

**ALIGNING ELEPHANT CONSERVATION  
WITH SOCIETAL ASPIRATIONS**

**by**

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requirements for the degree of Doctor of  
Philosophy (Science) in the  
School of Life Sciences  
University of KwaZulu-Natal,  
Pietermaritzburg.  
December 2022

As the candidate's supervisor I have approved this thesis/dissertation for submission.

Signed: Name: Prof. Rob Slotow

Date:

## ABSTRACT

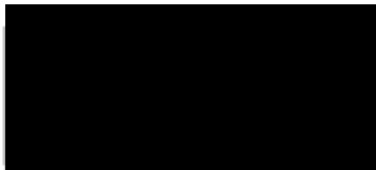
Protection of biodiversity and social development often seem at odds in the world of today. The aim of this thesis is to show that it does not need to be that way. Most global social compacts focus on either economic development, or biodiversity conservation. Few prioritise the needs, values and rights of local people living in or near conservation-sensitive areas. If biodiversity and human well-being goals are to be realised simultaneously, we must find ways to increase land use for conservation purposes, while respecting the values and needs of local people and future generations. In an effort to contribute to this aim, this thesis explores and analyses how elephants are valued and perceived by a wide range of stakeholders; it investigates why narrow conservation approaches fail; and it uses the research outcomes to develop an alternative roadmap for conservation, one that realises beneficial outcomes for elephants, people and the environment. Through literature review, participatory workshops, questionnaires, interviews and reports provided by reserves and provincial government, I developed: (1) the TUSKER framework to reconcile integrity of nature with human well-being, (2) the pluralist elephant valuation system to incorporate all values of elephants that I have been able to uncover and provide insight into trade-offs associated with conservation decisions, (3) a theory of change for human-elephant coexistence and building common ground, and (4) a One Well-being framework to holistically assess and rank the consequences of elephant management interventions at different scales of animal, human and environmental well-being. The frameworks can be used in strategies that promote animal well-being and range expansion, while simultaneously empowering local communities and enhancing local economies. They may be employed by policymakers and managers to work towards ‘living-in-harmony’ conservation schemes, in which elephants and other iconic species do not represent a threat to humans but a chance for development and joy. Through ‘Living in harmony’, ‘convivial conservation’, and the incorporation of African philosophy Ubuntu (a philosophy that recognises moral values such as justice, dignity and rights), we will move towards a more ethical, just, and sustainable world.

## Preface

1. The work described in this thesis was carried out by the author from August 2018 to October 2022 at the School of Life Sciences, University of KwaZulu-Natal, Pietermaritzburg campus, under the supervision of Prof. Rob Slotow. Data from questionnaires, interviews, and workshops were collected among residents of Dinokeng Game Reserve and the adjacent community Kekana Gardens (Gauteng Province) between April and August 2019. Data from an elephant expert workshop (June 2019), a reserve management questionnaire (2017), Provincial data on Damage Causing Elephants, and reports on applied elephant management interventions were collected from June 2019 to November 2021.

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

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## Declaration 1 - plagiarism

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## Declaration 2 - publications

### **Publication 1 (Chapter 2)**

Van de Water, A., Di Minin, E., & Slotow, R. (2022). Human-elephant coexistence through aligning conservation with societal aspirations. *Global Ecology and Conservation*, 37, e02165. <https://doi.org/10.1016/j.gecco.2022.e02165>

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#### *Author contributions:*

A.W., E.D.M., and R.S. developed the conceptual foundations and the main arguments. A.W. and R.S. prepared the first draft of the manuscript. A.W., E.D.M., and R.S. contributed to the development of the main arguments and to writing, and improving the structure and style. A.W. led the manuscript revision process.

### **Publication 2 (case study chapter 2, not peer reviewed)**

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Published in *Animal Sentience* in May 2020

#### *Author contributions:*

A.W. conducted the literature review, and designed and wrote the paper. M.H., L.B. and R.S. contributed to the paper, and provided valuable comments to the manuscript.

**Publication 3 (Chapter 3)**

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*Author contributions:*

A.W. conducted the literature review, processed the data, and designed and wrote the paper. M.H., L.B. and R.S. contributed to design the paper. M.H., L.B. and R.S. provided valuable comments to the manuscript. A.W. led the manuscript revision process.

**Publication 4 (Chapter 4)**

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In preparation to submit to *Diversity*, Special Issue “Elephants: Moving from Conflict to Coexistence with People II”.

*Author contributions:*

A.W., M.H., and L.S. developed the content of the questionnaires. A.W. developed the structure of the community workshop. A.W. and S.D. conducted the analysis. A.W. prepared the first draft of the manuscript, and S.D, M.H., A.W., E.D.M., and R.S. contributed to the development of the main arguments and to writing and improving the structure and style. A.W. led the manuscript revision process.

**Publication 5 (Chapter 5)**

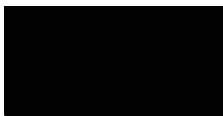
Van de Water, A., Garai, M., Burnett, M., Henley, M.D., Di Minin, E., Streicher, J., Bates, L., & Slotow, R. (In prep). Consequences of elephant management interventions: a ‘One Well-being’ approach.

Submitted to *Global Ecology & Conservation*.

*Author contributions:*

A.W. and R.S. developed the One Well-being scoring system and developed supplemental Table S5.1. All authors reviewed supplemental Table S5.1 and used the table to assigned scores to each elephant management intervention. A.W. and R.S. conducted the analysis. A.W. prepared the first draft of the manuscript, and M.G, M.B., M.H., E.D.M., J.S. and R.S. contributed to the development of the main arguments and to writing and improving the structure and style. A.W. led the manuscript revision process.

Signature:

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Antoinette van de Water

2 December 2022

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frameworks would mean in practice. I will use the gained knowledge and skills, and the developed frameworks for our foundation to grow, and our projects to improve, so that we can support more elephants, and the people living alongside them.

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## LIST OF ABBREVIATIONS

AEAP	African Elephant Action Plan
AsESG	Asian Elephant Specialist Group
BVC	Biodiversity Value Chain
CBC	Community-based conservation
CBD	Convention on Biological Diversity
CICES	Common International Classification of Ecosystem Services
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS	Convention on Migratory Species
DCA	Damage Causing Animal
DEAT	Department of Environmental Affairs and Tourism
DEDECT	Department of Economic Development, Environment, Conservation & Tourism
DFFE	Department of Environment, Forestry and Fisheries
EHRA	Elephant Human Relation Aid
EKZNV	Ezemvelo KZN Wildlife
ES	Ecosystem Services
ESAG	Elephant Specialist Advisory Group
HEC	Human-elephant conflict
ICCA	Indigenous and Community Conserved Area
IIED	International Institute for Environment and Development
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IUCN	International Union for Conservation of Nature
KNP	Kruger National Park
LEDET	Limpopo Department of Economic Development, Environment and Tourism
MA	Millennium Ecosystem Assessment
MEFT	Ministry of Environment, Forestry and Tourism

MER	Managed Elephant Reserve
NC	Natural Capital
NEMBA/PA	National Environmental Management Biodiversity Act: Protected Areas Act
NEMLAA	National Environmental Management Laws Amendment Act
NGO	Nongovernmental Organisation
NP	The Nagoya Protocol
OECMs	Other Effective area-based Conservation Measures
PA	Protected Area
SANParks	South African National Parks
SDG	Sustainable Development Goals
TEEB	The Economics of Ecosystems and Biodiversity
TFCAs	Transfrontier Conservation Areas
TUSKER	Towards a Unified System of Key Environmental Relations
UKZN	University of KwaZulu-Natal
UNGA	United Nations General Assembly
WHO	World Health Organisation's
WJC	Wildlife Justice Commission
WOAH	World Organisation for Animal Health

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# 1. GENERAL INTRODUCTION

## 1.1 Current conservation challenges

The ecosystem services that nature provides are essential for people's health, survival, and quality of life (Balvanera et al., 2022; Chaplin-Kramer et al., 2019; Guerry et al., 2015). Most of the world's biodiversity can be found in developing countries (Lenzen et al., 2012; Zhao et al., 2022), where a complete suite of iconic species attracts people from around the world (Gnonlonfoun et al., 2019, Naidoo et al., 2016). However, access to the benefits of natural resources is not equally shared in the global South, nor are the costs of living with this extraordinary biodiversity, notably with wildlife: local, often impoverished people receive little income from wildlife tourism, while their encounters with wildlife endanger their lives and livelihoods (Convention on Biological Diversity, 2021; Department of Environmental Affairs and Tourism, 2005; Garland, 2008; Tucker, 2010). Despite ongoing efforts to conserve biodiversity, extinction rates and environmental decline continue to accelerate. Generally, conservationists and scientists agree that to reverse the environmental crisis, protected land cover should increase to at least 30 % of the planet by 2030 (UN General Assembly, 2021). At the same time, other global issues also require urgent solutions, such as poverty and the widening gap between rich and poor (Díaz et al., 2018; Zhao et al., 2022). This is especially true for developing countries, where population growth and inequality are highest and where people are confronted with the decrease and unequal apportioning of ecosystem services (Chaplin-Kramer et al., 2019). The two global goals seem to be irreconcilable, as focusing on one goal in isolation usually has negative consequences for the other (Büscher et al., 2022; Zhao et al., 2022).

Globally, scientists, conservationists and NGOs have argued that narrow, one-sided conservation approaches, such as focusing on economic outcomes of nature conservation or protecting nature without considering the needs and rights of local people, can have detrimental effects on the socio-ecological system and prevent conciliation of the goals

of nature conservation and human development (Pascual et al., 2021). The trade-offs between conservation and other socio-economic or political agendas (McShane et al., 2011), can lead to long-term negative consequences. Such trade-offs build on a worldview that separates people from non-human nature, or perceives people as separate from non-human nature. They prevent them from fully benefiting from ecosystem services and disincentivises them to support nature conservation (Amit & Jacobson, 2018; Büscher & Ramutsindela, 2015; Dowie, 2009; Dudley et al., 2018; Hutton et al., 2005). A breach between the socio-economic system and nature undermines human well-being goals such as health, education, social cohesion and happiness, and motivates individuals to exploit natural resources for self-interest (Van de Water et al., 2022a). Since the late 1980s, more inclusive nature valuation systems have been developed, such as the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) (Adeyanju et al., 2022; Díaz et al., 2018, Pascual et al., 2017). IPBES acknowledges the influence of power relations and culture on people's perception of nature. However, the value of nature is still perceived as a flow from nature to people, which fails to acknowledge the truly intrinsic value of nature and lacks opportunities to promote reciprocity with nature (Kenter, 2018; Van Norren, 2020).

Resolving the current ecological crisis while promoting human development simultaneously requires reconciling biodiversity conservation and human well-being goals, especially the needs and values of local people affected by nature conservation and integrating the broad spectrum of values associated with nature in conservation decisions.

## 1.2 The value of having elephants in the world

In chapters 2-5 of this thesis, I use elephant conservation as a case study to build frameworks that may be used as tools for wildlife conservation in general. The vast array of elephant-human interactions and the number of benefits that people may receive from these interactions, make these animals excellent candidates for nature-based solutions to biodiversity, environmental and human crises (Blignaut et al., 2008; Chami et al., 2020; Geach, 2002; Naidoo et al., 2016). However, due to conflicting agendas and principles of

various stakeholders, and differences in power, elephant conservation is also highly contentious (e.g., see Biggs et al., 2017; Dickman et al., 2019, and the resulting commentaries). Furthermore, elephants are increasingly in conflict with the people who live alongside them due to increasing human-elephant conflicts, while local people are often excluded from access to the benefits of elephants (Gross et al., 2022). The complexity of elephant conservation and the multiple, well-documented services, benefits, values, and conflicts associated with elephants enabled me to create a comprehensive valuation system and to assess the underlying causes of conservation trade-offs.

Elephants provide multiple, overlapping socio- economic, cultural, and ecological benefits, and have intrinsic value as well (Van de Water et al., 2022b). As socially complex, intelligent, long-lived, sentient beings, very few animals evoke such strong emotions as elephants (Plotnik & Jacobson, 2022). They fascinate, inspire, and attract attention from people globally (Bates, 2020; Poole & Moss, 2008). They contribute to a sense of place and to the identity and prosperity of range countries and their people (Bandara & Tisdell, 2003; Blignaut et al., 2008; Geach, 2002; Lötter, 2016; Platt, 2014; Poufoun et al., 2016). As iconic species and representatives of certain areas, elephants are evidently important drawcards for ecotourism (Gnonlonfoun et al., 2019; Naidoo et al., 2016). Elephants provide various jobs related to ecotourism industries (Blignaut et al., 2008, Naidoo et al., 2016) and broader sectors such as transport, research, anti-poaching, administration, education, media, art and crafts. Over the lifespan of an elephant, each elephant contributes more than \$1.6 million to the economy (Platt, 2014). They play an essential role in protecting other species and habitat as umbrella species (Albert et al., 2018; Redmond, 1996; Sukumar, 1989). As keystone species, elephants have ecological value because they distribute seeds, maintain grasslands, increase access to water, and contribute to maintaining biodiversity and ecological balance in general (Berzaghi et al., 2022; Bunney et al., 2017; Haynes, 2012; Joshi & Puri, 2021; Poulsen et al., 2017).

No other animal species has played such an imaginative and useful role in human history, religion, culture, consciousness, and economy as the elephant. Historically, elephants have been valued for their services in wars and construction, for their meat, bones, hides,

and tusks, and as means of entertainment (Bansiddhi et al., 2020; Duffy & Moore, 2010; Kioko et al., 2015; Ngorima et al., 2020). They are associated with royalty and power, are viewed as wise chiefs of the forest, and are the national animal of countries such as Thailand and the Ivory Coast (Clucas et al., 2008; Kouakou et al., 2020). Various cultures promote deep respect for elephants; they are considered sacred and form part of religious or spiritual traditions, which enhances cultural values and advocates for the protection of elephants (Alves & Souto, 2015).

### 1.3 Elephant: symbol of Africa or symbol of exclusion?

In Africa, elephants have been extensively hunted throughout history, and there were times when ivory was one of Africa's top three export products, together with gold and slaves (Carruthers et al., 2008). In 1920, the ivory trade and professional hunters had nearly exterminated elephants in South Africa, with a remaining population of 120 individuals (Hall-Martin, 1980; Hall-Martin, 1992). The remaining elephants inhabited less than 100 000 hectares, divided into four areas: Knysna, Addo, Tembe and Olifants Gorge (which later became part of Kruger National Park) (Hall-Martin, 1992). Colonialism and white rule introduced a new way to protect the remaining elephants through the proclamation of protected areas (Dlamini, 2020). The people living in what is currently part of the Kruger National Park were considered an obstacle to nature conservation, or even the cause of nature's deterioration, even though they had used natural resources for ages without depleting them (Carruthers, 1995). With the proclamation of the protected area in 1897 came the decision to clear the area of human habitation (Carruthers, 1995). In 1903, the policy to remove Africans was reversed and people were allowed to stay, but only if they paid rent to the government, in cash or labour, which proved to be profitable for park management. Any trespassing of rules and regulations, such as hunting, or poaching in their case, was punished (Carruthers, 1995), and black people were often confronted with colonial and apartheid violence and neglect (Dlamini, 2020). The early decades of the 20th century gave rise to ecotourism as an increasing number of (white) people became fascinated by wilderness and wildlife.

Inspired by the American national parks system, the area opened to tourism in 1920 and became Kruger National Park in 1926 (Klein, 2021). Thousands of people who were born and bred in that region, with their ancestors buried there, were relocated. For black Africans, national parks became places of exclusion, and nature conservation a practice that caused suffering (Carruthers, 1995; Dlamini, 2020). The fences around the various protected areas were meant to keep animals in, and black Africans out (Thakholi, 2021). This discriminatory practice, officially abolished since the overthrow of the apartheid regime, still ripples through the daily business of many wildlife reserves. Elephants, as icons of wildlife reserves that perpetuate the marginalisation of local communities, may thus become emblematic of exclusion and inequality in the eyes of local communities. Dislike of their own marginalised position takes the form of dislike for elephants (Van de Water et al., In prep.)

The challenges associated with fortress conservation have been recognised globally, regionally, and nationally, and valuable initiatives have been taken towards an inclusive conservation, that regards humans as part of nature instead of masters and exploiters of nature (Büscher et al., 2022; Carruthers, 1995; Dlamini, 2020; Klein, 2021). Nevertheless, it will take a thorough change of ownership patterns and mindsets, highlighting the importance of a sense of belonging and of place, before disadvantaged black people will feel proud of the treasure that wildlife habitat represents (Carlos Bezerra & Paphitis, 2021; Klein, 2021). Increasing access to benefits of nature for marginalised communities is critical in this respect, as well as critical reflection on the dark, complex history of parks like KNP (Dlamini, 2020). Globally, nature conservation is showing a remarkable shift away from an exclusive focus on animals, plants, and their habitat, to including the people that live in and around these habitats. These aspirations are adopted in various social compacts that nations agree to.

#### 1.4 Social compact: our aspirations for the world

Social compacts are agreements among the members of society about norms, values, ethics, and aspirations (Haywood et al., 2019). They set clear goals for shaping global,

regional, national, and local policy and action and are essential for socio-political support and overall sustainability. They are consolidated into constitutions, charters, or conventions. Because social compacts are authoritative and generally accepted, it is important that they are well balanced and include all relevant variables. This thesis looks at the social compacts that are relevant for and guide conservation policies, such as the Sustainable Development Goals (SDGs), the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), and the Convention on Biological Diversity (CBD). In addition, I have reviewed social compacts specifically relevant to elephants (Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the African Elephant Action Plan, and the Convention on Migratory Species (CMS)). Where applicable to the global South, the United Nations' Declaration on the rights of indigenous peoples is included in this assessment. The indigenous African philosophy Ubuntu (Mabele et al., 2022; LenkaBula, 2008) is included as an example of a traditional social compact within the African natural resource systems, i.e., the range of African elephants. Ubuntu is an essential social compact, as it promotes the African concept of sustainability and helps making sustainability models relevant to Africa. Through reviewing literature on these nine social compacts, I assessed their focus regarding the three pillars of sustainability (social, environmental, and economic) (Purvis et al., 2019) (Supplemental Table S1.1). Clarifying and refining the social pillar, I additionally reviewed the social compacts regarding their performance on the four filters I outlined in the TUSKER framework in Chapter 2: good governance, environmental justice, intergenerational legacy, and human rights (Supplemental Table S1.1), and then used the outcomes to evaluate expected outcomes of the social compacts on the different elements of the socio-ecological system (Supplemental Figure S1.2).

The review of the social compacts (see Supplemental Table S1.1 and Supplemental Figure S1.2) shows that the broadest and most influential global agreements (SDGs, CBD, IPBES, and the Nagoya Protocol) have a strong focus on the economic pillar (Otero et al., 2020). In contrast, agreements specifically relevant to elephants (CITES, African Elephant Action Plan, CMS) emphasise the environmental pillar. Few social compacts prioritise the social pillar (UN Declaration on the rights of indigenous peoples and Ubuntu). Commodifying nature tends to promote behaviour motivated by short-term



human gain, especially when wildlife is considered private property (Blackmore, 2017; Menton et al., 2020). With persisting imbalances in social compacts, the system is threatened by increasing inequality, poverty, and unsustainable natural resource extraction (Menton et al., 2020; Otero et al., 2020). This highlights a need for a framework that includes all relevant variables, integrating the natural and social systems, which can be applied in the development of new, balanced social compacts.

### 1.5 An emerging social compact: Living in Harmony

Globally, a push towards a more inclusive conservation is emerging. ‘Living in harmony’ (United Nations General Assembly (UNGA), 2014), ‘convivial conservation’ (Büscher & Fletcher, 2020), and the incorporation of Ubuntu (LenkaBula, 2008) in conservation testify to this. Fundamental to these emerging approaches is the incorporation of the value systems of all stakeholders, including the intrinsic value of nature (Díaz et al., 2015). The UN’s Harmony with Nature resolution views nature not as property but as our home, recognises nature’s rights, and calls for a more ethical relationship with the Earth (UN, 2014). A conservation approach that is guided by a ‘living in harmony’ philosophy is ‘convivial conservation’ (Büscher & Fletcher, 2020). It has a strong focus on what is socially and ecologically just. The holistic One Well-being approach also promotes living in harmony and fair sharing of ecosystem services by acknowledging the interlinkages between animal well-being, human well-being, and environmental health (Bourque, 2017; Garcia Pinillos et al., 2016). Relevant moral values are incorporated in the African philosophy Ubuntu, which provides a viable conservation approach that promotes just and harmonious relations between humanity and the Earth based on relatedness, the common good of society, respect for all life, and compassion (LenkaBula, 2008; Mabele et al., 2022; Venter, 2004). ‘Living in harmony’ has been incorporated into social compacts such as the UN’s Harmony with Nature resolution, CBD, and the Aichi Biodiversity Targets. It has also been incorporated in constitutions, such as Bolivia and Ecuador, where the rights of Mother Earth (all components, including people) are recognised through an ‘Integral Development for Living Well (*Buen Vivir*)’ (Putzer et al., 2022; Van Norren, 2020). In Africa, the Rights of Nature were first recognised as

national legislation in Uganda, under the National Environment Act (2019). The act unites the rights of local people as the custodians of natural sacred sites and the rights of nature and links back to the human right to a healthy and clean environment (see, for example, Article 24 of the African Charter on Human and Peoples' Rights) (Putzer et al., 2022).

## 1.6 Aim and objectives

Using elephant conservation as a case study, the aim of my thesis is to investigate the shortcomings of existing conservation approaches, find out what causes these shortcomings, and use this knowledge to develop an alternative roadmap for conservation that can realise beneficial outcomes for elephants, people, and the environment alike. To accomplish this, I first looked at ways to align elephant conservation with societal aspirations (i.e., social compacts), since the absence of this alignment appears to be a major cause of failing conservation. I developed a conceptual framework that looks at conservation through a wide-angle lens, thus evading the risks and threats posed by narrow approaches. Second, to reveal the consequences of one-sided conservation approaches, I developed a pluralist elephant valuation system that incorporates all values associated with elephants I could uncover, including often ignored moral values. Third, I developed a Theory of Change framework that can help reconcile the needs, rights and aspirations of people who benefit from an elephant reserve, and local people who do not have access to these benefits. Lastly, I devised and implemented a One Well-being framework to holistically evaluate twelve elephant management interventions, based on their relative impact on different scales of animal well-being, human well-being, and environmental health.

Objective 1: To develop a conceptual framework that aligns conservation with societal aspirations and reconciles integrity of nature with human well-being.

Sub-objectives:

1. To assess the consequences of separating natural and social systems in the context of African elephant conservation and provide examples of fragmented conservation approaches.
2. To propose a framework to better align elephant conservation and management with societal values and aspirations, enhance the participation of local people in decision-making and benefit-sharing, and facilitate dynamic and practical implementation.
3. To apply the framework to the case study of African elephant conservation and existing community-based conservation programs.

Objective 2: To develop a pluralist elephant valuation system that incorporates all relevant variables and provides insight into the root causes of the trade-offs associated with [elephant] conservation decisions.

Sub-objectives:

1. Identify the full range of services, benefits, and values associated with elephants.
2. Develop a pluralist elephant valuation system incorporating all values and adding the dimensions missing from current systems.
3. Classify worldviews or principles underlying elephant valuations and gain insight in the impact of trade-offs that occur when certain principles are promoted or neglected.

Objective 3: To develop a theory of change for conservation to resolve conflicts and build common ground.

Sub-objectives

1. To assess the intrinsic, instrumental, relational, and moral values associated with [elephant] conservation, as perceived and held by people living inside a specific reserve and in the marginalised community outside the protected area.
2. To assess the trade-offs that occurred in this elephant reserve between [elephant] conservation and community development.
3. To develop a Theory of Change for conservation, with solutions that aid in resolving potential conflicts and enlarging common ground.

Objective 4: To holistically assess and rank the consequences of elephant management interventions at different scales of animal well-being, human well-being, and environmental health through the One Well-being framework.

Sub-objectives

1. To assess the consequences of twelve elephant management interventions commonly applied in South Africa.
2. To demonstrate how the One Well-being approach can be used to evaluate and rank the consequences of conservation interventions and develop sustainable conservation solutions.

## 1.7 Methods

Table 1.1: Methods for each Chapter and Associated Ethics Approvals

<b>Chapter</b>	<b>Methods</b>	<b>Ethics Approval from the University of KwaZulu-Natal Humanities and Social Sciences Research Ethics Committee</b>
1.	Literature review on social compacts and their acknowledgement of the three pillars of sustainability and the four filters outlined in Chapter 2.	n.a. Work conducted under the National Research Strategy for Elephant Management of the National Department of Environmental Affairs of South Africa.
2.	Literature review to establish the conceptual framework of this thesis (the TUSKER framework).	n.a. Work conducted under the National Research Strategy for Elephant Management of the National Department of Environmental Affairs of South Africa.
3.	Literature review to develop a pluralist elephant valuation framework.	n.a. Work conducted under the National Research Strategy for Elephant Management of the National Department of Environmental Affairs of South Africa.
4.	Literature review, in-depth interview, two community questionnaires, and a World Café community workshop.	HSS/0036/019D
5.	Literature review, a participatory workshop with elephant managers and scientists, reserve management questionnaires, databases of the provincial authorities, and reserve management reports.	HSS/2144/018 Work conducted under the National Research Strategy for Elephant Management of the National Department of Environmental Affairs of South Africa.
6.	Literature review on intended and unintended consequences of conservation approaches, their value priorities, and their expected outcomes in terms of long-term sustainability, and Sustainable Development.	n.a. Work conducted under the National Research Strategy for Elephant Management of the National Department of Environmental Affairs of South Africa.

## 1.8 Thesis structure

This thesis is divided into six chapters. After this introduction Chapter, I present a framework for balancing elephant conservation and human well-being in Chapter two, which has been published in *Global Ecology and Conservation* (Objective 1). This Chapter emphasises the importance of viewing people as part of nature and aligning conservation with human development. The TUSKER framework presented in this Chapter includes two dimensions that generally are missing from current conservation thinking and are needed to ensure socio-ecological sustainability: balancing the integrity of nature with social cohesion and moderating the use of nature through the filters of good governance, environmental justice, human rights, and intergenerational legacy. The balancing and moderating dimensions transform a Biodiversity Value Chain into a Biodiversity Value Cycle, promoting reciprocity with nature and improving access to a wider range of benefits of nature to a wider range of people, without compromising nature's resilience. The cycle promotes coexistence in a meaningful way that views people as part of nature, incorporates indigenous knowledge, and transforms political-economic structures (Van de Water et al., 2022a) (Chapter two, Objective one).

Building on the Biodiversity Value Cycle presented in Chapter two, I evaluate existing valuation systems, such as IPBES and the Common International Classification of Ecosystem Services (CICES). Common biodiversity valuation systems are often market-based and place price tags on nature, which risks encouraging the exploitation of nature (Büscher & Fletcher, 2019; Turnhout et al., 2013). They also view the value of nature as a one-way flow from nature to people, which does not fully recognise nature's intrinsic value, nor people's beneficial or harmful impact on nature. Current valuation systems fail to promote reciprocity of humans and nature and can cause negative feedback loops. I also found that moral values such as intergenerational legacy, rights of nature, environmental justice, and human rights are often not considered in biodiversity valuation systems. In short: these systems fall short of a full account of all that nature has to offer. Through a comprehensive literature review and using elephants as an example, I identified and classified 90 services, benefits, and values that elephants provide to human and nonhuman nature, which created the pluralist elephant valuation system that is

presented in Chapter three and is published in the journal *Ecosystem Services* (Chapter three, Van de Water et al., 2022b). To present a practical case study of the pluralist valuation approach, we published a short case study, 'Future of Thailand's captive elephants' in the journal *Animal Sentience*. The article shows how considering all values of elephants can contribute to the long-term survival of the Asian elephant, to environmental justice and overall sustainability (Van de Water et al., 2020) (Chapter three, Objective two).

In Chapter four, I present a study on the practical implementation of linking conservation to human well-being and applying a pluralist elephant valuation approach. Through a semi-structured interview with a key spokesperson, a participatory community workshop and questionnaires amongst people living inside and outside a specific elephant reserve, I assessed how stakeholders' needs and aspirations may be reconciled. I highlight how elephants can be perceived as symbols of exclusion, while they have the potential to be drivers of development and positive socio-political change. I present a Theory of Change framework that enlarges common ground between people with access to the benefits of [elephant] conservation and people who are historically excluded from access to these benefits. This Chapter proposes practical solutions that are inclusive, fair, and socially relevant while advancing elephant protection through range expansion and local support for conservation (Chapter four, Objective three).

While Chapter four looked at general strategies and solutions for policymakers and managers to take account of stakeholders' needs and aspirations, Chapter five evaluates twelve practical elephant management interventions that are increasingly needed and carried out in small, fenced reserves. In line with the frameworks presented in Chapter two, three and four, I devised a One Well-being framework to holistically assess the risks associated with the unintended consequences of these interventions. The One Well-being framework highlights the importance of aligning nature conservation with animal and human well-being and advocates an increase of habitat connectivity through just and ethical conservation practices that are in accordance with the global aspirations mentioned in Chapter two.

Besides Chapter one (Introduction) and Chapter six (General discussion and conclusions), the chapters of this thesis are formatted for the journals they have been or are to be

published in. Two of these manuscripts have been published in international peer-reviewed journals (Chapters 2 and 3), the case study presented in Chapter three has been published in a non-peer-reviewed journal, Chapter 4 has been submitted to a peer-reviewed journal, and Chapter 5 is in preparations to be submitted to a peer-reviewed journal.

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## 1.10 Supplemental information

Table S1.1: Explanation of the size of the bubbles under the sustainability bubble in Figure S1.1, per global agreement. The focus on each pillar of sustainability is scored on a scale of 1 (low) to 3 (high).

<b>Social compact</b>	<b>Explanation of the size of the bubbles under the sustainability pillar</b>
Sustainable Development Goals (SDGs)	The SDGs focus on Sustainable Development, with Prosperity as one of their five dimensions (people, planet, prosperity, peace, and partnerships) and with one SDG goal dedicated explicitly to continued economic growth (SDG 8); despite the challenges this will create for other SDGs (Otero et al., 2020) ( <b>Economic: 3</b> ). People are a central focus of the SDGs and are also one of the five dimensions, but an excessive emphasis on economic growth risks increasing inequality and poverty. Therefore, we scored the social pillar as secondary to the economic pillar ( <b>Social: 2</b> ). The emphasis on continued economic growth contradicts the goals’ life on land’ (SDG 15), ‘responsible consumption and production’ (SDG 12), and ‘climate action’ (SDG 13), and risks increasing unsustainable natural resource extraction (Menton et al., 2020; Turnhout et al., 2013; Wiedmann et al., 2020) ( <b>Environmental: 1</b> ).
Convention on Biological Diversity (CBD)	The CBD prioritises the value and sustainable use of biodiversity (Aichi Strategic Goal A target 1) (Otero et al., 2020) ( <b>Economic: 3</b> ), “whilst containing the impacts of the sustainable use of ecosystem services well within safe environmental limits”, (Aichi Strategic Goals B and C) rather than emphasising conservation per se. The Aichi Targets for 2020 also fail to address the relationship between biodiversity loss and economic growth (Otero et al., 2020) ( <b>Environmental: 2</b> ). Strategic Goal C emphasises the social benefits, human well-being and needs, including those of indigenous people, women and local communities, and Aichi Target 11 aims for “effectively and equitably managed” Protected Areas, but the focus on the economic pillar may limit the development of equitable conservation solutions (Aichi Biodiversity Targets, 2011-2020) ( <b>Social: 1</b> ).
The Intergovernmental Science-Policy Platform on Biodiversity and	The IPBES framework views the value of nature as instrumental and highlights nature’s contributions (the value of nature) (Kenter, 2018). Although IPBES acknowledges the need to move away from the current growth paradigm, highlighted by degrowth scenarios in some regional agreements (IPBES, 2019; Otero et al., 2020), the general emphasis still lies on instrumental values ( <b>Economic: 3</b> ). The

Ecosystem Services (IPBES)	approach is more inclusive than previous frameworks (e.g., Millennium Ecosystem Assessment), in terms of the central role of culture, and the integrations of values of indigenous communities (Pascual et al., 2017), but this appears as subsidiary to the economic pillar. IPBES is moving toward alternative models that promote equity and inclusive wealth accounting. However, there are still uncertainties associated with the implementation of such models (IPBES, 2019) ( <b>Social: 2</b> ). The framework’s goals mention conservation and sustainable use of biodiversity together (no separate focus on conservation) but emphasise sustainable development (Díaz et al., 2018), which can negatively impact the environment ( <b>Environmental: 1</b> ).
The Nagoya Protocol (NP)	The Nagoya Protocol is primarily about benefits from the use of genetic resources and generally views the relationship between economic growth and biodiversity as unproblematic (Otero et al., 2020) ( <b>Economic: 3</b> ). The NP highlights benefit sharing fairly and equitably, aims to address imbalances in resource use between the Global North and South (Deplazes-Zemp et al., 2018). However, in terms of non-commercial research, the protocol may have unintended consequences and promote North-South injustices rather than reducing them ( <b>Social: 2</b> ). The NP does not promote strategies to conserve nature ( <b>Environmental: 1</b> ).
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	CITES’s vision statement states that by 2030, all international trade in wild species will be legal and sustainable, consistent with the long-term conservation of species, thereby contributing to halting biodiversity loss ( <b>Environmental: 3</b> ). A subsidiary goal of CITES is to ensure sustainable use ( <b>Economic: 2</b> ). Although CITES does mention their aim of contributing to the 2030 Sustainable Development Goals, the convention does not specify concerns or goals related to social goals ( <b>Social: 1</b> ).
African Elephant Action Plan (AEAP)	The aim of the African Elephant Action Plan is to “Secure and restore where possible sustainable elephant populations throughout their present and potential range in Africa recognising their potential to provide ecological, social, cultural and economic benefits”, which highlights its focus on the environmental pillar ( <b>Environmental: 3</b> ). Social, cultural, and economic benefits are mentioned but are only briefly described in the Activities 7.1.3 and 7.1.4 ( <b>Social: 1; Economic: 1</b> ) (CITES, 2010).
Convention on the Conservation of Migratory Species of Wild Animals (CMS)	CMS recognises that wildlife is an indispensable part of nature and should be protected for the good of humanity. CMS’s mission emphasises the environmental pillar: Action is promoted “to safeguard the beneficial conservation status of migratory animals and their living space, and to ensure the ecological integrity, connectivity and resilience of migration systems” ( <b>Environmental: 3</b> ) (Convention on Migratory Species, 2014). Their strategic plan also highlights the global

	<p>importance of migratory species as various local people depend on regular visits of migratory species: “as a basis for subsistence; for economically and culturally important hunting, fishing, tourism and recreation; or to maintain ecosystem function in a way that allows another resource to be harvested” (<b>Economic: 2</b>). Although the convention does include social benefits, it only mentions subsistence and cultural use, which are more focusing on economic goals, and less on social goals (<b>Social: 1</b>).</p>
<p>UN Declaration on the rights of indigenous peoples</p>	<p>UN Declaration on the rights of indigenous peoples (OHCHR, 2007) is a universal framework of minimum standards for the survival, dignity, well-being, and rights of indigenous peoples (<b>Social: 3</b>). It ensures their right for indigenous peoples to pursue their priorities in economic, social, and cultural development (<b>Economic: 2</b>). The declaration acknowledges the importance of respecting indigenous knowledge, traditional practices, and cultures and contributes to sustainable and equitable development and proper management of the environment. Indigenous peoples have the right to the conservation and protection of the environment and the productive capacity of their lands or territories and resources. This indicates a right and not a mechanism for conservation. Moreover, the right to the conservation of the environment does not mean they can pursue their own priorities in terms of conservation (<b>Environmental: 1</b>).</p>
<p>Ubuntu</p>	<p>Ubuntu strengthens the societal common good and incorporates humanness as a vital element to promote human growth (Venter, 2004) (<b>Social: 3</b>). The philosophy also promotes just and harmonious relations between humanity, and the Earth, based on respect for all life (LenkaBula, 2008). Ubuntu can be viewed as an eco-philosophy and ecosophy aligned with the principles of the deep ecology movement (Grange, 2015). Similarly, the interrelatedness of the web of life accords moral standing to all living things and prizes harmonious relationships within the natural community (Behrens, 2014) (<b>Environmental: 3</b>). Ubuntu mitigates against the impact of capitalism, harmful ecological practices, excessive accumulation of ecological resources, and privatisation of commons (LenkaBula, 2008) (<b>Economic: 1</b>).</p>

Table S1.2: Explanation of the size of the icons of the moderating filter emphasis in Figure S1.1 per global agreement. The focus on each societal moderating filter is scored on a scale of 0 (not applied) to 3 (high).

Social compact	Explanation of the size of the icons of the moderating filter emphasis
Sustainable Development Goals (SDGs)	<p>Intergenerational legacy is emphasised in ‘Planet’ as one of the five dimensions of the SDGs, which includes the aim of conserving Earth to provide peoples’ needs, including recognising our intergenerational legacy (<b>Intergenerational legacy: 2</b>). Although many SDGs cover issues related to good governance, such as equity, the SDGs do not specifically promote multilevel governance approaches (<b>Good governance: 1</b>). Two of the 17 SDGs (SDG 5 and 10) are precisely about increasing equality, yet SDG 8 (decent work and economic growth) may risk increasing inequality (Wiedmann et al., 2020). Furthermore, although SDG16 focuses on inclusive societies with access to justice for all, generally, “environmental justice, and broader societal justice, are currently not incorporated within the vision of the SDGs” (Menton et al., 2020). Considering these contradictions between SDGs, we scored environmental justice as a subsidiary to intergenerational legacy (<b>Environmental justice: 1</b>). The SDGs aim to achieve gender equality and empower all women and girls (SDG5), recognise the risks posed to all, especially marginalised people, by climate change (SDG 13), and to establish sexual and reproduction rights and health (SDG 3.1, 3.7), which respects part of the human right filter. However, target 10.1 (economic inequalities and poverty reduction), for example, does not address vertical inequalities, therefore not reducing the ‘rising gaps between rich and poor’ (MacNaughton, 2017). Furthermore, the SDG reproductive health targets are merely a technical approach, not rights-based, lacking strategies addressing the root causes of structural undermining of women’s right to equality and control of their own lives’ (Winkler &amp; Williams, 2017) (<b>Human rights: 1</b>).</p>
Convention on Biological Diversity (CBD)	<p>Aichi target 17-18 focus on participatory planning, knowledge management and capacity building and highlight the importance of respecting traditional knowledge and practices of indigenous people (<b>Good governance: 2</b>). The Contracting Parties agree to protect and use natural resources sustainably for the benefit of present and future generations (Convention on Biological Diversity, 1992). However, these future benefits are merely framed around future use of biodiversity instead of the</p>

	<p>broad intergenerational legacy that includes existence and intrinsic values (<b>Intergenerational legacy: 2</b>). Aichi target 16 mentions equitable and just benefit sharing. Article 10(c) of the convention aims to conservation and promote sustainable use of natural resources following practices that are <i>compatible with conservation</i> or sustainable use requirements (i.e., only possible when it fits in, secondary to conservation) (<b>Environmental justice: 1</b>). Aichi target 14 considers the needs of indigenous and local communities, women, and the poor and vulnerable, but this is needs- and not rights-based, and without empowerment strategies (<b>Human rights: 0</b>).</p>
<p>The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)</p>	<p>In terms of future benefits, Díaz et al. (2015) mention the rights and needs of current and future generations and future-orientated values, including bequest values and option values. However, NCP category 18, “Maintenance of options” (i.e., potential opportunities of future benefits from nature), is only one of the 18 NCP categories used in IPBES assessments (Díaz et al., 2018) (<b>Intergenerational legacy: 2</b>). Governance is included in the IPBES framework as an indirect driver (Díaz et al., 2015a) and the framework embraces different disciplines and knowledge systems (including indigenous and local knowledge) (Díaz et al., 2015). IPBES intends to promote evidence-based best practices to inform processes, and not to promote and specify good governance processes per se, for which other components of the system are responsible (<b>Good governance: 1</b>). Although the framework is more inclusive as compared to previous assessments (e.g, Millennium Ecosystem Assessment), “a more comprehensive framing of inclusive valuation” (Kenter, 2018) is not yet prioritised (<b>Environmental justice: 1</b>). The IPBES scenarios do not explicitly consider the rights and perspectives of local, indigenous peoples (IPBES, 2019) and do not specify how rights could be taken into account yet. The contributions “are end-seeking, while rights are ends in themselves” (Kenter, 2018) (<b>Human rights: 0</b>).</p>
<p>The Nagoya Protocol (NP)</p>	<p>The Nagoya Protocol is primarily a governance mechanism built on the premise of states having sovereignty over their genetic resources (<b>Good governance: 2</b>) and equity and justice in benefit sharing of genetic resources. The NP rewards stewardship of genetic resources and traditional knowledge (<b>Environmental justice: 2</b>). However, the NP has failed to address concerns concerning policing the use of genetic resources, and it lacks a meaningful enforcement mechanism to secure the interests of both provider states and user states risking an imbalance between the interests of biodiversity-rich countries and the users of genetic</p>

	resources (Kariyawasam & Tsai, 2018). The NP does not explicitly address the right to use genetic resources by future generations ( <b>Intergenerational legacy: 0</b> ). Human rights are not explicitly mentioned in the protocol other than in the context of environmental justice ( <b>Human rights: 0</b> ).
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	The CITES is a global environmental governance organisation dedicated to ensuring that international trade in wildlife and plant species does not endanger further their survival. However, there are inconsistencies in stakeholder participation, as power imbalances (e.g., between developed vs developing nations; influential NGOs vs small community-based NGOs) and agendas can influence processes ( <b>Good governance: 2</b> ). We scored intergenerational legacy a two as it is subsidiary to international trade ( <b>Intergenerational legacy: 2</b> ). The convention can be regarded as an international regime which sustains North-South inequalities which arise from global neoliberalism (Duffy, 2013), similarly to most global governance networks which are dominated by the global North ( <b>Environmental justice: 0</b> ). The CITES Strategic Vision: 2021-2030 does not include any human rights strategies ( <b>Human rights: 0</b> ).
Convention on the Conservation of Migratory Species of Wild Animals (CMS)	The contracting parties of CMS recognise that wild animals must be conserved for the good of humanity, acknowledge our responsibility to conserve natural resources for future generations and must guarantee that intergenerational legacy is safeguarded and, where utilised, is used wisely ( <b>Intergenerational legacy, 3</b> ). The convention provides species listed in Appendix I (e.g., Asian elephants) legal protection across international boundaries and facilitates (not requires) transboundary collaborative governance between range states (Target 9), which is essential to achieve successful conservation outcomes ( <b>Good governance: 2</b> ) (Convention on Migratory Species, 2014; Joshi & Puri, 2021). The CMS convention does not cover environmental justice or human rights issues ( <b>Environmental justice: 0; Human rights: 0</b> ).
UN Declaration on the rights of indigenous peoples	Indigenous peoples have the right to maintain and strengthen their distinctive spiritual relationship with their traditionally owned or otherwise occupied and used lands, territories, waters, coastal seas, and other resources (article 25). The declaration requires governments to recognise and protect these rights ( <b>Environmental justice: 3</b> ). Confirming equality between all people, including indigenous peoples (article 2) while recognising people's right to be different and to be respected as such. Indigenous peoples should be free from discrimination of any kind. Acknowledging and promoting the rights of indigenous peoples, which derive

	<p>from their political, economic, and social structures and their cultures, spiritual traditions, histories and philosophies, especially their rights to their lands, territories and resources (OHCHR, 2007) (<b>Human rights: 3</b>). The Declaration recognises that indigenous peoples have rights to autonomy, self-government in issues concerning their lives, and provision of monetary support for their self-determination (article 4), initiatives to promote participation of indigenous peoples and engagement in developing solutions for local issues (article 41), alignment with moral values such as justice, human rights, democracy, equity, inclusiveness, good governance, and trust (article 46:3). Although these articles include elements of good governance, such as participation, the Declaration requires states to achieve this without proposing processes to realise this, nor highlight other aspects such as transparency or accountability (<b>Good governance: 2</b>). Article 25 states the right to maintain and strengthen people’s distinctive spiritual relationship with their traditional lands and other resources, and to uphold their responsibilities to future generations. Although this includes elements of intergenerational legacy, the declaration does not argue for conserving natural resources for future generations (<b>Intergenerational legacy: 1</b>).</p>
Ubuntu	<p>Ubuntu promotes just and harmonious relations between humanity, and the Earth, based on respect for all life, and justice for all species, especially those that are impacted by environmental harm or for communities that are negatively affected by ecological destruction or neoliberal international markets (LenkaBula, 2008) (<b>Environmental justice: 3</b>). Ubuntu means relatedness to (or embeddedness in) the web of life. Ubuntu’s beliefs about ancestors entail a sense that generations from the past, present, and future are all connected as one e moral community. Our connection with future generations demands an environmental philosophy the acknowledges and respects our moral obligations to future generations (Grange, 2015). “Human actions are sensitised to all dimensions of existence – past, present and future” and “the connecting thread in all three dimensions of existence is the moral values that have been inherited, treasured and passed on to future generations” (Murove, 2009) (<b>Intergenerational legacy: 3</b>). Ubuntu recognises the rights and the responsibilities of all people, whether individual or collective and promotes social and individual well-being. Although Ubuntu acknowledges that “an individual is an individual through others” and articulates values such as dignity, compassion, and respect, its desire for consensus also entails a risk in terms of demands for oppressive conformity and group loyalty (Louw, 1998). As Ubuntu is</p>



	<p>framed around African communal cultural life, individual rights are less prioritised (Tambulasi &amp; Kayuni, 2005) (<b>Human rights: 1</b>). Ubuntu centres around people, values and principles and does not encompass principles of democracy and good governance (e.g., transparency, accountability, equality). To prevent unintended negative consequences, the principles of Ubuntu should be applied complementary to principles of democratic good governance (Tambulasi &amp; Kayuni, 2005), which is not explicit (<b>Good governance: 0</b>).</p>
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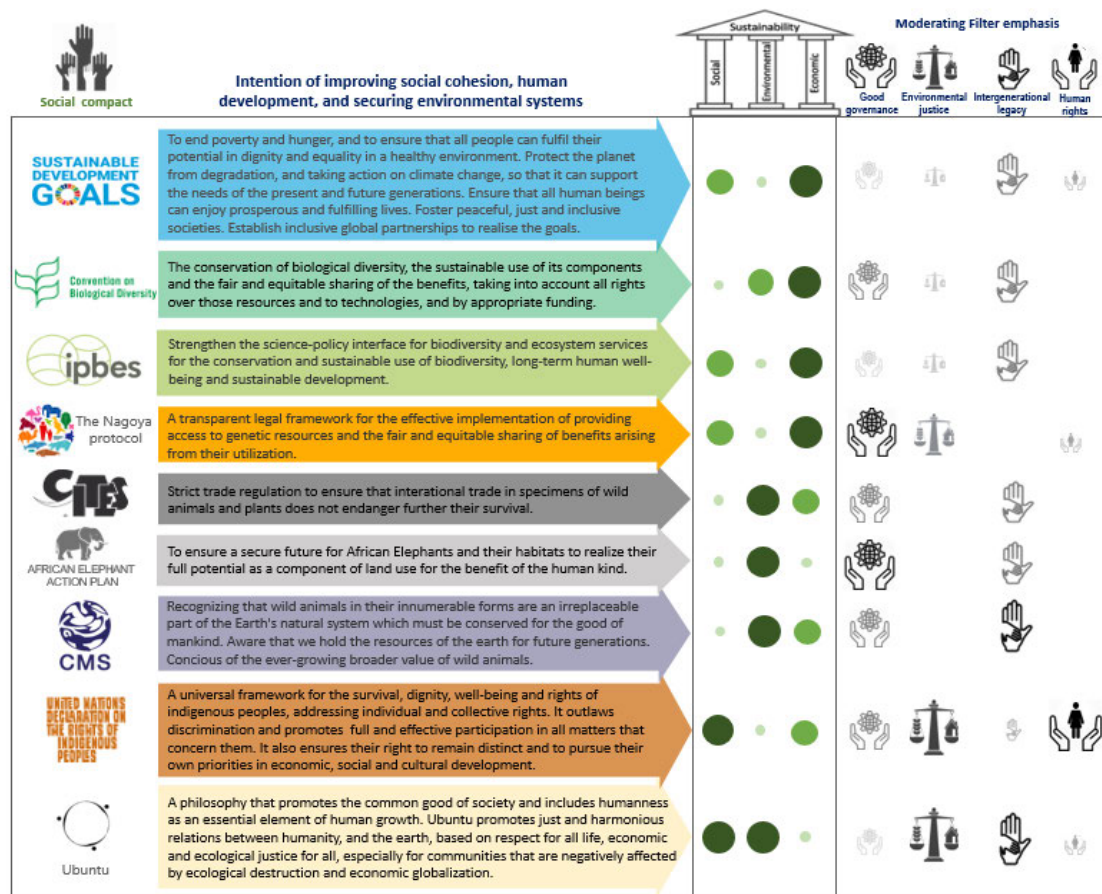


Figure S1.1: Social compacts and their scores on the pillars of sustainability and moderating filters. Social compacts are summarised in terms of their intention to safeguard biodiversity and improve human well-being and social cohesion while securing the environmental systems on which life depends (Column 1). The size of the symbols reflects a relative emphasis on the three pillars of sustainability (Table S1.1) and the four moderating filters (Table S1.2). It appears the social compacts have different priorities in terms of sustainability, with, for example, the SDGs, the Convention on Biological Diversity (CBD), IPBES and the Nagoya protocol emphasising the economic pillar, and CITES and the Convention on Migratory Species (CMS) the environmental pillar. Few prioritise the social pillar. Such imbalances exacerbate the risk of a disconnection between nature and people and are likely to cause conservation decisions to be inconsistent with societal aspirations and expectations. This highlights the need for moderation of the social compacts through the filters identified in the TUSKER framework, but these appear to be relatively weakly applied (Column 3).

## 2. HUMAN-ELEPHANT COEXISTENCE THROUGH ALIGNING CONSERVATION WITH SOCIETAL ASPIRATIONS

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## 2.1 Abstract

Nature's contributions to people diminish when people are alienated from nature. We developed a framework to help support more sustainable people-nature interactions in the context of the conservation of African elephants (*Loxodonta africana* and *L. cyclotis*). Elephants are iconic, and ecologically, culturally, and socio-economically important, but are also competing and in conflict with people who still benefit little from elephant conservation. We demonstrate how this framework can be used to address challenges over elephant conservation and management, and help achieve human-elephant coexistence, by (i) balancing integrity of nature with social cohesion and human wellbeing, and (ii) moderating the use of nature through widely accepted values, aspirations, and rights. The framework provides mechanisms for policymakers and managers to improve existing community-based conservation initiatives, promotes equitable policies for elephant conservation, and can be applied to the conservation of other iconic species that pose management challenges.

## 2.2 Introduction

Nature plays a crucial role in securing, maintaining, and enhancing peoples' life quality for current and future generations (Chaplin-Kramer et al., 2019; Díaz et al., 2018; Guerry et al., 2015). Natural resources (i.e., the world's stock of natural assets including soil, air, water, animals, and plants) provides important ecosystem services (e.g., pollination, carbon sequestration), which sustain human wellbeing in everyday life (Díaz et al., 2018). However, human activities are responsible for the global loss in biodiversity, and this is reducing ecosystem services and affecting human well-being (Bradbury et al., 2021; Chaplin-Kramer et al., 2019). By 2050, it is estimated that up to 5 billion people, particularly in Africa and South Asia, will be at risk of experiencing diminishing ecosystem services (Chaplin-Kramer et al., 2019). Strategies to reverse downward trends in ecosystem services may achieve positive outcomes but may not be sustainable when continuing human activities are still conflicting with conservation efforts (Kareiva, 2014; Marvier, 2014; Tallis et al., 2008). The development of Biodiversity Value Chains (BVC)

can enhance the benefits of nature and support the implementation of sustainable conservation actions, therefore helping achieve global agreements (e.g., the Sustainable Development Goals) (De Leeuw et al., 2018). However, local voices are often ignored, and the benefits of nature rarely fully reach the social domain (Büscher & Fletcher, 2019; Büscher et al., 2017; Dowie, 2009; López-Bao et al., 2017). To enhance the effectiveness of conservation actions, it is essential that local communities are an integral part of such strategies (Büscher & Fletcher, 2020), and that they are aligned with broader values and aspirations (Kenter, 2018).

Elephants are charismatic, sentient, complex, and intelligent beings (Department of Environmental Affairs and Tourism (DEAT), 2008; Di Minin et al., 2013; Lötter, 2016), and have great existence value, even for people whose experience with elephants is restricted to books or screens (Alexander, 2000; Wang et al., 2020). As an umbrella species, elephants help conserve their habitats and a large variety of co-occurring species (Albert et al., 2018; Roberge & Angelstam, 2004), and they strongly influence the structure and functioning of ecosystems, acting as ecological engineers (Berzaghi et al., 2019; Poulsen et al., 2017), for instance by dispersing seeds and recycling nutrients (Bunney et al., 2017). As a flagship species (i.e., species that have the ability to generate support for conservation), elephants provide a substantial source of income, and represent an intense focus of planning, management, and large conservation investments (Biggs et al., 2008; Di Minin et al., 2022; Naidoo et al., 2016; Walpole & Leader-Williams, 2002).

Elephant conservation and management strategies can be contentious, and discussions are often polarised as views and values of stakeholders diverge widely. First of all, there are ongoing debates as to whether elephants have adverse effects on biodiversity, for instance by impacting trees (Asner et al., 2016; Henley & Cook, 2019). Secondly, contention arises around access to, and property rights of, wildlife, often placed in the hands of national governments, conservation authorities, or wealthy individuals, and excluding local communities who bear the brunt of living with elephants (Brockington & Igoe, 2006). It is evident that elephants may be abhorred by the people who live alongside them due to increasing human-elephant conflicts (HEC), while the general public greatly admires them and is willing to pay just for seeing them (Thomas & Mmopelwa, 2012). The third point of contention centres around the illegal killing of elephants for their ivory, which

may be the most extensively debated and reported global conservation issue (Biggs et al., 2017). Finally, elephants are the subject of animated international, multilateral, and media discussions when they are hunted (e.g., Botswana's recent reversal of the elephant hunting moratorium (Di Minin et al., 2021a; Mokobela et al., 2019)), culled for management purposes (Owen-Smith et al., 2006), or held in captivity for entertainment purposes (Baker & Winkler, 2020 and resulting commentaries; Schmidt-Burbach et al., 2015).

To facilitate a shift towards an integrated conservation approach, we propose the Towards a Unified System of Key Environmental Relations (TUSKER) Framework to align the conservation of African elephants with societal aspirations. The present study (i) discusses the consequences of disconnected natural and social systems in the context of the African elephant; (ii) introduces the TUSKER framework to balance integrity of nature with social cohesion and human wellbeing and moderate nature use through the global social compact, and (iii) applies the framework to the case study of the African elephant. A social compact is an agreement among various societal stakeholders about norms, values, aspirations, and ethics, outlining the duties and rights of each party (Haywood et al., 2019). These agreements are consolidated into constitutions, charters, or conventions, such as the Sustainable Development Goals (SDGs), the Convention on Biological Diversity (CBD), the African philosophy Ubuntu, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), and the UN Declaration on Rights of Indigenous Peoples. Specifically relevant to elephants are the African Elephant Action Plan, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and South Africa's recently drafted Policy Position on the Conservation and Ecologically Sustainable Use of Elephant, Lion, Leopard, and Rhinoceros (DFFE, 2021). Policymakers and managers can apply the TUSKER framework to assess the broader implications of conservation decisions and align conservation with societal aspirations. The purpose of the framework is to facilitate meaningful human-elephant coexistence, enhance the participation and benefit-sharing of local communities, and help restore the full value that elephants have for nature and people.

## 2.3 Current conservation challenges

### 2.3.1 Ecosystem Disservices: Increased risk of human-elephant conflicts

Many areas across Africa are at potentially severe risk of HEC (Di Minin et al., 2021b). Kavango-Zambezi Transfrontier Conservation Area, home to half of the world's elephant population in Southern Africa, reported widespread crop damage by elephants which significantly reduced food security (Salerno et al., 2021). In the Eastern Okavango Panhandle in Northern Botswana, a HEC hotspot area, local communities compete with over 15,000 elephants (Poza et al., 2017; Songhurst, 2017; Songhurst et al., 2016). HEC-motivated policy changes have recently been proposed in Southern African countries. For instance, one of the objectives of the auction of 170 live elephants in Namibia was to reduce HEC (Ministry of Environment, Forestry and Tourism (MEFT), 2021) and South Africa's policy position has a strong focus on enhancing human-elephant coexistence (DFFE, 2021). To mitigate the threats of HEC to elephants and local communities, integrated, proactive solutions are needed, as opposed to reactive and disconnected solutions (Ceauşu et al., 2018; Shaffer et al., 2019).

### 2.3.2 Disconnected natural and social systems

Disconnected approaches are defined here as approaches that do not integrate the natural and social systems. The impact of disconnected natural and social systems on overall sustainability is visualised through assessing the elephant BVC. In conventional conservation practices, the value flow is often blocked by a physical or figurative 'fence' that separates the natural and social systems. The elephant BVC starts at the left at biodiversity (e.g., elephants as a key species), which forms part of the ecological infrastructure (e.g., elephant habitat for ecological communities, trees for shade, rivers for nutrient flow, corridors for dispersal), and provides ecosystem services (e.g., carbon storage in trees, clean air and water safeguarded in elephant habitat), or ecosystem disservices (e.g., natural disasters such as floods, human and livestock diseases, human-wildlife conflicts) which affect the social system. The social system here stands for the

benefits people derive from biodiversity through direct or indirect use (e.g., ecotourism, recreation, medicine), non-use (cultural, social, spiritual, and intrinsic values), and societal outcomes (e.g., wealth, health, wellbeing, cohesion), as well as the potential negative impacts of nature on humans (e.g., loss of life, stress, anger, loss of income, crop damage). The flow of the value chain goes in both directions: from left to right reflects nature's benefits to people, which are expected to generate positive societal outcomes, and contribute to multiple societal goals. The flow from right to left represents investments and mitigations required to enhance biodiversity, sustainability, and coexistence (Figure 2.1).

Conventionally, protected areas tend to focus on the natural system as if it exists in isolation, for instance when strictly protected areas exclude local communities, or when nature is perceived as separate from people (Büscher & Fletcher, 2019), or on the exclusive management or conservation of elephants (e.g., African Elephant Action Plan objectives are all framed around the natural system, and the reduction of conflict prioritises the protection of elephants (CITES, 2010); Norms and Standards for the Management of Elephants in South Africa all focus on elephants and their habitat (DEAT, 2008); all six main objectives of Kruger National Park's Elephant Management Plan focus on the natural system (Ferreira et al., 2012). By excluding the social system, such conventional conservation approaches do not consider the entire value chain. Few benefits reach local communities that bear the brunt of HEC, while the impact of disservices increases (Ceaşu et al., 2018; Goldman, 2011; Tallis et al., 2008) (e.g., frustration and anger over HEC increase when local communities are excluded from decision-making processes or from access to natural resources, which can lead to poaching, retaliatory killings, resentment, or human dispute). This increases risks and threats to both the natural (e.g., poaching, habitat degradation, over-exploitation, loss of local support for conservation) and the social system (e.g., inequality, crime, power imbalances, social conflicts).

### **2.3.3 Poor socio-ecological outcomes**

Conservation approaches that focus on *the natural system* in isolation (e.g., protectionist conservation), without sufficient attention given to the societal context, may fail to ensure



long-term results, as no incentives are created for local communities to conserve nature, nor for the broader society to prioritise nature over other land uses (Amit & Jacobson, 2018; Büscher et al., 2017; Dowie, 2009; Dudley et al., 2018; Hutton et al., 2005). Conservation approaches that focus on *the social system* in isolation may also pervert overall outcomes, as it may motivate people to exploit resources for self-interest and short-term economic gain, leading to the tragedy of the commons and depletion of natural resources (Hardin, 1968). Poor social outcomes resulting from disconnected natural and social systems are in conflict with, for instance, the intent of the UN Declaration on the Rights of Indigenous Peoples, and with SDG 10 (reducing inequality), and SDG 16 (justice, peace, and strong institutions). Policymakers and managers should consider that half of the SDG targets related to poverty, hunger, health, water, cities, climate, ocean, and land are negatively affected by the decline in biodiversity and ecosystem services (IPBES, 2019), and who it is that experiences the costs and benefits of conservation solutions. A disconnected system can increase consequences of scaling effects, which can lead to complex conservation trade-offs and resulting dissonance when issues of scale are not considered. For instance, conservation solutions may be effective on local levels, while they can have range-state-wide detrimental impacts (e.g., proposals by one country to sell ivory internationally can increase poaching rates in other countries where monitoring or protection is less viable) (Van de Water et al., 2022b).

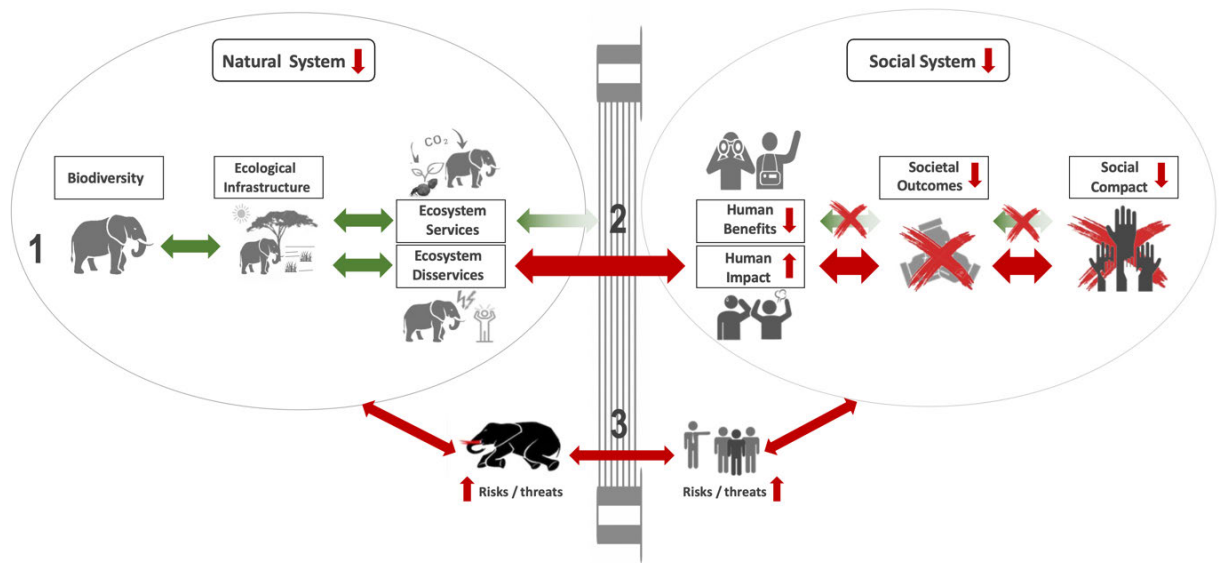


Figure 2.1: Visualisation of the Biodiversity Value Chain in a disconnected socio-ecological system. The blockage symbolised by a fence, whereby the value of biodiversity does not reach the social system. Green arrows represent beneficial pathways, and red arrows represent negative pathways. The barrier blocks the flow of ecosystem services (2) (green arrow blocked by the fence) and may even increase the negative impact of ecosystem disservices such as human-wildlife conflicts or diseases (enlarged red arrow crossing the fence) (Ceaşu et al., 2018). This increases risks and threats to the social system (e.g., inequality, crime, power imbalances) which, in turn, increases risks and threats to the natural system (3) (red arrows). Increased inequality and reduced social cohesion motivate individuals to exploit resources for economic gain to the utmost, such as by poaching (Dowie, 2009). This leads to the tragedy of the commons (3) (red arrows), which occurs when people act purely out of self-interest and short-term gain, to the extent of causing harm to others and the environment (Hardin, 1968). The end result is the depletion of natural resources and a breakdown of the social compact (Berkes, 2006; Hardin, 1968). The disconnected 'Natural Systems' and 'Social Systems' are depicted at the two sides of “fence” (i.e., people are seen as separate from nature), and apply to 1 and 2 as well as the feedback loops at 3.

