruger National Park, South Africa from April 2014 to March 2015 (Source SANParks)

Variable	Context	Data
Tourist visitor numbers (2014/2015)	Annual visitors	1.6 million
	Visitor composition by nationality: South African; SADC residents; International	77%; 2%; 21%
Activities (2014/2015)	Total visitors doing activities	160 314
	Proportion of visitors on game drives	87%
	Proportion of visitors on bush walks	11.3%
	Proportion of visitors on bush braai's	1.3%
	Proportion of visitors on bush cycles	0.3%

2.4.2.4 Capacity building through environmental education/outreach and research

A variety of environmental education projects and programmes aim to build capacity in and awareness of environmental related concepts in and around the KNP. Each programme has unique objectives, and is designed to achieve these through exposure to learning materials, engagement processes, and the natural environment. Often the length of the engagement is inversely correlated to the number of participants with more learners being accommodated in the shorter, intensive day programme visits (**Figure 2.3**) (**Table 2.3**). In addition to environmental education, KNP contributes to staff capacity through providing accredited courses for in-service training, providing bursaries for tertiary education as well as acting as an outdoor laboratory for science learning both within SANParks and through research collaborations.

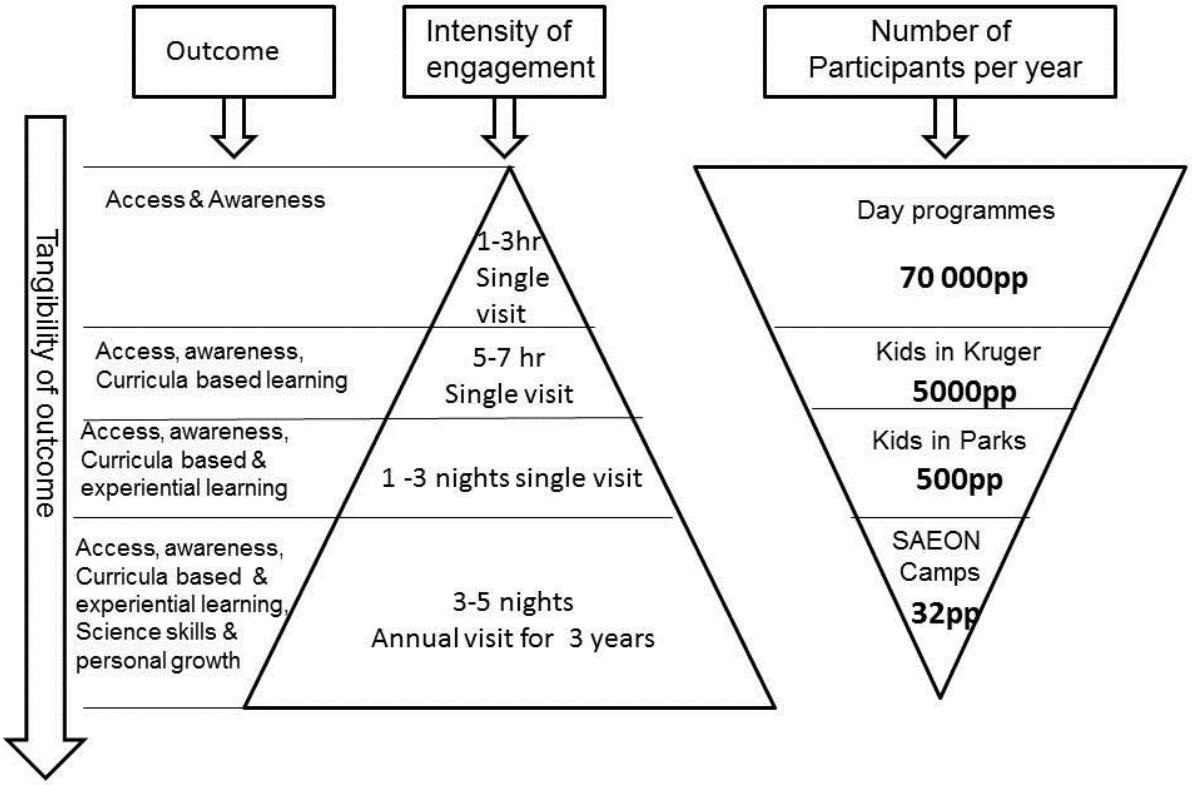

Figure 2.3 The scale and scope of four of the main Environmental Education programmes implemented in the Kruger National Park

Table 2.3 Quantitative summary of outputs from the main capacity building and awareness projects and programmes that are implemented at the Kruger National Park, South Africa

Variable	Context	Data
Park based environmental education programme	White EE participants (approximate figure for pre-1994)	95%
	Black EE participants (2015)	90%
	Annual number of EE participants	Between 55 000 and 80 000
	Participants in 1-3 hour day programmes	Average 70 000 pa
	Participants in 5-7 hour day programmes	Average 5000 pa
	Number of participants in overnight programmes	Average 500 pa
Tertiary education bursaries	Annual expenditure	Average R225 000 for 31 staff
Accredited courses for in-service training	Annual expenditure	Average R1.35 million for 510 staff
Science/research capacity	Number of peer reviewed papers published between 2003 and 2013	545
	Number of delegates attending annual research conference	Average 180

4.2.5 Employment and business opportunities

Over 4500 staff members are employed by SANParks, the Expanded Public Works Programme and the private concessionaires operating within KNP (**Table 2.4**). National, provincial and private conservation areas that abut KNP employ an additional 7880 staff. Most employees are from the villages and towns adjacent to KNP. Apart from direct employment, many privately owned businesses benefit through SANParks' Black Economic Employment (BEE) procurement processes, a specific focus of which is on small, medium and micro-sized enterprises (SMME's): local entrepreneurs who supply (but are not limited to) the procurement and delivery needs of the park.

Table 2.4 Summary of the main employment and business related opportunities that are accrued from the Kruger National Park, South Africa

Variable	Context	Data
Number of staff	SANParks staff (2015)	2243
	Expanded Public Works (BSP)	1011
	Concessionaires in KNP	1277
	Adjacent private, provincial, public or community conservation areas	7880
Race composition of staff	Coloured, Indian, White, Black	0.5%; 0.1%; 4.1%; 95.2%
Home towns of staff	Immediately next to the KNP	90%
Human resource costs	% total operational costs	60%
Black Economic Empowerment (BEE)	Contribution to total operational expenditure (2014)	90% R312 832 040
Small, medium and micro-sized enterprises (SMME's)	Event services (28 companies)	R255 455
	Community game drives (4 owners, 4 vehicles)	R192 952
	Car washes: Skukuza, Satara and Letaba Camps.	R237 688
	Arts and Craft Outlets: Crocodile Bridge, Numbi, Paul Kruger, Orpen and Phalaborwa (15 staff, supporting +- 400 crafters).	R3 190 174
	Building contractor development	36 contractors trained, 360 staff employed
	Total spend on SMME's for KNP Infrastructure	R 628.29
	Average total & monthly lodge concession expenditure on SMME's between 2011 and 2015	R14 million; R340 988

2.4.2.6 Infrastructure and service delivery

Although infrastructure and service delivery is not the primary mandate of conservation, this type of support has become a mandatory part of the public/private land lease agreements for private game reserves in some countries (e.g. Mozambique). Several projects funded through a 1% community levy collected from KNP tourist entrance fees since 2012, aim to contribute educational infrastructure to local schools (**Table 2.5**).

Table 2.5 Scale and scope of projects contributing infrastructure to local schools bordering the Kruger National Park, South Africa between 2013 and 2016 ($1 = R13.47)

Variable	Expenditure (Rand) and scale
School Science Laboratories	R5 515 554; 8 schools
School administration facilities	R2 000 000; 1 school
School Computer laboratories	R1 000 000; 1 school
School kitchen facility	R550 000; 1 school
School play equipment	R97 000; 1 school

2.4.2.7 Managing relationships and restoring rights

Seven community forums and one park forum (established in 1996 and 2004 respectively) provide platforms for communication between the park and its neighbours on issues of mutual interest including business and job opportunities and human wildlife conflict. The community forums represent 36 Traditional Councils from over 240 villages neighbouring KNP, 3 district and 7 local municipalities, local government, several hundred schools, churches and local businesses. The forums are governed by their own constitutions and a democratically elected committee (**Table 2.6**). Communicating with the public is also done through social media, road shows and open days. Additional programmes offer free or facilitated access to Kruger for environmental education, traditional councils, family and friends of staff members as well as for spiritual or cultural visits. SANParks week, celebrated for one week a year promotes free access to parks and focusses on celebrating their value to society. The "half-entry" permit enables local communities (who are active members of community forums) to come into the park at half the normal rates for South Africans. Although not yet currently in operation, a community wildcard is being investigated which will allow for local communities to pay a reduced rate for a wildcard that will enable unlimited entries to the park on an annual or lifetime basis. SANParks is partnering with the

Department of Rural Development and Land Reform in restoring access and ownership rights for communities bordering KNP. Donations of game to community owned reserves are increasing in support of community conservation, social and economic development and relationship building. Large efforts are being made to ameliorate negative impacts of conservation on local people including compensation for human-wildlife conflict and facilitating processes that reduce the impact of zoonotic diseases on human wellbeing.

Table 2.6 Quantitative summary of selective, illustrative data pertaining to the managing of relationships and the restoring of rights to neighbours of the Kruger National Park, South Africa

Variable	Context	Data
Community forum meetings	Frequency of meetings	2 monthly
	Average number of attendees per meeting	10 to 200
	Most well attended meeting	Hlanganani Forum - 200 meetings held since 1996
Free and facilitated access	SANParks week visitors since 2006	105 654
	Accompanying people allowed on a half-entry permit	14
	Number of half-entry permits issued in 2014	181
Land restitution - Makuleke	Number of concessionaires in Makuleke	3
	Number of Makuleke staff employed by concessionaires	81
Land restitution - Mdluli and Nkambeni	Number of Mdluli staff employed by concessionaires	10
	Number of concessionaires in Nkambeni	1
	Number of Nkambeni and Mdluli staff employed by Concessionaire	186
	Proportion of staff who are from Nkambeni and Mdluli communities	88%
	Additional support given to Nkambeni and Mdluli communities form concessionaire	Various SMME's, school support, sponsors for sports events, service delivery (boreholes)
Land restitution - General	Unsettled land claims inside the KNP	16
	Portion of land covered by unsettled land claims in KNP	25%
	Revenue paid to successful land claimants (per household) as part of the first phase of land restitution	R110 000

Support for Contractual Parks and Community owned game reserves	Permanent and temporary staff employed at Mjejane Private Reserve	146; 350
	Staff employed at Mthimkhulu Community Reserve	5
	Permanent and temporary staff at Mthethomusha Game Reserve	100; 30
	Proportion of local staff at Mthethomusha	95%
Game donations	Mashishimale Game Reserve	40 zebra; 2 elephant
	Mdluli Traditional Authority	5 rhino
Amelioration of negative impacts - Human wildlife conflict	Successful livestock loss claimants	155
	Verified livestock loss cases	184
	Amount paid to successful claimants for wildlife related livestock losses	R1 452 258

2.4.3 Who is benefitting and how?

There are vastly more beneficiaries receiving intangible benefits (tourism and environmental education) from the park compared to tangible, direct livelihood related benefits (employment, provisioning services) (**Table 2.7**). In many cases, it's the people living next to parks who incur most of the tangible costs (**Figure 2.4**).

Table 2.7 Relative numbers of beneficiaries per benefit category in an average year in the Kruger National Park (South African – not local includes South Africans from provinces not abutting the KNP; South African – local includes South Africans from the two provinces that abut KNP namely Limpopo and Mpumalanga Provinces)

		Approximate percentage per beneficiary category		
Beneficiary group	**Percentage of total**	**International**	**South African - not local**	**South African - local**
Tourists	94.6	24	26	50
Environmental Education	4.6	5	10	85
Employment	0.8	1.3	12.3	86.3
Natural Resource Use	0.06	0	0	100

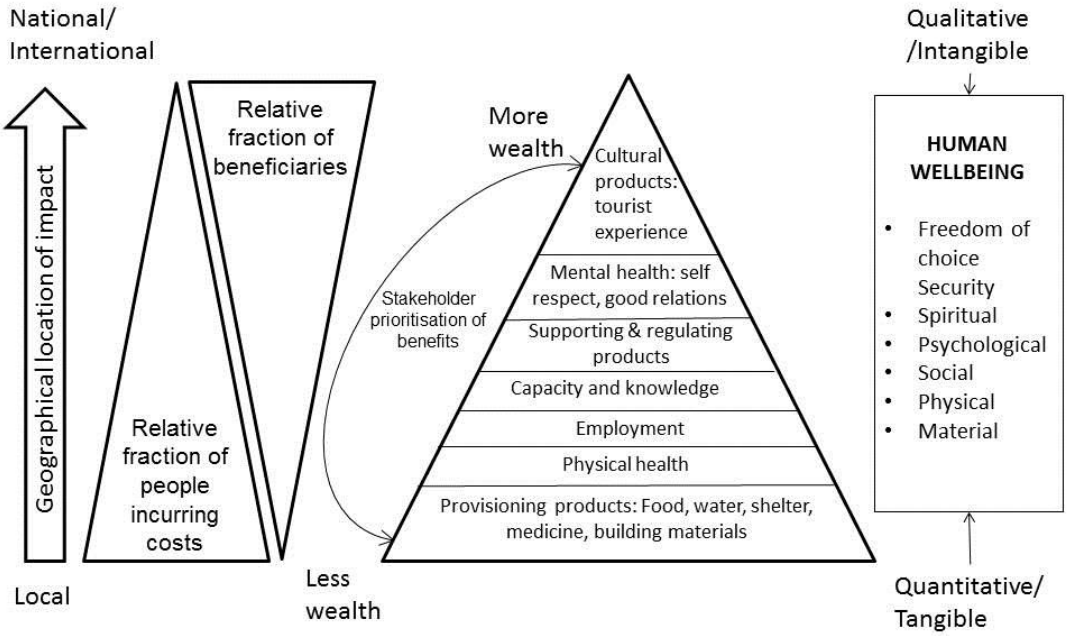

Figure 2.4 Benefits from conservation ranked according to basic human needs (adapted from Maslow 1943 and Freitag-Ronaldson & Grant unpubl.)

2.5 DISCUSSION

Acknowledging the gaps in current models that evaluate or account for benefits from nature, our study aimed to develop a framework to classify the pathway of benefit and cost production, to conduct a cost/benefit inventory and subsequently to use this to reflect on protected area benefit sharing approaches and processes. Millions of local, regional and international people benefit directly and indirectly from the social and ecological system in and around KNP. In many cases, the potential for these benefits is amplified through partnerships within the bioregional landscape. Our framework highlights that benefits can accrue at local, regional, national or global scales and that benefits from protected areas should be assessed in conjunction with costs. Our framework highlights additional new ecosystem production themes that should be included in protected area cost/benefit inventories over and above existing ecosystem service classifications (MEA 2004; Haines-Young & Potschin 2012), such as employment and business opportunities, capacity building

and awareness, and infrastructure support. Our framework highlights the need to include processes associated with managing relationships and restoring rights to people where required, in order to legitimise the sharing of benefits. Our research builds on the cascade ecosystem service model (Hains-Young & Potschin 2012) but proposes two main additions: firstly, that both services and products are included in both a positive and negative context, and secondly that cultural services are the experiential setting (sense of place) within the landscape where cultural products (tourism experience) are derived – hence we define science and environmental education as products from cultural services. It is important to acknowledge that our data cover mostly ecosystem product outputs, and that it is through the distribution of these products that real benefits (and costs) accrue in terms of their positive or negative impacts on human wellbeing. Equally important is that it is through the specific impact of these services on human wellbeing, where value/conservation constituency is built possibly leading towards pro-conservation behaviour. This is acknowledging that an understanding of perceptions towards conservation and the social context driving these is crucial to the success of benefit sharing projects or programmes (Guerbois *et al.* 2023; Bragagnolo *et al.* 2016). The comparisons of numbers of types of beneficiaries clearly demonstrates a current and historical bias towards cultural service categories (mostly intangible benefits associated with tourism and environmental education) a legacy of the protectionist approach to conservation and a mis-match between the scale of beneficiaries versus the socio-cultural preferences of local neighbours (Martin-Lopez *et al.* 2012; Brockington 2002). It is suggested that people will only value intangible benefits from nature once their basic human needs have been met (Maslow 1943). The needs of KNP stakeholders cover the full spectrum of categories identified in our framework, however the bulk of benefits accrued from KNP directly address cultural products and services. Yet for many neighbours living adjacent to the park, incurring tangible conservation related costs such as those associated with human-wildlife conflict is a reality while meeting basic human needs (food, water, shelter) remains a daily challenge.

Several limitations of our framework are worth mentioning: Firstly, although it was developed to enable an inventory of ecosystem services, products, costs and benefits regardless of stakeholder group, it was not developed to accommodate ranking or prioritization of benefits by different stakeholder groups. The value that people place on benefit types is determined by their own personal context – their history, social and economic situation, their culture, their personal preference, world views and experiences. In some

cases, people value tangible natural products that have a direct, positive impact on their basic livelihoods such as food, shelter, water, fuel wood and medicine. Some people value intrinsic, intangible elements of nature such as views, landscapes and sense of place (Barendse *et al.* in press). A subsequent step towards more legitimate benefit sharing would be to understand how the benefit processes identified in our framework are perceived (who perceives what to be of benefit to them) and in so doing to highlight opportunities for improved benefit sharing distribution and accrual as well as opportunities for education and outreach (Kettunen & ten Brink 2013). Secondly, although our framework acknowledges a significant secondary (as opposed to primary) level of impact exists as a result of downstream products and services at various levels from local to global outside of the KNP (Saayman & Saayman 2006), a more detailed study is needed to accurately inventorise this impact both in social and economic terms. Thirdly, our inventory focused on quantitative data for the various ecosystem processes (outputs). However, the desired outcomes of most benefit sharing programmes have both qualitative and quantitative components contributing collectively to human wellbeing. Deeper layers of analysis that include qualitative outcomes are needed for the identification and management of cost/benefit tradeoffs, important for any protected area that aims to understand the degree to which their benefit sharing programme is or is not contributing positively to human wellbeing. Fourthly, the links between positive impact on wellbeing and support for conservation/value requires further understanding if protected areas are to understand the links between benefit sharing and conservation outcomes. Finally, quantitative data for many of the ecosystem services from KNP do not exist, resulting in an under-accounting of the contribution that these make to societal wellbeing at various scales (local to global). In reality, the large numbers of people living adjacent to parks such as KNP remains a bottleneck in achieving greater conservation related benefit sharing while maintaining ecological integrity and in many cases the lack of benefits continues to result in most people feeling neutral and some feeling negative towards conservation.

2.6 CONCLUSION

We have built on the global ecosystem services discourse by developing a framework for conducting an inventory of projects, programmes and initiatives arising from the biophysical template within protected areas and impacting on human wellbeing. Our framework moves beyond conventional models by including ecosystem costs to society, because we acknowledge that it is the ratio between costs and benefits within and across scales that

ultimately determines impact. We demonstrated the diverse scale and scope of benefits and costs currently accruing from the park and in so doing, highlighted the need for a stronger focus on benefits that address tangible, basic human needs. We also highlight that in many cases, the actual benefits or costs are not measured, but rather inappropriate indicators (numbers of participants) are used as proxies. This in no way enables protected areas to measure the impact of their benefit sharing programmes on human wellbeing, and there is still a need for research that will contribute towards enabling protected areas to assess and reflect on the impact that their benefit sharing programs have on building support for conservation. However, we believe that this framework presents a positive step towards understanding protected area impact and in so doing contribute to more fair and equitable benefit sharing with positive conservation outcomes by (1) supporting more effective reporting on the societal contributions of protected areas, important for social legitimacy and (2) enabling protected areas to reflect on equity and fairness in terms of the relative numbers of beneficiaries accruing benefits of various scales and scopes.

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2.9 APPENDIX

Appendix 2.9.1 Front page of published paper from Chapter 2 - Swemmer, L.K., H.A. Mmethi and W. Twine. 2017. Tracing the cost/benefit pathway of protected areas: A case study of the Kruger National Park, South Africa. *Ecosystem Services* 28: 162-172.

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Tracing the cost/benefit pathway of protected areas: A case study of the Kruger National Park, South Africa

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ABSTRACT

The sustainability of protected areas is dependent on societal support. Protected area relevance (meaning and value) to society is based on vested interest grown through conservation related benefit accrual that outweighs costs. Protected areas generally don't report on their total societal impact in part due to a lack of an appropriate framework that accounts simultaneously for positive and negative, tangible and intangible components. We develop a framework and pathway that (1) includes ecosystem dis-services provided by protected areas, and (2) provides a tool for protected area managers to report on benefit sharing as a whole towards managing cost-benefit trade-offs. Ecosystem services and products from Kruger National Park were classified into themes, followed by a quantitative inventory of cost/benefit processes for the KNP. We demonstrate the skewed nature of costs versus benefits, with most beneficiaries living far from the park. Most local residents receive few benefits and are often recipients of costs. The framework highlights the need to understand the impact of benefit sharing on human well-being; the lack of an understanding of the outputs and outcomes from direct ecosystem service flows from parks; and the need for an understanding of the links between benefit accrual and conservation-related outcomes.

Appendix 2.9.2 Classification of projects according to theme and cost/benefit framework category, from a benefit sharing audit done for the Kruger National Park, South Africa

Project/programme/initiative	Objectives/Outcomes	Theme	Framework category
Kids in Parks	Learning, knowledge, constituency and relationships	Environmental education, awareness and outreach	Ecosystem product
Kids in Kruger	Learning, knowledge, constituency and relationships	Environmental education, awareness and outreach	Ecosystem product
Walk and learn on the wildside	Learning, knowledge, constituency and relationships	Environmental education, awareness and outreach	Ecosystem product
Junior honorary rangers	Learning, knowledge, constituency and relationships	Environmental education, awareness and outreach	Ecosystem product
Environmental Education Day programmes	Learning, knowledge, constituency and relationships	Environmental education, awareness and outreach	Ecosystem product
Take Kruger to Kassie	Constituency and relationships	Environmental education, awareness and outreach	Ecosystem product
School outreach	Constituency and relationships	Environmental education, awareness and outreach	Ecosystem product
World wildlife day	Calendar days and issue based campaigns	Environmental education, awareness and outreach	Ecosystem product
World environment day	Calendar days and issue based campaigns	Environmental education, awareness and outreach	Ecosystem product
Keep Kruger Clean Campaign	Calendar days and issue based campaigns	Environmental education, awareness and outreach	Ecosystem product
Arbor week	Calendar days and issue based campaigns	Environmental education, awareness and outreach	Ecosystem product
SANParks week	Calendar days and issue based campaigns	Environmental education, awareness and outreach	Ecosystem product
Pensioners day	Calendar days and issue based campaigns	Environmental education, awareness and outreach	Ecosystem product
Hospital visits	Calendar days and issue based campaigns	Environmental education, awareness and outreach	Ecosystem product
Library week	Calendar days and issue based campaigns	Environmental education, awareness and outreach	Ecosystem product
Churches against rhino poaching	Rhino poaching, Calendar days and issue based campaigns	Environmental education, awareness and outreach	Ecosystem product
Hosting of unemployed youth	Rhino poaching, Calendar days and issue based campaigns	Environmental education, awareness and outreach	Ecosystem product
Hosting of political parties and union members	Rhino poaching, Calendar days and issue based campaigns	Environmental education, awareness and outreach	Ecosystem product

Bongi's quest educational booklet	Rhino poaching, Calendar days and issue based campaigns	Environmental education, awareness and outreach	Ecosystem product
Mozambique community visits	Rhino poaching, Calendar days and issue based campaigns	Environmental education, awareness and outreach	Ecosystem product
Presidential visit to KNP	Rhino poaching, Calendar days and issue based campaigns	Environmental education, awareness and outreach	Ecosystem product
Prince Harry's visit to KNP	Rhino poaching, Calendar days and issue based campaigns	Environmental education, awareness and outreach	Ecosystem product
Training	Capacity and knowledge, constituency	Environmental education, awareness and outreach	Ecosystem product
Research - knowledge generation	Science learning, knowledge, capacity	Environmental education, awareness and outreach	Ecosystem product
Research - capacity support	Science learning, knowledge, capacity	Environmental education, awareness and outreach	Ecosystem product
Organisation for Tropical Studies (OTS)	Science learning, knowledge, capacity	Environmental education, awareness and outreach	Ecosystem product
South African Environmental Observatory Network (SAEON)	Science learning, knowledge, capacity	Environmental education, awareness and outreach	Ecosystem product
Bursary support	Staff morale, capacity building	Environmental education, awareness and outreach	Ecosystem product
KNP annual sports day	Staff morale, capacity building	Environmental education, awareness and outreach	Ecosystem product
Staff infrastructure development	Staff morale, capacity building	Infrastructure & services	Ecosystem product
Donation of mobile classroom	Staff morale, capacity building	Infrastructure & services	Ecosystem product
Performance awards	Staff morale, capacity building	Capacity building	Ecosystem product
Health and wellness	Staff morale, capacity building	Capacity building	Ecosystem product
Landscapes	Tourism experience, wellbeing	Cultural service	Final ecosystem service
Tourism experience	Aesthetic and psychological	Cultural product	Ecosystem product
Tourism activities: drives, walks, cycles	Aesthetic and psychological	Cultural product	Ecosystem product
Tourism infrastructure: camps, shops	Aesthetic and psychological, tourism experience	Cultural product	Ecosystem product
Cultural heritage protection and access	Constituency and relationships, conservation	Cultural product	Ecosystem product
Cultural tourism	Psychological, livelihoods	Cultural product	Ecosystem product

