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Behavioural interventions in conservation conflicts

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Abstract

Conservation conflicts occur when people clash over conservation objectives. They are damaging for biodiversity, livelihoods, and human well-being globally, and are often managed via interventions intended to change people's behaviour. However, variation in intervention approaches across contexts remains underexplored. This thesis seeks to inform management by better understanding the roots of conflict, and the factors constraining the choice and efficacy of different interventions. Using an empirical literature review, I first identify five intervention types – 'technical', 'cognitive', 'economic', 'enforcement' and 'stakeholder' – and how they associate with conflict frames, behaviours and geography. I then largely corroborate these results in an experimental survey with conservation professionals, which also uncovers how decision-makers' characteristics, including disciplinary and demographic backgrounds, predict their intervention priorities. I then draw upon stakeholder interviews in Enduimet Wildlife Management Area in Tanzania, and grey literature to identify how multiple levels of conflict – covering human-elephant interactions, stakeholder interactions, and governance structures – constrain local management options. Next, using an experimental public goods game in Enduimet, I find that stakeholder perceptions of intervener trustworthiness predict levels of cooperation with conflict interventions. Lastly, by analysing conflict over trophy hunting via the social media platform Twitter, I reveal how this issue is polarised along similar political and value-based dimensions as other environmental conflicts. Beyond advocating for behaviourally-informed interventions, these findings have three key management implications: that the backgrounds of decision-makers mediate their priorities, that the backgrounds of interveners mediate responses to interventions, and that the socio-political and governance background of conflicts will likely mediate the outcome of interventions.

Lay Summary

Conservation conflicts describe the situations in which different groups of people clash over conservation objectives. Such conflicts can often revolve around wildlife related impacts, such as crop-raiding, livestock depredation, and the associated retaliatory killing of wildlife. However, conflicts between people over conservation often also reflect much deeper socio-political roots, such as those reflecting contests over land, perceived injustice, cultural practices, or ethics. Such clashes often result in negative consequences for human well-being and threatened wildlife populations. As such, conservationists are interested in intervening to manage such conflicts globally, often by encouraging changes in human behaviour. However, although there is a much evidence to inform such interventions, there remain important gaps in our understanding, particularly with regards to why different interventions are prioritised across different contexts, how people respond to different interventions and how the socio-political context of conflicts might influence the effectiveness of different interventions.

The purpose of this thesis is to help inform conflict management by better understanding the roots of conflicts and the factors influencing both intervention decision-making and intervention effectiveness. I begin by describing how conflicts over conservation emerge and use a literature review to categorise interventions aiming to change behaviour in conflict into five types: 'technical' (e.g., fences), 'economic' (e.g., compensation), 'cognitive' (e.g., education), 'enforcement' (e.g., patrols), and 'stakeholder' (e.g., consultations). Next, analysing the conflict literature, and using a survey with conservation professionals, I find that different intervention priorities associate with whether a conflict is located in a highly developed or less highly developed country, whether there are illegal behaviours reported,

and the backgrounds of those making decisions (including their disciplinary and demographic background). I then introduce a case-study involving conflict over elephant conservation in northern Tanzania, and consider how different governance structures and actors from beyond the local context shape both the dynamics of local conflict over elephants, and the effectiveness of local interventions. Next, I report the results of an experimental game framed around elephant conflict interventions, which finds that people who think an intervening organisation is more trustworthy are more likely to cooperate with interventions. Lastly, I explore the factors affecting polarisation in wildlife conflicts and find that US-based Twitter users who support trophy hunting are more likely to be conservative than liberal, and more likely to use instrumental, rather than moralistic reasoning to support their positions.

Taken together, these findings support a more behaviourally-informed approach to conflict management. In particular, they suggest that further consideration should be given to how conflict intervention decisions are made and how different interveners are received. Furthermore, these findings support assertions that building trust between communities and conservation organisations – through more effective communication, collaboration and by avoiding unrealistic promises – is important in improving social and wildlife-related outcomes. However, these findings warn that the effectiveness of local stakeholder-engagement may be challenged wherever local conservation objectives and outcomes are heavily shaped by non-local actors and processes, and possibly where conflicts are highly polarized and value-based. In short, this thesis concludes that, whilst conflicts over conservation are socially created and socially resolved, both the choice of interventions and their effectiveness likely depend on the people making them.

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Declaration of Originality

I, Zac Baynham-Herd, declare that this thesis has been composed by me, that it is my own work, that it has not been submitted for any other degree or professional qualification and that the publications included in this thesis (below) are my own work except where indicated.

Signature: 

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Work carried out during the making of this thesis has also contributed to the following publication:

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List of Figures and Tables

Table of Contents

Prologue

When beginning this PhD, my plan was to better understand conservation conflicts by modelling them using game theory as a series of multiple-party dilemmas. I didn't. Although I still draw upon the concepts of game theory in some of this work, my approach shifted after I encountered an altogether different dilemma: that conflict is inextricably linked to conservation and that interventions which successfully change contributing behaviours are rare. The aim of this PhD has since been to use a variety of methods to explore why this is the case, and what we should do about it. Many of these insights presented here have been informed through my experience with conflict in Enduimet Wildlife Management Area in northern Tanzania. But, these ideas have also been shaped by a range of other experience and insights: from reading about conflict in historical accounts, to witnessing conflict in real-time via Twitter accounts. Such a wide focus has inevitably led to a broad, interdisciplinary thesis, which draws upon an array of approaches, including literature reviews, interviews, surveys, experimental games, framing experiments and social media mining. As such, this thesis is disjointed at times, shedding narrow beams of light onto complex, wicked, problems. But, when taken together, hopefully these insights help somewhat towards informing more behaviourally-focussed and effective conflict interventions, with better outcomes for both people and wildlife.

Chapter 1: Introduction

Tembo zikipigana huumia nyasi

(when elephants fight, it is the grass that suffers)

– Swahili proverb

Photo: Z. Baynham-Herd

1.1 Problem statement

Conflicts over wildlife conservation are widespread and are both socially and environmentally damaging (Redpath et al., 2013). Such conflicts negatively impact some of the world's most impoverished people (Adams and Hutton, 2007; Barua et al., 2013), as well as the viability of some of the world's most endangered species (Woodroffe et al., 2005a). Conflicts are claimed to be increasing in frequency and intensity; supposedly due to

increased competition for diminishing space and resources (Balmford et al., 2001; Boitani et al., 2010). Consequently, there is much interest in understanding and managing conservation conflicts (Pooley et al., 2016; Redpath et al., 2013). Historically, much of the conservation literature has focused on so-called 'human-wildlife conflicts' (HWC) (Nyhus, 2016; van Eeden et al., 2017). Within this framing, certain species (usually of conservation concern) exert direct or opportunity costs to the livelihoods and well-being of local people, who subsequently retaliate by often lethal means (Woodroffe et al., 2005a). However, although understanding particular human-wildlife interactions is key to understanding conservation outcomes (Evans and Adams, 2018), recently there have been calls to reconceptualise many of these issues as representing conflicts between people *over* wildlife (Peterson et al., 2010; Young et al., 2010). Under this interpretation, conservation conflicts occur wherever individuals or groups (stakeholders) clash over conservation objectives and where one party is perceived to assert its interests over the others (Redpath et al., 2013).

Conservation conflicts may embody contests over a wide range of issues ranging from wildlife impacts (Pooley et al., 2016; Young et al., 2010), to protected areas (Soliku and Schraml, 2018), to invasive species (Estévez et al., 2015). They involve dynamic ecological, economic and socio-political elements, with relationships driven by the attitudes, perceptions, and power of different stakeholders (Arbieu et al., 2019; Mason et al., 2017; Pollard et al., 2019), and often fundamentally different ways that different actors perceive, value, and use the natural world (Dhee et al., 2019; Dickman, 2010; Peterson et al., 2010). Some conflicts may play-out at the level of the material dispute, whereas others involve underlying, deep-rooted contestations over politics, culture, or ethics (Madden and McQuinn, 2014). Some conflicts may appear to have only one 'winning' position, whereas others may have more potential for mutually beneficial outcomes (Redpath et al., 2013).

Conservation conflicts are therefore diverse, hard to define and measure, and are often interpreted and framed differently by authors, managers, and stakeholders involved in the conflict (Rechciński et al., 2019). This complexity has led to conservation conflicts being identified as intractable, 'wicked' problems (Mason et al., 2018).

As a consequence of such realisations, academic interest in conservation conflict has risen sharply (Peterson et al., 2010) and much time, effort, and resources have been spent attempting to resolve or mitigate conflicts (Pooley et al., 2016; Redpath et al., 2013). Typically, interventions aim to change some kind of human behaviour, be that retaliatory killing (Inskip et al., 2016), livelihood practices (Bal et al., 2011), or active opposition to conservation (De Pourcq et al., 2017). To date, research into conservation conflicts has largely concentrated on attempting to predict (Cusack et al., 2018), prevent (Nyhus, 2016), or mitigate (Ravenelle and Nyhus, 2017) wildlife impacts. Another common approach has been to use interventions to try and increase the tolerance of people towards wildlife; either through direct incentives such as direct payments, indirect incentives such as community aid, or through education programmes (Inskip et al., 2016; Lindsey et al., 2013). To address underlying human-human conflicts, attempts have also been made to increase stakeholder engagement (Redpath et al., 2017), build trust (Young et al., 2016), and find mutually agreed upon solutions (Madden and McQuinn, 2015).

Various frameworks have also been proposed in an attempt to inform conservation conflict interventions (Rechciński et al., 2019). These range from tracing human-wildlife (Dickman and Hazzah, 2015) or stakeholder interactions (Young et al., 2016b), to mapping conflicts using game-theory (Colyvan et al., 2011; Lin and Li, 2016) or competing land-use projections (Balmford et al., 2001), to analysing the socio-political context through 'wicked problem'

(Mason et al., 2018) and 'social-identity' approaches (Colvin et al., 2015). Whilst conflict managers may have varying motivations, commonly they attempt to solve problems and achieve socio-environmental outcomes, such as reducing the harmful features of conflicts (such as violence), fostering more collaborative conservation management, and promoting the adoption of more wildlife-friendly behaviours (Butler et al., 2015; Redpath et al., 2013).

Better understanding conservation interventions is important to improve their effectiveness (Sutherland and Wordley, 2017). Accordingly, in many specific contexts the effectiveness of individual interventions have been assessed. Such studies range from identifying the outcomes of economic incentives on recreational hunting behaviours (MacMillan and Phillip, 2010), to measuring the effectiveness of awareness campaigns on reducing urban wildlife impacts (Baruch-Mordo et al., 2011) to assessing the outcomes of co-management efforts in resolving conflicts between groups of stakeholders (Butler et al., 2015). Despite such contributions however, evidence-informed conflict management is still largely lacking (Eklund et al., 2017; van Eeden et al., 2018) and there is a dearth of general conservation theory to inform conflict interventions. In particular, conflict interventions would be improved by better understanding and targeting human behaviours (Nilsson et al., 2019; Veríssimo et al., 2019).

Although there is a small but growing literature which attempts to explore the effectiveness of different interventions at a larger scale, these tend to be limited to one intervention type – e.g., compensation (Ravenelle and Nyhus, 2017) – one taxa – e.g., carnivores (Inskip and Zimmermann, 2009; van Eeden et al., 2017) – or one context – e.g., protected areas (Soliku and Schraml, 2018). Furthermore, whilst some studies have identified variation in how practitioners and researchers prioritise different interventions (Lute et al., 2018; Rastogi et

al., 2013; Shiffman and Hammerschlag, 2016), the reasons behind such differences in intervention priorities remain underexplored. Indeed, conflict intervention approaches across different contexts are rarely considered together, and many intervention-related assumptions remain untested (Pooley et al., 2016). The extent to which conflict interventions are planned in a logical, step-wise fashion to meet specified conservation objectives – a Theory of Change (Qiu et al., 2018) – has also not been evaluated. There is therefore a need to further explore the evidence and assumptions underpinning different interventions, and the factors that constrain the choice of intervention priorities across different contexts.