## 2.4 Elephant examples of disconnected conservation approaches

In order to conserve elephant habitat in Mozambique, it has been proposed to resettle people living in the Great Limpopo Transfrontier Conservation Area and to restrict traditional land-use practices (Spierenburg et al., 2006). By implementing an exclusionary and militaristic approach, this strategy can create challenges in the form of violation of human rights, social inequality, undermining of local incentives to conserve wildlife, and compromised overall sustainability (Booker & Roe, 2017; Büscher & Ramutsindela, 2015; De Leeuw et al., 2018; Duffy et al., 2019; Witter, 2013).

In South Africa, the Elephant Management Plan of Kruger National Park (KNP) integrates natural and social values, for instance by providing local communities with access to some of the benefits of the park (e.g., employment and business opportunities, free or facilitated access to KNP, environmental education, natural resource harvesting, meat donations), and establish partnerships that foster equity redress (Ferreira et al., 2012; Swemmer et al., 2017). The elephant population of KNP has grown significantly since a moratorium was placed on culling elephants in 1994 (Owen-Smith et al., 2006). KNP proposes innovative initiatives addressing the cause of local overabundance of elephants rather than simply the symptoms, such as through the closure of waterholes and range expansion by removing fences between KNP and adjacent reserves in South Africa and Mozambique. However, the KNP Elephant Management Plan can be improved based on other aspects of the social compact, for instance where it proposes a landscape of fear through lethal shooting and elephant pitfalls intended to provoke distress calls from trapped elephants to scare others (Map 8, Table 4, Box 15 in (Ferreira et al., 2012)). This ignores principles of good governance, as it does not comply with the Norms and Standards for Management of Elephants in South Africa (DEAT, 2008), which prohibit intentional disturbance of elephants to change their ranging behaviour (Amit & Jacobson, 2018). Moreover, it proposes illegal activities in terms of the South African Animals Protection and Meat Safety Acts and contradicts the global standards for the slaughter of animals of the World Organisation for Animal Health (Slotow et al., 2021). These regulatory documents encapsulate the social compact that protects the welfare and wellbeing of elephants, and safeguards the moral responsibility of people, in line with the environmental human rights, as established in the South African Constitution (*National*

*Council of the Society for Prevention of Cruelty to Animals v Minister of Environmental Affairs and Others*, 2017).

Botswana is known as an African success story, with a culture of democracy, public consultation, and equitable access to natural resources (Madzwamuse et al., 2020; Mogomotsi et al., 2018). As a result of Botswana's conservation success, and movement of elephants across national boundaries, Botswana currently supports the largest elephant population in the world (Junker et al., 2008; Lindsay et al., 2017; Thouless et al., 2016). Despite the many positive results, the conservation approach in Botswana can still improve on the social compact side. Control of wildlife and other natural resources, and community beneficiation, remained centralised, limiting the control of community-based conservation (CBC) governance structures over resources and the impact they can have on supporting livelihoods (Cassidy, 2021). Almost half of the interviewed residents of the Okavango delta stated that they engage in poaching for subsistence reasons, that they had no interest in participating in anti-poaching efforts, and that they had negative attitudes towards wildlife due to lack of consultation, access, or ownership (Cassidy, 2021; Ceaușu et al., 2018; Drake et al., 2021; Mogomotsi et al., 2020). Without adequate community-level governance and beneficiation, fair and sustainable outcomes are not likely to occur (Cassidy & Salerno, 2020; Di Minin et al., 2022; Drake et al., 2021). The example from Botswana illustrates an issue of scale (national vs household income), as the top-down approach of community trusts solely disbursing funds managed by the central government tend to manage the social implications of conservation poorly, undermine good governance, and risk alienation of communities from wildlife conservation (Drake et al., 2021; Mogomotsi et al., 2018). This has been exacerbated by the lifting of the moratorium on elephant trophy hunting in 2019 (Wasser & Gobush, 2019). Elephant trophy hunting has a long history in Botswana and is promoted as an important tool for community beneficiation (Mbaiwa, 2018). However, it is not clear how revenue from trophy hunting will provide adequate, long-term benefits for affected communities, or how inequity in the distribution of money will be avoided (Dellinger, 2019; Di Minin et al., 2021a; Wasser & Gobush, 2019). In terms of risks to the natural system, the commercialisation of hunting and problem animal control may result in the extinction of older bulls (Selier et al., 2014; Shaffer et al., 2019). Looking at the risks to the social system, trophy hunting converts wildlife into a commodity which opens the

door to short-term, individually motivated behaviour (Bilchitz, 2017; Mkono, 2019). Although Botswana's Community-Based Natural Resources Management approach does contribute to poverty alleviation and job creation (Chevallier & Harvey, 2016; Mbaiwa, 2018), a solution that solely depends on single-source economic systems, such as the sale of licences to a small group of wealthy hunters, is not likely sustainable (Hackel, 1999; Kinsky et al., 2020). A neoliberal system with neo-colonial characteristics could exacerbate risks related to power dynamics and inequity in distributing benefits gained from wildlife (Büscher & Fletcher, 2020; MacDonald, 2005; Mkono, 2019; Wasser & Gobush, 2019). Moreover, trophy hunting alone cannot offset the costs of coexisting with elephants (e.g., injury or death, crop losses, or infrastructure damage), and thus generate a net benefit to communities, which hunting conservation models often aim for (Drake et al., 2021). The global and local debates about lifting the trophy hunting moratorium reflect concerns over violating the social compact, including the traditional African social compact Ubuntu (Mkono, 2019).

## 2.5 TUSKER: a framework that links elephants and human wellbeing

To align elephant conservation decisions with societal values and aspirations and facilitate meaningful human-elephant coexistence, the TUSKER framework was developed (Figure 2.2). TUSKER is based on an inclusive conservation vision that integrates natural and social systems, in which elephants contribute fully to socio-ecological sustainability through removing barriers, and through applying the globally adopted social compact. The framework is centred around the BVC and incorporates two dimensions that are underrepresented in existing approaches. First, it includes a balancing dimension of integrating integrity of nature and social cohesion, through mitigating risks and threats to the natural system (e.g., poaching, habitat degradation, overexploitation, climate change), and to the social system (e.g., inequality, discrimination, crime). The balancing dimension promotes socio-ecological resilience (see 3.1 for more details), which is understood here as the system's capacity to continue to support human and ecological well-being despite experiencing change (Folke et al., 2016). Secondly, TUSKER includes a moderating dimension in which the social compact (i.e., global

values, aspirations, and rights) moderates all decisions along the BVC, through the filters of good governance, environmental justice, intergenerational legacy, and human rights, thereby ensuring accordance with the social compact (see 3.2 for more details). The balancing and moderating dimensions of the framework emphasise a Biodiversity Value Cycle, rather than a chain, creating positive feedback loops that increase a wide range of ecosystem services, including the socio-cultural and spiritual benefits of nature, and the resulting human benefits. The cycle facilitates *meaningful* coexistence, in a way that recognises human beings as part of nature, incorporates indigenous knowledge, and transforms political economic structures (Fiasco & Massarella, 2022). The scaling dimension of the TUSKER framework identifies potential trade-offs of conservation measures at local and global levels, which can help prevent dissonance within conservation and provide opportunities to mitigate potential mismatches in scale (sensu Cumming et al., 2006). Through integrating the socio-ecological system and balancing and moderating conservation decisions, we move beyond the fortress conservation idea that nature must be protected from people, while we also transcend the frame in which nature is purely commodified, without sufficient recognition of its broader values (Büscher & Fletcher, 2019).

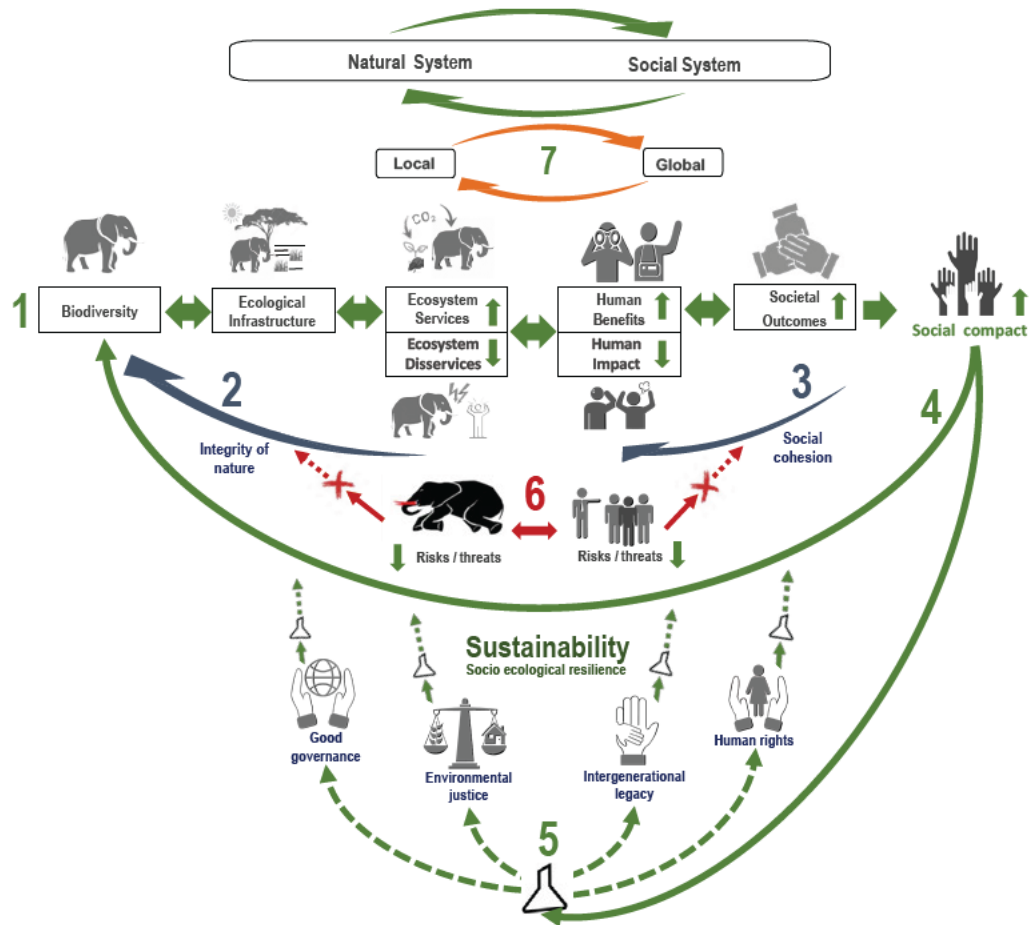


Figure 2.2: The TUSKER framework. Visual representation of the Towards a Unified System of Key Environmental Relations (TUSKER) framework linking biodiversity to societal outcomes as defined by the social compact, using African elephants as a case study. The green arrows (1) represent the cycle of expected values (left to right), balanced with the investments and mitigations required to enhance benefits and sustainability (right to left). Two mitigating processes ensure sustainability: a dimension that balances integrity of nature (2) with social cohesion (3) (blue arrows) through the mitigation of risks and threats to the natural system (e.g., poaching, habitat degradation, over-exploitation, climate change), and to the social system (e.g., inequality, discrimination, urbanisation, crime) with the aim of socio-ecological resilience (represented as Unified System in the name of the framework) (4) (orange arrow); and (5) a dimension in which the social compact (i.e., global values, aspirations, and rights) moderates all decisions along the Biodiversity Value Cycle, through four filters of good governance, environmental justice, intergenerational legacy, and human rights (green dashed arrows) (represented as Key Environmental Relations in the name of the framework). Overall

sustainability is realised by linking the natural and the social system through the balancing (4) and moderating dimensions (5). This will decrease ecosystem disservices and the resulting human impact (6) and mitigate the risk of the ‘Tragedy of the Commons’ (as highlighted in Figure 2.1). The scaling dimension local vs global (7) aids predicting the impact of interventions at local levels as well as beyond on-the-ground practice, and enables development of universal, mutually reinforcing solutions and regulations that mitigate scaling mismatches (Cumming et al., 2006).

### **2.5.1 Balancing integrity of nature with social cohesion and human wellbeing**

Two feedback loops enhance ecological (i.e., integrity of nature) and social (i.e., social cohesion) resilience. First, a feedback loop between ecosystem services and biodiversity represents the investment needed to mitigate risks and threats from human natural resource exploitation (i.e., exploitation of elephants and their habitat), including risks and threats from people’s responses to ecosystem disservices (Ceașu et al., 2018) (e.g., poaching as a reaction to elephant causing loss of life or damaging crops or infrastructure). Investments needed to protect the natural system and enhance ecological restoration can be planned through monitoring the impact of the use of nature on biodiversity, for instance through habitat restoration. Ecological resilience is vital to allow persistence during environmental change (Scheffer et al., 2015), and to guarantee future benefits of nature.

The second feedback loop between human outcomes and human benefits represents the investments needed to improve the sustainability of resource-use and social resilience, by mitigating risks and threats posed to the social system (e.g., inequality, discrimination, urbanisation, and crime). Social resilience contributes to solidarity, cohesion, and distributive justice (Doorn, 2017), which allows us to collectively cope with risks and threats and is critical to prevent the ‘Tragedy of the Commons’ (Hardin, 1968). With the social compact as guidance, conservation policymakers and managers can move toward holistic management by looking back and forth throughout the value cycle as shown in TUSKER, aiming for sustainability and resilience all around by balancing the ecological feedback loop with the social feedback loop.



### **2.5.2 Moderation through four filters of the social compact**

With an increasingly emphatic, informed, and participatory civil society (López-Bao et al., 2017), respecting the social compact is important to ensure that conservation decisions are societally and socially accepted and supported (DEAT, 2008; Lötter, 2016; Lötter et al., 2008). Conservation that results in holistic benefits sustains and strengthens the social compact. In order for this to happen, societal risks and threats to nature conservation (e.g., conflicts of interest, boycotts, sanctions) should be mitigated. To this end, a moderating dimension linking both extreme ends of the value chain (the social compact and biodiversity) was added, thereby creating a circular dimension, turning the value chain into a value cycle. Overall, the moderating function of the social compact directs what are aspirational outcomes, acceptable interventions, appropriate uses, priorities for investment, and identified beneficiaries. The moderating dimension implies that all decisions and actions along all aspects of the Biodiversity Value Cycle are moderated through the four filters of the social compact: good governance, environmental justice, intergenerational legacy, and human rights. The good governance filter is characterised by a multilevel approach (Ostrom, 2007) (from local communities and organisations to international institutions), as opposed to top-down, and defined by values such as equity, effectiveness, responsiveness, robustness, respect for the law, accountability, transparency, dynamism, as well as by innovative ways of social collaboration, and participatory institutions within and across multiple levels (Bennett & Satterfield, 2018; Gavin et al., 2018). The environmental justice filter moderates the risks associated with an inordinate emphasis on economic growth (SDG 8) (Otero et al., 2020), and recognises issues related to power, access, and injustice (Menton et al., 2020). Intergenerational legacy emphasises the sacrifices made for the benefit of future generations, and the importance of building a positive legacy, which are prerequisites for socio-ecological sustainability and resilience (e.g., the Well-being of Future Generations Act, Wales, 2015, anaw 2). The human rights filter ensures that conservation decisions are fair, and based on principles such as gender equality, inclusion, dignity, and freedom (e.g., UN Declaration on Rights of Indigenous Peoples, 2007; Constitution of the Republic of South Africa, 1996).

### 2.5.3 Applying the TUSKER framework

The TUSKER framework will improve upon existing CBC initiatives because, through its filters, it embeds conservation squarely in the broader social compact. Secondly, it allows for inclusion of differing perceptions of the value of elephants. Policymakers and managers can utilise the TUSKER framework to assess the broader consequences of elephant conservation decisions, thereby promoting mutually beneficial relationships between people, elephants, and the environment. For instance, a reserve manager who is confronted with increasing elephant excursions causing crop damage and subsistence farmers demanding compensation, can use TUSKER to assess how the BVC interacts with the social domain. This may uncover that the benefits of wildlife only reach a few, whilst the costs are carried by many (Cassidy & Salerno, 2020). These local lived experiences are often ignored by central governments, international bodies, or the global public, potentially leading to contention. For instance, when local communities call for legal hunting or culling of elephants to mitigate conflicts, whilst international animal welfare and conservation groups discourage the killing of threatened species, as uncovered by the scaling dimension of the TUSKER framework. The balancing dimension of TUSKER inspires managers to develop solutions that contribute to integrity of nature and social cohesion simultaneously, such as creating corridors of tolerance (Zimmermann et al., 2009), fencing farmland instead of conservation land (Fernando et al., 2019), applying natural elephant deterrents (e.g., bees and chilli, King et al., 2017), and developing elephant-friendly livelihoods (e.g., community-based ecotourism, fair trade, changing to crops disliked by elephants, Gross et al., 2017). The moderating dimension of the TUSKER framework filters conservation actions through social compacts relevant to the specific situation. This ensures that the farmer has a say in developing solutions, that injustices are avoided, and that benefits from wildlife, a healthy environment, and sustainable livelihoods can be experienced by present and future generations. Combined, these solutions promote a coexistence or convivial conservation approach (Büscher & Fletcher, 2019), which is in accordance with the scaling dimension of TUSKER and various social compacts. Supporting wildlife-friendly land uses (Salerno et al., 2021), ensuring access to natural areas to gather food sources, and increasing habitat connectivity and community benefits (Asian Elephant Specialist Group, 2017), can help offset the costs of living with elephants in a sustainable manner and decrease the impact

of elephants on food security (Salerno et al., 2020). By applying the framework, integrated, community-based solutions can be developed that not only reduce the costs of living with elephants, but also generate benefits to local communities, the environment, and society at large.

## 2.6 Discussion

### 2.6.1 Elephant conservation examples of TUSKER

Several African elephant conservation projects have successfully removed the barriers between the natural and social system, or apply the moderating filters, which aids in demonstrating the potential positive impact of the TUSKER approach (Figure 2.3). In Mali, communities were empowered to develop their own elephant and nature conservation approach based on their own values, for instance through unarmed joint community/forester patrols. By integrating the natural and social systems, ensuring easy access to natural resources, and promoting community benefits, the Mali Elephant Project has allowed for more elephant habitat to be protected, and for poaching to be reduced, while improving local livelihoods and social cohesion (Canney, 2021; Di Minin et al., 2022). Through an inclusive governance system that was locally rooted, community members were actively involved in managing natural resources, and in restoring degraded habitat (Canney, 2021), which shows the relevance of the good governance filter. The importance of the human rights filter is emphasised as the project showed that respecting the inherent rights of local communities, especially the rights to their lands, shows, contributed to the success of the project (Nelson et al., 2021). By acting on the understanding that a reduced elephant population indicates a reduction in nature's continued capacity to support life, the intergenerational legacy filter is also recognised. After decades of elephant absence in the southern Kunene and northern Erongo regions of Namibia due to poaching and war, elephants returned to the region in 1995. Competition for water has led to increasing conflicts between elephants and people without knowledge about elephants or experience in coexisting with them (Castaldo-Walsh, 2019). An integrated conservation project by Elephant Human Relation Aid

(EHRA), working with the Namibian Ministry of Environment, Forestry and Tourism (MEFT), has applied the environmental justice and human rights filters through investments in education, community empowerment and water point conservation, to benefit elephants and people alike (Castaldo-Walsh, 2019). EHRA's community education program empowers community members with practical knowledge about elephants, and skills to foster coexistence. The training includes practical sessions in the field to track and observe elephant behaviour, which aids in reducing fear and building tolerance (first author, personal observations). The water point conservation program balances the needs of farmers and elephants by building walls around vulnerable water infrastructures, to prevent damage by elephants, and secure access to water for both people and elephants. In the Laikipia-Samburu ecosystem in Kenya investments in the development of community-based wildlife tourism showed positive outcomes for both the natural system, in terms of reduced elephant poaching, and the social system, in terms of peaceful coexistence (Ihwagi et al., 2015). Community-based tourism enterprises that enhance community independence, transparency in decision making and community empowerment, and discourage elitism, are more likely to contribute to sustainable human development (Manyara & Jones, 2007). Also in Kenya, in the Tsavo ecosystem, Save the Elephants promotes beehive fences to deter elephants from entering agricultural land, resulting in reduced HEC, but also in increased income from the sales of honey, skills development, and social upliftment (King et al., 2017). The approach promotes a living in harmony approach and provides opportunities to remove barriers between the natural and social systems by protecting farmland, instead of building fences around protected areas (Fernando et al., 2019; Van de Water et al., 2020).



Figure 2.3: Examples of holistic elephant conservation approaches providing evidence of positive impact on integrity of nature and social cohesion: (a) community-based wildlife tourism contributing to reduced elephant poaching and peaceful coexistence in Kenya (photo credit: Labanowski, Save the Elephants), (b) bees help to deter elephants from farmland while increasing household income and social upliftment simultaneously in Kenya (photo credit: Van Fleteren, Save the Elephants), (c) an unarmed joint community/forester patrol to protect elephants and their habitat improves local livelihoods and equity in Mali (photo credit: the Mali Elephant Project, WILD Foundation/ICFC), and (d) by building protective walls around water points, Elephant Human Relation Aid protects water tanks and solar panels in a way that grants elephants access to water without them being able to cause damage to pipes or other infrastructure, supporting the wellbeing of people and elephants in Namibia (photo credit: Van de Water).

### **2.6.2 Broader relevance of TUSKER**

The relevance of the four filters and feedback loops of the framework have been demonstrated in several studies in other contexts. The International Institute for Environment and Development (IIED) identified best practices by engaging communities in tackling illegal wildlife trade, as reported by 49 community-based initiatives in Africa, Asia, and Latin America. In the report, IIED highlighted the importance of local management and ownership, and long-term multi-stakeholder partnerships (Booker & Roe, 2017), and therefore demonstrated the good governance and environmental justice filters. The TUSKER framework recognises, supports, and contributes to existing conservation approaches with similar overall win-win goals, such as CBC, “other effective area-based conservation measures” (OECMs), and areas protected by indigenous peoples and local communities (ICCAs) (Dudley et al., 2018). Although CBC can strengthen local governance institutions, the approach also varies greatly in standards of good governance, regarding equity in benefit-sharing and power distribution, and in their impact on biodiversity and human wellbeing (Calfucura, 2018; Drake et al., 2021; Salerno et al., 2021). Although, in theory, CBC is predicated on community ownership and economic benefits to communities, in practice CBC governance is often still centred at higher levels of government, and benefits are experienced by few (Brooks et al., 2013; Drake et al., 2021). CBC areas can also depend on nongovernmental organisations (NGOs) or private individuals, which prevents true local ownership (Galvin et al., 2018). These types of challenges can be revealed through the scaling lens of TUSKER that identifies these mismatches, and then provides opportunity for correction based on understanding which mechanism or process needs to be addressed.

Applying the TUSKER framework will require integration of the multilevel nature of CBC governance structures into conservation systems (Salerno et al., 2021), but with each component at the appropriate scale, e.g., national, community, or household. TUSKER will promote the integration of local governance arrangements and traditional leadership in the broader government conservation framework. A lack of building enduring local capacity and human agency, critical to the success of CBC projects (Brooks et al., 2013; Drake et al., 2021; Salerno et al., 2021), will be noticed when the human rights filter is applied, as per the UN Declaration on the Rights of Indigenous Peoples that highlights

the importance of social learning, local leadership, and consideration of cultural worldviews, which are often missing in CBC case study assessments (Galvin et al., 2018). Ownership of CBC projects is often not linked to ownership of land or land tenure security, preventing intergenerational legacy, another TUSKER filter (Borrini-Feyerabend & Campese, 2017; Brooks et al., 2013; Calfucura, 2018). Furthermore, ownership of CBC projects is not accorded equal status with Protected Area management agencies, which limits CBC projects' ability to engage and influence conservation decisions at similar levels. This lack of influence at higher levels, inequity in decision-making, and imbalance of control, violates the environmental justice filter, and hinders CBC objectives (Drake et al., 2021; Galvin et al., 2018; Salerno et al., 2021). Some promising steps aligned with some of the filters of the TUSKER framework have been made. OECMs emphasise the importance of good governance, human rights, and respecting diverse worldviews (Dudley et al., 2018). ICCAs are a good example of integrating various use and non-use values of nature perceived by local communities, as opposed to the perception of higher governance structures (Borrini-Feyerabend & Campese, 2017). But, despite IUCN's recognition of ICCAs as one of the four main conservation governance types, the ICCA Consortium identified as threats internal political and socio-cultural change, and external interventions, that undermine the institutions governing ICCAs (Borrini-Feyerabend & Campese, 2017).

The TUSKER framework can be applied to improve decision-making in complex socio-ecological contexts for other species, for example, where there are similar problems of lack of access or poor beneficiation from the BVC, associated with ecosystem disservices such as human-wildlife conflict. For instance, Lion Guardians' (<http://lionguardians.org/>), a successful lion (*Panthera leo*) conservation model and NGO in Eastern Africa, focuses on lion conservation on community land instead of in protected areas. By practicing community participation, adopting indigenous knowledge and value systems, and promoting local incomes, this unique network in fact applies the moderating filters of the TUSKER framework. Lion killings are reduced by 90% (Hazzah et al., 2019). In Costa Rica, a participatory assessment of the drivers of coexistence between local communities and jaguar (*Panthera onca*) and puma (*Puma concolor*) formed the basis for an "incentives to coexist with big cats plan". The plan highlights standards for equity, good governance, and social norms (Amit & Jacobson, 2018), similar to the

balancing and moderating filters of the TUSKER framework. In Ghana, an adaptive community-governed hippo sanctuary (*Hippopotamus amphibius*) showed that respecting the good governance and human rights filters, through balancing biodiversity protection and poverty alleviation, and through considering cultural practices and local livelihoods, balanced outcomes could be realised for the protection of an iconic species, biodiversity conservation, and poverty alleviation (Sheppard et al., 2010).

By applying the proposed framework, policymakers and managers will be able to look beyond the boundaries of protected areas and conservation-must-pay approaches, towards a conservation vision inspired by a public trust doctrine, and by the intention to protect the environment for all people and nonhuman nature alike. The TUSKER framework, thus, provides mechanisms for policymakers and managers to combine innovative elements of existing approaches, but promote success by mitigating risk through balancing and moderating for socio-economic sustainability. This will provide opportunities for local conservation initiatives to assert their material and spiritual significance, to prevent interventions from external powerful stakeholders with different agendas (Borrini-Feyerabend & Campese, 2017), and to move beyond monetising wildlife (Cassidy, 2021). Conservation policies conceived along this line will aim for equity in sharing the benefits of nature, including for local communities and future generations (Blackmore, 2017; Otero et al., 2020). Alignment with the social compact will likely attract local and global support for conservation measures. It creates opportunities for innovative solutions, including civic-based funding for conservation and human development, avoiding dependence on a single support system or on global markets (Soulé, 2013; Van Norren, 2020). This will lead to social and ecological resilience, which is vital, especially in a post-Covid-19 world (Naidoo & Fisher, 2020).

### **2.6.3 Outlook and conclusions**

Biodiversity-related social compacts set clear goals to improve human wellbeing and social cohesion through reduced poverty and inequality, improved education, nutrition, health, and employment opportunities, while securing the ecological systems on which life depends (Guerry et al., 2015; Pascual et al., 2017; Smith et al., 2020). Although these



goals require strategies that reconcile conservation and human wellbeing, this is not common practice nowadays (Van Norren, 2020). Conventional conservation frameworks are still often exclusion-based in the form of strictly protected areas or focused on economic growth and the commodification of nature (Büscher & Fletcher, 2019). Commodifying nature also promotes behaviour motivated by short-term human gain, especially when people consider wildlife as private property (Blackmore, 2017; Menton et al., 2020). This approach to nature has led to biodiversity loss, increased inequality, poverty, and unsustainable practices (Menton et al., 2020; Otero et al., 2020; Soulé, 2013; Turnhout et al., 2013; Wiedmann et al., 2020).

Nature conservation contributes more strongly to equitable sustainable development when all values of nature are included (Smith et al., 2020), and when multiple, carefully tailored solutions are moderated by the social compact. In this vein, the TUSKER framework guides transformation towards a more equitable, locally embedded, and multiple-value Biodiversity Value Cycle in which community ownership is central, thereby ensuring long-term sustainability (Dellinger, 2019; Mogomotsi et al., 2020; Shaffer et al., 2019; Wasser & Gobush, 2019). The TUSKER framework is inspired by a 'living with' philosophy and convivial conservation, which proposes peaceful, mutually beneficial relations within and among the components of the natural and social systems (Büscher & Fletcher, 2019; Turnhout et al., 2013). The framework is also based on the principles of the African philosophy Ubuntu and similar communal approaches that emphasise the importance of relatedness ("*I am because we are*"), the common good of society, humaneness, compassion, inclusiveness, and being in harmony with and respecting nature and people (Mkono, 2019; Van Norren, 2020). In the spirit of Ubuntu, the framework promotes meaningful coexistence and economic and ecological justice for all, especially for communities that are negatively affected by ecological destruction and economic globalisation (LenkaBula, 2008; Mabele et al., 2022; Venter, 2004). TUSKER guides a worldview of interconnectedness, in which nature is promoted for, to, and by humans, rather than protected from humans, and in which human development is dependent on regenerative socio-ecological systems (Büscher & Fletcher, 2019; Canney, 2021; Mabele et al., 2022). The application of the framework provides opportunities to realise bold conservation targets, such as to conserve or rewild large parts of the world, but with human rights and other filters in place to enable local and global support for

conservation (Dudley et al., 2018). Rather than by simplifying, dominating, and commodifying nature, societal goals are achieved by reconnecting with nature through recognising and promoting interactive relationships and positive feedback loops whereby people, and the rest of nature, benefit.

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## 2.9 Case study: Future of Thailand's captive elephants

Commentary on Baker & Winkler on Elephant Rewilding

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### 2.9.1 Abstract

Removal from natural habitat and commodification as private property compromise elephants' broader societal value. Although we support Baker & Winkler's (2020) plea for a new community-based rewilding conservation model focused on mahout culture, we recommend an expanded co-management approach to complement and enhance the regional elephant conservation strategy with additional local community stakeholders and the potential to extend across international borders into suitable elephant habitat. Holistic co-management approaches improve human wellbeing and social cohesion, as well as elephant wellbeing, thereby better securing long-term survival of Asian elephants, environmental justice, and overall sustainability.

### 2.9.2 Introduction

The coronavirus pandemic has currently put over a thousand captive elephants in Thailand out of work, and potentially out of food as well (Paddock & Suhartono, 2020). The pandemic exposes the vulnerability and unsustainability of wildlife in captivity and



illustrates the need for a new and sustainable conservation strategy. Baker & Winkler (2020) recommend a 3R model (Rescue, Rehabilitate, Rewild) for captive Asian elephants (*Elephas maximus*) that could benefit both elephants and humans. Baker & Winkler propose rewilding captive elephants, facilitated by traditional mahout-guardians who patrol the forest, monitor elephants, reduce human-elephant conflict, and develop ecotourism in their communities.

We recommend taking Baker & Winkler’s approach further: a large-scale, co-management initiative to connect wild elephant habitat by incorporating “trophic” rewilding principles (“rewilding”<sup>1</sup> elephants as a strategy to restore trophic interactions and ecological resilience; Svenning et al., 2016), where elephants will no longer be under direct human control, yet local communities access the benefits of living with elephants. This can promote elephant conservation, ensure sustainability, and enhance socio-economic development.

### **2.9.3 Conservation outcomes**

Integrity of nature Fragmentation and loss of habitat play a major role in the decline of both Asian and African (*Loxodonta africana*) elephants, with increased human-elephant conflict (Hoare, 2015; Robson et al., 2017; Van de Water & Matteson, 2018; Shaffer et al., 2019). In Thailand, most elephants currently live in small, isolated populations, often below the minimum viable 500 breeding individuals (Sukumar, 1989; Suksawang, 2018). Thailand’s 272 protected areas (PAs) cover about 20% of the country, but elephants inhabit only 69 PAs (Suksawang & McNeely, 2015; Kitratporn & Takeuchi, 2020). Only 45% of available wild land in Thailand has been declared PAs (Leimgruber et al., 2003). Although not all areas will be suitable as elephant habitat, there is wild land available for increasing habitat for elephants, creating and enhancing corridors for connectedness, and improving the long-term viability of Thailand’s elephant populations.

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<sup>1</sup> We are aware of the problems with the term “rewilding,” as raised by other commentaries (Lee & Lindsay, 2020); we use it as shorthand for managed and monitored rehabilitation and reintroduction of a species to its “wild” habitat.

The Asian Elephant Specialist Group (AsESG) gives priority to connectivity between elephant populations and promotes the Managed Elephant Range (MER) approach to achieve such corridors. MERs provide areas managed for elephants, where sustainable and compatible human use is allowed without the need for creating or enlarging PAs (AsESG, 2017). Creating new MERs through targeted captive elephant rewilding can increase the integrity of elephant habitat, provide alternatives for the unsustainable status quo of elephants in captivity, boost elephant numbers in high-deficit elephant areas, and set an example for other elephant range states in innovative elephant conservation (Robson et al., 2017). Reintroduction of elephants into historic ranges has shown positive results in Asia (Baker & Winkler, 2020; Thitaram et al., 2015) and Africa (Garaï et al., 2004; Millspaugh et al., 2007; Pinter-Wollman, Isbell & Hart, 2009). Rewilding entire social groups, including calves, into suitable habitat helps to create and maintain stable social networks and reduce stress (Jachowski et al., 2013; Thitaram et al., 2015).

#### **2.9.4 Human outcomes**

In addition to long-term elephant conservation, the main goals of rewilding elephants should align with the Sustainable Development Goals (United Nations, 2014). A holistic approach ensures that mahouts, elephant owners, local communities, and broader society all derive benefits from the conservation of the national elephant population in wild habitat. Mahouts are crucial for a rewilding scheme (Baker & Winkler, 2020), but the planning and implementation of conservation corridors (MERs) for rewilded captive elephants needs to include other local people as stakeholders to share in the enhancement of wellbeing and livelihoods. The development of skills and alternative livelihoods is critical for achieving overall sustainability (Suksawang, 2018). This includes planting crops that are less attractive to elephants on nearby agricultural land (Gross et al., 2017) and implementing extensive habitat restoration programs (Sitompul et al., 2011) as well as other sustainable human-elephant conflict measures.

Following COVID-19, the tourism landscape will be very competitive. Tourists who visit reserves with rewilded elephants would not only enjoy sightings of elephants in their habitats and “reconnect with nature” (Parker, 2008); they can also experience Thai culture

as connected to elephants. The elephant, the national animal of Thailand, can function as a link between the integrity of nature and the wellbeing of the Thai people, reinforcing feelings of pride and ownership, as well as historic cultural, symbolic, and religious values (Ribó, 2017). Broadening B&W's focus on rescuing both the elephants and mahouts will engender more participation and buy-in from local communities, conservation agencies, the government, and Thai and global society in general, moving beyond “compassionate conservation” (Bekoff, 2013; Baker & Winkler, 2020) to self-sustaining “convivial conservation” (Büscher & Fletcher, 2019).

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### 2.9.6 References

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### 3. THE VALUE OF ELEPHANTS: A PLURALIST APPROACH

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### 3.1 Abstract

Biodiversity conservation strategies may prioritise certain values of nature over others. Whilst there will likely always be a need for compromise in conservation planning, the consequences of trade-offs depend on peoples' relative perceptions of values that are promoted or neglected. In practice, not fully understanding or taking into account the value systems of all stakeholders, including local people, leads to contention, social inequality, and ineffectiveness. Elephants provide an excellent case study to illustrate the need for multidimensional valuation systems as they provide multiple overlapping services and benefits in ecological, socio-cultural, economic, and spiritual dimensions. Yet, their conservation is often highly contentious and fiercely debated. Here, we present a pluralist valuation system that identifies the varied services and benefits of elephants, but which adds important dimensions missing from current frameworks such as that of IPBES. Two key additions: (1) incorporating moral values alongside the services and benefits, and (2) incorporating a feedback loop to promote mutually reinforcing interactions, will better support holistic and equitable conservation. Additionally, to aid the interrogation of the kinds of problems that lead to contention in elephant conservation, we mapped the types of trade-offs that occur when different values are at stake, which allows us to identify balanced conservation solutions that will lead to unity. This pluralist valuation approach, which is similarly applicable to other species and ecosystems, clarifies the necessity of properly accounting for stakeholder values in decision making, and promotes fairer conservation decisions that will generate broader buy-in and support, uniting people, and facilitating socially just and sustainable conservation outcomes.

## 3.2 Introduction

Nature offers a range of benefits fundamental to our well-being and survival (Costanza et al., 2014). In the Anthropocene, human activities transform ecosystems in profound and uncertain ways (Dirzo et al., 2014), diminishing ecosystem services and posing risks to nature's resilience and people, especially in the developing world (Bradbury et al., 2021; Chaplin-Kramer et al., 2019). A paradigm shift is needed from a linear, extractive, and exploitative approach to a circular, regenerative valuation of nature that aims for well-being in an inclusive and equitable manner (Chami et al., 2020; Van Norren, 2020). By encouraging balanced conservation policies that consider the multidimensional benefits of nature and account for all stakeholder valuations and worldviews, nature conservation and human well-being could be better secured at both local and global scales (Biggs et al., 2017; Dwyer & Hodge, 2016; Kioko et al., 2015).

The valuations of nature – and the resulting trade-offs – made in conservation policies are often based on narrow, one-dimensional valuations of ecosystem services (Kenter, 2018; Pascual et al., 2021). Conservation approaches centred around economic valuation reflect a predilection for economic growth, which is often seen as essential for human development and conservation (Daw et al., 2015; Pascual et al., 2017). Market-based approaches such as the frameworks Natural Capital (Costanza et al., 2017), Ecosystem Services (Daily et al., 2000), The Economics of Ecosystems and Biodiversity (TEEB, 2020) and Common International Classification of Ecosystem Services (CICES) (Haines-Young & Potschin, 2012) have high levels of credibility, and aid in identifying socio-economic opportunities to enhance the well-being of local people. They also help to motivate people to prioritise conservation over alternative uses of nature (Díaz et al., 2015; Di Minin et al., 2013). However, market-based frameworks have been criticised for emphasising monetary value without sufficient recognition of nature's non-material benefits, such as recreation, inspiration, mental health, and social cohesion (i.e., well-being, sense of belonging, tolerance, equal rights, and opportunities in society) (Bratman et al., 2019; Fonseca et al., 2019; Russell et al., 2013). Similarly, these market-based systems have been argued to potentially encourage resource-extractive activities (Büscher & Fletcher, 2019; Turnhout et al., 2013).



A second bias in biodiversity conservation strategies is the frequently occurring approach utilising a single worldview, for instance focusing exclusively on the protection of species or habitat (Pascual et al., 2021). Implementing a one-dimensional valuation system – be it economic, ecological, or social – that does not fully account for all values of nature can disadvantage marginalised people, promote unsustainable resource extraction, and obstruct the long-term success of biodiversity conservation (Pascual et al., 2017, Pascual et al., 2021). To provide a more comprehensive account of nature’s role in human well-being, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) developed a framework to assess nature’s contributions to people (Díaz et al., 2018; Pascual et al., 2017). Building on earlier frameworks, IPBES identifies three overlapping elements in nature-people interactions: nature (intrinsic), nature’s benefits to people (instrumental), and good quality of life (relational). The IPBES framework emphasises the impact of culture and power relations on the perception and valuation of nature. It assesses the diverse views on human-nature interactions across stakeholder groups, especially those of indigenous communities (e.g., viewing the value of nature as ‘nature’s gifts to people’) (Pascual et al., 2017).

However, by viewing nature-people relations as a one-way flow from nature to people, and nature as a provider of benefits, opportunities to promote reciprocity with nature are missed even in the IPBES framework (Kenter, 2018; Van Norren, 2020). The framework incorporates intrinsic values, with examples such as animal rights and Gaia/Mother Earth (Pascual et al., 2017). Yet, the examples they provide are motivated by human ethics (e.g., morality, ideals, principles, broader life goals), thus are arguably anthropocentric and so not truly intrinsic. Furthermore, ‘good quality of life’ includes examples such as mental and physical health, cultural services, living in harmony with nature, and social cohesion, but important broader societal imperatives (e.g., human rights, environmental justice, rights of nature, intergenerational legacy) are missing (Kenter, 2018; Van de Water et al., 2022a). We argue that incorporating moral values related to biodiversity conservation into the valuation framework will create a positive feedback loop between benefits to humans and biodiversity. This feedback loop will aid conservation policymakers and managers to take decisions that promote reciprocity with nature and enhance biodiversity and sustainability (Van de Water et al., 2022a).

Given that nature's services, benefits, and associated values are inherently pluralist, biodiversity conservation needs a broad, pluralist approach (Pascual et al., 2021; Schwartz, 2021). It is increasingly argued that the valuation of nature must embrace and incorporate the diversity of benefits, valuations (i.e., intrinsic, instrumental, and relational), and underlying worldviews at play (Díaz et al., 2015; Neuteleers & Hugé, 2021; Pascual et al., 2017) and methods are being developed to integrate the multiple benefits of nature and associated worldviews and values. However, these have rarely been explicitly implemented in conservation policy because identifying the breadth of value systems can be difficult, time-consuming, or hindered by a lack of value-inclusive decision-support tools and connection to local contexts (Neuteleers & Hugé, 2021; Pascual et al., 2017).

Conflicting conservation views – which, for example, can arise when economic benefits are pitted against moral worldviews – divide stakeholders, cost valuable resources, and hamper solutions that promote the best outcomes for biodiversity and all stakeholders collectively (Biggs et al., 2017; Pascual et al., 2012; Sandbrook et al., 2019; Scheiter & Higgins, 2012). The processes driving contrasting views on conservation are numerous and varied. They may be related to material interests, but also to the way nature is perceived, i.e., as secular (e.g., that nature should be used for economic gain) or sacred (that nature should be respected) (Schwartz, 2021). This, in turn, can result in various types of trade-offs such as routine, tragic, or taboo trade-offs (Daw et al., 2015; Hanselmann & Tanner, 2008; Schwartz, 2021). Not all trade-offs are perceived as equally challenging because they vary in scale and the types of values involved (Daw et al., 2015), but sometimes, conservation policies can stumble over what appear to be irreconcilable differences, particularly when worldviews and beliefs are involved (Biggs et al., 2017).

Elephant conservation offers a strong example of this. At all levels, from international to local, policy decisions about elephant conservation are frequently contentious, with stakeholders who seem to have irreconcilable views (e.g., see Biggs et al., 2017; Dickman et al., 2019; (Van Aarde et al., 1999); and the resulting commentaries). Globally, the three elephant species are classified as endangered (African savanna elephant, *Loxodonta africana*, and Asian elephant, *Elephas maximus*) or critically endangered (African forest

elephant, *Loxodonta cyclotis*) (Gobush et al., 2021a; Gobush et al., 2021b; Williams et al., 2020). However, at local or regional levels, their conservation status may differ. For instance, in South Africa, the regional Red List status of the African savanna elephant is defined as ‘least concern’ (Selier et al., 2016a), and the elephant populations of Botswana, Namibia, South Africa and Zimbabwe are listed as Appendix II by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), whereas all other elephant populations are listed on Appendix I (CITES, 2017a).

These different listings result in varying levels of protection when savanna elephants cross international borders (Lindsay et al., 2017), and additional complexity arises because the majority of African elephants’ range falls outside of protected areas, which means that overlaps with land inhabited by people are common (Wall et al., 2021). As elephants represent multiple overlapping services, benefits, and values in ecological, socio-cultural, economic and moral dimensions (Bandara & Tisdell, 2003; Blignaut et al., 2008; Geach, 2002; Lötter, 2016; Platt, 2014; Poufoun et al., 2016), their conservation can be especially challenging and contentious. Local, national, and international views can diverge widely, and the economic benefits that some stakeholders routinely prioritise (such as using elephants for ecotourism, trophy hunting, as a source of ivory or labour) can conflict with the deeply held moral considerations of others (e.g., issues around animal welfare and the rights of nature) (Hanselmann & Tanner, 2008).

Despite evidence that long-term sustainability can best be achieved via conservation approaches that integrate all pertinent values (Chan et al., 2012; Pascual et al., 2021), current elephant conservation strategies often remain one-dimensional, focused on only economic or ecological or, rarely, social factors (e.g., Lainé, 2018). Policies typically focus on managing elephants in protected areas in isolation, where particular benefits are emphasised (e.g., economic or biodiversity benefits) whilst others are under-represented; or when local solutions are championed at the expense of global outcomes (e.g., proposals to sell ivory to fund local conservation which may impact poaching rates in other countries) (Lindsay et al., 2017), or vice versa. Given these controversies and challenges, this paper aims to develop a pluralist elephant valuation system that incorporates all relevant variables. The system will assist policymakers in weighing potential outcomes

of conservation approaches for stakeholders at various scales, thereby facilitating future nature conservation planning. Specifically, the objectives of this study are (1) to evaluate the full range of services, benefits and values associated with elephants, (2) to develop a pluralist elephant valuation system, and (3) to account for peoples' values related to conservation and evaluate the impact of trade-offs that occur when certain values are promoted or neglected. This holistic, open approach accounts for the range of values at stake and should reduce confrontation, engender societal support, deliver socially just outcomes for current and future generations and, therefore, promote genuinely sustainable conservation of elephants throughout their range.

### 3.3 Methods

#### 3.3.1 Working definitions

The word '**value**' has different meanings in conservation which are often used interchangeably, making it unclear what is meant when values or valuation are discussed. It can mean the worth or importance of biodiversity, but also refer to valuation systems (i.e., a system of expressing a value for a particular good or service, either financial, but also through measures from other disciplines (Büscher & Fletcher, 2020; MA, 2005). In conservation, the various meanings of 'value' can be defined as: (1) a *measure*, often monetary, of the instrumental or assigned worth of objects; (2) the non-instrumental *importance* for itself or others, (3) a *preference* for a certain state of the world, or (4) a *principle* related to a certain culture or worldview (Büscher & Fletcher, 2020; Chan et al., 2012; Kenter, 2018; O'Connor & Kenter, 2019; Pascual et al., 2017). In this paper, we use '**value**' to describe principles (i.e., human values), meaning the ways people perceive benefits through the perspectives of their differing worldviews. **Benefits** represent the tangible and intangible well-being gains derived from the contributions of elephants as experienced by people, for current and future generations (La Notte et al., 2017). For direct or indirect contributions of elephants to human well-being, we use '**services**' (MA, 2005; TEEB, 2020).

The valuation system further classifies benefits and values into secular or sacred principles. For **sacred principles** (e.g., human rights, human life, nature, justice, freedom, identity), compensation for infringement of the principle is unthinkable, as these principles are perceived as inviolable, infinite, or transcendental (i.e., principles that are universally valid and should never be infringed or dishonoured) (Schwartz, 2021). For the loss of **secular principles**, however (such as cost-effectiveness, assigned values), compensation is possible (Biggs et al., 2017).

### 3.3.2 Sampling and data analysis

To identify the benefits and values of elephants, we performed a search of studies about the valuation of elephants, followed by a literature review, with the aim of gathering *all* described benefits associated with elephants, i.e., all specific and concrete benefits or opportunities elephants bring for human and nonhuman nature. Searches were conducted for all three elephant species (*Loxodonta africana*, *Loxodonta cyclotis*, and *Elephas maximus*), as not all aspects have been studied for each species. The approach is generally transferable and relevant to all three species, notwithstanding that some elements may be more or less applicable to one or more species, or to local context. It should be noted that in this paper, we only consider services, benefits and values associated with elephant conservation, and do not take into account dis-services that may arise from elephants, such as human-elephant conflict (Di Minin et al., 2021), or ecological damage elephants may cause to vegetation (Asner et al., 2016; Henley & Cook, 2019). The importance of balancing elephant services and disservices are addressed in e.g., Ceaușu et al., 2018; Van de Water et al., 2022.

The search terms used were derived from previous elephant valuation papers (e.g., Bandara & Tisdell, 2003; Berzaghi et al., 2019; Berzaghi et al., 2022; Blignaut et al., 2008; Chami et al., 2020; Geach, 2002; Platt, 2014; Poufoun et al., 2016); from general nature valuation papers (e.g., Costanza et al., 2014; Costanza et al., 2017; Díaz et al., 2018; Kenter, 2018; Pascual et al., 2017, 2021; TEEB, 2020); from our knowledge of previous work on the benefits elephants provide; and from discussions with colleagues and experts. We searched Web of Science and Google Scholar for English language, peer-

reviewed publications, acts, constitutions, elephant conservation action plans, reports, news articles, and court cases, using broad search terms listed in appendix 1. To incorporate societal aspirations relevant to elephant conservation, national and regional elephant conservation strategies were assessed (e. g., the African Elephant Action Plan (CITES, 2010) and Asian Elephant Action Plan (Jackson & Santiapillai, 1990)), as well as the various social compacts relevant to elephant conservation (e.g., the Sustainable Development Goals, Convention on Biological Diversity, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, the Nagoya protocol, CITES, the Convention on Migratory Species, the UN Declaration on the Rights of Indigenous Peoples, Ubuntu). Articles focusing on human morality related to conservation, but not specifically to elephants, were searched by using “conservation” AND the search terms listed in appendix 1 related to moral values (e.g., moral duty, rights of nature, ethics, environmental justice). The reference lists of papers found were combed for other relevant sources, which were included where appropriate. Search and review were conducted between January 2019 and November 2021. The primary purpose was to ensure that the identification of potential services, benefits or values of elephants was evidence-based, rather than citing all sources that may link to or support a specific benefit or value.

For each service, benefit or value associated with elephant conservation, the description and citing reference(s) were recorded, as well as the elephant species the reference was focused on, and a name label was assigned. Similar benefits were subsequently collapsed under one label. Although there is still some overlap, each service, benefit, and value on the final list reflects a discrete theme that emerged from the published descriptions.

### **3.3.3 Building the valuation system**

To develop a comprehensive valuation system, we first assessed the existing ecosystem services valuation frameworks. CISES is based on the categories Regulating & Maintaining, Provisioning, and Cultural Services, which define ecosystem goods and services, or nature’s contribution to people (Haines-Young & Potschin, 2012). IPBES adds the elements ‘Nature’ (non-anthropocentric) and ‘Good Quality of Life’

(anthropocentric) (Díaz et al., 2015). Elements that are missing in the current systems were added: moral values and a feedback loop to promote reciprocity with nature (Kenter, 2018; Van Norren, 2020), as shown in Figure 3.1. The benefits we identified through the literature review were grouped into 16 categories (adapted from Díaz et al., 2018), characterising specific and concrete services, benefits, and values of elephants for human and nonhuman nature. The 16 service, benefit and value categories were further classified using the IPBES framework (intrinsic, instrumental, and relational), with the additional ‘moral values’ category (Figure 3.2). It is important to note that each service, benefit, or value may be interconnected to various others. For instance, economic benefits from ecotourism connect to inspiration and human well-being (Chan et al., 2012). To incorporate a higher-order classification, we then divided the identified services, benefits, and values according to whether they represent mainly sacred principles, mainly secular principles, or a combination of both (Schwartz, 2021) in order to highlight the link between moral and intrinsic values.

Finally, the various trade-offs that occur when the different types of principles are pitted against each other were assessed, as shown in Figure 3.3. Trade-offs influence the level of emotion and perceived difficulty in decision-making (Hanselmann & Tanner, 2008). The overview of potential trade-offs (routine, tragic, and taboo trade-offs) was adapted from Daw et al. (2015) and Schwartz (2021), but we added a fourth: marginalisation. Marginalisation trade-offs occur when expressed sacred principles are countered by secular principles. Furthermore, a dimension was added that considers the principles behind *expressed* (conservation) proposals or actions, juxtaposed with the principles behind the arguments that *resist or control* these proposals, in a matrix of the four trade-offs. This aids in the interrogation of the kinds of problems that lead to debate in elephant conservation, and the trade-offs that must be dealt with when values clash, which ultimately allows us to identify how balanced solutions/compromises can be reached that will lead to unity.

## 3.4 Results

### 3.4.1 Assessment of valuation elements

Figure 3.1 shows how the categories of existing valuation frameworks, such as CICES and IPBES (top left of Figure 3.1), are extended by adding the category “Moral values” (top right in Figure 3.1). Incorporating moral values into the valuation system creates a feedback loop back to biodiversity (bottom in Figure 3.1), which is also missing in one-way nature-people interactions (Kenter, 2018) (bottom of Figure 3.1). Our classification of sacred and secular principles highlights the relationship between human values and intrinsic values. Even though intrinsic values are considered to be independent of explicit human experience or evaluation (Pascual et al., 2017), there are implicit sacred principles attached to them, which involve moral values.



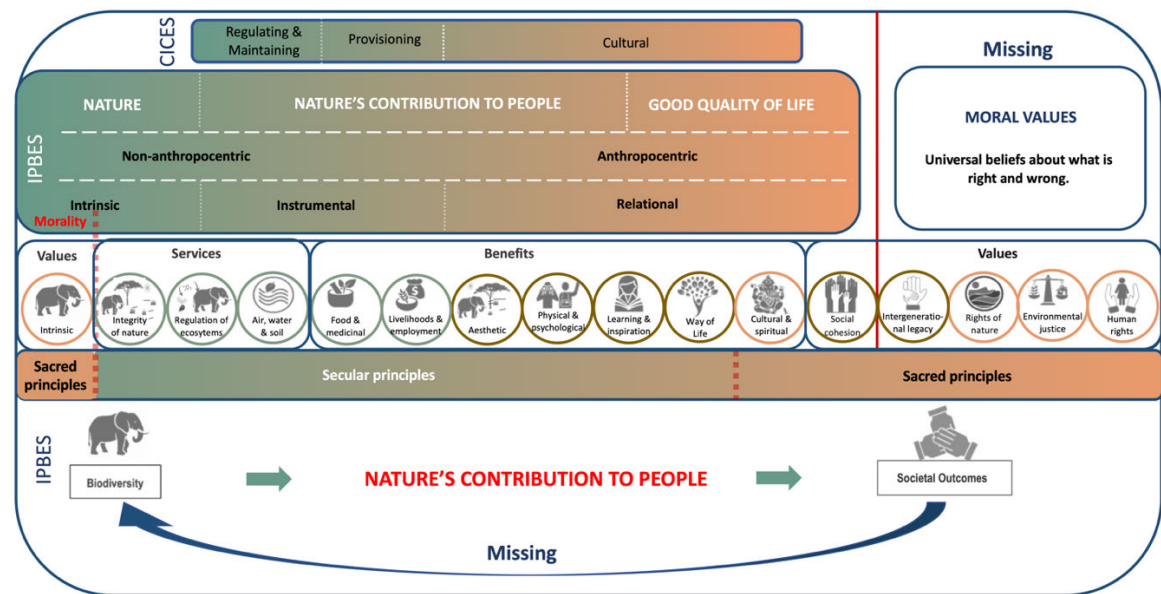


Figure 3.1: An assessment of the categories used in existing ecosystem valuation frameworks, incorporating our additional elements. Categories are taken from the Common International Classification of Ecosystem Services (CICES) (Haines-Young & Potschin, 2012) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) (Díaz et al., 2015)), with our additions of moral values and the feedback loop from societal outcomes back to biodiversity. Moral values that should be included in nature conservation are social cohesion (included in IPBES), intergenerational legacy, rights of nature, environmental justice, and human rights. The specific and concrete services and benefits of elephants for human and nonhuman nature, and the values associated with elephant conservation are grouped in a system of 16 categories (centre) (adapted from Díaz et al., 2018). The 16 categories are classified as mainly secular (green-edged circle), partly secular/partly sacred (brown circle), and mainly sacred (orange circle). The benefits of nature are presented as a one-way flow from biodiversity to people as per existing frameworks (bottom) (Kenter, 2018), but we include a feedback loop from collective human sacred principles, to ensure the enhancement of biodiversity and sustainability (sensu Van de Water et al., 2022). Intrinsic value highlights this feedback between people and nature, as people are intrinsically part of nature. The feedback loop thus allows a shift from the linear, aiming for growth dependent on the exploitation of natural resources, to circular, aiming for reciprocal well-being based on respect for nature (Van Norren, 2020).

### 3.4.2 Pluralist elephant valuation system

The services and benefits that elephants provide through their persistence in the natural system, and the values people attach to those benefits, have been collated into a pluralist elephant valuation system. Figure 3.2 illustrates which benefits and values are ignored when any one aspect is considered in isolation. For instance, when only economic benefits are acknowledged, all non-economic benefits and values will be overlooked (i.e., 64 out of 90 benefits). If a conservation approach takes a one-dimensional path, it will, in all probability, conflict with other desired benefits or the values held by different stakeholders.

To create a clear overview for policymakers, Figure 3.2 integrates services and benefits of elephants with peoples' values, allowing a pluralist conceptualisation of the valuation of elephants to emerge. The figure extends the valuation classifications of existing frameworks by adding moral values, and a higher-order dimension of secular and sacred principles. This can assist policymakers in predicting and preventing undesirable trade-offs, through incorporating the perspectives and values of all people, from local to global, which are often not considered in conservation policies in a balanced and equitable manner. Of course, perceived sacredness depends on individual values and cultural context (Daw et al., 2015), but this figure allows those different perspectives to be taken into account. For instance, the land that constitutes elephant habitat, such as forest, has a clear secular value, for which a market price can be calculated, but such land can also be perceived as sacred when linked to culture, identity, spirituality, sense of place, freedom, or in- dependence (Schwartz, 2021). Some sacred principles are endorsed by laws or social agreements, such as human rights, or biodiversity protection (e.g., UN Declaration on Rights of Indigenous People, Convention on Biological Diversity) which, *de facto*, should be respected, even if not held sacred by all (Schwartz, 2021). The outcome of this process is a detailed, comprehensive categorisation of the services, benefits and values awarded to elephants, and an overview of the relationships among valuation concepts.

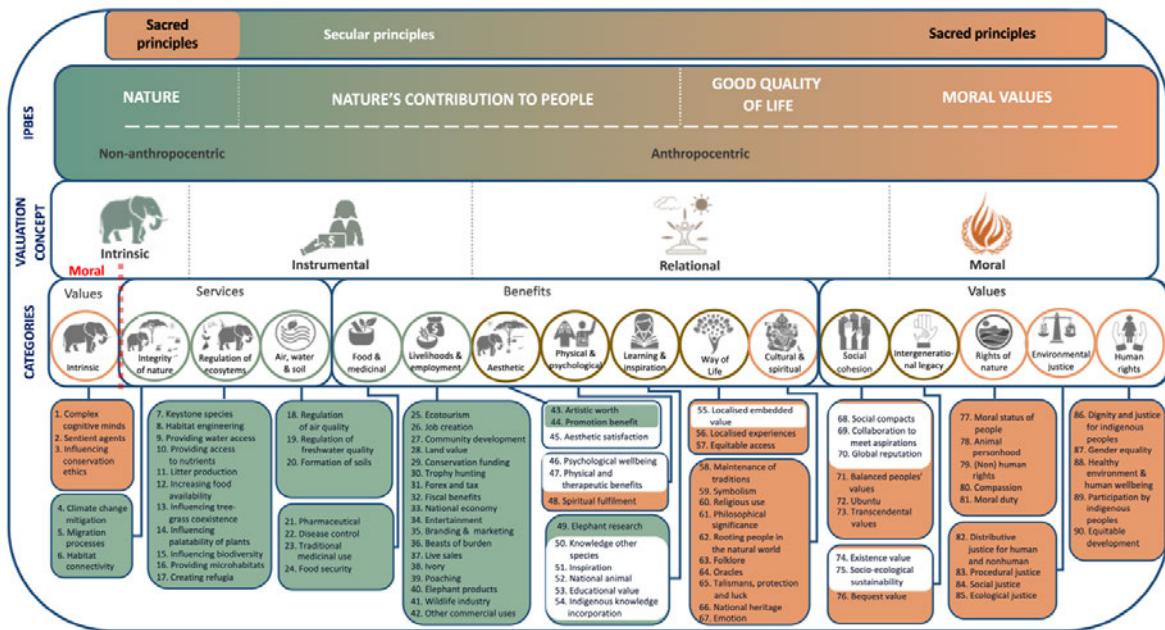


Figure 3.2: A visual representation of a pluralist elephant valuation system. The multidimensional relationships among four overlapping valuation concepts (intrinsic, instrumental, relational, and moral, adapted from Pascual et al., 2017) are shown above the 16 services, benefits, and values categories. The services, benefits and values associated with elephant conservation are further classified as mainly secular (green background), partly secular/partly sacred (white background), and mainly sacred (orange background).

### 3.4.3 The benefits of elephants

Table 3.1 gives a comprehensive overview of the services and benefits that elephants provide through their persistence in the natural system. The aim of this table is to be as comprehensive as possible. Therefore, benefits that some people experience, but which may not be legal in all circumstances are included, such as ivory sales, poaching, or sales of live elephants (CITES, 2019a; Cox & Collins, 2021). Inclusion of these potentially illegal activities aids in addressing the kinds of problems that can arise in elephant conservation and assist with the formulation of potential solutions. Additionally, it is important to note that some benefits, while producing apparent high value in themselves,

may compromise a range of other services, benefits, and values. For example, benefits arising from killing an elephant would compromise many other ecological, relational, and moral values, and could undermine the long-term viability of populations and, therefore, their existence value.

Among the overlapping and interconnected services (3 categories), benefits (7 categories) and values (5 categories), 3 provide intrinsic, 39 provide instrumental, 31 provide relational benefits, 17 are moral values. The category with most benefits was *livelihoods & employment* (17 benefits), followed by *regulation of ecosystems* (11 benefits), and *cultural & spiritual* (10 benefits) (Table 3.1).

Table 3.1: Comprehensive assessment of the services, benefits and values related to elephant conservation, as identified from an extensive literature review. The benefits have been grouped into 16 categories (adapted from Díaz et al., 2018). The first column shows the categories name, whether this concerns a service, benefit, or value, and the most relevant type of value: intrinsic, instrumental, relational (sensu IPBES), or moral (our addition). As services or benefits may differ per elephant species and as most services and benefits have been studied on single species, i.e., African savanna elephants (*Loxodonta Africana*), African forest elephants (*Loxodonta cyclotis*), and Asian elephants (*Elephas maximus*), the species each reference is focused on has been added (underlined in column 3; if applicable across species we insert the word general). For instance, forest and savanna elephants perform distinct ecological functions, and have different behaviours, diet preferences, and movement patterns. Less literature was found on the ecological role of Asian elephants, but more on the cultural benefits of Asian elephants. Rather than comprehensively referencing all possible literature, only selected references are provided to substantiate each of the benefits because the complete list is vast.