Cultural celebration support	Constituency, rights and relationships, cultural	Cultural product	Ecosystem product
Direct employment	Livelihoods and wellbeing, constituency	Employment & business	Ecosystem product
Expanded public works	Livelihoods and wellbeing, constituency	Employment & business	Ecosystem product
Concessionaires and private reserve employment	Livelihoods and wellbeing, constituency	Employment & business	Ecosystem product
Small, medium and micro-enterprises for KNP events	Livelihoods and wellbeing, constituency	Employment & business	Ecosystem product
Contractor development programme	Livelihoods and wellbeing, constituency	Employment & business	Ecosystem product
Kruger Park and Ride	Livelihoods and wellbeing, constituency	Employment & business	Ecosystem product
Arts and crafts outlets	Livelihoods and wellbeing, constituency	Employment & business	Ecosystem product
Community kiosks	Livelihoods and wellbeing, constituency	Employment & business	Ecosystem product
Concessionaire SMME support	Livelihoods and wellbeing, constituency	Employment & business	Ecosystem product
SMME development through the Jobs Fund	Livelihoods and wellbeing, constituency	Employment & business	Ecosystem product
Procurement - local	Livelihoods and wellbeing, constituency	Employment & business	Ecosystem product
Downstream economic impact	Livelihoods and wellbeing, constituency	Employment & business	Ecosystem product
Science Laboratories	Educational infrastructure, capacity building, constituency, wellbeing	Infrastructure & services	Ecosystem product
Pre-primary play equipment	Educational infrastructure, capacity building, constituency, wellbeing	Infrastructure & services	Ecosystem product
Nutritional kitchens	Educational infrastructure, capacity building, constituency, wellbeing	Infrastructure & services	Ecosystem product
School administration blocks	Educational infrastructure, capacity building, constituency, wellbeing	Infrastructure & services	Ecosystem product
School computer laboratories	Educational infrastructure, capacity building, constituency, wellbeing	Infrastructure & services	Ecosystem product
Black Economic Empowerment	Building relationships, local empowerment, local business development, livelihoods	Managing relationships	Ecosystem product
Small, medium and micro-enterprise development	Building relationships, local empowerment, local business development, livelihoods	Managing relationships	Ecosystem product
Land restitution	Relationships, constituency, sustainability	Managing relationships	Ecosystem product

Game donations	Relationships, constituency, sustainability	Managing relationships	Ecosystem product
Human-wildlife conflict management and compensation	Relationships, constituency, sustainability, livelihoods	Managing relationships	Ecosystem product
Benefits from communal land incorporation	Relationships, constituency, sustainability	Managing relationships	Ecosystem product
Natural products	Livelihoods, relationships	Provisioning service	Final ecosystem service
Mopane worm harvesting	Livelihoods, relationships	Provisioning product	Ecosystem product
Thatch harvesting	Livelihoods, relationships	Provisioning product	Ecosystem product
Medicinal plant harvesting and distribution	Livelihoods, relationships	Provisioning product	Ecosystem product
Tree and plant donations	Livelihoods, relationships, greening	Provisioning product	Ecosystem product
Fresh and clean water	Wellbeing at various scales	Provisioning product	Ecosystem product
BSP Nursery support	Constituency, wellbeing, livelihoods	Provisioning product	Ecosystem product
Disease regulation	Wellbeing at various scales	Regulating service	Final Ecosystem service
Flood regulation	Wellbeing at various scales	Regulating service	Final Ecosystem service
Climate control	Wellbeing at various scales	Regulating service	Final Ecosystem service
Gas regulation	Wellbeing at various scales	Regulating service	Final Ecosystem service
Free and facilitated access	Relationships, constituency	Managing relationships	Ecosystem product
Half entry permits	Relationships, constituency	Managing relationships	Ecosystem product
Traditional Authority permits	Relationships, constituency	Managing relationships	Ecosystem product
Park and community forums	Relationships, constituency	Managing relationships	Ecosystem product
Habitats for plants and animals	Wellbeing at various scales	Supporting service	Supporting service
Primary production	Wellbeing at various scales	Supporting service	Supporting service
Pollination	Wellbeing at various scales	Supporting service	Supporting service

Soil formation	Wellbeing at various scales	Supporting service	Supporting service
Waste treatment	Wellbeing at various scales	Supporting service	Supporting service
Nutrient cycling	Wellbeing at various scales	Supporting service	Supporting service
Erosion control	Wellbeing at various scales	Supporting service	Supporting service

CHAPTER 3

It's not just about the worm – the social and economic impact of harvesting *Imbrasia belina* larvae from the Kruger National Park, South Africa

3.1 ABSTRACT

A Mopane worm (*Imbrasia belina*) harvesting project in the Kruger National Park (KNP) was used as a case study to test whether conservation-related benefit sharing has a net positive impact on multiple dimensions of human wellbeing. Furthermore, the study assessed whether and to what degree, sharing such benefits influenced local perceptions of conservation, a requirement for the sustainability of protected areas across the globe. The project involved 263 people from 16 villages, adjacent to the KNP, harvesting 4,688 L worms contributing the equivalent of over half of the average household income during the months of harvest. Despite paying for transport, the participants gained from the experience; instilling the feeling that the park is opening up to them, and as a result seeing the park differently. For most participants the project provided them their first opportunity to visit the park, and participants perceived this to have further contributed positively to their wellbeing as a result of the associated learning experiences. Furthermore, participants enjoyed meeting and getting to know the park staff, with these new social connections contributing positively to social wellbeing. Respondents perceived their relationship with the park to be positive and expressed hope for building on this in the future. We conclude that measuring multiple dimensions of human wellbeing in impact assessments is beneficial, and that the social capital built through social connectedness between neighbours and protected area staff can have mutually beneficial outcomes both for people and conservation.

Citation

Swemmer. L.K., R. Landela, P. Mdungasi, S. Midzi, W. Mmatho, H. Mmethi, D. Shibambu, A. Symonds, S. Themba and W. Twine. In Press (due to published in March 2020). It's not just about the worm: social and economic impact of harvesting *Imbrasia belina* larvae (Kruger National Park, South Africa), *Conservation and Society*.

Author contributions

- Swemmer – 75% (designed, led and conducted the research, wrote the manuscript);
- Landela – 2.5% (implemented the harvesting, operational report);
- Mdungasi – 2.5% (community liaison, collected impact data)
- Midzi – 2.5% (implemented the harvesting, operational report);
- Mmatho – 2.5% (community liaison)
- Mmethi – 2.5% (coordination and initiation of project)
- Shibambu – 2.5% (community liaison, collected impact data)
- Symonds – 2.5 (legislation and governance support for operations)
- Themba – 2.5% (community liaison)
- Twine – 5% (supervisor, conceptual inputs to research design, reviewed the manuscript).

3.2. INTRODUCTION

Changing conservation mandates over the past three decades have seen many protected areas attempting to move away from colonial, elitist, and protectionist approaches that characterise many of their histories, towards a paradigm that embraces just and fair benefit sharing processes and approaches with a particular emphasis on rural neighbours (Pimbert and Pretty 1997; Brockington 2002; Brockington 2004; Hunt 2014; Boillat *et al.* 2018). As a result, many projects are implemented in and around conservation areas aiming to restore rights, share benefits, build relevance and support for conservation among the people living inside or adjacent to parks (Pimbert and Pretty 1997; Child 2004; Fabricius and Koch 2004). However, despite the wide scale implementation of such schemes, very little evidence exists of the real impact of such benefit sharing on participants and the subsequent impact on how participants view and experience conservation (Swemmer *et al.* 2017). Our study aims to explore these gaps in the literature by using a case study from South Africa involving benefit sharing through extractive resource use from within a protected area.

Recent increases in the poaching of threatened species (Ferreira *et al.* 2014) have led to local benefit sharing being further emphasised as a mechanism for promoting alternatives to and reducing the negative impacts of wildlife crime on people and wildlife (Biggs *et al.* 2016; Lunstrum 2014). In South Africa, 67% of the protected areas under state management are

managed by South African National Parks (SANParks), the primary mandate of which is the conservation of biodiversity for the benefit of the nation (SANParks 2017). Although fair and just benefit sharing in SANParks is a key priority (Swemmer *et al.* 2017); historically, benefits have mostly accrued to visiting tourists in some parks (representative of specific demographic groups) (Biggs *et al.* 2014) with previously marginalised ethnic groups often excluded from accessing resources and being part of decision making processes about resources within parks. Ironically, these groups are most often those that bear the bulk of the costs of living adjacent to parks (Swemmer *et al.* 2015). Some parks have a history of forced resettlements, where original residents were moved out of areas designated for conservation due to a perceived conflict between people and conservation objectives, at the time (Carruthers 1995).

Restricted access policies in South Africa further excluded the majority of South Africans from visiting parks until the advent of democracy in South Africa in 1994 which sparked an increased emphasis on sharing benefits from SANParks more fairly (Swemmer and Taljaard 2011). This included the promotion of access to new opportunities and resources within parks as well as a land restitution process that involves restoring rights to people to access and benefit from their land. This aimed to contribute towards conservation sustainability by enhancing relevance to broader society both by more fair benefit distribution and accrual mechanisms, as well as more inclusive governance processes leading to the sharing of benefits, in the context of environmental justice (Hunt 2014). In many cases, outcomes of such processes are assumed but not measured, with impact assessments focusing on quantitative outputs of benefit sharing such as number of jobs/number of participants or income generated (Swemmer and Taljaard 2011). Seldom are the multiple dimensions (both tangible and intangible) of human wellbeing included in such impact assessments and as such the *real or felt* impact remains elusive as does the subsequent impact of benefit distribution on conservation related attitudes and behaviour (Swemmer *et al.* 2015, Swemmer *et al.* 2017). Furthermore, unintended negative consequences of parks on people and of individual projects, remain undetected or are ignored despite an acknowledgement of their importance, making cost-benefit trade-offs in the context of human wellbeing and biodiversity, difficult to assess (Botha *et al.* 2007; Swemmer *et al.* 2015). The subjective and multidimensional nature of human wellbeing, defined for the context of this study as a state of mind and body that encompasses happiness, harmony, and peace of mind further adds to the complexity of such assessments (Narayan *et al.* 2000).

A recent framework attempts to highlight the importance of these research gaps, demonstrating that the impact of benefit sharing should be interpreted in the context of multiple dimensions of human wellbeing (Swemmer *et al.* 2017). The framework further suggests that net impact on wellbeing will drive pro-or anti-conservation related attitudes and behaviour through the building of vested interest in the conservation estate, a requirement for protected area sustainability (Swemmer *et al.* 2017). The framework acknowledges several untested assumptions; firstly, that benefit accrual from conservation related action leads to a net positive impact on human wellbeing, and secondly that benefit distribution from conservation related action leads to positive conservation-related outcomes. The purpose of this research was to use the harvesting of a popular edible insect— the larvae of the emperor moth (*Imbrasia belina*), commonly referred to as *Mopane worms*— from within the KNP to assess whether facilitating access to direct benefits arising from the flow of ecosystem services within a conservation area has a net-positive, measurable impact on the multiple dimensions of (qualitative and quantitative) human wellbeing. Secondly, to explore whether and to what degree participation in this project had any impact on the conservation estate, specifically in the context of participant perceptions of and relationship with the KNP, under the additional assumption that positive perceptions will lead to pro-conservation attitudes and behaviour (Swemmer *et al.* 2017). Although the focus was on the participants, we also noted the impact of the project on the perceptions of broader, non-participating stakeholder groups due to the mandate of protected areas to be of value to broader society. We believe that insights from this study will contribute to the robustness of benefit sharing frameworks currently used and as such could lead towards more effective benefit sharing approaches and processes used by conservation agencies globally.

Resource use within protected areas remains an on-going controversial topic all over the world based on the varying ways in which people's value systems and world views influence how they perceive the associated rights, risks, and opportunities thereof (Chester 1996; Nie 2003). In the South African context, both international agreements (Dudley 2008; CBD 2011), local policies and legislation (SA constitution 1996; NEMPAA 2003) provided a framework upon which enabling policies and procedures within SANParks were developed that make allowance for and promote the *sustainable* use of natural resources within and adjacent to parks (SANParks 2018; Scheepers *et al.* 2011; Swemmer *et al.* 2015, Vermeulen *et al.* 2019). Within the context of the SANParks policy (SANParks 2018), sustainable resource use is defined as "resource use that maintains the integrity of the ecosystem, is

economically viable and is socially just and acceptable". In SANParks, sustainable resource use is used as a conservation tool for the purposes of managing biodiversity, for sharing social and economic benefits, building relationships and promoting and diversifying just and fair opportunities to access parks in the context of environmental justice (SANParks 2018). Although natural resources have been and continue to be harvested from parks both illegally and legally (Van Wilgen and Herbst 2017), historically, legal resource harvesting was mostly implemented in accordance with specifications in park management plans (SANParks 2019) and/or codes of conduct (SANParks 2015). However, the supporting institutional policy mentioned above facilitated the formalising of existing resource use initiatives, as well as encouraged the exploration of new opportunities for resource use from parks specifically for broadening the beneficiary base. In 2010, Mopane worm harvesting from within the Kruger National Park (KNP) was identified as a new potential initiative. Mopane worms are a widely used source of protein in both rural and urban areas in southern and South Africa, both as a food supplement (providing limited seasonal food security) and as a source of cash income (Greyling and Potgieter 2004). Although popular, Mopane worms can be expensive to buy and are not always available due to seasonality of outbreaks, sensitivity to climate conditions, habitat suitability and loss, and overharvesting. A pilot harvesting project was implemented in 2010, providing an opportunity for local residents living adjacent to the park to access benefits inside the KNP while also aiming to positively influence how local neighbours perceived the park (SANParks 2011). Prior to this, Mopane worms had been harvested within the park by staff members only, normally under the restriction of 2 litres (L) of worms per person per day (SANParks 2015).

3.3 STUDY AREA

The KNP is situated in the Lowveld of South Africa, spanning the two provinces of Mpumalanga and Limpopo (**Figure 3.1**). Although having earlier predecessors, the park was officially proclaimed in 1926, from which time it has been perceived in a dual light (Carruthers 1995). On the one hand, the KNP is seen globally as a powerful symbol of conservation success; on the other hand, it is also perceived to be a symbol of segregation, inequality, and injustice to many living in close proximity to the park (Carruthers 1995). The history of forced resettlement of people beyond park borders from the interior of the park in the early years, as well as restricted access policies that only allowed entrance and use of facilities by certain sectors of society, fuelled a perception of segregation and injustice.

However, the emergence of South African democracy in 1994 facilitated several processes of change in the context of transformation (Swemmer and Taljaard 2011).

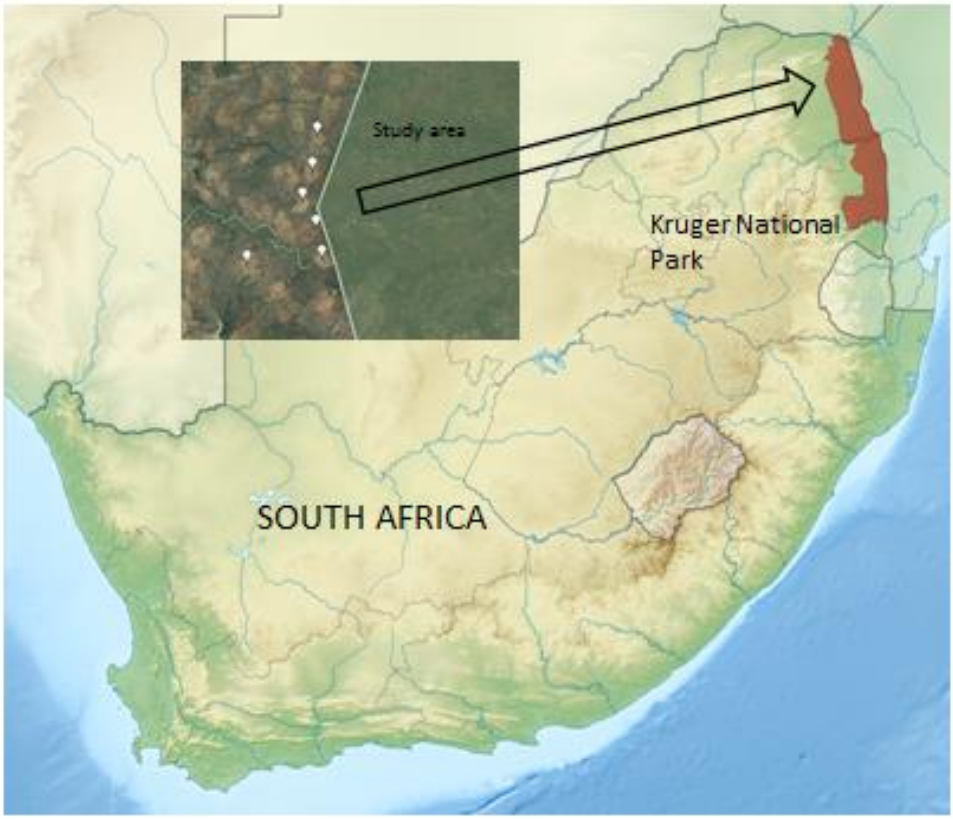

Figure 3.1 Location of the study area in the context of the Kruger National Park, in South Africa

With an annual rainfall between 400 mm and 750 mm, the 20,000 km^2 KNP is classed as semi-arid to arid wooded savanna vegetation, home to a large diversity of plants and animals that attract over 1.8 million tourists annually from around the world, resulting in a large regional economic impact (Saayman and Saayman 2006). The South African component of the 1,073 km perimeter of the KNP abuts seven South African municipalities covering land uses that include private and government conservation land, rural and urban towns, villages, agriculture and industry, and includes about 2 million people. Much of this land is of low agricultural potential (Lahiff and Cousins 2009) typified by high regional unemployment rates with residents being largely dependent on natural resources, subsistence agriculture, and social grants (Statistics SA 2015). The KNP employs over 3,000 people, and implements numerous projects and programmes aimed at benefitting local communities (Swemmer *et al.*

2017). However, the majority of neighbours do not visit the park nor do they receive any direct benefits from the park itself.

3.4 THE MOPANE WORM HARVESTING PILOT PROJECT

The two-way engagement between KNP staff and community representatives facilitated planning and implementation of the project. The invitation was open to villages adjacent to the KNP where Mopane worms are known to occur. Participating villages took part as a result of demand for worms and proximity to the park. In accordance with the harvesting protocol, access for Mopane worm harvesting was limited to 10 people per village, per day with each participating village harvesting for only one day. Participants were allowed to harvest an unrestricted volume of worms, within a designated area, during an allocated harvesting period as stipulated in the Kruger Management plan at the time of the study (SANParks 2008).

Community representatives including traditional council and community forum representatives were responsible for selecting participants with a maximum of one participant per household. The majority of the respondents heard about the Mopane worm harvesting via the Traditional Council's office (48.1%), followed by the KNP community forum representatives (44.2%), a SANParks representative (5.8%) and word of mouth (1.9%). Selection of individuals within communities differed between areas. In three of the participating villages, Traditional Councils selected the participants, and in two of these, participants were selected based on being "poor". In one village, anyone could apply, and names were selected from "a hat". In another village, those that could afford the transport to participate were chosen, and in the last village, people submitted their names to the Traditional Council who chose a sub-group based on being "poor" and the remainder of the participants for that village were chosen based on their names being drawn from "a hat". Harvesters were responsible for their own transport, food, and equipment arrangements, but were provided with a permit, free entry and an armed guard to protect them from dangerous game while harvesting. Harvesting involved walking through the bush, plucking individual worms from trees, and storing them in containers. Two harvesting seasons have taken place since the start of the project (**Table 3.1**).

Table 3.1 Mopane worm harvesting statistics from two harvesting seasons in the Kruger National Park, South Africa

	Season 1	**Season 2**
Dates	29 Dec 2010 to 5 January 2011	17 to 26 December 2012
Participants	6 villages	15 villages (3 of whom sent 2 separate groups) and one mixed community group
Mean number of people per village	8.9 people (range = 8 - 10 people; SD = 0.9 people)	9.5 people (range = 7 - 10 people; SD = 1 person)
Number of harvesters	62	161
Worms harvested per village	Mean 217.14 L (range = 80 - 320 L; SD = 94.64 L)	Mean 186.39 L (range = 46.4 - 285 L; SD = 78.50 L)
Total volume of worms harvested (L)	1,520 L	3,168 L

3.5 METHODS

A mixed methods data collection approach was used including focus groups and semi-structured questionnaires. With each group, a focus group was held first to discuss the research topic more broadly, followed by individual semi-structured questionnaires (see Appendix, in section 3.11) where participants were able to engage with the research in a more personal setting. Each participant, hence, took part in both a focus group and an individual semi-structured interview, with all data collection taking place between 15 February and 14 July 2011. A total of seven focus groups and 52 semi-structured questionnaire interviews were conducted with respondents comprising between 5 and 10 harvesters each from six participating villages from the first harvesting season, namely Mninginisi (9), Plange (10), Mashobye (7), Magona (6), Altein (7), Lombard (5) and one non-participating village (8). The non-participating village was planning to harvest but then was not able to participate due to road conditions at the time. The number of respondents in each village was based on how many of the harvesters that had participated in the mopane worm harvesting project during

the first harvesting season (maximum of 10 per village) were willing to voluntarily participate in the research study.

Research assistants were selected based on their ability to provide translation and facilitation support, and were either members of SANParks staff or members of the Hlanganani Community Forum, the community forum responsible for communication and engagement between the KNP and local communities in the study area. Despite being registered as a formal research project with SANParks, further approval for the research by local authorities and subsequent entrance into the various communities was also facilitated through the Hlanganani Community Forum.

Participants were briefed about the purpose and scope of the research at the start of both the focus groups as well as the questionnaires, and they were also informed that participation in the research was voluntary and that their individual identities would be treated with confidentiality. Focus groups were loosely structured around a broad set of questions that prompted discussion on the context of living next to the KNP, Mopane worm supply and demand, perceptions of the park and recommendations for KNP management. The semi-structured questionnaires comprised of an approximately 1 hour long interview that discussed multiple dimensions of human wellbeing; the impact of the project at individual, household, and community levels, the impact on perceptions of the park and management recommendations. Focus groups and questionnaires were conducted in XiTsonga and translated into English for the purposes of data collation and analysis.

Quantitative data was captured and analysed in MS Excel, from which descriptive statistics were conducted using pivot tables. Content analysis was applied to qualitative data, by using open coding to identify themes emerging from the latent content of data recorded for individual questions (Vaismoradi *et al.* 2013). Human wellbeing impacts were clustered according to five wellbeing categories namely material (shelter, food, water), physical (being strong, well and looking good), social (care for children, self-respect, peace and good relations, dignity), security (civil peace, safe and secure environment, person physical security and confidence in the future) and freedom of choice (including being able to help others in the community) (Narayan *et al.* 2000). Participation in both individual interviews and focus groups was voluntary, and participant and focus group identities and confidentiality have been protected by not including names of respondents nor names of villages linked to specific focus group responses in the data summaries or text (They are referred instead to

"Focus group A, Focus group B etc."). A debriefing meeting in the form of a focus group was held with approximately 8 SANParks staff from various departments after the harvesting where operational aspects were interrogated as well as anecdotal observations noted and discussed.

3.6 RESULTS

3.6.1 Demographics and livelihoods of respondents and their households

Most (83.9%) harvesting participants from season 1 took part in the focus groups and semi-structured questionnaire interviews. Respondents and their families varied in age, gender, and household size (**Table 3.2**) with respondents being mostly married women, with a mean age of 46.9 years (range = 22 - 80 years; SD = 10). Households had a mean of 6.1 people per household (range = 2 - 11; SD = 2.4), with approximately even numbers of male and female household members. The majority of the people in the household were under the age of 29 years. Just under half of the household heads were female, with a mean age of 52 years (range = 30 - 80 years; SD = 31.1 years). Household incomes were a mean of R1,791 (range = R0 - R13,750; SD = R4,095), with a mean of 79.4% (range: 0 - 100%; SD = 37.7%) of household income coming from government social grants (59.1% child grants and 41% pension grants), an important additional source of income for poor households (**Table 3.3**). Most households used wood as a primary fuel source, but those households also using electricity, spent a mean of R71.68 (range = R20 - R400; SD = R81.13) per household, per month on electricity. Many households owned at least one type of livestock and planted a mean of 6.08 different crop species (Range: 1 - 11 crop species; SD = 2.8 crop species) at home, using livestock and crops for subsistence and/or income generation. Most respondents ate Mopane worms at least once a week (92.2%), with fewer eating chicken feet (72.6%), fish (62.8%), chicken (51%), beef (13.8%) and pork (2%); with no respondents eating meat from goats or sheep.

Table 3.2 Individual and household demographics of respondents involved in Mopane worm harvesting in the Kruger National Park, South Africa

Group	Variable	Category	Percentage
Respondent	Gender	Women	84.6%
		Men	13.6%
	Marital status	Married	40.4%
		Single	38.5%
		Widowed	15.4%
		Divorced	5.8%
		Separated	1.9%
	Age	20-29	5.9%
		30-39	9.8%
		40-49	47.1%
		50-59	29.4%
		60-69	5.9%
		70-79	0%
		80-89	2%
Household	Size (no. of residents)	1-3	11.8%
		4-6	47.1%
		7-9	31.4%
		>9	9.8%
	Gender of hh	Females	52.3%
		Males	47.7%
	Age of hh members	0-19 years	37.5%
		20-39 years	38.8%
		40-59 years	18.5%
		60-79 years	4.9%
		80-89 years	0.32%
Head of household	Gender	Females	49.1%
		Males	51%
	Age	20-39 years	15.7%
		40-59 years	76.5%
		60-79 years	5.9%
		80-89 years	2%

Table 3.3 Livelihood strategies of households participating in Mopane worm harvesting from the Kruger National Park, South Africa

Strategy	Category	Type	Value
Income	Income earners	Portion of income earning household members	37.7%
	Source of income	Only income is child support grants	69.8%
		Only income is pension grants	11.2%
		Households with an ad hoc source of income	25.5%
	Monthly income of head of household	No income	75.5%
		Income from social grants	16.3%
		Income from other sources	8.2%
Fuel use	Electricity access	Yes	86.3%
		No	13.7%
	Electricity expenditure	R0-R100	90.0%
		R101-R200	2.5%
		R201-R300	5.0%
		R301-R400	2.5%
	Primary source	Wood	98.1%
		Electricity	2.0%
	Secondary source	Households that use a secondary fuel source	11.8%
	Type of secondary	Electric stove	66.7%
		Wood	16.7%
		Paraffin stoves	16.7%
Livestock ownership	Ownership	Households owning >= 1 species of livestock	55.0%
	Number of species of livestock	1	64.3%
		2	25.0%
		3	7.1%
		4	7.1%
	Type of livestock	Chickens	43.1%
		Cattle	15.7%
		Pigs	13.7%
		Goats	9.8%
		Donkeys	5.9%
		Horses	2.0%
Livestock primary use	Chickens	Household consumption	88.9%
		Eating and selling	5.6%
		Savings/insurance	5.6%
	Goats	Eating in the household	60.0%
		Insurance/savings	40.0%
	Cattle	Selling	37.5%
		Insurance	37.5%
		Milk	12.5%
		Eating at home	12.5%
		Meat for funerals and weddings	12.5%
	Donkeys	Ploughing fields	66.6%
		Draught animal	33.3%
	Pigs	Personal consumption	100.0%
Crops	Planting	Households planting crops	100.0%
	Location of planting crops	Both household and community gardens	43.2%
		Household gardens	37.3%
		Community gardens	17.7%
		Project garden	2.0%
	Crop sales	Households not selling crops	78.4%
		Selling 1 crop	13.7%
		Selling 2 or more crops	7.8%

3.6.2 Impact on participant wellbeing

A baseline understanding of respondent's perceptions regarding the degree to which Mopane worms contribute to wellbeing locally, despite the KNP Mopane worm project, provides context for assessing the demand for and subsequent impact of facilitating access to additional sources of worms from the KNP. As indicated by a focus group from Altein Village, "*Everyone likes to collect worms…we learnt it from our parents…sometimes if we get a bag we eat them the whole year*". Respondents indicated that when they are available, Mopane worms are collected for their material contribution to human wellbeing, both for household consumption and income generation, being desirable due to their taste, health benefits and long shelf life. Generally, respondents felt there were less worms available than in previous years, and this was attributed to harvester competition, habitat loss, rain, fire and inter-species competition. The reduced supply was perceived to have negative impacts on worm size, quality, and processing efficiency, and having to harvest elsewhere came with costs, both financial and security related. Consumption patterns varied ranging from eating worms all year round, to only eating during harvesting season, or in times of need. After harvesting, worms are degutted, and cooked with salt, then either dried or frozen. Some respondents indicated that in a normal season they would sell worms if they had managed to harvest a good amount, using the money for groceries and school related costs. Respondents generally expressed concern that there were less Mopane worms in current times, mostly due to the role that the worms play as a food and revenue source.