Although there is an increasing understanding of the social roots of conflict (Mason et al., 2018), the human-wildlife conflict frame is still pervasive in the published literature (Krafte Holland et al., 2018; Nyhus, 2016) and conservation policy (IUCN, 2018). Consequently, the factors which are assessed in relation to conflict interventions are still largely limited to human-wildlife interactions, such as levels of retaliatory killing (Dickman, 2010; van Eeden et al., 2017) or wildlife impacts (Ceauşu et al., 2019; Hill and Wallace, 2012). In contrast, the social factors which shape conflicts, such as human-wildlife narratives (Dhee et al., 2019; Pooley, 2016), negative stakeholder relations (De Pourcq et al., 2017), and wider governance and economic systems (Colvin et al., 2015; García-Frapolli et al., 2018), have been considered less in assessments of conflict interventions. In particular, the importance of both levels of stakeholder trust (Young et al., 2016a), political polarization (Persson et al., 2015) and multi-level conflict dynamics (Madden and McQuinn, 2014) have been identified, but remain relatively untested with regards to their influence conflict behaviours and interventions. Hence, it is also important to better understand how such social factors might sustain conflict behaviours and constrain the effectiveness of interventions.

1.2 Aims and objectives

The aim of this thesis is to contribute to informing more effective conflict management by:

- Better understanding the factors which sustain conflicts and associated behaviours
- Identifying and testing the factors which influence intervention decisions
- Identifying and testing the factors which constrain intervention effectiveness

1.3 Research approach

To address these aims, this thesis uses a mixed methods approach (Newing et al., 2010), combining both quantitative and qualitative research methods in a range of individual, but related, studies. Chapter 2 introduces the different ways conservation conflict is conceptualised and managed. Next, Chapter 3 uses a global empirical review of the conservation conflict literature to explore the different ways in which conflicts are framed, the behaviours they involve, and the different interventions recommended by authors. This analysis follows empirical review best practice (Haddaway et al., 2015) and recent examples in the conflict literature (Estévez et al., 2015; Peterson et al., 2010). As the results of this review raise questions around the factors which influence intervention decisions, Chapter 4 then uses a framing experiment, in the form of a survey with conservation professionals, to test a variety of possible influences on conflict intervention recommendations. This study uses a full factorial design (Wattage et al., 2005), and follows similar framing experiments that have been used to investigate how different people respond to variations in environmental messaging (Anspach and Draguljić, 2019; Sapiains et al., 2016).

Chapter 5 provides an historical overview of case-study location of Enduimet Wildlife Management Area (WMA) in northern Tanzania, which is an area rife with conservation

conflict (Homewood, 2017; Mariki, 2016). Chapter 6 draws upon qualitative research conducted in Enduimet and considers the behaviours and multiple levels at which conflict in Enduimet is produced, and how these may constrain the efficacy of different interventions. These research methods are guided by best-practice in conservation social science (Bennett et al., 2017; Drury et al., 2011; Newing et al., 2010). Chapter 7, reports the results of a novel experimental game played in Enduimet, which tests the role of trust in shaping cooperation with conflict interventions. This approach draws upon similar games used in conservation (Gatiso et al., 2018; Salk et al., 2017) and was developed during a research methods workshop focused specifically on conservation conflict games (Redpath et al., 2018). Chapter 8 uses a social media analysis to explore the nature of polarisation in the conflict around the trophy hunting of African megafauna (Hutton and Leader-Williams, 2003). Using Twitter data, Chapter 8 draws upon previous social media analysis methods (Barberá et al., 2015; Toivonen et al., 2019), and considers the extent to which positions on trophy hunting are politically polarized, the nature of interactions, and the different value-based reasoning underpinning positions. Chapter 9 then synthesises these findings, presents their implications for conflict management, and outlines future areas for research.

1.4 Thesis structure

In addition to the introduction, this thesis is split into a further eight chapters.

Chapter 2 interrogates the conceptual underpinning of conservation conflicts and their management.

Chapter 3 uses an empirical literature review to identify how intervention recommendations associate with conflict geography, behaviours, and framing. This chapter has been published as:

> **Baynham-Herd, Z.,** Redpath, S., Bunnefeld, N., Molony, T. & Keane, A. (2018). Conservation conflicts: Behavioural threats, frames, and intervention recommendations. Biological Conservation, 222, 180–188.

Chapter 4 tests these findings using an experimental survey of conservation researchers and practitioners. This chapter has been published as:

> **Baynham-Herd, Z.,** Redpath, S., Bunnefeld, N., & Keane, A. (2019). Intervention priorities in wildlife conflicts. *Conservation Biology* doi.org/10.1111/cobi.13372

Chapter 5 introduces the case study location – Enduimet WMA – and its' history.

Chapter 6 explores the multi-level drivers of conservation conflict in Enduimet WMA and how these shape behaviours and constrain local conflict interventions.

Chapter 7 uses an experiment public goods game to test the role of trust in shaping stakeholder support for conservation conflict interventions in Enduimet WMA. This chapter is under review at *People and Nature* as:

> **Baynham-Herd, Z**., Redpath, S., Bunnefeld, N., Molony, T. & Keane, A. (2018). Trust predicts cooperation with conservation interventions in an elephant conflict public goods game.

Chapter 8 analyses US Twitter users to explore the factors – such as politics, values and networks – underpinning polarization within the conflict over African trophy hunting.

Chapter 9 discusses the implications of the findings of this thesis for conservation conflict research and management.

1.5 Me

Exercising reflexivity is important as a researcher given the mediating role played by personal biases and experiences in all forms of knowledge creation (Berger, 2015; Harding, 1992). This is particularly the case when make recommendations affecting other peoples' lives and when undertaking social research (Pasgaard et al., 2017), such as the fieldwork I conducted in Tanzania. Hence, regarding my own positionality, I grew up in Britain, with an academic background rooted in the Natural Sciences (Zoology), and History and Philosophy of Science. Aware of the need to develop proficiency in qualitative research techniques, at the start of my PhD I undertook training in social research methods and ethics (with a focus on Africa), acquired additional social science supervision, and undertook Swahili language training. Consequently, I was able to communicate in a basic fashion with my research participants in Tanzania, but I also relied upon two local research assistants (Stephen Sankeni and Joseph Sankeni) to act as interpreters and facilitators. I travelled alone by local transport and emphasised my status as a student to demonstrate that I was not associated with any conservation organisation. However, both previous research and cultural experiences will have likely shaped the ways in which respondents perceived me, and how I interpreted my observations and interactions with them (Goldman, 2007; Jacobs-Huey, 2002). Indeed, by engaging with other stakeholders within a conflict, and by researching it, to some extent I became a stakeholder myself (Redpath et al., 2013). In particular, at times I found myself acting as a channel of communication between community members and the conservation management area staff. Lastly, by attempting to gain generalisable insights for conflict management, my scientific approach could be characterised as one of a 'pragmatic positivist' (Moon and Blackman, 2014), and as a conservation researcher, I identify as largely anthropocentric in my outlook (Holmes et al., 2017), instrumentalist, and open to a range of intervention mechanisms, including markets (Sandbrook et al., 2019).

1.6 Ethics

Most of the research undertaken during the production of this thesis involved research with, or about, people. As well as securing ethical approval, ensuring that relevant ethical safeguards were in place was therefore hugely important (Ibbett and Brittain, 2019). For instance, across all of this research I have anonymised both my raw data and in-text quotations – this includes not reproducing any personal information which could be traced back to individuals (John et al., 2016). By providing information sheets and appropriate spoken translations, I also ensured each research participant was able to give their full and informed consent before participating in my research. In the Tanzanian setting in particular – in which there was the possibility for more unequal power dynamics – efforts were made to reiterate and emphasise to participants that they did not have to continue with any interview or study if they did not feel comfortable (Tindana et al., 2006). For transparency, my position as a student researcher (i.e. not a policy-maker or NGO staff worker) was emphasised to avoid raising any expectations of possible outcomes (from the perspective of research participants). I also made sure that I returned to the field-site to thank the communities who participated in my research and to provide an opportunity to share and receive feedback about the research. In the experimental survey (Chapter 4), to ensure that participants' dignity and rights were upheld, ethical guidelines for social experimentation were followed (Humphreys, 2015), including offering participants the option to receive the full results (and premise of the study) before publication. With regards to the Twitter-based study (Chapter 8), although tweets may be public, and therefore in theory users have given their implicit consent for them to be analysed or used in other ways, in practice most users are unlikely to have given informed consent for their tweets to be used or reproduced in research (Townsend and Wallace, 2016). Hence, I did not reproduce any tweets which could be used to identify specific users.

Chapter 2: Conceptual background

2.1 On the origin of conservation conflict

"Lions plunder men's steading, seizing on their cattle and sturdy sheep, until they too are killed, cut down by the sharp bronze in the men's hands" (*Iliad* V: 548-50).

As described by Woodroffe et al. (2005), from reading Homer's *Iliad* it appears that conflict between humans and wild animals have occurred since antiquity. Indeed, a cursory exploration of the conservation literature reveals that such interactions are still widely prevalent (Pooley et al., 2016). By many authors, these interactions are described as examples of 'human-wildlife conflict' (Peterson et al., 2010). Such definitions are also prevalent in conservation policy. As the International Union for the Conservation of Nature (IUCN) task force on 'Human-Wildlife Conflict' states: *"Human-wildlife conflict… typically involves situations in which a threatened species poses a direct threat to people and their livelihoods, resulting in retaliation against the species they blame for this."* (IUCN, 2018). Consequently, many conservation organisations and researchers task themselves with the objective of establishing 'coexistence' between people and wildlife – often through the use of technical interventions (e.g., livestock fencing) or economic instruments (e.g., insurance or compensation payments) (Nyhus, 2016; Treves and Karanth, 2003). By solving, or mitigating these conflicts, conservationists thus seek to achieve 'win-win's for people and wildlife (Redpath et al., 2013).

It appears however, that humans are not actually in *conflict* with wild animals, at least in the traditional sense of the term (Peterson et al., 2010; Young et al., 2010). Indeed, a

conflict is commonly defined as "*a difference in goal, perception or interest*" (Coser, 1957; De Pourcq et al., 2017) and as such, they are considered to occur between at least two conscious antagonists. Hence, whilst researchers and stakeholders do ascribe varying levels of agency (Evans and Adams, 2018) and rights (Pooley and Redpath, 2018) to individual wild animals, what many authors refer to as 'conflict' – e.g., threats to human life, economic interests or recreation (Treves and Karanth, 2003) – might more accurately be described as wildlife impacts (Young et al., 2010), negative interactions (Karanth et al., 2017) or 'ecosystem disservices' (Ceauşu et al., 2019). Under this conceptualisation, conflict occurs when people clash over conservation objectives and when one party exerts their interest over others (Redpath et al., 2013). In other words, people come into conflict *over* wildlife (Peterson et al., 2010; Young et al., 2010). Indeed, people disagree on *whether* wildlife should be killed, *how much* of it should exist, *where* it should exist, *how* it should exist, *why* it should exist and *what*, exactly, should exist (Young et al., 2010). Hence, at a deeper level, conflicts between people over conservation are shaped by narratives of what conservation is, and should, be and by both normative and political ways of seeing the world (Manfredo et al., 2017; Nesbitt and Weiner, 2001; Peet and Watts, 1996), which can lead to polarization (Hodgson et al., 2019; Veríssimo et al., 2015). These ultimate factors interact to produce the proximate human behaviours through which conflict is realised (Redpath et al., 2013; Veríssimo et al., 2019).

The roots of conservation conflicts are myriad, and are often entangled in complex histories. Conservation objectives themselves are themselves similarly diverse (Karp et al., 2015). However, those that are enshrined in national-level policy and the workings of major conservation organisations, generally coalesce around preventing global extinctions of species (Salafsky et al., 2008). However, although such efforts to conserve species have

proliferated since the mid -19th century (Adams, 2013; Cowles, 2012), clashes over access to wildlife, and the preservation of certain animals or environments, have been documented throughout human history (Grove, 1995; Lambert, 2015). Furthermore, human-wildlife interactions, attitudes and narratives are similarly varied across different places and cultures, and are subject to change over time (Dhee et al., 2019; Pooley, 2016). Nonetheless, Redpath et al., (2015) identify six broad categories of human interests which can clash with conservation objectives, and thus lead to conflict: livelihoods, recreation, human health and safety, human well-being, development and infrastructure, and animal welfare. Significantly, these social roots of conflicts – sometimes referred to as 'human-dimensions' (Treves, 2008) – show how conservation conflicts can encompass much more than simply disputes over wildlife impacts, but extend to any situation that involves a conservation objective being challenged, resisted or obstructed (De Pourcq et al., 2017; Holmes, 2007; Stern, 2008a). The defining feature of a conservation conflict is therefore a combination of behaviours: typically actors pursuing and threatening a given conservation objective (Redpath et al., 2013). Hence the umbrella of conflict extends from carnivore-killings and illegal resource-use to debates in parliament or civil protest. This definition of conflict, which does not encompass all natural resource or environmental related conflicts, but just those involving conservation objectives (Salafsky et al., 2008), is that which is used throughout this thesis.