Label (out of 90)	Elephant species that the study is focused on, description and evidence.
1. Model minds	<p><u>General</u>: Research on elephants' social and cognitive skills indicates that elephants possess cognitively complex minds (Marceau v. Wiseman, 2020), and advanced abilities akin to human beings, such as insight, awareness of death, self-awareness, intentional and complex communication, memory and theory of mind (Bates, 2020; Moss et al., 2011; Münster, 2016; Plotnik &amp; Jacobson, 2022). For instance, elephants respond empathetically to other elephants in need or distress; they have preferred friends; and cooperate to solve problems (Byrne et al., 2009; De Silva et al., 2011; Plotnik et al., 2011). Their cognitive skills make elephants potential model organisms to increase our understanding of people (Bradshaw &amp; Schore, 2007; Hawley, 2011).</p> <p><u>African savanna elephants</u>: African savanna elephants are able to recognise up to 30 relatives from cues in urine and are aware of the location of these elephants (Bates et al., 2008), and are able to distinguish between the contact calls of elephants in their family and bonded group from elephants outside these group, indicating they are familiar with the acoustic communication of about 100 adult cows (McComb et al., 2000).</p> <p><u>African forest elephant</u>: Forest elephants have different personalities and express remarkable variation in movement patterns (Beirne et al., 2021).</p> <p><u>Asian elephant</u>: Asian elephants have different behavioural traits and abilities to adjust their behaviour to changing environments, and thus different personalities (Jacobson et al., 2022; Plotnik &amp; Jacobson, 2022).</p>

2. Sentient agents	<p><u>General</u>: Elephants are considered a higher-order intelligent species and complex social agents, forming multi-generational bonds even with non-relatives (Batavia &amp; Nelson, 2017; Goldenberg et al., 2019; Lötter, 2016). Elephants are considered among the most sentient nonhuman agents (Locke, 2013; Lötter, 2016; Pearce, 2015). They have shown empathy towards conspecifics (Mumby &amp; Plotnik, 2018), and have intrinsic value (Batavia &amp; Nelson, 2017).</p>
3. Influencing conservation ethics	<p><u>African savanna elephant</u>: Our knowledge about elephants' social and cognitive skills, and their social and spatial needs, influences our moral duties to elephants, and whether we should treat elephants differently compared to other animals, and consider their interest in conservation decisions (Lötter et al., 2008). As Samburu people regard elephants as moral beings, assigning a higher moral status to elephants than to any other animal, they view ownership of elephants as immoral (Kahindi, 2001).</p>
4. Climate change mitigation	<p><u>African forest elephant</u>: Being a keystone species (see benefit 45), elephants play a role in maintaining ecological processes and biodiversity, which can contribute to strategies to deal with climate change. In central African tropical forests, elephants reduce the number of plants and forest stem density, which results in a higher abundance of large trees with higher wood density, and increase aboveground carbon stored by 7% (Berzaghi et al., 2022; Chami et al., 2020). In addition to the carbon captured in their large bodies, elephants thus contribute to carbon dioxide reduction in the atmosphere (Chami et al., 2020) (African savanna elephants may limit aboveground carbon gains in African savannas, see e.g., Davies &amp; Asner, 2019). The forest elephants' carbon sequestration services can be translated to financial benefits that can be monetised on carbon markets for approx. USD 20.8 billion for the next ten years and USD 25.9 billion for the next 30 years (Berzaghi et al., 2019;2022; Chami et al., 2020). Companies or institutions that need to offset their carbon footprint can pay range states for the services of elephants, and contribute to a secure future for elephants, protection of their habitat, and support local communities living with elephants (Chami et al., 2020).</p> <p><u>African savanna and forest elephant</u>: Elephants can be used in responding to climate change impacts, for example the positive effects of elephants digging for water helps other species survive during droughts. Therefore, elephants provide a nature-based solution as agents in a climate change mitigation strategy (Berzaghi et al., 2019; Haynes, 2012; Poulsen et al., 2017).</p>
5. Migration processes	<p><u>General</u>: As a migratory species with large spatial displacements along regular routes, elephant migration pathways, like those of other keystone species, comprise clearly defined routes.</p> <p><u>African savanna elephant and Asian elephant</u>: Migration depends on large areas of landscape connectivity, and is a vital but threatened ecological process (Joshi &amp; Puri, 2021; Purdon et al., 2018). Elephants' migration routes aid in planning habitat corridors (Menon et al., 2020; Talukdar et al., 2020). Elephant migration, including transboundary movements, aids in maintaining meta-population processes, functional connectivity, reducing human-elephant interaction and repopulating sink habitats (Lindsay et al., 2017; Van Aarde &amp; Jackson, 2007).</p>

6. Habitat connectivity	<p><u>African savanna elephant</u>: The overall value of elephants motivates people to keep areas wild instead of converting them to other land uses, and increases security of tenure as conservation land use (Geach, 2002).</p> <p><u>General</u>: Elephants serve as an umbrella species, helping to conserve large areas of landscape, ensuring the survival and evolution of a large number of other species (Albert et al., 2018; Redmond, 1996; Sukumar, 1989).</p>
7. Keystone species	<p><u>African savanna and forest elephant</u>: As megaherbivores and keystone species, elephants play a role in maintaining ecological processes, and providing resources to other species, relative to their abundance (Berzaghi et al., 2019; Bunney et al., 2017; Haynes, 2012; Joshi &amp; Puri, 2021; Poulsen et al., 2017).</p> <p><u>Asian elephant</u>: Elephants have cascading effects on the availability of habitat, water and nutrients to other species (Joshi &amp; Puri, 2021).</p>
8. Habitat engineering	<p><u>African savanna and forest elephant and Asian elephant</u>: Elephants influence forest structure, stem density and plant diversity. By maintaining grassland and pathways elephants create migration routes and habitat, and increase access to important resources for other species (Blake &amp; Inkamba-Nkulu, 2004; Haynes, 2012; Keil, 2016; Kerley et al., 2008). Elephant pathways along forests adjacent to savanna ecosystems can function as firebreaks, contributing to the protection of forests (Cardoso et al., 2020). Elephants enhance long-distance seed dispersal (Bunney et al., 2017; Campos-Arceiz &amp; Blake, 2011; Poulsen et al., 2021), although they can also trample seeds or inhibit tree regeneration in disturbed areas (Omeja et al., 2014; Piironen et al., 2017).</p>
9. Providing water access	<p><u>African savanna elephant</u>: Elephants provide accessible water to other species by digging wells beneath the surface of dry riverbeds and trampling down river banks with their feet and trunks (Ramey et al., 2013; Stommel et al., 2016). Samburu people depend on elephants' knowledge to find water tables in dry riverbeds (Lemayian, 2018).</p>
10. Providing access to nutrients	<p><u>African savanna elephant</u>: Elephants provide access to mineral supplements to other species by excavating subterranean salt (Bowell et al., 1996).</p> <p><u>General</u>: Megafauna, such as elephants, enhance nutrient dispersal (Berti &amp; Svenning, 2020), and they stimulate (re)growth, thereby making nutrients more available and contributing to forest and savanna functionality (Campos-Arceiz &amp; Blake, 2011; Kohi et al., 2011; McConkey et al., 2018).</p>
11. Litter production	<p><u>African savanna elephant</u>: Elephants discard about 25% of the forage they pluck, and this material alters litter dynamics, which has cascading effects on biodiversity and ecosystem function (Kerley &amp; Landman, 2006; Kerley et al., 2008; Lessing, 2007).</p>
12. Increasing food availability	<p><u>African savanna and forest elephant</u>: Numerous invertebrates and vertebrates feed on the undigested materials in elephant dung, in some cases providing secondary seed-dispersing services. Over a hundred species of Scarabaeoidea beetles feed on elephant dung (Waltner-Toews, 2013). Vertebrates such as birds and small mammals feed on the invertebrates attracted to dung. Egrets feed on insects disturbed from grass where elephants walk (Ruggiero &amp; Eves, 1998). By pushing over and uprooting trees, elephants redistribute and improve the quality of forage, which benefits small browsing herbivores and</p>

	monkeys, and triggers a chain of events that creates habitat heterogeneity (Kerley et al., 2008; Kohi, 2013; Owen-Smith, 1989). Elephant browsing on <i>Colophospermum mopane</i> trees improves foliage growth which is important for browsing ungulates and for 'mopane worms', which can be harvested for human consumption (Redmond, 1996).
13. Influencing tree-grass coexistence	<u>African savanna and forest elephant</u> : Depending on the local context, elephants maintain heterogeneity and prevent converting grasslands into woodlands by suppressing tree cover (Goheen & Palmer, 2010; Omeja et al., 2014). Opening and maintaining patches of forest clearings supports grazers, mixed feeders and small browsers in foraging and predator detection, thus increasing biodiversity (Kohi, 2013; Poulsen et al., 2017).
14. Influencing palatability of plants	<u>African savanna elephant</u> : By influencing the chemical defences of plants, heavy browsing by elephants, like other browsers, stimulate plant defences for protection from herbivory, which can improve the palatability of forage for herbivores (Kohi et al., 2010), or reduce the palatability of some species (Callis-Duehl et al., 2017).
15. Influencing biodiversity	<u>African savanna elephant</u> : Elephants increase biodiversity by impacting woody vegetation (Nasseri et al., 2011). They can influence the available plant resources for ants, which affects trees (Palmer et al., 2008). Elephants can increase distributions of reptiles and amphibians (Nasseri et al., 2011), and disperse aquatic organisms (Vanschoenwinkel et al., 2011), which have cascading effects on biodiversity and ecosystem function (Lagendijk et al., 2011; Lagendijk et al., 2012) (However, elephants can also negatively impact biodiversity, see e.g., Abraham et al., 2021; Keesing, 1998; Lawes & Chapman, 2006; Ogada et al., 2008).
16. Providing microhabitats	<u>Asian elephant</u> : Elephant dung provides microhabitats for frogs, beetles, ants, centipedes, millipedes, scorpions, crickets, spiders, and termites (Campos-Arceiz, 2009). Water-filled elephant footprints provide microhabitats for tadpoles, frogs, and insects, and may function as stepping stones through an otherwise dry landscape (Platt et al., 2019).
17. Creating refugia	<u>African savanna elephant</u> : Vegetation broken by savanna elephants (e.g., stripping bark and splintering branches) creates refugia for arboreal lizards (Pringle, 2008). By damaging tree canopies, elephants create refuge for understory plants (Coverdale et al., 2016). <u>Asian elephant</u> : In the absence of litter, elephant dung provides daytime refuge for frogs (Campos-Arceiz, 2009).
18. Regulation of air quality	<u>African savanna elephant</u> : Because of elephants' requirement for space and resources and their value chain, large areas are protected and remain wild, instead of being used for, for instance, agriculture, providing ecosystem services which are essential to human and nonhuman health, including clean air (Ihwagi et al., 2015).



19. Regulation of freshwater quality	<u>African savanna elephant</u> : Depending on the elephants' spatial use and density and management approaches, conservation land use that includes elephants keeps land pollutant-free, with regulated freshwater quality, allowing for grasslands and woody vegetation, as compared to land use for domestic herbivores (overgrazing) or agriculture (chemicals use), which causes degradation and desertification (Kerley et al., 1995).
20. Formation of soils	<u>African savanna and forest elephant</u> : Elephant dung produces nutrient-rich compost, and, by searching for water and minerals, elephants excavate mineral hotspots, making nutrient-rich soil accessible (Klaus et al., 1998; Poulsen et al., 2017). The presence of elephants increases soil carbon and nitrogen pools and can reverse the negative effects of cattle (Sitters et al., 2020). As elephants prefer browsing nitrogen-rich leaves, they play an important role in transporting nitrogen to the soil (Doughty et al., 2016; Pretorius et al., 2011).
21. Pharmaceutical	<u>African savanna elephant</u> : Elephants have two extra cancer-fighting genes which suppress the development of cancer. This may advance medical science and the development of cancer treatment or prevention (Vazquez et al., 2018). <u>Asian elephant</u> : Observations of elephant diet, health problems, and self-medicating behaviour in Asian elephants have contributed to human medicinal knowledge and use of medicinal plants (Dubost et al., 2019).
22. Disease control	<u>African savanna elephant</u> : Traditionally, elephant dung is burnt outside households as an insect repellent, keeping mosquitoes at bay and reducing potential incidents of malaria (Kuriyan, 2002).
23. Traditional medicinal use	<u>African savanna elephant</u> : In Maasai culture, elephant skin, dung, liver, placenta, amniotic fluids, milk, fat, bones, ear and fat are used for medicinal purposes. Elephant dung mixed with water is used to make sick people vomit to reduce diseases (Kioko et al., 2015). In Namibia, elephant dung is traditionally steamed and inhaled as a cure for flu, Covid19, and to treat body ailments such as nosebleeds (also in Limpopo, South Africa, Mafumo, pers. Comm. 2021), headaches and toothaches (Froneman, 2020). Powdered burned elephant bones or teeth are believed to cure swelling by Maasai people in Tanzania (Kioko et al., 2015). Elephant bones are used to treat rheumatism and bone fractures by Yoruba people in Nigeria (Soewu, 2008). <u>Asian elephant</u> : Indigenous people in Bangladesh apply powdered elephant dung mixed with ashes of medicinal plants as an ointment to treat skin diseases (Rahmatullah & Biswas, 2012). Asian elephant teeth and tusks are used for medicinal purposes, such as to treat conjunctivitis and pimples by tribal populations of Tamil Nadu in India, for toothache by the Biate tribe, and to treat eczema, leukoderma, and ringworm by the Naga people in India (Ngorima et al., 2020; Sajem Betlu, 2013; Solavan et al., 2004).
24. Food security	<u>African savanna elephant</u> : Apart from the fertilising services of their dung (see <i>formation of soils</i> ), which can contribute to increased food production, elephants can provide substantial meat protein. In some cultures, elephant meat, liver, fat, tongue, and bones are used for food (Kioko et al., 2015). Community members in the Kavango Zambezi Transfrontier Conservation Area in Zimbabwe identified meat as the primary benefit elephants provide to their livelihood (Ngorima et al., 2020).

	<u>African savanna elephant and Asian elephant</u> : In other cultures, such as Maasai, Samburu, Nuer and Karen, elephants will never be eaten due to their perceived similarity to people or as they are viewed as brothers or sisters (Greene, 2021; Kahindi, 2001; Kioko et al., 2015; Lemayian, 2018).
25. Ecotourism	<u>African savanna elephant</u> : Elephants attract tourists and are an important driver of tourism revenue (Brown, 1993; De Boer et al., 2007; Edge et al., 2017; Geach, 2002; Gnonlonfoun et al., 2019; Naidoo et al., 2016). Annually, a single living African elephant generates USD 22,966 from ecotourism (Iworry, 2014).
26. Job creation	<u>African savanna elephant</u> : Elephants provide jobs in nature-based tourism and spin-off industries (Blignaut et al., 2008; Naidoo et al., 2016). As elephants are key draw cards for international tourists (Brown, 1993; Sims-Castley et al., 2005), they not only contribute to job creation in reserves, but also in wider sectors such as transportation (air travel, local car hire, petrol), education, administration, media, research, conservation, tourism, anti-poaching industry (Massé et al., 2018), service delivery, security, marketing, communication, manufacturing, art/crafts, catering, guide training, and construction (Gnonlonfoun et al., 2019). Wildlife-based ecotourism contributes to 3.5x more jobs compared to agricultural land use, provides more employee benefits, and provides proportionally more employment opportunities for women (Sims-Castley et al., 2005; Space for Giants, 2019). <u>African savanna elephant and Asian elephant</u> : Elephants also contribute to small enterprise development, such as the production of elephant-inspired crafts, using elephant dung for fuel supply, bio fertiliser, and the production of paper and soap (Canney, 2021; Petchimuthu & Fernando, 2019; Sayagie, 2021).
27. Community development	<u>African savanna elephant</u> : Although elephants can also have a negative impact on communities, job creation from land use with elephants increases wealth and contributes to community development. Through community engagement and collaboration, communities are empowered to conserve natural resources, and gain fair access to the benefits of elephants (Canney, 2019). For example. the Elephant Dung Paper project in the Pongolapoort Nature Reserve in South Africa contributes to skill development, job creation, and education through school programs ( <a href="https://thewildlifespirit.com/projects/">https://thewildlifespirit.com/projects/</a> ). Through such projects, elephants provide opportunities to improve reserve-community relations.
28. Land value	<u>African savanna elephant</u> : Land surrounding ‘Big 5’ game reserves (i.e., reserves with elephant, lion ( <i>Panthera leo</i> ), African buffalo ( <i>Syncerus caffer</i> ), leopard ( <i>Panthera pardus</i> ), and rhinoceros ( <i>Ceratotherium simum</i> )) has a higher market value (Geach, 2002). The reserves’ value also has trickle-down effects on the prosperity of neighbouring communities, creating opportunities for jobs, business and skill development (Di Minin et al., 2013; Sims-Castley et al., 2005). After investments, the value of a private game reserve in the Eastern Cape had increased by at least 10, up to 40x over a decade (Geach, 2002).
29. Conservation funding	<u>General</u> : As charismatic species, and given people’s emotional attachment to elephants, elephants are regarded as flagship species that encourage biodiversity conservation in general (Albert et al., 2018; Bandara, 2004), and attracts substantial international funds for conservation (Biggs et al., 2008; Redmond, 1996). In India, for instance, the Asian elephant was used to raise awareness and promote conservation in the Rajaji and Corbett National Parks (Johnsingh & Joshua, 1994).

30. Trophy hunting <sup>1</sup>	<p><u>African savanna elephant</u>: In Namibia, trophy hunting financially supported 82 conservancies which cover about 20% of the country's landmass. Over half of the income from trophy hunting in Namibia in 2013 was attributable to elephants (Naidoo et al., 2016). In Botswana, elephants represented 37% of the income through trophy hunting (Blignaut et al., 2008). South Africa generated USD 1.19 million from hunting 33 elephants in 2012 (Di Minin et al., 2016). The Zimbabwe Parks and Wildlife Management Authority stated that between 2010 and 2015 about 65% of CAMPFIRE contributions came from elephant hunts (USD 7.5 million in elephant hunting revenues in 5 years), by primarily American trophy hunters (Mandisodza-Chikerema, 2018). Botswana generated USD 2.3 million from selling hunting permits for 60 elephants in 2020 (an average of USD 39,000 per head) (Harvey, 2020).</p>
31. Forex and tax	<p><u>African savanna elephant</u>: Economic stimulation from elephants increased foreign exchange income, and national and regional tax revenues for elephant range countries (Blignaut et al., 2008).</p>
32. Fiscal benefits	<p><u>African savanna elephant</u>: In South Africa, landowners receive a tax deduction for conservation commitment under the Income Tax Act. S 37D, which allows the value of elephant reserves to be deducted from taxable income (Stevens &amp; Van Wijk, 2020).</p>
33. National economy	<p><u>African savanna elephant</u>: It was estimated that over its' life, every elephant contributes over USD 1.6 million to the economy through travel companies, airlines and local businesses in Kenya, Tanzania, Zambia, and South Africa (Platt, 2014).</p>
34. Entertainment	<p><u>Asian elephant</u>: Elephants have been used in zoos, circuses, and tourist camps involving elephant shows (elephants playing football or basketball, dancing, cycling, painting, making music, etc.), riding, washing, feeding, playing, or walking with them. In Thailand, where captive elephants are registered as working animals rather than as wildlife (Bansiddhi et al., 2020; Duffy &amp; Moore, 2010), the price of an elephant was estimated to be as high as an expensive car (Schmidt-Burbach &amp; Hartley-Backhouse, 2020). The average revenue from tourists bathing elephants in Thailand was USD 57.20 per visitor, which adds to a revenue of over USD 828,000 per day for all elephant bathing venues combined. An average full day of observation-only activity costs USD 106 (Duffy &amp; Moore, 2010; Schmidt-Burbach &amp; Hartley-Backhouse, 2020). It was estimated that pre-Covid-19, the captive elephant tourism industry generated between USD 581.3 to USD 770.6 million per year from 3,837 elephants in Asia (Schmidt-Burbach &amp; Hartley-Backhouse, 2020).</p> <p><u>African savanna elephant</u>: In South Africa, the price of interacting with, touching, and feeding elephants starts at USD 35 (the Elephant Sanctuary).</p> <p><u>African savanna elephant and Asian elephant</u>: The average price for a one-hour ride was USD 42,80 in Thailand and at least USD 150 in Botswana. Elephants are also featured in films, television, and books across the world (Duffy &amp; Moore, 2010).</p>
35. Branding and marketing	<p><u>General</u>: As an icon representative of an area (e.g., the Elephant Coast, the African continent), elephants promote national/regional/local branding and stimulate natural land use. Elephants are used in logos to symbolise strength (Pretoria Portland Cement), memory (Evernote), or national heritage (Thai Chang beer, Kenyan Tusker beer, South African Amarula liqueur). The marketing value of elephants was captured and used by media retailers and other companies, such as Cote d'Or chocolate, or the Miss</p>

	<p>World Contest in South Africa (Duffy &amp; Moore, 2010). As a Payment of Ecosystem Services, industries that used elephants for profit contributed financially to elephant conservation (e.g., Disney Worldwide Conservation Fund, National Geographic Conservation Trust, BBC Wildlife Fund, Lion's Share, Amarula Trust) (Good et al., 2017; Jepson et al., 2011).</p>
36. Beasts of burden	<p><u>African forest elephant and Asian elephant</u>: Asian and African elephants were trained to be used as beasts of burden for transportation, agricultural work, war projects, or logging (Bansiddhi et al., 2020; Bennett, 1957; Lainé, 2016; Locke &amp; Buckingham, 2016; Vanitha et al., 2011).</p>
37. Live sales <sup>1</sup>	<p><u>African savanna elephant</u>: Zimbabwe generated USD 2.7 million through selling over 90 live elephants to China and Dubai in 2019 (USD 30,000 each). In South Africa, between 2005 and 2007, live elephants were sold for USD 40,000-75,000 (trained elephants), USD 3,500-35,000 (juveniles), USD 1,000 (breeding herds, price per elephant), USD 4,800-6,800 (bulls) (Blignaut et al., 2008).</p> <p><u>African savanna and forest elephant</u>: As of 2019, wild-caught African elephants can only be sold "to in-situ conservation programmes or secure areas in the wild, within the species' natural and historical range in Africa" (CITES, 2019a).</p> <p><u>Asian elephant</u>: Myanmar exported 101 live elephants between 1980–2005, mainly to the Netherlands and China (Shepherd &amp; Nijman, 2008). In Myanmar, 240 elephants were illegally captured between 2004 and 2006, and about 80 elephants between April 2011 and March 2013, for sale to tourist facilities in Thailand, for between USD 21,500 and USD 30,500 per individual elephant (Nijman, 2014; Shepherd &amp; Nijman, 2008).</p>
38. Ivory <sup>1</sup>	<p><u>General</u>: Even though most international trade in ivory is illegal under CITES, domestic ivory trade is allowed, if the ivory (products) is/are registered, and it does not contribute to poaching or illegal trade (CITES, 2019b). Between 2007 and 2017, almost 365,000 kg of ivory was seized (CITES, 2018). Ivory prices were highest in Asia and lowest in Africa (Sosnowski et al., 2019). In 2020, the average price for raw ivory in Africa was estimated at 92 USD/kg, a decline from the value of 208 USD/kg in 2017 (Rapid Assessment of the Illegal Ivory Trade in 2020, 2020). In 2011, the average wholesale price of raw ivory at workshop level was reported as USD 791/kg in Vietnam. In contrast, a kilogram of raw ivory at poachers level was sold on average for USD 26/kg in Cameroon (Stiles et al., 2011). Japan and China bought 102 tons of ivory from Botswana, Namibia, South Africa and Zimbabwe through CITES-sanctioned auctions in 2008, for on average USD 157/kg, amounting to a total of USD 15 million (CITES, 2008).</p> <p><u>African savanna elephant</u>: Under certain circumstances, non-commercial international trade in individually marked and certified worked ivory (e.g., carvings or jewellery for personal or household use) is allowed for Namibia and Zimbabwe (CITES, 2017a; 2017b).</p> <p><u>Asian elephant</u>: The demand for ivory in East Asia, where it is used in medicine, curios, and luxury goods, is the main driver of poaching in Africa (Ngorima et al., 2020). Data from 2019/2020 showed a decrease in elephant poaching, which could be linked to a lower ivory price because of stricter law enforcement in China and elsewhere (Vigne, 2021; Wildlife Justice Commission (WJC), 2020a). However, large quantities of ivory are still on offer (WJC, 2020a), and it is unclear how the lifting of COVID travel restrictions, which limits ivory import into China, will affect ivory demand (Vigne, 2021; WJC, 2020b). Illegal trade in ivory and elephant parts in Mong La in Myanmar totalled an estimated</p>

	USD 1.2 million during a 2013–2014 survey (Nijman & Shepherd, 2014). On average, one tusk was worth about USD 20,000.
39. Poaching <sup>1</sup>	<u>African savanna elephant</u> : In areas with high rates of unemployment and a lack of alternatives, poaching can provide (illegal) income for impoverished families (Massé et al., 2018). In the Okavango Delta, for instance, almost half of the respondents of a household survey stated that they poach a variety of wildlife for subsistence purposes, while 35% noted that they poach for commercial reasons (Mogomotsi et al., 2020).
40. Elephant products	<u>General</u> : Besides the tusks, which are in most cases the reason for poaching, other body parts may be used for commercial or personal reasons, such as meat, feet, skin, tail, trunk, ears, fat, bone marrow, musth liquid (Cameroon), molars, pelvic bones, jewellery made out of elephant tail hairs (Myanmar, Thailand), and elephant skin beads and powder (Myanmar) (Elephant Family, 2018; Shepherd & Nijman, 2008; Stiles et al., 2011). In Maasai culture, elephant parts were used for commercial purposes (Kioko et al., 2015). For the poacher, the financial profit of elephant meat may exceed that of ivory (Stiles et al., 2011). Elephant dung is used to produce paper, soap, coffee and beer and as a mosquito repellent (Brough, 2015; Sayagie, 2021).
41. Wildlife industry	<u>General</u> : Industries centred around the management and protection of elephants emerged due to the need for anti-poaching measures, training of rangers and guides, translocation (Blignaut et al., 2008), or in the development, sales and implementation of equipment such as tracking, insurance, wildlife ranging, camera traps, genetic testing, darts, etc. (Marvin et al., 2016).
42. Other commercial uses	<u>Asian elephant</u> : Private elephant owners offered their elephants to join ceremonies (e.g., temple festivals, engagements, weddings), commercial activities (e.g., film shoots, VIP programs, circus companies) or used elephants for street begging (Vanitha et al., 2011).
43. Artistic worth	<u>General</u> : The artistic worth of elephants is represented through elephant jewellery, fashion, curios, sculpture and paintings (Gnonlonfoun et al., 2019; Redmond, 1996; Vijayakrishnan & Sinha, 2019).
44. Promotion benefit	<u>African savanna elephant</u> : The aesthetic benefit of, for instance, an elephant silhouette in front of an acacia tree at sunset is an image that promotes a continent as a tourist destination (Redmond, 1996).
45. Aesthetic satisfaction	<u>African savanna and forest elephant</u> : People derive aesthetic satisfaction from elephants and argue for humanitarian and compassionate considerations in elephant conservation (Glennon, 1990).
46. Psychological Well-being	<u>African savanna elephant</u> : Spending time in nature contributes to increased psychological well-being and reduced mental illness, mental fatigue or aggressive behaviour, implying that the same effects occur when observing content elephants in intact ecosystems (Bratman et al., 2019; Hausmann et al., 2016).

47. Physical and therapeutic benefits	<p><u>Asian elephant</u>: Elephant-assisted therapy for people with autism is argued to improve adaptive behaviour, sensory processing, postural control, and balance (Satiasukpong et al., 2008). Children with Down syndrome may have benefited from elephant-assisted therapy in improved visual motor integration (the ability to make sense of visual information and use it appropriately for motor tasks such as tool use, sports or writing) (Satiasukpong et al., 2016).</p>
48. Spiritual fulfilment	<p><u>African savanna elephant</u>: Spending time observing elephants and contributing to their conservation provides a sense of physical, emotional, and spiritual fulfilment (Naidoo et al., 2019; Wittemyer et al., 2008).</p>
49. Elephant research	<p><u>African savanna elephant</u>: After chimpanzees, African elephants are the most studied large mammals in sub-Saharan Africa (Trimble &amp; Van Aarde, 2010), contributing to increased scientific knowledge.</p> <p><u>General</u>: Due to the complexity of elephant conservation challenges, elephants motivate consideration of human dimensions of conservation and multi-disciplinary research (Marchini, 2014).</p>
50. Knowledge of other species	<p><u>General</u>: Studies and conservation strategies initially intended for elephants may be applicable to the conservation of other species. For instance, (transboundary) collaboration between different stakeholders (e.g., the African and Asian Elephant Action Plans, Convention on the Conservation of Migratory Species of Wild Animals (CMS)) focused on elephants may also be used to study or conserve other species. Mitigation methods developed to reduce human-elephant conflicts may also work for other human-wildlife conflicts (e.g., compensation and insurance schemes, fencing, community conservation, Hoare, 2015). Elephant researchers have contributed to knowledge about trees' survival strategies in savanna ecosystems, and elephant researchers have induced evolutionary association between ants and trees (Goheen &amp; Palmer, 2010; Sheil &amp; Salim, 2004).</p>
51. Inspiration	<p><u>Asian elephant</u>: Observing the behaviour and character of elephants provides spiritual inspiration, for instance for Buddhists (Ramanathapillai, 2009).</p> <p><u>General</u>: As an iconic species, elephants inspire people to develop an interest in them. People study, admire, respect or worship them, which can influence peoples' actions and interest in conservation (Barua, 2011).</p>
52. National animal	<p><u>Asian elephant</u>: The Asian elephant is Thailand's national animal and is used to increase public awareness of the need to conserve elephants and conservation in general (Clucas et al., 2008). In India, elephants are declared the national heritage animal; most people in India cannot imagine their country without elephants (Bist et al., 2002). In the past, the King of Laos declared the Asian elephant the national animal of Lao PDR (Norachack, 2002).</p> <p><u>African forest elephant</u>: The African elephant is the national animal of Côte d'Ivoire (Ivory Coast), which used to be home to one of the largest elephant populations in West Africa. The country dedicated its name to elephants and declared elephants their national animal (Kouakou et al., 2020).</p>

53. Educational value	<u>General</u> : Various conservation organisations offer educational programs centred around elephants for local schools and communities. Educational programs focusing on animal cognition have the potential to create a bond between people and other species and create more positive attitudes towards conservation (Makecha & Ghosal, 2017).
54. Indigenous knowledge incorporation	<u>African savanna elephant</u> : Some elephant conservation strategies encourage incorporating indigenous knowledge into natural systems management and community engagement in conservation (Kuriyan, 2002).
55. Localised embedded value	<u>African savanna elephant</u> : Integrating the local meaning, locally embedded value of elephants, and concerns about elephants in conservation strategies, will result in local support for conservation (Büscher & Fletcher, 2020; Kamau, 2017).
56. Localised experiences	<u>African savanna elephant</u> : The tourist perception of elephants differs from the perception of people sharing habitat with elephants, especially when their crops are impacted by elephants, or when fear of elephants impacts their lives (Redmond, 1996). Perceptions of elephants and large trees vary between tourists and private landowners (Edge et al., 2017). <u>Asian elephant</u> : Local residents are more willing to pay for human-elephant conflict (HEC) mitigation if they have experienced HEC injury in their family (Neupane et al., 2017), and are more tolerant toward elephants when they experience benefits from living with elephants (Van de Water & Matteson, 2018). <u>General</u> : When conservation solutions are at odds with local people's lived experiences, they may not be effective (Jimenez-Soto, 2020).
57. Equitable access	<u>African savanna elephant and Asian elephant</u> : Local perceptions about elephants and conservation are influenced by historical experiences, access to, and control over lands and resources, and the sharing of benefits, including non-materialistic benefits of living with elephants (Kamau, 2017; Kinsky et al., 2020; Van de Water & Matteson, 2018). Therefore, elephants highlight the need to ensure equitable access to the benefits of nature.
58. Maintenance of traditions	<u>African savanna elephant and Asian elephant</u> : In Maasai and Karen cultures, elephant parts and products have traditionally been used for cultural, spiritual, and ceremonial purposes. The loss of these practices equates to the degradation of traditional culture (Greene, 2021; Kioko et al., 2015). In various cultures in Africa and Asia, elephants form an integral part of religious or spiritual traditions (Vanitha et al., 2011). <u>Asian elephant</u> : In almost all south and southeast Asian countries, elephants have spiritual significance, and people feel a strong connection with elephants (Locke, 2017). In some Buddhist communities, elephant calves are welcomed as members of the community by rituals to connect the souls to the body, similar to when people are born (Greene, 2021).

59. Symbolism	<u>General</u> : Elephants symbolise wisdom, loyalty, patience, and power; they provide cultural benefits like totems (symbols of power and royalty), and as political emblems (e.g., the Republican Party in the United States). In San mythology, elephants are linked to rainmaking (Deacon, 1988). Cultures with a deeply rooted connection to nature may consider elephants to be sacred or have elephants as their totem or clan name to acknowledge interconnectedness, and advocate for their protection and the integrity of creation (Alves & Souto, 2015; Kioko et al., 2015; LenkaBula, 2008).
60. Religious value	<u>Asian elephant</u> : Elephants have religious significance in Buddhist and Hindu traditions (god Ganesh), in royal rituals and processions (Bansiddhi et al., 2020; Bowen-Jones & Entwistle, 2019; Buckingham, 2016; Jayewardene, 1994; Ringis, 1996; Sukumar, 2011). For instance, the night before Queen Maya gave birth to Buddha, she dreamt that a white elephant visited her. According to Jataka tales, Buddha had several elephant lives before his final reincarnation as a human being (Ramanathapillai, 2009; Wisumperuma, 2012). In Thailand, elephant statues can be found in stupas and on the corners of Buddhist temples to provide protection (Ringis, 1996). In Hinduism, elephants are associated with Ganesh, the God of wisdom and the remover of obstacles, and with Erawan, the white elephant with three heads who carries Indra, the king of heaven and the God of rain and fertility (Greene, 2021). Temples in India use captive elephants to perform rituals for the deity, bless devotees, and participate in temple-festival processions (Vanitha et al., 2011).
61. Philosophical significance	<u>Asian elephant</u> : Buddhist philosophy elevates elephants beyond the natural and human realms while emphasising that all beings are equal but can reach superior potential (Ramanathapillai, 2009). In Buddhism and Hinduism, elephants are seen as a symbol of mental strength and are, therefore, highly respected.
62. Rooting people in the natural world	<u>African savanna elephant</u> : Maasai people view elephants as similar to people in many ways and, therefore, care about their well-being (Kioko et al., 2015). A Samburu clan believes elephants came from humans and sees elephants as brothers and sisters who may not be killed (Kahindi, 2001; Lemayian, 2018). <u>African forest and Asian elephant</u> : Amongst Nuer (Sudan), Karen (Myanmar, Thailand) and Nepali people, the lives of elephants and people are viewed as entangled, and they have developed an intricate relationship with elephants in which they award elephants a degree of personhood (Greene, 2021; Kioko et al., 2015; Locke, 2013; 2017). For instance, for Nuer people killing an elephant is viewed as similar to killing a human being (Greene, 2021). In Assam, people and elephants both create pathways, contributing to shared habitat enhancement (Keil, 2016).
63. Folklore	<u>African savanna, forest and Asian elephant</u> : Elephants provoke a nostalgic appreciation of stories of the past. Elephants symbolise wisdom and leadership in folklore and traditions. Oral stories and legends, such as the view that elephants were once human (Kioko et al., 2015), illustrate a high level of integration of elephants in Maasai, Nuer, and Karen cultures.
64. Oracles	<u>Asian elephant</u> : Ancient cultures in China used elephant bones as oracles to advise on decisions affecting society (Dress et al., 2016).
65. Talismans,	<u>African savanna elephant</u> : In Kenya, elephant dung is used for various medicinal and cultural purposes,



protection, and luck	<p>such as the use of elephant dung smoke for cultural or spiritual cleansing, for instance, to repel evil spirits when opening a new house or during a marriage ceremony (Lemayian, 2018). A piece of elephant skin worn on the body is believed to give protection, and a piece of dried placenta is believed to bring luck (Kioko et al., 2015).</p> <p><u>Asian elephant</u>: Rings or pendants of ivory or elephant tail hair are worn for protection against strong spirits by Karen people by catalysing the spiritual strength of the elephant (Greene, 2021). As elephants are believed to increase fertility in Thailand, couples sometimes pose under elephants, elephants participate in fertility ceremonies and parades, and the umbilical cord of a new-born elephant is used in rituals to increase fertility, and to ensure a strong and healthy child (Greene, 2021).</p>
66. National Heritage	<p><u>Asian elephant</u>: Nations where elephants occur view elephants as their national heritage, enhancing people's sense of place. Elephants are symbols of national pride (e.g., the national animal of Thailand), and form an integral part of Indian culture and religion (Johnsingh &amp; Joshua, 1994). Elephants are valued for their services in past wars, contributing to the pride and identity of countries (e.g., China, Thailand, Indonesia, Vietnam) (Bowen-Jones &amp; Entwistle, 2019).</p>
67. Emotion	<p><u>African savanna elephant</u>: Throughout history, people have felt a close affinity with elephants; few animals evoke such strong emotions as elephants (Blignaut et al., 2008).</p>
68. Social compacts	<p><u>General</u>: To conserve elephants and secure ecological systems while improving human well-being and social cohesion simultaneously, national and regional elephant conservation strategies should be aligned with global, regional and national aspirations, for instance the SDGs, CBD, IPBES, the Nagoya protocol, CITES, the African and Asian Elephant Action Plans, CMS, the UN Declaration on the right of indigenous peoples or Ubuntu (Pascual et al., 2017, 2021; Van de Water et al., 2022; Van Norren, 2020). Together, the specific and concrete benefits of elephants for human and nonhuman nature contribute to the achievement of multiple regional and global goals. As elephants require large-scale protected areas, their conservation helps meet biodiversity conservation goals through encouraging land use for conservation purposes (Albert et al., 2018; Redmond, 1996).</p>
69. Collaborations to meet aspirations	<p><u>General</u>: All elephant range states collaborate through IUCN's Asian and African Elephant Specialist Groups. Thirty African elephant range states joined the African Elephant Coalition (<a href="http://www.africanelephantcoalition.org">www.africanelephantcoalition.org</a>). As a species on Appendix I of the Convention on Migratory Species, Asian elephants strengthen transboundary conservation and cooperation (Joshi &amp; Puri, 2021). By requiring large spaces, elephants encourage us to think beyond isolated protected areas, and to consider transboundary movements. This motivates transboundary cooperation to maintain meta-population processes. In Southern Africa, five Transfrontier Conservation Areas (TFCAs) have been established, generating ecological but also economic benefits in the form of international development assistance (Lindsay et al., 2017). At national levels, in some elephant range states government, elephant specialists, NGO's, elephant owners and managers, and communities living with elephants work together in processes to develop National Elephant Strategies, Elephant Action Plans, or Norms and Standards for the management of elephants. At local levels, elephants create opportunities for scientists, NGOs, government, and local communities to collaborate.</p>

70. Global reputation	<p><u>Asian elephant</u>: Elephants can impact the reputation of nations on a global scale. For instance, a recent elephant migration in China captured the world’s attention, and China received worldwide praise for its professional and considerate handling of the wandering elephants (e.g., evacuating towns and blocking roads to make way for the elephants, full compensation for damage, use of non-invasive technology). The media hype was a rare occasion of positive news about animal conservation in China, which helped create a more positive perspective on the country. A welcome message, as president Xi Jinping called in May 2021 for a “credible, lovable and respectable image of China” after receiving global criticism about human rights abuses. This showed that elephant conservation serves the nation’s interests, and successful, soft power conservation approaches can enhance a country’s global reputation (Li, 2021).</p>
71. Balanced peoples’ values	<p><u>General</u>: Framing conservation strategies around people’s aspirations and values promotes more diverse relations between human and nonhuman nature, and more equal recognition of the plural values of nature (Pascual et al., 2021; Van de Water et al., 2022). Therefore, the societal importance ascribed to nature, or elephants, should inform policymaking processes (Kenter, 2018).</p>
72. Ubuntu	<p><u>General</u>: As an African social compact for just relations between humanity and nonhuman nature, Ubuntu is relevant to African elephant conservation. Ubuntu promotes relationships that are in harmony, recognising intrinsic value of nature, and justice (ecological and economic) for all, especially for communities that are negatively affected by ecological destruction and economic globalisation (LenkaBula, 2008; Van Norren, 2020). Relatedness to future generations as expressed in the notion of Ubuntu can contribute to an ongoing discourse in environmental philosophy about our moral obligations to future generations (Grange, 2015). Ubuntu mitigates against the impact of capitalism and economic globalisation, harmful ecological practices, excessive exploitation of ecological resources, and privatisation of commons. Instead, it advances human dignity by promoting attitudes of care and nurture (LenkaBula, 2008).</p>
73. Transcendental values	<p><u>General</u>: Conceptions about desirable end states or behaviours that transcend specific situations, such as harmony with nature (Raymond &amp; Kenter, 2016). Aligning elephant conservation with local people’s transcendental values will enable local support for conservation, reciprocity, and harmony with nature (Raymond &amp; Kenter, 2016; Van de Water et al., 2022; Van Norren, 2020).</p>
74. Existence value	<p><u>Asian elephant</u>: Elephants impart to people a feeling of well-being derived from knowing that elephants exist (Bandara &amp; Tisdell, 2003; Wang et al., 2020). Motivated mainly by the non-use values of elephants, 88.7% of urban residents in Sri Lanka reported being willing to pay for solutions to reduce conflicts between elephants and people (Bandara &amp; Tisdell, 2002). Chinese residents were willing to annually donate USD 232 for the conservation of African elephants (Wang et al., 2020).</p> <p><u>African savanna elephant</u>: People in Sweden were estimated to be willing to pay USD 53.7 million for the conservation of African elephants (Blignaut et al., 2008).</p> <p><u>General</u>: Many people are willing to pay for elephant conservation, simply to know that elephants will continue to exist (Glennon, 1990), which may be influenced by feelings of moral obligation towards elephants (Bandara, 2004), or by past experiences of elephants (Bandara &amp; Tisdell, 2002).</p>

75. Socio-ecological sustainability	<u>General</u> : The elephant's existence and bequest value contribute to intergenerational legacy, which is a prerequisite for socio-ecological sustainability and resilience (e.g., the Well-being of Future Generations (Wales) Act 2015, anaw 2).
76. Bequest value	<u>General</u> : People enjoy the existence of elephants, and would like to know that elephants will continue to exist in the wild for future generations to enjoy (Bandara, 2004; Brown, 1993).
77. Moral status of people	<u>African savanna elephant</u> : The judgement of a lion bone case in South Africa gave two reasons for the constitutional importance of animal welfare: 1) to prevent the degeneration of the moral status of humans, 2) the intrinsic values we place on animals as individuals (Society for Prevention of Cruelty to Animals v Minister of Environmental Affairs, 2019). Conceptually, this easily extends to supporting the welfare of elephants.
78. Animal personhood	<u>Asian elephant</u> : As sentient beings, elephants have been recognised as persons in Sri Lanka in 2014, when an illegally captured elephant calf was found and taken into a rehabilitation facility. In the legal prosecution, the elephant was considered the "aggrieved party" (Jasinghe & Fernando, 2016). In 2018, the elephant Happy became the first elephant to have a habeas corpus hearing on an elephant's legal personhood and right to bodily liberty (The Nonhuman rights project, Inc., on behalf of HAPPY, v. James J. Breheny, 2018).
79. (Non) human rights	<u>African savanna elephant</u> : Limited elephant rights have been included in several policy and elephant management plans, such as the South African Norms and Standards for Elephant Management (DEAT, 2008; Lötter et al., 2008). <u>Asian elephant</u> : In 2018, a High Court in India ruled that animals have the status of legal entity/legal person (Pallotta, 2019). In 2020, a High Court in Pakistan recognised legal rights to nonhuman animals and ruled that keeping the elephant Kaavan in solitary confinement was an infringement of the right to life (Islamabad Wildlife Management Board v. Metropolitan Corporation Islamabad, 2020). <u>General</u> : Conservation strategies should aim to reconcile the rights of human and nonhuman species (Shoreman-Ouimet & Kopnina, 2015). In 2008, Ecuador became the first country to constitutionally recognise nature's rights, as a new sustainable development tool based on living in harmony with nature (Kauffman & Martin, 2017).
80. Compassion	<u>Asian elephant</u> : According to the Indian Constitution, citizens are expected to show compassion towards all living creatures, and the use of elephants for entertainment is illegal (Brara, 2017).
81. Moral duty	<u>General</u> : If an action is wrong, based on accepted rules or ethics, we are morally obligated not to commit the act, regardless of any beneficial outcomes. The intentions of the act are what count, rather than the outcomes (Batavia & Nelson, 2017). By recognising our moral duty to protect higher-order intelligent species against exploitation (Bandara, 2004), and by incorporating 'integrative' values, conservation decisions will not exclusively be based on economic benefits, self-interest or the greatest utility, but on attitudes of respect, and the acknowledgement of relationships between all living beings and their environment (Bilchitz, 2017; Lötter et al., 2008).
82. Distributive	<u>General</u> : The environment should be protected for humans and nonhuman nature alike, which is justice

justice for human and nonhuman nature	for nature (Kopnina & Washington, 2020), and the benefits from nature, including elephants, should be equally shared amongst all people (Blackmore, 2017). Conservation strategies should acknowledge that whether people view elephants as an asset or a burden may stem from inequality created by industrial economic development (Kopnina, 2016). Through distributive justice, risks associated with an excessive focus on economic growth can be moderated, recognising issues related to power, access, and justice (Menton et al., 2020; Van de Water et al., 2022).
83. Procedural justice	<u>General:</u> Procedural justice concerns fair and equitable processes and decision-making, including the distribution of benefits and burdens and recognition of who is involved and has influence in those decisions (Menton et al., 2020). Community participation in elephant conservation decisions, good governance, and economic transparency of benefit distribution enhances people's positive attitudes toward elephants (Neupane et al., 2017). Marginalising people who bear the brunt of conservation leads to inequality, which, in turn, leads to resistance to conservation and, sometimes, violence towards elephants or authorities (Mariki et al., 2015).
84. Social justice	<u>General:</u> The recognition of and respect for inter-human differences, traditional knowledge, cultural practices, the challenges of living with elephants, for different collective identities and their concerns, needs and livelihoods in relation to the environment should be integrated into inclusive conservation strategies (Menton et al., 2020; Van de Water et al., 2022).
85. Ecological justice	<u>General:</u> From a non-anthropocentric perspective and especially for elephants, environmental justice does not only concern people, but it also entails moral and legal considerations about the treatment of nonhumans (Kopnina, 2016). Through its nature, elephant conservation promotes integrated strategies that aim for justice for all species and mitigation of contention between those conservationists who focus on people and those who focus on wildlife or the environment, reconciling social justice and ecological justice (Shoreman-Ouimet & Kopnina, 2015).
86. Dignity and justice for indigenous peoples	<u>General:</u> Moderation of elephant conservation decisions through a human rights filter ensures that decisions are fair and based on principles such as equality, inclusion, dignity, and freedom (e.g., UN Declaration on Rights of Indigenous People) (Canney, 2021; Van de Water et al., 2022).
87. Gender equality	<u>General:</u> Elephant conservation provides opportunities for equitable social development, and can contribute to reduced gender inequality, for instance through the empowerment of women through skill development for ecotourism, for women-led initiatives to mitigate human-elephant conflicts by using chilli or beehive fences (Chang'a et al., 2016; Van de Water et al., 2020), or all-female anti-poaching teams (Mkono et al., 2021).
88. Healthy environment and human well-being	<u>General:</u> states have a legal obligation to protect people's right to a healthy environment, which is expressed in over 100 constitutions (Boyd, 2018; Menton et al., 2020), such as the right for all South Africans to have their environment protected (South African government, 1996) or the right for every person in Norway to a healthy environment and preservation of diversity and productivity (The Constitution of Norway, Article 112, 2018). As the previous benefits show, elephants contribute to

	healthy environments and enhance well-being.
89. Participation by indigenous peoples	<u>General:</u> Indigenous peoples have experienced historic injustices from colonisation and dispossession of lands, territories and resources (UN charter Indigenous people). In Africa alone, the number of people evicted to make way for conservation is estimated at 900,000 to 14.4 million (e.g., 250,000 people were evicted to establish Kruger National Park) (Geisler & De Sousa, 2001). Top-down, fortress conservation approaches with elite access open the door to racial, gender and class divisions (Büscher, 2016; Büscher & Fletcher, 2020). Recently proposed policy changes propose inclusive conservation strategies, by putting people at its core, and promoting the participation of local people (e.g., South Africa’s Draft policy position on the conservation and ecologically sustainable use of elephant, lion, leopard and rhinoceros, DFFE, 2021).
90. Equitable development	<u>General:</u> Elephant conservation strategies should balance conservation and human development goals, and acknowledge that exclusion-based, or an inordinate focus on economic growth and the commodification of nature, promote short-term human gain thereby risking increasing poverty and inequality (Büscher & Fletcher, 2019; Canney, 2021).
<sup>1</sup> It is important to consider that killing or displacing elephants can disrupt their behaviour and socio-ecological functioning (Goldenberg, 2017; Goldenberg et al., 2018; McComb, 2011; Shannon et al., 2013; Shannon et al., 2022; Slotow, 2000), potentially undermining the long-term viability of populations. The benefits that require the killing of elephants also compromise a wide range of ecological, relational, and moral values, which can lead to negative unintended consequences.	

#### 3.4.4 Peoples’ values and trade-offs

Elephant conservation can be contentious due to contrasting, yet veiled, value systems and agendas promoted by polarised interest groups and power asymmetries (Biggs et al., 2017; Büscher & Fletcher, 2019; Sandbrook et al., 2019). Contention centres around trade-offs, which can exacerbate negative emotions and perceived difficulty in decision-making. Balancing the benefits of elephants exposes trade-offs, where one needs to give up on something to gain something else (De Groot et al., 2010). Three types of trade-offs have been identified: routine, tragic, and taboo trade-offs (Hanselmann & Tanner, 2008). To include issues related to power inequality in conservation decisions, we have added a fourth trade-off termed marginalisation, which represents the trade-offs that occur when expressed sacred principles are countered by secular principles (Figure 3.3).

**Routine trade-offs** rely on rational calculations of costs and benefits between two secular principles (that can be economical or relational), which can result in socially acceptable decisions. For instance, proposals to build electric fences around elephant habitat to reduce human- elephant conflict (e.g., Slotow, 2012), countered by arguments for other types of barriers like beehive fences (e.g., King et al., 2017); culling elephants based on the argument that there are too many elephants that cause damage to vegetation, countered by arguments that many elephants represent a natural ecosystem and that change forms part of ecosystem dynamics (Owen-Smith et al., 2006); allowing ivory sales to satisfy demand and, thereby, reduce poaching (Martin et al., 2012), countered by the argument that permitting ivory trade will increase demand in destination countries, and so increase poaching (Bennett, 2014). In practice, conflicts arise when uncertainty remains about anticipated outcomes, but understanding the nature of the disagreement can illuminate what is required to move forward.

**Tragic trade-offs** occur when decisions involve two conflicting sacred values, where one needs to be sacrificed to enable the other. Decisions concerning tragic trade-offs are perceived as emotionally difficult and stressful (Daw et al., 2015; Hanselmann & Tanner, 2008). For instance, proposals to evict indigenous people from their land, or to prohibit cattle grazing by indigenous peoples to reduce threats to and from elephants, ensure free movement of wildlife, and protect fragile grassland ecosystems, countered by moral arguments related to human rights (Büscher & Ramutsindela, 2015; Spierenburg et al., 2006; Witter, 2013); or to sacrifice the life of individual animals to ensure the well-being of others within the dynamic web of life (Lötter et al., 2008).

**Taboo trade-offs** occur when secular principles are overruled by sacred principles. For instance, proposals to financially compensate for the loss of life as a solution to human- elephant conflict (Anthony & Swemmer, 2015), countered by the morality of putting a price tag on human life (Fiske & Tetlock, 1997); using trophy hunting to support community development (Dickman et al., 2019), countered by moral arguments based on the intrinsic value of elephant life (Horowitz, 2019); exploiting elephants for entertainment to fund local conservation or development, pitted against the global existence value of elephants which makes people care about elephant well-being

(Bandara & Tisdell, 2003; Wang et al., 2020); or culling of elephants to reduce local environmental pressure (Whyte et al., 1998), countered by global protests motivated by the intrinsic value of elephants and their rights (Dixon, 2008).

Lastly, we suggest **marginalising trade-offs** occur when expressed sacred principles are overruled by secular principles. When secular views take precedence in the trade-off, they tend to overcome the sacred views of a minority or a disempowered group, leading to the perception that the sacred principles are considered insignificant or peripheral. For instance, proposals to make space to conserve elephants and biodiversity through acknowledging the cultural integrity of indigenous peoples that used to occupy such spaces, countered by (short-term) economic arguments for investment in other land -uses (Canney, 2021); proposals to allow elephants to roam freely based on rights of passage and increasing connectivity (Menon et al., 2020), countered by arguments to issue so-called damage-causing animal permits to shoot roaming animals (Slotow et al., 2021); proposals to ban ivory trade or commercial exploitation of elephants based on intrinsic value and rights (Horowitz, 2019; Lötter et al., 2008), countered by the need for economic development and conservation funding (Roe et al., 2020).

Taboo and marginalising trade-offs are inherently more challenging, psychologically uncomfortable, negatively emotion-laden, and morally repugnant, compared to routine and tragic trade-offs (Daw et al., 2015, and our assessment). Economic solutions for taboo and marginalising trade-off conservation challenges may be scientifically or politically viable but may lead to moral outrage or social unrest because they are socially unacceptable (Schwartz, 2021). As such, people tend to avoid dealing with taboo and marginalising trade-offs, resulting in decision deadlocks (Biggs et al., 2017; Daw et al., 2015). Fair representation of all arguments, with appropriate weightings given to all voices, and recognition of moral principles, can help to overcome these deadlocks (Biggs et al., 2017).

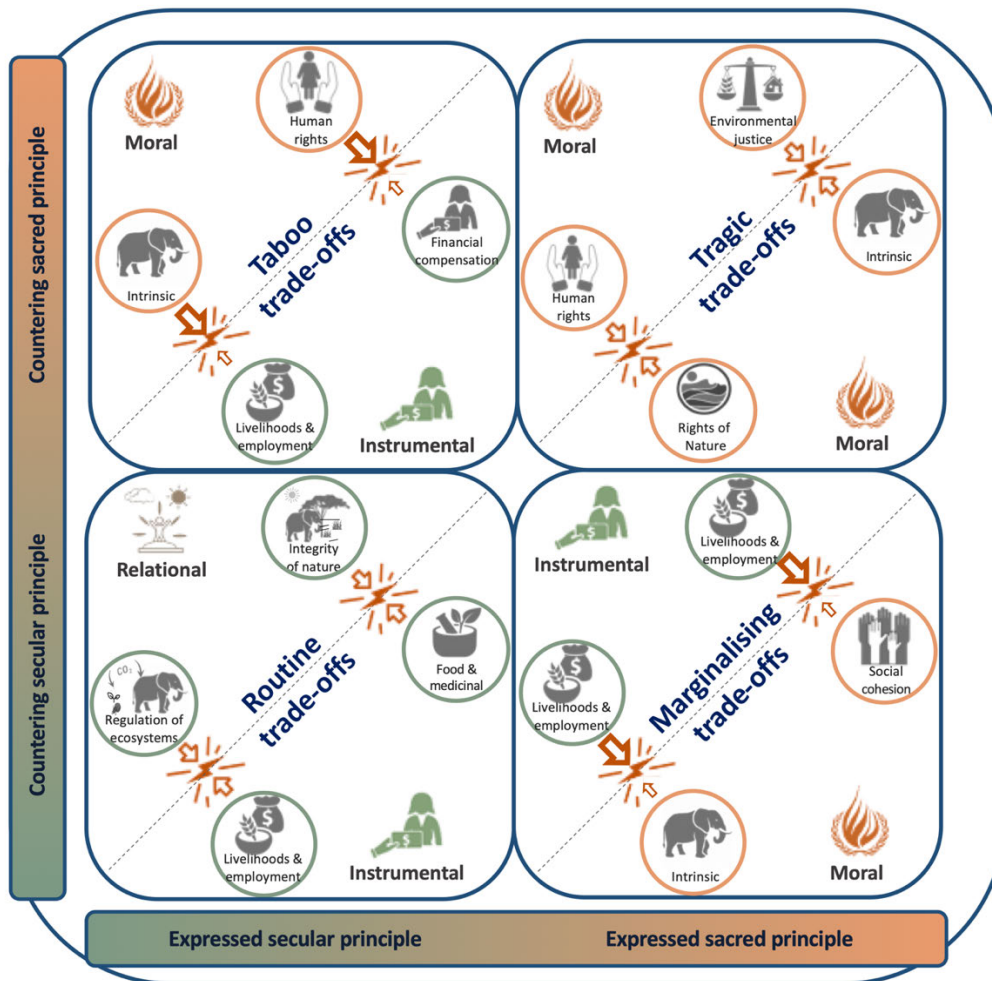


Figure 3.3: Trade-offs between sacred and secular principles relevant to elephant conservation debates (adapted from Daw et al., 2015; Schwartz, 2021). The x-axis shows the expressed principle (proposals for a conservation action), and the y-axis is the countering principle (that underpins the resistance to do so). Routine trade-offs rely on rational calculations of costs and benefits between two secular principles, which facilitates socially acceptable decisions. Tragic trade-offs occur when decisions involve two conflicting sacred principles and are perceived as emotionally difficult and stressful. Taboo trade-offs occur when sacred principles collide with secular principles, which can trigger moral outrage. Marginalising trade-offs occur when secular principles take precedence in the trade-off and overpower the sacred principles of a minority or disempowered group. Taboo and marginalising trade-offs are inherently challenging, psychologically uncomfortable, and often negatively emotion laden. The valuation concepts (intrinsic, instrumental, relational, and moral values) illustrate how the different concepts can become opposed to each other, resulting in a trade-off.



### 3.5 Discussion

Like many global conservation approaches, elephant conservation tends to have a narrow, one-dimensional focus which prioritises certain values of nature, such as economic or ecological values, over others (Pascual et al., 2021; Van de Water et al., 2022). Current elephant value assessments typically focus on their Total Economic Value, the valuation of ivory trade (average of USD 20,000 per tusk), trophy hunting (average of USD 39,000 per elephant head), or the carbon captured by elephants (estimated at USD 1.75 million per living African forest elephant) (Bandara & Tisdell, 2003; Blignaut et al., 2008; Chami et al., 2020; Geach, 2002; Naidoo et al., 2016). These assessments quantify elephants' benefits for human and nonhuman nature in terms of monetary value, and this economic value is then used to argue for their conservation (Di Minin et al., 2013). However, such a one-dimensional lens can promote conservation approaches that risk violating principles that are included in social compacts (e.g., the Sustainable Development Goals, the Convention on Biological Diversity, the UN Declaration on Rights of Indigenous Peoples, the African philosophy of Ubuntu), and, ultimately, contribute to continued environmental decline.

For example, promoting the belief that nature must provide financial benefits to people - as 'new conservation' perspectives do (e.g., Kareiva, 2014; Marvier, 2014) - will lead to decisions based solely on instrumental benefits. Applying the pluralist valuation system shows that this focus on instrumental benefits for people, and collaboration with profit-driven companies, may ignore benefits such as intergenerational legacy and the intrinsic value of nature. This can be viewed in the highly controversial topics of ivory trade, poaching, culling, and trophy hunting, which may provide short-term financial gain, but which could have long-term consequences that are often not considered, such as disruption of animal well-being and social systems which can affect environmental health, and which also ignore human (sacred) values. Acting for short-term gains often encourages unsustainable natural resource extraction to the cost of long-term conservation (Bilchitz, 2017; Büscher & Fletcher, 2019; Lopez-Bao et al., 2017).

Conversely, protectionist conservationists (Hutton et al., 2005) - who also apply a one-dimensional lens - emphasise aesthetic or ecological values of nature and pristine wilderness, while local people are excluded. Applying our pluralist valuation system, we see that these one-dimensional approaches ignore or even violate the value systems and views of people living alongside wildlife, who may have additional relationships with nature, incorporating multiple values (Pascual et al., 2021).

To develop more effective, equitable and fair conservation policies and practices, it is crucial to understand and incorporate a wide range of values of nature. The pluralist elephant valuation system presented in this paper promotes systematic thinking about the various interactions between elephants, the environment, and people. First, we highlight that instrumental benefits are broader than direct-use economic benefits like elephant viewing, rides, or hunting. For instance, evidence of the estimated USD 1.75 million indirect-use value for humanity per living African forest elephant exceeds direct-use economic benefits by far and provides additional arguments for legal rights for elephants (Chami et al., 2020). Secondly, we demonstrate the impossibility of using a single measurement scale to comprehensively recognise and realise all benefits and values associated with elephant conservation (Bengston, 1994). Sacred principles (e.g., human life, nature, freedom), for instance, cannot be expressed in one-dimensional economic values. Thirdly, we emphasise that one-dimensional conservation objectives, whether they focus on a benefit in isolation, or are planned by a stakeholder with a single value system, do not incorporate the diversity of stakeholder perspectives and the multiple values of nature, which will result in trade-offs that can be very contentious (Lainé, 2018). Our pluralist valuation approach added moral values to the IPBES classification system. These are often the strongest sacred values and ignoring these values results in limited understanding of the consequences of taboo and marginalisation trade-offs. Furthermore, by adding the dimensions of sacred-secular principles to the IPBES system, greater clarity is provided on the importance of understanding, recognising, and incorporating the full spectrum of benefits and values associated with elephant conservation, including peoples' worldviews. This is the first step for stakeholders to build mutual trust and look beyond what seem to be irreconcilable views on conservation (Biggs et al., 2017). The sacred-secular principles dimension will aid policymakers and managers in developing

conservation strategies that incorporate hitherto often neglected indigenous knowledge systems, respect the rights of local people and long-term sustainability (Pascual et al., 2021).

We acknowledge that the presented elephant valuation assessment has some limitations. First, it focuses only on favourable valuations of elephants (services) and does not assess potential disservices (*sensu* Ceausu et al., 2018), such as crop damage and threat to human life, which are a serious concern in most elephant range countries (Di Minin et al., 2021; Shaffer et al., 2019), nor potential ecological disservices that elephants cause to vegetation (Asner et al., 2016; Henley & Cook, 2019). Secondly, categorising all benefits of elephants involves a risk of double counting, as some services of elephants (e.g., supporting and regulating ecosystem services) are inputs to other benefits of elephants (Brouwer et al., 2013). For instance, elephants, as keystone species (benefit 45) feed into their aesthetic value (benefit 28), contribution to psychological well-being (benefit 34) and inspiring people (benefit 40), which in turn makes elephants a flagship species for conservation (benefit 61). Although overlaps are eliminated as much as possible, some overlapping benefits remain as we believe it is important to incorporate final and intermediate services to highlight the multi- dimensionality of value systems in which certain services benefits will influence the potential of perceiving other benefits. Furthermore, people may prioritise elements differently, which is lost when collapsing the detail. A better understanding of the interlinkages between (partly) overlapping benefits is key to promoting consideration of all these aspects in conservation.