Although we have anecdotal evidence of excitement and anticipation in the broader community on hearing about the project prior to participant selection, we recorded the direct impact that the Mopane worm project had on human wellbeing from when participants and subsequently their families and their communities heard that they had been selected to be part of the project. As indicated by a focus group participant, "[*on hearing that we were selected to participate...] we were happy and excited with the news from the Chief*". Happiness is an important indicator of overall wellbeing, and as such, it is important to note that happiness was broadly noted as the most common feeling expressed by respondents on hearing the news that they had been chosen to participate in the Mopane worm project (**Table 3.4; Figure 3.2**). The reasons behind the feelings of happiness were linked to the prospects of benefits from the harvest in terms of material (to get benefits from worms for food for self and family), social (going into KNP for the first time; received support from family members), and security

(going to harvest with permission; knew that they would be looked after) dimensions of human wellbeing.

Some respondents had mixed feelings about participation anticipating danger from wild animals in the park. Respondents perceived the news of their forthcoming participation and its impact on their family's wellbeing, both positively and negatively (**Table 3.5**). Most families were perceived to be happy and hopeful of respondents receiving material benefits and being able to provide support for respondents to prepare to participate (social wellbeing) as indicated by a focus group respondent from Altein village who said, *"*[our] families were very happy. They gave us money to go, they were not scared for us*"*.

Table 3.4 Individual harvester's reaction to hearing that they were chosen to participate in the harvesting of Mopane worms from the Kruger National Park, South Africa. Where the data source is expressed as a %, the data is from semi-structured questionnaires (n = 52), where the results are linked to a letter e.g. "C", the data is from focus groups, with the letter indicating the specific focus group where the data was collected (n = 7)

Attitude	Theme	Sub-theme	Data source
Positive, happy	Hopeful about opportunity	Happy, interested, excited about opportunity	82.7%
		Happy, hopeful would get chosen	3.9%
		Happy and excited	A, G, D, E, F
	Benefits for self and family	Happy to get food/relish for self and family	5.8%
		Felt happy that the KNP was starting a new project that would benefit them	B
	Legal and safe access	Happy, glad going somewhere with permission, normally go to other reserves with no permission	1.9%
		Knew that they would be well looked after	E, G
	Will get more worms	Happy, better than private farms where lots of harvesting competition for worms	1.9%
	First access to KNP	Happy as it was the first time to the park	1.9%
		For many it would be the first time that they would be going into the park	C
Mixed feelings	Benefits but safety concerns	Had mixed feelings in the beginning including fear due to the potential risks of being threatened or injured by wild animals	C, E
		Happy and scared	1.9%

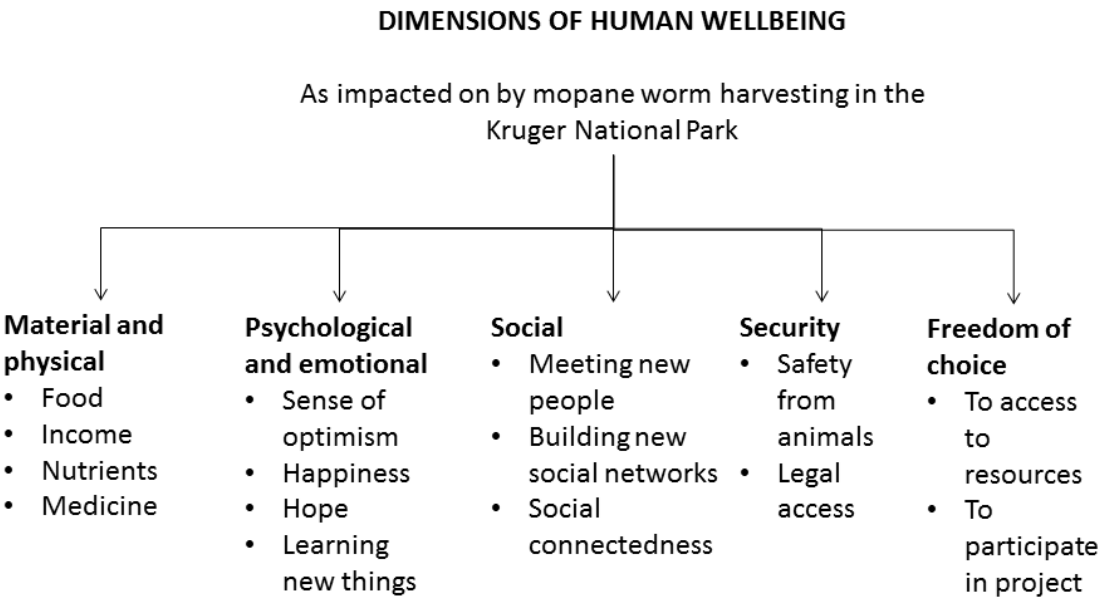

Figure 3.2 The contributions that Mopane worm harvesting from the Kruger National Park, South Africa has made towards multiple dimensions of human wellbeing

Table 3.5 Respondent's perceptions of their family's reactions on hearing that they were chosen to participate in the harvesting of Mopane worms from the Kruger National Park, South Africa. Where the data source is expressed as a %, the data is from semi-structured questionnaires (n = 52), where the results are linked to a letter e.g. "C", the data is from focus groups, with the letter indicating the specific focus group where the data was collected (n = 7)

Attitude	Theme	Sub-theme	Data source
Positive, happy	Supportive and helpful	Happy, supportive and helpful	64%
		Family members helped the harvesters to prepare for the harvesting process in some cases contributing to the travelling costs	A
		Helped to clean the worms afterwards	C
	Hopeful of benefits	Children happy and hopeful respondents would bring something home (e.g. food/money for school fees)	2%
	Excitement about access to KNP	Most families of the harvesters expressed happiness and excitement at the prospect of their family member going into the park to harvest worms.	A, B, C, E
		It was the first time they had ever visited KNP	F
Mixed feelings	Supportive and happy but concerned about safety	Happy, supportive, helpful, concerned about safety and injury	8%
		Mixed feelings of both joy as well as concern	D
	Happy but children concerned about safety	Happy, children concerned about parents safety from wild animals (e.g. python)	2%
	Concerned about safety, but changed when saw benefits	Family warned participants to be careful but then changed their minds later once they saw the benefits that the participants had got	F
Negative, concerned, afraid	Safety and injury or death concerns	Concerned about safety and injury	16%
		Afraid respondents wouldn't return	2%
		Afraid for the safety of the harvesters and told stories of dangerous pythons, elephants and lions that could injure or kill the harvesters	G
	Families fear made participants afraid, but they still participated	Families' concern elicited fear in participants, but they participated none the less	2%
Neutral	NA	Not concerned	4%

Table 3.6 Respondent's perceptions of their community's reaction to hearing that they were chosen to participate in the harvesting of Mopane worms from the Kruger National Park, South Africa. Where the data source is expressed as a %, the data is from semi-structured questionnaires (n = 52), where the results are linked to a letter e.g. "C", the data is from focus groups, with the letter indicating the specific focus group where the data was collected (n = 7)

Attitude	Theme	Sub-theme	Data source
Positive, happy	Happy, hopeful	Happy and hopeful	21.6%
		Happy for the harvesters	D
	Encouraging	Wishing the harvesters well, emphasising that the worms outside the KNP were smaller and represented other species, not Mopane worms	A
Mixed feelings	Happy, hopeful but also envious	Happy and hopeful, jealous, envious	5.9%
		Mixed feelings but happy for harvesters	D
Negative, scepticism, jealousy, fear	Animosity, sceptical, envy, jealousy, fear of danger	Sceptical, animosity, jealous, fearful of danger	39.2%
		Sceptical and bitter suggesting to those chosen that they would get injured in the process	C, F
	Envy, jealousy	Wanted to go as well	15.7%
		Wanted to go as well, jealous were not chosen	A, B, F
		Jealous	9.8%
	Concerned	Concerned about logistics	2%
	Envy, jealous, sceptical about selection process	Jealous, sceptical and animosity, wanted to go, felt selection process was not transparent	4%
	Misunderstood financial implications	Misconception about being paid	2%
	Sad, hurt, disappointed	Sad and hurt	F
		Were upset, unhappy, frustrated and disappointed that they didn't get an opportunity	B, C, D, G
	Danger of wild animals	Concern about danger of wild animals, saying that the harvesters may be mauled by lions	C, E, G

		Threatened harvesters with stories of dangerous animals	C, F, G
		Afraid to go themselves	G
	Removed names due to fear	Afraid and asked to have their names removed	E, G
	Ancestors didn't go	Said the grandparents never had gone so they shouldn't either	F
Neutral	Didn't have money	Were ok as they didn't have money to go	G, E
	Envious but not unhappy	Also wanted to go but they were not unhappy	A
		Were not upset since the list had come from the *Nduna* (headman)	G

The worms harvested in the park had the potential to contribute positively to the material dimension of human wellbeing, both through sales and direct consumption. Respondents harvested a mean of 27.83 L of fresh worms each (range = 5 L - 40 L; SD = 9.27 L) (**Table 3.7**). The economic value of the harvested worms per household was R562.27 (range = R100 - R800; SD = R173.67) [i], a noteworthy contribution of a mean of 50.3% of household income during the months of harvest (range = 4.5 - 100%; SD = 31.7%). Fewer than half of the respondents (38.5%) collected worms in areas other than KNP during the harvesting season, with those that did collect in other areas, collecting a mean of 19.28 L per person (range = 1 - 62.5 L; SD = 21.7 L). Of those, 35% had to pay a "fee" to the local traditional authority to collect the worms, impacting negatively on material wellbeing with fees ranging between R10 and R20 each, and/or 2 L of cleaned worms. For all respondents, the harvested worms contributed to material (sales and consumption) and/or social (donations to friends and family) wellbeing. Most of the respondents (75%) consumed all their harvested worms at home, while other households sold some of their worms (17.31%). Some used the worms in their households and gave some away (5.77%) while others sold all of their worms (1.92%). Those that sold worms, sold a mean of 20.39 L each (range = 5 - 37.5 L; SD = 18.11 L), amounting to a mean of R517.14 per person (range = R120 - R1,000; SD = R308.85), with worms retailing at a mean of R42.40 per L (range = R20 - R100 per L; SD = R37.77 per L). At the time of the study, most of the respondents (66.7%) no longer had any worms left from the harvesting season. Most respondents (97.7%) indicated that they were happy to have participated and that they wanted to participate again (**Table 3.8**). The reasoning was attributed to being able to get food and income (material wellbeing), the building of social connections by meeting new people (social wellbeing), seeing, visiting and learning about new places (mental and spiritual wellbeing) and feeling safe and looked after (security wellbeing).

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i The street value of Mopane worms at the time of the study was R40/ L. At the time of writing this article, the street value was estimated to have doubled, with worms retailing at approximately R80/L at main markets

Table 3.7 Mean volumes of worms harvested per person, per village, from the Kruger National Park, South Africa

Village	Mean volumes (litres) harvested per participant (range;
Mninginisi	35.56 L (range = 30 - 40 L; SD = 5.27 L)
Plange	31.11 L (range = 30 - 40 L; SD = 3.33 L)
Mashobye	30.00 L (range = 20 - 30 L; SD = 4.88 L)
Magona	30.00 L (range = 20 - 30 L; SD = 6.32 L)
Altein	28.57 L (range = 20 - 35 L; SD = 3.54 L)
Lombard	12.40 L (range = 10 - 15 L; SD = 2.51 L)
Combined	**27.83 L (range = 5 - 40 L; SD = 9.27 L)**

Table 3.8 Rationale for future participation in Mopane worm harvesting from the Kruger National Park, South Africa. Where the data source is expressed as a %, the data is from semi-structured questionnaires (n = 52), where the results are linked to a letter e.g. "C", the data is from focus groups, with the letter indicating the specific focus group where the data was collected (n = 7)

Theme	Sub-theme	Data source
Opportunity to get food for self and family	Need the worms (eat or sell) to help my family	74.3%
	More worms than elsewhere	2.9%
	It was the only opportunity to harvest worms	2.9%
	Need the worms (eat or sell) to help family	A, D
Social interactions and new experiences	To see animals, to meet and spend time with the staff (ranger)	11.4%
Personal satisfaction	Felt good	5.7%
New experiences	First visit to the park	C, E
	Was a new place to visit, was the first time to see KNP from the road	E
Felt safe and secure	Felt safe, were looked after and treated well	8.6%
	Felt safe, were looked after and treated well	C, D
	Would come again despite not getting many worms, as felt secure	B, C

Unintended consequences of actions can result in tangible and intangible costs which may outweigh benefits. As such, negative impacts associated with participating in the harvest were recorded. A direct impact on material wellbeing (cash) involved the payment of transport costs to and from the harvesting points, at a mean of R47.16 per person (range = R20 - R350; SD = R49.58). One participant spent R350, but she was a forum member who subsidised some of the transport costs for the other participants from her village. Other arrangements included preparing food and water, a container for holding the worms, and protective clothing and shoes. The majority of respondents (56.8%) indicated that they would have been doing domestic chores (including tending fields, collecting wood, and preparing food) had they not participated and these may have resulted in negative impacts on material, physical and social wellbeing dimensions at a household level. Others indicated that they would have done nothing/stayed at home (25%), harvested elsewhere (11.4%), harvested locally (9.1%) or done other temporary work (2.3%) on the day that they harvested. Some indicated that nothing else matters apart from Mopane worm harvesting with others cancelling other planned trips in order to come and harvest in KNP.

Despite noting these costs, none of the respondents indicated that they perceived to have experienced a net negative impact on themselves or their families' wellbeing having participated in the harvesting. Respondents generally indicated that the operational part of the harvesting went well, with the only complaint being the challenges associated with driving on dirt roads in the rain (Table 9). Most respondents indicated that there was nothing they were unhappy with regarding the implementation and negotiation phases (82.6%), while some indicated that they would have liked more time to harvest (8.1%), more rangers (2.2%) and a different selection process as there were poorer households that were not chosen to participate (2.2%). The majority of respondents and focus groups suggested increasing the harvest time and the numbers of participants.

Table 3.9 Perceptions of project operations and suggestions for improvement for Mopane worm harvesting from the Kruger National Park, South Africa. Where the data source is expressed as a %, the data is from semi-structured questionnaires (n = 52), where the results are linked to a letter e.g. "C", the data is from focus groups, with the letter indicating the specific focus group where the data was collected (n = 7)

Perceptions of operational side of harvesting		
Theme	**Sub-theme**	**Data source**
Positive - general	Operational part of the harvesting went very well	B, C, D, E
Positive - experience	When the harvesting was over, they didn't want to come out as it had felt like they were on a touring trip	C
Positive - staff	The rangers were commended as being very friendly	C, E
Positive - safety	Good, staff looked after the harvesters well	A, F
	Make the harvesters feel safe and not scared	B
	Harvesters obeyed the rules	A
Negative – road conditions	Harvested during the rain, which made it difficult to drive on the roads	A
Suggestions for improvement		
Theme	**Sub-theme**	**Data source**
None	None	9.8%
More time	A longer harvesting time and/or more harvesting days	62.8%
	Allow sleep over for more time	5.9%
	More time to harvest in the park	A, B, D, E, F
	Including overnight stays	C, F
Different time	Later in season (worms small)	2%
More participants	More participants/villages per day	7.8%
	Increasing the number of participants	B, C, D, E
More rangers	More rangers specifically to allow harvesters to cover more ground, to not get left behind and to not get lost	7.8%
	More rangers	B, C
	Having a consistent number of rangers per group (there were perceptions that some groups got more rangers which would have allowed them to harvest more)	C
Earlier communication	Earlier communication	5.9%
	Improved, earlier communication regarding harvesting operations	F
Place to process worms	Place for cleaning and drying	5.9%
Repair fence	Repair fence	5.9%
Secondary benefits	Exploring the option of using a local temporary security company	A
Harvesting area	Not taking people to areas that have already been harvested	C

3.6.3 Perceptions of and impact on the conservation estate

Perceptions of the KNP are thought to be driven in part by direct or indirect interactions that neighbouring people have with the KNP and or the KNP staff. However, it is important to put these perspectives into the broader context of village life in order to provide insight into the relative impact that KNP has on community wellbeing. We found that respondents all liked to live in their respective villages, with each area highlighting their own positive aspects and challenges of village life (**Table 3.10**). The best aspects of village life were associated with having access to benefits from the KNP (including visitation, employment, psychological benefits of living close to nature, and benefits from being able to harvest natural resources), access to natural resources more broadly and access to services such as electricity and water. One participant indicated *"...[because we live in this area we can] see wild animals, can show our children directly what animals such as impala look like*". Challenges associated with village life were either related to a lack of access to services (roads/transport, electricity, and water, education, and health care) or negative impacts associated with human-wildlife conflict (threats to human life, predation, herbivory, compensation, disease and livestock loss). As put by one respondent, "…*since the village is close to the KNP, we are not free to walk around, and especially when we are collecting fire wood we are scared of lions".*

Table 3.10 Most positive and most challenging aspects of village life according to participants in Mopane worm harvesting from the Kruger National Park, South Africa. Data from focus groups, A - G (n = 7)

Positive aspects of village life		
Theme	**Sub-theme**	**Focus group**
Access to benefits from KNP	Opportunities to benefit from the KNP through visitation, employment or resource use	C, D, F
	Access to meat from animals that escape from the park/are shot	C, F
	Opportunities to see wild animals and/or to show them to the younger generations	A, C
	Being close to nature, living close to KNP	D,F
	Opportunities for learners to access KNP free of charge	F
	Well maintained fence between KNP and the village	C
Access to natural resources	An ability to grow crops due to land and/or water access	A, E, G
	Opportunities to own livestock due to grazing land	A, D, E
	Access to natural resources e.g. wood, thatching grass and marula's to make beer	E
Access to services	Having access to electricity (although not everyone has access)	B
	Presence of dams	E
	Access to drinking water	E
Most challenging aspects of village life		
Theme	**Sub-theme**	**Focus group**
Access to roads and transport	Lack of transport during rainy season	A, E
	Bad roads	D, E
	Difficulty in getting public transport from secondary roads	E, G
	No bridges	E
	Dangerous roads due to animals	E
Access to electricity and water	Lack of access to electricity (although some in village do have)	B
	Lack of access to water	B
Access to education	No high school	E
Access to health care	No clinic	E
	Mosquitoes and malaria	E
Human wildlife conflict	Livestock predation	A, B, C, F
	No compensation for HWC	C, F
	Losing cattle that wonder into KNP through broken fences and then get shot	C
	Large herbivores raiding crops	C
	Foot and mouth disease	E
	Crocodile predation on livestock and people (children)	E

Having good social relationships contributes positively to the social dimension of human wellbeing, and as such the perceptions of the respondents specifically regarding their relationship with the KNP was noted. Most respondents felt positive about their relationship with KNP as a result of the benefits associated with the park, the communication channels with the park and the changes in the park with regards to promoting new access opportunities. A respondent from a focus group indicated "*Our feeling is that the park is opening, unlike the old days*" (**Table 3.11**). The focus group comprising people who had not participated in the project, were more neutral regarding their perceptions of their relationship with the park, yet still expressing hope that their relationship with KNP will grow stronger with one respondent indicating, "Our relationship with KNP is not strong enough. But lately it does look as though the KNP is reaching out. We want to build strong relations with Kruger*".* More specifically, respondents indicated that they felt differently about the KNP as a result of participating in the Mopane worm project with one group stating, "We feel that relations have improved, previously when we were collecting firewood and we heard the parks vehicle we would hide, but now we feel more relaxed." Respondents attributed this change in their perceptions about the KNP to be as a result of a number of improvements to their wellbeing induced through the project, namely being granted access to the park resulting in them being able to see, experience, and benefit from the park directly themselves, something that they never thought was possible (social and material wellbeing). Respondents indicated that their perceptions of the park changed in that they were no longer afraid of either the people or the animals in the park (security wellbeing) and that their perceptions had changed as a result of improved relationships with the park (social wellbeing).

Table 3.11 Mopane worm harvester's broad perceptions of the Kruger National Park, and the specific influence that the Mopane worm project has had on harvesters relationships with the KNP, as determined during focus groups, with the letter indicating the specific focus group where the data was collected (n = 7)

Broad perceptions of harvesters' relationship with the KNP			
Attitude	**Theme**	**Sub-theme**	**Focus group**
Positive	Broadly positive	Good	A, B, E, F
		See the KNP positively	A, B, D, E
	Aesthetic	KNP is a beautiful place	F
	Linked to benefits	Receive temporary and permanent job opportunities from the park	D, E
		Are beneficiaries of the park	C
		Glad KNP wants to share the park's resources	C
	Linked to communication	Strong and positive due to community forum	C
		Are informed by everything done in the KNP	D
		Have good communication including on DCA's and this was said to be in contrary to that of LEDET	D
	Linked to KNP changing	KNP is opening up and changing in comparison to previous times	B
		Previously harvesters could only see worms on trees through the fence, now they have access to those worms	C
Neutral	Need for improvement	Need for jobs and donations for special events	G
		Not strong enough, but looks like KNP is reaching out, we want to build strong relations with KNP	G
Influence of Mopane worm harvesting on perceptions			
Attitude	**Theme**	**Sub-theme**	**Focus group**
Positive, improved relationship	Broadly positive	Perceptions of the park positively influenced	C, E, F
	Access to KNP for getting worms	Opened up eyes, want to come again	A
		Having access resulted in them seeing the park differently	G
		Perceive that the park is opening up unlike previous times	B
		Enabled harvesters to realise how beautiful the park is on the inside	B
		Initially thought they would never get access to KNP to walk around	G
	Safety	Need not be afraid of the animals there	D
	Improved relationship	Relationship with the park has improved as a result	C

Anecdotal feedback from KNP staff after the harvesting suggested that the project had stimulated improved communication and relationships between park staff and neighbouring communities, with examples given of neighbours contacting park staff on occasions when they noticed something suspicious in their villages, post participation in the Mopane worm project. Staff also reported a more positive attitude towards the park during community meetings as a result. Despite the overwhelmingly positive reactions of participants and their families to the project, also noteworthy were the reactions from the broader public on hearing about the Mopane worm project via an official KNP news article. At the time of the harvesting, interested parties could make public comments via the SANParks Forum that had an interactive link on the SANParks website. Although some of the comments were neutral or positive, there was a strong theme of concern and negativity from people on the electronic forum on hearing about the harvesting, with comments such as, "Is this a joke? I cannot believe this…KNP is losing focus here in a big way" dominating the thread (SANParks 2010).

3.7 DISCUSSION

Our study demonstrated that facilitating access to small scale resource use from within a protected area contributes positively to local livelihoods in areas where natural resources are in demand and competition for resources is high (Matsika *et al.* 2013). We illustrated that while net benefits are accrued at an individual and household level, there is potential for communities at large to feel aggrieved about the process if they are not included, with the specific selection process playing a role in driving these perceptions. Randomly selected participation (e.g. names being "drawn from a hat") seemed more broadly acceptable than when participants were chosen based on their economic status (poorest of the poor). These results suggest that scale and local context (i.e. level of engagement with the project/or conservation area) are important to consider when conducting social and economic impact assessment and perception studies in and adjacent to conservation areas.

We demonstrated that the worms harvested from the KNP contributed positively to the physical components of participant and household wellbeing. The worms were mostly used for household consumption, but were equivalent to approximately half the financial value of one month's income for participating households, a significant amount if one considers the costs of replacement items (Shackleton and Shackleton 2004). Those that sold worms,

accrued about R517 each (9.6 times the minimum daily wage for farm workers in South Africa at the time of the study) (DOL 2008). Other studies have shown that although the number of households that sell wild harvested products (as opposed to using them in the household) is relatively small, the relative contribution that this form of income makes towards poorer household livelihoods is significant (Shackleton and Shackleton 2004). For most participants the worm harvest in the park was their only source of worms, with worms being the primary source of protein (together with fish and chicken feet) for many respondent households.

Consumption of 100 g of Mopane worms is estimated to contain up to 76% of a human's daily protein requirements (Makhado *et al.* 2014) suggesting that the worms harvested in KNP would have contributed the equivalent protein requirements for 114.21 "people protein days" per household. Mopane worm harvesting is a short season, but dried worms can contribute nutrition and income over a longer period when available in large enough quantities and the December/January harvest season coincides with additional expenditure on school related costs just after Christmas (Shackleton and Shackleton 2004). Most harvesters in our study were women, despite the invitation being open to both genders, many of whom were single household heads, over the age of 40 with no additional source of income. Insect collecting and processing by women is common (Hunter *et al.* 1990; Munthali and Mughogho 1992) with insects in some cases contributing a higher proportion of the diets of women and children in comparison to men (Illger and Nel 2000) suggesting that sustainable resource use opportunities have the potential to benefit marginalised and vulnerable groups more who are less likely to have other opportunities such as those linked to youth development (youth are defined as between the ages of 18 and 35).