The danger of such an all-encompassing definition is that it can become operationally useless. But, for conservation conflicts, the opposite is true. By acknowledging the social origin of all conservation conflicts, one can begin to explore the social dynamics and behaviours that produce and sustain them, and apply these lessons across different contexts. For example, it is known that conservation conflicts are also rooted in identities,

values, and politics (Madden and McQuinn, 2015), and although conflicts involve disagreements over objectives, they play-out through stakeholder interactions and perceptions of both other stakeholders and wildlife (Marshall et al., 2007). Conflicts can also involve disputes over information, management approaches, and decision-making processes (Young et al., 2010), and levels of power, collaboration, and trust between stakeholders also shape interactions between them (De Pourcq et al., 2017; Stern, 2008a). As conflicts are dynamic and can involve feedback loops, they can also be considered through the lens of 'wicked' problems (Mason et al., 2018). This understanding brings conflict managers to look less towards technological solutions, and more towards collaboration and stakeholder engagement (Redpath et al., 2017) – where stakeholders can be defined as any group or individual affecting, or is affected by, the achievement of an organisation's objectives (Colvin et al., 2015).

This approach to conceptualising conflict also necessarily shifts the focus from human-animal interactions, to human-human interactions. It does so primarily to better capture the social dynamics which shape human-wildlife interactions conflict related behaviours (Redpath et al., 2013). However, it is important to note that in doing so, this approach does not preclude other ways of conceptualising resistance to conservation, such as through a political-ecology lens (García-Frapolli et al., 2018; Margulies and Karanth, 2018; Massé, 2016; Peet and Watts, 1996). However, this approach does somewhat overlook other ways of considering multispecies interactions, such as those that consider socio-ecological 'assemblages', 'entanglements' (Pooley, 2016; van Dooren et al., 2016) and other 'more-than-human' conservation ethics, which do not necessarily prioritise conservation at the species level (Garlick, 2018; van Dooren et al., 2017).

2.2 Conflict interventions

Conservation conflict interventions are routinely developed, implemented, and assessed by conservation researchers and practitioners (Krafte Holland et al., 2018; Pooley et al., 2016; van Eeden et al., 2017). Although the aims of conservation conflict interventions may be multifaceted – and include combinations of biocentric, ecocentric, and anthropocentric rationales (Estévez et al., 2015; St John et al., 2018) – they typically target a species-related conservation objective (Salafsky et al., 2008). Whether trying to reduce retaliatory killing or improve stakeholder relations (von Essen and Hansen, 2015), conflict management invariably aims to influence human behaviour (Redpath et al., 2013) – even if this is achieved via changing animal behaviour. Accordingly, insights from the behavioural sciences can be used to inform and understand different types of behavioural interventions n(Nilsson et al., 2019; Reddy et al., 2017). Such intervention can be separated into technical (i.e., changing the external environment), cognitive (i.e., providing information) or structural interventions (i.e., changing regulations or economic pay-offs) (Heberlein, 2012a). Structural interventions can include stakeholder-bases interventions, including mediation, trust-building and participatory decision making (Madden and McQuinn, 2014; Reed and Ceno, 2015; Young et al., 2016a). These behavioural interventions are the types of interventions considered throughout this thesis.

Previous studies have made similar distinctions between different conflict intervention approaches (Dickman, 2010; Nyhus, 2016; Pooley et al., 2016; Young et al., 2013) and some have explored how different interventions are prioritised across different decision-makers (Lute et al., 2018; Shiffman and Hammerschlag, 2016) and contexts (Ravenelle and Nyhus, 2017; Soliku and Schraml, 2018). In the wider conservation literature, there have been increasing explorations of the psychological processes underpinning conservation priorities

(Jarvis et al., 2016; Sandbrook et al., 2019) and decision-making (Papworth, 2017), and the influence of biases and predispositions (Sheil and Meijaard, 2010). Such psychological influences have also been considered with regards to conflict intervention priorities (Jacobs et al., 2014a; Lute et al., 2018), but remain underexplored.

Efforts have also been made to assess the effectiveness of different conservation conflict interventions, but the object of measurement varies widely. For example, some interventions are assessed against the extent to which they reduce wildlife impacts (Hsiao et al., 2013; van Eeden et al., 2017), change attitudes (Holmes, 2003; Sakurai et al., 2015), change behaviours such as retaliatory killing (Inskip et al., 2014; Marino et al., 2016) or compliance (Solomon et al., 2015), or influence relations between stakeholders (Madden and McQuinn, 2014; Young et al., 2016a) and levels of co-management (Butler et al., 2015; Lundmark and Matti, 2015). Despite these contributions however, the evidence-base underpinning conservation conflict interventions is limited (van Eeden et al., 2018) and the application of behavioural science to conflict management is in its infancy (Veríssimo et al., 2019). In particular, how the social factors which are known to shape environmental conflicts generally – such as stakeholder trust (Hafner et al., 2017), political orientation (Costa and Kahn, 2013; Sapiains et al., 2016), and wider governance systems (de Vente et al., 2016; Stringer et al., 2006) – also mediate conflict behaviours and effectiveness of interventions remains underexplored.

Chapter 3: Behavioural threats, frames, and intervention recommendations

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3.1 Abstract

Conservation conflicts are widespread and are damaging for biodiversity, livelihoods and human well-being. Conflict management often occurs through interventions targeting human behaviour. Conservation interventions are thought to be made more effective if underpinned by evidence and a Theory of Change – a logical argument outlining the steps required to achieve goals. However, for conservation conflicts, the evidence and logic supporting different types of interventions has received little attention. Using conflict-related keywords, we reviewed trends in behavioural intervention recommendations across conflict contexts globally, as published in peer-reviewed literature. We developed typologies for conflict behaviours, intervention recommendations, and conflict frames and identified associations between them and other geographical variables using Pearson's Chi-squared tests of independence. Analysing 100 recent articles, we found that technical interventions (recommended in 38% of articles) are significantly associated with conflicts involving wildlife control and the human-wildlife conflict frame. Enforcement-based interventions (54% of articles) are significantly associated with conflicts over illegal resource use, while stakeholder-based interventions (37% of articles) are associated with

the human-human conflict frame and very highly developed countries. Only 10% of articles offered 'strong' evidence from the published scientific literature justifying recommendations, and only 15% outlined Theories of Change. We suggest that intervention recommendations are likely influenced by authors' perceptions of the social basis of conflicts, and possibly also by disciplinary silos.

3.2 Introduction

Conservation conflicts are some of the most intractable problems facing conservation and are increasing in frequency and intensity globally (Young et al., 2010). These conflicts negatively impinge upon biodiversity, livelihoods and human well-being, and therefore considerable effort is put into their management (Redpath et al., 2015). Conflicts involve situations where multiple stakeholders with strongly held positions clash over conservation objectives, and when one party imposes their interests over another (Redpath et al., 2013). They are hard to define and are often interpreted differently by authors, managers, and stakeholders involved in the conflict. The language used to describe a given interpretation of a conflict can be considered as a 'frame' (Peterson et al., 2010), and in the conservation literature conflicts are framed in many different ways (Table 3.1). Commonly, authors frame conflicts as primarily occurring between wildlife and humans - 'human-wildlife conflict' – (Woodroffe et al., 2005b). Others, however, posit that underpinning human-wildlife impacts such as crop-raiding are actually conflicts between different human interests, such as between conservation and agriculture (Peterson et al., 2010; Young et al., 2010). Under this interpretation, the umbrella of conservation conflict extends far beyond wildlife impacts on humans and also involves other conflicts such as those over resource-use, land-use or even animal welfare (Redpath et al., 2015). For example, in many cases

conservation rule-breaking, from illegal wildlife killing to resource use, has been identified as representing political protest or resistance to conservation (De Pourcq et al., 2017; Holmes, 2016).

The ultimate drivers of many conservation conflicts may be rooted in larger societal issues, such as poverty and inequality (Czech, 2008; Vedeld et al., 2012), imbalances of power (Raik et al., 2008), and inappropriate governance processes (Lute and Gore, 2014) (Table 3.1). However, the majority of interventions aimed at reducing conservation conflicts focus on the proximate human behaviours which impinge upon conservation interests (Schultz, 2011). These proximate behaviours are often referred to as behavioural 'threats' (Salafsky et al., 2008), and interventions commonly target their proximate drivers. For instance, the retaliatory killing of wildlife is often addressed by attempts to reduce wildlife impacts (Nyhus, 2016), deforestation by stronger enforcement (Duffy et al., 2014), and active opposition to conservation by efforts to improve stakeholder trust (Young et al., 2016) – though other social outcomes may also be targeted independently of conservation.

Following Heberlein (2012), interventions aiming to change human behaviour can be categorised into 'technical', 'cognitive' and 'structural' fixes. Technical fixes attempt to change the external environment and commonly target wildlife impacts such as crop-raiding and livestock depredation. These may include the erection of fences, provision of deterrents, the encouragement of wildlife-friendly products or the diversionary feeding of wildlife (Nyhus, 2016; Sutherland et al., 2017). These interventions operate under the assumption that retaliatory killing of wildlife, or active opposition to conservation, is directly related to human-wildlife impacts (Pooley et al., 2016). Cognitive fixes instead attempt to change behaviour through information dissemination. Examples include

conservation or livelihood education and conservation awareness campaigns (Baruch-Mordo et al., 2011; Holmes, 2003). Structural interventions attempt to change the context itself. Examples include financial instruments (such as incentives, insurance or compensation) or alternative livelihoods to reduce the physical or opportunity costs incurred by wildlife or conservation-related resource restrictions, or to discourage certain resource use (Kremen et al., 2000; Ravenelle and Nyhus, 2017). Likewise, structural fixes include the creation or enforcement of new rules aiming to increase compliance or discourage certain behaviours such as illegal resource use (Agrawal et al., 2014; Arias, 2015). Contrastingly, stakeholder engagement, mediation programmes, and conflict transformation efforts are structural fixes which target the social dimensions of conflicts. These operate under a range of rationales, from engendering greater support for conservation, to championing environmental justice (Madden and McQuinn, 2014; Redpath et al., 2017).

Like other types of conservation, conflict interventions are expected to be more effective if they are informed by evidence – from scientific evidence (Sutherland et al., 2017) to local ecological knowledge (Sterling et al., 2017) – and underpinned by a valid Theory of Change (ToC) (Biggs et al., 2017; Margoluis et al., 2013), which describes the logical and ordered sequence of interventions, actions, perturbations and outcomes identified during the planning process (Qiu et al., 2018). However, the evidence underpinning interventions is often lacking (Eklund et al., 2017; Treves et al., 2016), and the extent to which recommended conflict interventions are supported by ToC has not been assessed. Nor has there has been much consideration of the reasons underpinning different conflict interventions.

The purpose of this review is to contribute towards informed conservation conflict management by exploring, across a range of conflict contexts globally, behavioural intervention recommendations as presented in peer-reviewed academic journal articles. We aim to scrutinize how the types of behavioural intervention recommendations differ across these contexts and to inform researchers and decision-makers, particularly those acting at the local scale. To generate a sample of conservation conflict case-studies and intervention recommendations for comparison, we conducted a sampled literature review, and analysed 100 recent articles from the published conservation literature related to conflicts. To identify the prevailing intervention types, we first developed conflict typologies from directed content analysis and then highlighted the most common intervention types recommended by authors in different contexts. To further understand why certain types of intervention are recommended in certain contexts, we explored associations between the recommended interventions, different behavioural threats and conflict frames. We hypothesised that authors who frame conflicts as primarily occurring between humans, would be more likely to recommend stakeholder-based interventions. As some conflict interventions, such as compensation (Ravenelle and, 2017) and militarised enforcement (Duffy et al., 2014), appear to vary regionally, we also considered whether different types of interventions associate with other geographical factors, such as the development status of nations and the conservation status of species and areas. To identify any possible gaps in the intervention evidence-base, we assessed the extent to which intervention recommendations are supported by scientific evidence and ToC. Lastly, we also estimated the proportion of articles that focus on other forms of evidence (e.g. stakeholder knowledge), and explored whether intervention recommendations and framing could be analysed across academic disciplines.