Thirdly, the question as to whether all peoples' values should be considered equally in specific circumstances remains open. It may be necessary for conservation policymakers and practitioners to develop relative value weightings, dependent on circumstances. For example, the needs, rights, and values of people who experience elephant crop damage could be rated higher than those of people that have never experienced elephant disservices. However, it is evident that only by first recognising *all* values and stakeholders, can informed, appropriate, and fair decisions about relative weight be made. Fourth and relatedly, implementation can be challenged by power imbalances, as the short- term, private interests of powerful stakeholders may overwhelm the system, even

when there is awareness of the importance of balancing benefits and respecting all value systems. We hope our valuation assessment stimulates understanding and robust decisions that minimise trade-offs for current and future generations, by counterbalancing short-term, private, or inequitable interests against long-term common good (Nilsson et al., 2016).

Long-term common good centres around sacred principles that are shared (or at least recognised), and intergenerational. These are largely captured within the Moral values added to the IPBES classification system. We believe that including these will facilitate recognition of the long-term common good, which aligns with the concept of the public trust doctrine in which the environment is protected for all people, to serve the public interest and protect our common heritage (Blackmore, 2017). The recognition of sacred principles, the multiple value systems of people living with wildlife, and the transparent and equitable evaluation of potential trade-offs between secular and sacred principles, lead to conservation solutions that respect human rights, good governance, intergenerational legacy, and environmental justice (the social compact filters of Van de Water et al., 2022). Although it may remain impossible to realise 100 % satisfaction for all stakeholders involved in conservation decision-making, we believe that the presented process ensures consideration of all stakeholders' worldviews and interests, along with increased transparency and accountability. The greater understanding this would allow will promote the levels of consensus that are necessary to move forward collectively.

### **3.5.1 From one-dimensional to mutually reinforcing strategies**

Careful consideration of moral values in conservation decisions adds a circular dimension that promotes biodiversity conservation and facilitates the resolution of trade-offs. For instance, when people lose access to conservation areas on which they historically depended, compensation through creating temporary jobs with poor labour conditions (i.e., a marginalising trade-off) may result in social division, unrest, or poaching, as peoples' moral values were not respected. The added dimension of morality ensures that created jobs are meaningful, dignifying, and empowering, and that solutions are co-developed through community participation and ownership. Considering moral values

also requires policymakers and managers to think beyond commonly applied management interventions or conservation policies. Simply financially compensating for crop damage or loss of life due to human-wildlife conflict will be insufficient and may lead to negative human-nature interactions if moral values are not considered. A positive feedback loop with biodiversity conservation can be created through, for instance, mutual agreement on the type of compensation, ensuring the compensation is culturally appropriate, accompanied with an apology which acknowledges guilt and responsibility, and ensuring that efforts are taken to prevent future loss (Anthony & Swemmer, 2015; Schwartz, 2021). The morality feedback loop added to the IPBES classification system incentivises local people to conserve nature through inclusion, respect, and rights, and transforms the system from a one-way value chain to a value circle (*sensu* Van de water et al. 2022), promoting regenerative nature-people interactions. One-way nature-people interactions will only provide outcomes on one side of the value chain, while the circular feedback provides opportunities for multiple outcomes through mutual reinforcement. There are important additional dimensions of the consequences of conservation decisions to consider, such as localised versus global, individual versus communal, and short-term versus long-term. In general, the economic and relational benefits of elephants are often experienced individually, at local levels, while higher order value systems tend to be more communal or universal, and held at a global level. Considering these scaling dimensions helps to predict the impact of conservation decisions beyond on-the-ground practice, and enables the development of universal, mutually reinforcing solutions and regulations (*i.e.*, from a one-way chain to a circular system). For example, for some elephant conservation challenges, locally appropriate solutions may be effective (*e.g.*, fencing, anti-poaching measures, population control, agricultural changes) as they do not directly affect the overall survival prospects of the species in question across its entire range. However, for other conservation solutions, local measures might be expected to have an impact at a universal range level (*e.g.*, when one country wants to sell ivory internationally, this will arguably have an impact on poaching rates in other countries, as promoting or reducing ivory demand has range-state-wide impacts (Bennett, 2014)).

Local solutions are further challenged by transboundary migration (*e.g.*, 76 % of African elephants form part of transboundary populations) (Lindsay et al., 2017), especially when

species have different levels of legal protection when they cross national borders (Selier et al., 2016b). Although the Asian elephant has recently been included in Appendix I of the Convention of Migratory Species (CMS) (Joshi & Puri, 2021), both African species remain listed in Appendix II of the CMS (UNEP/CMS Secretariat, 2016). Asian elephants are also listed in Appendix I of CITES for all Asian range countries (Williams et al., 2020). Yet, because the CITES listing of African elephants varies across countries, elephants may migrate from a country where international commercial trade in, for instance, ivory or live elephants is prohibited (Appendix I of CITES; 33 African range States) into a country that allows some form of regulated trade (Appendix II of CITES, i.e., Botswana, Namibia, South Africa, and Zimbabwe). The varying classifications, and subsequently varying levels of protection, promote isolationist conservation solutions, ignore ecological realities, and prevent opportunities for realising international partnerships and sustainable conservation outcomes (Lindsay et al., 2017). Unified, consistent continental elephant conservation policies and transboundary cooperation can strengthen habitat connectivity, genetic diversity, and legal protection across the range (Joshi & Puri, 2021; Lindsay et al., 2017), but such unification requires an approach that is aware of the dimensions of scale.

### **3.5.2 Examples of mutually reinforcing conservation strategies**

Mutually reinforcing strategies enable accountable conservation decisions, decrease division in conservation, and reduce vulnerability to societal risks and threats (Nilsson et al., 2016; OECD, 2020). Careful consideration of the trade-offs involved in conservation goals, in concert with good governance practices, can resolve and even merge conflicting strategies and solutions, such as including local communities in some conservation areas where human benefits are enhanced, and excluding people in other areas with fair compensation for lost access, and with support to develop alternative livelihoods and new skills (Kopnina, 2016).

An example of a successful conservation solution that involved trade-offs is the establishment of the Thirunelli-Kudrakote Elephant Corridor in 2015 in Kerala, India (Menon et al., 2020). To increase habitat connectivity and reverse the negative impacts

of habitat fragmentation, a strategy was developed to establish a wildlife corridor in an area of intense human-elephant conflict. Local communities were asked to relocate voluntarily to create space for elephants and allow coexistence. When such interventions are carefully and fairly managed - with equal participation of communities in the decision-making, support for suitable alternative livelihoods, and with improved access to communication, healthcare, education or electricity - conservation initiatives can demonstrably provide long-term, mutual benefits for species (integrity of nature, intrinsic value); the environment (clean air, water, healthy soil, regulation of ecosystems, integrity of nature, rights of nature); and for people (livelihoods, employment, cultural & spiritual, intergenerational legacy, environmental justice, human rights) (Menon et al., 2020). Moreover, the promotion of wildlife-friendly land use aligns with the public's sacred principles associated with conservation, and can contribute to achieving multiple SDGs simultaneously, including SDG 1 (no poverty), SDG 2 (zero hunger), SDG 3 (good health and well-being), SDG 4 (quality education), SDG 5 (gender equality), SDG 8 (decent work and economic growth), SDG 13 (climate action), SDG 15 (life on land), SDG 16 (peace, justice and strong institutions), and SDG 17 (partnerships for the goals).

### **3.5.3 Conclusions**

The comprehensive categorisation of services, benefits and values associated with elephant conservation presented here increases our understanding of the dynamics of the conservation landscape and allows policymakers to interrogate the kinds of problems that arise and trade-offs that must be dealt with. However, although accounting for multi-dimensional services, benefits and stakeholder value systems helps map nature conservation and human well-being at different scales, the specific local context in which each conservation policy is implemented needs to be taken into account. The vast research on elephants enabled us to develop this comprehensive overview, which may not be possible for other less well-studied species or ecosystems. Our valuation system can be applied to other species and ecosystems and to conservation planning at national/regional scale, as well as at local scales. At a national scale (e.g., National Biodiversity Assessment and Action Plans under CBD, a National Protected Area Expansion Strategy, or National Elephant Action Plan under CITES), in-depth research on the different values associated

with conservation decisions, such as presented in this paper, may be required. Locally, managers may not have time or capacity to enumerate all values at stake, for example in developing Park Management Plans or intervention projects or programs, but they should, by default, assume that the broad scale of values, such as those presented in this paper, are relevant, and should be considered, consulted, communicated, and applied.

We believe that the pluralist valuation of elephants will help policymakers and managers to have a better understanding of what elephants mean to people, why elephants are important in themselves, and what values and interests are at stake. Recognition of all values helps to confront structural inequality and uneven socio-ecological pressures. This process provides insight into the consequences, often unintended, of conservation decisions, and can lead to solutions that promote equity and unity. We add indispensable dimensions to the IPBES framework, by including moral values, and emphasising a feedback loop to overcome the flawed one-way value chain (Kenter, 2018; Van Norren, 2020). The presented elephant valuation system aids in defining solutions that are not based on economic gains or political status for a few individuals, but on long-term common good and the goals and aspirations of society in general, enabling societal support and acceptance of solutions by preferably all stakeholders (Büscher & Fletcher, 2020; Kenter, 2018; Van de Water et al., 2022). The approach can be used in developing conservation action plans that are socially and politically acceptable, will garner public support, and are ecologically sound. Elephant conservation will then be mutually beneficial for human and nonhuman nature, for current and future generations.



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### 3.8 Supplemental information

#### **Info S3.1 Search terms used**

Search terms used for the literature review were: “elephant” AND “aesthetic” OR “artistic” OR “beasts of burden” OR “beliefs” OR “bequest” OR “biodiversity goals” OR “bioeconomic value” OR “Buddhism” OR “brand” OR “carbon sequestration” OR “climate change” OR “community development” OR “conservation” OR “cultural value” OR “cognitive minds” OR “ecological values” OR “ecosystem services” OR “ecotourism” OR “elephant dung” OR “emotions” OR “entertainment” OR “environmental justice” OR “existence value” OR “flagship species” OR “gender equality” OR “folklore” OR “habitat architecture” OR “human rights” OR “iconic species” OR “indigenous knowledge” OR “indigenous peoples” OR “ivory” OR “keystone species” OR “live sales” OR “migration” OR “moral duty” OR “national animal” OR “national heritage” OR “oracles” OR “pharmaceutical” OR “physical therapeutic” OR “poaching” OR “microhabitats” OR “religion” OR “rights of nature” OR “sentient agents” OR “spiritual” OR “symbolism” OR “trade” OR “traditional medicinal” OR “trophy hunting” OR “umbrella species” OR “Ubuntu” OR “value” OR “women empowerment”.

4. A THEORY OF CHANGE FOR HUMAN-ELEPHANT  
COEXISTENCE AND BUILDING COMMON GROUND: A CASE  
STUDY FROM A SOUTH AFRICAN GAME RESERVE

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Keywords:

Conservation, ecosystem services, elephants, moral values, pluralism, theory of change, trade-offs.

#### 4.1 Abstract

The global challenges of biodiversity loss and persistent poverty and inequality, which interact and shape each other at the local scale, require new strategies to improve human well-being and conserve biodiversity. In South Africa, where inclusive, transformative conservation approaches are especially needed, the Dinokeng Game Reserve was created to protect more land and combat poverty in adjacent communities. However, human-elephant conflicts and community development challenges led to complex conservation trade-offs. Using mixed methods, we assessed the value of [elephant] conservation and solutions to realise the vision of people living inside and outside the reserve. Common ground was found in ranking the benefits of elephants and the importance of considering moral values in conservation decisions. Identified solutions were investments in (1) multi-level good governance; (2) education and capacity building; (3) community development; (4) reserve expansion; and (5) promotion of the integrated conservation model. A pluralist and iterative Theory of Change was developed to build common ground with critical feedback loops that remove barriers and strengthen enabling conditions. The Theory of Change, which can be applied to other species or ecosystems, promote conservation strategies that are socially relevant and supported, and create mutually beneficial outcomes for biodiversity and multiple stakeholders.

Keywords:

Conservation, ecosystem services, elephants, human-elephant conflict, human-elephant coexistence, moral values, pluralism, theory of change, trade-offs, land-use planning.

## 4.2 Introduction

Globally, scientists agree that in order to reverse the decline in biodiversity and mitigate and adapt to climate change, more land must be protected or managed for conservation purposes (UN General Assembly, 2021). The High Ambition Coalition for Nature and People, which over 70 governments from across six continents have committed to, and the Kunming Declaration issued at the United Nations Biodiversity Conference in October 2021, aim to protect and conserve at least 30 % of the land area of the world by 2030 (UN General Assembly, 2021). In the developing world, biodiversity-rich land exceeds the global average by far, however, it is threatened by resource extraction and encroachment, and it is often the object of contention because of resistance to exclusionary conservation approaches, issues of power, inequality, or poverty (Lindsey et al., 2020; Redford & Fearn, 2007). At the same time, persistent poverty, inequality, and marginalisation demand socio-economic development and equity in sharing natural resources (Díaz et al., 2018). Resolving polarised conservation debates and trade-offs between conservation and human well-being goals is hindered by a lack of understanding of, or proper consideration of the aspirations of different actors or the widely differential socio-economic and political factors that drive people's interest in conservation (Biggs et al., 2017b; Büscher et al., 2022a; McShane et al., 2011).

South Africa is considered one of the most biodiversity-rich, yet one of the most socially unequal countries in the world (Convention on Biological Diversity, 2021; Department of Environmental Affairs and Tourism, 2005; Garland, 2008; Tucker, 2010). Conservation approaches in South Africa tend to focus on maintaining ecological processes, managing wildlife, and developing economic opportunities within and for the reserve (e.g., tourism, hunting) (Musavengane & Leonard, 2019), while generally social issues beyond the borders of reserves (e.g., low quality or temporary jobs, poor labour conditions, irregular donations) are given little meaningful attention or are only dealt with superficially (Thakholi, 2021). This occurs in a context where over half of South Africa's population lives in poverty (55.5% of the population has a monthly income of less than \$83 (*Gini Coefficient*, 2021) and rely on ecosystem services for their well-being, livelihoods, and health (e.g., traditional medicinal plants are the main source of health care for over 70% of the population (Convention on Biological Diversity, 2021)). The

interaction between poverty and inequality and dependence on natural resources in the absence of other opportunities creates feedback loops that threaten socio-ecological sustainability and resilience, particularly where conservation authorities and communities are in conflict over access to and control over the use of resources (Büscher & Ramutsindela, 2015; Duffy et al., 2019; Spierenburg et al., 2006; Witter, 2013). With a legacy of apartheid and colonialism, South African biodiversity conservation is positioned in a context of political struggle, challenged by complex historical injustices and power negotiations (Queiros, 2019). An integral part of overcoming this struggle is identifying and strengthening commonalities between stakeholder groups that have historically been divided due to socio-economic and political factors, and incorporating the perception, values, and needs of local people into conservation planning (Büscher et al., 2022a; Neuteleers & Hugé, 2021; Pascual et al., 2017). It is evident that there is a growing demand for integrating conservation with human well-being; however, transformative frameworks to guide such a transition are still lacking. A pluralist approach that embraces commonalities rather than differences can foster conservation policies that are socially relevant and supported, and beneficial to a wide group of stakeholders (Biggs et al., 2017b). The recently published Draft White Paper on the Conservation and Sustainable Use of South Africa's Biodiversity emphasises a need for an African conservation approach that aims to conserve and sustain biodiversity while providing access and beneficiation to local people, embracing diversity, indigenous knowledge and moral values such as those encapsulated in the African philosophy Ubuntu (DFFE, 2022).

The Dinokeng Game Reserve, and in particular, the African savanna elephant (*Loxodonta africana*) living in this reserve, provides an excellent case study to identify and evaluate lessons learned from initiatives that have integrated conservation and human development goals in South Africa. In 2011, low-value agricultural land in close proximity to Tshwane and Johannesburg was transformed into the residential Dinokeng Big Five Game Reserve. One of the founding principles was to develop a public-private partnership with historically marginalised communities, land/business owners, and the local/provincial authorities (Van Rooyen, 2005). Gauteng province aimed to boost socio-economic development and combat the high levels of unemployment in the disadvantaged communities surrounding the reserve by creating a premier tourism destination, including

a unique ‘All Africa in one day’ programme that links nature and culture (Burton et al., 2020; Van Rooyen, 2005). The conceptual planning of Dinokeng Game Reserve included several nodes surrounding the reserve offering cultural experiences, such as African craft, African adornment, traditional farming and medicine, African music, and dance (Burton et al., 2020). Since its opening, Dinokeng Game Reserve has created over 800 direct permanent jobs for residents in neighbouring communities (Burton et al., 2020) and an additional 1,242 indirect jobs related to spin-off industries, such as the sales of crafts (Boonzaaier, 2018). The reserve increased nature conservation land use with 21 000 ha of conserved, restored and rewilded land. Despite the progress that has been made to date, the full potential of the reserve has not been reached due to two conservation trade-offs at play: a trade-off between people and elephants (human-elephant conflicts) and between people with protectionist approaches and those aspiring access to the benefits of conservation (human-human conflicts) (Redpath et al., 2013).

The first trade-off is related to human-elephant conflicts (HEC). Elephants provide socio-economic and cultural benefits (e.g., benefits related to ecotourism, inspiration, or as cultural totems), and they have intrinsic value, irrespective of their relation to people (Bandara & Tisdell, 2003; Blignaut et al., 2008; Geach, 2002; Lötter, 2016; Platt, 2014; Poufoun et al., 2016; Van de Water et al., 2022b). Globally, people care about elephants and would like them to continue to exist (Bandara & Tisdell, 2003; Wang et al., 2020). In South Africa, elephants serve the public interest as key tourism drawcards and are viewed as a national heritage by the people (DFFE, 2020). Over the past 30 years, South Africa has (re)introduced approximately 800 African savanna elephants to small, privately owned reserves to reduce population numbers in some areas and boost wildlife-based tourism in other areas (DFFE, 2020; Naidoo et al., 2016; Selier et al., 2016; Slotow et al., 2005). The transition from agricultural land use to wildlife-based industries was supported by the fact that wildlife-based tourism generated more income than farming and by a change in the law that enabled the use of wildlife (Carruthers, 2008; Lindsey et al., 2009). However, failure to meet the needs of elephants in these reserves is causing unintended negative consequences, especially in reserves with high levels of human disturbances (Slotow et al., 2008; Zungu & Slotow, 2023). In 2011, ten elephants (a herd of nine elephants and a young bull) were introduced to Dinokeng Game Reserve, and in 2013, three additional adult bulls, which has contributed to the reserve’s promotion as a

wildlife destination and attracted tourists (Delsink et al., In prep.). Dinokeng Game Reserve is a high-density reserve, containing 57 properties with a 3,000 total bed capacity to accommodate tourists, a vehicle density of 5.89 vehicles per 1,000 ha (Boonzaaier, 2018; Burton et al., 2020), a large number of internal fences, as well as self-drive and off-road driving routes. This density causes stress to elephants and leads to Human-Elephant Conflict (HEC) especially if required refuge areas and guidelines to limit human disturbances are not in place (Jachowski et al., 2012; Szott et al., 2019). Since their introduction, elephants have been involved in HEC incidents, ranging from property damage to the loss of human and elephant lives. These conflicts and the resulting elephant management interventions (in one case lethal control) have resulted in negative media reports, reputational damage, and division between Dinokeng Game Reserve's landowners and other stakeholders. Although elephants did manage to break out of the reserve a few times, the majority of HEC incidents were internal, rather than external, because of high-quality external fences.

The second trade-off concerns human-human conflicts and is related to reserve-community relations. These have been fraught with socio-economic and political strife, despite legal agreements to ensure benefit-sharing with adjacent communities (Burton et al., 2020). The region surrounding Dinokeng Game Reserve comprises some of the most economically disadvantaged areas of the province, including Kekana Gardens, which has one of the highest poverty indices (67.0%) in Gauteng province (Cross et al., 2005). Community members have voiced concern over their loss of access to the reserve terrain, which they historically used to gather natural resources for religious and cultural purposes (Boonzaaier, 2018). Feelings of exclusion, lack of communication, and mistrust (Masombuka, 2014; Queiros et al., 2018) have fuelled incidences of social unrest and localised crime (e.g., break-ins, vandalism, sabotaged fences, setting of bushfires, poaching, and trespassing) (eNews Channel Africa, 2014; Masombuka, 2014; Omar, 2011). The high population density in surrounding communities, the high rates of inequality and poverty, changes in land use, and the multiplicity of stakeholders with different interests, needs and expectations in relation to the (instrumental) benefit of elephants confront the reserve with complex trade-offs.



This study aims to increase insight into local expectations and relations people have with nature, and to use this knowledge to contribute to the much-needed transition towards more inclusive and integrative conservation. We focused on Dinokeng Game Reserve as a case study to investigate (1) the intrinsic, instrumental, relational, and moral values associated with [elephant] conservation, as perceived and held by people living inside Dinokeng Game Reserve, as well as by people living in the marginalised community, Kekana Gardens, outside the reserve; (2) the trade-offs that are associated with decisions about elephant management and socio-economic community development; (3) solutions to realise shared visions for the future that enhance socio-ecological sustainability; and (4) to develop a generalised Theory of Change for conservation for human-elephant coexistence which aids in building common ground. The results can aid policymakers and managers in the development of strategies to restore and rewild more land, uplift marginalised communities, and support the proposed transition towards more inclusive and integrative conservation (Büscher et al., 2022b; Pascual et al., 2017, 2021; Van de Water, Di Minin et al., 2022).

### 4.3 The history and geography of the Dinokeng Game Reserve

#### 4.3.1 Kekana Gardens

The Dinokeng Game Reserve (21,000 ha, 25.4010° S, 28.3071° E) is located on the north-eastern periphery of South Africa's densely populated Gauteng province (Figure 4.1), a province characterised by high urbanisation, inequality, and unemployment (Nhamo et al., 2021). Socio-economic challenges are highly prevalent in Kekana Gardens (2.61 km<sup>2</sup>-15,709 people (Census 2011)), the community closest to Dinokeng Game Reserve and with which the reserve has a close relationship ('Kekana Gardens' in Figure 4.1) (Queiros et al., 2018). Kekana Gardens, part of the Hammanskraal region, started as an informal settlement in the 1990s, when migrants moved to the area, and was later formally established (Queiros, 2019). The area is managed using a block system, with each of the 28 blocks having its own elected block chairperson and an All-Blocks Chairperson to coordinate the entire block structure (Queiros, 2019). Every five years, chairpersons are

elected by the community members. The settlement falls under the AmaNdebele-a-Moletlane tribal authority, with a Chief as its political head. After a chieftaincy dispute and shift in power dynamics, descendants of the chieftaincy from Hammanskraal moved to Kekana Gardens where they established the AmaNdebele-a-Moletlane Tribal Authority of Kekana Gardens (Kekana Gardens community hereafter), which is not recognised within the formal structures of traditional authorities under the Traditional Leadership and Governance Framework Act 42 of 2003 (Amended Act 23 of 2009) (Godsell, 2013). The recognised Chief of the tribal authority in Hammanskraal has a legal mandate to participate in community development and restitution, while the unrecognised Kekana Gardens leadership lacks this influence. To date, issues about land claims between both traditional authorities, including over land bordering Dinokeng Game Reserve, remain unsolved (Queiros, 2019). In 2014, Kekana Gardens lodged a land claim against Dinokeng Game Reserve, which they lost as community members did not possess the title deeds for the property in the reserve. Prior to 1990, there was no community where Kekana Gardens is located now, so their relation to the land in Dinokeng Game Reserve is relatively new (Queiros & Mearns, 2022).

#### **4.3.2 Dinokeng Game Reserve**

The Dinokeng Game Reserve has been established as a public-private partnership with shares divided between 176 landowners and the Gauteng Department of Economic Development (Boonzaaier, 2018). The reserve officially opened in 2011 and is managed by elected landowners (Boonzaaier, 2018; Burton et al., 2020; Delsink et al., In prep.). In 2018, private landowners owned approximately 77% of the reserve, while the state-owned 23% ('State owned' in Figure 4.1), of which 4,200 ha belonged to the Gauteng Provincial Government and 3,000 ha to the South African National Defence Force (Boonzaaier, 2018). Previously degraded agricultural land has been rewilded into productive ecosystems consisting of savanna, grasslands, riverine terrain and wetlands that provide habitat to wildlife, among which the iconic Big Five species: lion (*Panthera leo*), leopard (*Panthera pardus*), black rhinoceros (*Diceros bicornis*), the African buffalo (*Syncerus caffer*), and the African savanna elephant. Dinokeng Game Reserve also

incorporates agricultural, residential (176 landowners, mostly with fences around their houses), and commercial land (e.g., lodges, restaurants, shops, brewery), as well as land dedicated to social services (e.g., schools, orphanages). For various reasons, including farming purposes (e.g., cattle, pigs, game breeding, lucern, pecan and macadamia nuts), eighteen landowners within the reserve boundaries decided not to join the reserve, and remained fenced out, surrounded by elephant-proof fences ('Island properties' in Figure 4.1).

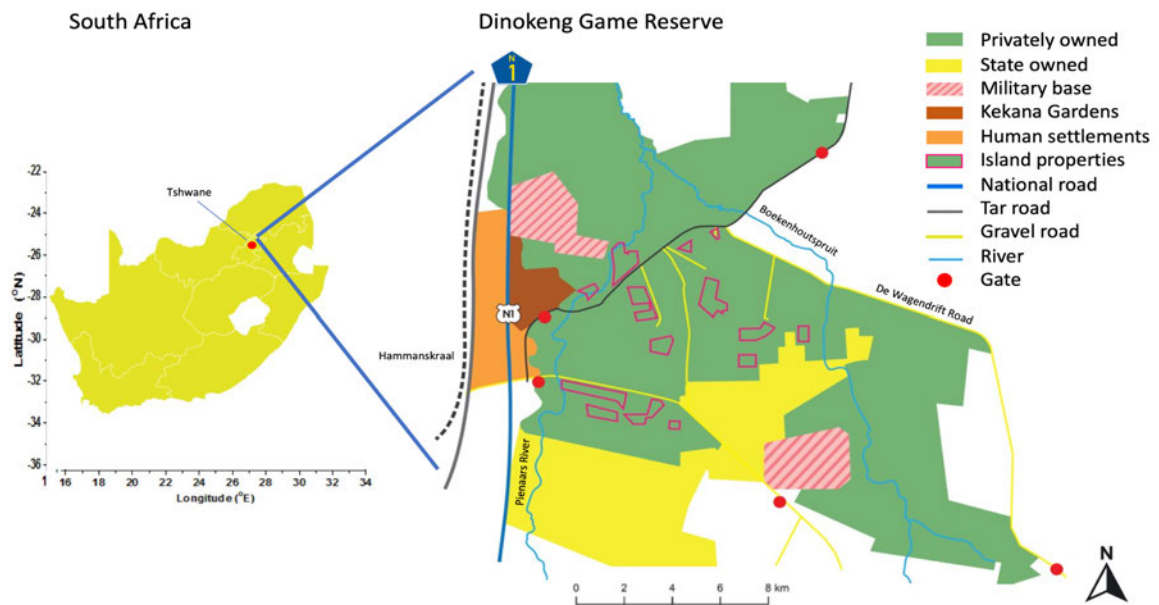


Figure 4.1: Map of South Africa (left) indicating the location of Dinokeng Game Reserve, north of the city Tshwane in Gauteng province (left). Dinokeng Game Reserve consists of privately owned land (green), state-owned land (yellow), and private properties that are fenced out (pink borders). Human settlements are indicated in orange, with Kekana Gardens in dark orange. A national freeway (N1 in blue) runs along the western border of the reserve, and a public tar road (black) cuts through the reserve (design: Van de Water).

## 4.4 Methods

### 4.4.1 Data collection

The study adopted a social constructivist approach using mixed methods, with qualitative data collected through (1) a semi-structured interview with the All-Blocks Chairperson of Kekana Gardens; (2) a World Café community workshop with Kekana Gardens block leaders (Brown et al., 2005); (3) personal observations; and (4) open-ended questions in a questionnaire administered to residents of Dinokeng Game Reserve and another questionnaire administered to residents of Kekana Gardens community. Quantitative data collected were collected through the same two questionnaires.

*Semi-structured interview.* Topics discussed in the semi-structured interview with the community leader were (1) attitudes and values of community members towards elephants and the Dinokeng Game Reserve; (2) barriers to and enablers of positive reserve-community relations; and (3) solutions needed to improve reserve-community relations and enable socio-ecological sustainability. The semi-structured interview took place in June 2019.

*Questionnaires.* The first questionnaire targeted the 176 landowners of Dinokeng Game Reserve ('Dinokeng questionnaire', hereafter). The reserve management introduced the study to the residents - who could be homeowners or commercial property owners - and distributed the online questionnaire through email and WhatsApp. A reminder message was sent two weeks later. A quarter ( $n = 43$ , 24.4%) of Dinokeng Game Reserve landowners completed the questionnaire. The second questionnaire targeted the 60 residents of Kekana Gardens community who had chosen to attend the World Café community workshop, out of the approximately 15,709 residents of the Kekana Gardens community (Census 2011), of whom 28 manage a community block ('Kekana Gardens questionnaire', hereafter). The respondents were invited to the study by the All-Blocks Chairperson of the Kekana Gardens community (i.e., the key informant for the semi-structured interview), who targeted (potential) local leaders, which may have introduced some bias as people that are more outspoken, higher educated or younger may have been more likely to attend the workshop. Of the 60 Kekana Gardens community World Café

participants,  $n = 37$  (61.7%) completed the full questionnaire. Both questionnaires were divided into four sections focusing on: (1) peoples' valuation of and attitudes towards elephants; (2) barriers to and enablers of socio-ecological sustainability; (3) peoples' vision of the future; and (4) demographic variables to gain insight into the socio-economic factors that influence people's perceptions and attitudes. To gain more insight into the context of each stakeholder group, each questionnaire included some stakeholder-specific questions that are not comparable between stakeholder groups (e.g., the Dinokeng Game Reserve questionnaire included a question about people's willingness to pay for [elephant] conservation, and the Kekana Garden community a question about the cultural importance of elephants). The Dinokeng Game Reserve questionnaire consisted of 41 questions (S1 Appendix), and the Kekana Gardens questionnaire consisted of 35 questions (S2 Appendix). The questionnaires were administered between April and August 2019 and were completed anonymously.

*Community workshop.* In August 2019, a participatory World Café community workshop was organised by the All-Blocks Chairperson and the first author at Mongena Private Game Lodge in Dinokeng Game Reserve, which sponsored the workshop venue. In total, 60 Kekana Gardens community residents joined the workshop, of which about 28 were block chairpersons. The workshop followed the methodology of the World Café (Brown et al., 2005), a participatory and open process of information gathering. During the workshop, participants were encouraged to share knowledge about three themes: (1) the value of elephants; (2) people's vision of the future; and (3) the action needed to realise positive change. A welcoming and inviting environment was created by Mongena Private Game Lodge to enable open discussion. The participants were welcomed by the All-Blocks Chairperson, who introduced the study in English and SeTswana. The first author explained the objectives and methodology of the workshop. Prior to the workshop, participants were given 45 minutes to complete the Kekana Gardens questionnaire. Their engagement with the questions in the questionnaire will have influenced their responses in the World Café as it would have resulted in a particular framing of the issues at hand, but it was administered first so that issues addressed in the World Café did not influence their individual responses in the questionnaire. After the questionnaire administration, the group was divided into three subgroups, each addressing one theme at a time. Three external volunteers joined the workshop as "theme hosts," and three community members

volunteered as “theme leaders” to assist with translation and ensure that each participant understood the process and felt comfortable contributing to the conversation. The theme hosts and leaders introduced the questions written on posters in English, translated if needed, and opened the discussion about the theme topic. Participants received pens and sticky notes and were encouraged to add their ideas to the posters. Subsequently, the groups discussed the input on the theme and organised the ideas into emerging categories. The groups then rotated so that each group contributed to each theme, and participants learned from the input from other participants. After the group discussions, the theme leaders presented their input on each theme to the rest of the group. The workshop concluded with a summary of the highlights of the discussions.

Furthermore, data were collected through personal observations and conversations with stakeholders, and input from the interview, questionnaires and workshop on the trade-offs that occurred in Dinokeng Game Reserve (i.e., giving up on something to experience the benefits of something else, (de Groot et al., 2010).

#### **4.4.2 Data analysis**

##### *The value of elephants*

Different methods were used to assess the value of elephants to account for differential underlying perceptions or valuation processes (e.g., more conscious vs more unconscious) and gain important insights into values otherwise missed. The value of elephants is assessed in three ways: (1) the ranking of various values of elephants (quantitative data from questionnaires); (2) the perceived value of elephants (qualitative data from semi-structured interview, open questions in questionnaires, and input from World Café workshop); and (3) experienced benefits, attitudes, and support for conservation (quantitative data from questionnaires). For the ranking of various values of elephants, quantitative data from the questionnaires were merged and analysed in SPSS (SPSS 27, SPSS, Inc., Chicago, USA). Respondents were asked how important (1 = *not important*; 5 = *very important*) they considered 16 values of elephants. We classified these values into the benefit categories and valuation concepts as developed in the

pluralist elephant valuation approach (Van de Water et al., 2022)<sup>2</sup>. A multivariate analysis of variance (MANOVA) was conducted to compare the perceived benefits of elephants between both stakeholder groups.

To gain additional insight into the perceived value of elephants, qualitative data were analysed through NVivo (NVivo 12 Pro, QSR International Pty Ltd., Victoria, Australia). A priori codes were generated from the pluralist elephant valuation approach (Van de Water et al., 2022b). Based on previous research on the drivers of people's attitudes towards conservation (Kideghesho et al., 2007; Van de Water & Matteson, 2018), Spearman Rank-Order Correlation was used to evaluate the importance of experienced benefits from elephants and the level of education on the importance people attribute to investment in elephant conservation and their willingness to pay for it. As we had expectations about the direction of effects (e.g., when people experience more benefits from elephants, they attribute more importance to investing in elephant conservation (Van de Water & Matteson, 2018)), we used one-tailed *p*-values for these comparisons. Due to the small sample size and low statistical power, alpha was determined at 0.1.

### *Conservation trade-offs*

Data collected through personal observations, interviews, questionnaires, and workshops, as well as insights into worldviews or principles that influence differential trade-offs, were combined to describe the trade-offs that occurred. The secular and sacred principles that were identified in the pluralist elephant valuation approach were used to increase understanding of the underlying causes of conservation trade-offs that occurred in Dinokeng Game Reserve. Each identified conservation trade-off was classified as a routine, taboo, tragic, or marginalising trade-off (Schwartz, 2021; Van de Water et al., 2022b). Routine trade-offs occur when secular principles are countered by other secular principles and for which rational outcomes can be calculated. In taboo trade-offs, secular

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<sup>2</sup> The 16 benefit categories that were specified in the pluralist valuation approach were intrinsic, integrity of nature, regulation of ecosystem services, air/water/soil, food/medicinal, livelihood/employment, aesthetic, physical/psychological, learning/inspiration, way of life, cultural/spiritual, social cohesion, intergenerational legacy, rights of nature, environmental justice and human rights. The four overlapping valuation concepts are defined as intrinsic, instrumental, relational, and moral values. Each benefit, service and value associated with elephants was further classified as secular (for which compensation is possible), sacred (for which compensation is unthinkable) or both (Schwartz, 2021; Van de Water et al., 2022b).

principles are countered by sacred principles, often through public outcry. Tragic trade-offs occur in decisions which involve two conflicting sacred principles, which can be emotional and stressful (Schwartz, 2021). Finally, marginalising trade-offs occur when secular principles take precedence in the trade-off and overpower the sacred principles of a minority or disempowered group (Van de Water et al., 2022b). Marginalising trade-offs occur where a power struggle is tipped to the disadvantage of marginalised minority groups whose knowledge base might not conform to western levels of thinking or even education (Supplemental Table S4.3).

#### **4.4.3 Developing a Theory of Change**

A Theory of Change is a strategic planning framework comprehensively describes how desired change is expected to happen, which is responsive to required flexibility in complex systems (Balfour et al., 2019). It demonstrates the linkages between the current state, the desired state, and the interventions (and underlying assumptions) that are needed to achieve the desired state (a shared vision for the future or long-term goals) (Biggs et al., 2017a). Using input from both stakeholder groups and analysing differences and commonalities, a Theory of Change was developed to (1) describe current barriers to and enablers for socio-ecological sustainability; (2) distil elements of the desired state or vision for the future; (3) list all the solutions mentioned by the two stakeholder groups, and integrate solutions by using a unifying, pluralistic angle (i.e., identifying solutions that promote the unified aspects, but also that unify the polarised aspects); and (4) identify important feedback relations.

## **4.5 Results**

### **4.5.1 Socio-economic profile of the respondents**

Table 4.1 presents the socio-economic characteristics of the Dinokeng Game Reserve residents and the Kekana Gardens community members. When assessing the socio-economic profiles of the respondents, it is important to consider that the Kekana Gardens community was only established after 1990 and Dinokeng Game Reserve in 2011



(Queiros & Mearns, 2022). Therefore, for all respondents, the local socio-economic challenges and opportunities are relatively new. The majority of both stakeholder groups had lived in the area before the reserve was established, indicating that their initial motivation to move to the area may not have been related to the creation of the reserve, although the idea to open the reserve was born in 1995 (Queiros, 2019). Generally, Kekana Garden respondents are younger, receive less education, and are more often unemployed compared to Dinokeng Game Reserve respondents. The majority of the Dinokeng Game Reserve respondents speak Afrikaans or English, while the Kekana Garden respondents speak Sepedi or SeTswana. The majority of the Dinokeng Game Reserve respondents are business owners, and almost half of them (48.7%) state that they generate some income related to the Dinokeng Game Reserve

Table 4.1: Socio-economic characteristics of respondents from Dinokeng Game Reserve (n = 43) and the Kekana Gardens community (n = 37). The percentages may not sum to 100% due to missing values.

Characteristics	Residents Game Reserve (%)	Dinokeng Residents Gardens (%)
Gender		
Male	51.2	45.7
Female	41.9	45.7
Age		
19-40	25.6	25.7
41-60	32.6	51.4
>61	32.6	2.9
Native language		
Afrikaans	46.5	
English	39.5	
Sepedi		31.4
SeSotho		14.3
SeTswana		28.6
Other	7.0	22.8

## Highest education level

No schooling		8.6
High school Certificate	25.6	51.4
Tertiary education diploma	18.6	14.3
Tertiary education degree	48.9	5.8
Employment		
Business owner	44.2	8.6
Government, teacher, medical, management	11.6	14.3
General labour	4.7	11.4
Reserve management, conservation	4.7	
Other	14.1	22.9
Unemployed	10.0	42.9
Has visited the reserve	100	71.4
Lived in the area before the reserve was opened as a Big Five game reserve in 2011	53.3	84.4

#### 4.5.2 The value of elephants

##### *Ranking various values of elephants*

Respondents were asked to value elephants in terms of their intrinsic, instrumental, relational, and moral values. Figure 4.2 (Supplementary material Table S4.1) presents the ranking of various values of elephants by Dinokeng Game Reserve (green) and Kekana Gardens (blue) respondents. The ranking of both groups indicates common ground, with both respondent groups presenting high scores for the existence value of elephants for future generations, the potential for community development and education, the sense of well-being experienced through the joy of observing elephants, and the benefits from ecotourism. The highest ranking of Dinokeng Game Reserve respondents was given to ecotourism, while Kekana Gardens respondents ranked community development as the highest value. Both groups assigned the lowest ranks to the consumptive instrumental benefits of elephants, such as trophy hunting, sales of body parts (ivory, hides, meat), or meat consumption (average score < 2). Compared to Kekana Gardens respondents,

Dinokeng Game Reserve respondents assigned significantly more importance to the intergenerational legacy of elephants (feelings of well-being from the comfort of knowing that elephants may exist for future generations), ecotourism, intrinsic value (irrespective of their relation to us), and the elephant’s role in maintaining ecological balance. Although generally low scores were given, Kekana Gardens respondents assigned a higher score to elephant benefits related to religious, spiritual, or cultural benefits, sales of body parts, and traditional medicine, as compared to Dinokeng Game Reserve respondents.

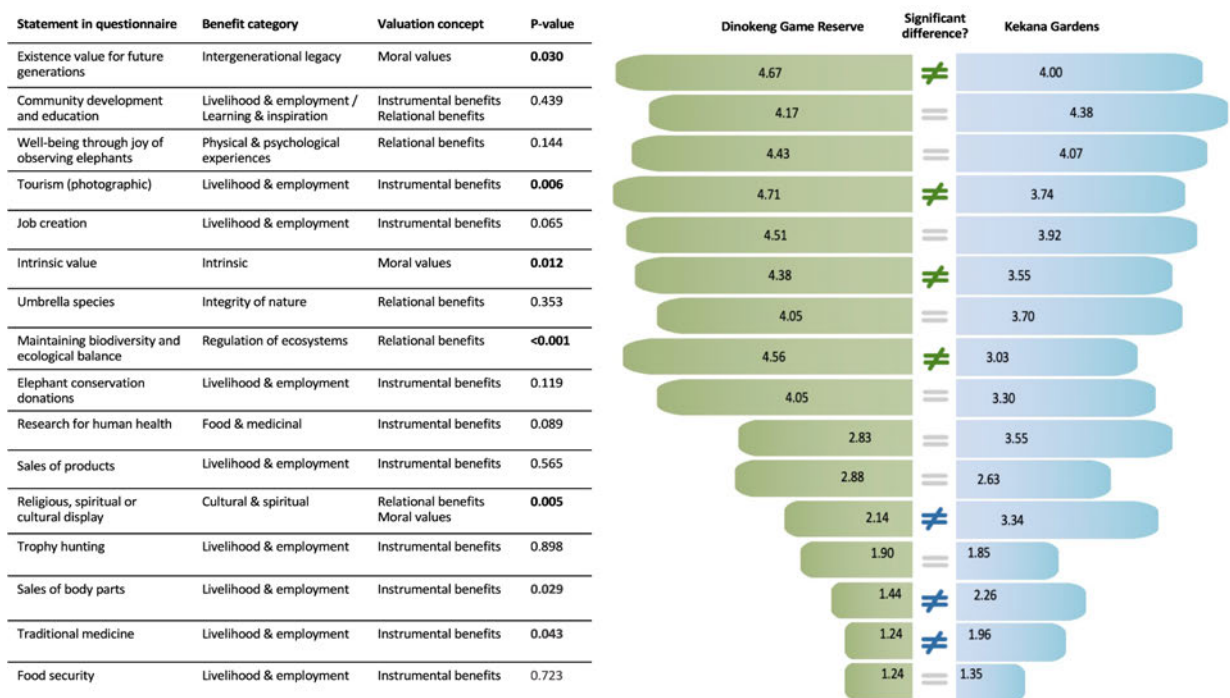


Figure 4.2: Rankings of Dinokeng Game Reserve (green) and Kekana Gardens (blue) respondents on statements in the questionnaire related to the importance of various services, benefits, and values of elephants, rated on a 5-point Likert scale ranging from 1 "Not important" to 5 "Very important". The number in the bars indicates the average perceived importance assigned to each benefit. To enable comparison of broader valuation categories, the benefits mentioned in the questionnaires were linked to the elephant benefit categories and valuation concepts identified by (Van de Water et al., 2022b) (columns 2 and 3). The items are ranked from the highest to the lowest overall mean score. The signs in between the bars indicate a significant difference, using MANOVA, in the valuation of the values between the subgroups, with the grey equal

sign indicating no significant difference, the green  $\neq$  sign indicating significantly more importance given by Dinokeng Game Reserve respondents, and the blue  $\neq$  signs indicating significantly more importance given by Kekana Gardens respondents for that item at  $p < 0.05$  (Supplementary material Table S4.1).

*Perceived values of elephants*

The first question in the questionnaire was an open question to list the value elephants bring to the people of South Africa. Dinokeng Game Reserve respondents first mentioned instrumental benefits, such as ecotourism (100.0%) and job creation (44.4%), which was followed by relational benefits, such as conservation value as an umbrella species (27.8%), education (16.7%), and connection to nature (13.9%). The five values mentioned most frequently by the Kekana Gardens respondents were ecotourism (57.1%) (instrumental benefit), community education (50.0%) (relational benefit), job creation (50.0%) (instrumental benefit), business development related to tourism (35.7%) (instrumental benefit), and cultural value (28.6%) (relational benefit). During the Kekana Gardens community workshop, a broad range of benefits of elephants was discussed, which included instrumental benefits (job creation, business development, medicinal use), social benefits (support for community-based projects, educational programs, reserve visits, skill development, research), ecological benefits (ecosystem engineers), and cultural benefits (totem animals, family's beliefs, sense of place), and the intrinsic value of elephants (rights of nature, animal well-being). Statements about the value of elephants mentioned by the Dinokeng Game Reserve and Kekana Gardens respondents have been summarised in Figure 4.3. In this overview, each statement is classified as intrinsic, instrumental, relational, or moral. The overview also gives insight into related secular or sacred principles, which aids in understanding the complexity of conservation decisions and the occurrence of trade-offs that will be discussed in the next section (adapted from Van de Water et al., 2022b).

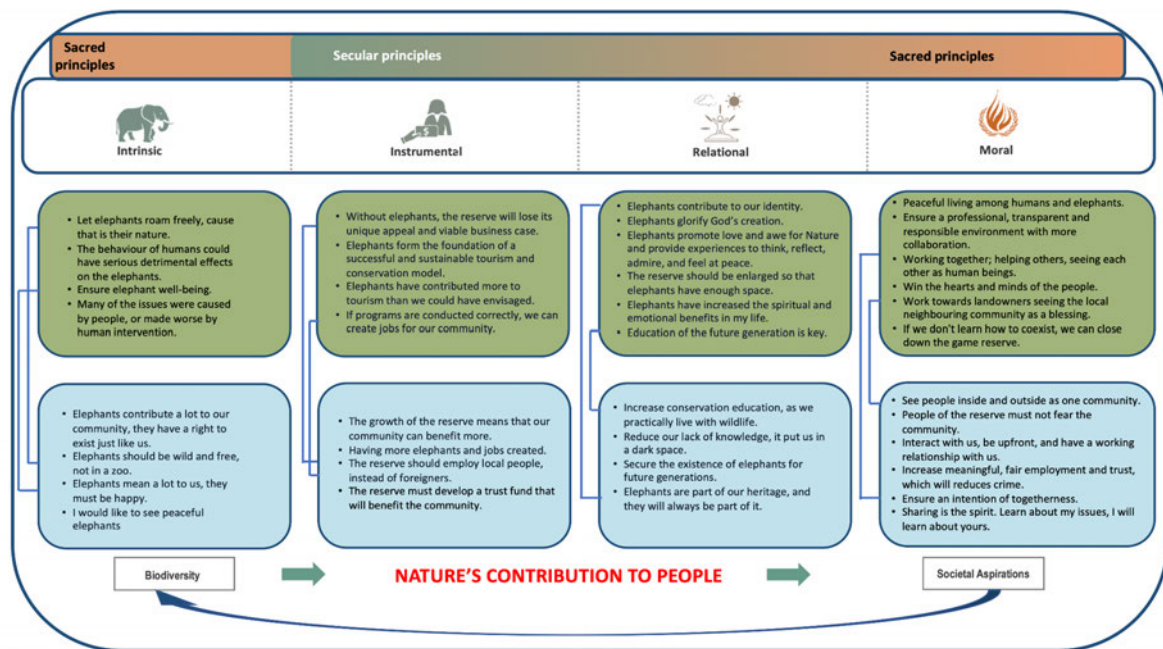


Figure 4.3: An overview that brings together statements made by Dinokeng Game Reserve respondents (in green) and Kekana Garden respondents (in blue) regarding intrinsic, instrumental, relational, and moral values associated with elephants. The connecting blue lines indicate overlapping values that highlight common ground. Including moral values in [elephant] conservation strategies will create a feedback loop from societal outcomes and values to biodiversity (bottom), which promotes reciprocity with nature and socio-ecological sustainability (modified from Van de Water et al., 2022b).

#### 4.5.3 Experienced benefits, attitudes and support for conservation

Attitudes towards, and benefits derived from elephants were explored in the questionnaire with both stakeholder groups and the World Café workshop with the Kekana Gardens community group. Dinokeng Game Reserve respondents reported significantly more often than Kekana Gardens respondents that they gained non-financial benefits from elephants (Figure 4.4). In addition, they experienced a significantly higher number of benefits from elephants. These results are expected, as Dinokeng Game Reserve respondents have unlimited access to the reserve, opportunities to observe elephants and to create livelihoods centred around elephants. In contrast, Kekana Gardens respondents do not have these opportunities in the same way. In line with this finding, the percentage

of respondents who reported no benefits at all from elephants significantly and substantially varied between the two subgroups, with only 2.3% of the Dinokeng Game Reserve respondents gaining no benefits, compared to 60.0% of the Kekana Gardens respondents. In addition, Dinokeng Game Reserve respondents reported significantly more positive attitudes toward elephants (82.5%) than Kekana Gardens respondents (47.3%)<sup>3</sup>. Dinokeng Game Reserve respondents mainly reported feelings of admiration (28.7%), excitement (27.6%), awe (16.1%), and happiness (13.8%), whilst 29.1% of Kekana Gardens respondents reported feelings of fear, followed by excitement (18.2%), and happiness (18.2%). Despite the differences in experienced benefits and attitudes toward elephants, we uncovered important common ground: both subgroups agreed that it is important to invest in elephant conservation: 95.1% of Dinokeng Game Reserve respondents and 84.4% of Kekana Gardens respondents<sup>4</sup>. All Dinokeng Game Reserve respondents (100.0%) and the majority of Kekana Gardens respondents (88.2%) stated that they believe that elephants have a right to exist regardless of their value to humans.

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<sup>3</sup> Possibly driven by their positive attitudes towards elephants, the majority of Dinokeng Game Reserve respondents (78.0%) expressed a willingness to pay for elephant conservation. The majority of Dinokeng Game Reserve respondents believed that the value of their property has increased since the Big Five species have been introduced (81.4%), and stated that the benefits of having elephants in the reserve outweigh the costs (88.4%). It is therefore not surprising that all Dinokeng Game Reserve respondents (100.0%) indicated that they tolerated elephants, mostly because of their intrinsic value (76.9%), followed by the fact that elephants did not cause any significant damage to them (12.8%), or because of their value to people (10.3%).

<sup>4</sup> The cultural value may have influenced this, as the majority of the Kekana Gardens respondents stated that elephants were important to their culture (72.7%).

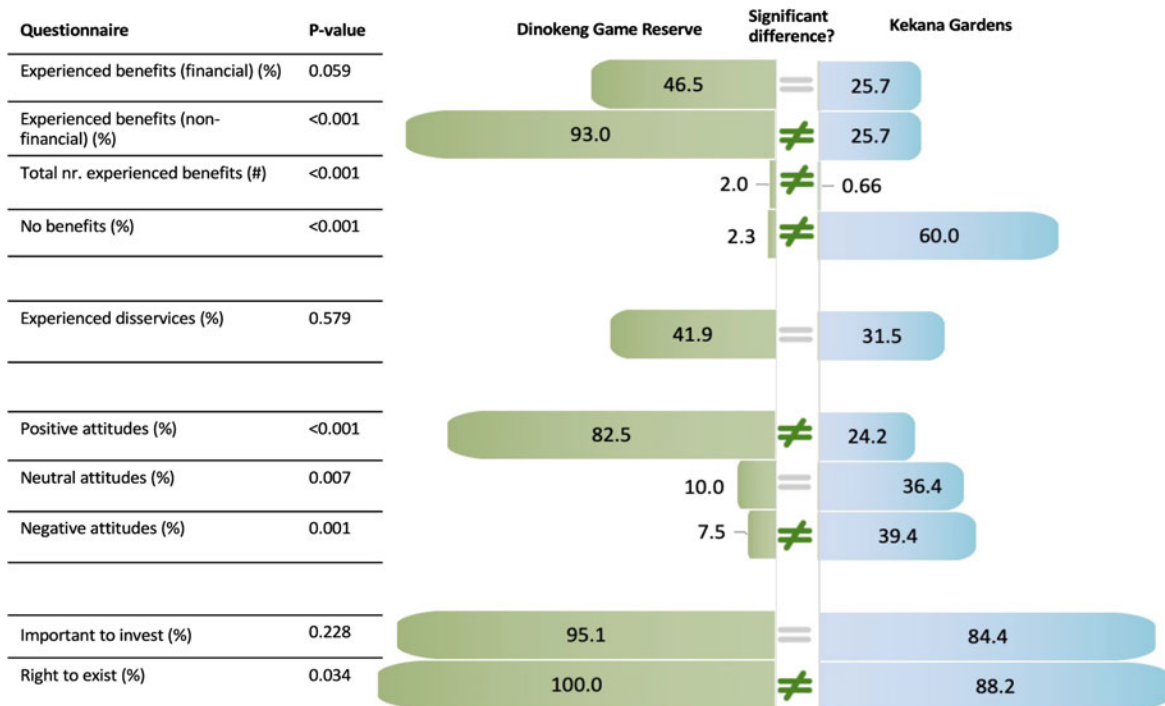


Figure 4.4: Overview of the similarities and differences between the Dinokeng Game Reserve (green bars) and Kekana Gardens (blue bars) respondents. Chi-square tests were used to examine differences in experienced benefits from elephants and attitudes towards elephants, and Fisher's Exact Test to assess differences between both subgroups in believing that elephants have a right to exist and that it is important to invest in elephant conservation. The signs in between the bars indicate a significant difference between both subgroups, with grey equal signs indicating no significant difference and green or blue not equal signs indicating Dinokeng Game Reserve respondents or Kekana Gardens respondents were significantly more likely to report the benefit/attitude/support, at  $p < 0.05$ .

We also examined which factors predict the perceived importance of investing in elephant conservation and willingness to pay for conservation. Among Dinokeng Game Reserve respondents, the experience of benefits was significantly and positively related to their willingness to pay for conservation ( $r_s = .95$ ,  $n=4$ ,  $p=0.03$ ), as was their level of education ( $r_s = .70$ ,  $n=5$ ,  $p=0.09$ ). Among Kekana Gardens respondents, a higher level of education ( $r_s = .87$ ,  $n=5$ ,  $p=0.03$ ) and the number of experienced benefits ( $r_s = .78$ ,  $n=4$ ,  $p=0.06$ )



predicted the importance of investing in elephant conservation (Supplementary material Table S4.2).

These results highlight the importance of providing access to the benefits of elephants and the reserve<sup>5</sup>, as this will likely improve attitudes and support for the reserve by Kekana Gardens residents. These benefits do not necessarily need to be financial, as other benefits were assigned more importance (e.g., educational programs at local schools and community game drives). Despite the challenges of reserve-community relations, Kekana Garden community members do see the value of the reserve<sup>6</sup> and Dinokeng Game Reserve residents make efforts to support the local community<sup>7</sup>.

#### 4.5.4 The impact of conservation trade-offs

In Supplemental Table S4.3, the examples of trade-offs that occurred in Dinokeng Game Reserve are specified, as well as potential solutions and outcomes. Trade-offs that have occurred in Dinokeng Game Reserve are classified as routine trade-offs (two examples), taboo trade-offs (three examples), tragic trade-offs (two examples), and marginalising trade-offs (two examples) (DFFE, 2022; Schwartz, 2021; Van de Water et al., 2022b). **Routine trade-offs** (two secular principles pitted against each other) occurred, for instance, where arguments to introduce elephants to provide ecotourism benefits dominated arguments about making the reserve more suitable for elephants before their arrival, which resulted in costs of elephant management interventions that are needed in a high-density reserve. Another example of a routine trade-off was the decision to kill a damage-causing elephant to reduce costs of management and damage, which took precedence over arguments that the intervention does not solve the cause of problematic

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<sup>5</sup> Even though they live in close proximity to an elephant reserve, most Kekana Gardens respondents stated that they only see elephants a few times per year (51.5%), or they only have seen elephants a few times in their lives (30.3%).

<sup>6</sup> When asked, “What do people generally say about Dinokeng Game Reserve in your community” most Kekana Gardens respondents gave positive examples (60.7%) related to job creation, spin-off benefits from ecotourism, and excitement to see wildlife. Although most Kekana Gardens respondents stated that they have not personally benefited from Dinokeng Game Reserve (60.0%), the majority believed that the reserve contributes to the development of the community (58.8%).

<sup>7</sup> The majority of the Dinokeng Game Reserve residents (94.1%) stated that their household or company provides employment for people living in neighbouring communities (76.5%), which mostly entailed employment for two community members or more. Almost half of the Dinokeng Game Reserve respondents (41.2%) stated they support local businesses in the community (e.g., craft shops, restaurants, shops, cultural performances, or professional services), and another 41.2% mentioned they support community development initiatives (e.g., orphanages, training, or in-kind donations).

elephant behaviour and may thus not prevent future costs. **Taboo trade-offs** (secular principles countered by sacred principles) occurred when the secular arguments for rational decisions to kill a damage-causing elephant were countered by public outcry based on sacred principles related to our moral duty to protect elephants and provide for their needs, and the belief that elephants have intrinsic value and, therefore, a right to live, which was mentioned by both the Dinokeng Game Reserve and Kekana Gardens residents. The negative outcome of these trade-offs, such as social division, and reputational damage due to a public outcry, may outweigh the positive outcomes of the intervention. **Tragic trade-offs** (two sacred principles pitted against each other) happened in Dinokeng Game Reserve when the sacred principles behind the goal of increasing land for conservation and elephant habitat conflicted with concerns about animal welfare issues of introducing elephants to a high-density reserve. Another tragic trade-off occurred when the reserve was opened with ceremonious words addressing poverty and inequality through job creation in marginalised communities and the need for more land for conservation purposes, while in effect, the sacred principles of community members related to access to land used for cultural and religious purposes, and to principles of good governance (e.g., lack of transparency and communication, missed opportunities to engage local community leaders) were violated (Bruskotter et al., 2022). When considering the reserve's sacred intentions, this trade-off can be classified as a tragic trade-off. However, if the reserve's arguments are mainly secular (e.g., boosting the economy), this trade-off should be classified as marginalising. In either case, this may have contributed to less-than-desirable reserve-community relations. **Marginalising trade-offs** (sacred principles countered by secular principles) occurred when the community members expected sacred outcomes such as increased human rights, dignity, and justice, but felt marginalised when they experienced mainly secular outcomes that were not always perceived as fair, meaningful, or empowering. In terms of reserve-community relations, arguments to open a Big Five game reserve adjacent to a marginalised community to decrease poverty and unemployment (from a secular perspective) ignored sacred principles held by Kekana Garden residents related to unfair labour practices and the lack of transparency (feelings related to fairness, dignity, trust).

#### 4.5.5 A Theory of Change for Conservation

The findings of the interview, questionnaires and workshop are integrated into an overarching Theory of Change that builds on the perspectives and solutions of Dinokeng Game Reserve stakeholders, highlighting commonalities and shared pathways, with the aim of moving from the current state toward the desired state as reflected by the shared vision (Figure 4.5). First, the current state was assessed by summarising the barriers and enablers of socio-ecological sustainability and the interactions amongst them, as experienced by both stakeholder groups (1a and 1b in Figure 4.5). Second, a shared vision for Dinokeng Game Reserve was identified by combining elements identified by both stakeholder groups (2 in Figure 4.5). Third, following a commonality approach, the potential solutions identified by both stakeholder groups (3a) were synthesised into five solutions that are based on common ground (3b). Fourth, a circular dimension to conservation was added from the common ground solutions back to the current state. Feedback 4a aids in removing the barriers, and feedback 4b strengthens the enablers of socio-ecological sustainability. Together, the feedback loops remove disparities and increase unity, thus enlarging the overlapping sections in the centre of the figure. For instance, the feedback loop from good governance to barriers to socio-ecological sustainability will decrease the lack of trust, communication, and unity, thereby removing division and transforming barriers into enablers. This requires governance by learning organisations that foster a spirit of co-learning, co-developing, co-governance, and accountability for the implementation of integrated solutions (Cowling et al., 2008). Learning organisations strive to create, gain and share knowledge and experience, and modify policies and behaviour to reflect newly gained insights (Garvin, 1993). These important feedback relations continuously change the current state and the need for future solutions, highlighting an iterative, adaptive and holistic Theory of Change (Sarabi et al., 2019). Considering these feedback loops aids in understanding the iterative, underlying and ongoing cycles (Termeer & Dewulf, 2019). From linear thinking, the theory of change promotes system thinking, through which vicious cycles that lead to harmful consequences are prevented, and virtuous cycles that generate increasingly beneficial consequences are promoted (Garud & Kumaraswamy, 2005).