Our study further highlighted that apart from the important material benefits of the harvested worms (food, income, nutrition, medicine), additional impacts included the psychological (sense of optimism, hope, happiness and learning new things), social (meeting new people, building new networks and social connections), security (safety from animals and having legal access to a resource), and freedom of choice (to access resources) dimensions of human wellbeing (**Figure 3.3**). Although it has been suggested that basic human needs must be met before higher level, intangible needs are prioritised (Maslow 1943), some suggest that the psychological components of wellbeing can contribute a larger fraction of overall wellbeing (Bartels *et al.* 2019). Although the wellbeing dimensions can be assessed separately, their linkages are also important, with increased levels of physical health widely recorded as a

driver for increased psychological wellbeing among various age groups (Edwards *et al.* 2005). Also relevant is the engagement with nature through direct exposure and connectedness which has shown a positive impact on psychological wellbeing (Kamitsis and Francis 2013).

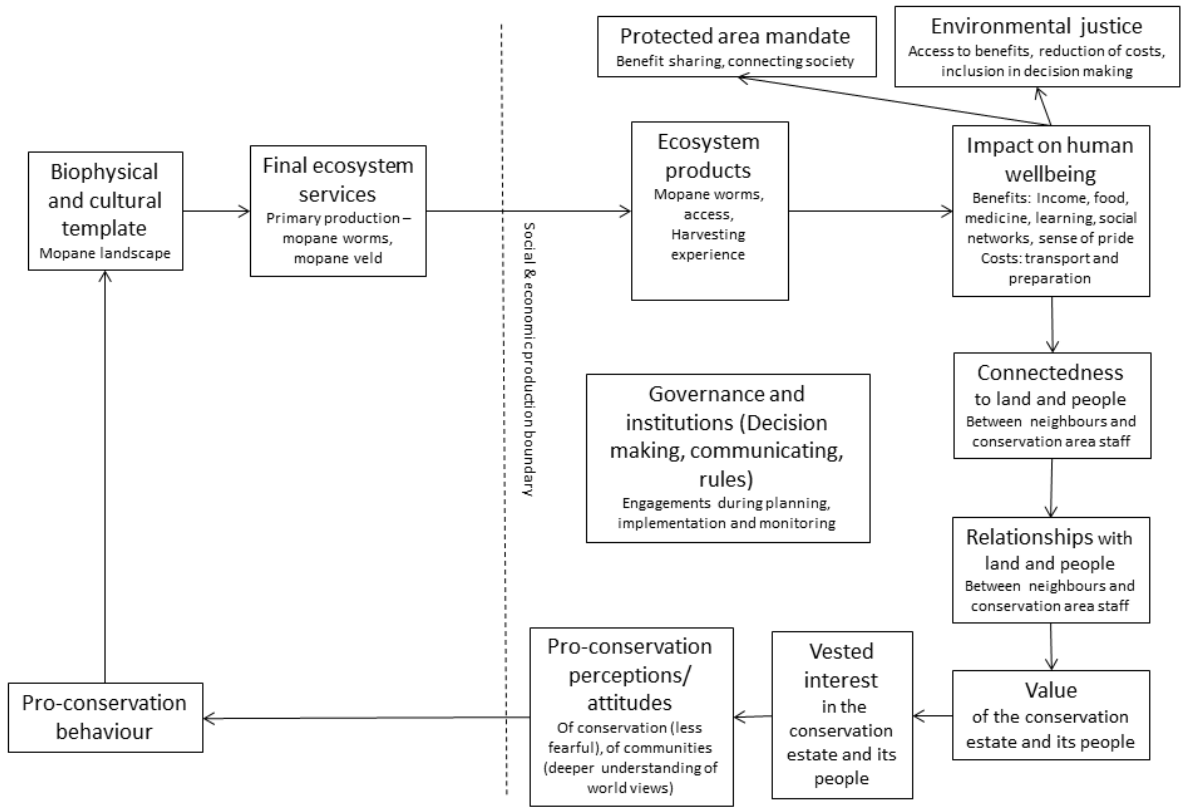

Figure 3.3 Ecosystem service cascade adapted from Swemmer et al. (2017) interpreted in the context of Mopane worm harvesting from the Kruger National park, South Africa

The psychological impacts of learning linked to the harvesting included visiting the park (for the first time in some cases), seeing animals, and spending time with and getting to know the park staff. Learning new things promotes greater satisfaction and optimism, can boost self-confidence and can help build a sense of purpose in so doing contributing positively to mental wellbeing (NHS 2019). Informal learning processes (such as those associated with the learning experiences of being part of the Mopane worm harvesting project) have been associated with higher wellbeing (Jenkins and Mostafa 2015), while learning amongst older adults promotes an active and engaged lifestyle (Merriam and Kee 2014).

We therefore suggest that the learning experiences associated with the Mopane worm harvesting clustered under the theme of 'seeing new places and things' contributed positively to psychological and mental wellbeing of participants, over and above the worms being a source of food and income. In addition to the learning that already took place, such projects can provide an additional space for more structured 'social learning', described as learning by all stakeholders to manage the issues in which they have a stake (Ridder *et al.* 2005). Outcomes from social learning processes include knowledge, improved relationships, and a change in values, all of which have the potential for positive protected area benefit sharing outcomes (Lumosi *et al.* 2019). Learning with others increases social capital by helping to develop social competencies, extending social networks and promoting shared norms and tolerance of others (Field 2009). Meeting new people and building social connections with SANParks staff was perceived by participants to be an additional benefit, and we suggest that this is due to the contribution that building social connections (and social cohesion) make towards the social wellbeing of individuals and groups (Narayan *et al*. 2000). We feel that these observations are particularly relevant in rural contexts adjacent to parks where people do not necessarily have opportunities to leave the area, to find work, nor to learn new things nor to meet people from outside of their own local settings.

Our study highlighted that participants perceive good communication and engagement with park personnel to be an important driver of relationships between themselves and the KNP, both prior to and as a result of participation in the Mopane worm harvesting. People-parks relationships are defined as historical and current connections with "the people" and "the place" of protected areas (Allendof 2010), hence this is an important observation as it is often assumed that positive perceptions and relationships can be built through the sharing of tangible benefits alone. This suggests that by promoting access for people to enter and harvest resources from land that they had been denied access to previously can play a role in reconnecting people to the land, and in so doing to building relationships between people and land inside of protected areas.

Also broadly referred to as social capital, social bonds or connections are networks of relationships among people that enable society to function effectively and to access resources (Lin 2001). Social capital can be bonding (within homogenous groups) or bridging (between groups) (Smith 2000-2009), and we suggest that Mopane worm harvesting contributed to the building of bridging social capital between harvesters and SANParks staff, something that is often missing in disadvantaged communities contributing to them being caught in the poverty

trap (Villalonga-Olives and Kawachi 2015). Where social capital exists, it is assumed that the benefits of working together would outweigh the costs (Villalonga-Olives and Kawachi 2015), with trust and reciprocity, key components of social capital, facilitating further cooperation, reducing transactional costs, enhancing long term agreements and promoting collective action (Smith 2000-2009). Hence, in the absence of social capital, individuals tend to act in an asocial manner, in their own interest with low levels of collaboration and at the expense of the larger group.

Social bonding (between conservation and societal actors) resulting from people-people engagement throughout the benefit sharing governance processes (including planning, implementation and monitoring) stimulates social connectedness that results from mutual understandings between groups and leading to the building of positive relationships and trust seemingly regardless of the tangible benefits (e.g. worms harvested).

Although we did not explicitly measure behaviour, we suggest that social connectedness between people working in conservation areas (as opposed to the agency itself) and people living alongside these conservation areas provide an opportunity for, as well as stimulate a willingness to work together towards relevant, common goals while reducing the likelihood of one party making decisions that may not be in the other's best interest (some examples could include poaching and social unrest from a neighbouring community perspective, and human wildlife conflict, and/or communication and level of engagement in decision making from a conservation perspective). An important acknowledgement that needs to be highlighted is that despite the benefits of building social capital between conservation agency staff and participants through engagement opportunities created through data collection processes such as this, there remains a potential for bias in situations where respondents may choose to respond to questions in a manner that will be in their favour for future engagement with the conservation area, as opposed to otherwise. It would be difficult for the researchers to assess whether or not this was the case for this case study, however, it was clarified that responses would be treated as confidential and respondents were asked to respond as truthfully as they could so that the process accurately reflected their perceptions, in order to monitor effectively and subsequently adapt the project where necessary.

Although we have been able to demonstrate that the Mopane worm project has had positive impacts on human wellbeing, positive impacts on perceptions and subsequent attitudes towards conservation, and has built social capital between actors, it is important to

acknowledge that the link between perceptions, attitudes, and behaviour are complex, non-linear, and dependent on various additional factors (Freymier and Nadler 2017). The greater the level of specificity (the link between the type and scale of attitude, and type and scale of behaviour being measured), the stronger the predictability of attitude influencing behaviour (Freymier and Nadler 2017). Equally important is the perception of control over behaviour (greater perceived control resulting in greater likelihood of attitude influencing behaviour), how the attitude and perceptions were formed in the first place (direct experience being more likely to directly influence behaviour), how often the attitudes are accessed from the brain (spoken about and or engaged with), and the situational context within which the behaviour is performed (personal setting providing individual opportunity to act on and be responsible for behaviour, whereas a group setting provides anonymity) (Freymier and Nadler 2017). A more in depth study would be needed to specifically track the links between attitudes and behaviour in the context of resource use inside the park, especially if such studies were to inform how sharing benefits in this manner could have an impact on the degree to which people living adjacent to parks would play a role in the illegal wildlife trade.

Participants in the focus groups seemed broadly content living in their villages, with about half of the positive aspects of village life mentioned, being linked to the presence of the KNP (e.g. the opportunity to benefit from the park, to see wild animals and to live close to nature). The most commonly mentioned negative aspects of village life was human-wildlife conflict (HWC) which has been recorded as having a significant negative impact on livelihoods and subsequently a source of discontentment in communities living adjacent to the park (Rademan 2004; Anthony 2007). Noteworthy was that less than half of the negative impacts mentioned could be directly attributed to the KNP, with many respondents listing lack of access to services such as transport, water, electricity, sanitation, health and education as significant challenges of living in the area. In other studies, people living adjacent to the KNP have reported the frequency of household shocks experienced over a 5 year time frame as being mostly linked to climatic conditions, disease, lack of capital, and unemployment as opposed to being linked to their proximity to the KNP (Parent *et al.* 2012). Although this would need more careful exploration, this does suggest that despite being a very emotive issue, the perceptions that conservation areas have firstly an overall negative impact on neighbour wellbeing, and secondly, are responsible for the majority of the challenges faced by people living in these areas, may be overestimated.

Since the data was collected between 2 and 7 months post-harvest, it is unlikely that the positive feelings recorded are only temporary euphoria associated with the harvesting event. The one focus group that was held with the group of people whose harvesting day was cancelled, perceived their relationship with the KNP to be weak, but they indicated that they did feel that as a result of the engagement that the KNP was starting to reach out to them, and were hopeful that their relationship with the park would improve. Noteworthy is that despite not having participated, this focus group indicated that just having had the possibility of harvesting worms made the potential participants realise that they might get the chance to go into the park, and this had changed how they viewed the park. One focus group indicated that even if they didn't get many worms, they would still like to participate again. Normally, due to both ecological and economic sustainability principles, harvesting only takes place when Mopane worm outbreak sizes are large based on the assumption that participants would only want to participate when they would have a good chance of harvesting enough to outweigh the costs (transport, opportunity costs, and preparation).

However, our research has shown that the benefits of participating go beyond just the worms harvested, including the learning opportunities of seeing new places, reconnecting to land as well as the social interactions and connections between new people that are built along the way. This suggests that potential harvesters should be part of the process of deciding whether it would be in their interests to harvest or not, not only for the positive outcomes that arise from effective governance (including co-decision making) (Ostrom 1990) but in order to provide access to benefits including the harvesting experience and social capital between harvesters and park staff. It is important to acknowledge that positive relationships require on-going positive and repeated engagement events, and these need to be maintained if relationships are to be nurtured and sustainable. The challenge with most protected areas is that they lack sufficient resources to allocate towards this task which can be time consuming and resource heavy.

The negative comments observed on the SANParks forum regarding the news of the Mopane worm harvesting suggests a broader public resistance to such projects, most likely due to contrasting value systems, perceptions of protected areas being 'no-take zones' and perceptions that the harvesting of worms will have negative impacts on the conservation estate. Interestingly, a second media address was shared in response to the negative outcry, emphasising that the project was a pilot, would be implemented at a small scale, and that the impacts were being closely monitored and as such would not negatively impact the

environment. Anecdotal observations subsequent to this suggest that the content of the second release (clarifying the small scale and scope of the project) alleviated many of the broader publics concerns in this regard. However, this would need to be investigated further.

It is important to acknowledge that positive relationships leading to social capital are built over time as a result of multiple positive connections between people and places. As such, on-going engagement is required for such relationships to be sustained. It has been suggested that increased law enforcement in reaction to increased rhino poaching may lead to a hardening of boundaries between parks and neighbouring areas (Lunstrum 2014; Annecke and Masubulele 2016). However, at the time of the study, rhino poaching had just started to escalate as had the subsequent responses by the KNP, and as such it is unlikely that there would have been significant negative, poaching related impacts on local neighbours. However, relationships are built on trust and reciprocity, and as such, any actions between conservation area staff and local communities that breaks trust could result in reduced relationship potential, further highlighting the potential positive role that such resource use projects can play in promoting access, softening borders, building conservation support and contributing to sustainability in a climate of increasing illegal wildlife trade.

Our findings are relevant to conservation agencies that aim to share conservation related benefits for human wellbeing and for building relationships, growing positive perceptions and in so doing, building long-term support for conservation. Our results are especially relevant where benefit sharing arrangements have an environmental justice focus, specifically regarding promoting access to tangible resources within protected areas through processes that aim to address the negative impacts of historical practices involving forced removals of people, and restricted access policies based on race. Globally protected areas are facing challenges of illegal hunting/poaching especially where social relationships with nearest neighbours may be fragile, and we suggest that projects such as the one described in this study have the potential to reduce conflict by acting as a catalyst for enhancing people and parks relationships at a small cost to conservation.

3.8 CONCLUSION

Our study demonstrates that despite the Mopane worm harvest volumes being relatively small, and the harvesting seasonal, facilitating access for local neighbours to collect natural resources from protected areas such as the KNP has the potential to contribute positively to

material (food and income), psychological (learning), social (connections) and security (safe and legal) dimensions of participant and household wellbeing. We further highlight that such processes can positively influence perceptions of and relationships between protected area staff and neighbours through the building of social capital between actors and we believe this to have mutually beneficial outcomes. We further suggest that broad stakeholder perceptions can be managed with transparent communication. In order to further understand project induced change in conservation related perceptions, attitudes and actions, future research could explore multi-scale indicators, focussing on behaviour measurement specificity and including a deeper investigation of social learning and connectedness over a longer time frame. More specifically, our study has the potential to inform global debate on consumptive resource use from protected areas by demonstrating that when done sustainably (ecologically, economically and socially), such initiatives should be seen as a tool leading to environmental and societal sustainability. We view this in the context of catalysing restorative and distributional justice processes in and around parks such as the KNP, with a history of unjust access, benefit sharing policies and practices.

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3.11 APPENDIX

Structured questionnaire used to assess the social and economic impact of Mopane worm harvesting from the Kruger National Park, South Africa

CONSUMPTION OF MOPANE WORMS IN THE LIMPOPO PROVINCE

QUESTIONNAIRE

Please answer each question by drawing a circle around the appropriate number in a shaded area or by writing your answer in the space provided

A	Village	
B	Date	
C	Respondent	
D	Worms harvested in KNP	

SECTION A: MOPANE WORM HARVESTING

A1. How did you first hear about the Mopane worm harvesting in the KNP?

A2. What was your initial reaction to this news?

A3. What preparations did you have to make in order to participate?

A4. What did it cost you to participate (money and time? Other?)

A5. If you didn't participate, what would you have been doing on those days?

A6. How do you feel about having participated in the harvesting?

A7. Would you like to participate again if the opportunity comes along? Why?

A8. Were there any aspects that you were not happy with regarding the way the negotiation process, and then the harvesting was carried out?

A9. How did the rest of your family react to the fact that you were coming into KNP to

harvest worms?

A10. How did the rest of your community react to the fact that you were coming into KNP to harvest worms?

A11. Is there anything that you would like to recommend to us in KNP, that we could do to improve the way in which the harvesting is done?

A12. You harvested _____ worms from KNP this year. How many more worms did you harvest the rest of the season before and after the KNP harvesting? (PRA methods)

Total number of units harvested in season outside KNP	

A13. What did you do with the worms that you harvested?

A14. Of the total worms you collected this season, how many have you sold/will you sell? (PRA methods)

Total number of units that will be sold/have been sold	

SECTION B: HOUSEHOLD RESOURCE USE AND LIVELIHOOD STRATEGIES

B1. Do you have any livestock at your household?

Yes	1
No	2

B2. If so, please complete the following table regarding your livestock

Type	Number	Main use	Other uses	
Chickens				
Goats				
Sheep				
Cattle				
Donkeys				
Horses				
Pigs				
Other				
Other				

B3. Do you plant crops at your household?

Yes	1
No	2
In community gardens	3

B4. Crops at the household/in community gardens

Type	Indicate if you have this crop	Indicate if you sell this crop
Mangos		
Beans		
Muroho		

Tomatoes		
Cassava		
Maize		
Rice		
Groundnuts		
Onions		
Pumpkins		
Cabbage		
Paw paw		
Guava		
Spinach		
Sweet potatoes		
Other		
Other		

SECTION C: HARVESTER HOUSEHOLD INFORMATION

C1. Person that harvested the worms in KNP

Gender

Male	1
Female	2

Age

Marital status

Single	1
Married	2
Divorced	3
Widowed	4

C2. People living in the household

#	Age (yrs)	Gender		Regular monthly income (Rands)	Relationship to person interviewed
1 (person interviewed)		M	F		
2		M	F		
3		M	F		
4		M	F		
5		M	F		

6		M	F		
7		M	F		
8		M	F		
9		M	F		
10		M	F		
11		M	F		
12		M	F		
13		M	F		
14		M	F		
15		M	F		

C3. Please circle the head of the household above?

C4. Does your household have any other sources of income through year?
(This includes money sent by kids from afar, spaza shop etc.)

Source of income	Annual contribution

C5. Do you have an electricity connection at home?

Yes	1
No	2

C6. How much do you spend on electricity a month (Rands)?

C7. What is the main way that you cook your food?
(please rank the most important with a 1)

Firewood	
Electric stove	
Paraffin stove	
Gas stove	

C8. How often do you eat the following meat products in your household?

Beef	
Chicken	
Goat	
Sheep	
Mopane worms	
Other	
Other	
Other	
Other	

CHAPTER 4

It's not just about the cash – the social and economic impact of conservation related employment in the Kruger to Canyon Biosphere, South Africa

4.1 ABSTRACT

The national Environmental Monitor (EM) governmental programme aims to address challenges of unemployment and poaching adjacent to and inside conservation areas in South Africa. The programme uses an employment model to increase capacity for conservation while simultaneously improving human wellbeing. Historically, programme impact was measured by quantitative indicators, but our study used meetings, focus groups and semi-structured questionnaires to assess and develop indicators for both qualitative and quantitative impacts of the programme in an area where 19.5% of the EMs in South Africa are employed. We recorded positive tangible (e.g. cash, improved health and shelter) and intangible (improved self-esteem and personal image) wellbeing impacts, as well as an increase in the role that employees play as conservation ambassadors outside of the workplace. We attribute this to the unique programme approach that focuses on learning opportunities, and suggest that this has direct implications for conservation success globally as wildlife crime increases.

Citation

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Author contributions

- Swemmer LK– 72.5% (research lead, coordinated the research, wrote the manuscript)
- Buthelezi – 2.5% (research design, data collection)
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- Morale – 2.5% (research design, data collection)
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- Twine - 5% (supervisor, conceptual inputs, reviewed the manuscript).
- Swemmer AM – 2.5% (assistance with data analysis and interpretation)

4.2 INTRODUCTION

The primary mandate of protected areas is the conservation of biodiversity for its intrinsic (Ghilarov 2000) as well as utilitarian values (UNDP 2010; CBD 2011; SANParks 2018). Protected areas contribute various benefits (and costs) to society as a result of products that flow from ecosystem services (and disservices) including natural resources, capacity building opportunities, cultural products, employment and business opportunities, and infrastructure or service support (MEA 2005; Haines-Young and Potschin 2012; Swemmer et al. 2017). However, the complex history of many protected areas also includes restricted access policies alongside local negative impacts such as human wildlife conflict, and these have resulted in limited support for conservation endeavours in certain areas (Anthony 2007; Biggs et al. 2014; Swemmer et al. 2017). As a result, Protected areas (PA) have been exploring ways to share benefits more effectively both in striving for environmental justice (Cock and Fig 2002) and in order to build support for conservation (Swemmer et al. 2017; Hall 2019; Swemmer et al. forthcoming). Having local stakeholder support for conservation has become even more pertinent in the context of the relatively recent increase in the illegal wildlife trade that is threatening conservation areas across the globe (Wilson-Wilde 2010).

A recent framework developed by Swemmer et al. (2017) highlights the importance of understanding benefit flows, proposing that ecosystem services and disservices be included in benefit sharing assessments from protected areas, and that these services and disservices be seen as the processes giving rise to ecosystem products. The framework further suggests that ecosystem products only become benefits (or costs) when they are accessed by people and that this access results in tangible and/or intangible costs and/or benefits to the multiple dimensions of human wellbeing (as opposed to the benefits being the services or products themselves). The framework then suggests that it is the net impact of ecosystem products on human wellbeing that ultimately build or break value and vested interest in and pro/anti conservation behaviour towards biodiversity conservation. However, the above-mentioned

framework makes two major assumptions, neither of which have received significant attention in the benefit sharing literature previously: firstly, that ecosystem service and product flow from the biophysical template within and associated with protected areas has an impact on human wellbeing; and secondly, that net benefit distribution from conservation-related action leads to positive conservation-related outcomes in the form of value, vested interest, and positive attitudes and behaviour.

One of the most sought-after benefits from and expectations of conservation remains employment opportunities (Rademan 2004; Strickland-Munroe et al. 2010). Many areas adjacent to national parks in South Africa are typified by high unemployment rates, reliance on natural resources and dependency on social grants and subsistence agriculture (Pereira et al. 2014). The local economic contribution of some parks such as the Kruger National Park (KNP) has been estimated in the broader context of employment and business opportunities nationally and internationally (Saayman and Saayman 2006; Chidakel et al. 2020). However, less attention has been paid to understanding the direct and indirect (in some cases intangible) wellbeing impacts of conservation-related employment at a local level. Ironically, it is most likely at the local level where biodiversity related costs are normally felt, and where the most potential and need lies for building pro-conservation attitudes and behaviour. Ironically, most wellbeing assessments in the conservation sector have focused primarily on the hedonic or tangible, economic indicators (McKinnon et al. 2016) despite the acknowledgement that the eudemonic or intangible components of wellbeing can contribute a greater proportion of overall workplace wellbeing (Bartels et al. 2019). Furthermore, there is also little understanding if/how conservation-based employment influences perceptions, attitudes and subsequent behaviour of employees, their families, and their communities towards conservation areas.

Our study aimed to use a conservation-based employment model adjacent to the Kruger National Park in South Africa to assess firstly, whether conservation-based employment, expressed as an ecosystem product from the biophysical template within the area, impacts in a net positive way on the multiple dimensions of human wellbeing; and secondly, whether and to what degree the net impact of being employed in the conservation sector results in positive biodiversity-related outcomes. We believe that such an understanding would assist protected area managers globally to maximize the potential for conservation-related

employment schemes to maximize benefits, facilitate connectedness, build relationships and vested interest in conservation, and in so doing, contribute to conservation sustainability.

4.3 BACKGROUND TO THE ENVIRONMENTAL MONITOR PROGRAMME

Two concurrent national challenges in South Africa, namely high levels of unemployment in areas adjacent to protected areas (Matsika et al. 2013) and a steady increase in poaching of rhino (*Diceros bicornis* and *Ceratotherium simum*) since 2008 (Thomas 2010), resulted in the development of the Environmental Monitor (EM) Programme, a South African government initiative of the Department of Environmental Affairs falling under the Expanded Public Works Programme (K2C BR 2013). The programme deploys and pays for the salaries of EMs to increase the capacity of conservation-based institutions/partners for monitoring, patrols, data collection and environmental education, in and around conservation areas, with the partners covering operational costs (K2C BR 2013). Unemployed residents adjacent to protected areas are targeted for employment, with a total of 1,441 EMs deployed around the country at the time of the study, 20% of whom work in the Kruger to Canyons Biosphere (K2C) located in the Mpumalanga and Limpopo provinces of South Africa (**Figure 4.1**). The K2C links the environment and people through an extensive partnership network including private and provincial reserves. At the time of this study, there were 265 EMs employed in the K2C BR (48% male, 52% female, 83% youth and 1% disabled) working for 38 different host institutions including game reserves, research institutions, non-governmental organizations (NGOs) and community based organizations (CBOs), each hosting between one and 38 EMs, depending on needs, resources and EM availability. At the time of the study, the K2C EM management team was led by an overall coordinator, 4 Data Collators (DCs) to facilitate data capturing and a leadership group of 12 selected EMs (The *Maeba* Group) who function as links between the DCs and the rest of the EM staff, facilitated through monthly management meetings that encourage peer education, collective and social learning, capacity development and transparent communication between various levels of staff on the programme. The EMs are not employed permanently, with most being on 3 year contracts with a monthly salary of between ZAR3 129 and ZAR3427. All EMs engage in formal (accredited) and informal training (done by the DCs) with the aim of increasing their personal and work-related capacity and skills, to enable them to be more effective in the workplace and to empower them for their future careers. The purpose of this study was to

assess to what extent the Environmental Monitor (EM) Programme within the K2C Biosphere impacts on (1) wellbeing, including skills and capacity and (2) biodiversity.