Table 3.1. A non-exhaustive, and non-mutually exclusive list of different conflict drivers and associated frames presented in the literature, based upon our interpretation.

Conflict drivers	Otherwise framed as
Wildlife impacts Livestock depredation or crop-raiding and/or human injury, with associated retaliatory killing or persecution of wildlife and/or active opposition to conservation efforts trying to prevent this. Similar conflicts surround proposed reintroductions, or predator management on recreational hunting estates.	Human-wildlife conflict (HWC), (Woodroffe et al., 2005b) coexistence (Rust and Marker, 2014), human-wildlife relations/interactions (Pooley et al., 2016) stakeholder conflict (Redpath et al., 2015) persecution (Whitfield et al., 2004), pest-control (Delibes-Mateos et al., 2013)
Resource-use and restrictions Unsustainable or illegal harvest of fauna and flora and associated efforts to prevent/reduce such harvest. This includes commercial activities (e.g. logging, fisheries, wildlife trade, recreational hunting) and non-commercial activities (e.g. subsistence hunting or foraging).	Natural resource related conflict (NRRC) (De Pourcq et al., 2017), Illegal wildlife trade (Nijman, 2010), logging, poaching, unsustainable use, encroachment (Mackenzie et al., 2012) fisheries management (Marzano et al., 2013), common-pool resource conflict (Adams et al., 2003)
Land-use decisions Protected areas, land-use change, relocations and/or associated loss of livelihoods, traditions identity. Associated behaviours may include 'encroachment' and local (or international) opposition to conservation regulations and organisations	People-park conflict (Stern, 2008b), environmental justice, indigenous rights, land-use conflict (West et al., 2006)
Conservation governance Lack of transparency in decision-making process, lack of trust, unequal power dynamics, ineffective governance	Stakeholder conflict (Young et al., 2016), conservation governance (Lute et al., 2018; Peterson et al., 2005; Stern and Coleman, 2015), natural-resource management (Raik et al., 2008)
Development and economics Conflicts between poverty and/or economic growth and conservation, commercial or state-sanctioned development in 'green' spaces or protected areas, and associated civic and organisational protest/opposition	Development conflict, Natural resource management, (Bockstael et al., 2016; Hopcraft et al., 2015), poverty traps (Vedeld et al., 2012), Environmental Kuznets Curve (Czech, 2008)
Clashing of values Animal-rights campaigns against lethal control, or trophy hunting. Also includes conflicts over different approaches, philosophies or ethics	Animal welfare (Crowley et al., 2017), human-human conflict (Redpath et al., 2015), conservation values (Holmes et al., 2017), conflict over stakeholder participation (López-Bao et al., 2017)

3.3 Materials and methods

To generate a sample of conservation conflict case-studies we conducted a search of peer-reviewed conservation literature using ISI Web of Knowledge in October 2016. To facilitate reproducibility and transparency, we followed best-practise guidelines (Haddaway et al., 2015) and applied carefully designed keyword search-strings to capture a wide variety of conflict contexts, including those not necessarily identified in the conservation conflict literature (Table 3.1).

To focus on interventions, in our final search we included wildcard search terms for a series of active verbs. Using the English language only, we searched for the following combination of terms in the titles, abstracts or keywords of all articles in the ISI core collection: “conservation conflict*" OR ("conservation" AND "illegal") OR ("conservation" AND "conflict" AND ("stakeholder*" OR "human-wildlife")) AND either - "prevent*" OR "mitigat*" OR "reduc*" OR "resolv*" OR "resolution*" OR "solv*" OR "solution*" OR "manag*" OR "interven*" OR "improv*". To avoid unconscious bias in the sample selection (Haddaway et al., 2015), we decided the temporal and spatial boundaries before the final search. We excluded publications before 2011 to focus on the most recent interventions. To aid comparison, reviews and book chapters were excluded to focus on primary case-studies of roughly similar length. The final search yielded 897 results.

To produce a representative sample for analysis, we used a random list generator to sort the sample into a randomly ordered list, from which we analysed articles sequentially. We excluded any publications (n=57) which did not describe contexts falling within the definition of conservation conflicts provided by Redpath et al., (2013), those which we

could not access, reviews, and those which did not make any intervention recommendations (Appendix 1). We continued analysing articles, following the random sequence until we had a total sample of 100 relevant articles. This total sample size (n=100), and proportion of articles reviewed (157/897), was comparable to previous similar studies (Estévez et al., 2015; Peterson et al., 2010; Redpath et al., 2015). Demonstrating representativeness, there was no significance difference in the proportions of key search terms between the analysed sample and non-analysed sample (Appendix 1, Table A1.1).

To avoid selection bias (Haddaway et al., 2015) we developed our conflict and intervention typologies (Table 3.2) and our coding system prior to collecting and analysing our final sample. We used directed content analysis (Hsieh & Shannon 2005), whereby we first derived each typology from previous reviews, before refining each typology through analysing a large sample of conflict case-studies. This preliminary sample of case-studies (n=150) was drawn from the published literature using a similar search and sampling process described above (Appendix 1, Search 1). Following Heberlein (2012), we first categorised interventions into 'technical', 'cognitive' and 'structural' types. With reference to previous conservation conflict reviews (Dickman, 2010; Nyhus, 2016) and content analysis of the preliminary sample, we subdivided 'structural' further into 'economic', 'enforcement' and 'stakeholder' types. Our typology of human behavioural threats was derived from existing literature (Salafsky et al., 2008) and content analysis of the preliminary sample to include: 'wildlife control', 'resource-use', 'environment change', 'indirect damage' and 'active opposition'. Likewise, from existing reviews we identified two key frames –'human-wildlife conflict' (HWC) and 'human-human' conflict (HHC) (Peterson et al., 2010; Redpath et al., 2015). We then derived an additional frame – 'illegal resource use' (IRU) – from content analysis of the preliminary sample.

Table 3.2. Our typology of conservation conflict intervention types, behavioural threats, and frames.

Variable	Examples	References
Intervention type		
Technical	Wildlife control lethal (traps, shooting, pesticides, poison), non-lethal (translocation, deterrents, diversionary feeding, fertility/disease management) Habitat manipulation buffer crops, alternative food, barriers (fences, nets, enclosures) Livelihoods livestock /crop protection, guarding , modify crops, rotations, immunization People control barriers, surveillance systems, modified gear, signposts	(Lute et al., 2018; Nyhus, 2016; Pooley et al., 2016; Sutherland et al., 2017)
Cognitive	Livelihood training husbandry techniques, crop cycles, sustainable yields Awareness wildlife attitudes and perceptions, conservation benefits Regulatory information species protection laws, quotas, access rights	(Baruch-Mordo et al., 2011; Holmes, 2003; Keane et al., 2011)
Economic	Remuneration compensation & insurance schemes (state, charitable, private) Incentives direct payments, payments for ecosystem services, tourism income, sustainable use/harvest Employment direct employment, alternative livelihoods Services education, healthcare, infrastructure	(Kremen et al., 2000; Ravenelle and Nyhus, 2017; Wünscher and Engel, 2012)
Enforcement	Regulation creation protective status, land-use zoning, land rights, quotas, trade-bans, equipment/practice ban (e.g., poisons) Regulation enforcement increased patrols, trials, punishments, reduced corruption, legal processes	(Agrawal et al., 2014; Arias, 2015; Challender et al., 2015; Donald et al., 2007)

Stakeholder	Stakeholder engagement participatory planning, knowledge sharing, consultations, deliberations Conflict resolution trust building, transformation, third-parties Devolution community-based natural resource management, land rights, power sharing	(Madden and McQuinn, 2014; Peterson et al., 2005; Young et al., 2016a)
Behavioural threat		
Wildlife control	Lethal retaliatory killing, persecution of wildlife Non lethal Harassment, scarring of wildlife	(Jensen et al., 2008; Carolina Marquez et al., 2013; Nyhus, 2016)
Resource use	Illegal poaching, bush-meat, wildlife trade, encroachment Non-illegal unsustainable harvest (e.g., logging, fisheries)	(Nijman, 2010; Watson et al., 2013)
Environment change	Land-use development, recreation, agriculture Ecosystem stewardship, management change	(Bockstael et al., 2016; Gross et al., 2013)
Indirect damage	Primary damage pollution, bycatch, collisions Secondary spread of disease or invasive-species, consumer demand	(Gilman, 2011; Lin et al., 2013)
Active opposition	Protest civic protest, lobbying, campaigns against conservation efforts Resistance sabotage, hostility, non-participation with conservation efforts	(Holmes, 2007; Stern, 2008b)
Frame Human-wildlife conflict (HWC)	Authors describe conflict as primarily occurring between humans and other animals. Often involves crop/livestock loss and associated retaliatory killing of wildlife	(Nyhus, 2016; Woodroffe et al., 2005b)

Illegal resource use (IRU)	Authors describe rule-breaking natural resource use (such as illegal wildlife trade, logging, bush meat, fisheries, encroachment), without reference to underlying relationships between different stakeholders. These behaviours are usually considered illegitimate	(Nijman, 2010; Solomon et al., 2015)
Human-human conflict (HHC)	Authors describe human disagreements between particular actors over conservation actions or decisions Conservation-related rule-breaking may be considered as acts of protest or resistance	(De Pourcq et al., 2017; Redpath et al., 2015)

All data analysis was conducted by the lead author, but the typologies were created and refined in consultation with co-authors. In the final sample, each article was analysed at least twice to check for errors, with ambiguous articles marked and returned to. For all variables (besides framing), we used a binary coding system within larger non-mutually exclusive categories – e.g., articles could describe more than one threat or intervention type, but were categorised as one frame. The development status of nations (as designated by the Human Development Index) (UNDP, 2016), protected area presence, the conservation status of species (as designated by the IUCN Red List) (IUCN, 2017) was recorded, as was the identification of stakeholder groups, wildlife impacts and illegal activity. After categorising each article in our final sample (n=100), we calculated intervention recommendation proportions across variables, and identified associations between interventions, behavioural threats and frames, using Pearson's Chi-Squared test for independence and a mosaic plot of Pearson's residual values (using the "vcd" package) in R 3.4.1 (R Development Core Team, 2014).

We recorded articles as demonstrating reasoning akin to a ToC if they identified the steps required for interventions to achieve a desired outcome. We assessed the level of published scientific evidence supporting recommendations using three categories. 'Strong' evidence included articles in which all, or nearly all, recommendations were supported either by reference to previous studies, and/or by experimental, correlative or comparative evidence from the study itself. 'Partial' evidence included articles in which over half of recommendations were supported by references or within-study evidence. 'Weak' evidence included articles in which less than half of recommendations were supported by references or within-study evidence. Following Estévez et al., (2015), we also explored author affiliations (region) and journal geographical scope, and attempted to categorise institution and journal types by disciplinary focus. However, during analysis we found that the interdisciplinary nature of many conservation-related journals and departments meant such a categorisation approach was ultimately unsatisfactory (Appendix 1, 'Journals').

Lastly, following our initial analysis – in which we (unintentionally) overlooked non-scientific forms of knowledge – we later attempted to overcome this by estimating the proportion of articles in the whole sample which focused on stakeholder-based knowledge specifically. To do so, we conducted a keyword search (in article titles, abstracts and keywords) of the entire sample (n=897) for: "local knowledge", "traditional knowledge", "ecological knowledge", "stakeholder knowledge" or "indigenous knowledge".

3.4 Results

Across the final sample (n=100), we categorised 30 articles as using the frame 'human-wildlife conflict' (HWC), 41 as 'illegal resource use' (IRU), and 29 as 'human-human conflict' (HHC). Of these, we recorded 32 articles describing wildlife control, 59 resource use, 26 environment change, 34 indirect damage and 33 active opposition. 48 articles included IUCN Red Listed species, 40 articles focused on very high development countries, 20 high development, 31 medium development, and 9 low development. 61 articles described protected areas, and 66 reported illegal behaviours (Appendix 1, Table A1.2). 88% of articles were published in journals with a global scope (Appendix 1, Table A1.10) and both study locations and author affiliations were spread across the worlds regions (Appendix 1, Figure A1.1). Across the sample 'enforcement' was the most commonly recommended intervention type, appearing in 54% of articles. 'Economic', was the next most popularly recommended intervention type (suggested in 47% of articles), followed by 'cognitive' (40%), 'technical' (38%) and 'stakeholder' (37%) (Figure 3.1).