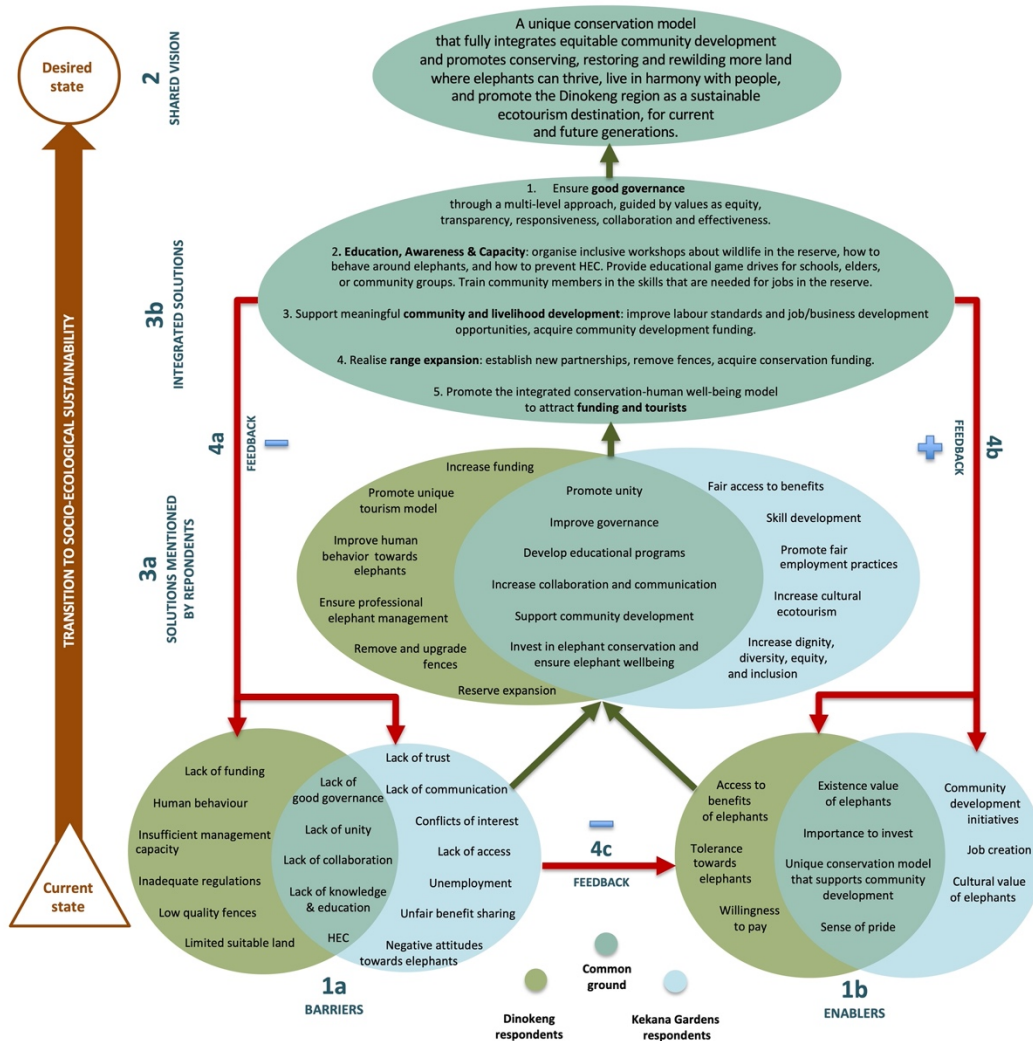


Figure 4.5: A Theory of Change toward a ‘living in harmony’ conservation approach (UN General Assembly, 2021). The pluralist framework summarises qualitative data from open questions in the Dinokeng Game Reserve and Kekana Gardens questionnaire and the participatory workshop with Kekana Gardens respondents. The planning process starts at the bottom by describing the current state and evaluating the barriers to (1a) and enablers (1b) of socio-ecological sustainability that both stakeholder groups identified. The overlapping sections highlight commonalities shared by the Dinokeng Game Reserve (green) and Kekana Gardens (blue) subgroups. The desired state reflects a shared vision that we created based on input from the respondents of sustainability, combining elements that were identified by both stakeholder groups (2). The solutions to realise the shared vision that was identified by both stakeholder groups (3a) were integrated into five solutions that are based on common ground (3b). Three important feedback relations were

identified (red arrows): feedback 4a aids in removing the barriers, feedback 4b in strengthening the enablers of socio-ecological sustainability, and feedback 4c occurs when barriers are removed, strengthening or creating new enablers. The feedback loops create an iterative process with ongoing cycles (Termeer & Dewulf, 2019), which prevent harmful vicious cycles and promote beneficial, virtuous cycles (Garud & Kumaraswamy, 2005). The feedback relations remove disparities and increase unity, enlarging the overlapping sections and updating initially proposed solutions (Kioupi & Voulvoulis, 2019; Sarabi et al., 2019).

#### 4.6 Discussion

The increasing pressure on natural resources demands strategies that reconcile conservation and human well-being goals. Nature conservation can contribute to global aspirations such as equality, human well-being, and reduced poverty, provided they incorporate all stakeholders' needs, rights, and values and that unavoidable trade-off decisions are taken democratically and transparently (i.e., good governance) (Pascual et al., 2021; Van de Water et al., 2022a). However, many conservation areas in South Africa are managed along the lines of a protectionist approach, with inadequate access and benefit-sharing for communities (Convention on Biological Diversity, 2021; DFFE, 2021; Musavengane & Leonard, 2019). By excluding a large part of the population from the benefits of the wildlife economy, conservation risks actively reproducing social and spatial inequality (Thakholi, 2021). Given the history of political struggle and diverging socio-economic circumstances and access to reserves, it is vital to develop solutions that tackle the problems at the root by acknowledging and addressing differences in influence, access, and values among stakeholders and by seeking commonalities to reconcile stakeholders' aspirations (Büscher et al., 2022a). Through a case study of elephant management in Dinokeng Game Reserve, we assessed the perceived values of elephants, barriers to and enablers of socio-ecological sustainability, and solutions to realise the shared vision of people living inside the reserve and people living in a marginalised adjacent community.

Although Dinokeng Game Reserve achieved some positive outcomes in biodiversity conservation (21,000 ha of land conserved) and job creation (800 direct jobs), the reserve's full potential has not yet been realised. The assessment of the values related to elephants shows that both stakeholder groups hold and perceive moral values alongside the services and benefits that may be derived. Incorporating moral values into conservation management decisions will create a feedback loop that promotes mutually reinforcing human-nature interactions, creating a virtuous circle to the transition to socio-ecological sustainability (Termeer & Dewulf, 2019; Van de Water et al., 2022b). Both stakeholder groups value the existence of elephants for current and future generations and prefer the non-consumptive use of elephants to contribute to the well-being of people in South Africa, which highlights the importance of filtering conservation decisions through a lens of morality (Van de Water et al., 2022b). Exploring the benefits people experience highlighted some differences that are important in understanding what drives peoples' attitudes towards elephants. Even though elephants did not harm people in the Kekana Gardens community, when they broke out of the reserve into Kekana Gardens community, it affected the attitudes of community members who were struggling with poverty, limited access to resources, and inequality, which was stated in the semi-structured interview and aligned with other studies (Barua et al., 2013; Bruskotter & Wilson, 2014). Combined with the lower level of experienced benefits, it is not surprising that Kekana Gardens respondents expressed less positive attitudes towards elephants. Conversely, elephants caused more frequent damage to Dinokeng Game Reserve respondents than to the Kekana Gardens respondents, but the former expressed more positive attitudes towards elephants and felt that the benefits of elephants outweigh the costs. Direct benefits, therefore, shape and reconfigure responses to risks from elephants. The results of this study are indicative of a need for the wildlife sector to consider animal well-being in management decisions, which both stakeholder groups highlighted, is incorporated in the Norms and Standards for the Management of Elephants (DEAT, 2008), and the recently gazetted National Environmental Management Laws Amendment Act (NEMLAA), and provisions of the minister to establish regulations for animal well-being (DEAT, 2008; NEMLAA, 2022). The results also point toward the need for conservation strategies that not only aim to minimise the costs of living with wildlife in terms of human-wildlife conflict but also to provide meaningful benefits to local people

and restore lost access to natural resources. What this means will be different for the various groups. In its most limited form, it involves providing free access for community members a few days a year, in its most far-reaching form, it requires land reform, co-management, removal of power imbalances and recognition of moral values and non-material injustices (Carlos Bezerra & Paphitis, 2021). Similarly, job creation as a conservation benefit can range from temporary construction, cleaning, or construction jobs with poor labour conditions, to permanent jobs which involve training and opportunities for career growth (Thakholi, 2021). People turn to poaching when they are poverty-stricken, often as a result of marginalisation, so there is a vicious cycle playing out when the historical context of socio-ecological dilemmas is ignored (Termeer & Dewulf, 2019; Thakholi, 2021). To test buy-in to the theory of change, the results of this paper and the theory of change need to be taken back to the community and residents, which we anticipate will be part of future research.

When the needs of elephants and the needs, aspirations, and values of local people are not fully accounted for, this can lead to consequences of interlinked *human-elephant* and *human-human* conflicts which are characterised by four types of trade-offs: routine, taboo, tragic and marginalising trade-offs. Multiple findings of this study (e.g., in the perceived values, the analysis of trade-offs, and the discussed solutions) show that respecting people's sacred principles is essential, especially when expectations regarding community upliftment have been created. When they felt this promise was not sufficiently kept and their sacred principles neglected, negative trade-off consequences were to be expected. Considering the context of the reserve-community relations, without considering moral values, the community will not likely let go of their sacred principles when a marginalising trade-off is asked of them. As the interview data showed, ignoring people's needs, expectations and values in decision-making processes can lead to unintended negative consequences of conservation decisions (e.g., anger, crime, reduced social cohesion). A potential conflict between secular and sacred principles may also occur through differences in value systems. Leaders of Kekana Gardens community use traditional approaches to community development, guarding African customs, which may or may not be compatible with western, liberal conservation and rural development models. South Africa's proposal of restoring an African conservation approach aligned with the African philosophy of Ubuntu (DFFE, 2022) can bridge this gap, as it

disassociates from western models of understanding human-nature interactions (Mabele et al., 2022). Ubuntu is an African social compact that stands for embeddedness in the web of life and recognition of one's position and well-being relative to another: *I am because we are* (LenkaBula, 2008; Mabele et al., 2022). The philosophy promotes just and harmonious relations between humanity and the earth and between people mutually, based on respect for all life and economic and ecological justice for all, especially for communities negatively affected by socio-ecological issues (LenkaBula, 2008). The identification of trends in the trade-offs that have occurred in Dinokeng Game Reserve increases our understanding of the value systems of relevant stakeholders, which increases the space for fair representation of all values and inclusion of all voices, and results in better-informed decisions (Biggs et al., 2017b). It is evident that trade-off conflicts will need to be resolved in the context of good governance and truly integrated community development. Mapping the types of trade-offs and gaining insight into the values at stake aids in identifying balanced solutions that will enlarge common ground (Van de Water et al., 2022b).

The shared vision that was distilled in this study aligns with global “Living in harmony with nature” conservation strategies, as well as with South Africa’s new conservation vision of “a prosperous nation, living in harmony with nature, where biodiversity is conserved for present and future generations, equitable livelihoods secured, and human well-being improved” (Díaz et al., 2018; United Nations General Assembly, 2021). The solutions that were identified through this assessment promote unity and equity in sharing the benefits of nature conservation on the one hand and range expansion on the other in a way that generates mutually beneficial outcomes for biodiversity and multiple stakeholders. As identified by both stakeholder groups, it is evident that the transition to socio-ecological sustainability is dependent on good governance through building and maintaining relations and trust through fair participation, sharing of knowledge, and clear communication, which was also found in other studies (van Putten et al., 2022; Young et al., 2016). A conservation approach that can aid in realising the living in harmony vision is Convivial Conservation, which incorporates different value systems, and has a strong focus on what is socially and ecologically just. It offers an integrated, post-capitalism approach to conservation, reconnecting nature and people on various levels (Büscher et al., 2022a; Büscher & Fletcher, 2020). Taking a Convivial Conservation approach,



proposals can be considered to establish community-owned (part of) reserves and wildlife-based tourism models, contributing to South Africa's land restitution and redistribution aspirations and re-introducing people to (the benefits of) wildlife (DFFE, 2020).

It is important to acknowledge that the shared vision of living in harmony is not easy to achieve and cannot be achieved instantly. The presented Theory of Change outlines the dimensions that either promote or compromise socio-ecological sustainability. In a developing country with a history of apartheid and colonialism, where local people are often excluded from conservation areas, negative attitudes towards game reserves and wildlife are to be expected (DFFE, 2020). Elephants, as icons of wildlife reserves that perpetuate the marginalisation of local communities, may even become emblematic of exclusion and inequality in the eyes of these communities, in which case their lack of support for elephants is representative of their marginalised position in relation to conservation. From this perspective, human-human conflict acts as a driver of human-elephant conflict. This perspective has been echoed in South Africa many times before, where communities state that wildlife (including penguins, rhinoceros and other emblematic wildlife) are assigned more importance than the lives of black people (Thakholi, 2021). The Theory of Change follows a phased approach through the co-implementation of solutions by a suite of learning organisations (Cowling et al., 2008). Co-implementation of the proposed solutions will iterate the current state through various phases and virtuous circles, shifting participation to ownership and temporary jobs to career development and personal growth to achieve socio-ecological sustainability in a complex context over time. The presented pluralist Theory of Change framework can aid policymakers and managers in taking shared vision elements as a driver for change, identifying polarising areas and building areas of common ground, thereby increasing unity and reducing the negative impacts of trade-offs (Pascual et al., 2021).

## 4.7 Conclusion

The Dinokeng Game Reserve case study juxtaposes various complex developing world biodiversity challenges and highlights the importance of considering the linkages between the natural and social systems (Van de Water et al., 2022a). A pluralist approach places conservation in a wider context, incorporating diverse knowledge and value systems and overcoming social division by seeking commonalities (DFFE, 2020; Pascual et al., 2021). As iconic, keystone species, elephants have vast potential in accelerating rewilding processes through their role as megaherbivores, but also in providing benefits to the local and broader society (DFFE, 2020; Jepson & Blythe, 2020; Roy & Sukumar, 2015). Thereby, elephants can serve as our allies in achieving contemporary global goals, such as equality and protecting 30% of the globe's land by 2030 (Chami et al., 2020; Jepson & Blythe, 2020; Peller et al., 2013). The lessons learned from this study can inspire a new conservation narrative that moves beyond traditional protectionist conservation approaches, by inspiring action to increase natural areas and rewild degraded land while simultaneously contributing to human well-being and harmonious reserve-community relations (Garland, 2008; Queiros, 2019). Thereby, conservation not only contributes to the global conservation goals of reversing biodiversity loss, mitigating climate change and protecting at least 30 % of the land (UN General Assembly, 2021) but also to poverty alleviation and increasing equality and social cohesion.

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#### 4.9 Ethics statement

The research was reviewed and approved by the University of KwaZulu-Natal Humanities & Social Sciences Ethics Committee with protocol reference number HSS/0036/019D. Gatekeeper permission letters were provided and signed by the Dinokeng Game Reserve management and a Kekana Gardens All-Blocks Chairperson. Informed consent was obtained before participants enrolled in the study.

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## 4.11 Supplemental information

### 4.11.1 Gatekeeping permission letter Dinokeng Game Reserve



DGR Management Association  
P.O. Box 2451  
Hammanskraal, 0400  
2 December 2018

Professor Shenuka Singh  
The Chair  
Human and Social Sciences Research Ethics Committee  
University of Kwazulu-Natal

Ref: Gatekeeper Permission for PHD researcher Ms Van de Water for the study 'Living with Elephants'.

Dear Professor Singh,

Ms Antoinette van de Water has approached us to facilitate her community engagement project 'Living with Elephants. A transnational, cross-cultural investigation of the social dimensions of human-elephant coexistence'. She has requested the DGRMA to inform landowners about her project and requested permission to conduct interviews, questionnaires, and participatory workshops on finding integrated strategies to coexist with elephants through community engagement and citizen science.

We agreed that Ms Van de Water will follow all the rules and instructions of the DGRMA, that she will inform the DGRMA about all activities in relation to the study and that the project will be self-funded. Both parties will sign an MOU to agree on the details of our collaboration.

The DGRMA welcomes Ms Van de Water' project and has agreed to facilitate her study. We would be happy to circulate information about the research to landowners and other stakeholders as needed, to ensure as wide a study participation as possible.

Please feel free to contact me directly for any queries.

Yours Sincerely,

Ludger Helm  
DGRMA Secretary

### 4.11.2 Dinokeng Game Reserve Questionnaire

## DINOKENG BIG 5 GAME RESERVE HUMAN-ELEPHANT COEXISTENCE LANDOWNER QUESTIONNAIRE

TO FILL IN THE QUESTIONNAIRE ONLINE, PLEASE OPEN  
[HTTPS://WWW.SURVEYMONKEY.COM/R/DGRELEPHANTS](https://www.surveymonkey.com/r/DGRELEPHANTS)  
OR SCAN THE QR CODE:



Dear Landowners of Dinokeng Game Reserve,

My name is Antoinette van de Water and I am a PhD student from the University of KwaZulu-Natal and I am currently living at Kaallagte road in Dinokeng Game Reserve which has allowed me the pleasure of meeting some of you already. I would like to invite you all to please participate in a study that I am conducting with the aim to gain a deeper understanding of the added value of elephants to the Dinokeng Game Reserve and the surrounding communities as well the variety of ways in which humans and elephants can coexist. My research "Living with elephants" is supervised by Prof. Rob Slotow (University of KwaZulu-Natal), Dr. Michelle Henley (Elephants Alive) and Dr. Kevin C. Matteson (Miami University) and has been approved by the management of DRG. The study is expected to enrol a diverse range of people living with elephants from various cultural and social groups.

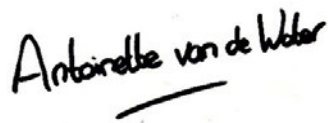
Your experience as a landowner in a reserve with elephants is invaluable to this study as you have first-hand experience of living with elephants and the challenges this may bring. The findings will contribute to the development of an integrated human-elephant coexistence strategy and will provide valuable information for the Dinokeng Game Reserve and for South Africa's National Elephant Strategy.

The questionnaire will only take about 15 minutes to complete. Your participation is completely voluntary, and all of your responses are anonymous. None of the responses will be connected to identifying information, that I can assure you. I will make every effort to protect the confidentiality of personal information, and the limits of confidentiality if applicable. This study

has been ethically reviewed and approved by the University of KwaZulu-Natal Humanities and Social Sciences Research Ethics Committee (approval number HSS/0036/019D). Your involvement in this study is much appreciated! You may skip questions and withdraw at any time. Results will only be presented publicly as aggregate summaries, of which a copy will be shared with the participants.

Thank you so much for providing this important information!

Kind regards,

A handwritten signature in black ink that reads "Antoinette van de Water". The signature is written in a cursive style and is underlined with a single horizontal line.

### **Consent form**

“I have been informed about the study entitled “Living with elephants” by Antoinette van de Water of the University of KwaZulu-Natal. I understand the purpose and procedures of the study. I declare that my participation in this study is entirely voluntary and that I may withdraw at any time without affecting any of the benefits that I normally am entitled to. I understand that my personal details will be held as confidential.

I understand that by clicking yes below, I give informed consent to participate in this study.”

Do you agree to the terms above?

- Yes
- No

If you have any questions or concerns about your rights as a study participant, or about an aspect of the study or the researchers or if you need more information prior to completing this survey, you can contact me, Antoinette van de Water, at [antoinette@bring-the-elephant-home.nl](mailto:antoinette@bring-the-elephant-home.nl), or 072 5683704 or Prof. Rob Slotow at [slotow@ukzn.ac.za](mailto:slotow@ukzn.ac.za) or at +27 33 260 8026.

If you have questions or concerns about the rights of research subjects, you can contact the University of KwaZulu-Natal Humanities & Social Sciences Research Ethics Committee, contact details as follows:

HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION

Research Office, Westville Campus, Govan Mbeki Building

Private Bag X 54001, Durban, 4000

KwaZulu-Natal, SOUTH AFRICA

Tel: 27 31 2604557- Fax: 27 31 2604609

Email: [HSSREC@ukzn.ac.za](mailto:HSSREC@ukzn.ac.za)



**THE POTENTIAL VALUE OF ELEPHANTS FOR SOCIETY**

1. WHAT ARE THE FIRST THREE WORDS THAT COME TO MIND WHEN YOU THINK OF ELEPHANTS?

- 1) \_\_\_\_\_
- 2) \_\_\_\_\_
- 3) \_\_\_\_\_

2. ARE YOU AWARE OF ANY BENEFITS THAT ELEPHANTS BRING TO SOCIETY, FOR EXAMPLE, TOURISM, JOBS, CULTURE, TRADITIONS? LIST AS MANY AS YOU FEEL ARE RELEVANT (IN ORDER OF MOST IMPORTANT TO LEAST IMPORTANT)

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

3. DOES YOUR HOUSEHOLD OR COMPANY PROVIDE ANY BENEFITS FOR PEOPLE LIVING IN NEIGHBOURING COMMUNITIES (E.G., KEKANA GARDENS OR HAMMANSKRAAL)? YOU CAN SELECT MULTIPLE ANSWERS

- YES, THROUGH EMPLOYMENT. PLEASE SPECIFY THE NUMBER OF PEOPLE EMPLOYED BY YOU OR YOUR COMPANY PER MONTH:
- YES, BY SUPPORTING COMPANIES IN THE LOCAL COMMUNITY (CRAFTS, RESTAURANT, SHOPS, CULTURAL PERFORMANCES, PROFESSIONAL SERVICES)
- YES, BY SUPPORTING COMMUNITY DEVELOPMENT INITIATIVES (ORPHANAGE, TRAINING, IN-KIND DONATIONS, ETC)
- No
- OTHER FORMS OF COMMUNITY SUPPORT OR COMMENTS:

4. Over the last three years have you or your family members gained any benefits from living with elephants? You can select multiple answers.

- YES, FINANCIAL BENEFITS THROUGH TOURISM
- YES, FINANCIAL BENEFITS THROUGH EMPLOYMENT
- YES, THROUGH FEELINGS OF PRIDE, JOY OR EXCITEMENT TO LIVE WITH WILD ELEPHANTS
- YES, THROUGH APPRECIATION OF CULTURAL OR SPIRITUAL VALUES OF ELEPHANTS
- NO, I HAVE NOT EXPERIENCED ANY BENEFITS FROM LIVING WITH ELEPHANTS
- OTHER (PLEASE SPECIFY):

\_\_\_\_\_







10. DO YOU THINK THAT ELEPHANTS HAVE A RIGHT TO EXIST REGARDLESS OF THEIR VALUE TO HUMANS?

- YES  
 NO

#### HUMAN-ELEPHANT COEXISTENCE

11. PLEASE READ THE FOLLOWING STATEMENTS CAREFULLY AND RATE ON A SCALE OF 1 "NOT AT ALL CONCERNED" TO 5 "EXTREMELY CONCERNED".

HOW CONCERNED ARE YOU THAT:

	1 Not at all concerned	2 Not so concerned	3 Somewhat concerned	4 Very concerned	5 Extremely concerned
Elephants can cause property damage.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Elephants can cause physical harm.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Elephants can attract poachers and can cause militarisation of an area.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Elephants can cause loss of biodiversity and disrupt ecological balances if their habitat is too small.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

12. OVER THE PAST THREE YEARS, HAVE YOU EXPERIENCED A SIGNIFICANT NEGATIVE IMPACT FROM ELEPHANTS?

- Yes  
 No

13. HAVE YOU DONE ANYTHING TO MITIGATE THE NEGATIVE IMPACT OF THE ELEPHANTS (E.G., CHANGING YOUR BEHAVIOUR TO AND WITH THE ELEPHANTS, UPGRADING YOUR FENCE OR GATE, REMOVING SPECIFIC PLANTS OR TREES, USING A METHOD TO DETER ELEPHANTS, ETC.) AND WHAT WAS THE RESULT OF THIS?

14. OVERALL OVER THE PAST THREE YEARS, DO YOU THINK THAT THE NEGATIVE IMPACT OF ELEPHANTS HAS DECREASED, INCREASED OR STAYED THE SAME?

- INCREASED
- DECREASED
- STAYED THE SAME
- I HAVEN'T EXPERIENCED ANY NEGATIVE IMPACT

15. HOW DO YOU FEEL ABOUT THE BENEFITS OF HAVING ELEPHANTS IN THE RESERVE VERSUS THE COSTS THEY MAY BE ASSOCIATED WITH?

- THE BENEFITS OF HAVING ELEPHANTS IN THE RESERVE OUTWEIGH THE COSTS.
- THE COSTS OF HAVING ELEPHANTS IN THE RESERVE OUTWEIGH THE BENEFITS.
- OTHER (PLEASE SPECIFY):

---

---

16. WHAT ISSUES (E.G., SOCIAL OR POLITICAL) DO YOU THINK AFFECT THE DEVELOPMENT OF EFFECTIVE ELEPHANT MANAGEMENT? PLEASE LIST AS MANY AS YOU FEEL ARE RELEVANT, IN ORDER OF MOST IMPORTANT TO LEAST IMPORTANT.

---

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17. DO YOU FEEL IT IS IMPORTANT TO INVEST IN ELEPHANT CONSERVATION?

- YES
- NO
- WHY?

---

18. IN YOUR OPINION, WHO IS RESPONSIBLE FOR ELEPHANT CONSERVATION OR MANAGEMENT?

---

19. IF A TRANSPARENT AND APPROPRIATE PROGRAM WERE TO BE ESTABLISHED TO CONSERVE ELEPHANTS, WITH A GOAL OF REDUCING HUMAN-ELEPHANT CONFLICTS, WOULD YOU BE WILLING TO CONTRIBUTE FINANCIALLY TO THIS PROGRAM?

- YES, I WOULD BE INTERESTED
- NO, I WOULD NOT BE INTERESTED
- I AM ONLY WILLING TO PAY TO HAVE ELEPHANTS REMOVED FROM MY AREA

20. FOR THE NEXT THREE YEARS, HOW MUCH WOULD YOU BE WILLING TO CONTRIBUTE TO SUCH A PROGRAM PER MONTH? (YOUR ANSWER SERVES FOR ACADEMIC PURPOSES ONLY).

- 0 ZAR PER MONTH  
 1 - 50 ZAR PER MONTH  
 51 - 100 ZAR PER MONTH  
 101 - 249 ZAR PER MONTH  
  $\geq$  250 ZAR PER MONTH

IF 0 ZAR, PLEASE SPECIFY WHY:

---

### ATTITUDE TOWARDS ELEPHANTS

21. WHICH STATEMENT DESCRIBES YOUR ATTITUDE TOWARDS ELEPHANTS MOST ACCURATELY?

- I TOLERATE ELEPHANTS BECAUSE OF THEIR INTRINSIC VALUE (VALUE IN THEIR OWN RIGHT).  
 I TOLERATE ELEPHANTS BECAUSE OF THEIR VALUE TO PEOPLE (ECONOMIC, SOCIAL, CULTURAL).  
 I TOLERATE ELEPHANTS BECAUSE THEY DO NOT CAUSE ANY SIGNIFICANT DAMAGE TO ME.  
 I WOULD TOLERATE ELEPHANTS ONLY IF THEY WOULD STOP CAUSING DAMAGE.  
 I WOULD PREFER THE ELEPHANTS TO BE ERADICATED.

22. WHICH ANSWER BEST DESCRIBES YOUR FEELINGS TOWARDS ELEPHANTS BEFORE THEY WERE INTRODUCED TO THE GAME RESERVE? FOR EXAMPLE, HOW DID YOU FEEL ABOUT ELEPHANTS DURING AN ENCOUNTER IN KRUGER NATIONAL PARK OR ANY OTHER LOCATION BEFORE THEY WERE INTRODUCED TO DINOKENG GAME RESERVE (MAX 2 OPTIONS)?

- |                                     |                                                  |
|-------------------------------------|--------------------------------------------------|
| <input type="checkbox"/> AWE        | <input type="checkbox"/> CONCERN                 |
| <input type="checkbox"/> ADMIRATION | <input type="checkbox"/> FRUSTRATION             |
| <input type="checkbox"/> HAPPINESS  | <input type="checkbox"/> FEAR                    |
| <input type="checkbox"/> EXCITEMENT | <input type="checkbox"/> ANGER                   |
| <input type="checkbox"/> NEUTRAL    | <input type="checkbox"/> OTHER (PLEASE SPECIFY): |
- 

23. WHICH ANSWER BEST DESCRIBES YOUR CURRENT OR RECENT FEELINGS TOWARDS ELEPHANTS? FOR EXAMPLE, HOW DO YOU FEEL DURING AN ELEPHANT ENCOUNTER IN DINOKENG GAME RESERVE (MAX 2 OPTIONS)?

- |                                     |                                                  |
|-------------------------------------|--------------------------------------------------|
| <input type="checkbox"/> AWE        | <input type="checkbox"/> CONCERN                 |
| <input type="checkbox"/> ADMIRATION | <input type="checkbox"/> FRUSTRATION             |
| <input type="checkbox"/> HAPPINESS  | <input type="checkbox"/> FEAR                    |
| <input type="checkbox"/> EXCITEMENT | <input type="checkbox"/> ANGER                   |
| <input type="checkbox"/> NEUTRAL    | <input type="checkbox"/> OTHER (PLEASE SPECIFY): |

- 
24. IF YOU WERE TO WRITE A VISION STATEMENT FOR THE FUTURE OF THE ELEPHANTS IN DINOKENG GAME RESERVE, WHAT ELEMENTS WOULD YOU LIKE TO INCLUDE?

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25. DID YOUR VISION FOR ELEPHANTS IN DINOKENG GAME RESERVE CHANGE AFTER THE ELEPHANTS WERE INTRODUCED TO THE RESERVE? IF SO, PLEASE SPECIFY HOW IT CHANGED.

---

---

26. IN YOUR OPINION, WHAT ARE THE MAIN ISSUES OF CONCERN FOR THE ELEPHANTS IN DGR AND HOW COULD THESE ISSUES BE ADDRESSED?

---

---

27. DO YOU SHARE THE VISION OF DINOKENG GAME RESERVE?

- YES
- NO
- PLEASE SPECIFY:

---

28. DO YOU HAVE ANY ADDITIONAL SUGGESTIONS OR COMMENTS? THIS CAN BE ABOUT ANY QUESTION IN THE SURVEY, YOUR FEELINGS ABOUT ELEPHANTS IN GENERAL OR ANY EXPERIENCE WITH THE ELEPHANTS IN DGR THAT YOU WOULD LIKE TO SHARE.

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---

## DEMOGRAPHIC QUESTIONS

29. WHAT IS YOUR GENDER?

- Male
- Female
- Other

30. WHAT YEAR WERE YOU BORN? \_\_\_\_\_

31. WHAT IS YOUR NATIVE LANGUAGE?

- AFRIKAANS
  - ENGLISH
  - ISINDEBELE
  - SEPEDI
  - SESOTHO
  - SISOATI
  - XITSONGA
  - SETSWANA
  - TSHIVENDA
  - ISIXHOSA
  - ISIZULU
  - OTHER (PLEASE SPECIFY):
- 

32. WHAT IS YOUR PRIMARY SOURCE OF INCOME?

- BUSINESS OWNER: TOURISM
- BUSINESS OWNER: OTHER
- EMPLOYED IN TOURISM
- RESERVE MANAGEMENT, CONSERVATION
- HUNTING
- NON-PROFIT ORGANISATION
- CROP FARMING
- CATTLE FARMING
- GOVERNMENT OFFICER, MEDICAL PROFESSION, TEACHER OR MANAGEMENT
- GENERAL LABOUR
- I AM UNEMPLOYED
- OTHER (PLEASE SPECIFY):

33. DO YOU HAVE A SOURCE OF INCOME RELATED TO THE DGR?

- No
- YES

PLEASE SPECIFY:

---



34. WHAT IS THE HIGHEST LEVEL OF SCHOOL YOU HAVE COMPLETED? IF CURRENTLY ENROLLED, PLEASE INDICATE THE HIGHEST LEVEL COMPLETED.

- NO SCHOOLING COMPLETED
- NURSERY SCHOOL COMPLETED
- PRIMARY SCHOOL COMPLETED
- HIGH SCHOOL DIPLOMA
- COLLEGE DIPLOMA
- BACHELOR'S DEGREE
- HONOUR'S DEGREE
- MASTER'S DEGREE
- DOCTORATE DEGREE

35. HOW LONG HAVE YOU LIVED IN DINOKENG GAME RESERVE? \_\_\_\_\_ YEARS

36. ARE YOU A (MULTIPLE ANSWERS POSSIBLE)

- OWNER OF LAND THAT IS PART OF DGR
- OWNER OF LAND THAT IS FENCE OUT OF DGR (ISLAND PROPERTY)
- PRODUCT OWNER
- TENANT OF A RENTED PROPERTY IN DGR
- EMPLOYED WITHIN DGR
- MEMBER OF THE MANAGEMENT OF DGR

37. If you own an island property, would you consider becoming part of DGR and drop your fences in the near future?

- YES
- NO

PLEASE SPECIFY YOUR REASON FOR BEING FENCED OUT OF DGR

---

38. WHAT WERE YOUR REASONS, OBJECTIVES OR VISION FOR BECOMING PART OF DGR?

---

---

THANK YOU FOR PARTICIPATING!

PLEASE LEAVE THE COMPLETED QUESTIONNAIRE AT THE NDLOVU OR TAU GATE, THE DINOKENG COFFEE AND CURIO SHOP OR CONTACT ME AND I WILL PICK IT UP.

YOUR PARTICIPATION IS COMPLETELY ANONYMOUS SO I CAN'T CONTACT YOU. IF THERE IS ANYTHING RELATED TO THE TOPICS OF THIS QUESTIONNAIRE THAT YOU WOULD LIKE TO SHARE IN PERSON, PLEASE CONTACT ME AT:

ANTOINETTE VAN DE WATER

PHD RESEARCHER - UNIVERSITY OF KWAZULU-NATAL  
ANTOINETTE@BRING-THE-ELEPHANT-HOME.NL  
+66 72 5683704

IN CASE YOU, OR OTHER RESIDENTS OF DGR, WOULD LIKE TO FILL IN THE  
QUESTIONNAIRE ONLINE PLEASE USE THIS LINK  
[HTTPS://WWW.SURVEYMONKEY.COM/R/DGRELEPHANTS](https://www.surveymonkey.com/r/DGRELEPHANTS) OR SCAN THIS QR CODE:



### 4.11.3 Kekana Gardens community questionnaire

To fill in the questionnaire online, please open

<https://www.surveymonkey.com/r/Kekana> or scan the QR code:



## KEKANA GARDENS COMMUNITY QUESTIONNAIRE ON THE VALUE OF ELEPHANTS FOR SOCIETY

Dear Community members of Kekana Gardens,

My name is Antoinette van de Water and I am a PhD student from the University of KwaZulu-Natal. I am conducting a study on the value of elephants for the people of South Africa. I would like to invite you to please participate in my research called 'Living with Elephants', which is supervised by Prof. Rob Slotow (University of KwaZulu-Natal), Dr. Michelle Henley (Elephants Alive) and Dr. Kevin C. Matteson (Miami University). The study is expected to enrol a diverse range of people living close to elephants from various cultural and social groups.

Your experience as a resident of a community near a reserve with elephants is invaluable to this study as you have first-hand experience of the potential benefits elephants may (indirectly) bring to your community. The findings will contribute to the development of an integrated strategy in which elephants provide benefits to the people living near them and to the sustainable development goals.

The questionnaire will take about 20 minutes to complete. Your participation is completely voluntary and all of your responses are anonymous. None of the responses will be connected to

identifying information. I will make every effort to protect the confidentiality of personal information, and the limits of confidentiality if applicable. This study has been ethically reviewed and approved by the University of KwaZulu-Natal Humanities and Social Sciences Research Ethics Committee (approval number HSS/0036/019D). Your involvement in this study is much appreciated! You may skip questions and withdraw at any time. Results will only be presented publicly as aggregate summaries, of which a copy will be shared with the participants.

Thank you so much for providing this important information! Kind regards,

*Antoinette van de Water*

Consent form

“I have been informed about the study entitled “Living with elephants” by Antoinette van de Water of the University of KwaZulu-Natal. I understand the purpose and procedures of the study. I declare that my participation in this study is entirely voluntary and that I may withdraw at any time without affecting any of the benefits that I normally am entitled to. I understand that my personal details will be held as confidential.

I understand that by clicking ‘yes’ below, I give informed consent to participate in this study.”

1. Do you agree to the terms above?

Yes

No

If you have any questions or concerns about your rights as a study participant, or about an aspect of the study or the researchers or if you need more information prior to completing this survey, you can contact me, Antoinette van de Water, at [antoinette@bring-the-elephant-home.nl](mailto:antoinette@bring-the-elephant-home.nl), or 072 5683704 or Prof. Rob Slotow at [slotow@ukzn.ac.za](mailto:slotow@ukzn.ac.za) or at +27 33 260 8026. If you have questions or concerns about the rights of research subjects, you can contact the

University of KwaZulu-Natal Humanities & Social Sciences Research Ethics Committee,  
contact details as follows:

HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION

Research Office, Westville Campus, Govan Mbeki Building  
Private Bag X 54001, Durban, 4000  
KwaZulu-Natal, SOUTH AFRICA

Tel: 27 31 2604557- Fax: 27 31 2604609 Email: HSSREC@ukzn.ac.za

THE POTENTIAL VALUE OF ELEPHANTS FOR SOCIETY

2. What are the first three words that come to mind when you think of elephants?

- 1) \_\_\_\_\_
- 2) \_\_\_\_\_
- 3) \_\_\_\_\_

3.

3. How often do you see an elephant?

- I have never seen one
- Daily
- Weekly
- Monthly
- A few times a year
- A few times in my life

4. Which answer best describes your feelings towards elephants (max 2 options)?

- Awe
- Admiration
- Happiness
- Excitement
- Neutral
- Concern
- Frustration
- Fear
- Anger
- Other (please specify):  
\_\_\_\_\_

5. Are you aware of any benefits that elephants may bring to the people of South Africa?  
Please list as many as you feel are relevant (in order of most important to least important)

---

---

---

6. Are elephants important to your culture?

Yes

No

If yes, in what way?

---

7. Over the last three years, have you or your family members gained any benefits from elephants? You can select multiple answers.

Yes, financial benefits through tourism

Yes, financial benefits through employment

Yes, through feelings of pride, joy or excitement of seeing wild elephants

Yes, through appreciation of cultural or spiritual values of elephants

No, I have not experienced any benefits from elephants

Other (please specify):

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11. Please read the following potential socio-cultural values carefully and rate on a scale of 1 "Not important" to 5 "Very important" based on how important you believe they are.

	1 Not impor tant	2 Slightly important	3 Medium Important	4 Important	5 Very important	6 I don't know
The role of elephants in religious, spiritual or cultural display is:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The role of elephants in research for human health (e.g. discovery that elephant genes suppress cancer tumors) is:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The contribution of elephants to human well-being through enjoying observing them is:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The contribution of elephants to human well-being through recognizing and appreciating their intelligence and sensitivity is:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The contribution of elephants to human well-being through the comfort of knowing that elephants may exist for future generations is:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

12. Do you think that elephants have a right to exist regardless of their value to humans?

- Yes  
 No

13. Do you believe that an elephant that has caused damage to your property should have a right to exist?

- Yes  
 No

14. Do you feel it is important to invest in elephant conservation?

- Yes  
 No  
 Why? \_\_\_\_\_



15. Have you ever been inside Dinokeng Game Reserve?

Yes

No

16. If yes, on what occasion(s) have you been to Dinokeng Game Reserve?

Work

School

For fun

On invitation

Other: \_\_\_\_\_

17. Over the last three years, have you or anyone in your family gained any benefit from the Dinokeng Game Reserve?

Yes

No

If yes, in what way: \_\_\_\_\_

18. When you are in a group together (for example with friends or family) and you talk about Dinokeng Game Reserve, what would be said about the reserve (what do you believe is a general opinion):

\_\_\_\_\_

19. Do you think that Dinokeng Game Reserve has contributed to the development of Kekana Gardens?

Yes

No

Please specify:

\_\_\_\_\_  
\_\_\_\_\_

20. Did you ever experience any significant negative impact from elephants?

Yes

No

Please specify:

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21. What issues (e.g., social or political) do you think affect the development of effective elephant management? Please list as many as you feel are relevant, in order of most important to least important.

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22. In your opinion, who is responsible for the conservation of African elephants?

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23. What change is needed for the reserve to contribute more to social development? In other words, what would enable more benefits of the reserve to flow to your family or community?

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24. If you were to write a vision statement for the future of the elephants, what elements would you like to include?

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25. If you were to write a vision statement for your own future, an ideal future in 10-15 years, what elements would you like to include?

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26. Do you have any suggestions or comments? This can be about any question in the survey, your feelings towards elephant or the Dinokeng Game Reserve that you would like to share.

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## DEMOGRAPHIC QUESTIONS

27. What is your gender?

- Male
- Female
- Other

28. What year were you born? \_\_\_\_\_

29. What is your native language?

- Afrikaans
- English
- IsiNdebele
- Sepedi
- SeSotho
- SiSwati
- XiTsonga
- SeTswana
- TshiVenda
- IsiXhosa
- IsiZulu

Other (please specify): \_\_\_\_\_

30. What is your primary source of income?

- Business owner
- Crop farming
- Cattle farming

- Hunting / gathering
- Government officer, medical profession, teacher or management
- General labour
- Employed in Dinokeng Game Reserve
- I am unemployed
- Other (please specify): \_\_\_\_\_

31. What is the highest level of school you have completed? If currently enrolled, please indicate the highest level completed.

- No schooling completed
- Nursery school completed
- Primary school completed
- High school diploma
- College diploma
- Bachelor's degree
- Honour's degree
- Master's degree
- Doctorate degree

32. How long have you lived at this location? \_\_\_\_\_ years

33. What were your reasons to move to this location?

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34. How many people are in your household? \_\_\_\_\_ people.

Thank you for participating! Your participation is completely anonymous so I can't contact you. If there is anything related to the topics of this questionnaire that you would like to share in person, please contact me at: Antoinette van de Water - PhD Researcher - University of KwaZulu-Natal. antoinette@bring-the-elephant-home.nl  
+66 72 5683704

Table S4.1: MANOVA analysis on multiple statements related to the importance of various benefits of elephants, which respondents indicated on a 5-point Likert scale. The mean indicates the average scoring of importance on a scale of 1 "Not important" to 5 "Very important". The benefits are ranked on the overall importance of both subgroups. The effect sizes (partial eta squared) can be interpreted as S=0.01, M=0.06, L=0.14, in which a larger effect size indicates a stronger relationship between the two variables. Benefits highlighted in green were given significantly more importance by Dinokeng Game Reserve respondents, and benefits highlighted in blue were given significantly more importance by Kekana Gardens respondents at  $p < 0.05$ .

Statement in questionnaire	Benefit category	Valuation concept	DGR				KG				P-value	Effect size
			Mean	Rank DGR	95% CI Lower bound	95% CI Upper bound	Mean	Rank KG	95% CI Lower bound	95% CI Upper bound		
Existence value for future generations	Intergenerational legacy	Moral	4.67	2	4.43	4.89	4.00	3	3.28	4.72	0.030	0.066
Community development and education	Livelihood & employment / Learning & inspiration	Instrumental & Relational	4.17	6	3.83	4.51	4.38	1	3.98	4.90	0.439	0.009
Human wellbeing through enjoying observing them	Physical & psychological experiences	Relational	4.43	5	4.19	4.64	4.07	2	3.56	4.60	0.144	0.031
Tourism (photographic)	Livelihood & employment	Instrumental	4.71	1	4.43	4.98	3.74	5	2.99	4.49	0.006	0.11
Job creation through tourism	Livelihood & employment	Instrumental	4.51	4	4.24	4.79	3.92	4	3.21	4.63	0.065	0.051
Intrinsic value	Intrinsic	Moral	4.38	6	4.16	4.57	3.55	7	2.75	4.29	0.012	0.089
Umbrella species (species that indirectly protect other species)	Integrity of nature	Relational	4.05	7	3.56	4.48	3.70	6	3.21	4.55	0.353	0.012
Maintainers of biodiversity and ecological balance	Regulation of ecosystems	Relational	4.56	3	4.32	4.75	3.03	10	2.33	3.99	<0.001	0.233
(International) donations for elephant conservation	Livelihood & employment	Instrumental	4.05	7	3.51	4.59	3.3	9	2.17	4.07	0.119	0.036
Research for human health	Food & medicinal	Instrumental	2.83	9	2.33	3.38	3.55	7	2.87	4.33	0.089	0.041
Sales of elephant-related products (e.g. crafts, art or jewellery)	Livelihood & employment	Instrumental	2.88	8	2.38	3.38	2.63	11	1.86	3.40	0.565	0.005
Religious, spiritual or cultural display	Cultural & spiritual	Moral	2.14	10	1.69	2.65	3.34	8	2.40	4.08	0.005	0.109
Trophy hunting	Livelihood & employment	Instrumental	1.9	11	1.46	2.34	1.85	14	1.12	2.59	0.898	<0.001
Sales of body parts is (e.g. ivory, hides, meat)	Livelihood & employment	Instrumental	1.44	12	1.1	1.78	2.26	12	1.49	3.03	0.029	0.070
Traditional medicine (e.g. the use of body parts, dung)	Livelihood & employment	Instrumental	1.24	13	0.92	1.57	1.96	13	1.13	2.63	0.043	0.062
Food security (elephants as a source of meat)	Livelihood & employment	Instrumental	1.24	13	0.94	1.55	1.35	15	0.70	1.78	0.723	0.002

Table S4.2: Spearman Rank-Order Correlation between the number of experienced benefits from elephants and the level of education on the importance to invest in and willingness to pay for elephant conservation (Supplementary Figure S4.2). Grey shading highlights significance at  $p < 0.1$ .

Variable	DGR		KG	
	Coefficient ( $R_s$ )	p-value	Coefficient ( $R_s$ )	p-value
<b>Importance to invest</b>				
Number of experienced benefits from elephants	0.77	0.11	0.78	0.06
Level of education	0.71	0.09	0.87	0.03
<b>Willingness to pay</b>				
Number of experienced benefits from elephants	0.95	0.03		
Level of education	0.70	0.09		

Table S4.3: Examples of potential solutions to reduce barriers, promote enablers and enlarge the common ground.

TRADE-OFF	POTENTIAL SOLUTIONS & OUTCOMES
<p><b>Routine trade-off (secular principles countered by secular principles:</b></p> <p>The reserve's proposal to introduce elephants to generate economic benefits from ecotourism was countered by arguments about elephants' basic needs, which may not be met in a high-density reserve. This has resulted in HEC and may subsequently require invasive elephant management interventions that can result in negative unintended consequences of public outcry, division of stakeholders, and reputational damage.</p> <p>For example, questionnaire data showed that over the past three years, no less than 41.9% of the Dinokeng Game Reserve respondents had experienced negative impacts from elephants. To</p>	<p>Solutions:</p> <ul style="list-style-type: none"> <li>● Share knowledge and organise workshops on how to maintain hard (electric fences) and soft barriers (beehives etc) to prevent HEC to both Kekana Gardens and Dinokeng Game Reserve stakeholders simultaneously.</li> <li>● Organise inclusive workshops on elephant behaviour and how to behave around elephants for both Kekana Gardens and Dinokeng Game Reserve stakeholders simultaneously.</li> <li>● Ensure that people have access to the benefits of elephants, so that those who carry the costs of elephants also experience benefits. For instance, provide discounted access for community members, organise days that community</li> </ul>

<p>mitigate the negative impact of elephants, most respondents indicated to have implemented measures to prevent future damage (81.3%), which mostly consisted of improving property fences (78.6%), for example, by adding electric wires, beehives (Supplemental Figure 4.1b) or layers of rocks (Supplemental Figure 4.1c), or by removing plants and trees that attract elephants (e.g., citrus, Marula trees (<i>Sclerocarya birrea</i>), aloes) (28.8%).</p> <p>During the semi-structured interview, the community leader stated that people's negative attitudes towards elephants and the reserve may be caused by a negative experience of elephants breaking out into the community area. About a third (31.5%) of the Kekana Gardens respondents reported having experienced a negative impact from elephants, which referred to two specific incidents when an elephant broke into the community, damaging property and causing fear.</p>	<p>members can access for free (e.g., youth, elders, teachers), or encourage lodges to make their guides available for educational programs at local schools.</p>
<p><b>Taboo trade-offs: (secular principles countered by sacred principles:</b></p> <p>Rational decisions to introduce elephants to boost ecotourism can infringe on the intrinsic value of elephants. Several comments in the questionnaire revealed concerns of residents about the way elephants were treated (e.g., inexperienced management, fear that more elephants would get killed/hurt, the fact that elephants are lured to lush</p>	<p>Outcomes:</p> <ul style="list-style-type: none"> <li>● Both stakeholder types acquire knowledge while realising they have the same goals of keeping people and elephants safe and that there is equal room for learning (find common ground in a shared vulnerability).</li> <li>● Increased knowledge about wildlife and the importance of conservation</li> <li>● Increased knowledge about elephants, less human-elephant conflicts, increased elephant well-being.</li> <li>● Improved attitudes towards elephants and the reserve.</li> </ul> <p>Solutions:</p> <ul style="list-style-type: none"> <li>● Prioritise range expansion to ensure that elephants have the place they need and sufficient refuge areas away from human disturbances.</li> <li>● Increase knowledge about the conservation and management of elephants: collaborate with scientists, organise workshops on elephant</li> </ul>

<p>gardens or waterholes on private properties which causes fence-breaking or chasing elephants with vehicles).</p> <p>For instance: Decisions to kill a damage-causing elephant were countered by arguments based on the rights of nature and our moral duty to provide for the needs of elephants.</p> <p>Dinokeng Game Reserve respondents identified a lack of good governance concerning elephant management (e.g., irresponsible human behaviour towards elephants, inadequate regulations, unprofessional management, low-quality fences at some private properties, and limited elephant space) as barriers to allowing elephants to thrive.</p>	<p>behaviour, causes of HEC (e.g., chasing elephants with vehicles or luring elephants) and mitigation methods.</p> <ul style="list-style-type: none"> <li>● Co-develop and test solutions for HEC together and share learning experiences.</li> <li>● Incentivise upgrading fences around private properties, removing elephant attractants from gardens, and creating indigenous gardens that are not attractive to elephants.</li> <li>● Improve reserve-community governance structures. Communicate how the reserve is contributing to the community and explain the reasons why some expected benefits may take longer to generate.</li> <li>● Develop labour standards for land and business owners in the reserve to prevent unfair labour practices.</li> <li>● Create a database to match Dinokeng Game Reserve's job requirements and Kekana Gardens's availability of skills.</li> <li>● Increase community participation in reserve management, decision-making and benefit-sharing.</li> </ul> <p>Outcomes:</p> <ul style="list-style-type: none"> <li>● Reduced HEC, reduced elephant stress, less conflict between people. Common ground replaces judgement.</li> <li>● Increased understanding of Dinokeng Game Reserve's job creation efforts, needed skills, and efforts to recruit staff locally. This will increase trust, increase local employment, and decrease</li> </ul>
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	<p>social unrest.</p> <ul style="list-style-type: none"> <li>● Increased positive attitudes towards the reserve.</li> </ul> <p>Less localised crime or social unrest.</p>
<p><b>Tragic trade-offs: (sacred principles countered by sacred principles:</b></p> <p>The reasons to open a Big Five game reserve to decrease inequality and contribute to human rights and environmental justice (sacred principles) were countered by other sacred principles held by residents of adjacent communities who stated they had lost access to land where they used to gather natural resources for religious and cultural purposes (also an environmental justice issue), which caused feelings of exclusion and mistrust. The sacred principles behind the goal of increasing land for conservation and as elephant habitat conflicted with concerns about animal welfare issues of introducing elephants to a high-density reserve.</p> <p>The planned contributions to human rights can be countered by a lack of good governance (e.g., lack of transparency and communication, missed opportunities to engage local community leaders), which can negatively affect reserve-community relations. For instance, during the semi-structured interview, the community leader stated: <i>“Communication of the right message and transparency is vital. Otherwise, it will create unrest”, and “People in Dinokeng Game Reserve do provide support for people in Kekana Gardens, but nobody knows about it. Communicate this to the community, and people will have more positive attitudes towards</i></p>	<p>Solutions:</p> <ul style="list-style-type: none"> <li>● Appoint a reserve-community relations manager and host regular reserve-community meetings to ensure inclusion and that people are informed about the reserve.</li> <li>● Organise monthly events to harvest e.g., medicinal plants, firewood, or thatch for community members to join.</li> <li>● Establish a community-run Dinokeng Game Reserve indigenous plants nursery that provides indigenous plants free of charge or for a donation to local schools and people living in and around Dinokeng to encourage indigenous gardens.</li> <li>● Organise events (e.g., sports, music, or cultural events) for both stakeholder groups to join.</li> <li>● Improve communication at all levels.</li> <li>● Educate stakeholders about guidelines on how to behave around elephants to improve animal welfare.</li> <li>● Increase space and refuge areas for elephants.</li> </ul> <p>Outcomes:</p> <ul style="list-style-type: none"> <li>● Increased human well-being and social cohesion.</li> <li>● Motivation to remove exotic plants and plants that attract elephants from gardens inside the reserve, which contributes to biodiversity and reduced HEC.</li> <li>● Increased understanding to the reserve, and positive attitudes towards the reserve.</li> </ul>

<p><i>the reserve</i>". This was confirmed in the Kekana Gardens questionnaire, where respondents mentioned the lack of communication about the benefits of the reserve for the community ("<i>There is no communication, so we have no idea</i>").</p>	<ul style="list-style-type: none"> <li>● Reduced risks of localised crime or social unrest.</li> </ul>
<p><b>Marginalising trade-offs: (sacred principles countered by secular principles:</b></p> <p>Communication about how reserve would reduce poverty and inequality, which creates expectations among local people in terms of human rights, dignity, and environmental justice. A marginalising trade-off occurred when community members felt that this objective was only partially fulfilled through the creation of jobs that were not perceived as fair or dignifying.</p> <p>For instance, Kekana Garden respondents believed that many employees in the reserve were not from the local community (semi-structured interview and respondent of the Kekana Gardens questionnaire stating "<i>Dinokeng Game Reserve provides jobs in villages far away and foreigners</i>"). Perceived unfair labour practices also increased the gap between the reserve and the community and caused feelings of distrust, lack of community spirit, and negative attitudes. This may subsequently have led to incidents such as poaching, break-ins, and other crime (semi-structured interview).</p> <p>Arguments to open a Big Five game reserve adjacent to a marginalised community to decrease poverty and unemployment (a secular objective) overruled sacred principles held by Kekana Garden residents related to</p>	<p>Solutions:</p> <ul style="list-style-type: none"> <li>● Instead of just focusing on creating jobs, focus on creating meaningful jobs.</li> <li>● Invest in inclusive training to develop skills that are needed in the reserve.</li> <li>● Encourage community ownership in social development, e.g., through cultural tourism experiences or the development of community enterprises to supply the reserve.</li> <li>● Increase knowledge and appreciation of people's historical relationship with the land of Dinokeng Game Reserve.</li> </ul> <p>Outcomes:</p> <ul style="list-style-type: none"> <li>● Increased skills and opportunities to generate income in a fair and dignifying way,</li> <li>● Increased local buy-in for the reserve and social cohesion.</li> </ul>

issues of governance, such as unfair labour practices and the lack of transparency (feelings related to fairness, dignity, trust). This marginalising trade-off has created poor reserve-community relations, caused anger, and has led to crime and reduced social cohesion.



Figure S4.1: (a) an incident of elephants causing damage to a private property fence inside Dinokeng Game Reserve, (b) an initiative to increase the effectiveness of fences by adding beehives, and (c) an initiative to increase the effectiveness of an electric fence by adding a layer of rocks. Pictures: Antoinette van de Water and Anton Schele (middle).

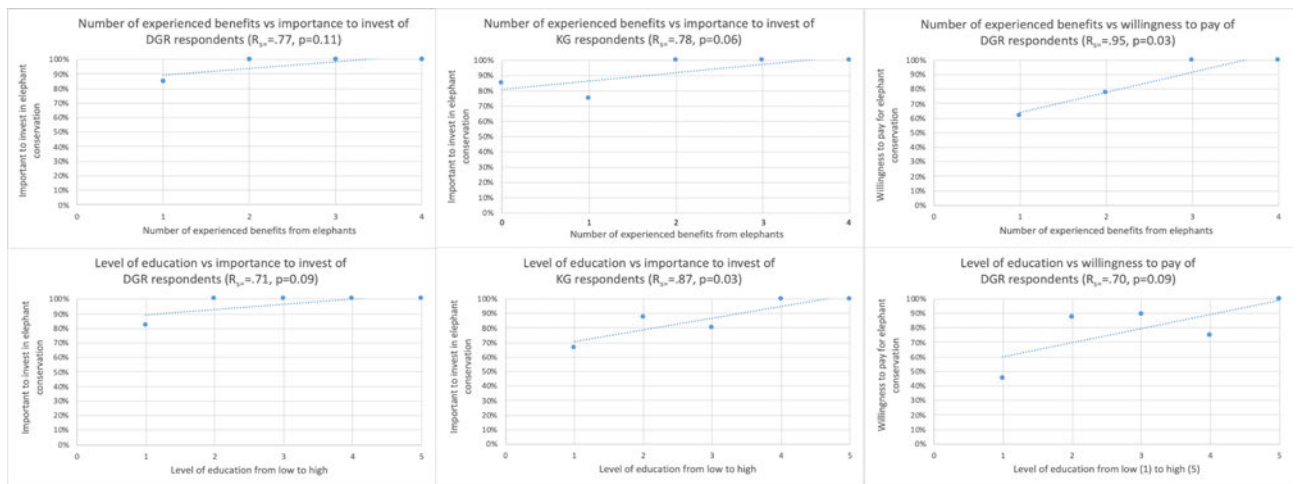


Figure S4.2: Scatterplots of the predictive variables “number of experienced benefits from elephants” and “level of education” of respondents on the x-axis, and the variable that we try to predict (perceived importance to invest in elephant conservation and willingness to invest) on the y-axis. Spearman’s correlation coefficient indicates the association between the predictive and outcome variable. A higher level of education among Kekana Gardens respondents was associated with more importance given to investing in elephant conservation ( $p=0.03$ ), and the number of experienced benefits from elephants was associated with more willingness to pay for elephant conservation ( $p=0.03$ ).

#### Info S4.1 on the development of the Theory of Change

As a first step in the planning of conservation strategies, the current state was assessed by summarising the barriers and enablers of socio-ecological sustainability and the interactions amongst them, as experienced by both stakeholder groups (1a and 1b in Figure 4.5). Dinokeng Game Reserve respondents highlighted barriers related to governance (insufficient management capacity, inadequate regulations), funding, and the lack of suitable land for elephants. The Kekana Gardens respondents experienced barriers related to lack of access, benefit sharing, trust, and communication. Although the DGM Environmental Plan proposes providing access to the community to harvest natural resources (e.g., firewood, thatch, or medicinal plants) (Boonzaaier, 2018), the community did not report having experienced these benefits. Restricting access to land to which

people historically had access aggravates a lack of trust and unity and can cause loss of cultural identity. Barriers that were shared by both groups were for instance a lack of good governance, knowledge, and unity. The lack of unity between people living inside Dinokeng Game Reserve may have been caused by contention around elephant management approaches (e.g., the decision to kill a damage-causing elephant), and other management decisions. The lack of unity among stakeholder groups may be caused by the division between people with access to resources living inside the reserve, and people without access living in the adjacent community, and the lack of meaningful initiatives to bridge this gap. Compared to the barriers, the enablers show more common ground, such as the sense of pride in the unique conservation model that supports community development, the importance of investing in conservation, and the importance attached to the non-consumptive benefits of elephants, such as their existence value for future generations. This study also found enablers of support for the conservation model, such as the importance of experiencing the benefits of elephants which corresponds with positive attitudes towards [elephant] conservation.

Second, shared elements of people's vision for Dinokeng Game Reserve was summarised (2 in Figure 4.5). Both stakeholder groups prioritised intangible elements such as unity, living in harmony, learning as a community, good governance, and thriving people and elephants that promote the conservation model (Happy elephants that are understood, and respected and do not break into the community). Dinokeng Game Reserve respondents emphasised more vision elements related to the reserve, such as suitable habitat, expansion, a model for future conservation and tourism, and unique living. Kekana Gardens respondents emphasised the importance of positive reserve-community relations, fair access to the benefits of the reserve, job creation, dignity, and inclusion. It was stated that the perception that people have of poor people should change (e.g., feeling pity) as there is wisdom in the community. A need for togetherness was expressed. They envisioned a future of social cohesion, being part of a conservation model that balances conservation and human well-being, with structures in place that promote collaboration and education.

Third, following a commonality approach, the potential solutions that were identified by both stakeholder groups (3a) were integrated into five solutions that are based on common ground (3b). Solution 1: Many of the solutions that were proposed by both stakeholder groups (e.g., promoting unity, increasing collaboration, professional management) depend on good governance as an important first step in the transition to socio-ecological sustainability. Sustainable solutions mentioned during the semi-structured interview were initiatives to re-establish reserve-community relations, creating platforms to share experiences, increase transparency, and co-develop strategies to move forward together. The interviewee expressed the need for a formal community development structure to ensure clarity and communication of the right message. According to the interviewee, this will build trust and prevent social unrest, such as roadblocks, crime, and poaching. Solution 2: Education was a priority for both groups, as both groups are interested to learn more about elephants, and in promoting respectful human behaviour towards elephants (e.g., “*I would like elephants to be accepted by as many landowners as possible and respected as the gentle giants they are.*”). Kekana Gardens respondents expressed a need for educational programs related to skills development. Solution 3: Kekana Gardens respondents prioritised solutions that promote community and livelihood, which are also included in the vision of the reserve by Dinokeng Game Reserve respondents. Stimulating employment in marginalised communities is important, but from a wider perspective of redress, equity and empowerment, solutions that contribute to *meaningful* jobs are required, i.e., capacity building, ownership, and empowerment. The respondents also highlighted a desire for more community members to be able to visit the reserve, which can contribute to positive attitudes toward elephants and the reserve in general (Makecha & Ghosal, 2017; Manfredo, 2008; Van de Water & Matteson, 2018). As examples, the Kekana Gardens respondents mentioned improving access to (the benefits of) the reserve, skills development, creating a database of available skills in the community and needed skills in the reserve, and the organisation of events that bring people from inside and outside the reserve together (e.g., sport or other social activities, opportunities for Dinokeng Game Reserve residents to visit Kekana Gardens, and vice versa). By creating more meaningful jobs and better communicating the ways in which the reserve improves local people’s lives, the All-Blocks Chair believed that people would have more positive attitudes towards the reserve (“*Get to know the hearts and minds of the community. Even*

*small efforts can change people's lives, and their attitudes toward the reserve*"). Solution 4: The Dinokeng Game Reserve respondents emphasised solutions focusing on the natural system, such as habitat improvement, range expansion, and improving elephant management. Range expansion promotes elephant well-being, the establishment of new partnerships, fence removal, reduced risk of HEC and opportunities to acquire investors or conservation funding. Common ground was found in the importance of investing in elephant conservation and ensuring elephant well-being. Solution 5: The integrated conservation-human well-being model can be promoted to attract funding and tourists, for instance, by including community-based tourism around cultural values and practices, or attracting biodiversity funding to conserve and rewild degraded land and increase habitat for elephants ("*Elephants forming the foundation to a successful and sustainable conservation model of the future where human, and animals live in harmony*", wrote a Dinokeng Game Reserve respondent). Solutions focusing on promoting the unique tourism model (mentioned by Dinokeng Game Reserve respondents) contribute to the needs and proposed solutions related to job creation, fair access, and increasing cultural tourism (mentioned by Kekana Gardens respondents), thereby removing polarisation, and increasing unity.

Fourth, a circular dimension to conservation was added from the integrated solutions and shared vision back to the trade-off outcomes. Once the integrated solutions have been implemented, the current state (i.e, identified barriers and enablers) will change, which will change potential future solutions, highlighting important feedback relations and an iterative, holistic process of conservation planning (green arrows in Figure 4.5) (Sarabi et al., 2019). For instance, when governance is improved through the creation of regular community participation meetings, communication improves and trust increases, which will reduce the likelihood of social unrest and trespassing and change the need for future solutions.

## 5. CONSEQUENCES OF ELEPHANT MANAGEMENT INTERVENTIONS: A ‘ONE WELL-BEING’ APPROACH

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Keywords: African elephant; conservation management; wildlife management; conservation policy; one health



## 5.1 Abstract

Conservation of elephant populations often requires active management, necessitating interventions that can have consequences for the animals, people, and ecological systems. Building on One Health and One Welfare approaches, we introduce and implement a framework to evaluate twelve interventions currently or historically used to manage elephant populations in South Africa. We evaluated 3,118 cases of elephant management intervention implemented since 1991, based on their relative impact on environmental, human, and animal well-being. We identified 208 consequences of these interventions, of which 47 can be considered direct intentional, 96 direct unintentional, and 65 indirect. Most of the direct intentional consequences (85.1%) were beneficial overall, while the majority of direct unintentional (93.8%) and indirect (67.7%) consequences were harmful. Eight interventions scored positively for environmental well-being, four for animal well-being and only three for human well-being, potentially suggesting that promoting human and animal well-being needs to be better integrated into elephant management strategies. Results suggest that integrated management, focusing on increasing habitat connectivity while including local people and mitigating risks of human-elephant conflicts, is preferential, supporting ethical conservation practices that align with global aspirations.