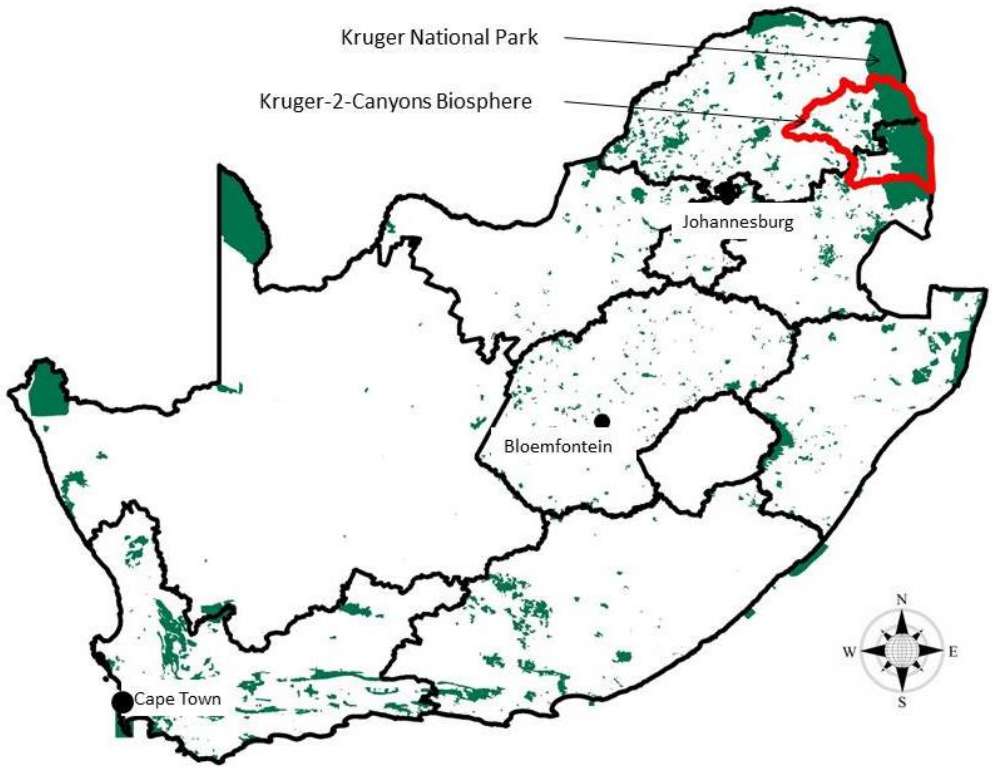

Figure 4.1 Location of the Kruger-2-Canyons Biosphere in the context of the Kruger National Park, South Africa

4.4 METHODOLOGY

The present study uses Narayan et al.'s (2000) definition of wellbeing, as "the state of mind and body that encompasses happiness, harmony and peace of mind". Wellbeing is characterised by five dimensions including material (shelter, food, water), physical (being strong, well and looking good), social (care for children, self-respect, peace and good relations, dignity), security (civil peace, safe and secure environment, physical security and confidence in the future) and freedom of choice dimensions (including being able to help others in the community) (Narayan et al. 2000; Swemmer et al. 2015). We used a mixed methods approach to collect, analyse and interpret both qualitative and quantitative data from workshops, semi-structured focus and a structured questionnaire consisting of both open-ended and closed-ended questions. The research approach and broad set of research questions

was collaboratively charted at a planning workshop attended by the researcher, the EM coordinator, four DCs and two EM managers (31 July 2014). Research themes were identified at a follow-up workshop with the same attendees (15 August 2014) based on personal observations of project impacts that had been made by the DCs and the EM managers over the course of the project. These were subsequently combined into a semi-structured interview. Interview questions were validated by the DCs at 4 focus groups with EMs representing host institutions from different geographical areas within the K2C biosphere (September to October 2014). Participation in focus groups was based on (1) host representation, and (2) participant availability. Availability was determined by approval from host institutes, since the focus groups were held during working hours. Focus groups were attended by 4, 6, 8 and 9 EMs respectively, involving in-depth discussions on main research themes. Qualitative data from focus group discussions were used to develop the structured questionnaire which was piloted with 10 EMs that were chosen based on their host institute (with the objective of getting as wide representation of host institutes as possible), convenience and availability. A questionnaire **(Appendix 4.9.1)** was administered to a total of 109 EMs, either by the DCs or the EMs themselves), with participation being based on (1) host institute representation, and (2) convenience, availability and willingness to participate. Focus groups and questionnaires were conducted in SePedi and XiTsonga and translated into English for the purposes of recording, collation and analysis.

Quantitative data were captured into MS Excel. Content analysis was applied to qualitative data, using open coding to identify themes and sub-themes, and captured in MS Excel (Vaismoradi et al. 2013). For human wellbeing, an approach including both theory and induction was used to identify and name wellbeing themes, as most of these are already well defined in the literature (Syed and Nelson 2015). The percentage of respondents noting positive and negative impacts on each wellbeing dimension at an individual, family and community level were plotted using MS Excel. Differences in the number of positive and negative responses were tested with a paired T-test for each theme by subtracting the number of negative responses from positive responses for each respondent. Sample size per theme varied as not all respondents answered all questions. A Pearson's Chi-squared test was used to test for differences in how often respondents spoke to their families about conservation.

The main researcher was the “gold standard” or “master” coder, with the EM coordinator serving as a reliability coder, coding 20% of the thematically coded data to establish an

interrater percentage agreement reliability index of 90.2% (Syed and Nelson 2015). The participatory approach strengthened the validity and legitimacy of the process (Anthony and Swemmer 2015). Participation in interviews and focus groups was voluntary, and participant and focus group identities and confidentiality were protected.

4.5 RESULTS

4.5.1 Demographics and livelihoods of Environmental Monitors and their families

Respondents were from 56 different villages and towns in the K2C area, representing 17 out of 38 host institutions (n = 109). Respondents were mostly single females with some form of tertiary education and a mean of 4.96 dependents each (range = 1 - 13; SD = 2.9). Households had had access to electricity for a mean of 14.3 years (range = 2 - 25 years; SD = 5.6 years), spending a mean of ZAR200 on electricity per household (range ZAR50 – 1,200; SD = ZAR103). Despite having access to electricity, most households used wood as their primary fuel source, with half of the respondents buying wood, at a mean rate of ZAR266 per household per month (range = ZAR13 – 840; SD = ZAR179.24). Most of the households planted crops, while about half of the households owned livestock and harvested natural resources (**Appendix 4.9.2**).

4.5.2 Social and economic impact of employment

Employment through the program contributed to the material wellbeing of EMs by making up 60% (range = 8 - 100%; SD = 25%) of the monthly income of participating households, compared to 16% from government social grants (range = 0 - 60%; SD = 15%) (n = 109) (**Appendix 4.9.3**). Cash income enabled respondents to purchase/pay for building materials, groceries, furniture, clothing, transport, school fees, rent, electricity and cell phone airtime. Most respondents (87%) were able to save money as a result of being employed, saving a mean of ZAR248.53 per month (range = ZAR0 – 2,000; SD = ZAR388.99) in the form of cash, [ii]stokvels, funeral policies and/or investments. Most respondent EMs had accounts at various retail outlets (64.2%), with most having opened the accounts since being employed as EMs (75.4%). The majority of these (80%) indicated that their EM salary slip made it

[ii] an informal savings pool or syndicate in which funds are contributed in rotation, allowing participants lump sums for family needs

possible for them to open their accounts, having either one (68.6%), two (21.4%) or three (10%) accounts each. Monthly account repayments were at a mean of ZAR362 (range = ZAR50 - 1,500; SD = ZAR300) per person. Most account holders experienced a variety of positive impacts on their material wellbeing as a result of having accounts (84%), including being able to buy items on demand without money (40%) especially for family members (31%). Other positive impacts included the EMs and their families being able to dress better (11%), being able to save money (11%), being able to buy furniture immediately by paying in monthly instalments (9%), being able to plan and stick to a budget (3%), and being able to do house renovations (3%). The few respondents who had experienced negative impacts from having accounts (13%) indicated that this was as a result of buying clothes under pressure (40%), having to buy things for family members (20%), not having enough money to buy groceries due to account repayments (20%) and having to ask family members to help to pay the debt (20%). For the EMs that did not have accounts (35%), the main reason for this included preferring to use cash for purchases (37%) and perceptions that accounts were unaffordable (21%), especially since repayments are challenging without having permanent employment, since the EM programme operated on a three year contract basis (21%). Only 5% of respondent EMs owned credit cards. Most respondents (66.3%) were able to improve on their family's and/or their own material wellbeing by making improvements to their homes in the form of extensions to existing houses (40.6%), fixing or refurbishing parts of their homes (33.3%), buying building material (15.9%), building new houses from scratch (8.7%), investing in property (1.5%) or furniture and/or appliances (1.5). As indicated by one EM, "[*being employed as an EM] helps us a lot because we have a house to sleep in".* Another said, *"[because of my job] I'm currently renovating my parents' house and built a room for myself. This had a positive impact on me and my family because I now have my own room. I no longer share with my mother".*

Overall, respondents noted a variety of positive tangible and intangible impacts as a result of being employed as EMs (**Table 4.1**). The majority of the positive impacts were related to improved social relationships between the EM and his/her family as well as the broader community. This was in the context of a feeling of being able to contribute to others, as well as a sense of greater respect and appreciation from the community and family towards the EM. Having a happy and positive outlook was perceived as an important positive impact as illustrated by one respondent who said *"[as a result of my job] I am a happy person, confident and beautiful always".* Respondents also listed independence as a benefit from their

employment, with one respondent saying *"[I am now] stress free, I am independent"*. Additional positive impacts included having greater economic stability, improved psychological state and self-image, learning new things, improved health and spiritual wellbeing, greater dignity and a sense of accomplishment. Most respondents (88%; n = 108) indicated that they felt that since being employed, they could voice their opinion if it differed from that of a larger group.

Table 4.1 The overall impact of being employed as an Environmental Monitor on respondent wellbeing (tangible and intangible), as measured in the Kruger to Canyon Biosphere, South Africa (n = 108)

Theme	Percentage of respondents (%)	Sub-theme	Percentage of respondents (%)
Social contributions and connections	31	Feel respected by family and community	23
		Take care of family	7
		Spend time with family at home, don't pay rent	2
		Meet people, share ideas	1
		Sense of belonging	1
Happy and positive outlook	25	Joyful/happy (emotional)	13
		Living a good life, changed my life, everything is good	9
		Stress-free	5
		Comfortable/satisfied	2
		No longer depressed	1
Gained independence	25	Self-sufficient, look after myself/free/independent	19
		Own room/stand/house	3
		Don't depend on my family, now feel comfortable around them	1
		Able to take care of myself	1
Greater economic choice and stability	23	Able to afford what I couldn't before (e.g. cosmetics)	13
		Have money, save more money	9
Positive perceptions of self - psychological	16	Self-confident, feel good about myself	16
Positive perceptions of self - physical	15	Beautiful (Physical)	7
		Wear/buy nice clothes	7
Learning new things	13	Capacity and knowledge for future	8
		Gained knowledge on environment and conservation	5
Improved health	3	Eat healthily	3
Spiritual wellbeing	2	Grateful	1
		Feel blessed	1
Greater dignity	1	Have dignity	1
Sense of accomplishment	1	Achieved personal goals	1
Changed behaviour	1	Changed behaviour	1

Almost all respondents (97%; n = 108) indicated that they had contributed positively to changes in their families' wellbeing since being employed by being able to supply their families with direct, household benefits in the form of furniture, clothing, shelter, electricity and groceries (36%); being able to support and meet their families' needs, helping their families with decision making and with their families depending on them (30%); families being proud of and respecting the EMs and seeing them as role models (13%); contributing to families happiness and satisfaction (13%); contributing to the financial stability of families (8%); being recipients of knowledge and learning (2%) and receiving benefits from increased access to environmental awareness and a healthier environment (2%), security (1%) and recreational space (1%). One respondent indicated that there had been no change in his/her family's lives as a result of employment. Most respondents (84%; n=107) indicated that there was a change in the role that they played in their families, for most of whom (95%) it was a positive change, attributed to being able to contribute financially towards buying food, clothing, doing building and buying electricity (69%), with some indicating that they had become the main income earner in the family (15%) and had since become involved in family decision making, were viewed as valuable, and were given increased responsibility (11%). Additional impacts included being able to eat healthily and well (4%), being a role model to siblings (3%), being a source of knowledge about nature (3%), being able to fix things that were no longer working (1%), enabling their families to contribute to funeral schemes (1%), and being able to open accounts (1%), resulting in happier families (1%), with one respondent indicating that *"They [my family] are happy because I am working and able to take care of them".* Only two respondents indicated that they perceived the change in their role in the family as negative, attributing this to not being able to use their money for themselves and having to buy various items for the home.

Most respondents (69%; n = 104) indicated that their employment had impacted on how their families were viewed by their communities, with reasons including getting more attention and respect, being treated with dignity and being appreciated (40%), being supportive and happy for respondents' families as they no longer needed to ask for assistance (19%), and taking the family more seriously (7%). Additional impacts included the community being comfortable to lend various items to the family, and the family being able to lend items to others (7%), the family no longer being perceived as "poor" (7%), an increase in strength of family ties (2%), and a belief that the family has a positive future (2%). On the other hand,

some respondents perceived their families to be viewed negatively by their communities as a result of them being employed, due to jealousies, suspicion and unhappiness (23%).

The positive impacts on families in turn led to positive impacts on the EMs themselves (n = 50), ranging from a sense of fulfilment being able to help their families (38%), a sense of responsibility to care for family and finances (10%), a sense of pride of themselves and a greater self-esteem (10%), a positive outlook on life (8%), a sense of empowerment being able to care for family members (6%), happiness at being able to be a role model and inspiration (6%) and satisfaction as a result of the respect and value felt by the family (6%) with reduced stress (6%) and a feeling of greater independence (4%). Additional reasons given included being able to participate in decision-making, being able to buy wood instead of collecting it, eating healthy food, being able to work in place of a parent, being able to spoil the children in the family and being able to help the family save natural resources (2% each). Most respondents also contributed to their communities by helping at various community projects (87%; n = 104) and based on their good understanding of the community context, were well placed to advise on future proposed projects. Respondents specifically contributed to needy groups such as orphanages, churches and the elderly (27%; n = 62) and shared knowledge with their community on environmental issues (19%) (**Appendix 4.9.4**).

Apart from 2% (n = 108) of the EMs who indicated that they enjoyed everything about their jobs, respondents mostly enjoyed the learning (both about the environment and life skills) that they experienced (31%), the people interactions (25%), conserving nature (25%), experiencing nature (23%), teaching and sharing knowledge (18%), achieving self-growth (10%), doing research (9%), and helping others (9%) (**Appendix 4.9.5**). Others enjoyed travelling and events (2%), cooking (1%), being located close to home (1%) and the administration aspects of their work (1%), with one respondent indicating, *"I get to do what I love, improve my knowledge and help people"*. Although 10% (n = 89) of respondents indicated that they did not have nor experience any negative or least enjoyable parts of being an EM, the most common negative experiences were those associated with repetitive, mundane work that did not involve learning anything new (19%) (**Appendix 4.9.6**). A number of respondents indicated that they did not enjoy the danger and safety risks associated with certain tasks (15%) while others did not enjoy conflict situations (10%), working in the bush (8%), the office (8%), doing environmental education (7%), using their own money for transport to get to and from work (7%), the discomfort associated with working in the bush

(5%), working with people (4%), and handling animals (2%). Single respondents disliked doing maintenance work, their working hours, monitoring, doing conservation activities and cleaning. Respondents indicated that the most challenging aspects of their work related to people engagement (44%; n = 96) including conflict situations (30%) and not having community acceptance and support for their work (14%). Additional challenges included difficult working environments (14%), not having sufficient capacity (10%) and resources (10%) to do their work, safety concerns (7%), financial challenges (5%), living conditions (4%) and feelings of isolation (2%) (**Appendix 4.9.7**).

All respondents felt that the selection process was fair, expressing feelings of happiness and excitement having been employed, with one respondent indicating *"It felt like a dream come true"*. Respondents all perceived their families to have been happy on hearing the news on their employment, apart from one respondent that didn't know. In contrast, respondents perceived their communities to have felt positive (55%), negative (30%) or neutral (15%) on hearing the news. Had they not been employed as EMs, most respondents (n = 108) would have been studying at school or a tertiary institution or training facility (29%), job hunting (29%), staying at home and doing chores (28%), doing other work or starting a small business (12%), volunteering on other community projects (11%) or they did not know (3%). Respondents most commonly did not have any suggestions to make the work more appealing (30%; n = 101), while some suggested a salary increase (11%), more uniform and name tags (10%), making the employment permanent (8%) or advertising at schools (5%) (**Appendix 4.9.8**). Most of the respondents (95%; n = 97) said that they would recommend the EM job to their friends and family, mainly because of the income that comes with the job (27%), so that their friends can also learn about nature and its importance (24%), to gain work experience which is seen as growth (11%) and to improve lives (10%) (**Appendix 4.9.9**).

More than half (60%; n = 100) of the respondent's experienced negative impacts on their domestic activities as a result of their employment, ranging from not having time to do household chores such as crop maintenance, having to hire someone to do their chores, as well as financial costs for airtime and transport (**Appendix 4.9.10**). Less than half of the EMs who owned livestock, experienced a change in their numbers of livestock since they were employed (41.2%), for whom 76.2% experienced an increase. The majority of the reasons given for the increase (60%) were attributed to employment-related positive impacts (purchasing more cattle, cattle breeding better due to being in better condition as a result of

better food and health care, respondents slaughtering fewer animals as a result of being able to purchase fresh meat, and employing a herder to care for the cattle).

4.5.3 Contribution of skills and capacity development

The respondents had participated in a mean of 2.7 formal training events (range = 1 – 6 formal training events; SD = 1.3 formal training events; n = 106) since being employed as EMs, with the training covering 25 unique topics, the training for which varied in intensity and length. The most commonly attended formal training event was a basic EM course, followed by a course on plant, bird and insect identification, Health and Safety and First Aid (**Appendix 4.9.11**). Most of the respondents (88%) indicated that this formal training had thus far helped them to do their work more effectively, with the plant, bird and insect ID course (32%) and the basic EM course (15%) being highlighted as the most useful to EM-type work. This was highlighted by one respondent who said, *"It has helped me with knowledge I didn't have before"*. Most respondents (52%; n = 63) did not feel that there were any improvements needed for the formal training whereas others suggested that courses should be certified (13%) and that they would like more training material (11%). Most respondents (81%; n = 104) indicated that they would like more formal training. For most, it was because they wanted to be able to protect themselves at work (49%), but also to learn new things, and increase their knowledge and capacity (23%), as well as to be able to stop poaching in their communities and in conservation areas (23%). Some respondents (15%) felt that more formal training would help them to know more about the subjects that they teach to the community with one respondent indicating, *"[I would like more] EE Training [so that] I can teach family, community and learners about the environment"*. Others felt that more training would help them to do their jobs better, make more informed decisions and be more passionate about what they do (7%). Respondents participated in informal training covering 33 unique topics, broadly categorized as either health and safety, environmental education or life skills. Most respondents found the informal training useful (90%; n = 91), with the training on HIV/Aids and time management being the most useful (27%) and the course on pregnancy was the least useful (17%) to them. For those who did not find all of the informal training events useful (10%), this was attributed to already having the knowledge that was presented (82%), the topic not being well presented (20%), the trainees needing more information on the topic (20%) or the training being irrelevant to the work they were doing (18%).

Most (92%; n = 105) respondents felt that they were more employable having worked on the EM programme, due to the knowledge, capacity and experience gained (56%), the certifications of formal training (14%) and having greater self-confidence (6%) (**Appendix 4.9.12**). As noted by a respondent, "*Since I became an EM I've gained knowledge that I can also use in future"***.** Most respondents (74%; n = 103) did not know anyone who had left the programme, but of those who did, the most common reason was salary related (48%), followed by greener pastures/better opportunities (30%), permanent jobs (19%), scholarships (7%) or the dissatisfaction with the EM job (4%). The most common job that was taken up after being an EM, was working for Statistics South Africa (38%; n = 12) followed by mining (23%), forestry (15%), working for a private environmental company (15%) and working in security (8%).

4.5.4 Positive and negative impacts on wellbeing

We recorded a wide variety of positive and negative impacts on multiple dimensions of human wellbeing (**Figure 4.2).** Most respondents accrued positive impacts on six of the wellbeing dimensions at the individual level, with families and communities accruing the majority of positive impacts on five and four dimensions respectively **(Figure 4.3**). In some cases these were direct impacts, while in other cases they were indirect as a result of a wellbeing impact on another stakeholder group that led to a secondary impact. This is illustrated one respondent who mentioned, *"[it gives me] great fulfilment that I can help my family financially"*. For individual respondents, families and communities there were significantly more positive than negative impacts for six, five and four of the seven wellbeing dimensions respectively (**Table 4.2**).

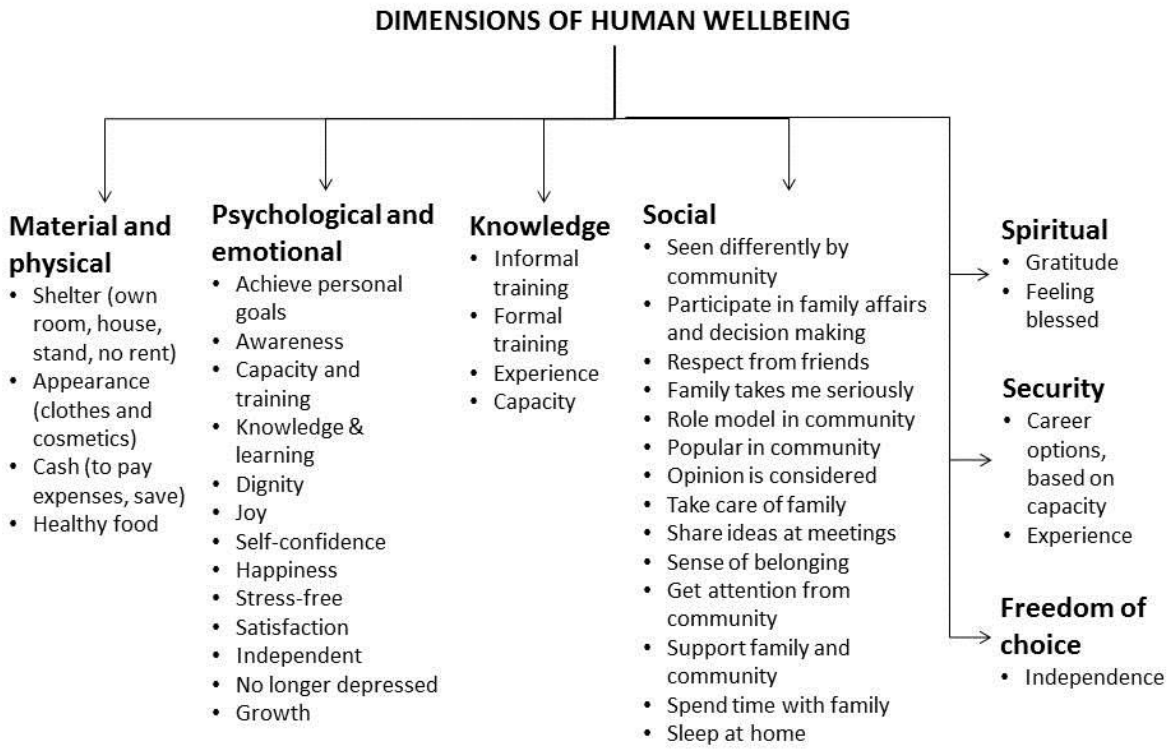

Figure 4.2 The contributions that employment through the Kruger to Canyons Biosphere Environmental Monitor programme in South Africa has made towards multiple dimensions of human wellbeing

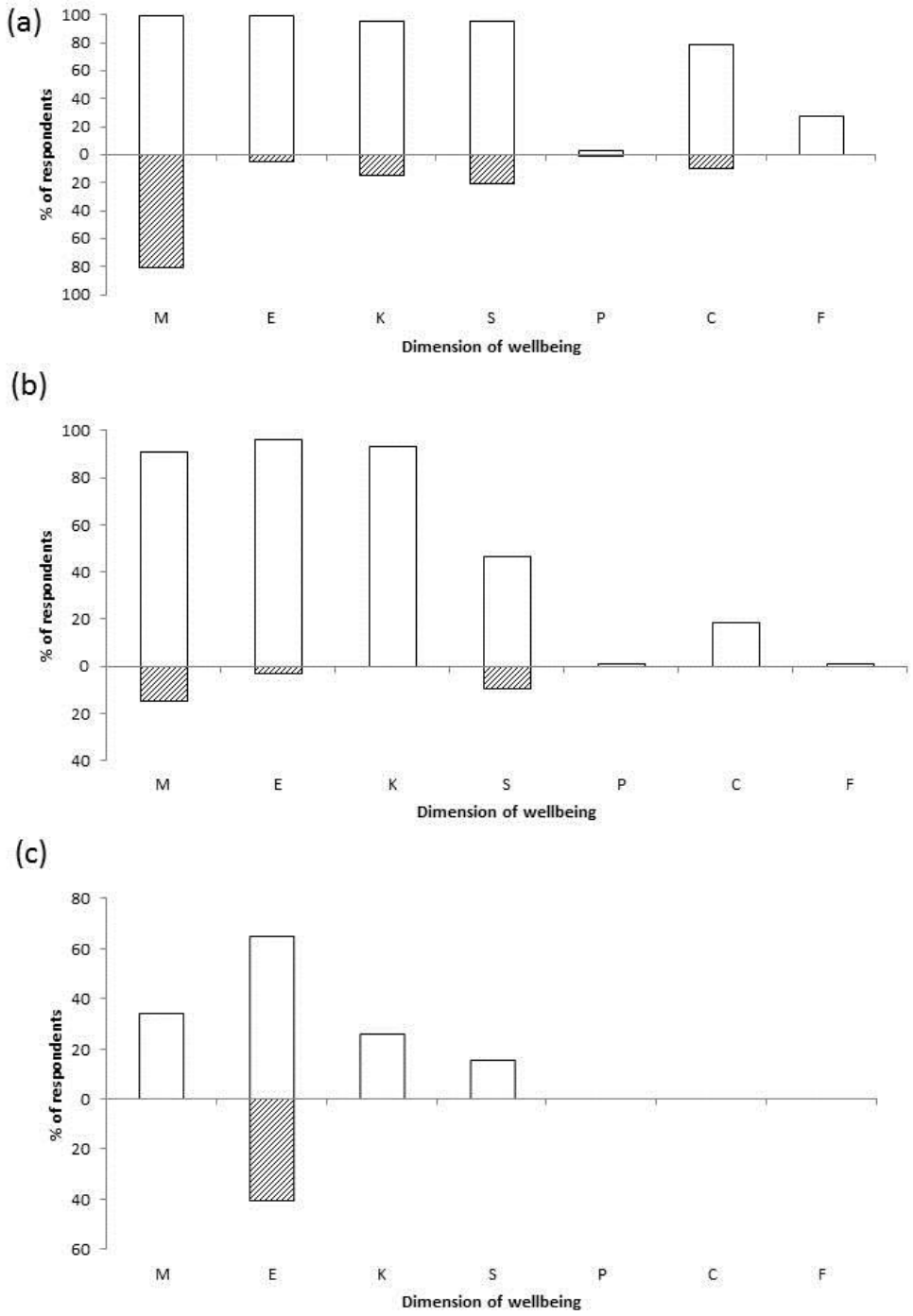

Figure 4.3 Respondents incurring positive and negative wellbeing impacts at the (a) individual, (b) family and (c) community level (clear bars indicate positive responses, lined bars indicate negative responses, M = Material wellbeing, E = Psychological wellbeing, K = Knowledge, S = Social wellbeing, P = Spiritual wellbeing, C = Security, and F = Freedom of choice

Table 4.2 Mean of differences between the number of positive and negative impacts per respondent, for each of the wellbeing dimensions, for questions related to individual, family or community impacts. Values in parentheses are standard error. Bold values are significant at $p < 0.05$ according to a paired-samples T-test.