Technical interventions (such as fences, diversionary feeding or guarding tools) were over 2.5 times more likely to be recommended (Odds ratio (OR) > 2.5) when authors reported behaviours related to wildlife control (such as retaliatory killing) (OR: 2.63, $P < 0.001$) (Figure 3.2) and when they used the HWC frame (OR: 2.59, $P < 0.001$) (Appendix 1, Table A1.3). Cognitive interventions – such as livelihood training and education awareness programmes – showed no clear associations with any conflict variables. Economic interventions – such as compensation payments or alternative livelihoods – did not associate with any threat, but were positively associated with high, mid and low development countries (OR, 1.94, $P = 0.005$), and were negatively associated with very high development countries (OR: 0.51, $P = 0.005$) (Appendix 1, Table A1.3).

Enforcement is also positively associated with high, mid and low development countries (OR: 1.73, P = 0.006) and negatively associated with very high development countries (OR: 0.58, P = 0.006). In contrast, stakeholder interventions – such as participatory decision-making or peace-building – are positively associated with the threats of active opposition (OR: 2.98, P < 0.001), environment change (OR: 2.17 P = 0.003), the human-human conflict frame (OR: 4.02 P < 0.001) and very high development countries (OR: 2.46, P <0.001). Stakeholder interventions are negatively associated with the resource use threat (OR: 0.53, P = 0.014), the illegal resource use frame (OR: 0.22, P < 0.001), IUCN Red-Listed species (OR: 0.29, P < 0.001) and high, mid and low development countries (OR: 0.41, P < 0.001).

Only 22% of articles recommended just one intervention type, and on average authors recommended 2.16 intervention types. No authors recommended interventions pertaining to all five of our intervention categories, and only enforcement and stakeholder types showed a significant (negative) association (P = 0.004) (Appendix 1, Table A1.7). Many of the conflict variables associated with different intervention types were also strongly associated with each other (Appendix 1, Table A1.6). The HWC frame was positively associated with articles describing wildlife control, wildlife impacts and IUCN Red-Listed species. The IRU frame was positively associated with articles describing resource use, indirect damage, illegal activity and high, mid and low development countries. In contrast, the HHC frame was positively associated with articles describing active opposition, environment change, stakeholder groups and very high development countries.

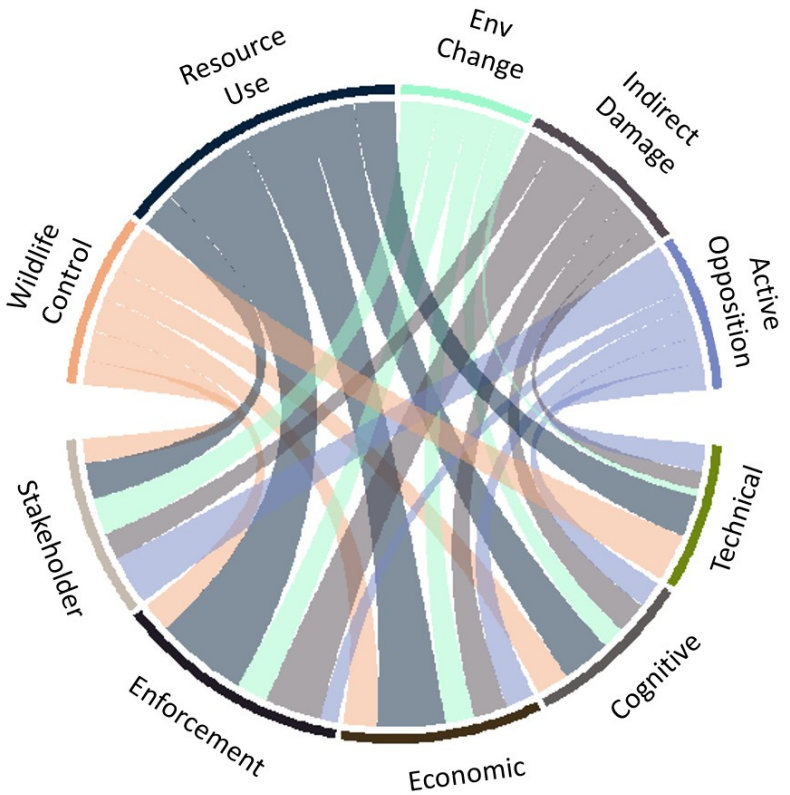

Figure 3.1. Chord diagram showing the relationship between behavioural threats (top) and recommended intervention types (bottom). The width of each outer rim depicts the proportion of total articles describing each threat and intervention type. The direction and width of inner flows show the proportion of articles within each behavioural threat category that recommend each intervention type. 'Env' = Environment.

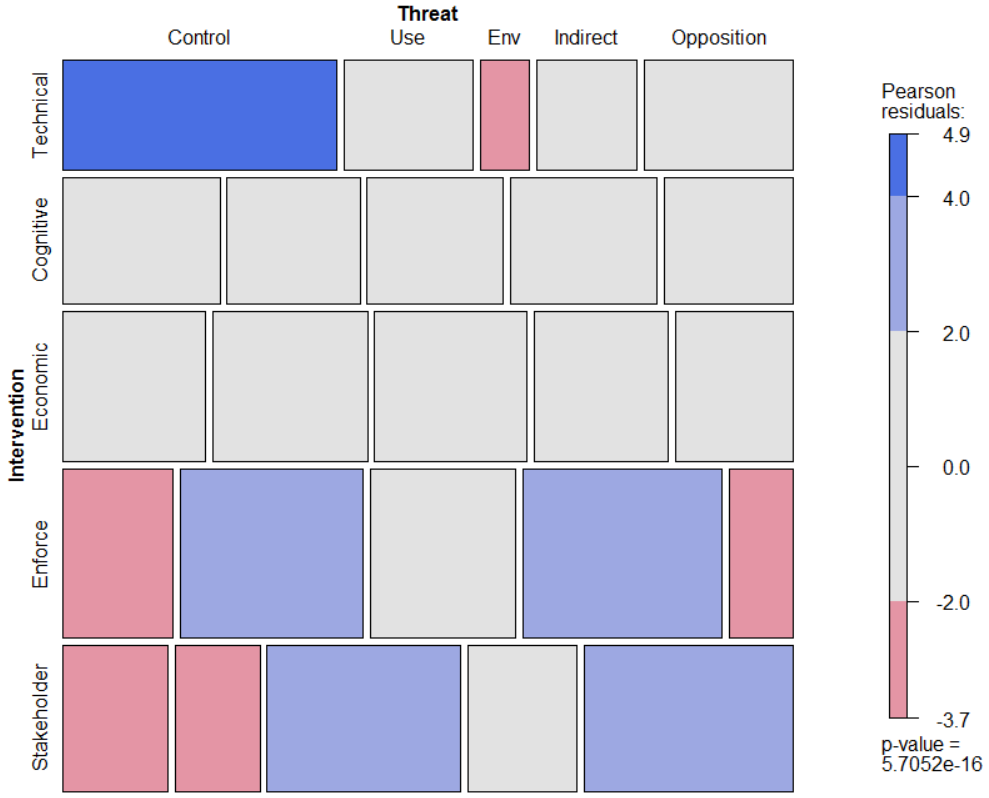

Figure 3.2: A mosaic plot depicting the association between intervention recommendations and behavioural threats, colour-coded by Pearson's residual values, with blue cells indicating significantly more observations than would be expected under independence (positive association), red cells indicating fewer observations than would be expected (negative association). Box size is proportional to the observed frequencies of each cross-classification. 'Control = Wildlife control, 'Use' = Resource Use, 'Env' = Environment change, 'Indirect' = Indirect damage, 'Opposition' = Active opposition, and 'Enforce' = Enforcement

15% of articles outlined the steps required for an intervention to reach a goal, but none of these were explicitly referred to as ToC. 10% of articles offered 'strong' scientific evidence to justify recommendations, 65% offered 'partial' scientific evidence and 25% offered 'weak' scientific evidence. Articles offering 'weak' evidence tended to recommended less interventions, but this relationship is not significant (Appendix 1, Table A1.9). Economic recommendations were positively associated with ToC (OR: 1.94, P= 0.006) and strong evidence (OR: 2.13, P = 0.004) and enforcement was positively associated with weak evidence (OR: 1.58, 0.037). Only 16 (1.8%) articles out of the entire search sample (n=897) made explicit reference to stakeholder-based forms of knowledge in their titles, abstracts or keywords. 68% of first-author affiliations corresponded to same geographical region as the study conflict (Appendix 1, Figure A1.1). Of those that studied a conflict in a different region, 88% of first-author affiliations were based in Europe or North America.

3.5 Discussion

Globally, many different actors, from scientists, to practitioners to governments, design and implement interventions to tackle conservation conflicts, and these conflicts take many forms. From reviewing the published academic literature, we compare together for the first time a wider range of conservation conflict contexts and show that conflict intervention recommendations vary with regards to the behaviours they target, the way conflicts are framed, and the evidence and reasoning underpinning them.

In contexts where there are conflicts over wildlife impacts (e.g. crop or livestock loss) and often the subsequent retaliatory killing of wildlife, we find that authors tend to recommend technical interventions. Such technical interventions (including wildlife fences and

diversionary feeding) aim to alter human behaviour by changing the external environment (Heberlein, 2012a). Like others (e.g., Pooley et al., 2016), we find that that those who recommended these interventions typically reason that the retaliatory killing of wildlife will reduce as the damage exerted by wildlife reduces. In contexts where there is illegal natural resource use, or indirect environmental damage, and in countries with lower levels of human development, we find enforcement-based interventions are favoured. As elsewhere (Keane et al., 2008) we identify that enforcement-based interventions are often recommended under the logic that the greater policing of natural resources and stricter regulations will reduce over-harvesting and illegal behaviour directly. Where there is undesirable environment change – such as agriculture or recreation expansion – or active opposition to conservation – such as protests, hostility or objections – and in more highly developed countries, we find that stakeholder-based interventions are favoured. These authors often perceive that social, sometimes non-material factors, sustain the conflict and hence stakeholder interventions commonly target emotions and aim to increase dialogue and trust, with the idea that shared, and agreed-upon problems and solutions can be met (Redpath et al., 2017; Young et al., 2016). However, as documented elsewhere (Peterson et al., 2005; Reed, 2008) in our sample, stakeholder-based interventions vary considerably in style and motivation. Some advocate for collaborative decision-making or more devolved governance (Dandy et al., 2014), whereas others focus on increasing decision-making transparency or on conducting stakeholder consultations (Elston et al., 2014).

In terms of behavioural threats, we find that economic interventions are recommended less selectively, but they are more common in less developed countries. This result contrasts with that found for wildlife impact compensation (Ravenelle and Nyhus, 2017), but this might be because we also considered other economic mechanisms (like alternative

livelihoods), and other contexts such as natural resource where economic interventions are common (Agrawal et al., 2014). Economic interventions were generally best supported by evidence and reasoning, but no article considered whether it mattered which group or institution was conducting the recommended intervention, despite indications that perceptions of trust can play a key role in responses to conservation interventions (Stern and Coleman, 2015). Cognitive interventions associated with no variables, suggesting they may be deemed suitable across contexts. However, we found many cognitive interventions to be undeveloped in reasoning and unsupported by evidence. Given critiques of the information deficit model underpinning information-based interventions (Heberlein, 2012; Schultz, 2011), we suggest they would benefit from further testing.

Like similar reviews (Estévez et al., 2015; Peterson et al., 2010; Ravenelle and Nyhus, 2017), we were unable to include non-English-language articles or grey literature, which would likely have provided further insight. Our conclusions are also limited to recommendations about interventions which are unlikely to be accurate reflections of actually implemented interventions – as recommendations are likely less limited by resources or other constraints. Hence, comparing our findings with implemented interventions, including in regions such as South America which are underrepresented in our sample, would be useful future work. The rigour of the analysis could also have been improved by training multiple coders (e.g., Peterson et al., 2010), increasing the sample size and checking the quality of references used as evidence. Experiments could also be designed to test our findings; for example, a choice experiment with conflict mangers or researchers could test the effect of framing on intervention preferences.