## 5.2 Introduction

Existing conservation strategies have not been able to stop the rapid decline of wildlife species in the face of global change (Pascual et al., 2021). Limited community participation in conservation decision-making can result in increasing human-wildlife conflicts and decreasing quality of life and health for people living around protected conservation areas (Díaz et al., 2018). Additionally, the impact of conservation activities on the welfare of wild animals is of increasing concern (Beausoleil, 2014), in terms of both moral obligations and the effectiveness of the conservation action (Harrington et al., 2013; Vucetich et al., 2018). Studies to assess the impact of conservation policies and interventions are mostly focused on direct, intended consequences for wildlife, often without considering the broader well-being of animal populations, people, or the environment (e.g., Beausoleil et al., 2016; Derkley et al., 2019; Mellor, 2016). There is growing awareness that the well-being of animals, people, or the environment is interconnected, and that *holistic* approaches are required for global conservation. For example, the One Welfare approach, borne out of the World Health Organisation's (WHO) One Health initiative (Zinsstag et al., 2011), integrates animal welfare, human well-being, and the environment by emphasising each pillar's impact on the others (Fawcett et al., 2018; Garcia Pinillos et al., 2016). Here, we apply this approach - reframed as 'One Well-being' to better reflect the collective well-being of humans, animals, and the environment - to consider the consequences of conservation management of African savanna elephants (*Loxodonta africana*) in South Africa. Highlighting the inherent links between the environment, human well-being, and animal welfare allows for more holistic evaluation of the consequences of conservation policies and interventions (Fawcett et al., 2018; Garcia Pinillos et al., 2016), and fosters socio-ecological sustainability, multidisciplinary collaboration, and support for conservation (Garcia Pinillos et al., 2016).

South Africa has extensive experience and success in managing protected areas, typically favouring the creation of fenced reserves to contain and conserve large mammals (Hayward & Kerley, 2009; Slotow, 2012). Fencing often results in intensive management, and the long-term or indirect consequences of these management interventions are not

always known or considered (DEA, 2014; Zungu & Slotow, 2022). Moreover, management interventions may be unsustainable or lead to contention, especially concerning charismatic ‘flagship species’ such as elephants (Convention on Biological Diversity, 2021; DEAT, 2005; Di Minin et al., 2013a). As fencing is increasingly being relied upon to mitigate Human-Wildlife Conflict (HWC) (e.g., see Woodroffe et al., 2014, and the resulting letters), South Africa’s experience in managing the consequences of confining large mammals in fenced reserves (Shaffer et al., 2019; Zungu & Slotow, 2022) is of increasing relevance.

While the conservation status of the African savanna elephant has recently changed from Vulnerable to Endangered on the global IUCN Red List of Threatened Species (Gobush et al., 2021), the southern African population is increasing and listed as Least Concern in South Africa (Selier et al., 2016). The elephant population in South Africa is estimated to be over 28,000 (Pretorius et al., 2019; Selier et al., 2016), and increasing densities of elephants led to concerns over the impact on vegetation in reserves because elephants push over trees and can create grass-dominated landscapes (Owen-Smith et al., 2006). Several management interventions have been implemented to address these concerns, aimed at either reducing elephant densities or changing their use of space (DEAT, 2008; Zungu & Slotow, 2022). Of these interventions, culling is arguably the most publicly debated and criticised (Henley & Cook, 2019; Owen-Smith et al., 2006). Other management interventions adopted in South Africa include translocation, whereby individuals are moved between reserves; contraception; and reconnecting habitats. In South Africa, over 800 elephants have been translocated in the last 30 years (DFFE, 2020; Naidoo et al., 2016; Selier et al., 2016; Slotow et al., 2005), the use of contraceptives on elephants has been studied since 1995 (Bertschinger et al., 2018; Delsink et al., 2013), and increasing habitat connectivity has been promoted (Di Minin et al., 2013b; Henley et al., 2023; Van Aarde & Jackson, 2007).

All such management interventions are regulated by various national policies and agreements in South Africa. In 2008, the Norms and Standards for the Management of Elephants in South Africa (DEAT, 2008) were gazetted to ensure that elephant management is uniform across the Republic and enacted in accordance with national and

international agreements. The Norms and Standards regulate the practical application of various elephant management interventions (birth/population control, water provision, fire, supplementary feeding, fencing, corridors, range expansion, translocation, and culling). Since 2008, each reserve with elephants is required to have an Elephant Management Plan that is in accordance with the Norms and Standards and the National Environmental Management Biodiversity Act: Protected Areas Act (NEMBA/PA, 2004).

The (often indirect) consequences of reserve management interventions for environmental well-being (note, hereafter we use the term environmental well-being instead of environmental health as it is more encompassing and relevant to conservation, Lindenmayer & Kaufman, 2021), and both human and animal well-being can create positive or negative feedback loops in the socio-ecological system (Bourque, 2017; Garcia Pinillos et al., 2016). The interlinkages and trade-offs between animal well-being, biodiversity conservation, and sustainable human development, and the cascading consequences of management interventions, are poorly understood, and often lead to contention (DEA, 2014; DFFE, 2020).

In this study, we propose a framework to holistically evaluate and rank conservation management interventions based on their relative impact on animal, human, and environmental well-being with evidence collated from both literature and reserve management experience. Although policy papers and scientific articles about elephant management interventions abound, there is also extensive experience on the ground that, up to now, has not been included in these assessments or published literature. Therefore, we aim to give voice to that experience, as clear identification of the range of management consequences can aid policymakers and managers in future decision-making. We also aim to demonstrate how the One Well-being approach can be used to evaluate and rank the identified consequences of twelve elephant management interventions. The experience and knowledge of South African researchers and managers regarding elephant management (Scholes & Mennell, 2008; Zungu & Slotow, 2022), as well as the extensive policies, legislation, and aspirations that have been developed through active stakeholder engagement (DEAT, 2008), provide a unique opportunity to gain insight into the consequences of conservation management interventions. The broader One Well-being

framework presented in this paper can aid policymakers and managers in planning conservation strategies for elephants and other species or ecosystems, and encourage the conservation community to develop more ethical, socially just, and sustainable conservation strategies (Lindenmayer & Kaufman, 2021).

### 5.3 Methods

In order to identify the consequences of twelve elephant management interventions, this evaluation draws on five sources of evidence: (1) literature on elephant management interventions published between 2007-2021; (2) qualitative data collected through a participatory workshop with elephant managers and scientists in 2019; (3) questionnaires distributed among managers of 46 South African reserves in 2017 by the Elephant Specialist Advisory Group (ESAG); (4) databases of the provincial South African authorities responsible for permit issuance pertaining to restricted activities or interventions for Damage Causing Animals (DCAs), containing details of 469 DCA cases that occurred between 2015-2020; (5) reserve management reports about the effectiveness of 386 cases of elephant management interventions that have been conducted since 1991, and detailed reports from a local non-profit organisation, Elephants Alive, on the handling of 10 DCA incidents that occurred between 2008-2010.

#### 5.3.1 Data collection

##### *Literature review of the consequences of elephant management interventions*

Zungu & Slotow (2022) conducted a systematic review of the consequences of nine elephant management interventions. They incorporated all publications published between 2007-2021 regarding interventions with the African savanna elephant (*Loxodonta africana*), the African forest elephant (*L. cyclotis*), and the Asian elephant (*Elephas maximus*), supplementing an earlier elephant management assessment (Scholes & Mennell, 2008). They listed beneficial consequences, demographic responses, and unintended consequences for elephants. We classified these consequences as beneficial or harmful, included them in Supplemental Table S5.1, and we checked the articles

mentioned in Zungu & Slotow for data related to the impact of these interventions on human and environmental well-being. Additional articles were searched, incorporating those that specifically discuss the impact of the twelve elephant management interventions on human and/or environmental well-being. Between February 2022 and January 2023, we searched Web of Science and Google Scholar for English language, peer-reviewed publications, using the search terms: “elephant” AND “laissez-faire” OR “range expansion” OR “corridor” OR “connectivity” OR “population control”, OR “artificial water” OR water provision” OR “fencing” OR “fences” OR “militarised anti-poaching” OR “anti-poaching” OR “pZP” OR “contraception” OR “GnRH” OR “vasectomy” OR “translocation” OR “DCA” OR “trophy hunting” OR “culling”. Relevant citations for the consequences of elephant management interventions on animal, human and environmental well-being were extracted, classified as beneficial and harmful, and included in Supplemental Table S5.1.

We evaluated these impacts for twelve management interventions, adding (1) doing nothing; (2) DCA control; and (3) militarised anti-poaching to Zungu & Slotow’s (2022) list. While the impact of doing nothing to control an overabundance of elephants is seldom included in assessments, we believe this should be included because it is, in fact, a management decision that can have long-term consequences. A DCA is defined as “an individual animal or group of animals that, when in conflict with human activities, there is proof that it causes substantial loss to livestock or to wild animals; causes substantial damage to cultivated trees, crops or other property; or presents an imminent threat to human life” (NEMBA, 2016). The control of DCAs is a relatively common management intervention in South Africa that can result in elephant death. Militarised anti-poaching is included in this assessment because it is an intervention aimed at protecting elephants (and rhinoceroses) from ongoing poaching threats. It is often managed militarised (i.e., green militarisation), which can impact human well-being (Büscher & Ramutsindela, 2015; Duffy, 2014; Mogomotsi & Madigele, 2017).

Finally, as trophy hunting is very selective, it is not suitable as a measure of population control (Milner et al., 2007) and, thus, is not typically viewed as a management intervention. However, trophy hunting is a legal, highly regulated land-use practice that

is a component of wildlife management in South Africa and is sometimes suggested as an intervention to control elephant populations (e.g., DEAT, 2008), therefore trophy hunting is also included in this assessment.

#### *Elephant expert workshop*

On 5th - 6th June 2019, 58 delegates signed consent forms to attend an expert workshop hosted by ESAG at the Southern African Wildlife College in Limpopo province. The workshop included group discussions about the intended and unintended consequences of management interventions, during which delegates discussed what went wrong and what worked during and after elephant management interventions. After the group sessions, the groups presented summaries of their discussion to the rest of the participants to gain additional input. This assessment focused on the most frequently applied elephant management interventions, but the data collected also provided some insight into experiences with exclusion fencing, collaring, tree protection, and food supplements. Data related to beneficial/harmful and intended/unintended consequences of elephant management interventions were extracted and categorised in Supplemental Table S5.1.

#### *Reserve management questionnaire*

In 2017, ESAG distributed a questionnaire among managers of 46 reserves in South Africa as part of its long-term monitoring activities. Reserve managers, ecologists, and conservation agency staff were contacted through e-mail and by phone and by visits to key reserves to increase participation in the survey. Managers and key staff were requested to provide reports on elephant management interventions and were interviewed in order to obtain any relevant information not included in written documents (ESAG survey in Table 5.1). Relevant information regarding elephant management interventions was extracted, and consequences were classified as beneficial or harmful, as shown in Supplemental Table S5.1.

*Provincial data on Damage Causing Elephants*

The Limpopo Department of Economic Development, Environment and Tourism (LEDET) provided us with electronic spreadsheets of DCA incidents with elephants in Limpopo province, which included a total of 470 reported DCA cases that occurred between 2015-2020. Northwest Province Department of Economic Development, Environment, Conservation & Tourism (DEDECT) also provided a spreadsheet with five DCA incidents (Supplemental Table S5.1).

*Reports on applied elephant management interventions*

As detailed in Table 5.1, information on elephant management interventions was provided by South African National Parks (SANParks) for interventions in two National Parks, and by Ezemvelo KZN Wildlife (EKZNW), for interventions in five provincial Protected Areas. The management interventions for LEDET-managed Protected Areas are included in the DCA database mentioned above, and LEDET provided summary information on elephant management interventions conducted in one additional reserve. Two key private reserves with a substantial ecotourism presence, where a range of management interventions have taken place, also provided information. An elephant research non-profit organisation, Elephants Alive, provided detailed reports on handling DCA incidents in Limpopo province between 2008 and 2010, involving the killing of 14 elephants (Supplemental Table S5.1).



Table 5.1: Elephant management intervention data.

Data were provided by the ESAG survey (covering 46 reserves), provincial governments (ten reserves from LEDET, and four reserves from Northwest Provincial government), reserves data (from 1991 or since elephant introductions), and Elephants Alive. The hashtags indicate what is being counted in each row.

Source (year)	ESAG survey	Provincial data on DCA	Reserves data	Elephants Alive data	TOTAL
<b>Intervention</b>	<b>(2017)</b>	<b>(2015-2020)</b>	<b>(since 1991)</b>	<b>(2008-2010)</b>	
Artificial water created (#waterholes)	1 304				<b>1 304</b>
Collaring (#elephants)			84		<b>84</b>
Culling (#elephants)	74		10		<b>84</b>
DCA: chasing (#elephants)		71	133	2	<b>206</b>
DCA: culling/hunting (#elephants)	46	74	5	12	<b>137</b>
DCA: return on their own (#elephants)		171		6	<b>177</b>
DCA: not found (#elephants)		50			<b>50</b>
DCA: not specified (#elephants)		104	40		<b>144</b>
GnrH (#elephants)	47		4		<b>51</b>
Hunting (#elephants)	186				<b>186</b>
pZP (#days)	215		79		<b>294</b>
Range expansion (#events)	73		8		<b>81</b>
Translocation (#elephants)	220		68		<b>288</b>
Vasectomy (#elephants)	32				<b>32</b>
<b>TOTAL</b>	<b>2 197</b>	<b>470</b>	<b>431</b>	<b>20</b>	<b>3 118</b>

### 5.3.2 Building the framework

The twelve elephant management interventions that are included in this assessment were first classified into three categories, reflecting the type and degree of invasiveness or interference with elephant socio-ecology: (A) interventions that require *no direct contact with elephants* (A1. doing nothing, A2. range expansion/opening corridors, A3. closure of water points (to encourage dispersal and limit population sizes); A4. fencing, and A5. militarised anti-poaching); (B) interventions that necessitate *direct contact with elephants* (B6. population control via contraception with Porcine Zona Pellucida vaccine (pZP), B7. population control or control of problematic bull behaviour through Gonadotropin-Releasing Hormone (GnRH) treatment, B8. population control through vasectomy; and B9. translocation); and (C) interventions that require *direct contact with an intention to*

*end an elephant's life* (C10. control of DCA; C11. trophy hunting; and C12. culling) (Table 5.2).

For each of the sub-components of the three well-being pillars, we categorised the consequences as direct intentional, direct unintentional, and indirect. For direct intentional, interventions directly affected the animals/people/environment and were conducted deliberately for that purpose. For direct unintentional consequences, the impact of the intervention was caused directly, but in unintended ways. Indirect means that the harm or benefits to animals/people/the environment occurred indirectly from human actions (Fraser & MacRae, 2011). To gain insight into the balancing of consequences for elephants, people, and the environment, we created a table with the number of beneficial and harmful direct intentional, direct unintentional and indirect consequences we found per well-being pillar.

We considered the consequences of elephant management interventions for animal well-being, human well-being, and environmental well-being. These three overlapping pillars were divided into sub-components to allow more nuanced and detailed understanding of the consequences. Animal well-being was divided into basic health and functioning, natural living, and affective states (happiness) (Fraser, 2008). For human well-being, we distinguished between material well-being (wealth & livelihood), subjective well-being (physical and psychological), and relational well-being (sociocultural & spiritual) (McGregor & Pouw, 2016). Environmental well-being was subdivided into ecological functioning, ecosystem services, risk of biodiversity loss, and ecological resilience (adapted from Bibri, 2021).

### **5.3.3 Scoring the framework**

The purpose of this phase was solely to test the framework, thereby providing an initial assessment of each management intervention. It is not currently intended to influence conservation policy around these interventions. This is because we acknowledge that broader stakeholder involvement in scoring is needed to produce a more robust ranking of the elephant management interventions according to this One Well-being framework,

and we anticipate that this will form part of future research. Nonetheless, our approach provides an initial assessment of the risks associated with implementing the different management interventions, using a holistic interrogation of the beneficial and harmful intended, unintended and indirect consequences.

Eight scientists (five researchers from the University of KwaZulu-Natal that conducted this work for the National Department of Forestry, Fisheries, and the Environment of South Africa, and three additional elephant researchers who are co-authors of this paper) tested the framework and scored the consequences of the twelve elephant management interventions that have been commonly applied in South Africa. After reviewing the information in Supplemental Table S5.1 and using their acquired knowledge, the eight researchers individually assigned scores for each elephant management intervention, which were ranked according to their interference level (A1 to C12, see section 5.2.2), as well as by their effects on each of the sub-components of the well-being pillars. Scores could range from -2 for strong negative effects, to +2 for strong positive effects. We determined the modal score on each sub-component for each intervention. The sub-component modal scores were then averaged to give one score per intervention for each of the three well-being pillars (animal, human, and environmental). We then summed these three pillar scores to obtain an overall One Well-being Intervention Score for each management intervention. Finally, we used the One Well-being Intervention Score to rank the interventions based on relative One-Well-being outcomes.

With twelve elephant management interventions and ten categories, each scorer assigned 120 scores. Personal experiences with the elephant management interventions may have influenced the scores each researcher assigned. Thus, for each intervention and sub-component, the level of agreement was calculated. For almost half of the scores (45% of 120), concordance was reached, or only one score differed from the mode score (Table 5.3). For 36% of the scores, two of the eight scorers gave a different score from the mode, 14% of the scores had three people who assigned a different score, and in 5% of the cases, four different scores were given. We also calculated the average disagreement across the scores for each intervention as the number of scorers who disagreed with the mode score across all sub-components for that intervention, divided by ten (the number of sub-

components scored). Most variation in assigned scores was observed concerning vasectomy and trophy hunting. The greatest consensus was found on the scores for doing nothing, range expansion, and translocation. Spearman Rank-Order Correlation was used to compare ranking based on interference on elephants and the calculated One Well-being score, for which we used two-tailed P values for these comparisons.

## 5.4 Results

### 5.4.1 The consequences of elephant management interventions

Data from literature and on-the-ground practice in South Africa on the intended and unintended consequences of twelve elephant management interventions are summarised in Table 5.2. In total, we listed 208 consequences, of which 47 were determined to be direct intentional, 96 direct unintentional, and 65 indirect. Most direct intentional consequences were beneficial (85.1%), while most unintentional and indirect consequences (93.8% and 67.7%, respectively) were harmful. All harmful direct intentional consequences concerned harm to elephants, and none to people or the environment. Comparing the beneficial and harmful consequences among the three One Well-being pillars, 74.4% of the listed consequences for animal well-being were harmful, 65.4% of the consequences for human well-being were harmful, and 60.4% for environmental well-being were harmful. The greatest number of harmful consequences were recorded for control of ‘damage-causing animals’ (21 harmful consequences, of which 9 were harmful to elephants, 11 to people and 1 to the environment), fencing (20, of which 7 were harmful to elephants, 6 to people and 7 to the environment), and translocation (17, of which 9 were harmful to elephants, 5 to people and 3 to the environment). Relative to other interventions, more consequences were reported for fencing (28 consequences), translocation (25 consequences), and DCA (25), while the fewest consequences were noted for vasectomy (11 consequences) and doing nothing (10).

Table 5.2: Summary of intended and unintended consequences related to elephant management interventions on animal, human, and environmental well-being, drawn from literature and on-the-ground practice. The complete overview of consequences drawn from the literature review, the ESAG workshop, reserve management questionnaire, provincial data on DCAs, reports from reserves, and Elephants Alive data can be found in Supplemental Table S5.1.

Elephant management intervention	Consequences of intervention		
	Animal well-being	Human well-being	Environmental well-being
	Basic health & functioning; Natural living; Affective states	Wealth & livelihoods; Physical & psychological well-being; Socio-cultural & spiritual well-being	Ecological functioning; ecosystem services; biodiversity loss; and ecological resilience
<p><b>A: No direct contact (low interference)</b></p> <p><i>1. Doing nothing/laissez-faire (in the case of overpopulation in fenced systems)</i></p>	<p><b>Direct intentional</b></p> <p>(+) Avoids the difficulty of artificially maintaining elephant populations below a maximum threshold (Van Aarde &amp; Jackson, 2007).</p> <p>(+) Prevents potential negative impacts on well-being from intrusive interventions, respecting elephants' short-term interests and rights (Lötter, 2005).</p> <p><b>Direct unintentional</b></p> <p>(-) During a major drought, an overabundance of elephants could lead to a population crash, which involves elephant suffering (Lötter, 2005).</p> <p><b>Indirect</b></p> <p>(-) An overabundance of elephants can use up local food sources, causing the suffering of animals that were not directly affected by the intervention (Chamaillé-Jammes et al., 2008; De Beer et al., 2006).</p>	<p><b>Direct intentional</b></p> <p>(+) Having many elephants in reserves increases the viewing experiences and draws tourists to the reserve (ESAG survey; Kerley et al., 2003).</p> <p>(+) Avoids conservation decisions that lead to public outcry and a reduction in support for conservation (ESAG workshop).</p> <p><b>Direct unintentional</b></p> <p>(-) Allowing elephant populations to increase affects reserve managers who witness the consequences (Lötter, 2005).</p> <p>(-) The aesthetic aspects of the landscape (large trees, riverine vegetation) may be reduced due to elephant impact on the vegetation, which may reduce the aesthetic appreciation (Edge et al., 2017; Henley &amp; Cook, 2019).</p>	<p><b>Indirect</b></p> <p>(+) In open systems, doing nothing contributes to environmental well-being within a non-equilibrium management approach that allows for natural processes (e.g., rainfall) to regulate population numbers and promote spatial-temporal heterogeneity (Van Aarde &amp; Jackson, 2007; Zungu &amp; Slotow, 2022).</p> <p>(-) In fenced reserves, fragmented habitats, or manipulated systems, doing nothing may lead to vegetation impact and affect species and ecological functioning in the long term (Lötter, 2005; Van Aarde &amp; Jackson, 2007).</p>

<p><b>A: No direct contact (low interference)</b></p> <p>2. Range expansion/corridors</p>	<p><b>Direct intentional</b></p> <p>(+) More space for wildlife contributes directly to increased animal well-being and can reduce HEC (Hecht &amp; Allcock, 2020; Osborn &amp; Parker, 2003).</p> <p>(+) Older bulls who are recently introduced are more likely to respond quickly to range expansions (whereas other bulls and breeding herds may be more cautious, taking more time to explore new areas) (Druce et al., 2008).</p> <p>(+) Young bulls have the largest home range sizes of all cohorts of bulls in areas with substantial opportunity for locomotion (Henley, 2014).</p> <p><b>Direct unintentional</b></p> <p>(-) Corridors could increase the stress levels of elephants when not looked after properly and increase aggression and HEC, which negatively affect animal well-being (Ahlering et al., 2013; ESAG workshop; Hunninck et al., 2017; Jachowski et al., 2013; Kikoti et al., 2010; Tingvold et al., 2013).</p> <p>(-) When fences are not removed properly, the wires can be used for snaring wildlife (Henley, pers. obs.).</p> <p><b>Indirect</b></p> <p>(+) Elephant corridors can ameliorate population sizes, allowing elephants to adapt to climate change by providing greater suitable habitat (Zacarias &amp; Loyola, 2018).</p>	<p><b>Direct intentional</b></p> <p>(+) Communities can benefit from range expansion and corridors by reducing HEC and increasing livelihood and income opportunities. This can lead to positive attitudes toward conservation (Osborn &amp; Parker, 2003).</p> <p>(+) Twenty-six reserves indicated the possibility of range expansion: five indicated potential to link with neighbouring elephant reserves, which would not necessarily decrease densities but would create economies of scale for reserves (ESAG survey).</p> <p><b>Direct unintentional</b></p> <p>(+) Range expansion contributes to a positive reputation: “We are going to be judged on the success of the expansion of the range of elephants” (ESAG workshop).</p> <p>(-) HEC in surrounding communities can increase when corridors are left unattended. This will lead to an increased risk of physical harm and mental stress, as people may not be used to living with elephants (Kikoti et al., 2010).</p> <p>(-) When corridors exclude local people and natural resource use, it can create conflict with local people (Horskins et al., 2006).</p> <p>(-) The areas where elephants newly roam may not be suitable for tourism yet or may be relatively further from established lodges, reducing tourist viewing possibilities (Slotow, pers. obs.).</p> <p>(-) Range expansion can lead to problems with elephant ownership, and consequential</p>	<p><b>Direct unintentional</b></p> <p>(-) Dropping of fences to expand habitat can locally increase elephant numbers at preferred habitats (e.g., rivers, artificial waterholes, preferred tree species for feeding), which can affect local vegetation (e.g., high-value riverine vegetation) (ESAG survey; ESAG workshop; Green et al., 2018; O’Connor, 2017; O’Connor &amp; Page, 2014; Slotow, pers. obs.).</p> <p><b>Indirect</b></p> <p>(+) Corridors increase habitat connectivity for other wildlife, especially migratory species (Bartlam-Brooks et al., 2011; Crego et al., 2021) and are important to prevent large-scale biodiversity loss and maintaining ecological resilience and long-term sustainability (Van Aarde &amp; Jackson, 2007).</p> <p>(+) 29 of 46 reserves have managed to add substantial additional areas through connecting existing reserves, land purchases, and the incorporation of additional landowners into existing conservancies. Eighteen reserves indicated potential corridor opportunities. Where suggestions of potential corridors were proposed, most included a linkage to a state reserve (ESAG survey).</p> <p>(-) When corridors are heavily used or unprotected, they can be subject to habitat degradation, undermining the role of corridors in reducing elephant impact on vegetation (Green et al., 2018; Schüßler et al., 2018).</p> <p>(-) When the focus shifts to corridors without addressing</p>
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		<p>reinstallation of fences can result in the reserve not qualifying for having elephants according to governmental laws (ESAG survey, ESAG workshop).</p> <p><b>Indirect</b>          (+) Range expansion provides opportunities to increase inclusivity and the ‘living in harmony’ philosophy, which can contribute to a range of indirect benefits (DFFE, 2022).</p>	<p>concerns within PAs, this could result in the connection of degraded systems. For instance, if deforestation and land invasion in PAs is happening, then the focus on connectivity might be misdirected as protection of PAs to serve corridor functionality should be the primary focus (Henley, pers. obs.).</p>
<p><b>A: No direct contact (low interference)</b>          3. Population control/Spatial use: closure of water point</p>	<p><b>Direct intentional</b>          (+) As water-dependent species, elephant numbers can increase locally when artificial water is present, especially when water availability is limited (Druce et al., 2008; Owen-Smith et al., 2006). The closing of artificial waterholes can lead to the natural fluctuation of elephant numbers and natural spatial distribution, which helps to naturally control populations and reduce elephant impact on vegetation in certain areas (Chamaillé-Jammes et al., 2007a, 2007b).          (-) 43 of the 46 reserves that participated in the ESAG survey have created a combined total of 1,304 artificial water holes (ESAG survey). The closure of artificial water points increases daily-movement distances, which may increase the stress for elephants and other water-dependent species (De Beer &amp; Van Aarde, 2008).</p> <p><b>Direct unintentional</b>          (-) Closing of water holes can potentially lead to the mortality of weaned calves in times of drought (Young &amp;</p>	<p><b>Direct intentional</b>          (+) Most landowners in game reserves adjacent to Kruger National Park support the closure of water points (Elephants Alive data).</p> <p><b>Direct unintentional</b>          (-) Closing waterholes likely has a negative impact on tourism, as elephants will likely be more spread, and general viewing opportunities could decrease (e.g., Smit et al., 2007).          (-) Tourists may potentially be confronted with the sight of the suffering of elephants during a drought (when the weaned and elderly are the most vulnerable) due to resource limitation and consequent natural mortalities.          (-) Some waterpoints (e.g., in KNP) were placed in the memory of deceased people, which may complicate removal due to human rights or risk of causing social disharmony (Henley, pers. obs.).</p> <p><b>Indirect</b>          (+) The measure provides opportunities to remove the division between scientists, reserve managers, and the general public, thereby</p>	<p><b>Direct intentional</b>          (+) Depending on the context (e.g., in areas where water is limited and where elephant numbers are high), the closure of artificial water points greatly influences spatial use (as elephants have to walk long distances to access water) and can reduce population growth rates (Chamaillé-Jammes et al., 2007a, 2007b).</p> <p><b>Direct unintentional</b>          (-) Although population growth rates can be reduced, there is still a lack of evidence on the effectiveness of closing water holes in reducing elephant numbers overall (Chamaillé-Jammes et al., 2007a; ESAG workshop; Franz et al., 2010; Smit et al., 2007).          (-) Closure of <i>artificial</i> water points may not decrease elephant populations and could, consequently, result in negative impacts on the vegetation and biodiversity if elephants gather at rivers or other natural water sources (Chamaillé-Jammes et al., 2007a).          (-) Closing water holes in one area could negatively impact nearby areas (ESAG</p>

	<p>Van Aarde, 2010).</p> <p><b>Indirect</b></p> <p>(-) Climate change may cause rivers to dry up in the future, so this measure requires more research and continued monitoring when implemented (Smit et al., 2007).</p>	<p>reducing polarisation in the conservation sector (Chamaillé-Jammes et al., 2007b).</p> <p>(+) As direct interference is avoided, the mental anguish of other heavy-handed or legislatively questionable methods is avoided (Chamaillé-Jammes et al., 2007b).</p> <p>(+) The limited number of water points may provide more productive wildlife sightings at these strategic points.</p> <p>(+) Sharing game sightings at limited strategically placed water points could call for greater cooperation between stakeholders who support the closure of water points (72.2% of respondents of a landowner questionnaire), for instance, among private landowners in protected areas (Elephants Alive data), although policies are required to plan who will close water holes (EGAG workshop).</p> <p>(-) There are risks of future public outcry when artificial water is not provided during drought, and animal suffering is observed by tourists, who are generally concerned about elephant welfare issues (Hammond et al., 2022).</p>	<p>workshop).</p> <p><b>Indirect</b></p> <p>(+) This measure can reduce elephants' negative local impact on vegetation, thereby contributing to wider environmental well-being (Zungu &amp; Slotow, 2022).</p>
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<p><b>A: No direct contact (low interference)</b></p> <p>4. Fencing</p>	<p><b>Direct intentional</b>          (+) Fences contain elephants within certain ranges, reduce HEC, and thus prevent stress and injuries (Grant et al., 2008; Hayward &amp; Kerley, 2009; Hoare, 1992; Pekor et al., 2019; Slotow, 2012).          (+) As fences control access, they prevent poaching for bushmeat and other wildlife products, promote wildlife/livestock health, and reduce road kills (Clevenger &amp; Waltho, 2000; Hayward &amp; Kerley, 2009; Pekor et al., 2019).</p> <p><b>Direct unintentional</b>          (-) Shortened migratory routes, and reduced access to resources and other elephants (Bartlam-Brooks et al., 2011).          (-) Fence-breaking can lead to DCA control measures (e.g., chasing, culling, hunting) (Slotow et al., 2008).          (-) Fences could cause increased stress and conflict between animals where no dispersal is possible (Davies-Mostert et al., 2013).          (-) Small areas force musth and non-musth bull ranges to overlap, which can lead to aggression (Jachowski et al., 2012; Van de Water, pers. obs.).          (-) Fencing can cause injury or mortality through entanglement in the fence material or snares constructed from fences (Davies-Mostert et al., 2013; Pekor et al., 2019).</p> <p><b>Indirect</b>          (-) Fencing leads to reduced wildness and can have a negative impact on genetic diversity, reducing opportunities for natural</p>	<p><b>Direct intentional</b>          (+) Using fences to separate elephants from areas of potentially high conflict is important to reduce HEC and protect communities (resulting in less injury and death, improved mental health, and reduced crop damage) (Di Minin et al., 2021b; Grant et al., 2008; Pekor et al., 2019; Slotow, 2012).          (+) The management of protected areas can be eased by fencing, and fencing can create jobs for communities via installation and maintenance (Pekor et al., 2019).</p> <p><b>Direct unintentional</b>          (-) Putting up fences between communities and wildlife areas can cause conflict if proper consultation is not undertaken (Di Minin et al., 2021b).          (-) Reduced access affects peoples' cultural and spiritual values. Fencing affects relations with place, limits the use of natural resources, and can lead to inequality and power imbalances (Abrams, 2022; Thakholi, 2021).          (-) Areas of high aesthetic value to tourists, such as riverine areas, may be compromised by fencing (Slotow, 2012).          (-) Fences are expensive to install and maintain (ESAG workshop; Pekor et al., 2019) and continuously need maintenance as elephants are very good at breaking fences (ESAG workshop; Grant et al., 2008; Slotow, 2012).          (-) Fences allow people to practice more extractive uses within a confined area, such</p>	<p><b>Direct intentional</b>          (+) Fences influence the ranging of elephants and can increase the heterogeneity of their use of the landscape by inducing differential temporal use of certain parts of the landscape (Hayward &amp; Kerley, 2009; Hoare, 1992; Pekor et al., 2019; Slotow, 2012).          (+) Reduced disease transmission from other species, e.g., from buffalo to domestic animals or other wildlife (Pekor et al., 2019).</p> <p><b>Direct unintentional</b>          (-) Fences can cause a double-edge effect on vegetation and result in relatively high levels of local impact (Dupuis-Desormeaux et al., 2016; Loarie et al., 2009).          (-) Electric fences cause the mortality of vulnerable, sometimes critically endangered, species (e.g., tortoises, pangolins). For instance, 8.67 dead leopard tortoises (<i>Stigmochelys pardalis</i>) were found per km of electric fence, indicating strong negative consequences for population survival (Holt et al., 2021; Lee et al., 2021). The mortality rate of pangolins (<i>Smutsia temminckii</i>) is one pangolin per 11 km of electric fence annually, making electrocution possibly the greatest threat to this critically endangered species (Pietersen et al., 2014).</p> <p><b>Indirect</b>          (-) Fencing prevents dispersal and natural processes for elephants and other species, which can be harmful to environmental well-being (Grant et al.,</p>
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	<p>selection and adaptation, e.g., to climate change (Child et al., 2019).</p> <p>(-) Elephants with large tusks can learn to break electric fences with their tusks without getting shocked. This could make large-tusked individuals particularly vulnerable to DCA control (Henley, pers. obs.).</p>	<p>as planting exotic or evergreen plants in camps near lodges. When elephants try to access these resources, it can lead to issuing DCA permits (Henley, pers. obs.).</p> <p><b>Indirect</b></p> <p>(-) Fences accentuate the need for ownership, remove people's rights to manage or benefit from wildlife, and alienate people from wildlife, which can further reduce tolerance (Kinnaird &amp; O'Brien, 2012).</p>	<p>2008; Pekar et al., 2019; Shrader et al., 2010).</p> <p>(-) Due to a lack of dispersal, populations may overuse resources within the fenced area leading to higher predation pressure and catastrophic resource reduction with no recovery time (Dupuis-Desormeaux et al., 2016; Hayward &amp; Kerley, 2009).</p> <p>(-) Habitat fragmentation threatens the metapopulation level and genetic processes critical to maintaining heterozygosity and the evolution/adaptation of many species (Hayward &amp; Kerley, 2009).</p> <p>(-) Fence-enhanced kills increase predator populations, subsequently decreasing prey populations, which can have ecosystem-wide consequences (Davies-Mostert et al., 2013).</p> <p>(-) Fencing herbivores in small sections of a larger landscape may decrease the carrying capacity of that area and could cause population decline and, ultimately, extirpation (Pekar et al., 2019).</p>
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<p><b>A: No direct contact (low interference)</b></p> <p><i>5. Militarised anti-poaching</i></p>	<p><b><i>Direct intentional</i></b>          (+) Militarised anti-poaching contributes to reduced poaching and thereby protects animal well-being in general (Chapron &amp; López-Bao, 2019; Mogomotsi &amp; Madigele, 2017).</p> <p><b><i>Direct unintentional</i></b>          (-) By not addressing the causes of poaching, the inequality of strictly excluding local people can serve to increase wildlife poaching (Witter, 2021).</p> <p><b><i>Indirect</i></b>          (-) Militarised anti-poaching can indirectly cause environmental harm (see column 3) (Duffy et al., 2019; Van de Water et al., 2022a; Witter, 2021), which will, in-turn affect animal well-being through the negative impact on life-sustaining processes.</p>	<p><b><i>Direct unintentional</i></b>          (-) Excluded and militaristic conservation approaches can create challenges in the form of human rights violations, social inequality, undermining local incentives to conserve wildlife, and endangering overall sustainability (Booker &amp; Roe, 2017; Büscher &amp; Ramutsindela, 2015; De Leeuw et al., 2018; Duffy et al., 2019; Witter, 2013).          (-) Green militarisation normalises and legitimises violent conservation approaches and justifies militaristic control over resources as white privilege (Marijnen &amp; Verweijen, 2016).          (-) Banning subsistence hunting of bush meat negatively impacts human well-being due to lack of access to protein and resentment of conservation policies prioritising the lives of wildlife over the lives of local people (Strong &amp; Silva, 2020).          (-) The intervention creates a dangerous landscape that risks physical and psychological harm to people (death, injury, and mental health issues) (Lunstrum, 2014).          (-) Disruption of families, sense of loss and resentment when wildlife security personnel get killed or assassinated as well as when poachers are killed. Families lose a breadwinner, which leads to acute and long-term vulnerability for women and children (“the crisis of widows”) (Massé et al., 2021).</p>	<p><b><i>Indirect</i></b>          (+) Habitat and biodiversity are positively affected by the reduction of poaching (Chapron &amp; López-Bao, 2019); protecting wildlife increases ecological resilience.          (-) Militarised anti-poaching approaches may be counter-productive as the involved violations of human rights can result in revenge/protest hunting or other forms of harm to the environment (Duffy et al., 2019; Van de Water et al., 2022a; Witter, 2021).</p>
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<p><b>B. Direct contact with increasing cost and risk of irreversible consequences and risk to life to elephants</b></p> <p><i>6. Population control pZP</i></p>	<p><b><i>Direct intentional</i></b>          (+) PZP, a non-hormonal immunocontraception, reduces growth rates of populations (with reported efficacies of up to 80%) with no reported negative effects on elephants (Ahlers et al., 2012; Bertschinger &amp; Caldwell, 2016; Delsink et al., 2006, 2007; ESAG workshop). In the Greater Makalali Private Game Reserve, pZP application demonstrated 100% effectiveness in reducing population growth (Bertschinger &amp; Caldwell, 2016; Delsink et al., 2006).          (+) The application of pZP is reversible (Delsink et al., 2013), is safe for pregnant animals, has no observed behavioural effects, and has no known long-term health effects (Bertschinger et al., 2018; Zungu &amp; Slotow, 2022). One reserve reported that the young age structure could be corrected in the long term by contraception (ESAG workshop).</p> <p><b><i>Direct unintentional</i></b>          (-) Reduction in the number of offspring changes social interactions, female/male ratios, and population demographics. Group cohesion can be affected in the short term, and issues with allomothering can occur (Bertschinger et al., 2008; ESAG workshop).</p> <p><b><i>Indirect</i></b>          (+) pZP could lead to an aging population; the subsequent increased population-level mortality is beneficial in the context of long-term population decline (Bertschinger et al., 2008). Some calves are needed to</p>	<p><b><i>Direct intentional</i></b>          (+) Darting from a helicopter and treatment of 2,657 elephants with pZP immunocontraception went smoothly, without any complications noted (Reserve data).          (+) As a humane and reliable method, contraception maintains support for conservation compared to more intrusive methods (Bertschinger et al., 2018).</p> <p><b><i>Direct unintentional</i></b>          (-) pZP vaccinations require boosters, which will increase the costs of this procedure (Delsink et al., 2013).          (-) Three of the 39 contraception interventions recorded difficulty relocating specific herds needing a booster (Reserve data).</p>	<p><b><i>Direct unintentional</i></b>          (-) Monitoring and research are needed on the effect that pZP immunocontraception may have on genetic diversity (Bertschinger et al., 2008; ESAG workshop).          (-) Due to contraception, chemicals (incl. from altered hormones) can be released into the water system (ESAG workshop).          (-) In an open system, contraceptive management may not be viable (ESAG workshop)</p> <p><b><i>Indirect</i></b>          (+) Reducing population growth can support ecological functioning and prevent biodiversity loss (Delsink et al., 2013).          (-) One reserve reported the effectiveness of pZP in stabilising elephant populations, but it was unclear if the impact on biodiversity was reduced (ESAG workshop).</p>
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	<p>come through the population to ensure that (allo-) mothering skills are perpetuated (ESAG workshop).</p> <p>(-) Loss of social learning/opportunity to acquire and practice mothering skills (ESAG workshop). (-) Some elephants are regularly exposed to helicopters for pZP treatment, which causes stress (ESAG workshop).</p>		
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<p><b>B. Direct contact with increasing cost and risk of irreversible consequences and risk to life to elephants</b></p> <p><i>7. Contraception or control of problematic bull behaviour (GnRH)</i></p>	<p><b><i>Direct intentional</i></b>          (+) GnRH treatment could effectively suppress elephant aggression in small, fenced reserves, which may prevent killing elephants as DCA (it must be ensured that there is no chance that bulls treated with GnRH will encounter non-treated elephants that could challenge them) (ESAG survey; Zungu &amp; Slotow, 2022).</p> <p><b><i>Direct unintentional</i></b>          (-) The effect of GnRH may be irreversible depending on the elephant's age and the duration of use (ESAG survey; Lueders et al., 2014; Mitchell, pers. obs). After 2 to 4 years of ongoing treatment, GnRH use is comparable to surgical castration (Lueders et al., 2017). It has a range of unintended negative consequences: acute swelling, reduced muscle growth, feminisation of males, reduced ability of elephants to defend themselves and mate, reversal or disruption of dominance hierarchies, physiological effects on olfactory function as well as throughout the central nervous system which are likely to affect a range of bodily functions, with potentially serious consequences for individual</p>	<p><b><i>Direct intentional</i></b>          (+) GnRH treatment could be effective in suppressing elephant aggression in small, fenced reserves where there is no chance that bulls treated with GnRH will encounter elephants that could challenge them (ESAG survey; Zungu &amp; Slotow, 2022), which may have a positive effect on tourism.</p> <p><b><i>Direct unintentional</i></b>          (-) GnRH emasculates bulls (Garaï et al., 2018), reducing their symbolic and spiritual standing (ESAG workshop).</p>	<p><b><i>Indirect</i></b>          (+) GnRH may effectively reduce population numbers and vegetation impact when applied in small populations, in cases where all bulls are treated, and none are able to inseminate females (Zungu &amp; Slotow, 2022).          (-) In populations in which dominant bulls were treated with GnRH, calving still occurred, presumably sired by younger bulls (Doughty et al., 2014). Therefore, the intended consequences of controlling elephant populations and reducing their impact on vegetation are not likely to occur (ESAG workshop).</p>
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	<p>health and reproduction (ESAG survey; Garaï et al., 2018; Kirkpatrick et al., 2011; Lueders et al., 2014, 2017). GnRH can lead to a serious negative impact on cardiac function and blocking GnRH production can increase the risk of coronary infarction.</p> <p>(-) Bulls on GnRH tend to spend more time with breeding herds, causing harassment to cows (Doughty et al., 2014).</p> <p>(-) Experiences with GnRH treatment to control problematic bull behaviour have caused younger bulls to attack/kill bulls on GnRH because those on GnRH show reduced aggressive reactions (ESAG survey; ESAG workshop).</p> <p>(-) Three bulls that were treated with GnRH were euthanised as DCA as their aggressive behaviour continued (ESAG survey).</p> <p><b>Indirect</b></p> <p>(-) GnRH risks increasing activities indicative of depression and, in the cerebellum, has been linked to two genetically based disorders (Kirkpatrick et al., 2011).</p> <p>(-) Taking bulls off the vaccine can cause a rapid return to problematic behaviour. As the pituitary gland re-activates, initial testosterone levels can be very high, leading to lengthened musth periods, potentially leading to increased aggression and further disruption of dominance hierarchies (ESAG survey; ESAG workshop; Mitchell, pers. obs.).</p>		
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	<p>(-) In populations where dominant bulls were treated with GnRH, calving still occurred, presumably sired by younger bulls (Doughty et al., 2014). Siring of calves by younger, less preferred males may have an impact on genetic fitness (ESAG workshop).</p>		
<p><b>B. Direct contact with increasing cost and risk of irreversible consequences and risk to life to elephants</b></p> <p><i>8. Population control: vasectomy</i></p>	<p><b><i>Direct intentional</i></b>          (+) Because vasectomy only needs to be implemented once, it limits the stress caused to elephants (Marais et al., 2013; Rubio-Martínez et al., 2014; Zitzer &amp; Boulton, 2018).          (+) Vasectomy has not been observed to have behavioural consequences for treated individuals (Garaï et al., 2018; Zitzer &amp; Boulton, 2018).  <b><i>Direct unintentional</i></b>          (-) Vasectomies are invasive, and some elephants have large intestine lacerations or surgery complications (Rubio-Martínez et al., 2014). Of the 45 free-ranging elephants that had a vasectomy, one died, and two others had surgery complications (Marais et al., 2013).  <b><i>Indirect</i></b>          (-) Vasectomy can affect herd cohesion (ESAG workshop).          (-) When not all sub-adult bulls are treated, young bulls will continue to breed, which may decrease population</p>	<p><b><i>Direct intentional</i></b>          (+) Vasectomies are a low-risk and cost-effective elephant management tool because it is a one-time treatment (Zitzer &amp; Boulton, 2018).  <b><i>Direct unintentional</i></b>          (-) Vasectomy emasculates bulls, reducing their symbolism and spiritual standing (albeit to a lesser extent than GnRH contraception or control of problematic bull behaviour).          (-) The public dislikes invasive interventions, which can reduce support for conservation (e.g., Edge et al., 2017).</p>	<p><b><i>Direct unintentional</i></b>          (-) Vasectomy may be ineffective in larger populations or when not all males are vasectomised, as young animals could inseminate females, which may reduce population fitness (Doughty et al., 2014; ESAG workshop; Garaï et al., 2018; Nolan, 2019).  <b><i>Indirect</i></b>          (+) In small populations, vasectomy can be a reasonable procedure without negative effects (Garaï et al., 2018), thereby contributing to ecological functioning. However, there is a risk of younger elephants inseminating cows (Zungu &amp; Slotow, 2022).</p>



	<p>fitness (Doughty et al., 2014).</p> <p>(-) No studies have assessed the reversibility or the longer-term demographic responses to vasectomy (Zungu &amp; Slotow, 2022).</p>		
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<p><b>B. Direct contact with increasing cost and risk of irreversible consequences and risk to life to elephants</b></p> <p><i>9. Translocation</i></p>	<p><b><i>Direct intentional</i></b>          (+) The introduction of older males has become an important intervention to delay the onset and/or reduce the duration of musth in younger males, thereby reducing the occurrence of abnormal behaviours and correcting abnormal age structures (Reserves data; Slotow et al., 2005).</p> <p><b><i>Direct unintentional</i></b>          (+) A behavioural study of elephants on a donor reserve from which they were translocated detected no unintended consequences from two removals of family groups (Druce, 2012).          (-) Translocation can lead to high-stress levels for translocated elephants, even years after release, as well as long-term effects on social behaviour and aggression (including inter-species competition) (Dickens et al., 2010; ESAG workshop; Fanson et al., 2013; Jachowski et al., 2013;</p>	<p><b><i>Direct intentional</i></b>          (+) Translocation provides educational opportunities and opportunities to develop wildlife-based tourism and create jobs in areas where elephants have been introduced (ESAG workshop; Naidoo et al., 2016; Selier et al., 2016; Slotow et al., 2005).          (+) Translocation has been used to reduce HEC in areas of limited size, low food availability, and unfavorable habitat conditions (Dalm, 1995; Fischer &amp; Lindenmayer, 2000; Wambwa et al., 2001).</p> <p><b><i>Direct unintentional</i></b>          (+) As an alternative to culling, translocation is ethically appealing and builds a good reputation for the country, which has economic benefits (ESAG workshop).          (+) Translation has educational value as there are expert groups available, and it affords a unique opportunity to collect bio-</p>	<p><b><i>Direct intentional</i></b>          (+) Translocation provides opportunities for range expansion and the establishment of new populations (ESAG workshop).</p> <p><b><i>Indirect</i></b>          (+) Elephants can be re-introduced to their former range as a strategy to restore trophic interactions (i.e., the food chain), curb ecological losses, and increase ecological resilience (ESAG workshop; Fischer &amp; Lindenmayer, 2000; Gordon et al., 2023; Svenning et al., 2016; Van de Water et al., 2020).          (-) Removing elephants to reduce vegetation impact at the original reserve was unsuccessful in various reserves (ESAG workshop).          (-) Refuge behaviour can lead to extensive habitat degradation (Legendijk et al., 2011).          (-) Translocated elephants have been shown to exhibit exponential population</p>
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	<p>Millspaugh et al., 2007; Viljoen et al., 2008, 2015).</p> <p>(-) Chronic stress in translocated elephants leads to reduced space use and alters habitat preferences, affecting the animal's ability to attain a healthy nutritional state (ESAG workshop; Jachowski et al., 2012).</p> <p>(-) Multiple elephants have died during transit and offloading, and translocated elephants have a higher death rate (Jachowski et al., 2012; Reserves data).</p> <p>(-) It is unwise to translocate anything other than entire herds, leaving no individuals behind, to avoid issues such as rhino killing by young males (Reserves data).</p> <p>(-) Translocated elephants may not integrate well into their new environment, and problem behaviour can move with them. When five elephants were translocated to reduce HEC, three were killed illegally, and one continued damage-causing behaviour (Tiller et al., 2022).</p> <p><b>Indirect</b></p> <p>(-) Populations founded on translocated individuals tend to show abnormal population structures (e.g., unbalanced sex ratios, disproportionately high proportion of adults and sub-adults, etc.) and to have above-average reproduction rates (Dickens et al., 2010; Reserves data; Slotow et al., 2005).</p> <p>(-) Social disruption caused by the translocation of small groups has long-term impacts, such as a breakdown of social networks (Wittemyer et al., 2005), loss of social and</p>	<p>samples and measurements from animals at close quarters that otherwise may not have been possible (ESAG workshop).</p> <p>(-) Elephants likely have elevated stress responses, which can lead to aggressive behaviour toward people (Fernando, 2015; Fernando et al., 2012).</p> <p>(-) Lack of knowledge about managing elephants in the receiving reserves can be challenging (ESAG workshop; Jachowski et al., 2012).</p> <p>(-) Elephants moving to areas far away from the release site (ESAG workshop) and refuge behaviour (Jachowski et al., 2012; Woolley et al., 2008) can reduce tourist viewing experiences (ESAG workshop; Jachowski et al., 2012).</p> <p>(-) The intervention is expensive and involves a risk of breakout at the release reserve and issues with communities, especially if the translocated elephants are not used to any fencing employed at the new site (ESAG workshop; Grobler et al., 2008).</p> <p>(-) When translocation is implemented to reduce human-elephant conflicts, it may create new human-elephant conflicts at the receiving site (Tiller et al., 2022).</p>	<p>growth at the release site, damaging vegetation and transforming the composition, structure, and diversity of woody vegetation (ESAG workshop; Howes et al., 2020; O'Connor, 2017; O'Connor &amp; Page, 2014). Therefore, the receiving reserve needs to be large enough to accommodate this.</p>
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	<p>environmental knowledge (Foley et al., 2008; Shannon et al., 2013; Whitehead, 2010; Whiten et al., 2017), reduced social competence (Kalcher-Sommersguter et al., 2013), increased reproduction (rebound effect) (Foley &amp; Faust, 2010; Hein et al., 2015); effects on sex ratio (Trivers &amp; Willard, 1973; Clutton-Brock &amp; Iason, 1986), effects on epigenetics (Burton &amp; Metcalfe, 2014; Jensen, 2013) and ultimately genetics (Whitehouse &amp; Hall-Martin, 2000; Zippel et al., 2019).</p> <p>(-) When elephants move through unfamiliar territory, 'homing' behaviour can cause stress, aggressive behaviour, and HEC (Fernando, 2015; Fernando et al., 2012; Pinter-Wollman, 2009).</p> <p>(-) Stress can cause increased vulnerability to disease, predation, starvation, decreased reproductive capacity, or dispersal away from the release site, which are factors that can lead to translocation failure (Hambrecht et al., 2020; Teixeira et al., 2007). A calf died two months after translocation, which was likely caused by stress and continuous long-distance movement of the herd (Jachowski et al., 2012).</p>		
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<p><b>C. Direct contact with increasing intent to take elephant lives (with increasing number of elephants involved)</b></p> <p><i>10. Damage Causing Animal (DCA) Control</i></p>	<p><b><i>Direct intentional</i></b></p> <p>(+) Killing DCA elephants may be appropriate in cases of serious injury or danger to human life if the DCA can be accurately identified (Hoare, 2001, 2012, 2015).</p> <p>(-) Killing DCAs directly causes stress and suffering, as it is challenging to kill elephants outright due to the thickness of the skull (Slotow et al., 2021).</p> <p>(-) Routine killing of DCA animals has been evaluated as ineffective or as not needed (e.g., Reserve data and Elephants Alive data) because the majority of escaped elephants return on their own or could be chased back (Hoare, 2015). Of the 470 DCA applications, only 66 cases were reported as a ‘threat to human life.’ Ten of these 66 elephants were hunted (one by a community hunter), four were shot and</p>	<p><b><i>Direct intentional</i></b></p> <p>(+) DCA control is a quick and cheap way to temporarily decrease the risk of elephant aggression toward people and improve community relations (Hoare, 2012), as people may feel that their lives and livelihoods matter and are protected.</p> <p>(+) The meat distribution from the killed animal improves community relations (ESAG workshop).</p> <p><b><i>Direct unintentional</i></b></p> <p>(-) Revenues from hunted animals that ought to be distributed to affected communities are often not disbursed (e.g., Anthony et al., 2010).</p> <p>(-) People from local communities are not allowed to hunt as many DCA elephants as private landowners can, which raises concerns over equality (Provincial data).</p>	<p><b><i>Indirect</i></b></p> <p>(+) DCA permits prevent disease transmittance for other species as fences remain more intact and fortified reserve management can continue (Chaminuka et al., 2012).</p> <p>(-) Ecological functioning and ecosystem services are affected as DCA control prevent elephant-based ecosystem services, such as seed dispersal, nutrient transfer, path opening, etc. (Bunney et al., 2017; Haynes, 2012; Kerley et al., 2008).</p>
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	<p>injured but not killed, one elephant was found dead on communal land with the tusks removed, and the rest (51) returned on their own or could not be found (Provincial data).</p> <p>(-) Roaming elephants are sometimes provoked/harassed to justify the killing as a life-threatening situation (Elephants Alive data).</p> <p><b>Direct unintentional</b></p> <p>(-) Unintended harm is caused when elephants are injured but not killed when other elephants are around, and when calves still depend on the DCA animal (ESAG survey; Reserve data).</p> <p>(-) Witnessing the shooting of elephants can traumatise and cause stress to other elephants, which can result in conflict (Elephants Alive data).</p> <p>(-) When a matriarch who charged a vehicle was shot, it caused social disruption and loss of knowledge in the remaining herd, which decreases the herd's capability to assess threats and survive (Reserve data; McComb et al., 2001, 2011).</p> <p>(-) When a cow protecting her calf was shot with her calf at her side, the calf died a month later (Reserve data).</p> <p>(-) The intervention carries a high risk of misidentifying DCA elephants (ESAG survey), which may lead to killing other elephants to satisfy the affected people (Chiyo et al., 2011; Hoare, 2012).</p> <p><b>Indirect</b></p> <p>(-) DCA control prevents elephant dispersal to other areas (e.g., an elephant that</p>	<p>(-) The destruction of DCA is often interlinked with hunting or poaching, using DCA as a justification for otherwise illegal killings using civilian hunters (e.g., luring animals out of protected areas) (Anthony et al., 2010; Malima et al., 2005; Reserve data; Elephants Alive data).</p> <p>(-) Some DCAs are hunted to generate income, which creates a bias in conservation decisions (ESAG survey; Elephants Alive data).</p> <p>(-) DCA conflicts can be perceived as from colonial times (Hoare, 2012) and often reflect larger conflicts of human value, interests, and class (McGregor, 2005). There are several governance concerns around managing DCAs and involve conflicts between institutions (e.g., between the provincial government and traditional authorities) as much as conflicts with animals. These are issues around inequality, trust, inadequate response time and reporting, weak and sometimes competing institutions, corruption, and a lack of understanding of elephant behaviour. This results in inappropriate action and a lack of considering possible alternatives (Anthony et al., 2010; Elephants Alive research data).</p> <p>(-) When elephants are injured or have witnessed the killing of other elephants, they can threaten human life (Elephants Alive data).</p> <p>(-) The damage caused by elephants is often not mitigated by killing the 'problem elephant,' as other</p>	
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	<p>moves out of a protected area risks being labeled as DCA and euthanised), which affects natural living (Henley, pers.obs.).</p>	<p>elephants may have learned this behaviour and will continue the problematic behaviour (Chiyo et al., 2011; Hoare, 2001; Elephants Alive data).</p> <p>(-) When collared roaming elephants are killed, research effort will be lost, as well as institutional knowledge of migratory paths between trans-frontier conservation areas, and investment (Elephants Alive data, Henley, pers. obs.).</p> <p>(-) Labelling and euthanising elephants as DCA can result in reputational risk if one country allows movement paths to be forged, and then the animal is shot in neighbouring jurisdictions/countries (Henley, pers. obs.).</p> <p>(-) When the killing of elephants is witnessed by tourists or appears in the media, it can potentially have consequences for tourism, cause reputational damage and have negative psychological effects (Reserve data; (Zungu &amp; Slotow, 2022.).</p> <p>(-) There may be health and safety risks regarding how the disposed animal is handled and the meat distributed to communities (Elephants Alive data).</p>	
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<p><b>C. Direct contact with increasing intent to take elephant lives (with increasing number of elephants involved)</b></p> <p><i>11. Trophy hunting</i></p>	<p><b><i>Direct intentional</i></b>          (+) Some studies showed that if trophy hunting is done properly, the remaining elephants have no significant behavioural responses (Burke et al., 2008).          (-) Trophy hunting directly causes stress and injury to the targeted animal, as it is difficult to kill an elephant outright due to the thickness of the skull (Slotow et al., 2021).</p> <p><b><i>Direct unintentional</i></b>          (-) Trophy hunting can lead to increased stress, aggression, and refuge behaviour in elephants (ESAG workshop; Gobush et al., 2008; Shaffer et al., 2019).          (-) Selective hunting and/or poor hunting practices can lead to the loss of leaders/mentors that are vital to younger elephants, which has negative impacts on social structures, dominance hierarchies, group cohesion, social knowledge, and animal well-being (Allen et al., 2020; ESAG workshop; Gobush et al., 2008; Milner et al., 2007; Slotow et al., 2021).          (-) Selective hunting can result in higher proportions of younger bulls, increased musth, and reproduction (Bradshaw et al., 2005; ESAG workshop; Selier et al., 2014; Slotow et al., 2000).</p> <p><b><i>Indirect</i></b>          (-) Selective hunting can have genetic effects and lead to reduced tusk size and tusklessness (Campbell-Staton et al., 2021; Jachmann et al., 1995). Genetic loss can lead to genetic drift</p>	<p><b><i>Direct intentional</i></b>          (+) Trophy hunting can set up a value chain (Burke et al., 2008; Di Minin et al., 2021a; ESAG workshop; Mbaiwa, 2018), which can be used to support surrounding rural communities, especially when hunting fees are high and/or where ecotourism is not feasible (Burke et al., 2008; De Boer et al., 2007; Di Minin et al., 2021a; ESAG workshop; Mbaiwa, 2018).</p> <p><b><i>Direct unintentional</i></b>          (-) Trophy hunting is economically and ecologically less favorable than elephant viewing in areas where ecotourism profit per elephant is high (De Boer et al., 2007). As tourists prefer non-interventionist approaches (Edge et al., 2017), hunting elephants or the removal of older males will likely affect ecotourism revenues (Harvey, 2020; Slotow et al., 2008).          (-) It is not clear how revenue from trophy hunting will provide adequate, long-term benefits for communities or how inequity in the distribution of money will be avoided (Dellinger, 2019; Di Minin et al., 2021a; Wasser &amp; Gobush, 2019).          (-) The intervention is controversial; the public perception of hunting has led to negative reports and media backlash on tourism operations, causing division (ESAG workshop).          (-) As a neoliberal system with neo-colonial characteristics of converting wildlife into a commodity, trophy hunting conflicts with</p>	<p><b><i>Indirect</i></b>          (+) Trophy hunting is promoted to generate support for habitat conservation (Di Minin et al., 2021a).          (+) It can have a relatively small environmental footprint on the land relative to tourism, where extraction of resources such as water and space occupation could be large (ESAG workshop).          (+) It helps to keep areas wild, for instance, where ecotourism cannot be developed (Di Minin et al., 2016; ESAG workshop).          (-) Biased sex ratios and population-genetics effects reduce ecological resilience and ecosystem services (Slotow et al., 2008; ESAG workshop).          (-) Trophy hunting is not suitable as a measure of population control to maintain environmental well-being (Milner et al., 2007), even though the main biological reason for trophy hunting was reported as overpopulation (ESAG survey).</p>
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	<p>(Whitehouse &amp; Harley, 2001).</p> <p>(-) The loss of larger, stronger bulls (the preferred mates of females (Hollister-Smith et al., 2007)) may lead to weaker offspring (Moss, 1983; Sheikh, 2019; Whitehouse, 2002) and disruption of the fine-scale genetic structure (Archie et al., 2008), possibly leading to less adaptable offspring, as well as changing the phenotype with evolutionary consequences (Coulson et al., 2018).</p>	<p>moral values (Batavia et al., 2019), opens the door to short-term, individually motivated behaviour (Bilchitz, 2017; Mkono, 2019), and could exacerbate risks related to power dynamics and inequity in distributing benefits gained from wildlife (Büscher &amp; Fletcher, 2020; MacDonald, 2005; Mkono, 2019; Wasser &amp; Gobush, 2019).</p>	
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<p><b>C. Direct contact with increasing intent to take elephant lives (with increasing number of elephants involved)</b></p> <p><i>12. Culling</i></p>	<p><b>Direct intentional</b>          (+) Culling is a more humane alternative to slow deaths in periods of drought or resource limitation.          (-) Culling directly causes stress and injury, as it is difficult to kill elephants outright due to the thickness of the skull (Slotow et al., 2021).          (-) Culling directly causes stress for the remaining animals (Slotow et al., 2021).  <b>Direct unintentional</b>          (-) Culling can lead to a breakdown in the social structure, increased group size, and irruptive growth rates (Gobush et al., 2008; Parker et al., 2021; Selier et al., 2014; Slotow et al., 2008).          (-) The current method of culling family groups is likely inhumane (and therefore illegal) in South Africa (Slotow et al., 2021).  <b>Indirect</b>          (-) Culling can lead to inbreeding depression (i.e., reduced survival and fertility of offspring), and skewed sex ratios (Gobush et al., 2008; Selier et al., 2014).          (-) Culling can lead to increased stress levels for the elephants that are not culled, social disruption, and loss of social and ecological knowledge (Gobush et al., 2008; Parker et al., 2021; Puyravaud et al., 2017; Selier et al., 2014; Shannon et al., 2013; Slotow et al., 2008).          (-) Culling can result in declining tusk sizes, higher mortality, and less bonding (Garaï et al., 2023).</p>	<p><b>Direct intentional</b>          (+) Meat from DCA culls can be handed out to communities, contributing to building relations (ESAG workshop).  <b>Direct unintentional</b>          (-) Culling is highly controversial and can cause division in the conservation sector (Lötter, 2005).          (-) The public perception of culling has led to negative reports and media backlash on tourism operations. Tourists prefer non-interventionist approaches (Edge et al., 2017), so culling elephants will likely affect ecotourism revenues (Harvey, 2020; Slotow et al., 2008).          (-) The level of intervention required to maintain low elephant numbers is likely expensive.          (-) Culling may cause refuge behaviour; elephants moving away from tourist areas may lead to aggression toward local people and reduced tourist viewing options (Jachowski et al., 2012, 2013; Slotow, pers. obs.).          (-) The current method of culling family groups is likely illegal in South Africa, which leads to legislative discord and reputational risk (Slotow et al., 2021).</p>	<p><b>Direct intentional</b>          (+) Culling, when implemented continuously, can reduce elephant populations in the short term (Slotow et al., 2008).  <b>Indirect</b>          (+) When implemented continuously, culling can reduce elephant impact on vegetation and restore ecosystem services potentially lost by elephant overpopulation (Parker et al., 2021; Slotow et al., 2008).          (-) Unless it is continually practiced, culling is ineffective in reducing elephant numbers in the long term, as reducing elephant density in the short-term increases the amount of food available per elephant, leading to increased reproductive rates (i.e., rebound effect) (Foley &amp; Faust, 2010; Hein et al., 2015; Koenig, 2007; Mackey et al., 2009; Slotow et al., 2008; Van Aarde et al., 1999).          (-) Culling elephants to protect vegetation has not achieved its objectives due to the complexity of the system (Henley &amp; Cook, 2019).</p>
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#### **5.4.2 One Well-being: balancing consequences**

Most elephant management interventions appear unbalanced when contrasting consequences across the three pillars (Table 5.3, Figure 5.1). Only two interventions scored positively for all three pillars of One Well-being (range expansion and pZP contraception). Nine out of twelve interventions scored positively for environmental well-being (average score across interventions = 0.49), while only four scored positively for animal well-being (average -0.42), and three for human well-being (average -0.20) (Table 5.3). Five of the twelve interventions had a positive overall score, but two of these were harmful to human well-being, and another harmful to animal well-being. Three interventions scored negatively across all three pillars of One Well-being (doing nothing; fencing; DCA control). From a One Well-being perspective, based on scores from eight researchers, DCA control, culling, and fencing are the least preferred elephant management interventions. Additionally, range expansion, pZP contraception, and closure of water points ranked as the most preferable (Table 5.3).