Dimension of wellbeing	Individual	Family	Community
Material (M)	**2.45 (0.17)**	**1.73 (0.09)**	**0.34 (0.04)**
Psychological (E)	**3.92 (0.11)**	**1.43 (0.07)**	**0.20 (0.08)**
Knowledge (K)	**2.06 (0.08)**	**1.03 (0.04)**	**0.28 (0.04)**
Social (S)	**1.58 (0.08)**	**0.46 (0.07)**	**0.15 (0.03)**
Spiritual (P)	0.02 (0.02)	0.01 (0.01)	0 (0)
Security (C)	**0.87 (0.06)**	**0.18 (0.03)**	0 (0)
Freedom of choice (F)	**0.30 (0.05)**	**0.01 (0.09)**	**0 (0)**

4.5.5 Motivations for employment, perceptions of and impact on the conservation estate

Despite the EM programme having a strong biodiversity focus, respondents most commonly wanted the EM job because they needed the income (45%; n = 106). Only 20% originally wanted the job because of their love of nature as indicated by one respondent who said *"I always wanted to work in a nature reserve taking care of [the] environment".* Others wanted to get job experience (12%), for personal improvement, status and economic reasons (8%), to fund further studies (7%) or to help their communities (4%). The majority of respondents expected their jobs to enable them to help their families with their needs (28%) as indicated by one respondent who said, "*I wanted the job to take good care of my family"* (**Appendix 4.9.13**). Others wanted to be able to buy what they needed without depending on others (17%) or to be able to build a home (12%). The majority of respondents (59%) indicated that their expectations of the job were met completely, while some indicated that their expectations were only partially (24%) met or not met at all (17%).

Just over half of the respondents (54%) did not think that the conservation of biodiversity was important before they started working as EMs, attributing this mainly to not having information or knowledge about nature and its value, with one respondent indicating, *"It didn't mean anything to me, I didn't know the importance of it"* (**Table 4.3**). Most respondents' perceptions of biodiversity changed since being EMs (92%; n = 101), with the majority subsequently valuing biodiversity for the supply of provisioning services (food,

shelter and furniture). Almost all respondents talked to their friends and families about their jobs (98%), with the frequency of doing this increasing significantly after they were employed ($X^2 = 103$, $p<0.01$).

Table 4.3 Respondent perceptions of the role of biodiversity before and after working as Environmental Monitors in the Kruger to Canyon Biosphere, South Africa.

Rationale for pre-employment perceptions of the value of biodiversity conservation (n = 88)		**Percentage of respondents (%)**
Not important (51%)	Did not know or have information about nature conservation and its importance	35
	Had no meaning to respondent	11
	Thought trees would easily re-grow when chopped	2
	Never have been exposed to protected areas	1
	Felt that it was ok to kill animals for bush meat	1
	In the village people poach and use firewood unsustainably	1
	Thought it was just for people visiting parks	1
	Thought nature was fine and in good condition	1
Important (49%)	Knew about it and its importance	18
	Role nature plays in food, water and oxygen production	7
	Respect it, love it, have a passion for nature	6
	Know it through daily activities - trees protect people from storms, collect herbs, fire wood collecting, fishing	5
	Were taught to conserve	3
	Were taught it at school	3
	Studied nature conservation/did courses at SAWC	3
	For future generations	2
	Live near a protected area	2
	Learnt it from community meetings	2
	Family member works in park	1
	Knew it from history	1
	Thought about it as a career	1
Post-employment perceptions of the most important functions of biodiversity (n = 84)		**Percentage of respondents (%)**
Shelter, water, oxygen, shade, wood, food, furniture, for plants and animals		44
Our lives and all living things depend on biodiversity		15
For it to be clean, healthy and conserved		10
For the next generation to see and have		7
Refreshes our minds		6
Entertainment, watching wild animals and how they interact is interesting		5
To avoid species extinction		1
Trees - wind breaker		1
Cool down temperature		1
Life cycle - ecological systems		1
Sustainable use		1
Jobs - from tourism		1
Healthy environment for people		1

4.6 DISCUSSION

4.6.1 Household livelihoods

Our study demonstrated that households planted crops, owned livestock and harvested natural resources as livelihood strategies, typical of households in the study area (Pereira et al. 2014). Fewer EM households used wood as a primary fuel source (65%), than the 95% that has been recorded in other studies (Madubansi and Shackleton 2006), and the mean household income of EM households was typically 2 to 3 times higher than those recorded in other studies (Matsika et al. 2013; Perreira et al. 2014). Complete dependency on social grants was also lower in our study (32%) than in other studies (48% social grant dependency in Swemmer et al. in press). The EM households may hence not be a representative sample of most households in the study area, as a result of the relatively higher formal education levels of EMs compared to other community members, based on the fact that the minimum qualification level to be an EM is a grade 12 school pass. Wealthier households have been known to demonstrate higher levels of formal education (Woodhall 1987).

4.6.2 Multiple wellbeing dimensions

This study documented the direct economic impact of EM employment on the material components of human wellbeing at an individual and household level including income, expenditure and savings (McKinnon et al. 2016). The study also demonstrated the additional ways in which conservation-based employment contributes to the psychological (inter- and intrapersonal) dimensions of human wellbeing. This included aspects such as the role of social connections, an improved sense of personal image and happiness and the value of learning new things. These are important findings since psychological wellbeing contributes a larger fraction of overall wellbeing (Bartels et al. 2019). Although wellbeing dimensions can be assessed separately, their linkages are equally important, with many of the psychological benefits recorded, stemming from tangible benefits such as having access to cash.

We note both the similarities and differences between the most positive impacts versus the most enjoyable aspects of EM employment. Building social connections (resulting in social cohesion) contributes positively towards the social wellbeing of individuals and groups in and outside of the workplace (Narayan et al. 2000; Bartels et al. 2019), and we found this to be

true for the EM programme. In some parts of the world, the remote locations of protected areas has resulted in the breaking of social connections at a family and community level, when employees live far away from home for extended periods of time (Reid-Hresko 2018) and as such a focus on employee wellbeing would be well placed in the conservation sector.

Employment as EMs contributed to psychological wellbeing at an individual level, including having a happy and positive outlook on life, gaining independence and having an improved self-image. A relatively smaller fraction of respondents highlighted learning new things as a positive impact, in comparison to other impacts, while the majority saw learning as the most enjoyable aspect of the EM job. The emphasis on the enjoyment of learning reflects the value and appreciation of experiences that are linked to personal growth and capacity building. Outside of the conservation sector, learning new things in the workplace has been noted to boost self-esteem and confidence by fostering the ability to master tasks, enabling a feeling of independence and leading to personal growth (NHS 2019). Informal learning processes have been associated with higher wellbeing (Jenkins and Mostafa 2015) and learning with others develops social skills, extends social networks and promotes connections (Field 2009) that contribute towards social wellbeing. As such our results suggest that the unique approach taken by the K2C EM programme that facilitates multiple ways of learning and capacity building, incorporating hard and soft skills through on-going formal and informal training has impacted positively on multiple dimensions of wellbeing.

The majority of EMs fall in the youth category (ranging between 18 and 35 years old), and it has been documented that the youth have been shown to flourish in a working environment that promotes a sense of purpose and opportunity to make a difference in society (White 2015). Our study reflects this, in that respondents emphasized how they enjoyed elements of their jobs where they felt they were conserving nature through their actions, helping, teaching and sharing knowledge with others and contributing to the greater good.

4.6.3 Cost and benefit trade-offs

Being able to simultaneously compare costs and benefits across multiple dimensions of wellbeing is important for assessing net impact. This has been done by comparing quantitative indicators such as income versus financial costs, subjectively by comparing qualitative lists of positive and negative impacts (Swemmer et al. 2015), or by measuring

perceptions e.g. Participant willingness to participate in a project more than once (Swemmer et al. forthcoming). These methods have shortfalls such as the indicators not reflecting the realised impact as well as challenges in comparing the relative importance of impacts. This study developed a method to compare positive and negative impacts on the multiple dimensions of human wellbeing, providing a framework for protected area managers who are aiming to promote fair benefit sharing and are aiming to use benefit sharing as a tool to build support for conservation.

4.6.4 Conservation implications

Measuring and understanding the impact of conservation-based employment on the psychological dimensions of employee wellbeing has implications for the conservation sector globally. Where employment has had a broadly positive impact on the eudemonic components of human wellbeing, there is enhanced efficiency and productivity in the workplace, and subsequently an increase in contract-based performance at an individual and an organization level (Baptiste 2008). Furthermore, effective employee engagement through positive management relationships including a supporting and trusting environment increases employee wellbeing (Truss et al. 2013).

Increased psychological wellbeing in the workplace positively influences organizational citizenship behaviour (OCB), an individual's behaviour that is discretionary (performed by personal choice), not formally part of paid tasks and not directly or explicitly recognized by the formal reward system but promotes the effective functioning of the organization (Organ 1988). A similar concept is called contextual performance, defined as non-task related work behaviours that contribute towards the social and psychological aspects of the organization (Borman and Motowildo 1993). Contextual performance has four defining elements, namely, the persistence of enthusiasm, assistance to others, rule and prescribed procedure following and openly defending the organization's objectives (Borman and Motowildo 1993). Extra-role behaviour (ERB) is behaviour that attempts to benefit the organization and goes beyond existing role expectations (Organ et al. 2006). Interestingly, ERB includes whistle blowing, involving the reporting of one employee by another so that unethical and or illegal practices are brought to the attention of authorities (Organ et al. 2006).

Extra-contractual activities such as defending organizational objectives outside of the workplace and whistle blowing could be important for conservation, specifically in the context of increasing wildlife crime that is driving some species towards extinction (Tilman et al. 2017; SANBI 2018). In some cases people working for conservation agencies are involved in wildlife crime (Warchol and Johnson 2009), and in many cases, as is the case for the KNP, the majority of employees working in the park live in villages and towns close to the borders of parks (Swemmer et al. 2017). Unfortunately most conservation employees from local areas next to parks are earning low incomes, filling jobs that are labour related such as cleaning and gardening. It is unclear whether such work that involves such repetitive actions, is not challenging, does not involve work that contributes to a greater good and does not involve learning new skills will have a positive impact on eudemonic wellbeing, and result in conservation ambassadorship.

The majority of respondents applied for their EM jobs because they needed the money. However, once they were employed, many EMs (32%) enjoyed being able to play a role in conserving and experiencing nature, with most participants perceptions of the role of biodiversity changing. Having access to resources, knowledge and information about the role of biodiversity in human wellbeing, specifically in the role nature plays in the provision of ecosystem services, has been a major contributor in changing participant perceptions, and this suggests the important role that capacity building and environmental education can play in changing attitudes and behaviour. This impact was observed at an individual, a family and a community level with all sectors being more aware and knowledgeable on environmental issues postemployment. In talking to their friends and family about conservation, EMs are acting as conservation ambassadors away from the work place, demonstrating the potential for more conservation staff to be conservation ambassadors, with the correct information, management and leadership.

4.6.5 Research process

Almost all respondents were interested in getting feedback from this study, and although this can be a common observation in this type of study, it may also suggest that the participants felt empowered having contributed to the sustainability of their jobs, but also suggests that respondents felt a sense of ownership of this assessment, having been part of the process from

the conceptualization phase through to the interpretation of the results. As such, they have a sense of ownership of the process, and are invested in it. This is consistent with stakeholder engagement literature suggesting that co-developing ideas with the impacted party from the inception phase leads not only to buy-in, empowerment and co-learning but also to shared decision making and shared responsibility for the outcomes (Guijt and Gaventa 1998; Ostrom 1990). Important to note that this approach does have a potential negative trade-off in that respondents may have been tempted to respond in a manner that would have positively influenced their chances of future employment, or their relationships with their DC's. However, it was made clear before the interview that this would not be the case, and that they were requested to answer honestly and openly. We believe that the nature of the relationships between the DCs and EMs enabled the EMs to answer freely and honestly and as such we do not think that this compromised the research process, although it would be impossible to know for sure.

4.7 CONCLUSIONS

This study developed and tested a method to measure the positive and negative impacts of conservation-based employment in order to test an assumption that conservation-based employment has a net positive impact on human wellbeing. This was done by measuring and comparing the cost and benefit trade-offs across a range of tangible and intangible wellbeing dimensions, concluding that the K2C employment model has a net positive impact on participant, family and community wellbeing, with psychological wellbeing playing an important role. The study highlighted the importance of learning, and adds this as a seventh dimension of wellbeing. The study also tested whether and to what degree conservation-based employment contributes to conservation, concluding that improvements in workplace wellbeing have the potential to lead to increased productivity and increased organizational voluntary constituency. These findings are relevant to conservation areas around the globe in the current climate where resources for conservation are limited, and wildlife crime is becoming an increasing threat to conservation.

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4.9 APPENDIX

Appendix 4.9.1 Structured questionnaire used to assess the social and economic impact of the Environmental Monitor programme in the Kruger to Canyon Biosphere, South Africa

SOCIAL AND ECONOMIC IMPACT OF THE ENVIRONMENTAL MONITOR PROGRAMME

KRUGER TO CANYON BIOSPHERE RESERVE

QUESTIONNAIRE FOR ENVIRONMENTAL MONITORS

If you don't mind, we would like to talk to you about your job, mainly because we would like to get an idea of the social and economic impact that your job has on you and your family. It is really important to us that you are happy in your job and that you are benefiting as much as possible. In order for us to do this from our side, it is important that you be as honest as you can as you answer the questions so that we can get an accurate picture of the impact of your job. Our discussion/interview will probably take about an hour. There are no right or wrong answers. If you feel uncomfortable answering any questions you can skip them, and you are also welcome to stop the interview at any time.

Interviewer	
Location of interview	
Date of interview	
Interview code	

SECTION A: RESPONDENT INFORMATION

The first section contains basic questions about you and your job.

A1.	Respondant's name	
A2.	Place of residence	
A3.	Place of residence while working (if different from above)	
A4.	Type of EM	
A5.	Name of host institute	

A6. Marital status

Single	1
Married	2
Divorced	3
Widowed	4

A7.

Male	1
Female	2

A8. Please indicate if you have any of the following:

Certificate	
Diploma	
Degree	
None	

SECTION B: HOUSEHOLD AND LIVELIHOOD INFORMATION

This section contains questions about your household, the financial situation within your household, your households access to services such as water and electricity as well as your households use of livestock, crops and natural resources. This is important because we are interested in understanding the contribution that your employment makes to your household livelihood.

B1. People living in the household

#	Age (yrs)/ year born	Gender		Regular monthly income (Rands)	Type of work (incl. pension, child grant)	Relationship to person interviewed
1 (person interviewed)		M	F			
2		M	F			
3		M	F			
4		M	F			
5		M	F			
6		M	F			
7		M	F			
8		M	F			
9		M	F			
10		M	F			
11		M	F			
12		M	F			
13		M	F			
14		M	F			
15		M	F			

B2. Please circle the head of the household above?

B3. How many people from your house depend on your salary?

B4. Has your household size (no. of people) changed since you started working?

Yes	No

B5. If yes, please elaborate how and why.

B6. Does your household have any other sources of income through year?
(This includes money sent by family members from afar, spaza shop etc.)

Source of income	Monthly contribution	Source of income	Monthly contribution

B7. Do you have an electricity connection at home?

Yes	No

B8. When did your household get this electricity connection?

B9. On average, how much does your household spend on electricity a month (Rands)?

B10. What are the main (and other if appropriate) ways that your household prepares food?

Main	Other

Firewood	1	1
Electric stove	2	2
Paraffin stove	3	3
Gas stove	4	4
Other (spec.)	5	5

B11. If your hh uses wood, do you collect or buy wood? If buy, how much and how often?

Collect	1
Buy	2
Amount	R
How often	

B12. If you collect, how much time does your hh spend collecting per week?

B13. Has any of this changed since you started working (process and responsibility of collecting or buying and the time spent?)

B14. Where does your household access water from?

Taps in the house	1	Purchase			8
Tap in the garden	2		If purchase, how much (Rands)?	R	
Tap on the street	3		If purchase, how often?		

Collect from tank	4	Other? (spec.)	9
Collect from truck	5		
Collect from a river/stream	6		
Collect from a dam	7		

B15. How much time does it take your hh to collect water? And how often does your hh collect?

B16. How do you manage now that you are working? (has the responsibility of collecting water changed in the hh?)

B17. Are there times during the month when your hh does NOT have access to water?

Yes	No

B18. If yes, how often does this happen?

Daily			1
2'ce weekly			2
2'ce monthly			3
Other (specify)			4
Reason			

B19. How often does your hh eat the following meat products in your household?

Daily	3 times a	1'ce a	2ce a	1'ce a	Never/v

		week	week	month	month	rare
Beef						
Chicken						
Goat						
Sheep						
Pork						
Mopane worms						
Chiken feet						
Fish						
Bushmeat						
Other						

B20. Has the frequency that your hh eats meat changed since you started working?

Yes	No

B21. If yes, please elaborate

B22. Do you have any livestock at your household?

Yes	No

B23. If so, please complete the following table regarding your hh's livestock

Type	Number	Main use	Other uses
Chickens			

Goats			
Sheep			
Cattle			
Donkeys			
Horses			
Pigs			
Other			
Other			

B24. Who looks after your hh's livestock?

B25. Did this change when you started working? Yes | No

B26. If yes, please elaborate

B27. Have your hh's livestock numbers changed since you started working? Yes | No

B28. If yes, please elaborate

B29. Do you plant crops at your household?

B30. Crops at the household/in community gardens

Yes	1
No	2
In community gardens	3

B31. Who looks after your hh's crops?

B32. Did this change when you started working? How?

Type	Do you have this crop?	Do you sell this crop?
Mangos		
Beans		
Muroho		
Tomatoes		
Cassava		
Maize		
Rice		
Groundnuts		
Onions		
Pumpkins		
Cabbage		
Paw paw		
Guava		
Spinach		
Sweet potatoes		
Other		
Other		

B33. Do you or anyone from your household harvest any other natural resources from the bush/veld?

Yes	No

B34. If yes, please list the products as well as the frequency of harvest

No.	Species/type	Use	Harvest frequency	Use frequency

1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				

B35. Has your families harvesting and use of natural resources changed since you started working?

Yes	No

B36. If yes please elaborate

SECTION C: PERSONAL EMPLOYMENT AND SALARY INFORMATION

This next section aims to evaluate the contribution that your salary makes within the household in terms of expenses and knock on impact

C1. Please could you indicate your own personal average monthly expenditure on the following items:

	Item	Monthly expenditure
1	Groceries	R
2	Cell phone	R
3	Rent	R
4	School fees	R
5	Transport	R
6	Clothing	R
7	Furniture	R
8	Electricity	R
9	Building	R
10	Other	R
11	Other	R

C2. How did you cover these costs before you started working?

C3. How much of your income is spent on your personal goods (toiletries, clothes, airtime) versus items and goods for the whole family or the community? (% or Rand)

	Amount (R) or %
Personal	
Hh/family	

Community	
Other (pls specify)	

C4. Are you able to save any money on a monthly basis?

Yes	No

C5. If yes, can you indicate how?

	Yes/no	Cost	Notes (how)
Stokvel		R	
Funeral policy		R	
Cash savings		R	
Other		R	

C6. Were you participating in any of these prior to employment as an EM?

Yes	No

C7. If yes, which ones and how did you fund them?

C8. Do you have any accounts at shops?

Yes	No

C9. If yes, can you tell us some more about them?

Shop name	Did you open the account before or after you got your job?	Monthly payments

1			R
2			R
3			R
4			R
5			R

C10. Has having accounts had an impact on you and your family?

Yes	No

C11. If yes, please elaborate how - positive and negative if appropriate

C12. Was it easier to open an account with a job?

Yes	No

C13. Please elaborate why if yes.

C14. If you do not have any accounts, can you tell us why not?

C15. Do you have a credit card?

Yes	No

C16. Being employed in a job 5 days a week means you are not at home all this time. Has this impacted on things you would normally have done (looking after kids, gardening, fetching water etc.), and if so how? Who does these tasks for you now?

C17. Does your job cost you anything extra that you would not have needed to pay for before? E.g. transport, cell phone etc?

Yes	No

C18. If yes, please elaborate what and how much.

C19. Has your job enabled you to improve on your/your families houses in terms of building?

Yes	No

C20. If yes, please elaborate what building you have done, as well as how this has impacted on yourself and/or your family

SECTION D: IMPACT ON INTANGIBLE ELEMENTS OF WELLBEING

This section aims to evaluate the impact of the programme on your personal life, your happiness, and generally on yourself as a person.

D1. Think of that time before you were employed and tell me why you wanted the job when you heard about the vacancies?

D2. Think of the day that you were phoned/told that you had got the job as an EM. What did you expect would change in your life or that you would be able to do now that you were employed?

D3. If you think back to your expectations of the job, how does your actual job compare to what you were expecting? (which of your expectations were met and which were not met?)

D4. Look back on the time that you have been employed from your first day to now, and tell me about the changes that have happend in your life during this time, as a result of you being employed **(a) personally, (b) family/hh and (c) community**

D5. What projects are you currently involved in that benefit your community?

D6. Do you have any additional ideas for projects that your community wants or that you think could benefit them?

D7. Think of the time before you were employed, and about the role that you played in your family. Now think of the role that you currently play in your family. Has there been a change?

Yes	No

D8. If yes, can you explain what changes you have seen?

D9. How have these changes effected you personally? (can be positive and negative)

D10. Has your employment effected the way your family is viewed by the community? (pos or neg)

Yes	No

D11. If yes, can you elaborate?

D12. Please indicate if the following is "true" or "false" and explain your choice

	True/False
I feel I contribute to my own and my families wellbeing	

I feel I can participate in family and community discussions and decisions	
If my opinion differs from those in my community or family, I can voice my opinion	

D13. What do you enjoy most about your job and why?

D14. What elements of your job have helped you the most in your life todate and why?

D15. What elements of the job do you enjoy the least and why?

D16. What are the most challenging parts of being an EM to you personally?

SECTION E: IMPACT OF TRAINING AND CAPACITY BUILDING

This section aims to evaluate the impact of the EM training programmes. Capacity building is an important part of the programme so we want to assess how well it is working. We will ask questions about the training programmes you have participated in.

E1. What *formal* training have you participated in todate? Please tick.

1	Basic EM course at SAWC	
2	CARA training in cultural heritage	
3	FGASA training	
4	WESSA EE training	
5	First Aid	
6	Health and safety	
7	Basic Ecology - Wits	
8	Plant, bird and insect identification - Wits	
9	Dashboard CBNRM training	
10	Resource Africa Rhino Ambassador training	
11	Other (pls. specify)	
12	Other (pls. specify)	
13	Other (pls. specify)	

E2. Has any of this training helped you to do your job more effectively?

Yes	No

E3. If yes, which ones and how have they helped you?

E4. Can you recommend any improvements on the current *formal* training that will help you to do your job more effectively?

E5. Do you think you need any additional *formal* training to do your job better?

Yes	No

E6. If so, what and how will it help you?

E7. Which 1 of the 3 themes of *informal* training by your data collator has been the **(a)** most and the **(b)** least useful to you?
Please tick and give reasons why

	(a) Most useful	Reason	**(b)** Least useful	Reason
Life Skills				
Health and safety				
Environmental Education				

E8. Within each theme, which specific aspects have been the most and the least useful to you and why?

	Indicate the three most useful	Indicate the three least useful	Reason why
Life skills			
HIV/Aids			
Personal goal setting, skills and action plan			
Facilitation and communication skills			
Leadership development skills			
Personal financial management			
Participation in community structures			
Conflict management skills			
Health and safety			
On the job:			
Time management			
Pregnancy			
K2C Code of conduct			
Safety awareness (PPE, vehicle, tools)			
Water purification			
BSP/K2C health and safety revised standards			
Pollution (standards)			
Conflict management skills			

Off the job:			
Motivation (self esteem)			
HIV/Aids			
Substance abuse awareness			
Peer pressure			
Biharzia and other related diseases			
Malaria talk			
Pollution Awareness			
How to handle conflict in the work place			
Environmental Education			
Ecology - how things are connected and interrelated			
Awarness on protecting and conserving wetlands			
Water-wise and conservation			
Biodiversity awarness			
Combating climate change//cc mitigation			
Alien plant control measures (awareness)			
Importance of the catchment system			
Waste management awareness			
Mammals of South Africa and their importance			

E9. If there anything you would like to suggest regarding the above training that would improve or make the training more effective, please elaborate here:

E10. Is there any additional training that you don't get exposed to that you think would make you more effective in your job?