Our finding that framing seems to influence whether socially-focused interventions are recommended is significant because all conservation conflicts are ultimately rooted in social conflicts (Redpath et al., 2013). For instance, beyond wildlife impacts, cultural factors such as religion, or levels of opposition to conservation can determine levels of the retaliatory killing of wildlife (Dickman and Hazzah, 2015; Mariki et al., 2015). Likewise, illegal activities such as poaching or protected area encroachment often reflect protest, opposition or resistance to conservation (Holmes, 2007; Stern, 2008b). Reframing conflicts to better reflect their root cause is therefore crucial for successful conflict management (Peterson et al., 2010; Young et al., 2010). Our attempts at exploring the possible influence of disciplinary silos on both framing and intervention recommendations proved unfruitful. However, others have identified disciplinary silos in conservation (Margles et al., 2010), and that interventions recommended by conservation researchers may reflect their disciplinary training (Sandbrook et al., 2013). Hence, given these findings and the importance of framing identified here, we suggest it would be beneficial for researchers to think more broadly about conflicts in conservation, and look beyond the literature specifically related to their study context.

Future work should examine the extent to which authors' disciplinary background, beliefs, expertise or the nature of the conflict itself influence their intervention recommendations. For instance, does variation in ethical positions or rationales for conservation (Holmes et al., 2017) influence the types of intervention recommended? Do those that perceive illegal behaviour as being more or less legitimate (e.g., Sheil et al., 2016) differ in the extent to which they advocate enforcement over participatory approaches? Likewise, the reasons why enforcement and stakeholder-based interventions appear to differ depending upon the development status of countries needs to be explored. Does this trend just reflect the

increased presence of threatened species or protected areas, or does it represent perceptions of the strength of governance, or more problematic biases revolving around top-down conservation that prevail where conservationists have relatively more power (Duffy, 2014; Kashwan, 2017; Sandbrook, 2017)? Future work could also look at factors such as the broader socio-economic, cultural or governance context, as well as the involvement of particularly marginalised or minority communities in conflicts.

We find that few authors provide ToC, authors rarely justify all intervention recommendations with published scientific evidence, and the adaptive approach was largely overlooked, despite the effectiveness of decision-making frameworks and adaptive management having been regularly advocated (e.g., Bunnefeld et al., 2017). The lack of causal-reasoning and scientific evidence is problematic as it suggests conservation interventions often borne out of intuition, group-think or convention rather than evidence (Eklund et al., 2017; Sutherland and Wordley, 2017), which might prevent otherwise successful interventions from being considered. One reason for the lack of ToC might be that only recently has a framework been developed to bridge different methodologies and guide their development for conservation (Qiu et al., 2018). Step-wise reasoning (ideally underpinned by behavioural theory) and the outlining of clear goals would also make it easier to assess the effectiveness of interventions (Agrawal et al., 2014), thus contributing to the possible evidence-gap that we have highlighted. However, other forms of knowledge, including local ecological knowledge (LEK), or expert/stakeholder experience can also inform interventions (Sterling et al., 2017). We identify that such knowledge forms may be underrepresented in the published literature, and argue that future work could explore this trend further, and identify how best to incorporate multiple knowledge forms in conflict management.

3.6 Conclusions

Individuals or groups who actively participate in conservation-related rule-breaking, such as protected area infringement, may as much be in conflict with conservation as those who poison livestock-raiding predators, or those who lobby against conservation regulations in parliament. Behavioural interventions recommended to tackle such conflicts vary with the types of behaviours targeted, the conflict frames adopted by authors, and by the evidence and reasoning underpinning them. Technical intervention recommendations are associated most with conflicts involving wildlife control (such as retaliatory killing) and those framed as 'human-wildlife conflict'. Enforcement-based recommendations are associated most with conflicts involving (often illegal) natural resource use, and those in less developed countries. In contrast, stakeholder-based intervention recommendations are associated most with conflicts framed as 'human-human conflicts' and more highly developed countries. We suggest that effective interventions should be informed by robust and appropriate evidence, and underpinned by carefully considered ToC. We highlight that other factors appear to influence intervention recommendations which might potentially lead to poor decisions being made. Lastly, we recommend that future studies should make the theoretical and evidential basis of their recommendations clearer and research should study why certain conflict frames arise and their impact.

3.7 Recommendations

- Researchers should seek to recognise and transcend the barriers which categorise different conflicts, so that any entrenched silos do not lead to potentially successful solutions being overlooked.
- Researchers should further explore how the framing of conservation conflicts is generated and how it influences intervention suggestions.
- Those recommending conflict interventions should more clearly outline the social and environmental goals targeted, and the steps and behaviour change required to reach these goals.
- Those recommending conflict interventions should justify recommendations with greater evidence, including scientific and stakeholder-based knowledge.
- Researchers should aim to contribute to this evidence-base by testing the assumptions underpinning how particular interventions are intended to influence behaviours.

Chapter 4: Predicting intervention priorities in wildlife conflicts

This chapter has been published as:

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4.1 Abstract

There is growing interest in developing effective interventions to manage socially and environmentally damaging conservation conflicts. There are a variety of intervention strategies that can be applied in various contexts, but the reasons one type of intervention is chosen over another remain underexplored. We surveyed conservation researchers and practitioners (n=427) to explore how the characteristics of conflicts and the characteristics of decision makers influence recommendations to alleviate conservation conflict. Using a full-factorial design, we experimentally manipulated 3 aspects of the descriptions of 8 different wildlife conflict scenarios (development status of the conflict country, conflict framing, and legality of killing wild animals), and recorded which of 5 intervention types (wildlife impact reduction, awareness, enforcement, economic incentives or stakeholder engagement) respondents prioritized. We also recorded information on respondents' demographic and disciplinary backgrounds. Stakeholder-based interventions were recommended most often in the survey and in written feedback. However, when we fitted multinomial mixed logit models with fully completed scenario responses (n=411), recommendations were influenced by small changes in the details of conflict and differed according to respondent characteristics. Enforcement and awareness interventions were prioritized relatively more for conflicts in more highly developed nations and by respondents with more natural-science backgrounds and relatively less experience with

conflict. Contrastingly, economic interventions were prioritized more when wildlife killing was described as illegal. Age, gender, and development status of the respondent's home country also predicted some intervention decisions. Further interrogating the influences shaping conservation decision making will further the development of evidence-informed interventions.

4.2 Introduction

Conservation conflicts are damaging for both people and wildlife and as such, there is much interest in designing and implementing interventions to resolve or mitigate them (Redpath et al., 2013). Although conservation conflicts can involve clashes over any conservation objective (Redpath et al., 2015), conflicts centering on the impacts of wildlife on livelihoods are particularly widespread (Pooley et al., 2016). In these situations – which are often framed as human-wildlife conflict or coexistence problems – interventions commonly aim to mitigate the negative impacts of wildlife, reduce wildlife killings or improve the relationships among stakeholders (Chapter 3).

The geographical distribution of interventions (Ravenelle and Nyhus, 2017) and their effectiveness (Eklund et al., 2017; van Eeden et al., 2018) have been explored and variation in how practitioners and researchers prioritise interventions (Rastogi et al., 2013; Shiffman and Hammerschlag, 2016) identified. For instance, how conflicts are framed by authors, whether they involve illegal behaviours and the development status of the countries in which they are located, has been hypothesized to influence intervention decisions (Chapter 3; Soliku & Schraml 2018). Moreover, it appears researchers and practitioners from different disciplinary backgrounds and regions tend to recommend different solutions (Lute

et al., 2018). However, the underlying reasons accounting for this variation in intervention priorities has been less explored, in part because much previous work in this area has been observational, making it harder to unpick potential relationships. Moreover, as intervention strategies used in conflicts can often be contested or controversial (Duffy et al., 2019; López-Bao et al., 2017), it is important to understand the factors driving support for such different approaches.

One pathway to better understanding how decisions are made in conflicts is through exploring the social and psychological mechanisms underpinning conservation decision making (Papworth, 2017). For instance, subtle changes in the way problems are framed often change how people suggest solving them (Sapiains et al., 2016). Such subtleties may be particularly important when people are making quick decisions with limited information. This is because under such circumstances people are thought to rely more on intuition and pattern matching compared with when they are making slower, more analytical decisions, based on multiple sources of information (Evans, 2008; Kahneman, 2011). Furthermore, like all people (Schultz, 2011), the priorities of conservation professionals differ (Sandbrook et al., 2019) and are likely shaped by predispositions, cognitive biases, and values (Kiik, 2018; Sheil and Meijaard, 2010). However, how such factors may influence conflict intervention decision-making remains underexplored.

We sought to test how particular characteristics of conflicts and of decision-makers influence conflict intervention priorities. To do this we conducted an experimental survey of international conservation researchers and practitioners (n=427), in which we presented participants with eight different conflict scenarios, and asked them to prioritise one (out of five) intervention types to manage the conflict in each scenario. Drawing on similar

strategies used in choice (Keane et al., 2016) and framing experiments (Sapiains et al., 2016), by offering limited information per scenario, we aimed to identify possible predispositions and tacit influences on decisions. Using a full-factorial design, we experimentally manipulated three factors hypothesized to influence conflict decisions: the framing of the conflict as being between people and wildlife or between groups of people, whether behaviours were reported as illegal, and the development status of the country where the conflict occurs. We experimentally manipulated these three factors – rather than other relevant factors such as taxa or types of impacts – because their potential influence has been highlighted in a previous review (Chapter 3) but not yet tested.

We then used multinomial mixed logit regressions to test whether these manipulations and the characteristics of participants predicted intervention recommendations. These related to respondents' disciplinary and disciplinary background, and experience with conflicts on the ground and in the literature – which we hypothesised influences how respondents conceptualize conflicts and subsequently the extent to which stakeholder interventions are prioritised.

4.3 Methods

Survey design

We designed and carried out a short (5-10 minute) online survey using the platform Qualtrics (qualtrics.com). We used an online survey, rather than a written survey, to allow for greater flexibility over survey design (including randomization of the specific sub-set of scenarios presented to participants), to reduce the risk of biased responding (of socially undesirable answers) (Gnambs and Kaspar, 2014), and to enable the survey to be disseminated internationally. The survey included an information sheet, a series of demographic questions, and then it presented participants with eight different conflict scenarios in turn (Appendix 2, Information sheet). Each scenario related to a real-world conflict described in the literature and involved one particular species of conservation concern, and some kind of human activity that was threatening the species.

The number of scenarios was constrained by survey-length, and the cases selected had to appear in the conflict literature, have species' ranges that encompassed at least one very highly developed country and one less highly developed country, and reflect a mix of herbivorous and carnivorous, marine and terrestrial mammals, and non-mammals (Table 4.1). For each scenario, participants were asked to select one of five different intervention types, which they deemed of highest priority in that scenario. Following Chapter 3, we included five different conflict interventions types: wildlife impact reduction, awareness or training programs, enforcement, economic incentives or compensation, and stakeholder engagement. Scenarios (<100 words) and intervention options (<15 words) were described in brief and consistent manner and appeared in the same order for each participant (Figure 4.1).

Table 4.1: Description of the 8 wildlife conflict scenarios presented in surveys, and each of the two possible countries that each scenario was described as being located in.