Table 5.3: Scores for management interventions. The eight researchers used Table 5.2 and Supplemental Table S5.1 as a basis for scoring each intervention on each sub-component of the three well-being pillars. Interventions are ordered from lowest to highest interference level (A1 to C12). Scores range from very negative (-2) to very positive (+2). For all scores, the modal average was calculated for the eight scores assigned by the different scorers. Unhighlighted scores (45.0% of all 120 scores) indicate a consensus was reached by all eight scorers, or only one score was different from the modal score. Light blue scores (35.8%) indicate two of the eight scores were different from the mode. The medium blue highlighted scores (14.2%) indicate three people assigned a score different to the mode. The darkest blue highlighted scores (5.0%) received four scores that were different from the mode. The different sub-component scores were averaged to a single score for each well-being pillar, shown in blue (+) or red (-) text under the three One Well-being pillars). The average disagreement (second last column) indicates the number of people who scored differently from the mode across all the categories within an intervention, divided by ten sub-components. The One Well-being intervention score (last column) is the sum of the mean values for that intervention across the three pillars.

Elephant management intervention	Consequences of intervention on Animal Well-being			Consequences of intervention on Human Well-being			Consequences of intervention on Environmental Well-being				Average disagreement (persons)	One Well-being Intervention Score
	-0.42			-0.20			0.49					
	Basic health & functioning	Natural living	Affective states (happiness)	Material well-being	Subjective well-being	Relational well-being	Ecological functioning	Ecosystem services	Risk of Biodiversity loss	Ecological resilience		
A1. Doing nothing (overpopulation)	-0.88	0.00	0.00	0.00	-0.88	0.00	-1.75	-1.13	-1.28	-1.13	0.40	-1.90
A2. Range expansion/corridors	2.00	2.00	1.88	0.72	0.56	1.50	1.88	1.88	1.13	1.88	0.80	4.57
A3. Closure of water points	0.25	1.63	0.63	-0.75	-0.13	-0.25	1.88	1.31	1.75	1.88	1.40	2.16
A4. Fencing	-0.88	-1.88	-0.75	0.59	0.75	-0.72	-1.63	-1.16	-1.63	-1.75	1.80	-2.50
A5. Militarised anti-poaching	2.00	2.00	1.88	-2.00	-1.69	-2.00	1.88	0.38	1.31	0.56	0.90	1.09
B6. Contraception (pZP)	0.50	-0.75	0.63	0.19	0.88	0.94	1.88	1.06	1.75	1.75	1.70	2.40
B7. GnRH	-1.88	-1.75	-1.75	0.13	0.88	-1.16	0.59	0.13	0.13	0.13	0.90	-1.60
B8. Population control: vasectomy	-0.75	-1.00	-0.75	0.00	0.00	-0.34	1.13	0.50	0.38	0.38	2.20	-0.35
B9. Translocation	-0.88	0.00	-1.75	0.88	0.75	0.75	1.13	1.88	1.50	1.88	0.80	1.51
C10. Damage Causing Animal control	-1.88	-1.63	-1.75	-0.38	-0.50	-1.63	-0.88	-0.75	0.50	-0.13	1.80	-2.90
C11. Trophy hunting	-1.75	-0.88	-1.63	0.84	-0.47	-0.75	-0.13	1.00	0.34	-0.75	2.10	-1.42
C12. Culling	-2.00	-1.38	-2.00	-1.13	-1.13	-1.56	0.50	0.69	0.53	0.00	1.40	-2.63


































































	 Animal Well-being	 Human Well-being	 Environmental Well-being	One Well-being Intervention Score	Interference Rank	3 pillars of One Well-being
Range expansion				4.57	 A 2	 $\geq 1.25$
Contraceptives pZP				2.40	 B 6	 0.75 and 1.24
Water point closure				2.16	 A 3	 0.25 and 0.74
Translocation				1.51	 B 9	 0.24 and -0.24
Militarized anti-poaching				1.08	 A 5	 -0.25 and -0.74
Vasectomy				-0.35	 B 8	 -0.75 and -1.24
Trophy hunting				-1.42	 C 11	 $\leq -1.25$
GnRH				-1.60	 B 7	
Do nothing (overpopulation)				-1.90	 A 1	<b>One Well-being Intervention Score</b>
Fencing				-2.50	 A 4	 $\geq 3.0$
Culling				-2.63	 C 12	 2.0 to 2.99
DCA control				-2.88	 C 10	 1.0 to 1.99
						 0.99 to -0.99
						 -1.0 to -1.99
						 -2.0 to -2.99
						 $\leq -3.0$

Figure 5.1: Performance of the interventions across the three well-being pillars. Interventions are ranked from highest to lowest intervention score (i.e., the sum of the three pillar values, see Table 5.3). Beneficial consequences are presented in shades of blue, darker being more beneficial, and harmful consequences in shades of red, darker being more harmful. The Interference Rank represents the interference level on elephants from low to high (A1-C12) and represents (A) where *no direct contact* (A) is shown in blue, *direct contact* (B) is yellow, and *direct contact with intention to end an elephant's life* (C) is red (icons: Van de Water).

### 5.4.3 Interference ranking vs One Well-being ranking

Spearman's rank correlation was computed to assess the relationship between the interference rank (see Section 2.2) and the One Well-being ranking (see Figure 5.1) of elephant management interventions. There was no significant correlation between the interference ranking (where higher numbers indicate greater interference, and therefore a

greater welfare concern for the *individual* involved) and the One Well-being ranking (where the top rank of 1 suggests holistic benefits in terms of the three well-being pillars, and lower ranking indicates reducing benefits and increasing harm, with 12 as the worst ranked intervention) ( $r_s = 0.41$ ,  $n = 12$ ,  $p = 0.18$ ).

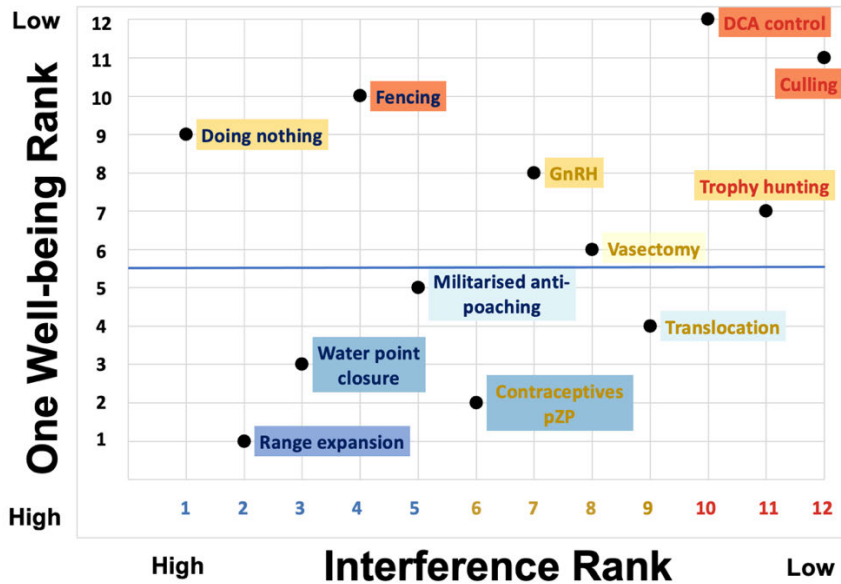


Figure 5.2: The One Well-being and interference ranking of the management interventions. Interventions have been plotted according to their interference rank (where a higher number indicates greater interference, and therefore a greater welfare concern for the *individual* involved) and One Well-being Score (where the rank of 1 suggests holistic benefits in terms of the three well-being pillars, and lower ranking indicates reducing benefits and increasing harm, with 12 as the worst ranked). The fonts of management interventions are coloured according to their broader interference category as given in Figure 5.1, where blue indicates no direct contact with elephants, yellow indicates direct contact with elephants, and red indicates direct contact with an intention to end an elephant's life. The shading in the background of the interventions corresponds with One Well-being categories (Figure 5.1), where shades of blue indicate beneficial (darker being more beneficial) and shades of red indicate harmful consequences (darker being more harmful). The interventions below the blue horizontal line scored positively on One Well-being, and the interventions above the line had a negative One Well-being score. There was no significant correlation between the ranks of two variables ( $r^s = 0.41$ ,  $n = 12$ ,  $p = 0.18$ ).

## 5.5 Discussion

By collating and reviewing a wide range of evidence sources, the framework presented here provides insights into the direct and indirect, and beneficial or harmful consequences of twelve elephant management interventions commonly applied in South Africa (DEAT, 2008; Zungu & Slotow, 2022). This holistic assessment of the potential consequences of elephant management interventions relies on a combined evaluation of the three overlapping pillars of the One Well-being framework. We argue that viewing these pillars in isolation is an artificial separation (Colonius & Earley, 2013; Garcia Pinillos et al., 2016). We expanded the One Welfare framework to the broader “One Well-being Framework” here to incorporate the broader, collective well-being of animals, people, and environments. Animal welfare tends to consider individual animals’ physical and mental state (WOAH, 2022). The term well-being, in contrast, better reflects the importance of considering both individuals and populations, because individual suffering may have a ripple effect and impact on the entire population, especially with social animals. For example, elephant hunting in Pilanesberg was shown to affect the short-term well-being of the remaining population (Burke et al., 2008); Calves born in populations that were previously translocated showed higher stress levels, suggesting that trauma and stress can cause epigenetic modification and affect subsequent populations (Burton & Metcalfe, 2014; Jachowski et al., 2012; Jensen, 2013); and extremely disruptive social events such as culling or translocation decrease essential social skills (Garaï et al., 2023) and affect well-being at the population level, even for individual animals that were not exposed to these interventions (Shannon et al., 2013, 2022). Other frameworks, such as Derkley et al.’s (2019) which assesses the impact of rhino policies on animal welfare, similarly provides guidance on integrating welfare of individual animals and populations. Moreover, incorporating animal well-being into our approach allows it to align better with the human pillar, as human well-being also requires consideration at both individual and community levels (e.g., Tomita et al., 2022).

The One Well-being scoring system revealed an imbalance in the consequences of conservation actions, with more management interventions being positive for environmental well-being than for animal or human well-being. This potentially indicates

a prioritising of environmental protection over the well-being of either animals or people. That most of the interventions score positively on environmental well-being is arguably an outcome of actions being designed by biologically trained professionals for the primary aim of achieving biodiversity targets (Van Meerbeek et al., 2019). In comparison, the lower number of interventions scoring positively on the animal well-being pillar suggests a relatively low importance is placed on animal well-being. A possible explanation for this finding is that leading conservationists have traditionally prioritised the importance of populations, rather than the individual animals (Sekar & Shiller, 2020). Notably, the One Well-being scoring showed that none of the interventions scored very positively for human well-being, which is indicative of poor consideration of social and societal aspects in conservation management decisions (Van de Water et al., 2022a).

Most direct intentional consequences across all twelve interventions were beneficial, while most unintentional and indirect consequences were harmful. This could indicate that decisions on elephant management interventions are often based on expected direct outcomes without considering broader, potentially negative consequences for the socio-ecological system. The listed consequences mostly focused on one pillar in isolation or only on direct or indirect consequences, indicating gaps in knowledge, particularly in holistic assessments of consequences that consider direct and indirect, long-term consequences. The lack of correlation between the interference rank and the One Well-being rank further emphasises the need to apply a broader lens when assessing the consequences of management interventions. The interference ranking here is based on individual animal welfare concerns centred around the direct consequences of the intervention itself. By contrast, the One Well-being ranking is a holistic approach considering broader, long-term consequences for the entire socio-ecological system. The interventions are evidently ranked and plotted differently across the two ranking systems (Figure 5.3), which indicates the need to move beyond looking only at one pillar in conservation decisions. Therefore, we argue that conservation decisions should no longer be made in isolated disciplines. Instead, a holistic, interdisciplinary framing should be applied that promotes and balances the well-being of animals and people who can thrive in connected ecosystems and societies (Colonus & Earley, 2013).



We acknowledge three limitations of the One Well-being scoring system. The first concerns the relative weight of the three pillars. Which pillar should be prioritised, and who decides what should be prioritised? Who decides about the weight of the pillars is critical, as conservation decisions are often challenged by power imbalances and short-term gains of a few powerful stakeholders (Van de Water et al., 2022b). Despite evidence on the importance of reconciling conservation and human well-being goals, trade-offs are still the norm (McShane et al., 2011). The One Well-being scoring system provides insight into the consequences of ignoring one of the pillars, even if those consequences are not directly experienced. We suggest that all three pillars be evaluated when making management decisions. For example, when two pillars score positively against one with a negative score, management decisions should consider the severity of those negative consequences and potential feedback loops that can have long-term consequences. Therefore, the One Well-being scoring system can aid policymakers and managers in developing integrated solutions that minimise negative trade-offs, or at least make them fully apparent and part of transparent and accountable decision-making.

There is a need for a risk management approach with controls to mitigate risks of a negative score for one pillar or even sub-component. Our framework allows policymakers and managers to assess the current situation for each sub-component of that intervention, strategically plan risk management, monitor consequences, and apply an adaptive management approach for potential future scenarios (DEAT, 2008; Gillson et al., 2019). Thereby, the presented framework becomes an iterative process, allowing policymakers and managers to conduct a desktop process to identify strengths and weaknesses of management approaches, identify opportunities for improvement, and monitor changes within the system when improvements are implemented.

Secondly, this study only included the scores of eight researchers for ranking management interventions and developing and testing the One Well-being framework and these findings need to be considered with great caution. Broader stakeholder involvement is needed in future assessments to rank management interventions to reduce potential bias in scores and present a more robust overview from multiple perspectives. Comparing scores given by researchers, landowners, reserve managers, or people living

with wildlife could be part of such an assessment, as these stakeholders may prioritise different pillars (e.g., marginalised communities prioritised human well-being, while landowners expressed more concerns about animal well-being and environmental well-being, Van de Water et al., In prep.).

Third, it is essential to look beyond the implementation of each intervention in isolation and consider future scenarios that may require additional interventions, e.g., lethal interventions or the closure of water points may be impacted by future changes in ecosystems, for example, species decline and climate change (Zungu & Slotow, 2022). Despite these limitations, we believe the One Well-being framework presented here can create new, evolving pathways that can address conservation trade-offs and advance the well-being of life on earth (Colonijs & Earley, 2013). It can help to assess interventions at site or landscape level, and, thereby, aid policymakers and managers in the planning of [elephant] conservation strategies that contribute to socio-ecological sustainability, and are aligned with Best Practice Principles and with (newly emerging) policies and legislation that address welfare and well-being challenges.

Examples that illustrate the necessity of the holistic One Well-being approach are range expansion and corridor creation, which score well on all One Well-being pillars, and reduce the need for the other elephant management interventions (e.g., less need for population control, although the need for coexistence solutions may increase). Militarised anti-poaching, on the other hand, scores well on the animal well-being and environmental well-being pillars but involves severe risks to human well-being through the violation of human rights (Booker & Roe, 2017; Büscher & Ramutsindela, 2015; De Leeuw et al., 2018; Duffy et al., 2019; Witter, 2013). The severity of these consequences, which conflict with various social compacts countries have agreed to, should be prioritised over the other consequences, as explained above: The One Well-being score alone is insufficient on which to base a decision; each consequence needs to be considered individually and against consequences in the other domains. Anti-poaching efforts should be organised in a way that does not increase inequity or promote violence. Instead, efforts could, for instance, empower women to safeguard wildlife through snare sweeping and advocating for wildlife protection in communities, to alleviate the potential negative

effects on human well-being while contributing to animal well-being effectively and positively, which increases community buy-in and the chance of eliminating poaching altogether (Agu & Gore, 2020; Janssens et al., 2022; Massé et al., 2017).

Range expansion and the creation of corridors ranked highest in this iteration of the approach, as they increase animal well-being, prevent biodiversity loss, and increase the resilience of the socio-ecological system (Row 2 in Table 5.2) (Hecht & Allcock, 2020; Osborn & Parker, 2003; Van Aarde & Jackson, 2007). As most elephant reserves in South Africa have adjacent land suitable for elephants, there are opportunities for major range expansion and connectivity. In the development of such initiatives, it is critical to strategically plan the location and maintenance of corridors (Henley et al. 2023). Obstruction or human development in close proximity to corridors could deter elephants and work against goals of connectivity whilst magnifying human-elephant conflicts and mortality (Canney, 2021; Ngene et al., 2010; Okita-Ouma et al., 2021). Our results have shown the importance of fully integrating the human well-being pillar in range expansion planning to ensure long-term sustainability.

Additionally, the preliminary One Well-being assessment presented here demonstrates that ‘command and control’ approaches to conservation and land management can have long-term negative consequences that are not always foreseen nor accounted for (Zungu & Slotow, 2022). South African policy development has been dominated by an aggregative approach focusing on the protection of ecosystems and species survival (Bilchitz, 2017). While it is recognised that large ecological systems and increased connectivity require fewer management interventions (Department of Environmental Affairs (DEA), 2014), in South Africa – and increasingly in other parts of Africa (Di Minin et al., 2021b) – policies and preferences have historically favoured limited reserve size and fencing of wildlife. This has restricted elephant movement and necessitated further management interventions with unintended negative consequences (Zungu & Slotow, 2022). Yet subsequent management interventions that have direct negative impacts on animal welfare can negatively affect tourism revenue and the country’s reputation (Edge et al., 2017).

In contrast, an integrative approach, which has been referenced by the South African Constitutional Court (National Society for the Prevention of Cruelty to Animals v Minister of Justice and Constitutional Development and Another, 2016), promotes respect for individuals *and* systems, with opportunities to integrate conservation solutions for issues that are intrinsically interlinked and related to the well-being of individuals and their connected environment (Bilchitz, 2017; Colonius & Earley, 2013; Lindenmayer & Kaufman, 2021). For example, if it is necessary to manage wildlife overpopulation, it is vital to acknowledge people's values system regarding animal welfare (Brown et al., 2019), and to prioritise interventions that gain public support, as this will increase their effectiveness and sustainability (Nugent et al., 2011). The One Well-being approach thus considers the essential feedback loops that affect the broader socio-ecological system.

In the context of this study, it appears that the most preferential conservation approaches are exactly those that integrate human, animal, and environmental well-being, providing elephants with the space they need through enlarged, connected protected areas that simultaneously include and support local people and promote human-elephant coexistence, supporting just and ethical conservation practices that align with global aspirations.

## 5.6 Conclusions

Assessing the consequences of conservation interventions for the socio-ecological system as a whole leads to an acknowledgment of the interlinkages between the three One Well-being pillars, which can aid in predicting the long-term consequences of interventions. South Africa's extensive experience with elephant management interventions enabled us to devise the One Well-being approach. However, the approach can be applied to other species and ecosystems to increase awareness of how animals, humans, and the environment are intrinsically interconnected (Bourque, 2017; Colonius & Earley, 2013). Incorporating the consequences of conservation decisions on animal well-being is critical because animal well-being, especially of sentient beings or species that people intensely manage, receives increasing global attention (Beausoleil, 2014; Harrington et al., 2013),

and increasingly influences global conservation policies (Brown et al., 2019; CITES, 2021).

Upholding animal well-being is important because animals – here exemplified with elephants – have intrinsic value, because people have a moral obligation to ensure the elephants’ quality of life (Bandara, 2004), because people benefit from elephants (Van de Water et al., 2022b), and to prevent the decline of the moral status of people (e.g., Society for Prevention of Cruelty to Animals v Minister of Environmental Affairs, 2019). Incorporating moral values, which include human rights, into conservation decisions, ensures that the rights of people to have their environment protected are met (Van de Water et al., 2022b). Globally, over 100 national constitutions have expressed a legal obligation to protect peoples’ right to a healthy environment (Boyd, 2018; Menton et al., 2020), which includes the protection of animals, populations, and nature in general as these provide vital ecosystem services.

Here, these requirements for animal, human and environmental well-being are integrated under the One Well-being approach. Management actions that align with this approach would ensure that peoples’ rights are met, which in turn increases local and global support for conservation (Roe, 2010; Van de Water et al., 2022a). The presented framework can help policymakers and managers assess the implications and trade-offs of conservation decisions, leading to more sustainable conservation outcomes and aligning conservation planning with societal goals and aspirations.

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## 5.8 Competing interests

Although the work was conducted under contract from the National Department of Forestry, Fisheries and the Environment of South Africa with the University of Kwazulu-Natal, the authors undertook the work independently. AW and MH are both founders of elephant research and conservation NGOs (Bring The Elephant Home Foundation and Elephants Alive, respectively), that apply conservation approaches that align with some of the concepts proposed in this paper.

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## 5.10 Supplemental Information

Table S5.1: The beneficial and harmful consequences of different management interventions based on information from the literature review, Elephant Specialist Advisory Group (ESAG) survey, ESAG workshop, provincial data, reserve data, and elephant research (see methods for details).

<b>Elephant management intervention</b>	<b>Beneficial consequences</b>	<b>Harmful consequences</b>
A1. Doing nothing (overpopulation in fenced systems)	Literature review: <ol style="list-style-type: none"> <li>1. The potential negative impact on animal well-being from intrusive interventions (e.g., culling) is prevented, and targeted elephants' short-term interests and rights are respected (Lötter, 2005).</li> <li>2. It avoids the difficulty of artificially maintaining elephant populations below a maximum threshold (Van Aarde &amp; Jackson, 2007).</li> <li>3. Having many elephants in a reserve increase viewing experiences and draws tourists to the reserve (e.g.,</li> </ol>	Literature review: <ol style="list-style-type: none"> <li>1. An overabundance of elephants could lead to a population crash during a severe drought, which can cause the suffering of elephants in the future (Lötter, 2005).</li> <li>5. Overabundance and large aggregations of elephants can deplete local food sources (De Beer et al., 2006; Chamaille-Jammes et al., 2008).</li> <li>6. Allowing elephant populations to increase affects reserve managers who witness the consequences (Lötter, 2005).</li> <li>7. Elephant impact on vegetation may reduce aesthetic aspects of the landscape (large</li> </ol>



	<p>Addo Elephant National Park (Kerley et al., 2003)).</p> <p>4. In open systems, doing nothing contributes to environmental well-being within a non-equilibrium management approach that allows natural processes (e.g., rainfall) to regulate population numbers and promote spatial-temporal heterogeneity (Van Aarde &amp; Jackson, 2007; Zungu &amp; Slotow, 2022).</p>	<p>trees, riverine vegetation), reducing aesthetic appreciation (Edge et al., 2017; Henley &amp; Cook, 2019).</p> <p>8. Doing nothing can impact vegetation in the long term, which will affect ecological functioning and other species (Lötter, 2005; Van Aarde &amp; Jackson, 2007).</p>
	<p>ESAG survey:</p> <p>1. One reserve that stated to have an elephant population over the carrying capacity is doing nothing about this for tourist visibility.</p>	
	<p>ESAG workshop</p> <p>1. It avoids conservation decisions that lead to public outcry and a reduction in support for conservation (ESAG workshop).</p>	
<p>A2. Range expansion/corridors</p>	<p>Literature review</p> <p>1. More space for wildlife contributes directly to increased animal well-being and can reduce HEC (Hecht &amp; Allcock, 2020; Osborn &amp; Parker, 2003).</p> <p>2. (+) Recently introduced older bulls are more likely to respond quickly to range expansions (whereas other bulls and breeding herds may be more cautious, taking more time to</p>	<p>Literature review:</p> <p>1. Elephants moving through corridors have been shown to exhibit elevated stress levels, which may lead to aggressive behaviours, increasing human-elephant conflict in human settlements adjacent to or bordering corridor areas or in corridor areas within reserves themselves (Ahlering et al., 2013; Hunninck et al., 2017; Jachowski et al., 2013a; Tingvold et al., 2013).</p>

	<p>explore new areas) (Druce et al., 2008).</p> <p>3. Elephant corridors are beneficial to the communities surrounding elephant ranges by reducing human-elephant conflict and increasing income through tourism and hunting (Osborn &amp; Parker, 2003).</p> <p>4. Range expansion provides opportunities to increase inclusivity and the ‘living in harmony’ philosophy, which can contribute to a range of indirect benefits (DFFE, 2022).</p> <p>5. Elephant corridors can allow elephants to adapt to climate change by providing them access to suitable habitat areas (Zacarias &amp; Loyola, 2018).</p> <p>6. The provision of access to additional land is viewed as a critical mechanism for the long-term sustainability of elephant populations within areas enclosed by fences because the relative density of elephants is decreased, and, therefore, the relative impact of the elephants in the system is reduced (Van Aarde &amp; Jackson, 2007).</p> <p>7. Corridors can serve to increase connectivity for wildlife in general, as elephant occurrence is strongly associated with that of other mammals (Bartlam-Brooks et al.,</p>	<p>2. Elephants can move into surrounding human settlements, causing extensive crop damage and endangering human life, leading to enhanced human-elephant conflicts (Kikoti et al., 2010).</p> <p>3. High levels of conflict with people may lead to negative attitudes toward conservation among members of surrounding villages, causing high rates of elephant deaths as a result of retaliatory killings (Kikoti et al., 2010; Selier et al., 2016).</p> <p>4. Corridor presence does not mean use, which can lead to conflict between corridor use and corridor function (sensu Horskins et al., 2006).</p> <p>5. If elephant corridors have been identified, but are unprotected, inevitably, development will occur, undermining their effectiveness (Schüßler et al., 2018).</p> <p>6. Elephants are cautious in exploring a new area, moving into new areas over a long time (Druce et al., 2008).</p> <p>7. Opening up fences for sedentary populations may lead to wasted efforts, as those groups are unlikely to incorporate new areas into their ranges unless elephants are occurring at very high densities or there is an attractant in the new area such as water points, rivers or preferred habitat or tree species, as has been observed in areas incorporated to the west of KNP (Slotow, pers. obs).</p> <p>8. Elephants that move into a new area of the reserve that may not be set up for tourism or</p>
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	<p>2011; Crego et al., 2021) and are important to prevent large-scale biodiversity loss and maintain ecological resilience and long-term sustainability (Van Aarde &amp; Jackson, 2007).</p> <p>8. Druce et al. (2008) studied the response of elephants to fence removal between Phinda Game Reserve and two neighbouring communal reserves. After fence removal, older, recently introduced bulls responded quickly and moved into a new area, whereas young bulls and family groups took a long time (Druce et al., 2008).</p> <p>9. Young bulls have the largest home range sizes of all cohorts of bulls in areas with substantial opportunity for locomotion (Henley, 2014).</p>	<p>may be relatively further from established lodges (Slotow, pers. obs.).</p> <p>9. Because such areas previously had no elephants, when they move in, elephants select at-risk species of trees for feeding, leading to their quick reduction in the new areas (O'Connor, 2017; O'Connor &amp; Page, 2014).</p> <p>10. When new areas include a large river, elephants may spend a substantial amount of time there, impacting the high-value riverine vegetation (Slotow pers. obs.).</p> <p>11. When fences are not removed properly, they can become wire sources for snaring wildlife (Henley, pers. obs.).</p>
	<p>ESAG survey:</p> <p>1. 29 of the 46 reserves have managed to add substantial additional areas by connecting existing reserves, land purchases, and the incorporation of additional landowners into existing conservancies.</p> <p>2. Twenty-six reserves indicated the possibility of range expansion: five stated the potential to link with neighbouring reserves with elephants, which would not necessarily decrease densities but create economies of scale.</p>	<p>ESAG survey:</p> <p>1. The dropping of fences to become included in a larger system with elephants has resulted in increased elephant densities in those reserves and not decreased densities through expansion. Densities in some areas increased to very high levels, especially when rivers/water points became available to elephants and have raised concerns about the impact on habitat.</p> <p>2. In one reserve, elephants have moved into state land, which was not planned, and created contention around the ownership of elephants.</p>

	<p>3. Eighteen reserves indicated potential corridor opportunities. Where suggestions of potential corridors were proposed, most included a linkage to a state reserve.</p>	<p>3. As a result of interpersonal issues between owners, including over elephant management approaches, four reserves have raised fences within elephant areas.</p>
		<p>ESAG workshop:</p> <ol style="list-style-type: none"> <li>1. When former partners disagree, the fences need to be reinstated. This reduces the area accessible to elephants, which can result in the reserve not qualifying to have elephants in terms of the elephant N&amp;S.</li> <li>2. Issue of ownership of elephants.</li> <li>3. When you have water and attractive vegetation, more elephants end up on your property after the fence drops.</li> <li>4. Dropping fences to open up areas can rapidly increase elephant numbers which has a high impact on trees.</li> <li>5. Elephants killed an injured rhino after the fence dropped.</li> <li>6. Elephants damaged boundary fences and walked further than they were allowed to.</li> <li>7. “We are going to be judged on the success of expanding the range of elephants.” This highlights the importance of range expansion and implies potential unintended consequences if SA does not achieve expansion goals.</li> </ol>
<p>A3. Closure of water point</p>	<p>Literature review:</p> <ol style="list-style-type: none"> <li>1. The provision of artificial water sources increased elephant numbers where surface water was limited or nonexistent in the dry season (Druce</li> </ol>	<p>Literature review:</p> <ol style="list-style-type: none"> <li>1. The closure of artificial water points increases daily-displacement distances, affecting the welfare and survival of weaned calves (Young &amp; Van Aarde, 2010).</li> </ol>

	<p>et al., 2008; Owen-Smith et al., 2006). This suggests that artificial water point removal will be effective mainly in areas where elephants are severely water-limited (Chamaillé-Jammes et al., 2007a; 2007b).</p> <ol style="list-style-type: none"> <li>2. The closing of artificial waterholes can lead to the natural fluctuation of elephant numbers and natural spatial distribution, which helps to naturally control populations and reduce elephant impact on vegetation in certain areas (Chamaillé-Jammes et al., 2007a, 2007b).</li> <li>3. Depending on the context (e.g., in areas where water is limited and where elephant numbers are high), the closure of artificial water points greatly influences spatial use (as elephants have to walk long distances to access water) and can reduce population growth rates (Chamaillé-Jammes et al., 2007a, 2007b).</li> <li>4. The measure provides opportunities to remove the division between scientists, reserve managers, and the general public, thereby reducing polarisation in the conservation sector (Chamaillé-Jammes et al., 2007b).</li> </ol> <p>(+) As direct interference is avoided, the mental anguish of other heavy-handed or legislatively questionable methods is avoided (Chamaillé-</p>	<ol style="list-style-type: none"> <li>2. Removing artificial water holes increases thermal stress, as elephants need water to regulate their temperature (Thaker et al., 2019).</li> <li>3. Considering future impacts of climate change, including increasing temperatures which may cause rivers to dry up, this measure requires more research and careful monitoring when implemented (Smit et al., 2007).</li> <li>4. Closure of artificial water points away from rivers may not reduce elephant numbers and could, consequently, result in negative impacts on the vegetation and biodiversity if elephants concentrate along rivers (Chamaillé-Jammes et al., 2007).</li> <li>5. Artificial water point provision affects not only elephants but also other herbivores, especially water-dependent species (De Beer &amp; Van Aarde, 2008).</li> <li>6. The closure of artificial water points is likely to negatively impact the tourism potential of protected areas by restricting elephant movement only to areas with high water availability (e.g., Smit et al., 2007a; 2007b), but this critical issue is yet to be investigated.</li> <li>7. Some waterpoints (e.g., in KNP) were placed in the memory of deceased people, which may complicate removal due to human rights or the risk of causing social disharmony (Henley, pers. obs.).</li> </ol>
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	<p>Jammes et al., 2007b).</p> <p>(+) The limited number of water points may provide more productive wildlife sightings at these strategic points.</p> <p>(+) Sharing game sightings at limited strategically placed water points could call for greater cooperation between stakeholders who support the closure of water points (72.2% of respondents of a landowner questionnaire), for instance, among private landowners in protected areas (Elephants Alive data), although policies are required to plan who will close water holes (EGAG workshop).</p>	
		<p>ESAG workshop:</p> <ol style="list-style-type: none"> <li>1. If water holes in one area are closed, it will impact nearby areas.</li> <li>2. Policies are required about who will close artificial waterholes.</li> <li>3. In one area where water access was removed, the expected response did not happen.</li> </ol>
		<p>ESAG survey:</p> <ol style="list-style-type: none"> <li>1. 43 of the 46 reserves that participated in the survey have created artificial water holes, a combined 1,304 water holes.</li> </ol>
		<p>Elephants Alive data:</p> <ol style="list-style-type: none"> <li>1. 72.2% of respondents of a landowner questionnaire in a private reserve to the west of KNP and part of an open system supported the closure of water points.</li> </ol>

<p>A4. Fencing</p>	<p>Literature review:</p> <ol style="list-style-type: none"> <li>1. The benefits of wildlife fencing include increased landscape productivity, reduced conflicts between wildlife and humans, and prevention of mixing between wildlife and livestock, excluding wildlife use of particular areas that are sensitive to disturbance, and increasing landscape heterogeneity by inducing differential temporal use of certain parts of the landscape (Hayward &amp; Kerley, 2009; Hoare, 1992; Pekor et al., 2019; Slotow, 2012).</li> <li>2. Fencing reduces encroachment and poaching for bushmeat and other wildlife products (Hayward &amp; Kerley, 2009; Pekor et al., 2019).</li> <li>3. With regard to elephants, fencing is perceived as the most effective method for the containment of elephant populations within certain ranges and, thus, is an essential aspect of their management (Grant et al., 2008; Slotow, 2012).</li> <li>4. Fences change the way elephants use the landscape and can increase heterogeneity, for instance, by not having access to land on the other side of the fence and increased use near the fence (Slotow, 2012).</li> <li>5. In areas of high conflict, fences can prevent human death, increase mental</li> </ol>	<p>Literature review:</p> <ol style="list-style-type: none"> <li>1. In order for fencing to be effective against elephants, Protected Areas are required to have electrified perimeter fences meeting particular minimum standards (Grant et al., 2008; Slotow, 2012).</li> <li>2. Fragmentation of ecosystems, especially due to fences, has reduced migrations, leading to population declines of migratory species (Bartlam-Brooks et al., 2011) as well as reduced animal welfare (Hecht &amp; Allcock, 2020).</li> <li>3. Fences limit the mobility of elephants, causing fenced areas to be fragments within a larger landscape (Boone &amp; Hobbs, 2004).</li> <li>4. Shrader et al. (2010) found that fencing restricted elephant movement mostly in the wet season, the period in which they move widely across the landscape, as their ranging patterns are less limited by water and forage availability.</li> <li>5. The prevention of the dispersal of individuals from populations may exclude the natural processes that regulate the populations within particular levels in response to resource availability (Grant et al., 2008).</li> <li>6. Populations may overuse the resources within the fenced area, leading to catastrophic declines and even local extinctions within the fenced area (Hayward &amp; Kerley, 2009).</li> <li>7. Fences can cause a double-edge effect on vegetation; populations may overuse</li> </ol>
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	<p>health, and decrease community costs, such as guarding crops or livestock and risks of infectious diseases (Di Minin et al., 2021b).</p> <p>6. Fencing can avert road kills by directing wildlife toward underpasses and other accidental mortality (Clevenger &amp; Waltho, 2000).</p> <p>7. Fencing eases the management of protected areas and can create jobs for communities in fence installation and maintenance (Pekor et al., 2019).</p> <p>8. Reduced disease transmittance from other species, e.g., from buffalo to domestic animals or other wildlife (Pekor et al., 2019).</p>	<p>resources within the fenced area leading to catastrophic declines and degradation of resources, and lack of dispersal may cause no recovery time in small reserves (Hayward &amp; Kerley, 2009).</p> <p>8. Fences may restrict the immigration of individuals into the population, leading to a collapse in gene flow between populations, which will threaten the genetic processes critical to the maintenance of heterozygosity and the evolution of such populations (Hayward &amp; Kerley, 2009).</p> <p>9. Fencing may also threaten metapopulation-level processes whereby local population extinction is offset by recolonisation, and gene flow maintains high levels of heterozygosity (Hayward &amp; Kerley, 2009).</p> <p>10. Loarie et al. (2009) demonstrated that fences cause elephants to bunch up against them and can, thus, increase the local impact on vegetation.</p> <p>11. The confinement of herbivores to small sections of the broader landscapes can reduce the area's carrying capacity and, thus, is a potential source of massive population declines and, ultimately, extinction (Pekor et al., 2019).</p> <p>12. Fences may cause wildlife to be unable to escape predators, which may alter predators' foraging behaviour. This can result in predators killing larger prey and animals in better condition than usual, potentially comprising the fitness of prey populations (Davies-Mostert et al., 2013). Fence-</p>
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		<p>enhanced kills also offered more prey biomass per unit hunting effort, suggesting that it may lead to the explosion of predator populations and subsequent decimation of prey, which may have ecosystem-wide consequences (Davies-Mostert et al., 2013).</p> <p>13. Elephants are very good at breaking fences, even electrified ones, by snapping or pushing over poles or using tusks to snap electrical wires (Grant et al., 2008; Slotow, 2012).</p> <p>14. Learned fence-breaking behaviour is challenging to correct, and the animal becomes a habitual fence-breaker and often needs to be euthanised as a damage-causing animal (Slotow et al., 2008).</p> <p>15. Fence-breaking necessitates the repair and capturing of escaped animals and may be costly even in terms of subsequent damage elephants may cause to crops in neighbouring communities, thus exacerbating human-elephant conflicts (Hayward &amp; Kerley, 2009).</p> <p>16. Fencing causes elephants to be unable to offset local food shortages by shifting their spatial distribution (Shrader et al., 2010). Consequently, their survival becomes more dependent on rainfall patterns, potentially causing mass mortalities during periods of drought (Wato et al., 2016).</p> <p>17. In areas where elephants are excluded, the vegetation can increase unchecked, leading to higher predation pressures (Dupuis-Desormeaux et al., 2016). Predation pressure</p>
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		<p>was enhanced in the 50 m radius around the fence, causing an edge effect, which reduced the effective area of the reserve (Dupuis-Desormeaux et al., 2016).</p> <p>18. By preventing migratory movements, fencing can eliminate natural processes as regulators of species populations within particular bounds of resource availability levels (carrying capacity) (Hayward &amp; Kerley, 2009).</p> <p>19. Fences separate people from nature, influence relations with place, restrict the use of natural resources, and can lead to spatial injustice and inequality (Abrams, 2022; Thakholi, 2021).</p> <p>20. Erection of fences between communities and wildlife areas can cause conflict if proper consultation is not undertaken (Di Minin et al., 2021b).</p> <p>21. Areas of high aesthetic value to tourists, such as along riverine areas, may be compromised by fencing (Slotow, 2012).</p> <p>22. Electric fences cause the mortality of vulnerable, sometimes critically endangered, species (e.g., tortoises, pangolins). For instance, 8.67 dead leopard tortoises (<i>Stigmochelys pardalis</i>) were found per km of electric fence, indicating strong negative consequences for population survival (Holt et al., 2021; Lee et al., 2021). The mortality rate of pangolins (<i>Smutsia temminckii</i>) is one pangolin per 11 km of electric fence annually, making electrocution possibly the</p>
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		greatest threat to this critically endangered species (Pietersen et al., 2014).
	ESAG workshop: Young bulls cause problems and experiment with fences – a single positive strand hanging over the fence prevented them from moving through.	ESAG workshop: 1. Fence costs are higher when a reserve has elephants.
		Reserve data: 1. Reserve B (2016-2017): Break-ins/outs ceased after repairing fences and gate electrics or raising fences to 2.4m.
A5. Militarised anti-poaching	Literature review: 1. The militarisation of anti-poaching contributes to reducing poaching (Chapron & López-Bao, 2019; Mogomotsi & Madigele, 2017) and protects animal welfare in general. 2. Reduction of poaching positively affects habitat and biodiversity (Chapron & López-Bao, 2019); protecting it increases resilience.	Literature review: 1. Militarised anti-poaching can indirectly cause environmental harm (Duffy et al., 2019; Van de Water et al., 2022a; Witter, 2021), which will, in-turn affect animal well-being through the negative impact on life-sustaining processes. 2. Exclusionary and militaristic conservation approaches can create challenges in the form of violation of human rights, social inequality, the undermining of local incentives to conserve wildlife, and compromised overall sustainability (Booker & Roe, 2017; Büscher & Ramutsindela, 2015; De Leeuw et al., 2018; Duffy, 2019; Witter, 2013). 3. A reduction of subsistence poaching (e.g., bush meat) could affect human well-being, where local people are dependent on bush meat as their source of protein and resentment of conservation policies

		<p>prioritising the lives of wildlife over the lives of local people (Strong &amp; Silva, 2020).</p> <ol style="list-style-type: none"> <li>4. The intervention risks physical and psychological harm to people (death, injury, and mental health issues). Disruption of families, sense of loss and resentment when wildlife security people get killed or assassinated as well as when poachers are killed, and families lose a breadwinner, causing acute and long-term vulnerability for women and children (“the crisis of widows”) (Massé et al., 2021).</li> <li>5. Prohibition of subsistence hunting (e.g., bush meat) negatively affects human well-being through lack of access to protein and resentment from conservation policies prioritising wildlife over local people’s lives (Strong &amp; Silva, 2020).</li> <li>6. By not addressing the causes of poaching, the inequality of strictly excluding local people may give them a moral justification to engage in wildlife poaching (Garland, 2008; Witter, 2021).</li> </ol>
<p>B6. Population control: contraception (oestradiol &amp; pZP)</p>	<p>Literature review:</p> <ol style="list-style-type: none"> <li>1. The oestradiol treatments of 10 cows in Kruger Park resulted in the cows not falling pregnant for a year (Bertschinger et al., 2008).</li> <li>2. Treatment of elephants with pZP was found to successfully control their birth rates, with reported efficacies of up to 80% (Delsink et al., 2007).</li> <li>3. In the Greater Makalali Private Game Reserve, the pZP application was</li> </ol>	<p>Literature review:</p> <ol style="list-style-type: none"> <li>1. The ten cows treated with oestradiol in Kruger Park were in oestrus for 12 months, which created behavioural problems in the herds. This option was discontinued and is no longer an option for the contraception of elephants (Bertschinger et al., 2008).</li> <li>2. One issue with pZP vaccination is that boosters are necessary, which may increase the costs associated with this procedure (Delsink et al., 2013a).</li> </ol>

	<p>demonstrated to be 100% effective in reducing population growth (Bertschinger &amp; Caldwell, 2016; Delsink et al., 2006).</p> <ol style="list-style-type: none"> <li>4. In a long-term pZP application program in Makalali, the success and the reversibility of the pZP technique were confirmed (Delsink et al., 2013a).</li> <li>5. In a study at Thornybush Private Nature Reserve (South Africa), two years after the initiation of pZP vaccination, complete functionality in the ovary in over half of the treated elephants was indicated (Ahlers et al., 2012).</li> <li>6. pZP appears to cause no harm to pregnant females or the foetuses at any stage of their development (Bertschinger et al., 2018), suggesting that it is unlikely to have negative effects when applied inadvertently on pregnant females.</li> </ol>	<ol style="list-style-type: none"> <li>3. Due to pZP immunocontraception, there could be an increased adult female-to-male ratio due to disproportionate male mortality from various causes (Bertschinger et al., 2008).</li> <li>4. A population-level consequence of pZP immunocontraception is an ageing population (Bertschinger, 2008); notably, the subsequent increased population-level mortality from senescence would be beneficial in the context of long-term population reduction.</li> <li>5. There may be unintended effects of pZP immunocontraception on genetic diversity, and monitoring and research on this are required (Bertschinger et al., 2008).</li> </ol>
	<p>ESAG workshop:</p> <ol style="list-style-type: none"> <li>1. The intervention worked well without complications.</li> <li>2. Contraception was successful, slowed down the growth rate, and stabilised the population.</li> <li>3. In the long term, the young age structure could be corrected by contraception.</li> </ol>	<p>ESAG workshop:</p> <ol style="list-style-type: none"> <li>1. Risk of altering the genetics of the population.</li> <li>2. Loss of cultural information transmission (if cows do not have offspring, they may not transfer the collective knowledge. Decreasing knowledge of the population in the future).</li> <li>3. Releasing chemicals and altered hormonal levels into the water system.</li> </ol>

	<p>4. It has stabilised elephant populations, but unclear if the impacts on biodiversity have been reduced.</p> <p>5. Rotation of individuals who receive contraception.</p>	<p>4. Contraception should be given as soon as possible based on our expectation of when elephants first breed, but young cows had calves younger than expected.</p> <p>5. Elephants are more regularly exposed to stress effects from helicopters, which causes stress.</p> <p>6. Issues with allomothering.</p> <p>7. The cohesion of the groups in the short term can be affected.</p> <p>8. In an open system, contraceptive management may not be viable.</p> <p>9. Wasting a resource that could be hunted or consumed.</p>
		<p>Reserve data:</p> <p>1. Reserves A-F (2004-2020): The darting from a helicopter and treatment of 2,657 elephants with pZP immunocontraception went smoothly, without any complications noted. Three of the 39 contraception interventions recorded difficulty relocating specific herds needing a booster.</p>
<p>B7. Contraceptives &amp; problematic bull behaviour (GnRH)</p>	<p>Literature review:</p> <p>1. GnRH treatment could effectively suppress elephant aggression in small, fenced reserves, which may prevent killing elephants as DCA (it must be ensured that there is no chance that bulls treated with GnRH will encounter non-treated elephants that could challenge them (Zungu &amp; Slotow, 2022)).</p>	<p>Literature review:</p> <p>1. GnRH can lead to reduced muscle growth, feminisation of males, reduced ability of elephants to defend themselves and mate, reversal or disruption of dominance hierarchies, and physiological effects on olfactory function as well as throughout the central nervous system which are likely to affect a range of bodily functions, with serious consequences for individual health and reproduction (Garaï et al., 2018;</p>

	<p>2. GnRH has been shown to contracept male elephants, effectively a chemical castration (Bertschinger &amp; Caldwell 2016; Bertschinger &amp; Lueders, 2018; Leuders et al., 2017).</p>	<p>Kirkpatrick et al., 2011; Lueders et al., 2014).</p> <p>2. Calving continued to occur in the population, suggesting that subordinate sub-adults were fathering the calves (Garai et al., 2018), raising concerns about the fitness prospects of the population (Doughty et al., 2014).</p> <p>3. GnRH was not necessarily developed to be reversible, so the threshold application level at which it will produce permanent infertility is unknown (Lueders et al., 2014).</p> <p>4. A problem associated with GnRH is acute swelling and inflammation post-surgery (Lueders et al., 2014).</p> <p>5. GnRH application in pregnant animals may lead to abortion for species relying on the luteinising hormone (LH) for maintaining corpus luteum during pregnancy (Kirkpatrick et al., 2011).</p> <p>6. Following a decline in elephant births after treatment with GnRH, males were spending more time with female herds, causing more harassment to females (Doughty et al., 2014).</p> <p>7. GnRH can lead to a severe negative impact on cardiac function, and blocking GnRH production can increase the risk of coronary infarction.</p> <p>8. Effects after taking bulls off the vaccine could equally have negative consequences as the pituitary gland activates again. This may cause initial testosterone levels to be</p>
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		<p>very high, leading to lengthened musth periods, potentially leading to increased aggression, along with renewed disruption of dominance hierarchies (Mitchell, pers. obs.).</p> <p>9. GnRH emasculates bulls (Garaï et al., 2018), reducing their symbolic and spiritual standing (ESAG workshop).</p>
		<p>ESAG workshop:</p> <ol style="list-style-type: none"> <li>1. Loss of cultural information transmission: if cows do not have offspring, they may not transfer the collective knowledge, which leads to a decrease in knowledge in future populations.</li> <li>2. Contraception can affect herd cohesion in the short term.</li> <li>3. In an open system, contraceptive management may not be viable.</li> <li>4. Through contraception, a resource that could be hunted or consumed could be wasted.</li> <li>5. Experiences with GnRH treatment to control problematic bull behaviour have shown no effect and have caused younger bulls to attack/kill bulls on GnRH as they lose their willingness to fight.</li> </ol>
	<p>ESAG survey:</p> <p>Of the 11 reserves that stated to have used GnRH on bulls, nine said that aggression decreased, two mentioned suppressed musth, and two noted a shift in dominance.</p>	<p>ESAG survey:</p> <ol style="list-style-type: none"> <li>1. A 20-25-year-old bull taken off GnRH killed a guide on foot. The reserve suspected this was due to a ‘hormonal surge’ after not being treated with GnRH for a year (he was treated every five months in the seven years before). They reported</li> </ol>



	<p>that he had been in musth for over two months and chased and charged vehicles. The decision was taken to apply for a DCA permit because they feared that he might kill another person.</p> <ol style="list-style-type: none"> <li>2. A 45-year-old bull was hunted, as two GnRH treatments did not work. After GnRH treatment, he attacked vehicles and killed a rhino.</li> <li>3. An 18-a 22-years-old bull that rolled a vehicle and attempted to roll another two vehicles received three GnRH treatments. He initially calmed down but went into musth and became very aggressive, charging vehicles and rhinos. He was killed for safety concerns.</li> <li>4. A dominant bull that had killed a younger bull was treated with two doses of GnRH when younger bulls started injuring him, causing severe wounds.</li> <li>5. Adult bulls that received GnRH on a 5-monthly basis since 2007 were tested and found to be sterile after GnRH use.</li> </ol>
	<p>Provincial data:</p> <ol style="list-style-type: none"> <li>1. A reserve applied 3x for a DCA permit to destroy a subadult bull. The province did not find excessive damage and suspected the permit application might be due to the carry capacity number in the management plan (i.e., culling instead of DCA control). On the advice to try alternative interventions first, the landowner claimed that GnRH was not working.</li> </ol>

B8. Vasectomy	<p>Literature review:</p> <ol style="list-style-type: none"> <li>1. Of the 45 free-ranging elephants subjected to vasectomy in seven nature reserves in South Africa, 42 showed no complications and no abnormal behaviour (Marais et al., 2013).</li> <li>2. Vasectomy only needs to be implemented once, as opposed to several treatments for immunocontraception, which limits the stress caused to elephants (Marais et al., 2013; Rubio-Martínez et al., 2014).</li> <li>3. At present, vasectomy is unlikely to have behavioural consequences for treated individuals (Garaï et al., 2018).</li> <li>4. Vasectomies are a low-risk and cost-effective elephant management tool because it is a one-time treatment (Zitzer &amp; Boulton, 2018).</li> </ol>	<p>Literature review:</p> <ol style="list-style-type: none"> <li>1. After vasectomy, large intestine lacerations were seen in elephants, but these healed without any complications (Rubio-Martínez et al., 2014).</li> <li>2. If only dominant males, and not all mature males, are vasectomised, sub-adult males may succeed in breeding (Garaï et al., 2018), reducing population fitness (Doughty et al., 2014).</li> <li>3. Of the 45 free-ranging elephants that had a vasectomy in South Africa, one died, and two others had surgery complications (Marais et al., 2013).</li> <li>4. No studies have been assessed on the demographic responses to vasectomy nor the reversibility (Zungu &amp; Slotow, 2022).</li> <li>5. Vasectomy may be ineffective in larger populations or when not all males are vasectomised, as young animals could inseminate females, which may reduce population fitness (Doughty et al., 2014; ESAG workshop; Garaï et al., 2018; Nolan, 2019).</li> <li>6. Vasectomy emasculates bulls, reducing their symbolism and spiritual standing (albeit to a lesser extent than GnRH contraception or control of problematic bull behaviour).</li> <li>7. The public dislikes invasive interventions, which can reduce support for conservation (e.g., Edge et al., 2017).</li> </ol>
		<p>ESAG workshop:</p> <ol style="list-style-type: none"> <li>1. It did not slow down the growth rate (younger bulls started to breed).</li> </ol>

		<ol style="list-style-type: none"> <li>2. Other bulls broke in from neighbouring reserves and defeated the purposes. The vasectomised bulls did not sire the calves.</li> <li>3. Contraception can affect herd cohesion in the short term.</li> <li>4. In an open system, contraceptive management may not be viable.</li> <li>5. Through contraception, a resource that could be hunted or consumed could be wasted.</li> </ol>
<p>B9. Translocation</p>	<p>Literature review:</p> <ol style="list-style-type: none"> <li>1. Translocation has been used for a wide range of wildlife applications, such as reducing human-wildlife conflicts, reintroducing rare species, and introducing species to former ranges (Fischer &amp; Lindenmayer, 2000).</li> <li>2. Translocation provides educational opportunities and opportunities to develop wildlife-based tourism and create jobs in areas where elephants have been introduced (ESAG workshop; Naidoo et al., 2016; Selier et al., 2016; Slotow et al., 2005).</li> <li>3. Limited home range size, low food availability, and unfavourable habitat conditions cause elephants to encroach into surrounding farmland as there are no corridors over which they can move safely and freely from human disturbance (Daim, 1995). Consequently, translocation has been proposed to avert these problems</li> </ol>	<p>Literature review:</p> <ol style="list-style-type: none"> <li>1. Although translocation is ethically appealing, this approach is considered not to be a practical solution to reduce elephant numbers in large populations because translocation is associated with high costs and is cumbersome to conduct (Daim, 1995).</li> <li>2. Populations founded on translocated individuals tend to show abnormal population structures (e.g., unbalanced sex ratios, a disproportionately high proportion of adults and sub-adults, etc.) (Slotow et al., 2005).</li> <li>3. Slotow et al. (2005) studied introduced elephant populations across South Africa and found that these populations reproduced at rates far above average.</li> <li>4. Kuiper et al. (2018) found that introduced/translocated elephants in Hluhluwe-Imfolozi Park showed rapid (exponential) population growth, with the elephant population size doubling every ten years.</li> </ol>

	<p>(Dalm, 1995; Fischer &amp; Lindenmayer, 2000; Wambwa et al., 2001).</p> <p>4. Young male bulls exhibited a heightened and prolonged state of musth when older bulls were not around to suppress their musth patterns. Consequently, these bulls exhibited aggressive behaviours towards other species, especially rhinos. The introduction of older males to reduce the duration and the onset of musth has thus become a critical intervention to reduce the occurrence of these abnormal behaviours (Slotow et al., 2005).</p> <p>5. Chronic stress does not lead to failure of the translocation attempt: it is a necessary evil of the translocation process (Dickens et al., 2010).</p> <p>6. The only behavioural study of the elephants on the donor reserve from which they were translocated detected no unintended consequences from two removals of family groups (Druce, 2012).</p> <p>7. Trophic rewilding principles can be applied by using elephants as a strategy to restore trophic interactions and ecological resilience (Gordon et al., 2023, Svenning et al., 2016; Van de Water et al., 2020).</p>	<p>5. Animals are subjected to chronic stress, and when exposed to chronic stress levels, the physiological and behavioural responses to stress cease to be beneficial to survival but become detrimental (Dickens et al., 2010).</p> <p>6. The effect of stress is indirect by causing increased vulnerability of individuals to factors that directly cause translocation failure, such as disease, predation, starvation, decreased reproductive capacity, or dispersal away from the release site (Hambrecht et al., 2020; Teixeira et al., 2007).</p> <p>7. Following the transportation of elephants during translocation, faecal glucocorticoid levels increased significantly, indicating stress (Fanson et al., 2013; Millspaugh et al., 2007; Viljoen et al., 2015; Viljoen et al., 2008).</p> <p>8. Translocated elephants display 'homing' behaviour, whereby translocated individuals return back to the initial capture site (Fernando, 2015). On their return journey, individuals may be experiencing stress due to moving over unfamiliar territory (Hambrecht et al., 2020), and there have been reports of aggressive behaviours that resulted in human deaths (Fernando, 2015).</p> <p>9. Studies conducted in Sri Lanka and Kenya on translocated elephants showed that all the translocated individuals left the areas they were translocated to, with some returning to the capture site more than 100 km away</p>
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		<p>(Fernando et al., 2012; Pinter-Wollman, 2009).</p> <p>10. Some of these translocated elephants spent some time wandering about in the release site, and many moved into adjacent highly populated areas, elevating the level of human-elephant conflict there (Fernando, 2015; Fernando et al., 2012).</p> <p>11. Translocated elephants have been shown to kill a far higher percentage of people than non-translocated elephants, and consequently, they experienced a higher mortality rate (Fernando, 2015; Fernando et al., 2012).</p> <p>12. Translocation, instead of solving the human-elephant conflict, rather amplifies and spreads it over large areas, compromising both human-elephant conflict mediation and elephant conservation (Fernando et al., 2012).</p> <p>13. Elevated stress hormone levels were reported in reintroduced elephants in five Protected Areas in South Africa even 24 years after the initial release, suggesting that post-release, animals require a long period of time to acclimate to the new conditions (Jachowski et al., 2013b).</p> <p>14. Chronic stress leads to reduced space use and alters habitat preferences in elephants, which can affect their ability to attain a healthy nutritional state (Jachowski et al., 2012).</p> <p>15. One young elephant was reported to have died following release, likely due to stresses</p>
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		<p>associated with translocation and long, continuous movements of the family group after release (Jachowski et al., 2012).</p> <p>16. Translocated elephants have a higher mortality rate (Pinter-Wollman et al., 2009).</p> <p>17. Elephants with elevated stress response exhibited refuge behaviour (Jachowski et al., 2012; Woolley et al., 2008), which can reduce tourist viewing experiences, lead to aggressive encounters with humans (Jachowski et al., 2012), and can lead to extensive habitat degradation (Lagendijk et al., 2011).</p> <p>18. There is also a risk of breakout at the release reserve, especially if the translocation elephants are not used to electric fences (Grobler et al., 2008).</p> <p>19. Following elephant introduction, elephants accounted for more than 63% of tree death in Venetia-Limpopo Nature Reserve, South Africa (O'Connor, 2017).</p> <p>20. One population of trees was eliminated, with many remaining vulnerable to extirpation due to high adult tree mortality and poor regeneration (O'Connor, 2017).</p> <p>21. The composition, structure, and diversity of woody vegetation were transformed by elephant impacts, leading to a less complex community (Howes et al., 2020; O'Connor, 2017; O'Connor &amp; Page, 2009).</p> <p>22. In an enclosure experiment at Phinda, reintroduced elephants, in combination with Nyala (<i>Tragelaphus angasii</i>), strongly</p>
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		<p>reduced the recruitment of threatened sand forest species (Lagendijk et al., 2011).</p> <p>23. Translocation of smaller groups results in social disruption and breakdown of social networks (Wittemyer et al., 2005), which in turn results in cultural loss, loss of environmental and social knowledge and may impede social competence (Whiten, 2017; Whitehead, 2010; Foley et al., 2008; Shannon et al., 2003; Kalcher-Sommersguter et al., 2013).</p> <p>24. Small, translocated groups will most likely reproduce faster (rebound effect), which may be undesirable, as females start breeding at a younger age with shorter interbirth intervals (Hein &amp; Jacob, 2015; Foley &amp; Faust, 2010; Belsky et al., 2016; Lee et al., 2021).</p> <p>25. Reduced fitness through stress can affect the sex ratio of offspring, as breeding mammals can manipulate the sex ratio to maximise their fitness (Clutton-Brock &amp; Iason, 1986; Trivers &amp; Williard, 1973). The results thereof may not be desirable to managers.</p> <p>26. Early life experiences, even before conception, can be transmissible to subsequent generations (Burton &amp; Metcalfe, 2014). Studies on epigenetic modifications of DNA reveal that these effects occur during the individual's lifetime, are stable, and are passed on transgenerationally (Jensen, 2013).</p> <p>27. These epigenetic effects and changes influence subsequent genes and may be</p>
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		<p>favourable or not. Genetic bottlenecks decrease the adaptability of populations (Whitehouse &amp; Hall-Martin, 2000; Zippel et al., 2019).</p>
	<p>ESAG workshop:</p> <ol style="list-style-type: none"> <li>1. Goals for translocation were achieved.</li> <li>2. Establishment of new populations.</li> <li>3. Elephant range expansion.</li> <li>4. As a flagship species, the introduction of elephants creates benefits for other species.</li> <li>5. An expert group was available to guide and give directions, which can also inform elephant management plans.</li> <li>6. It provides opportunities to learn about elephants and their impact.</li> <li>7. The country builds up a good reputation.</li> <li>8. Stopped culling – scored brownie points.</li> </ol>	<p>ESAG workshop:</p> <ol style="list-style-type: none"> <li>1. Long-term effects on social behaviour. Stress levels in individuals persist for years.</li> <li>2. Strange herd dynamics, and the young age structures are still present. The initial founder populations were not balanced in terms of age and sex.</li> <li>3. Strange (reduced) use of available range (e.g., elephants are only using 20% of the area available to them, and they moved to an area far away from the boma where they were released).</li> <li>4. When elephants are removed from larger, open systems, other elephants will move into the area. A costly intervention, but it is not clear if it will reduce elephant numbers.</li> <li>5. Increased aggression and tree pushing (especially if young and only a few individuals were translocated).</li> <li>6. Negative impact on tourism from strange elephant behaviour.</li> <li>7. Rapid population growth.</li> <li>8. Expensive.</li> <li>9. Risk of disease and parasite translocation (reserves restricted by TB restrictions).</li> <li>10. Genetic dilution of subspecies.</li> <li>11. Problems of bush encroachment [at reserve of origin] have not been solved, although this could be because of other management</li> </ol>