Yes	No

E11. If yes, please elaborate

E12. Is there any additional training on softer issues that you would like to spend more time on that would help you in your personal life?

Yes	No

E13. If yes, please elaborate

E14. Do you think that you would be able to get a job easier in the future having been part of the EM programme?

Yes	No

E15. If yes, please elaborate

E16. Do you know of anyone who has left the programme?

Yes	No

E17. If yes, why do you think that they left?

E18. If they are working elsewhere, do you know what they are doing, and if so, please elaborate?

SECTION F: IMPACT ON BIODIVERSITY CONSERVATION

A main objective of the EM programme is to contribute to biodiversity conservation. This section aims to assess how the programme has contributed to biodiversity indirectly through you as conservation ambassadors.

F1.	Think of the time before you were employed. Did you think that conserving biodiversity was important?	Yes	No

F2. Please elaborate why

F3.	Since being involved in the Em programme, has your perception of the value of biodiversity changed?	Yes	No

F4. What do you think are the most important functions of biodiversity for people and animals?

F5.	Do you talk to your friends and family about your job?	Yes	No

F6. If yes, which parts do you talk to them about?

F7. How often do you talk to your family and friends about any aspects relating to conservation or biodiversity now and before you got your job? (please tick)

	Now	Before job as EM
Every day		
1'ce a week		
1'ce a month		
1'ce a year		
Never		

SECTION G: SELECTION PROCESS

G1. How were you selected to participate in the EM programme?

G2. How did you feel about being chosen?

G3. Do you think the selection process is fair?

Yes	No

G4. How did your families feel about you being selected?

G5. How did the rest of your community feel about you being selected?

G6. Can you recommend any ways in which the selection process can be improved?

G7. Did you know about K2C before you were selected?

Yes	No

G8. If yes, how did hear about them?

G9. If you were not working in this job, what would you be doing? (e.g. at school etc?)

SECTION H: GENERAL COMMENTS

H1. Is there anything specific that you would suggest be changed with the EM programme to make it better and to make the job more appealing to others?

H2. Would you recommend the EM programe to any of your friends who were looking for work?

Yes	No

H3. If yes, please tell us why

H4. The results from this study will be written up in both a detailed reprt and shorter summary. Your Dc will give you feedback directly, but please indicate if you would also like to receive copies of the reports?

Detailed report	
Short report	

Thank you very much for your time completing this questionnaire :)

Appendix 4.9.2 Baseline demographics and livelihood strategies of environmental monitors in the Kruger to Canyon Biosphere, South Africa (n = 109).

Main category	Sub-category	%
Gender	Female	74
	Male	26
Marital status	Single	84
	Married	14
	Divorced	1
	Widowed	1
Formal education	Tertiary qualification	73
Household heads	EMs heads of their households	17
Fuel use	Have access to electricity	99
Wood	Use wood as a primary fuel source	65
	Households buying wood	50
	Households collecting wood	44
	Households collecting and buying wood	6
Water access	Communal tap	45
	Tap in the house	19
	Tap in the garden	15
	Boreholes	5
	Tanks	4
	Trucks	4
	Purchasing	4
	Collecting from streams, wells or other sources	4
Crop production	Plant crops	89
Livestock ownership	Livestock owners	54
	Chickens	56
	Cows	28
	Goats	8
	Pigs	8
Natural resources	Did harvest	43
	Did not harvest	57
	Number of species harvested (% of respondents)	1 (72)
		2 (19)
		3 (7)
		4 (2)

Appendix 4.9.3 Income, expenditure, savings and debt of Environmental Monitor households in the Kruger to Canyon Biosphere, South Africa (n = 109)

Main category	Sub-category	Value
Monthly income	Total	Mean = R 6,493 (range = R2,600 - R36,227; SD = R7,381.44)
	EM salary	Mean = R 2,844 (range = R2,600 - R4,000; SD = R247.23)
	Social grants	Mean = R 872 (range = R0 - R4,320; SD = R838.52)
Monthly expenditure	Building	Mean = R 1,210 (range = R200 - R5,000; SD = R1,041.90)
	Groceries	Mean = R 866 (range = R200 - R2,500; SD = R413.98)
	Other	Mean = R 599 (range = R100 - R2,500; SD = R560.24)
	Furniture	Mean = R 483 (range = R50 - R1,000; SD = R227.96)
	Clothing	Mean = R 447 (range = R50 - R1,500; SD = R304.08)
	Transport	Mean = R 288 (range = R20 - R1,670; SD = R268.86)
	School fees	Mean = R 288 (range = R70 - R2,000; SD = R409.69)
	Rent	Mean = R 208 (range = R200 - R250; SD = R20.41)
	Electricity	Mean = R 187 (range = R50 - R500; SD = R108.26)
	Cell phone	Mean = R 127.08 (range = R12 - R700; SD = R109.79)
	Total	Mean = R 2,558 (range = R 805 – R7,512; SD = R1,199.87)
Monthly savings	Saving households (n = 44)	Mean = R 629.88 (range = R5 - R2,000; SD = R378.40)
	Stokvel* participants (n = 53)	Mean = R 388 (range = R100 - R1000; SD = R252.93)
	Funeral policy owners (n = 29)	Mean = R 138 (range = R5 - R400; SD = R80.47)
	Cash savers (n = 57)	Mean = R 513 (range = R100 - R2,000; SD = R390.66)
	Investment (n = 1)	R 200

*an informal savings pool or syndicate in which funds are contributed in rotation, allowing participants lump sums for family needs

Appendix 4.9.4 Work related changes observed in the lives of the communities in which Environmental Monitors working in the Kruger to Canyon Biosphere, South Africa (n = 62)

Changes in lives of communities as a result of EM being employed	**Percentage of respondents (%)**
Contributions to needy groups (children, elderly, orphans, churches)	27
Increased knowledge on environmental issues (poaching etc.)	19
EM is networked and well-known, which helps community	13
Funeral contributions	11
Increased knowledge which has led to increased environmental protection/action (decreased deforestation and littering)	10
Benefit from EMs knowledge, include EM in decision making- helps community	10
Happy for EM	6
Schools and teachers benefit from EM knowledge	3
Community feels jealous and has animosity towards EM	3
Decreased unemployment rate	2
EM purchases water for the community	2
EM helps to develop projects that employ people	2
Contribute to stokvels	2
Changed lifestyle in community	2
No impact	2

Appendix 4.9.5 The most enjoyable components of working as an Environmental Monitor in the Kruger to Canyon Biosphere, South Africa (n = 108)

Theme	Percentage of respondents (%)	Sub-theme	Percentage of respondents (%)
Learning	31	Learning - broadly, gaining experience	6
		Learning - about nature and environment	19
		Learning - seeing animals for the first time in real life	3
		Learning - life skills, computers	5
People interactions	25	Working in and around the community, community meetings, working with people, talking to people	9
		Households surveys	5
		Training - meeting new people	1
		Teamwork	3
		Working with people, including farmers	6
		Listening to people	1
Conserving nature	25	Conserving nature	9
		Sweeping, removal of snares	4
		Security - road blocks, catching thieves, gates	2
		Contributing to anti-poaching	3
		Fence or foot patrol	7
Experiencing nature	23	Working in the bush, love wildlife and animals	20
		Car patrol at night, see animals at night	1
		Game drives	1
		Field work	1
Teaching and sharing knowledge	18	Teaching/sharing knowledge	6
		Guiding	1
		Environmental Education, working with children, changing mindsets	7
		Working in vegetable garden	3
Self-growth	10	Self-growth and self confidence	8
		Respect from community	1
		Having responsibility	1
Research/monitoring specific themes	9	Research, collecting data	3
		Camera trap monitoring	1
		Grass biomass measuring	1
		Cattle patrols and inspection at dip tanks	3
		Research on insects and beetles	2

Helping others	6	Donating food to my village	1
		Helping people and community to improve	2
		Having a role to play in my family and community	3
Everything	3	Everything	3
Travelling and events	2	Travelling and events	2
Cooking	1	Cooking	1
Location of job	1	Working close to home	1
Administration	1	Office work	1

Appendix 4.9.6 Least enjoyable parts of being an Environmental Monitor in the Kruger to Canyon Biosphere, South Africa (n = 89)

Theme	Percentage of respondents (%)	Sub-theme	Percentage of respondents (%)
Boring, don't learn anything, repetitive	19	Gate security – boring, don't learn anything	9
		Not being busy	1
		Doing the same thing over and over is boring	2
		Recharging camera batteries - doesn't challenge me	1
		Anything we do that doesn't teach us anything, and doesn't challenge us	7
		Fence or foot patrol, we don't learn anything	2
Safety and danger	15	Mistaken to be a spy	3
		Rhino poaching - puts us in danger	3
		Going to the reserve - we are scared of the animals	2
		Doing night patrol - we have no guns	**1**
		Rural patrol - especially along river, its not safe	2
		Working near snakes	1
		Working in veld without protective clothing	1
		Things that bite us	1
Conflict	10	Gate security - people get angry when we search them	9
		Criticism	1
		Ignorant people	1
None	10	None	11
Field work – bush related	8	Working in the bush	2
		Bush clearing	2
		Working with and learning about animals - EMs should be working with communities	1
		Fire and burning as it can cause damage	1
		Site patrol	1
		Vegetation	1
Office work	8	Writing assignments	2
		Reception duties	2
		Theory	1
		Data entry	1
		Office work	1
		Insect ID – e.g. microscope work	1
Environmental education	7	Teaching about Environmental Monitors	3
		Vegetable garden work	2
		Educating people	1

		Environmental Education games	1
Financial cost	7	Using lots of our own money for transport for work	8
Discomfort	5	Fence or foot patrol, its long	2
		Sweeping for snares and walking far - if its very hot	2
		Having to wear boots - doesn't look nice	1
		Doing night patrol - its cold and we don't have warm uniform	1
Working with people	4	Meetings - when other people don't share ideas	1
		Household questionnaires	1
		Workshops	1
		Talking and discussing with people	1
Don't know	2	Don't know	2
Handling animals	2	Dog vaccinations	1
		Handling animals	1
Maintenance work	1	Maintenance work - would rather be in the bush	1
Working hours	1	Marula project - have to wake up at 3 to collect fruit	1
Monitoring	1	Monitoring	1
Conservation	1	Saving the environment	1
Cleaning	1	Cleaning	1

Appendix 4.9.7 The most challenging parts of being Environmental Monitor in the Kruger to Canyon Biosphere, South Africa (n = 96)

Theme	Percentage of respondents (%)	Sub-theme	Percentage of respondents (%)
Conflict, people engagement	30	Household surveys - get insulted, chased away, its very hot	14
		Community expectations - people need so much that I can't deliver on	3
		Interaction with rhino poachers: criticize us if meet them or go to their houses	5
		Working with people who need to be dragged along	2
		Mistaken for being an informer	2
		Interviewing people about rhino poaching	1
		Working with farmers	1
		Meeting with people especially if they are discouraging	1
		Difficult to approach someone in the community when they are doing wrong	1
Community acceptance and support	14	Public that don't want to change despite the EE outreach	3
		In the early days, the community didn't take us seriously, without our uniform	2
		Working with community - getting no support or cooperation	3
		Answering to the community not ourselves	2
		CEBA - people take time to adapt	2
		Being undermined by the community when doing EE & community engagement	1
Working environment	14	Working with grasses and trees	2
		Hard labor - not very fit	2
		Travelling	2
		CEBA - planting trees is hard	2
		Lots of assignments from unearth	2
		Restoration project	1
		Working with ranger	1
		Working with fire	1
Capacity to do job	10	Tracking down poachers in the reserve	1
		Knowing all areas of the reserve, it is very big	2
		Sweeping for snares - don't always know where to start	2

		Working at the gate - don't understand the job	1
		When I get asked questions that I don't know and have to research	1
		Having pledged myself to protect resources	1
		Learning something new	1
		Dealing with pollution and rhino poaching	1
Lack of resources/support to do job	10	Not having protective clothing (e.g. bush clearing)	4
		Communicating with the community - not enough resources and only few EMs	3
		Lack of tools - books for plant ID	1
		No support from host	1
		Lack of teaching resources	1
Nothing	10	Nothing is challenging about the job	10
Safety	7	Safety from and fear of snakes - makes sweeping difficult	2
		Patrolling in reserve without a ranger or security, day or night	3
		Monitoring animal behaviors as was scared of animals, but not any more	1
		Patrolling - poachers threaten to kill us	1
Financial	5	Low salary	4
		Saving for my studies	1
Living conditions, working hours	4	Working over-time, knocking off late	1
		Being away from the family for the whole week	1
		Not having own room - no privacy, too crowded	2
Isolation	2	Not knowing what other EMs are doing	1
		Working in my community and not going out places	1
Don't know	1	Don't know	1

Appendix 4.9.8 Suggestions by the Environmental Monitors what would make the job better and more appealing to others, Kruger to Canyon Biosphere, South Africa (n = 101)

Suggestions for improvements to job	**Percentage of respondents (%)**
Nothing	30
More money	11
Provide with another uniform and name tags	10
Permanent jobs	8
Lecture at schools to tell them about the programme	5
More projects for more jobs and development, expansion of programme	5
Engage, interact more with community on environmental issues	4
Empower with more environmental knowledge so they can present with confidence to community	3
Transport money	3
learning exchange with other hosts	2
More training	2
Access to computers	2
More working equipment	2
Plant more trees	2
Educational venue at game reserve	1
Advertise posts	1
Formalise training	1
Must have specific jobs as sometimes don't know what to do	1
Fewer assignments, very tiring	1
Marketing in community - roadshows, word of mouth, flyers	1
Take kids on game drives once a month	1
No more age specific selection	1
Not such a focus on females	1
More practical's	1
Communication	1
Continue current contracts for longer	1

Appendix 4.9.9 Reasons why Environmental Monitors would recommend their jobs to friends and family, working in the Kruger to Canyon Biosphere, South Africa (n = 97)

Reasons why EMs would recommend this job to their friends and family	Percentage of respondents (%)
Money, people need jobs to help them at home with themselves and their families, there is shortage of work and people need to be uplifted	27
Learn about nature and its importance	24
Gain work experience which is growth	11
The job gives hope to people, improves their lives, and makes a positive change to lives	10
It is an interesting and good job, its stable and is a good programme	9
They can help us to look after nature	7
Training and certificates	6
Gain knowledge	5
It helps to understand and help the community better	4
Exposure to new opportunities	4
Its for more than the money - its to get to understand life and its challenges, and how to develop as an individual	4
Learning and knowledge, we learn so much in this job	3
Gain respect	2
I want my friends to have knowledge about what I do	2
It’s a good opportunity for the youth	2
They can have real jobs as opposed to wasting time on getting lots of qualifications	1
They are staying at home doing nothing	1
We learn important work ethics	1

Appendix 4.9.10 Direct, work related negative impacts experienced by EM households working in the Kruger to Canyon Biosphere, South Africa (n = 100)

Type of impact	**Details of impact**	**Value**
Negative impacts	Households experiencing negative impacts	60%
Type of negative impact	Change in time when chores/other activities are done (after work, on weekends, during holidays)	32%
	Someone else in family has to do chores	30%
	No one to look after children	20%
	No time for family and children	19%
	No time for chores	9%
	Hire someone to do chores	2%
Monthly costs	Households incurring additional costs	68 %
	Financial value	Mean = R330.94 (range R12 – R1,400; SD = R242.85)
	Type of costs	
	Transport	R341.90 (range = R50 - R1,400; SD = R257.78; n = 36)
	Additional groceries	R400 (n = 1)
	Airtime	R143.56 (range = R12 – R300; SD = R113.83; n = 9)
Livestock production	Change in person looking after livestock	18%
	Type of change	
	Can afford to pay someone else to look after them	57%
	A family member looks after them	29%
	No one looks after them	14%
	Change in livestock numbers	**%**
	Increase	
	Breeding	29
	Purchased some as a result of having a salary	24
	Healthier as have more food and medicine	18
	Able to buy meat, so don't eat own livestock	12
	Unknown	12
	Could afford to pay a herder to look after them	6
	Decrease	
	Ate some, some were stolen	25
	Disease	25
	Incorrectly dosed on drugs	25
	Theft	25
Impacts on crop	Gardens were looked after by a family member previously	72

production	Respondents looked after gardens previously	24
	Change in person looking after crops once EM employed	30
	Type of change	
	Have more resources to manage crops better (tractor, fertilizer etc)	40
	Don't have enough time to help with crops	27
	Family member looks after crops	13
	Hired help	7
	Crops getting damaged by goats	7
	Don't plant as much as before	7
Impact on wood collection	Households impacted	39
	Type of change	
	EM buys or contributes towards buying wood	39
	Someone else collects wood	4
	Collect and use less wood	17
	Buy more electricity	17
	Can buy more wood, so use more	9

Appendix 4.9.11 Value of formal (n=106) and informal (n = 91) training participated in by Environmental Monitors working in the Kruger to Canyon Biosphere, South Africa

Formal training	**Respondent participation (%) n = 106**	**Respondent perception of most useful (%) n = 78**
Basic EM course - SAWC	31	15
Plant, bird and insect ID - Wits	27	32
Health and safety	21	10
First aid	19	9
Basic Ecology - Wits	15	9
Unearth training	12	5
WESSA EE	10	9
FGASA	10	12
Fire arm	9	1
Fire fighter	8	3
AUP Protrack	8	1
Resource Africa Rhino Ambassador training	6	5
CARA	5	1
CBNRM - dashboard	3	1
Hand to hand contact	3	3
Leadership - EE Field ranger	3	1
Cybertracker	2	0
Tree and alien plants ID	2	6
Green Economies	2	0
Hospitality/tourism	2	0
None	2	0
Birdlife	1	0
Ecotraining	1	0
K2C EM Monthly life skills development	1	0
Planting vegetables	1	0
All of them	1	0
Informal training	**Most useful (%) n = 91**	**Least useful (%) N = 75**
HIV/Aids	27	16
Time management	21	5
Personal goal setting, skills and action plan	18	1
Personal financial management	18	1
Leadership development skills	15	5
Alien plant control measures (awareness)	13	3
Conflict management skills	12	8
Waste management awareness	11	4
BSP/K2C health and safety revised standards	10	1
Safety awareness (PPE, vehicle, tools)	9	0

Pollution Awareness	9	4
All of them	9	0
Facilitation and communication skills	8	3
Participation in community structures	8	3
Mammals of South Africa and their importance	7	0
Ecology - how things are connected and interrelated	4	1
Water-wise and conservation	4	9
Importance of the catchment system	4	1
K2C Code of conduct	3	0
Water purification	3	1
Motivation (self-esteem)	3	0
Peer pressure	3	4
Awareness on protecting and conserving wetlands	3	1
Biodiversity awareness	3	1
Combating climate change//cc mitigation	3	1
Pregnancy	2	17
Pollution (standards)	2	1
Malaria talk	2	5
How to handle conflict in the work place	2	1
Life skills	2	3
Team Building	1	0
Bilharzia and other related diseases	0	3
Substance abuse awareness	0	1
None	0	61

Appendix 4.9.12 Perceived reasons the Environmental Monitors would/would not get jobs easier having been employed as Environmental Monitors working in the Kruger to Canyon Biosphere, South Africa (n = 99)

Reason for getting a job easier since working as an EM	**Percentage of respondents (%)**
General knowledge, capacity and experience	56
Formal qualifications (eg. Certificates)	14
Self-confidence	6
Report writing skills	3
Exposure to people and networking	3
Better communication skills	2
Environmental knowledge, capacity and experience	2
Skills from working in a team	2
EM work is perceived to be important in SA	2
Managerial experience	1
Poacher tracking skills	1
Public drivers license - PDP	1
Reserves know the programme	1
Reason for not getting a job easier since working as an EM	**Percentage of respondents (%)**
Jobs hard to find	1
Don't always get certificates for the training	1

Appendix 4.9.13 Expectations of what would change once being employed as an Environmental Monitor in the Kruger to Canyon Biosphere, South Africa (n = 106)

Expectations of what would change once employed	**%**
Help family with their needs (food, clothing)	28
Buy what I need without depending on others	17
Build a home	12
Experience and exposure to opportunities, permanent job, networking, learning	9
Take care of self, self-image, confidence	6
Money/Income	6
Save for and further my studies	5
Know more about and help nature	5
Save school money for kids, better schools, lunch money	4
Change my life and the life of people around me, positive outlook on future, life is easier	3
Save money	2
Eat healthy food (me and family)	1
Help my community through projects	1
Happiness	1
Work as a tourism officer	1
Work from home	1

CHAPTER 5

It’s not just about the numbers - study synthesis and discussion

5.1. INTRODUCTION

As human populations increase, so does the pressure on the natural environment to supply natural resources to sustain life. Making sustainable trade-offs between conservation and development becomes increasingly important, as conservation is expected to demonstrate its relevance to broader society (Swemmer et al. 2015). In some cases, people do not benefit from protected areas (PA), incurring costs as a result of the conservation of biodiversity within parks (Anthony 2007). This is unethical, as well as leads to a lack of support for the conservation cause. Evaluation of conservation-based benefit and cost distribution and accrual approaches and processes enables conservation area managers to (1) be informed of their impact, and (2) identify gaps and opportunities for more effective benefit sharing that is not only fair and just, but could lead to greater sustainability. There are examples of assessments of benefit distribution from conserved areas (MEA 2000), but in many cases, the full suite of benefits (tangible and intangible components) is not included and costs are ignored. This makes the cost to benefit trade-off impossible to assess. Furthermore, the subsequent links between benefit accrual and conservation attitudes and behaviour are not well understood. This makes it difficult to identify appropriate leverage points or places to intervene in a system that will yield effective results towards improved benefit sharing approaches and processes.

This study used a broader perspective of ecosystem services and the linkages to products and wellbeing to develop a holistic framework to classify the pathway of benefit and cost production. This was done in the context of the Kruger National Park (KNP) in South Africa. The approach allowed for the development of a cost/benefit inventory and subsequent reflection on protected area benefit sharing approaches and processes (Swemmer et al. 2017). Including both costs and benefits into a framework is important in order to get the full picture of net impact. This study demonstrated how valuable it is to acknowledge the full impact in order to guide management actions accordingly towards a socially relevant (and hence sustainable) social, ecological and economic system (Swemmer et al. 2015). Furthermore, this research focussed on assessing the impact of projects and programmes on human

wellbeing. This was in order to better understand the role of wellbeing as a leverage point for sharing biodiversity benefits in a way that leads to a vested interest in conservation and pro-conservation attitudes and behaviour (Swemmer et al. forthcoming; Swemmer et al. under review). Beyond the high level framework, the study used two case studies, namely the harvesting of Mopane worms and a conservation-based employment programme to segment the broader conceptual framework into empirical, on-the-ground studies. The study developed methodologies that recorded the net impact of project participation on tangible and intangible elements of wellbeing, including both positive and negative impacts. This enabled the assessment of cost to benefit tradeoffs. The study highlights the importance of legitimate monitoring and evaluation processes in guiding more effective approaches to sharing benefits from conservation areas, and the role that this can play in conservation sustainability.

5.2. SUMMARY AND DISCUSSION OF MAJOR FINDINGS

5.2.1. The development of a protected area cost/benefit pathway framework

The framework developed in this thesis (**Chapter 2**) supports the cascade ecosystem service model of Hains-Young and Potschin (2012) that separates the biophysical template from ecosystem services, by using a production boundary. This is a hypothetical crossing point in the framework where the natural ecosystem becomes relevant to people. Our framework also separates ecosystem products and from costs and benefits (Hains-Young and Potschin 2012). However, our model highlights important additions. Firstly that it is useful for both services and products to include positive and negative outcomes. Secondly that cultural services are the experiential setting within the landscape where cultural products such as science, the tourist experience and environmental education are derived (as opposed to the latter being described as services themselves). Having reflected further, this study also suggests that the biophysical template (natural environment) from which ecosystem services flow should include both biophysical and cultural template components since the cultural services flow from the cultural template which is interpreted as an integral part of the original landscape (**Figure 5.1**).

The model from this study suggests that despite being the easiest to measure, the services and products that flow from the biophysical template only partly account for the reasons why society values conservation. It is also important to understand how these services and products impact on human wellbeing. In the South African context, having access to PAs and

the benefits that flow from them has been a limiting. This is especially true for many people who have not had the opportunity to build value and vested interest in PAs through e.g. harvesting resources or visitation. This study hence suggests that the impact of access to ecosystem products leading to positive impacts on wellbeing should be a major focus of monitoring the outcomes of benefit sharing processes for protected areas. This is specifically relevant in the context of environmental justice and building support for conservation.

In the Hains-Young and Potschin (2012) model, "value" is said to come directly from wellbeing, but the mechanism that links this value to biodiversity is not well explored. In the framework from **Chapter 2**, it is suggested that costs and benefits give rise directly to value and based on value, there will be vested interest or lack thereof. The same framework then implies that pro-conservation attitudes and behaviour would arise directly from value and vested interest. However, the Mopane worm case study (**Chapter 3**) highlights that the direct benefits and subsequent impacts on human wellbeing from the harvesting of Mopane worms only partly explains the overall positive impacts recorded. In addition, the interactions between the people harvesting, the people working in the KNP, and the natural and cultural environment are significant. These build connections and subsequent relationships among and between people, and between people and the natural and cultural landscape and this builds even greater value (**Figure 5.1**). This suggests that relationships are an important part of benefit sharing for protected areas where changing attitudes and perceptions are a priority.

A second additional acknowledgement is that there is a certain amount of value attributed to biodiversity as a result of the services and products that flow from them (**Figure 5.1**). However, this study highlights the "added value" of including the impact on human wellbeing. Furthermore, this reflection acknowledges there is an intrinsic value of biodiversity that gives rise to value in its own right that is not linked to services, products, wellbeing or relationships (Ghilarov 2000). This study does not preclude that biodiversity has an intrinsic value, but it suggests that by including realised benefits and relationships, the value of biodiversity will be increased (**Figure 5.1**).