Conflict scenario	Country	References
American manatee *(Trichechus manatus)* Conflict between commercial fishing interests and manatee conservation, with manatees drowning in fishing nets and being injured by boats in certain areas with speed restrictions.	USA Guyana	(Castelblanco-Martínez et al., 2012; Mason et al., 2018; Solomon et al., 2004)
Gray wolf *(Canis lupus)* Conflict between rural livestock herding and conservation interests, with wolves predating upon livestock and being killed in retaliation.	Portugal Nepal	(Fernández-Gil et al., 2016; Pimenta et al., 2017; Werhahn et al., 2017)
Saltwater crocodile *(Crocodylus porosus)* Conflict between human safety and conservation interests, with crocodile-related injury and retaliatory killing	Australia Papua New Guinea	(Fukuda et al., 2015)
Geese *(e.g., Anser anser, Alopochen aegyptiaca)* Conflict between agriculture and conservation interests, with crop-raiding and retaliatory scaring or killing	Sweden Ethiopia	(Tombre et al., 2013)
Sea eagle *(Haliaeetus albicilla)* Conflict between rural livestock farming and conservation interests, with livestock depredation and retaliatory killing	Scotland Pakistan	(Marquiss et al., 2004)
Vulture *(e.g., Gyps fulvus, Gyps africanus)* Conflict between rural livelihoods and conservation interests, with livestock depredation, perceived spread of disease and retaliatory killing	France Zimbabwe	(Margalida et al., 2014; Ogada et al., 2016)
Sea otter *(Enhydra lutris)* Conflict between fishing and conservation interests with competition for catch and associated killing	Canada Mexico	(Carswell et al., 2015; Echeverri et al., 2017)
Asiatic black bear *(Ursus thibetanus)* Conflict between agriculture and human safety and conservation interests with crop-raiding, attacks and retaliatory killing	Japan Vietnam	(Can et al., 2014; Takahata et al., 2013)

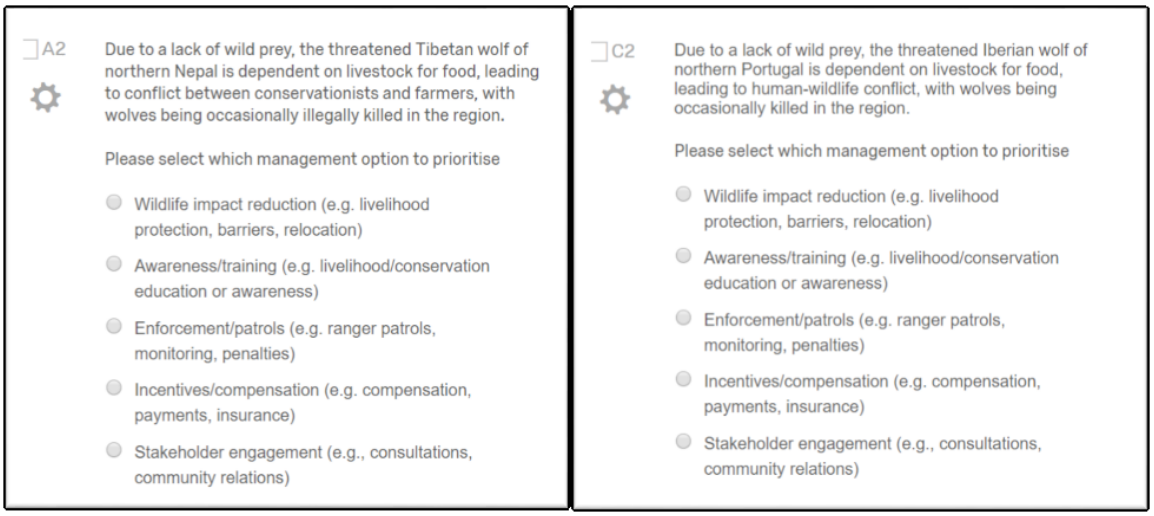

Figure 4.1: An example of two different versions of the same scenario which were presented to different participants, from two of eight different question blocks. In this case the location and framing, and the illegality of wildlife killing differs between the two scenarios.

Between participants, a full-factorial design was used to systematically vary three aspects of scenario descriptions: whether they were framed as human-human or human-wildlife conflict, whether wildlife killing was described as illegal, and the country the conflict was located in (Figure 4.1). Each scenario was adapted from existing literature and different pairs of countries were chosen on the basis of maximizing the variation in development status (as determined by the Human Development Index [HDI] [UNDP 2016]), whilst keeping within a given species' range (IUCN, 2017). The final combination of scenarios was chosen to ensure a geographical spread across world regions (Table 4.1). For the 'geese' and 'vulture' scenarios, the precise species was not named because the conflicts related to different, but functionally similar species.

In each survey, we randomly varied the set of questions (A-H) seen by each participant using the question block randomization feature on Qualtrics. We also included questions on characteristics of the participants, including their disciplinary background, career role and position, nationality, gender, age, and familiarity with conflicts in the literature and on the ground. Last, we included a section for participants to give open-ended written feedback on both the survey design (e.g., intervention options) and the factors influencing their decisions.

Participant recruitment

We first conducted a pilot study at the Scottish Conservation Conflict Research Group (https://www.conservationconflicts.info/) meeting in June 2018. After adapting the survey design, we recruited research participants at the 2018 European Congress for Conservation Biology in Finland – which was attended by international delegates with varying experience in conflicts and backgrounds. To include a wider range of responses, we conducted a literature search in ISI Web of Knowledge to identify authors who had recently published studies related to conflicts, and emailed each corresponding author (n=335) asking this person to complete the survey and invited people to share the survey on Twitter and via relevant mailing lists. Participants were invited to share their email address (to receive results) but participant anonymity was preserved. This study received ethical approval from the University of Edinburgh School of Geosciences Ethics panel.

Table 4.2: Variables used in multinomial mixed logit models of the likelihood of different intervention types being prioritized across a series of conflict scenarios presented to 411 conservation professionals in a survey, including variables related to experimental manipulations in conflict scenario descriptions, and the personal characteristics of respondents.

Predictor variable	Factor levels	Source	Descriptive summary (*n*)	Model Set
Frame	Human-Human conflict (HHC) Human-Wildlife conflict (HWC)	Experimental manipulation	Scenarios = HHC (1644), HWC (1644)	1,2
Illegal Behaviour	Illegal Legal	Experimental manipulation	Scenarios: Illegal (1644), legal (1644)	1,2
Conflict HDI		Experimental manipulation (from UNDP[b])	Mean= 0.75, SD = 0.17, Range = 0.45-0.94	1,2
Question Block	A-H	Survey	Scenarios: A (360), B (520), C (568), D (336), E, (368), F (320), G (408), H (408)	1,2
Scenario	1-8	Survey	Scenarios: 411 each	1,2
Disciplinary Background		Survey (subjective scale)	Mean= 75.9, SD = 23.64, Range = 0 (Social Sciences/Humanities only) - 100 (Natural Sciences/Ecology only)	2
Ground Experience		Survey (subjective scale)	Mean= 62.16, SD = 26.84, Range = 0 (no experience) - 100 (main specialism)	2
Literature Knowledge		Survey (subjective scale)	Mean= 66.07, SD = 22.73, Range = 0 (no knowledge) - 100 (main specialism)	2
Age		Survey	Mean= 37.92, SD = 10.99, Range = 20-80	2
Participant HDI		Survey	Mean= 0.84, SD = 0.12, Range = 0.42-0.95	2
Gender		Survey	207 female, 197 male	3

Career Position	Early, Mid, Senior	Survey	Early (180), Mid (112), Senior (109)	-
Role	Researcher, Practitioner or Other	Survey	Researcher (321) Practitioner/Other (84)	-

[b] UNDP = United Nations Development Program

Analyses

We carried out statistical analysis using the statistical programing software 'R' (R Development Core Team, 2016) and the package 'mlogit'. To analyse how different predictors influenced the choices between the five intervention categories, we used multinomial logit linear regressions, with random-parameters to model the correlation between multiple responses (n=8) from each individual. We used the stakeholder intervention type as the reference intervention in reported models, but each other intervention type was used as a reference level in other models for comparison (Appendix 2, Table A2.3).

Due to some missing responses, models with more variables had slightly reduced sample sizes. Explanatory-variable collinearity was checked using Spearman's rho for numerical variables and 1-way analysis of variance for categorical variables. Because age was associated with both position ($F_{2,400} = 183.90$, $p < 0.01$) and 'Gender' ($F_{1,407} = 35.42$, $P < 0.01$) only the numerical variable age was included in models. Because role was associated with ground experience ($F_{1,356} = 7.081$, $P < 0.01$), only the numerical variable ground experience was included in the models. Gender was analysed separately in models (model set 3) without age.

We analysed the data collected from open-ended questions using the software package 'NVivo'. Using a directed content analysis approach (Hsieh and Shannon, 2005), we first grouped responses according to whether they addressed pre-determined themes (each intervention type, development status, legality, framing, and taxa). Next, using an inductive approach, we added new themes and sub-themes encompassing other commonly discussed subject areas which emerged during analysis (e.g., intervention combinations). We then calculated the frequency of respondents whose feedback was recorded in each given category and reflected on the content of the prevailing themes with regards to our survey results and interpretation.

4.4 Results

We received 634 responses. For analysis, we omitted those who identified as 'not working in conservation' (n=14) and insufficiently competed responses (<97% completed) leaving a sample of 427. For our models, we only including responses with all scenarios eight answered (n=411). Participants came from 52 countries (Appendix 2, Table A2.1) and from across different career stages and ages (Table 4.2), with 84 respondents identifying as 'practitioners' or 'other' and 321 as 'researchers'.

Across the analysed sample (411 participants, 3,288 decisions), the stakeholder intervention type was the most popular but most people varied their priorities across scenarios. Stakeholder interventions were chosen 27% of the time, followed by awareness (25%), economic (20%), wildlife impact reductions (19%) and enforcement (9%). We found that 92% of participants chose at least two of the five intervention type, and 85% chose at least three. Of those who did not deviate from one intervention type (n=33), 85% chose

stakeholder only, 6% enforcement only, 3% awareness, 3% wildlife impacts, and 3% economic only.

Intervention priorities varied dramatically across different conflict taxa. We found that 56% of participants recommended awareness interventions in the vulture conflict scenarios, but only 8% of participants did so for the wolf conflicts. Likewise, 49% of respondents suggested economic interventions in the wolf conflicts, compared with 1% for crocodile conflicts. Enforcement was most popular in the manatee conflicts (25%) and least in the geese conflicts (2%). Stakeholder interventions were most popular for sea otter conflicts (39%) and least for wolf conflicts (18%). Impacts-based interventions were favoured most in bear conflicts (49%) and least in the vulture conflicts (4%) However, intervention decisions varied across the two locations in each scenario (Figure 4.2).

Intervention prioritisations were predicted by the development status of the conflict location and whether illegal activity was reported, but not by the conflict framing variable (Figure 4.3). These effects were consisted across multinomial mixed logit regression models which controlled for the multiple responses per individual, respondent's question blocks and the independent effect of each scenario (Model Set 1, n=411), and those that also included the characteristic of respondents (Model Set 2, n=341). Below, for each predictor variable, results are reported in order of decreasing effect size (odds ratio).

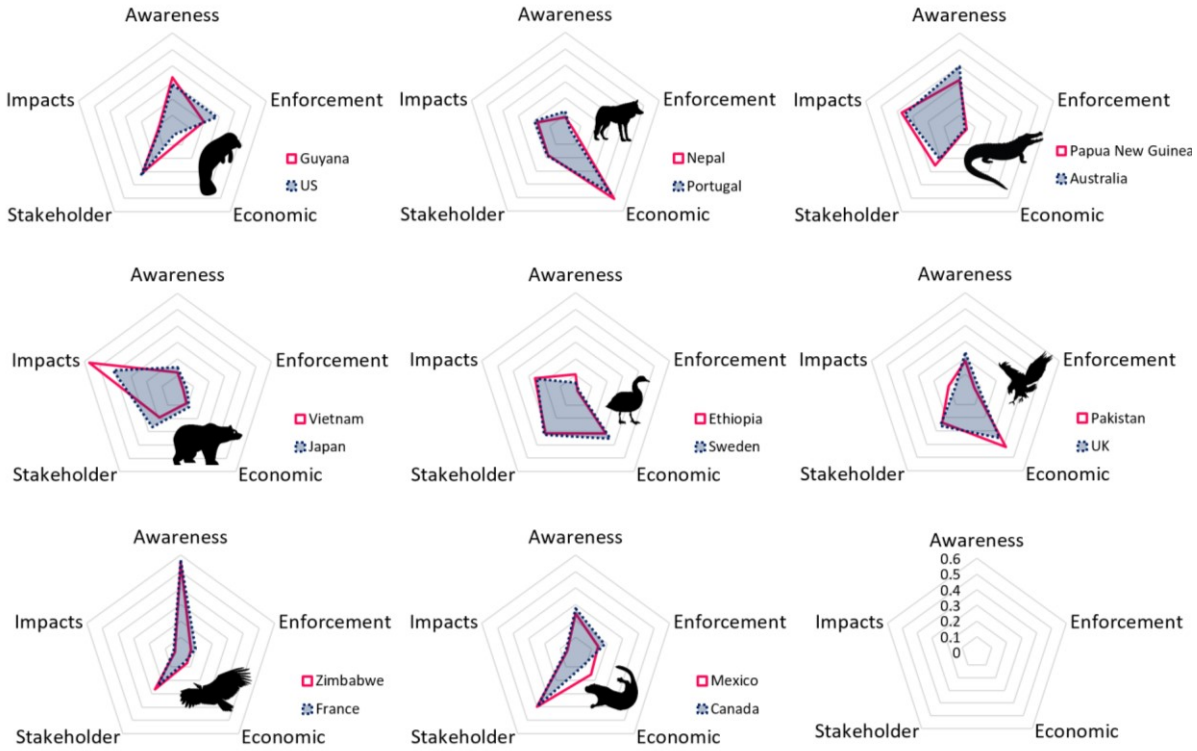

Figure 4.2: Proportion of each intervention type (impacts, awareness, enforcement, economic, stakeholder) prioritized by conservation professionals, across the 2 alternative conflict locations (countries), in the 8 conflict scenarios presented.