		<p>actions being withheld (fire has been kept out for 30 years).</p> <p>12. Did not anticipate the ecological damage caused by introduced elephants.</p> <p>13. Underestimate the amount of grass elephants eat, which may have consequences for grazers.</p> <p>14. Elephants hammered the land, which led to erosion.</p> <p>15. The impact on biodiversity [at the reserve of origin] was not reduced, so the investment may not be valuable.</p> <p>16. The inter-species competition was not anticipated – an elephant killed a rhino.</p> <p>17. Impact on infrastructure if not prepared/managed well (e.g., water pipes, electric cables).</p> <p>18. Tourism did not increase after the introduction of the elephants; there was not enough tourism development to take advantage of the elephant introduction.</p> <p>19. Issues with the community.</p> <p>20. The objectives were vague, and no actual risk assessment was done. Therefore, the reserve has to deal with the consequences later.</p> <p>21. The reserve did not anticipate the difficulties and challenges of keeping elephants.</p> <p>22. Lack of knowledge about managing elephants or the history of the elephants there were moved.</p> <p>23. The reserve did not anticipate how difficult it was to implement elephant management actions.</p>
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		<p>24. The reserve became stricter, which made management more difficult.</p> <p>25. All resources got directed to focusing on elephants. This distracts from the other activities and has severe effects on shareholders – specifically open areas.</p> <p>26. Devaluing elephants is reducing the ability to expand their range.</p>
	<p>Reserves data:</p> <ol style="list-style-type: none"> <li>1. Reserve A (2003): Three older bulls that were translocated to a new reserve to increase the presence of mature bulls successfully contributed to correcting the abnormal age structure of the population.</li> </ol>	<p>Reserves data:</p> <ol style="list-style-type: none"> <li>1. Reserve A (1990-1999): Three out of the four translocations that occurred in the 90's involved elephant deaths during transit, during offloading, or soon after release when an elephant was killed as a DCA.</li> <li>2. Reserve A (1991): 17 orphans were translocated; one animal died in transit.</li> <li>3. Reserve A (1993): One calf died in transit and another one from injuries sustained during offloading.</li> <li>4. Reserve A (2003): Two elephants died during the darting operation (one fell on its truck after darting, and one died during loading from respiratory distress).</li> <li>5. Reserve C (2018): Four bulls that were part of the herd that was translocated were left behind. It was strongly suspected that they killed a black rhino cow and a white rhino bull nine days after the capture event. It was stated that for future translocations, entire herds should be moved, and no individuals should be left behind.</li> <li>6. Reserve E (2018): One mortality occurred during the translocation of 30 elephants.</li> </ol>

		<p>7. Reserve F (x): Unnatural elephant population structure (lacking 45+ age class and containing a disproportionate number of elephants in the 26–30-year age class) can result in problematic bull behaviour, as the absence of older animals has been shown to cause severe aggressive behaviour.</p>
<p>C10. Damage Causing Animal (DCA) control</p>	<p>Literature review:</p> <ol style="list-style-type: none"> <li>1. Killing a DCA elephant may be appropriate in cases of severe injury or animals that cause danger to human life if the DCA can be accurately identified (Hoare, 2001; Hoare, 2012; Hoare, 2015).</li> <li>2. DCA control is a quick and cheap way to temporarily decrease the risk of elephant aggression toward people and improve community relations (Hoare, 2012), as people may feel that their lives and livelihoods matter and are protected.</li> <li>3. DCA permits prevent disease transmittance for other species as fences remain more intact and fortified reserve management can continue (Chaminuka et al., 2012).</li> </ol>	<p>Literature review:</p> <ol style="list-style-type: none"> <li>1. As the routine killing of DCA animals has been evaluated as ineffective or as not needed (e.g., Reserve data shows that the majority of escaped elephants returned on their own or could be chased back), DCA strategies should not rely on killing (Hoare, 2015).</li> <li>2. The intervention carries a high risk of misidentifying DCA elephants (ESAG survey), which may lead to killing another elephant to satisfy the affected people (Chiyo et al., 2011; Hoare, 2012).</li> <li>3. DCA control prevents elephant dispersal to other areas (e.g., an elephant that moves out of a protected area risks DCA control), which affects natural living.</li> <li>4. Revenues from hunted animals are to be distributed to affected communities, which are often not disbursed (e.g., Anthony et al., 2010).</li> <li>5. DCA conflicts can be perceived as from colonial times (Hoare, 2012) and often reflect larger conflicts of human value, interests, and class (McGregor, 2005).</li> <li>6. There are a number of governance concerns around managing DCAs and involve</li> </ol>

		<p>conflicts between institutions (e.g., between the provincial government and traditional authorities) as much as conflicts with animals, with issues around inequality, trust, inadequate response time and reporting, weak and sometimes competing institutions, and corruption (Anthony et al., 2010).</p> <p>7. The damage caused by elephants is often not mitigated by killing the ‘problem elephant,’ as other elephants may have learned this behaviour and will continue the problematic behaviour (Chiyo et al., 2011; Hoare, 2001).</p> <p>8. Loss of research, institutional knowledge of migratory paths between transfrontier conservation areas, and investment when collared roaming elephants are destroyed (Henley, pers. obs.).</p> <p>9. Reputational risk if one country has allowed for movement paths to be forged and then the animal is shot as DCA in neighbouring countries (Henley, pers. obs.).</p> <p>10. People from local communities are not allowed to hunt as many DCA elephants as private landowners can, which raises concerns over equality.</p> <p>11. Ecological functioning and ecosystem services are affected as DCA control prevent elephant-based ecosystem services, such as seed dispersal, nutrient transfer, path opening, etc. (Bunney et al., 2017; Haynes, 2012; Kerley et al., 2008).</p>
	<p>ESAG workshop</p> <p>1. Meat from DCA culls can contribute to building relations with</p>	

<p>communities by handing out meat to schools.</p>	
	<p>ESAG survey</p> <ol style="list-style-type: none"> <li>1. The motivation for DCA was mainly aggression toward people and infrastructure damage, but also there was also a strong motivation for generating income through DCA hunting, which creates a bias in conservation decisions.</li> </ol>
	<p>Reserves data</p> <ol style="list-style-type: none"> <li>1. Reserve A (1996): A bull in musth was shot in self-defence after he attacked guests on foot. (It can be assumed that this has unintended consequences for tourism).</li> <li>2. Reserve A (1996): A cow attacked a film crew on foot in an effort to protect her calf, after which the cow was shot with her calf at her side. The calf died one month later (unintended consequences for animal well-being).</li> <li>3. Reserve B (2017-2020): 44 incidences of elephants breaking out of the reserve were registered, of which 39x helicopters were used to chase the elephants back to the reserve, 2x elephants were chased back on foot, and 3x the elephants were culled by the section ranger.</li> </ol> <p>Reserve C (2017-2020): 24 incidences of elephants roaming outside of the reserve were recorded. In all cases, the elephants were successfully chased back by helicopter, but the outcome seemed temporary, possibly related to an unfenced boundary.</p>

		<p>Provincial data</p> <ol style="list-style-type: none"> <li>1. The Limpopo Department of Economic Development, Environment and Tourism (LEDET) provided us with electronic spreadsheets of DCA incidents with elephants in Limpopo province, which included a total of 470 reported DCA cases that occurred between 2015-2020.</li> <li>2. The 470 reported DCA cases that occurred between 2015-2020 resulted in the following intervention events: 55 culls, one unsuccessful cull, 15 hunts, five unsuccessful hunts, and 27 cases where permits were issued for hunting, but the outcome was unclear.</li> <li>3. Of the 470 DCA applications, 66 cases mentioned ‘threat to human life’ as the nature of the problem. This concerned five cases of elephants roaming on farmland, four cases of elephants causing damage within the reserve, and 57 cases of elephants roaming on communal land. In 15 of these cases, the elephants were hunted (1x by a community hunter), four were shot and injured but not killed, and one elephant was found dead on communal land without tusks. The rest of the elephants that were a threat to human life returned on their own or could not be found.</li> <li>4. One threat to human life DCA application was based on an elephant’s footprint on communal land.</li> <li>5. Of the 430 elephants that broke fences, roamed in communal/farming areas, or on</li> </ol>
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		<p>roads or villages, the majority (39,5%) returned on their own, while 15,6% of the elephants were chased back, 14.7% were successfully hunted, 2.3% were attempted to be hunted, and in two cases elephants were injured but not killed during the hunt. In one case, it was suspected that the injured elephant was found dead on communal land a week later, with the tusks removed).</p> <p>6. In 17 cases, managers went out to cull DCA elephants but failed because the elephants had already returned or could not be located.</p> <p>4. After one inspection, it was reported that a DCA elephant did not cause a serious problem and assumed that the application for a DCA permit was an excuse to hunt elephants.</p> <p>5. Of the 26 DCA applications related to damage to infrastructure, 42.3% of the elephants were chased back.</p> <p>6. In one area where elephants escaped, the elephants were captured and translocated to a captive venue, which may have contravened the Norms &amp; Standards for the management of elephants in South Africa.</p> <p>7. The approval to destroy a DCA elephant due to concerns of injury to people on the ground/ damage to property did not comply with Norms &amp; Standards for the management of elephants in South Africa, which resulted in staff being suspended for this action.</p> <p>8. A reserve applied 3x for a DCA permit to destroy a subadult bull. The province did not</p>
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		<p>find excessive damage and suspected the permit application might be due to the carry capacity number in the management plan (i.e., culling instead of DCA control).</p> <p>9. Northwest Province Department of Economic Development, Environment, Conservation &amp; Tourism (DEDECT) provided a spreadsheet with five DCA incidents, which included data on the culling of one breakout and one DCA elephant from a state-owned reserve, and two breakout elephants and one DCA from a privately-owned reserve.</p>
		<p>Elephants Alive research data:</p> <ol style="list-style-type: none"> <li>1. A collared elephant that broke into a private reserve was shot while no provincial officer was present, and no wardens or researchers were notified. The landowner failed to present an official permit and did not take the initiative to return the collar. It was suspected that the elephant was hunted for monetary gains.</li> <li>2. When a group of bulls escaped a protected area, a provincial officer decided to shoot the biggest bull, believing that the rest of the bulls would flee back to the protected area. When the elephants were not moving after he shot the biggest bull, he proceeded to shoot all of them, including one young, collared bull. Six elephants were shot, but later it became evident that two other bulls were likely part of this group. The handling of this situation indicates a lack of understanding of elephant behaviour, as</li> </ol>



	<p>young bulls would not leave older individuals, especially the ones who had led them there.</p> <p>3. Following the above incident, two bulls that were part of the escaped group were found on the road at night. One bull broke two of his legs when he was involved in a collision with a vehicle and was consequently euthanised. The other bull later also caused a serious accident with a vehicle with tourists a distance away from where the other bull was euthanised. These bulls were more than likely in a state of shock, as they would probably be traumatised from the shooting incident and were potentially dangerous. This shows that if it was handled differently, these threats to human and animal lives would not have occurred.</p> <p>4. A crowd of people came to assist when an elephant was hit by a vehicle. Although initially stressed, the elephant was later calmly grazing and did not appear injured or aggressive. People contacted the reserve manager, who wanted to herd the elephant back to the reserve. A vehicle with a provincial officer and a civilian hunter appeared and, without notifying the crowd, shot the elephant, after which the elephant approached the crowd. When more shots were fired, the elephant was killed, and people, including the ambulance driver, started to collect the meat.</p>
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		<p>5. Various DCA cases involved civilians assisting with the killing of elephants, which is against DCA legislation.</p> <p>6. When four elephants entered private property, the landowner said the elephants were calm. The residents of his and neighbouring properties were happy to have the elephants. He expected that the elephants would get to the river on his farm and use the river as a safe way to get back to the protected area. Civilian hunters, who were given permission by the provincial government to destroy the elephants, entered his farm. The landowner managed to chase the hunters off his land, and the elephants returned to the protected areas on their own.</p> <p>7. In two cases, elephants that broke into private property where they were calm were provoked/harassed. Once the animal gets irritated or defensive, it can be shot and justified as a life-threatening situation.</p> <p>8. In four cases, collared elephants were shot, which caused the loss of research efforts, as well as institutional knowledge of migratory paths between trans-frontier conservation areas and investment.</p> <p>9. The examples of DCA procedures indicate that decisions are often taken by people with insufficient knowledge about elephant behaviour, which leads to inappropriate action but also to general failure to consider possible alternatives effectively.</p>
C11. Trophy	Literature review:	Literature review:

<p>hunting</p>	<ol style="list-style-type: none"> <li>1. Trophy hunting of elephants has been suggested to control elephant population numbers and for economic gains (Burke et al., 2008; Di Minin et al., 2021a; ESAG workshop; Mbaiwa, 2018). Revenues can be used to support surrounding rural communities, especially when hunting is more profitable than ecotourism (Burke et al., 2008; De Boer et al., 2007; Di Minin et al., 2021a; Mbaiwa, 2018).</li> <li>2. Burke et al. (2008) observed no significant behavioural responses to hunting and reported no significant changes in the occurrence of elephant breakouts or attacks on infrastructure (Burke et al., 2008).</li> <li>3. Although hunting may have some effects on the remaining individual elephants, these are not strong enough to elicit strong behavioural responses as long as it is done properly (Burke et al., 2008).</li> <li>4. Trophy hunting is promoted to generate support for habitat conservation (Di Minin et al., 2021a).</li> <li>5. It helps to keep areas wild, for instance, where ecotourism cannot be developed (Di Minin et al., 2016).</li> </ol>	<ol style="list-style-type: none"> <li>1. Family groups in an elephant population in Mikumi National Park in Tanzania that were exposed to hunting/poaching in the past showed low group relatedness (i.e., a low number of first-order adult relatives), and weak social bonds. Females in groups displaying these characteristics were shown to have significantly higher faecal glucocorticoid levels and, consequently, lower reproductive output (Gobush et al., 2008).</li> <li>2. Removal of older males may negatively impact tourism, distort the male dominance hierarchy, and reduce fitness (Slotow et al., 2008).</li> <li>3. Hunting may lead to a breakdown in the social structure of elephants (Slotow et al., 2008).</li> <li>4. Elephants subjected to hunting exhibited increased stress hormone levels, even those not directly affected by hunting, suggesting that the stress transmitted from stressed individuals to the rest of the population (Burke et al., 2008).</li> <li>5. Increased stress in elephants may result in elephants moving away from prime tourism areas. For example, elephants change their spatial use when experiencing higher stress levels and then retreat to refugia (Jachowski et al., 2012) or move faster through corridors (Jachowski et al., 2013a). Refuge areas tend to be less used by people and, hence, not prime tourist areas (Slotow, pers. obs.).</li> </ol>
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		<ol style="list-style-type: none"><li>6. Selective hunting of older bulls impacts the broader elephant society by losing mentors/leaders vital to younger bulls migrating through unfamiliar, risky habitats (Allen et al., 2020).</li><li>7. The refuge behaviour of elephants may reduce their tourism value and, thus, the ecotourism potential of protected areas for elephant enthusiasts.</li><li>8. The commercialisation of hunting may result in the extinction of older bulls, which could degrade the genetic health of elephant populations (Selier et al., 2014; Shaffer et al., 2019).</li><li>9. Removal of the largest tuskers results in tuskless females and reduced size of tusks in both sexes (Jachmann et al., 1995).</li><li>10. Genetic loss of larger older bulls may lead to genetic drift and possibly lead to less adaptable offspring and even changes in phenotype with evolutionary consequences (Whitehouse, 2002; Sheikh, 2019; Coulson et al., 2017) and disruption of fine-scale genetic structure (Archie et al., 2008).</li><li>11. Trophy hunting removes the largest, strongest bulls from the population, possibly making the offspring weaker, as females prefer the larger, stronger bulls for mating (Moss, 1983).</li><li>12. It is unclear how revenue from trophy hunting will provide adequate, long-term benefits for affected communities or how inequity in the distribution of money will be</li></ol>
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		<p>avoided (Dellinger, 2019; Di Minin et al., 2021a; Wasser &amp; Gobush, 2019).</p> <p>13. Trophy hunting converts wildlife into a commodity which opens the door to short-term, individually motivated behaviour (Bilchitz, 2017; Mkono, 2019).</p> <p>14. As a neoliberal system with neo-colonial characteristics, trophy hunting <sup>2</sup> conflicts with moral values (Batavia et al., 2019) and could exacerbate risks related to power dynamics and inequity in distributing benefits gained from wildlife (Büscher &amp; Fletcher, 2020; MacDonald et al., 2005; Mkono, 2019; Wasser &amp; Gobush, 2019).</p>
	<p>ESAG workshop</p> <ol style="list-style-type: none"> <li>1. Hunting is using the resource sustainably.</li> <li>2. A quick way to generate revenue.</li> <li>3. It is a means to compete with other land uses, such as agriculture, where tourism is not feasible.</li> <li>4. Hunting has a smaller environmental footprint than ecotourism, generating the same income.</li> <li>5. Quick and easy if done properly.</li> </ol>	<p>ESAG workshop</p> <ol style="list-style-type: none"> <li>1. Increased stress levels of elephants that are not hunted.</li> <li>2. Increased movement by bulls out of the area.</li> <li>3. Trouble on the boundary of the reserve (depending on size).</li> <li>4. Lack of older bulls.</li> <li>5. Loss of elephant knowledge (movement routes by bulls).</li> <li>6. Skewed sex ratios.</li> <li>7. Declining tusk sizes.</li> <li>8. Media backlash on tourism operations.</li> <li>9. Public perception around hunting – negative reports.</li> <li>10. It may increase the international market for ivory and drive-up poaching.</li> <li>11. Elephants that were hunted were not the target animals.</li> <li>12. Creation of a landscape of fear.</li> </ol>

		<p>ESAG survey data:</p> <ol style="list-style-type: none"> <li>1. The main biological reason for trophy hunting given was overpopulation rather than aggression or infrastructure damage <sup>1</sup>.</li> </ol>
C12. Culling	<p>Literature review:</p> <ol style="list-style-type: none"> <li>1. Culling is the only intervention that can directly and substantially reduce the population size in the short term (Slotow et al., 2008).</li> <li>2. In a retrospective study, Smit &amp; Ferreira (2010) analysed the historical KNP census information and concluded that culling reduced the density of elephants on the major rivers.</li> <li>3. Parker et al. (2021) found that adult elephant death, in addition to its direct effects, also indirectly decreases population growth through orphaning.</li> <li>4. Culling is a more humane alternative to slow deaths in periods of drought or resource limitation.</li> </ol>	<p>Literature review:</p> <ol style="list-style-type: none"> <li>1. Elephant specialists are sceptical about culling, as it fails to limit elephant numbers in the long run (Koenig, 2007; Slotow et al., 2008).</li> <li>2. Culling leads to eruptive growth when stopped (Slotow et al., 2008), as the young population and relatively high availability of resources increases the reproductive rate to bring the population to the level where their resource requirements approximate resource availability (Mackey et al., 2009; Slotow et al., 2008; Van Aarde et al., 1999).</li> <li>3. Culling can lead to abnormal social structures, with populations characterised by smaller family units with the age structure skewed towards younger individuals (Gobush et al., 2008; Parker et al., 2021; Selier et al., 2014; Slotow et al., 2008).</li> <li>4. Culling has also been demonstrated to result in high ratios of females relative to males due to selective culling of lone bulls, resulting in depressed levels of fecundity due to a lack of the bull's capacity to breed (Selier et al., 2014).</li> <li>5. According to Slotow et al. (2008), one major demographic consequence of elephant culling is the population entering a growth phase, with the age distribution inevitably skewed toward younger individuals.</li> </ol>

6. Parker et al. (2021) found that orphans had lower survival compared to non-orphaned age mates.
7. Loss of environmental and social knowledge, lost learning opportunities, reduced ability to care for offspring, skewed sex ratio of offspring, higher mortality, and less bonding (Garai et al., in prep).
8. Culling may lead to a breakdown in the social structure of elephants (Slotow et al., 2001; 2008).
9. Poached groups are characterised by aggregating into large groups due to coalescing of family units (Nyakaana et al., 2001). The indirect effect of this increase in group size is accelerated habitat degradation.
10. Culling may make populations biased towards females, as lone bulls are most likely to be problem animals and, thus, are selectively harvested to reduce human-elephant conflicts (Puyravaud et al., 2017).
11. In a comparative study of elephant populations in Amboseli National Park (Kenya) and Pilanesberg National Park (South Africa), Shannon et al. (2013) found that elephants that experienced separation from family members as young (Pilanesberg) exhibited a poor understanding of social knowledge, as they failed to separate calls from elephants, they are familiar with from those they were not (Shannon et al., 2013).
12. Important decision-making abilities were impaired in elephants exposed to culling and

	<p>translocation (Shannon et al., 2013), and there may be loss of cultural information and experience from the population (McComb et al., 2001; 2011).</p> <p>13. Culling also reduces local population density, leading to high reproductive rates to offset the low densities: this results in high growth rates, suggesting that culling can produce results opposite to those intended (i.e., rebound effect) (Hein &amp; Jacob, 2015; Van Aarde et al., 1999).</p> <p>14. Interventions such as culling that increase stress in elephants may result in elephants moving away from prime tourism areas; for example, elephants change their spatial use when they are experiencing higher stress levels and then retreat to refugia (Jachowski et al., 2012) or move faster through corridors (Jachowski et al., 2013a). Refuge areas tend to be those that are less used by people and, hence, not prime tourist areas (Slotow, pers. obs.). The refuge behaviour of elephants may reduce their tourism value and, thus, reduce the ecotourism potential of protected areas for elephant enthusiasts.</p> <p>15. Chronic stress and subsequent refuge behaviour displayed by elephants following culling may lead to elephant aggression toward humans, although the link between the two is unsubstantiated at the moment (Jachowski et al., 2013a).</p> <p>16. Culling elephants to protect vegetation has not achieved its objectives due to the</p>
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	<p>complexity of the system (Henley &amp; Cook, 2019).</p> <p>17. Culling brings in other related issues, such as the continental-wide elephant decline and the arguments for lifting the ban on the ivory trade, which complicates the debate even further (Dickson &amp; Adams, 2009).</p> <p>18. A potential unintended consequence of culling is the risk of injury/death to people involved in the process (Fernando et al., 2008).</p> <p>19. A recent evaluation of the legal context for culling concluded that the current method of culling family groups by first killing the matriarch and then subsequent group members with the youngest last is likely inhumane and illegal in South Africa (Slotow et al., 2021).</p> <p>20. When culling is implemented as a management approach, this may lead to the impression that regulators are encouraging the killing of elephants, leading to upsurges in killings of elephants by people, potentially leading to crashes in elephant numbers (Fernando et al., 2008).</p> <p>21. Culling can result in declining tusk sizes, higher mortality, and less bonding (Garai et al., 2023).</p>
<p>ESAG survey:</p> <p>1. 21 of the 42 reserves that answered this question stated that they view culling as an elephant management option but mostly as a last resort.</p>	<p>ESAG survey:</p> <p>1. One reserve indicated not wanting to cull as it would impact tourism negatively, and three reserves mentioned disagreement between landowners/management regarding culling.</p>

<p>Exclusion Fencing</p>	<p>Literature review:</p> <ol style="list-style-type: none"> <li>1. Enclosure fences have been used in Addo Elephant National Park to create botanical reserves (Lombard et al., 2001) as well as to protect key areas of sand forest in Phinda Private Game Reserve and Tembe Elephant Park (Lagendijk et al., 2011).</li> <li>2. The exclusion of elephants from some areas using two-strand electric fences that prevent elephants from entering, but allow other animals free entrance, can be effective (Slotow, 2012).</li> </ol>	<p>Literature review:</p> <ol style="list-style-type: none"> <li>1. The exclusion of elephants from some areas using two-strand electric fences can have unintended consequences in that, in the absence of elephants, mesoherbivore release can result, having cascading effects on other species (Lagendijk et al., 2011; 2012).</li> </ol>
	<p>ESAG workshop:</p> <ol style="list-style-type: none"> <li>1. Vegetation in the excluded area has become denser.</li> </ol>	<p>ESAG workshop:</p> <ol style="list-style-type: none"> <li>1. The exclusion area has not changed in a positive way.</li> <li>2. Maintenance of the fence is expensive.</li> <li>3. Exclusion fencing affects giraffes as well. There have been cases of giraffes breaking exclusion fences.</li> </ol>
<p>Collaring</p>		<p>Reserve data:</p> <ol style="list-style-type: none"> <li>1. Reserve A (2015-2020): The collaring operations of 25 elephants happened without complications. Occasionally, elephants have shown movement away from areas where collaring took place.</li> </ol>
<p>Tree protection</p>	<p>ESAG workshop:</p> <ol style="list-style-type: none"> <li>1. Works for small reserves or to protect valuable trees around lodges.</li> </ol>	<p>ESAG workshop:</p> <p>Method: use cut-down tree stumps to protect certain species.</p> <ol style="list-style-type: none"> <li>1. Because you clear areas around a marula or camelthorn, it becomes a target for the elephant.</li> </ol>

		<p>2. Wood barrier creates a fire risk to the tree, and natural defences are reduced.</p> <p>Method: wire wrapping, rocks, chilli, bees:</p> <ol style="list-style-type: none"> <li>1. Some of these methods are difficult to maintain, as you have to bring rocks in.</li> <li>2. Labour intensive, so it is only realistic for a limited number of trees.</li> <li>3. Sugar water for bees attracted monkeys, which became a nuisance.</li> </ol>
Detusking	<p>ESAG workshop:</p> <p>Method: Within four years, elephants were detusked twice to mitigate ringbarking of trees.</p> <ol style="list-style-type: none"> <li>1. It did reduce the debarking.</li> <li>2. There were no associated behavioural consequences – tusks grew back.</li> </ol>	<p>ESAG workshop:</p> <p>Within four years, elephants were detusked twice to mitigate ringbarking of trees.</p> <ol style="list-style-type: none"> <li>1. Associated costs.</li> <li>2. Security risks with storage of ivory.</li> <li>3. Became more difficult over time to implement the methodology.</li> </ol>
Food supplements		<p>ESAG workshop:</p> <ol style="list-style-type: none"> <li>1. An elephant bull gorged himself and passed away from colic.</li> <li>2. Elephants figured out where the food was stored. They were not aggressive, but they used that area around the food store a lot, which greatly impacted that area.</li> </ol>
Chasing animals from lodges		<p>ESAG workshop:</p> <ol style="list-style-type: none"> <li>1. Potato guns with chillies, rubber bullets etc. – to try chasing elephants from lodges. Lots of things have been tried [implication is not a lot have worked].</li> </ol>

## 6. SYNTHESIS, DISCUSSION AND CONCLUSION

In the first paragraph, I revisit the four main objectives and eleven sub-objectives identified in section 1.6 of Chapter 1. The following paragraph summarises how I have made these objectives operational in four theoretical frameworks that address the gaps in current conservation approaches and social compacts, which cause them to be blinkered, and less sustainable or equitable than they should be. Convivial conservation and the holistic living-in-harmony approach are identified as conservation pathways that include the full spectrum of socio-economic, ecological, and intrinsic values of nature, and do not presuppose a separation of human and nonhuman nature. This chapter concludes with policy recommendations that specify how convivial conservation and the holistic living-in-harmony approach may be taken forward.

### 6.1 Revisiting the objectives

Generally, scientists agree about the importance of integrated and pluralist conservation approaches (Díaz et al., 2018; Pascual et al., 2021), but truly holistic frameworks that balance outcomes in all relevant dimensions and protect vulnerable people and nonhuman species are lacking. In Chapter two, I present the TUSKER framework to balance outcomes for the socio-economic and ecological systems and promote positive people-nature interactions. The framework facilitates an analysis of the Biodiversity Value Chain of elephants, specifically of the blockages that prevent a free and equitable flow of biodiversity values between nonhuman and human nature. In order to develop a holistic, mutually beneficial system, I concluded that the chain needs to be transformed into a cycle and assessed the prerequisites of a free and equitable flow of benefits. I highlighted the need to moderate conservation decisions through the filters missing from existing frameworks: good governance, intergenerational legacy, environmental justice, and human rights. By applying these filters, conservation will be better equipped to respect the rights of people and nonhuman nature, since they embed conservation squarely in the broader social compacts (i.e., agreements among stakeholders about aspirations, values,

norms, and ethics). The TUSKER framework can be applied to strengthen existing community-based conservation programs, or develop new conservation strategies.

Chapter two deals with the risks of looking at conservation through a narrow lens. Existing nature valuation frameworks run these risks, for example, by assigning only economic values to nature, such as Natural Capital (Costanza et al., 2017), Ecosystem Services (Daily et al., 2000), The Economics of Ecosystems and Biodiversity (TEEB, 2020) and Common International Classification of Ecosystem Services (CICES) (Haines-Young & Potschin, 2012). Other systems may adopt a wider value spectrum, but still perceive the value of nature as a one-way flow from nature to people, which does not incorporate the value of nature irrespective of people (e.g., IPBES (Díaz et al., 2018, Pascual et al., 2017)), nor the reciprocal effects on nature of people using it. In order to create a holistic nature valuation system, in Chapter 3 (Objective 2), I listed all benefits, services and values that elephants have and provide for human and nonhuman nature, based on literature and opinion. The resulting table includes the categories that are used in existing frameworks such as IPBES and CICES, but I paid special attention to values of elephants irrespective of people, and to values that can and often do cause contention. In the process, it was useful to investigate the definitions of value, as the word value can have a monetary meaning, express the importance of or a preference for something, but also represent principles related to culture or worldviews (Büscher & Fletcher, 2020, Chan et al., 2012, Kenter, 2018, O'Connor & Kenter, 2019, Pascual et al., 2017). Especially worldviews proved to be an important dimension that is nonetheless not always considered in conservation decisions. Reviewing the literature on conservation trade-offs, I found that contentious trade-offs causing marginalisation of disadvantaged communities often occur in the Global South when different worldviews are pitted against each other. To gain insight in this phenomenon, I classified each benefit, service and value associated with elephants as mainly secular, partly secular/partly sacred, or mainly sacred, based on frameworks developed by Daw et al. (2015) and Schwartz (2021). The sacred dimension brought together many values that are not incorporated in existing frameworks, especially values related to morality such as international legacy, rights of nature, environmental justice and human rights. To give a practical example of the pluralist valuation system in action and to promote a holistic co-management approach

that contributes to animal, human and environmental well-being, I wrote a short article about the potential benefits of rewilding Asian elephants. It shows how rewilding elephants can transform elephant-human-environmental relationships into a mutually beneficial coexistence and restore systems on which they all depend. In line with the TUSKER framework, this article suggests moving away from a narrow, exploitative approach that causes animal suffering and provides economic benefits for a few individuals, towards a pluralist approach that provides mutually beneficial and equitable outcomes for elephants, humans, and the environment. To reach a broader audience, a popularised version of this article was published in *The Revelator* (Van de Water, 2020).

In Chapter four, I examine a practical example of a recently established South African elephant reserve that has the mandate to support people in marginalised adjacent communities (Objective 3). I lived in this reserve from February 2018 to May 2019, and thus had an opportunity to connect with landowners, management, community leaders, researchers and other stakeholders of Dinokeng Game Reserve. This gave me a unique opportunity to observe the current challenges, and experience some of the tensions that exist between the various stakeholder groups. During my stay in the reserve, elephants regularly caused damage to property, and people regularly chased elephants with vehicles. This resulted in the management's decision to kill the oldest bull and give GnRH treatment to the younger bulls. As the One Well-being framework presented in Chapter five demonstrates, these interventions can have severe unintended consequences. I also witnessed human-human conflicts, both between the landowners and the reserve management and between the reserve and the local community, resulting in social unrest and division. It is therefore not surprising that, although the outcomes in terms of job creation looked good on paper (800 direct permanent jobs created, Burton et al., 2020), the reserve suffered from unintended consequences such as break-ins, fence cuttings, vandalism, intentional bushfires and poaching (eNews Channel Africa, 2014; Masombuka, 2014; Omar, 2011). Human-elephant conflicts were causing concern, but diving deeper, it appeared that human-human conflicts caused even more severe consequences for conservation and human well-being. The Theory of Change presented in this Chapter aims for a resolution of these conflicts using the broad scale of values that elephants represent and the commonalities in stakeholders' perspectives and aspirations.

It offers a pathway to transform elephants from symbols of exclusion - as they often are now for marginalised people - to drivers of the urgently needed socio-political change (Thakholi, 2021; Van de Water et al., In prep.). I identified five ways to tackle the problems at the root and realise a vision of living in harmony: investment in good governance, education, building awareness and capacity, community development, and reserve expansion. En route, tourists and funds may also be attracted. The effectiveness of the solutions depends on feedback loops that remove barriers and strengthen enabling conditions, thereby increasing common ground. The Theory of Change aims to mitigate human-elephant conflicts through the mitigation of human-human conflicts. It can be applied to conservation strategies for other species or ecosystems, where there is a need for more conservation land and for mutually beneficial outcomes for biodiversity and multiple stakeholders.

The moderating filters described in Chapter two, the moral values of Chapter three and the need to include human well-being in conservation of Chapter four are all incorporated in the One Well-being framework presented in Chapter five (Objective 4). While the previous chapters focus on the theoretical strategic planning of conservation, Chapter five is about actual conservation implementation, and evaluates the consequences of twelve elephant management interventions that are commonly applied in South Africa. My evaluation showed that overall, there were more interventions with positive scores for environmental outcomes, as compared to positive outcomes for people or animals. This could indicate a lack of considering the well-being of people or animals in management decisions. It reinforces previous findings that ‘living in harmony’ conservation needs holistic approaches that realise range expansion with meaningful community engagement. The One Well-being framework provides policymakers and managers with a tool to carefully consider all consequences of management interventions, direct and indirect, which aids in selecting the intervention with the least negative consequences, mitigating the costs of future interventions, and building a more sustainable system. It also increases awareness about the consequences of having a narrow focus on conservation and about the interlinkages between animal, human and environmental well-being.

## 6.2 Thesis synthesis

Together, the four chapters highlight the need for a broad, inclusive conservation frame that accounts for the vast expanse of values nature has to offer. They show that to achieve sustainable outcomes on all fronts, just aiming for ecological or economic benefits is not sufficient. In Chapter three, I have shown what elephants mean to people and the world, and how elephants can be drivers of the socio-political reform that is urgently needed, especially in the global South. In particular, this study highlights opportunities to create positive nature-people relations, with feedback loops that ensure a sustainable cycle of reciprocity. The results can aid policymakers and managers in developing bold conservation solutions and achieve results beyond traditional nature protection goals. The TUSKER framework, the pluralist elephant valuation system, the Theory of Change and the One Well-being framework can be used to halt biodiversity loss and increase the percentage of protected planet, while reducing poverty and inequality at the same time. They can assist in the strategic planning of, for instance, community-owned corridors, rewilding of degraded areas or other range expansion initiatives, while simultaneously empowering local communities and enhancing local economies.

A common thread throughout this thesis is the importance of considering moral values, which often remain hidden in conservation decisions and, precisely because of this, cause contention. Recognising and respecting people's moral values is especially relevant when decisions concern sentient species that are culturally and spiritually meaningful to people around the world (Van de Water et al., 2022b). The added dimension of human morals ensures that the needs of future generations are considered (intergenerational legacy), the inherent rights of ecosystems and species are protected (rights of nature), community engagement is meaningful, fair, and equitable (environmental justice), and the basic rights and freedom of all people are protected (human rights). Careful consideration of these dimensions in conservation decisions will ensure that people are included in conservation in meaningful and uplifting ways while the environment and the well-being of all species are protected.



## 6.3 Implications of my research for policy development

### 6.3.1 Implications for social compacts

By assessing the social compacts relevant to nature conservation, I uncovered what they are lacking, which goals are not met, and which conflicts with other (parts of) social compacts these agreements will likely instigate. An example of the negative repercussions of one-sided social compacts is found in the global and local debates about lifting the ban on trophy hunting. Adversaries are concerned that lifting the ban may increase short-term, individually motivated behaviour (Bilchitz, 2017), increase risks related to power imbalances and inequality in access to benefits, and may violate the principles of the African social compact Ubuntu (Mkono, 2019). Another example: proposals to resettle people and restrict traditional land-use practices to create space for conservation purposes (Spierenburg et al., 2006) violate social aspirations of equity and justice. A particularly glaring example is the militaristic approach to nature conservation, where armed guards patrol nature reserves and keep local people out. This exclusion risks violating human rights, increases inequality, undermines local incentives to conserve wildlife, and compromises overall sustainability (Booker & Roe, 2017; Büscher et al., 2017; DEAT, 2008; Duffy et al., 2019; Witter, 2021).

Conclusion: social compacts relevant to nature conservation need to incorporate and balance the economic, ecological, and social pillars of sustainability. The social pillar prescribes good governance, environmental justice, intergenerational legacy, and human rights.

### 6.3.2 Implications for conservation approaches

In general, four conservation approaches dominate elephant conservation debates, each clearly holding certain preferential values and different intended and unintended consequences on animal, human and environmental well-being. In South Africa we see primarily **Protectionist Conservation** in combination with New Conservation. This approach preaches strict enforcement of protection through ‘fences and fines’ to prevent

human disturbances, prevent unregulated access to conservation areas for local people, and safeguard biodiversity (Büscher & Dietz, 2005; Hutton et al., 2005). Protectionists focus on the integrity of nature and wilderness, which are relational values (see Chapter 3). Elephant habitat is often patrolled by rangers, only tourists and scientists are allowed access, while local people are excluded. Protectionism recognises the importance of peaceful coexistence between people and elephants, but generally separates people from the rest of nature. **New Conservation** (e.g., Kareiva, 2014; Marvier, 2014) is characterised by a commodification of wildlife as an in South Africa commonly applied mechanism to fund conservation, as well as to provide benefits to local communities through the direct use of natural resources (e.g., various tourism models, trophy hunting, trade in wildlife products, wildlife/meat donations, thatch, Mopane worm or medicinal plant harvesting programmes) (Swemmer et al., 2017). From a New Conservation perspective, elephants must provide financial benefits to support their own conservation and provide benefits to local people. New Conservationists prioritise instrumental values. There is a range of wildlife reserve models in South Africa, using protectionist and new conservation measures to various degrees, with state agencies tending more to the protectionist, and the private sector more to new conservation (Child et al. 2019). **Compassionate Conservation** (e.g., Ramp & Bekoff, 2015; Batavia & Nelson, 2017) combines the fields of conservation and animal welfare. Supporters of this approach often conflict with New Conservationists. Compassionate Conservation values the individual elephant and its right to exist and live undisturbed. It is based on a philosophy of not doing harm and prioritises moral values. Finally, **Convivial Conservation** (e.g., Büscher & Fletcher, 2020) promotes a vision and practice of ‘living in harmony’ and has an emphasis on human rights, environmental justice and uncovering power issues. This aligns with South Africa’s Draft White Paper on the Conservation and Sustainable Use of South Africa's Biodiversity (DFFE, 2022). Convivial Conservation offers an integrated, post-capitalism ‘living in harmony’ approach to conservation that contributes to an equal and sustainable world. It has a strong focus on what is socially and ecologically just, thereby prioritising moral values (Büscher & Fletcher, 2020).

Key for developing well balanced conservation strategies is a recognition of the interconnectedness of economic, ecological and social challenges (Jordan & Kristjánsson,

2017). For example, protectionist conservation focuses on maintaining ecological processes, the direct management of wildlife, and the development of economic opportunities within and for the reserve (e.g., tourism, hunting), often without sufficient attention for meaningful social development outside the borders of protected areas (Musavengane & Leonard, 2019; Thakholi, 2021). Providing local people with inadequate access to the benefits of conservation while they rely on natural resources for their livelihood and well-being creates conflict and threatens the sustainability of the socio-ecological system (Büscher & Ramutsindela, 2015; Duffy et al., 2019; Rai et al., 2021).

Figure 6.1 highlights the contribution of four conservation approaches to the three pillars of sustainability and five pillars of sustainable development. This assessment can aid policymakers and managers in deciding what conservation approach, or which combination of conservation approaches, may be most effective for the conservation of elephants in their area. Including elements of all four approaches and adaptation to local circumstances is likely to be the most appropriate approach, noting the range of wildlife models in South Africa (Child et al. 2019). This includes multiple, sometimes conflicting strategies, such as including local communities in some areas and excluding people in others. The Constitutional Court has recognised the need for integrative approaches (National Council of Societies for the Prevention of Cruelty to Animals v. Openshaw 2008, 462/07 ZASCA), such as that of Convivial Conservation. Figure 6.1, which aims to contribute to the discussion about conservation approaches but requires further development and testing, shows that Convivial Conservation has a pluralist value approach, recognising and balancing the sustainability and sustainable development pillars.

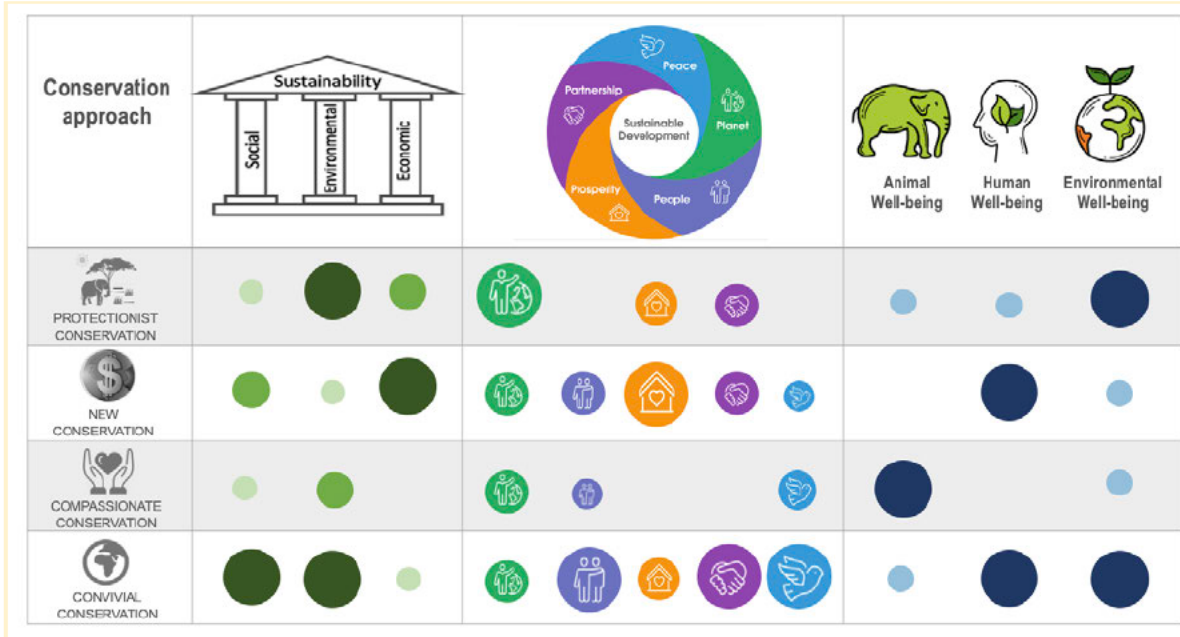


Figure 6.1: An example of how elements of the TUSKER and One Well-being frameworks can be combined to compare expected outcomes of four existing conservation approaches relevant to elephant conservation. The size of the bubbles indicates the focus of the four conservation approaches on the three pillars of sustainability, the five pillars of Sustainable Development, and the three pillars of the One Well-being approach (Van de Water et al., In prep.).

### 6.3.3 Implications for broader conceptual understanding

Fortunately, as highlighted by Otero et al., global valuation systems like IPBES are starting to move away from the current growth paradigm, and alternative approaches are emerging (e.g., Convivial Conservation, Buen Vivir, Ubuntu, Living in harmony) (Krauss, 2021). However, integration across all agreements, implementation of alternative approaches and importantly, shifts in socio-political structures are yet to be realised (IPBES, 2019; Otero et al., 2020). The TUSKER framework, the pluralist valuation framework and the One Well-being frameworks are efforts to contribute to this development.

The presented frameworks also provide tools for policy developers to improve existing community-based conservation programs. The frameworks promote equity in sharing and

access to the economic and broader benefits of elephants and the landscapes in which they thrive, to ensure that local people can develop as well (Drake et al., 2021). They motivate policymakers and managers to address and move beyond inequality, not by creating temporary jobs with poor labour standards, but by creating meaningful opportunities for people (Thakholi, 2021). Similarly, they support addressing and alleviating issues such as power asymmetries and inequality in landownership, which may lead to equity in sharing land and wildlife. The Theory of Change provides an umbrella framework to bring people together to find common ground and work with rather than against each other. As part of future research, I am planning additional participatory community workshops in Dinokeng Game Reserve to test local buy-in to the Theory of Change developed as an outcome of my research there. Finally, the frameworks will ensure that community-based conservation works with a wide-angle lens that sees all values of nature, thus opening up possibilities for expanding and connecting conservation areas (DFFE, 2021; 2022).

The research I did for Chapter 5 resulted in the conclusion that developing the One Welfare to the One Well-being framework is advisable. Well-being incorporates the well-being of individuals as well as the group, which is important in a holistic assessment. As part of future research, the scoring of consequences of elephant management interventions should be conducted with reserve managers. This will achieve more robust results and may uncover differences and commonalities between the scoring of scientists and reserve managers. A practical tool can be developed to assist policymakers and managers in applying the One Well-being framework, at site or landscape level, in order to align elephant management interventions with Best Practice Principles, and with emerging policies and legislation on animal welfare and well-being.

## 6.4 Recommendations

The results of this thesis can be translated into two overall recommendations:

(1) to develop a living-in-harmony conservation approach that promotes integrity of nature, social cohesion, and equity in sharing of the socio-economic and ecological benefits of elephants, and nature in general.

(2) to link natural and social systems in nature conservation and include moral values in the valuation of elephants and nature in general, to encourage holistic and equitable conservation.

The first recommendation aligns with the global biodiversity vision of “Living in harmony with nature” (UN General Assembly, 2021), as well as South Africa’s recent High-Level Panel report (DFFE, 2020) and the Draft White Paper on the Conservation and Sustainable Use of South Africa's Biodiversity (DFFE, 2022). The vision of South Africa’s conservation approach has been defined as: “Secured, restored, and rewilded natural landscapes with thriving populations of Elephant, Lion, Rhino, and Leopard, as indicators for a vibrant, responsible, inclusive, transformed, and sustainable wildlife sector”. This aligns with South Africa’s Strategic Plan 2024 that states: “A prosperous and equitable society living in harmony with our natural resources”. Crucial elements of ‘living in harmony’ are inclusivity and equity in the sharing of the benefits of conservation, which promotes peaceful, mutually beneficial relations within and between the components of the natural and social systems. Living in harmony also speaks for habitat connectivity (i.e., removal of fences) to increase habitat availability for elephants, ensure integrity of nature, reduce management costs, and create more opportunities for communities that have been negatively affected by socio-ecological issues through restoring access to conservation areas (Büscher & Fletcher, 2019; Fernando et al., 2019).

The second recommendation aims for consideration in conservation strategies of the broadest possible spectrum of benefits and values provided by elephants and nature in general, as well as the inclusion of human needs and values, especially of marginalised communities. This recommendation is in line with South Africa’s High-Level Panel’s vision of a vibrant, responsible, inclusive, transformed, and sustainable wildlife sector.

Implementation of this recommendation provides opportunities for the conservation sector to grow and support more people, and for an increase of elephant well-being, human well-being, and environmental health.

Consideration of the broader value of nature, including moral values, requires a new conservation philosophy, as an alternative to current western conservation approaches (Mabele et al., 2022; Slotow et al., 2022). Such a new conservation philosophy could align with the African philosophy Ubuntu, which adapts conservation to the African context and increases inclusion and local support for conservation. Ubuntu provides a viable decolonial conservation approach that fosters harmonious and just interactions between humanity and the earth, based on relatedness, the common good of society, respect for all life, compassion, and justice (LenkaBula, 2008; Mabele et al., 2022; Venter, 2004).

I have tested the theoretical frameworks I developed in this thesis in two case studies and in an evaluation of a range of elephant management interventions. Further testing of local buy-in and adjustments for practical implementation will be part of future research.

Overall, my thesis demonstrate how contentious conservation decisions can be resolved, societal support and acceptance of solutions by stakeholders increased, and overall sustainability realised. As opposed to commodifying nature and separating people from nature, I have highlighted how societal goals can be achieved through promoting positive nature-people relationships whereby people, elephants, and the environment benefit.

## 6.5 Final conclusions

With growing urgency to implement solutions to reduce ecological decline and combat poverty, new approaches and practical solutions to reconcile these goals are imperative. This thesis provides frameworks to align conservation with societal aspirations, incorporate all values of nature, and balance the consequences of conservation interventions for animal well-being, human well-being, and environmental health. Throughout, I used elephant conservation as an example. Elephants are iconic,

charismatic, sentient, keystone species, with values far beyond just economic opportunities. As megaherbivores, elephants can play a key role in accelerating ecosystem restoration and rewilding processes, while they also create opportunities for local and societal beneficiation (DFFE, 2020; Jepson & Blythe, 2020; Roy & Sukumar, 2015; Van de Water et al., 2022b; Van de Water et al., In prep.). My thesis shows that a change in our thinking is needed. Rather than dominating, intensely managing, and commodifying elephants and separating human and nonhuman nature, elephants should be seen as our allies in realising a sustainable and equitable world (Chami et al., 2020; Jepson & Blythe, 2020; Pelsler et al., 2013; Van de Water et al., In prep). Conservation approaches should recognise the inescapable fact that we are part of nature. Through a ‘living in harmony’ conservation philosophy, which recognises moral values such as justice, dignity, and rights, we will move towards living and flourishing in a more ethical, just, and sustainable world.

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## 6.7 Supplemental information

Table S6.1: The intended and unintended consequences of the four conservation approaches relevant to elephant conservation in South Africa.

<b>Conservation approach</b>	<b>Intended Consequences</b>	<b>Unintended consequences</b>
<b>Protectionist conservation</b>	<ol style="list-style-type: none"> <li>1. Prevents human disturbances and the decline of the world's biodiversity through strict state-based protected areas (Kopnina, 2015).</li> <li>2. Ensures protected and enlarged wilderness areas.</li> <li>3. Reduces human-elephant conflicts through fences (e.g., Kruger National Park, van Wilgen &amp; Biggs, 2011), which is regarded as the most effective method for the containment of elephant populations within certain ranges, and, thus, is an important aspect of their management (Grant et al., 2008; Slotow, 2012).</li> <li>4. Fences influence the range of elephants and increase the heterogeneity of their use of the landscape (Slotow, 2012).</li> </ol>	<ol style="list-style-type: none"> <li>1. As a top-down approach, Protectionist Conservation risks militarisation, inflicts harm to indigenous communities, promotes individually motivated behaviour, and hinders decolonising conservation policies (Büscher &amp; Fletcher, 2020; Dominguez &amp; Luoma, 2020).</li> <li>2. Separating people from nature risks the exploitation of power and increasing inequality (e.g., privatisation, exploitation of human and nonhuman individuals) (Duffy et al., 2019; Thakholi, 2021).</li> <li>3. There are human costs associated with creating strictly protected areas, especially when combined with militaristic approaches, such as depriving people of their traditional livelihoods or creating conservation refugees. This restricts traditional land-use practices and sometimes violates human rights and environmental justice (Büscher &amp; Ramutsindela, 2015; Kopnina, 2016; Spierenburg et al., 2006; Witter, 2013).</li> <li>4. Fences around protected areas highlight power imbalances and conflicting political interests of stakeholders (Evans &amp; Adams, 2016), and can cause conflict between reserves and local communities if proper consultation is not undertaken (Di Minin et al., 2021).</li> <li>5. Isolated islands of (fenced) protected areas block genetic flow and disturb the ecological balance and natural behaviour. Many species of wildlife have to move between different habitats at different times of the year in order to satisfy their nutritional requirements; thus, the confinement of herbivores to small</li> </ol>

		<p>sections of the broader landscapes can reduce the carrying capacity of the area, and, thus, is a potential source of massive population declines and ultimately extinction (Pekor et al., 2019).</p> <p>6. Fences may cause elephants to bunch up against them and can increase the local impact on vegetation (Loarie et al., 2009).</p> <p>7. Poor fence maintenance can be an issue, as elephants first learn to break out through weak points and then learn to do this through fully functional fences (Grant et al., 2008, Slotow 2012). Learned fence-breaking behaviour is difficult to correct, and the animal becomes a habitual fence-breaker and often then needs to be euthanised as a damage-causing animal (Slotow et al., 2008). Fence-breaking necessitates the repair, and capturing of escaped animals, and may be costly even in terms of subsequent damage elephants may cause to crops in neighbouring communities, thus exacerbating human-elephant conflicts (Hayward and Kerley 2009).</p> <p>8. As fencing results in elephants being confined to small habitat areas, this causes them to be unable to offset local food shortages by shifting their spatial distribution (Shrader et al., 2010). Consequently, their survival becomes more dependent on rainfall patterns, potentially causing mass mortalities during periods of drought (Wato et al., 2016). By preventing migratory movements, fencing can eliminate natural processes as regulators of populations of species within particular bounds of resource availability levels (carrying capacity) (Hayward and Kerley 2009). This may result in the over-use of an area, causing declines or extinctions within closed areas (Hayward and Kerley 2009).</p>
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<p><b>New conservation</b></p>	<ol style="list-style-type: none"> <li>1. People-centred utilitarianism approach focusing on the use of nature to generate benefits from nature for people can aid in realising human development goals (Marvier, 2014).</li> <li>2. Through this devolved approach, people are able to manage their own resources, which contributes to empowerment and equality (Kareiva &amp; Marvier, 2012).</li> <li>3. Land use change for human benefits brings new opportunities in terms of sustainable use of natural resources (Marris, 2011).</li> <li>4. Financial benefits through corporate partnerships, green economies, and other market-based mechanisms.</li> <li>5. Working with corporations and resource extractors aids in minimising the impact on development and could steer development away from the habitat of vulnerable species such as elephants (Kareiva, 2014).</li> <li>6. Promoting human benefits from elephant conservation increases support for conservation as it broadens the conservation appeal (Marvier, 2014). New conservation advocates for conservation to benefit the poor and to contribute to human development (Marvier, 2014).</li> <li>7. Including rural communities and providing benefits provides opportunities for elephant range expansion in rural areas (Schnegg &amp; Kiaka, 2018). Prioritisation of conservation locations protection should consider the benefits of conservation for humanity, rather than on the basis of biodiversity alone, so that conservation can contribute to poverty alleviation (Marvier, 2014).</li> </ol>	<ol style="list-style-type: none"> <li>1. An exclusive focus on human outcomes may prioritise land use modification and resource extraction as the system depends on processes of wealth accumulation (Bilchitz, 2017; Büscher &amp; Fletcher, 2019; López-Bao et al., 2017).</li> <li>2. Decisions are primarily based on economic value to people, rather than broader values, risks tragedy of the commons, and increased inequality (van de Water et al., 2022a).</li> <li>3. Embedding conservation in a capitalist system and prioritising benefits for people allows profit-driven stakeholders to accumulate capital from the continuous exploitation of habitat, as it is this system that drives unsustainability and inequity (Büscher &amp; Fletcher, 2019). This can result in shrinking and fragmented elephant habitat, which reduces genetic diversity and increased human-elephant conflicts (Kopnina, 2016).</li> <li>4. Emphasising the economic value of elephants for self-interest leads to contention, which may decrease support for conservation (Biggs et al., 2017).</li> <li>5. A focus on benefits for people and collaboration with profit-driven companies promotes short-term financial gain and self-interest (Bilchitz, 2017; Büscher &amp; Fletcher, 2019; López-Bao et al., 2017).</li> <li>6. Community beneficiation from elephants based on the utilitarian moral approaches of profit-driven corporations risks exploitation and economic inequality through unfair benefit-sharing, which violates environmental justice (Kopnina, 2016; Schnegg &amp; Kiaka, 2018).</li> <li>7. The commodification of nature can conflict with traditional African religions that view land, and its resources, as communal assets of spiritual concern for current communities as well as ancestors and future generations (Byers et al., 2001).</li> </ol>
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8. Commodifying elephants and seeing them as mere objects could deny their right to live and to live in dignity (Kopnina, 2016). This can result in an outcry from civil society, causing reputational damage, threats to tourism, and negative impacts on social cohesion (Harvey, 2020).
9. Rejecting strictly protected areas and allowing extractive industries risk elephants losing safe havens away from people, increasing human-elephant conflicts and fragmentation of previously protected habitats, which are vital for their survival (Harvey, 2020).
10. When conservation, or conservation-compatible livelihoods, does not generate sufficient income relative to extractive land uses such as mining or agriculture, there is a risk of decreased support for conservation and change in land use (Di Minin et al., 2013).

**Compassionate conservation**

1. Biocentric approach of protecting individual animals and enhancing ecological justice (Ramp & Bekoff, 2015).
  2. Promoting the intrinsic values of animals and the treatment of individual animals in conservation research, policy or practice with respect, dignity, and compassion aligns with the public appeal and can therefore generate support for conservation (Baker, 2013; Bekoff, 2013; Coghlan & Cardilini, 2022).
  3. Compassionate conservationists argue for elephant personhood to be recognised and their moral status be respected (Wallach et al., 2020).
  4. Overabundance and rapid growth of elephant populations require management intervention. As an alternative to culling, a compassionate approach is the use of immunocontraception (Druce et al., 2011).
  5. Another compassionate alternative to culling is the creation of elephant corridors, such as the Thirunelli-Kudrakote corridor in India, which prevents geographical isolation while providing opportunities for elephant-friendly land use and tourism (Osborn & Paker 2003). Corridors can serve to increase connectivity for wildlife in general, as elephant occurrence is strongly associated with that of other mammals (Crego et al., 2021). Elephant corridors can allow elephants to adapt to climate change by providing them with a means to access suitable habitat areas (Zacarias & Loyola 2018).
  6. Rescuing, rehabilitating and rewilding individual elephants provides opportunities to respect the moral status of elephants and establish peaceful coexistence (Baker & Winkler, 2020).
1. The needs or worldviews of people living in proximity to wildlife and the consequences of conservation action on human well-being are not adequately considered (Coghlan & Cardilini, 2022).
  2. Prioritising the well-being of individual elephants without adequately considering the well-being or values of people living with elephants is problematic, especially in human-elephant conflict situations (Oommen et al., 2019).
  3. Compassionate conservation could threaten conservation when messages result in limited understanding by the general public of complex conservation challenges (Hayward et al., 2019).
  4. Compassionate arguments against contraception because it diminishes the chances of reproduction can result in more harmful methods to manage elephant populations (Callen et al., 2020).
  5. Using corridors, elephants can move into surrounding human settlements, causing damage to crops and endangering human life (Kikoti et al., 2010). Elephants moving through corridors have been shown to exhibit elevated stress levels, which may lead to aggressive behaviours (Jachowski et al. 2013), which may lead to negative attitudes towards conservation among members of surrounding villages, causing high rates of elephant deaths as a result of retaliatory killings (Selier et al., 2016). Corridor presence does not mean use, leading to conflict between corridor use and corridor function (*sensu* Horskins et al., 2006). Heavily utilised areas may be more subjected to habitat degradation, undermining the role of corridors in reducing elephant impact on vegetation (Green et al., 2018). If elephant corridors have been identified, but are

unprotected, inevitably, development will occur, undermining their effectiveness.

6. Compassionate conservation does not acknowledge the scale of environmental and social problems in the developing world context, which are often a product of difficult social, political, and economic circumstances (Oommen et al., 2019).
7. Compassionate conservation may conflict with traditional ways of coexisting with wildlife (Oommen et al., 2019).
8. Anthropomorphising a species that is involved in human-wildlife conflict may trivialise the desperate situation of people living with wildlife (Manfredo et al., 2020).
9. Rewilding elephants as a compassionate alternative to captivity risk increasing human-elephant conflicts (Thitaram, 2012), which may frustrate conservation efforts and reduce people's tolerance towards elephants.



<p><b>Convivial conservation</b></p>	<ol style="list-style-type: none"> <li>1. As convivial conservation is a more holistic, pluralist system that removes barriers between people and the rest of nature, it ensures that interventions for one sector will positively affect another (Büscher &amp; Fletcher, 2019).</li> <li>2. A democratic, inclusive approach that integrates conservation and poverty reduction will enhance prosperity, equality, and environmental justice (Büscher &amp; Fletcher, 2019).</li> <li>3. Calls for a transformation in global political-economic structures, towards a living in harmony philosophy and meaningful human-wildlife coexistence (Fiasco &amp; Massarella, 2022; Turnhout et al., 2013).</li> <li>4. Transforming protected areas in 'promoted areas' in which nature is promoted for, to, and by humans, rather than protected from humans, integrates decolonial thinking and Ubuntu philosophy, based on moral worldviews of mutual sharing and caring between and among humans and nonhumans (Mabele et al., 2022).</li> <li>5. Nature supports people's livelihoods from a human well-being perspective, but not through market-driven approaches or by separating humans from nonhuman nature (Büscher &amp; Fletcher, 2020).</li> <li>6. Decision-making power empowers local residents and is grounded upon a Whole Earth vision that is socially and ecologically just (Büscher et al., 2017).</li> <li>7. Self-regulation and communal interest are promoted through communally Protected Areas that prioritise social values as opposed to economic benefits, resulting in communal ownership and ecological stewardship (Shanee et al., 2020).</li> <li>8. Consensus philosophy, rules and regulations are social rules generated by the social compact, thereby preventing power imbalances (van de Water et al., in review).</li> </ol>	<ol style="list-style-type: none"> <li>1. Opening up strictly protected areas risks elephants losing safe havens away from people, an increase in human-elephant conflicts, and in extractive types of land use which may degrade and fragment previously protected habitat (Schussler et al., 2018).</li> <li>2. Evidence shows a positive impact of stricter control in certain areas on endangered wildlife species (Kopnina, 2015).</li> <li>3. Convivial conservation may not support a gradient of approaches depending on differences in land-use options across national boundaries, such as in GLTCA with already established historical impacts which would take time to redirect. Shifting away from wilderness ideology involves risk when it lacks awareness of the negative consequences of this approach (Fiasco &amp; Massarella, 2022) and may ignore community-based conservation projects that are centred around protected areas that do integrate ecological and social justice.</li> <li>4. Win-win solutions may not be achievable if not all indirect consequences are accounted for (e.g., community wealth or conservation job creation may increase illegal natural resource extraction) (Sarkar et al., 2022).</li> </ol>
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9. By promoting elephant-friendly alternatives or supplemental livelihoods and community ownership/participation, people are better prepared to live with elephants and are more tolerant towards them. For example, by implementing beehive fences or planting alternative crops to reduce elephant impact, develop new skills and generate income (Gross et al., 2017; Van de Water et al., 2020).
10. Convivial conservation argues for 'promoted areas' instead of 'protected areas' and for inclusive approaches that integrate elephant conservation and human development based on a living in harmony philosophy (Büscher & Fletcher, 2020; Fernando et al., 2019).