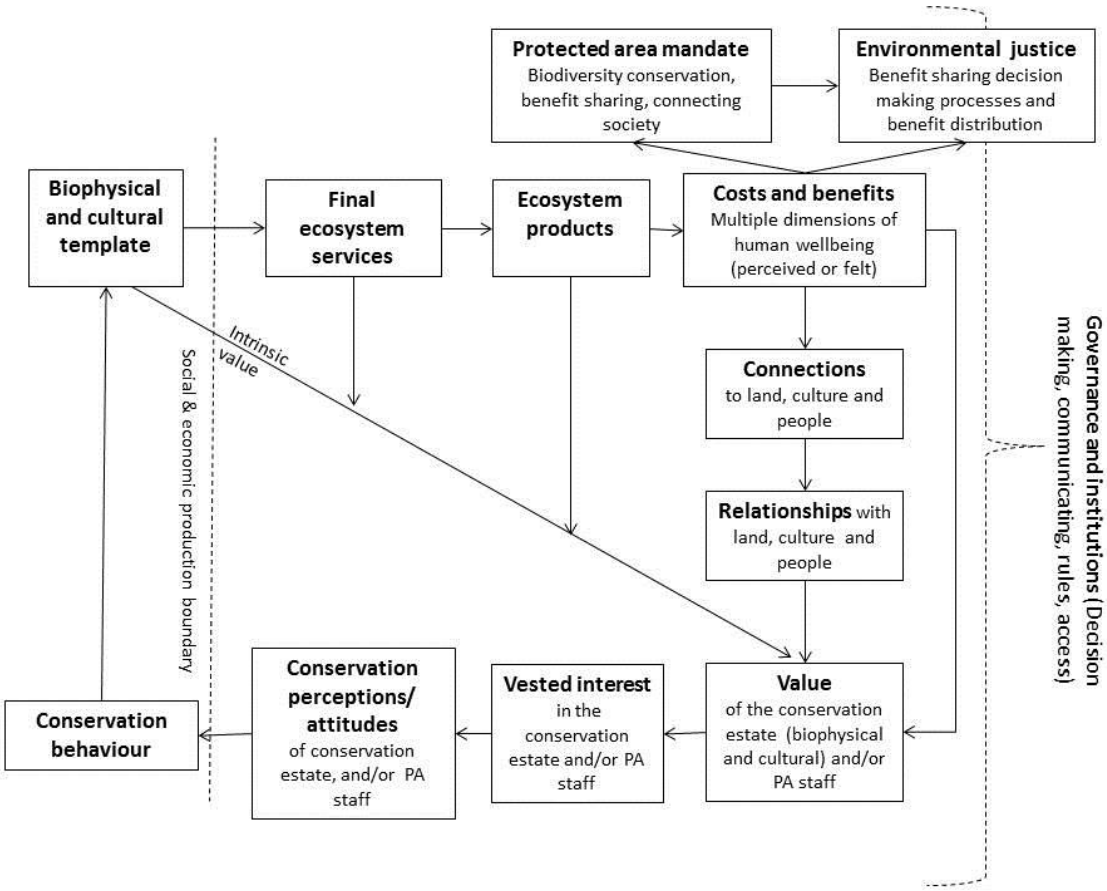

Figure 5.1 Cost/benefit pathway framework demonstrating ecosystem dis/services and ecosystem products that flow from the Kruger National Park biophysical and cultural template

5.2.2. A cost/benefit inventory of the KNP

In **Chapter 2**, this study expanded on the traditional ecosystem service categories previously defined (MEA 2004) and those outlined in Hains-Young and Potschin (2012). This was done by suggesting four main benefit themes that can be used as a means for protected areas to use as an approach to take stock of what is currently being monitored in the context of benefit sharing. These include (1) employment opportunities, (2) capacity building, (3) infrastructure and service delivery and (4) ecosystem services. However, this study further highlighted the importance of managing stakeholder relationships as well as restoring stakeholder rights as a critical part of the benefit sharing process. This suggests that this is more of a right than a benefit, especially when considering history of the KNP that includes forced removals of people and restricted access policies. As a result, this study added a fifth category into the framework, namely managing relationships and restoring rights. The study further suggests

that including these aspects could be an additional and important leverage point for building conservation constituency (**Figure 5.2**).

The benefit audit in this study was based on what quantitative data there was available for the various projects and programmes falling under the categories identified in the framework. The framework did not attempt to articulate secondary or downstream benefits associated with any of the categories, with the assumption that the main benefits are those associated with each category. However, in **Chapter 3** and **Chapter 4**, this study highlights that having access to a tangible resource (categorised as a provisioning service in the framework) or to employment (categorised as employment or business opportunity) has several additional benefits associated with the multiple dimensions of human wellbeing. As such, this study suggests that conservation agencies could use thematic clustering developed with actors working within the PA context to effectively articulate the types of programmes that may lead to a variety of benefits. However, the benefits themselves need a much more in depth investigation into the multiple dimensions of human wellbeing.

Finally, to note that the framework from this study focusses on direct primary impact, covering the majority of the social and ecological components. However, there would be value in expanding the study to include secondary and downstream impact, for a more comprehensive audit (Chidakel 2018). The framework also does not rank or prioritise benefits within a stakeholder group. Subsequent research can build on this by incorporating insights of how the benefits and costs identified in the framework are perceived by different groups.

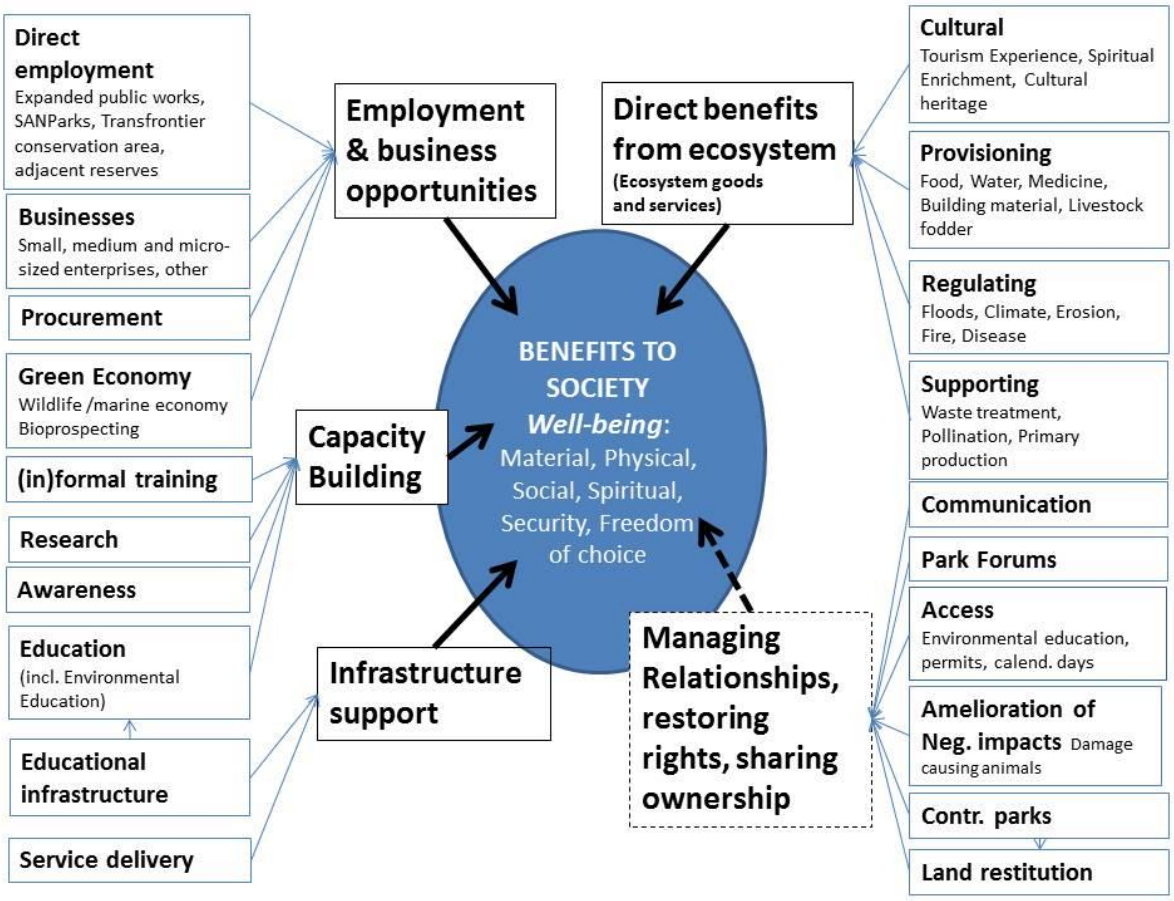

Figure 5.2 Thematic clustering of primary benefit, relationship and rights categories resulting from a benefit audit of the Kruger National Park, South Africa

5.2.3. A reflection on who is benefitting and how

The first framework in this study (**Chapter 2**) highlighted the importance of and developed a tool for assessing the numbers of beneficiaries in the context of types of benefits accrued from protected areas. The results demonstrate a current and historical bias towards cultural ecosystem services, the most numerous being tourist visitation, in the region of 1.8 million people per annum (the top layer of **Figure 2.4**). Noteworthy is that the majority of tourists are from cities and towns from parks. However, the numbers of people accruing tangible benefits linked to employment (approximately 12,000 pp) and provisioning services (lowest layer in **Figure 2.4**) such as extractive resource use (approximately 500 pp) are relatively low. This is despite the fact that many of these people live in close proximity to parks and incur direct wellbeing costs as a result. These results highlight the importance of doing such benefit audits in order to assess who is benefitting and how, in order to identify gaps and opportunities for more effective and fair benefit sharing approaches and processes. This is

especially relevant when protected areas have a history of forced removals of people from within parks boundaries to make way for conservation. It also relevant where PAs have had restricted access policies for resource use and visitation that have resulted in feelings of ambivalence or even resentment among local residents. The framework did not assess impact of the various projects and programmes on human wellbeing, and as such the numbers used in the framework (**Chapter 2**) do not reflect the realised net impact on the multiple dimensions of wellbeing. In the subsequent work on resource use (**Chapter 3**) and employment (**Chapter 4**), this study demonstrated many different ways in which access to benefits can impact on people, both in tangible and intangible ways, across a range of wellbeing dimensions. The study hence suggests that benefit categories cut across various components of human needs. This suggests that needs-based approaches that separate tangible and intangible needs may not truly reflect how people prioritise their own wellbeing, and as such may be of less value in conservation contexts.

5.2.4 The impact of benefit sharing on livelihoods

This research demonstrated that participants in both benefit sharing projects were from low-income households with a high dependency on subsistence agriculture, natural resources and social grants, typical of many households in the study area (Matsika et al. 2013). The study showed that both projects contributed positively to participant and household livelihoods and wellbeing with impacts going well beyond simply the direct benefit of the resource or the salary. Harvesting Mopane worms contributed to approximately half of the household's income during the months of harvest (one month per year) with the EM salary contributing just over half of the monthly household income, but over a three-year contract period. Harvested Mopane worms were sold, and revenue used for household expenses, but most were used within the harvesting households. This was identified as a small but valuable safety net during times of need, especially after Christmas when additional expenses (often school-related) became challenging. Longer term revenue accrued as a result of the employment model resulted in families being able to make more significant changes to their lives. These include opening accounts, making changes to the infrastructure of their homes, participating in various forms of savings, making significant contributions towards their families and communities and furthering their studies, all of which most likely would result in greater resilience to shocks and reduced vulnerability. These case studies demonstrate that protected areas should consider a range of benefit sharing projects or programmes when

trying to broaden the beneficiary base beyond traditional tourism visitation models. This will grow societal relevance by efficiently using resources while maximising the opportunity to share a wide range of benefits sustainably.

5.2.5 Benefit sharing and the multiple dimensions of wellbeing

This study demonstrated the value of recording the impact of benefit sharing projects and programmes on multiple dimensions of wellbeing, in order get a holistic interpretation of net impact of benefit sharing approaches. This is important for protected areas that are wanting to avoid under-valuing the specific project or programme or PA. This also important to get an idea of the net impact (costs versus benefits) in order to ensure a fair and just approach is being taken for sharing benefits, and that adaptations are made when necessary. In situations where one or more wellbeing dimensions are not included, if there are negative impacts that may outweigh any positive impacts at either an individual, a family or a community level, then these would be overlooked (Botha et al. 2007).

5.2.6 Linkages between wellbeing impacts at an individual, family and community level

Although the earlier framework (**Chapter 2**) suggests that wellbeing impacts arise directly from ecosystem products, both of the case studies (**Chapter 3** and **Chapter 4**) demonstrated that additional, secondary wellbeing impacts arise as result of linkages between individual, family and community levels (**Figure 5.3**). These included direct tangible, as well as intangible impacts (costs and benefits) that accrued at a variety of rates. This demonstrates that conservation-related benefit sharing projects can include primary (participant), secondary (participant's families) and tertiary beneficiaries and monitoring this can assist in demonstrating value and impact. Not only does the benefit flow to the larger groups from the individual, but additional wellbeing benefits accrue to the individual as a result of the knowledge that his/her actions have led to positive/negative impacts at a family or community level.

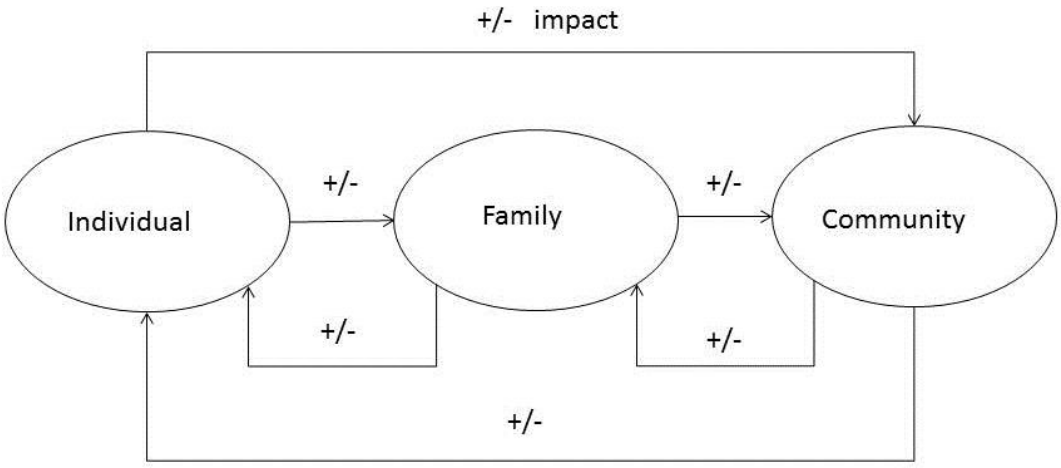

Figure 5.3 Interactions between the flow of wellbeing across scales of beneficiaries

5.2.7 A reflection on tradeoffs

Acknowledging the importance of including both benefits and costs in wellbeing assessments, and the lack of literature on this topic, this study explored two different techniques to assess the tradeoffs between positive and negative impacts of the benefit sharing process. In the Mopane worm case, the willingness and enthusiasm that participants expressed in wanting to participate in the project again if they got the opportunity was used as an indicator. Based on the positive responses in this regard, the assumption was made that participants received a net benefit. In the EM study, the participants indicated they would recommend the EM jobs to friends and family, and this was also taken to suggest a net benefit. However, the EM study went a step further comparing the counts of impacts categorized under the wellbeing dimensions for both positive and negative impacts, and compared these. In this way, the study was able to statistically demonstrate the significance of the difference between recorded impacts at an individual, family and community level. The latter two scales (family and community) were only assessed based on respondent perceptions, and it would be useful to compare these perceptions to data collected from the families and communities themselves. Being able to measure such trade-offs between costs and benefits of the benefit sharing process is important for protected areas when evaluating net impact, especially when benefit sharing programmes are striving for both environmental justice and constituency building.

5.2.8 The impact of benefit sharing on conservation

It is commonly assumed in conservation that if people benefit from conservation, there will be a conservation-related benefit in the form of positive perceptions, and in some cases more conservation orientated action or behaviour leading to conservation sustainability (Swemmer et al. 2017). The case studies in this thesis (**Chapter 3 and Chapter 4**) set out to test the social impact of benefit sharing approaches and processes on conservation, and found net positive impacts in both cases. This study did not test conservation perceptions prior to project participation. However, post-harvesting, Mopane worm harvesting participants perceived their relationship with the KNP to be strong, and they believed the KNP was becoming more accessible to them as a result of being able to harvest Mopane worms. Prior to the harvest, participants were fearful of the KNP, animals and staff but participating in the harvest resulted in these feelings changing. This is an important outcome in post-apartheid South Africa for a park such as the KNP that is trying to transform and promote access to broader society.

A second important outcome was the acknowledgement that regardless of the number of worms harvested, which was low in some cases, participants would like to participate again. This was attributed to wanting to see the KNP, spend time with the staff, see the animals and to learn more about it while participating in the project. This study noted that benefit sharing processes and approaches that reconnect people to land and the associated cultural and biophysical resources promotes stronger connections and ties. These have positive ethical, justice and constituency outcomes, all important for sustainability. The study also emphasised that the benefits of such programmes go far beyond the tangible impacts associated with the resource itself. These include highlighting the role of relationships in contributing towards perceptions and attitudes, regardless of the scale of resources that were harvested. As such we identify relationships and social capital as a leverage point in building support for conservation. The study on the EMs demonstrated that not only direct benefits, but knowledge about the indirect benefits of biodiversity is important in building support for its conservation. This was due to most EMs perceptions of the value of biodiversity changing before and after they were employed. Benefit sharing processes and approaches that empower people with knowledge and that builds environmental conscientiousness and awareness builds passion for the environment. This was demonstrated by the observation that post employment, EMs spoke to their friends and family's about biodiversity on a regular basis in comparison to before they themselves were aware. We highlight the role that

workplace wellbeing plays in overall wellbeing and identify workplace wellbeing as a further leverage point for conservation sustainability. This highlights the potential role for all levels of conservation staff to play as conservation ambassadors away from the workplace, as opposed to only relying on outreach and awareness staff. Further research into what processes and approaches would lead to general conservation staff (cleaning, gardening and labour staff) becoming conservation ambassadors would greatly enhance our understanding of leverage points for building conservation support.

5.3 LOCAL TO GLOBAL IMPLICATIONS OF MAJOR FINDINGS

In the literature, the term "benefit sharing" is most commonly interpreted through its conceptualisation in the Convention on Biological Diversity (2011), where it is defined as "the division and distribution of monetary and non-monetary benefits in a way that has equitable outcomes and is procedurally fair". Its application has mostly been in the context of protecting biodiversity rich countries from exploitation by biodiversity poor (but mostly technologically rich) countries (Wynberg and Hauck 2014). It is mostly used in the context of genetic resources, indigenous knowledge, rights and bioprospecting (CBD 2011). However, prior to and since this, the term continues to be used in a variety of ways across the globe in the context of people and conservation (Nkatha et al. 2012; Wynberg and Hauck 2014). Although not defined as part of this study, earlier work by the author included redefining the term "benefit sharing" for it to be used in the context of PAs, to support processes that aimed to holistically recognise and manage cost and benefit tradeoffs on multiple wellbeing dimensions at various scales (Swemmer et al. 2015). The interpretation of the term benefit sharing as used in the context of this thesis provides a useful tool for PA managers across the globe aiming to holistically assess the impact of PA on people.

As described by Ostrom (1990), congruence between costs and benefits is critical, meaning that the distribution of benefits should be roughly proportionate to the costs imposed. This is a core principle of this study, which highlights the importance of acknowledging cost and benefit tradeoffs. This study provides the first framework that we know of that facilitates an understanding of the various components of benefit sharing (as defined for the purpose of this study). This includes an assessment of the scale and scope of both costs and benefits in a way that can be used by conservation agencies to guide their approaches and to chart and categorise their benefit sharing processes. Tradeoffs between costs and benefits and

subsequent wellbeing and biodiversity impacts occur over different space and time scales. These tradeoffs also play out both within and between stakeholder groups and between people and natural environment. In the example of Mopane worm harvesting, economic and social benefits and costs were felt locally, at a harvester level, within harvester families and communities. However, concerns expressed over social media by a separate stakeholder group could be interpreted as a wellbeing (concern and anxiety) cost that was incurred at both a local and a global scale (responses were from a wide array of concerned SANParks stakeholders). PA managers thus are required to be aware of and to make decisions with regards to managing PAs to minimise such tradeoffs on the context of sustainability. This is often difficult as the indicators are seldom comparable (monetary, social, psychological, ecological).

Effectively sharing biodiversity-related benefits has major implications for the sustainability of conservation, by building social relevance and acceptability at a number of levels. At a local level, understanding how conservation is impacting various sectors of society is imperative when striving for a just and fair benefit sharing process. This is specifically important when there has been a history of restricted access policies. Transitioning from unjust to fair benefit sharing both in terms of approaches and processes of benefit distribution and accrual is the right thing to do. However, it is also imperative if conservation areas are going to be seen and felt to be relevant by local society. Despite the numbers of participants in the resource use projects being relatively low, facilitating access for people to harvest tangible resources from PAs provides an additional opportunity to reconnect people to land, cultural and natural resources. Such projects should be explored and expanded upon in the context of the provision of basic human needs.

Important to note that while small benefits may be generated from benefit sharing arrangements, any one option will only provide a partial solution to poverty (Altman 2009). However, our study has shown that over and above the actual benefit, connections to the land, the cultural and biophysical resources and the people within protected areas are also important. These are built through participation in benefit sharing projects and programmes and lead to positive connections and subsequent relationships, and social capital. These findings suggest that social capital is a leverage point that can be used in addition to benefit sharing, to build vested interest and social relevance that will lead to positive conservation related attitudes and behaviour. At a national and global level, being able to demonstrate that

benefit sharing is fair, and that biodiversity is valued at a number of levels, is important for ensuring political buy-in and support from national government and beyond.

Overall this study has developed a framework to guide approaches towards more effective benefit sharing from PAs, especially those in biodiversity rich countries with high levels of unemployment. This study has demonstrated examples of monitoring the impact of the processes of benefit sharing including the qualitative components of wellbeing. It is acknowledged that in some cases the intangible components may account for a larger component of the wellbeing basket than the tangible, culminating in the main message which emphasises that "*Its not just about the numbers*". The study hence suggests that excluding the intangible components of wellbeing leads to under-accounting of benefit sharing impacts, and this is a message that is relevant across a variety of scales and scopes within the conservation context across the globe. It was highlighted that understanding and monitoring trade-offs between costs and benefits across variables (hard and soft) and between stakeholder types is necessary. This provides a holistic picture of impact, and this has implications for local and global assessments of biodiversity and social impact assessments. The identification of connections to land, cultural and natural heritage, relationships and social capital as possible leverage points in benefit sharing has important implications across scales. This is especially important when conservation agencies are under resourced and there is pressure for action.

Biodiversity across the globe is facing a myriad of threats as a result of global change phenomenon including the over-harvesting in the context of the illegal wildlife trade (Wilson-Wilde 2010). As such the role of PAs is becomingly increasingly important for their intrinsic or bequest value and as providers of ecosystem services for society. Ensuring strong support for PAs in the coming decades of uncertainly is critical to ensure PA persistence, and effective benefit sharing, as outlined in this study, can play an important role in contributing towards this.

5.4 POLICY AND RESEARCH RECOMMENDATIONS

Apart from the academic contributions, this study has nine important findings that are specifically relevant to decision making by conservation management agencies and policy makers.

1. Understanding the processes that enable benefit sharing to flow from the biophysical template can contribute directly towards a more sustainable system when done effectively.
2. Thematic clustering of benefits into thematic areas (employment and business, capacity building, infrastructure, ecosystem services and the processes of managing relationships and restoring rights) can be done to get a snap-shot of what biodiversity-related costs and benefits are flowing from a particular area. This is important to firstly be able to market the value of the biodiversity in question and secondly to be able to assess net impact (costs and benefits), to guide when adaptations may be necessary.
3. Measuring the impact of conservation on wellbeing itself, as opposed to simply reporting on the products that may or may not lead to an impact on wellbeing, leads to more effective benefit sharing. The rationale being that it is in the wellbeing impact that the leverage points lie for more effective benefit sharing outcomes leading to attitudes and possible pro-conservation behaviour.
4. Wellbeing should be measured not only as a tangible quantitative variable (e.g. worms harvested or money earned), but in its entirety, using multiple tangible and intangible dimensions, in order to get the full impact and subsequent value to recipients, and their communities.
5. Being aware of and managing for trade-offs between costs and benefits is important and possible, using wellbeing dimensions at an individual, family and community level. This tool would be useful for conservation managers that are aiming to use benefit sharing as a tool to build support for conservation and in the context of environmental justice when there is a focus on restitution and fair and just approaches.
6. Over and above direct benefit distribution (employment, resource access, capacity building), maximising positive connections with the land, cultural and natural heritage, and people inside parks will lead to positive relationships on a number of levels and the more positive connections and relationships that exists, the stronger the perceptions and attitudes towards conservation will be.
7. Protected areas should channel more effort into building human resource capacity that acknowledges the importance of building and maintaining a variety of positive connections and relationships at a scale at which it will be meaningful to the majority.

8. Linked to number 7, this study highlights the potential for all conservation staff to act as conservation ambassadors when managed effectively, increasing the potential and resources available for local engagement.
9. Finally, this study demonstrated that when managed effectively, facilitating access for extractive resource use from within protected areas can be used as a tool to facilitate connections to land and people within protected areas, and as such has potential for the conservation sector to build value.

Although this study has contributed to new knowledge in several areas relevant too conservation in a global context, it is important to also note several gaps and assumptions remain in understanding approaches and processes that will lead to more effective conservation-related benefit sharing.

1. Firstly, the specific links between attitudes and behaviour was not explored in detail and there remains a substantial gap in the literature in understanding the conditions that are required to move from pro-conservation attitudes to pro-conservation actions and behaviour. Acknowledging that these will vary depending on context, an exploration of some specific examples where this has or has not happened would be valuable, especially linking this to conservation-based employment and the illegal wildlife trade.
2. Secondly, although the results presented for the Mopane worm study demonstrate a net positive impact on the harvesters and a positive change in attitudes and perceptions towards conservation, such projects can be controversial, as some stakeholders perceive extractive resource use to be a threat to conservation. Research that investigates the drivers behind various stakeholder perceptions on extractive resource use would help in more effective communication and management of the cost and benefit trade-offs of such projects.
3. Finally, the EM study suggests that when managed effectively, conservation-based employees would be less likely to act outside of the interests of the organisation they work for. However, it is believed that there is a significant level of internal involvement in illegal wildlife activities in some protected areas and game reserves such as rhino poaching. This poses a real risk to the success of conservation efforts. Research that explores staff incentives to participate (or not) in illegal activities would be of value.

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