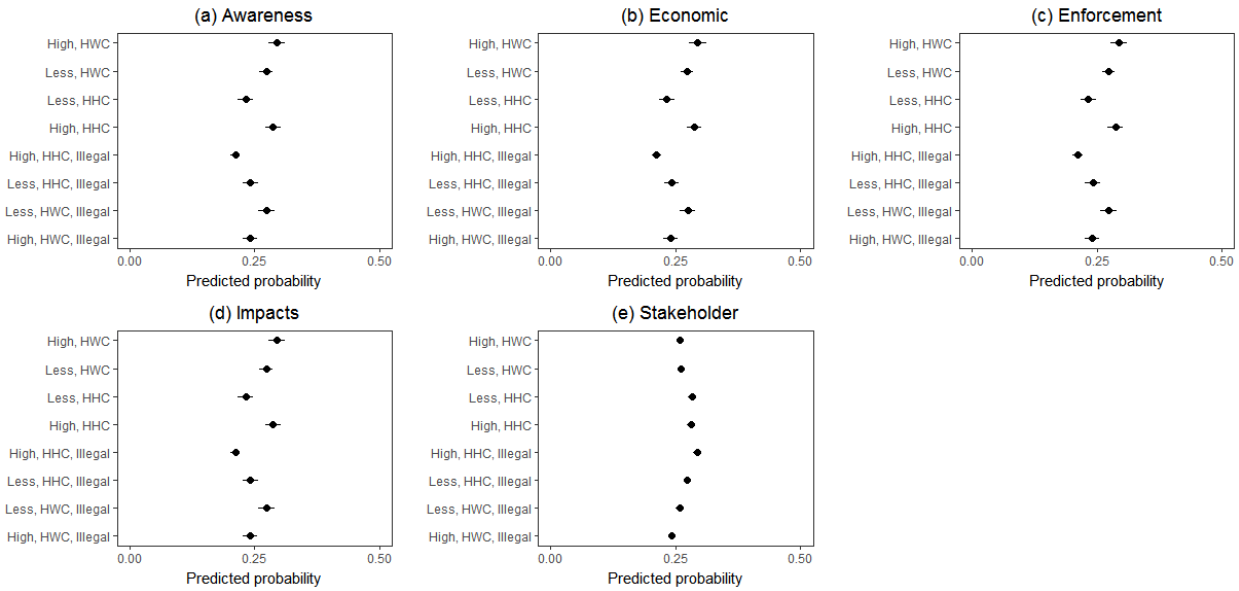

Figure 4.3: Results from a multinomial mixed logit regression model (model set 1, reference level stakeholder) showing the predicted probability of choosing each intervention type (a) increase awareness, (b) enforce laws, (c) provide economic incentive, (d) engage stakeholders, (e) reduce impacts) across the different combinations of the experimentally-manipulated scenarios presented to survey respondents (see Table 4.2), (whiskers, 95% CI; HWC, human-wildlife conflict; HHC, human-human conflict; high, very highly developed nation; less, high, medium, or less highly developed nation; illegal, behavior described as illegal).

The higher the HDI of the conflict location the more enforcement and awareness were prioritised. As HDI increased, the likelihood of choosing enforcement was greater than the likelihood of choosing economic interventions ($p < 0.01$, odds ratio 1.43, 95% CI 1.13-1.79), impacts ($p < 0.01$, Odds Ratio 1.33, 0.95 CI: 1.08-1.67), or stakeholder interventions ($p < 0.05$, Odds Ratio 1.31, 0.95 CI: 1.06-1.63). Similarly, the likelihood of choosing awareness was greater than the likelihood of choosing economic interventions ($p < 0.01$, Odds Ratio 1.26, 0.95 CI: 1.07-1.47) or impacts ($p < 0.05$, Odds Ratio 1.18, 0.95 CI: 1.02-1.36). When wildlife killing was described as illegal, the likelihood of choosing economic interventions was greater than the likelihood of choosing awareness ($p < 0.01$, Odds Ratio 1.52, 0.95 CI: 1.12-2.08), impacts ($p < 0.05$, Odds Ratio 1.49, 0.95 CI: 1.07-2.07), or stakeholder interventions ($p <0.05$, Odds Ratio 1.45, 0.95 CI: 1.05-1.99) (Table 4.2, Figure 4.4).

The characteristics of respondents also predicted intervention priorities. The more respondents' disciplinary backgrounds were weighted toward natural science over social science, the more likely they chose enforcement and awareness. Specifically, as weighting towards natural science increased, the likelihood of choosing enforcement was greater than the likelihood of choosing stakeholder ($p < 0.01$, Odds Ratio, 1.47, 0.95 CI: 1.21-1.78) or economic interventions ($p < 0.01$ Odds Ratio, 1.33 0.95 CI: 1.09-1.64), and the likelihood of choosing awareness was greater than the likelihood of choosing stakeholder ($p < 0.01$, Odds Ratio, 1.36, 0.95 CI: 1.18-1.56), economic ($p < 0.01$, Odds Ratio, 1.38, 0.95 CI: 1.18-1.63), or, to a lesser extent, impacts interventions ($p < 0.05$, Odds Ratio, 1.21, 0.95 CI: 1.04-1.40).

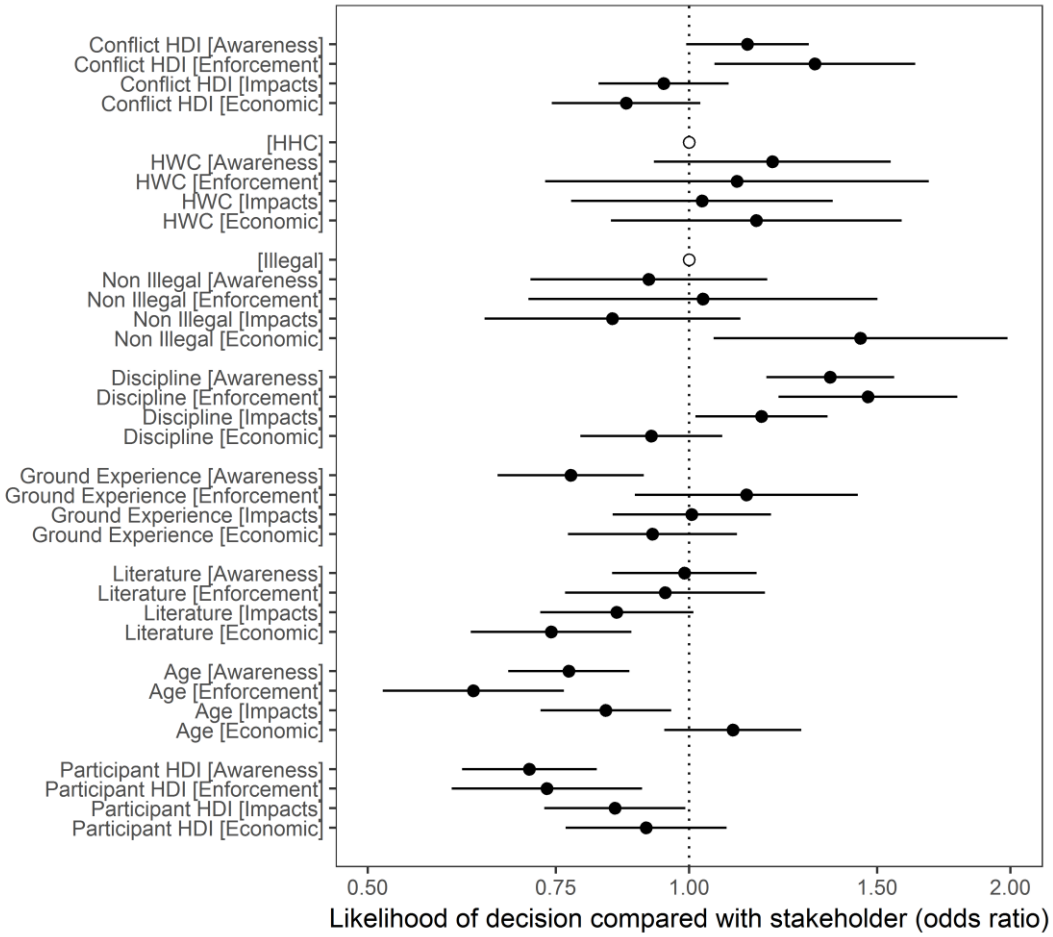

Figure 4.4: Results from a multinomial mixed logit regression model (model 2) (see Table 4.2), showing estimated conditional effects of each predictor variable on the likelihood of a respondent choosing each, of the 4, other intervention types compared with the likelihood of them choosing stakeholder-based interventions (HDI, human development index; HWC, human-wildlife conflict frame; HHC, human-human conflict frame; discipline, disciplinary background; literature, knowledge of the literature). Odds ratios (solid) (converted model coefficient estimates) show the expected change in likelihood of a choice when each continuous variable increases by a unit of 1 or when each factor variable changes level from a baseline (open). Whiskers represent 95% CI. Variables with whiskers that do not cross 0 are those predicted by the model to associate with intervention decisions (effect size is distinguishable from 0). The larger the odds ratios the greater the predicted strength of association.

As experience with conflicts on the ground increased, the likelihood of choosing awareness reduced. Specifically, as experience increased, the likelihood of choosing awareness was lower than the likelihood of choosing enforcement ($p < 0.01$, Odds Ratio, 0.72, 0.95 CI: 0.58-0.91), stakeholder ($p < 0.01$, Odds Ratio, 0.78, 0.95 CI: 0.66-0.91), or impacts interventions ($p < 0.05$, Odds Ratio, 0.80, 0.95 CI: 0.68-0.95). As the HDI of participants' home nation increased, the likelihood of choosing stakeholder interventions was greater than the likelihood of choosing awareness ($p < 0.01$, Odds Ratio, 1.41, 0.95 CI: 1.21-1.61), enforcement ($p < 0.01$, Odds Ratio, 1.35, 0.95 CI: 1.11-1.67), or, to a lesser extent, impacts interventions ($p < 0.05$, Odds Ratio, 1.18, 0.95 CI: 1.01-1.37), and the likelihood of choosing economic interventions was greater than the likelihood of choosing awareness ($p < 0.01$, Odds Ratio, 1.25, 0.95 CI: 1.06-1.47).

As respondent age increased the likelihood of choosing both enforcement and awareness reduced. As age increased, the likelihood of choosing enforcement was lower than the likelihood of choosing stakeholder ($p < 0.01$, Odds Ratio, 0.63, 0.95 CI: 0.52-0.76), or economic ($p < 0.01$, Odds Ratio, 0.63, 0.95 CI: 0.51-0.77), or to a lesser extent, impacts interventions ($p < 0.01$, Odds Ratio, 0.76, 0.95 CI: 0.63-0.93), and the likelihood of choosing awareness was lower than the likelihood of choosing economic ($p < 0.01$, Odds Ratio, 0.75, 0.95 CI: 0.67-0.90) or stakeholder interventions ($p < 0.01$, Odds Ratio, 0.77, 0.95 CI: 0.68-0.88). Male respondents were more likely than females to prioritise enforcement than stakeholder interventions ($p <0.01$, Odds Ratio, 1.42, 0.95 CI: 1.05, 1.93), but less likely to prioritise awareness ($p < 0.05$, Odds Ratio, 0.64, 0.95 CI: 0.49-0.84), or impacts ($p < 0.05$, Odds Ratio, 0.62, 0.95 CI: 0.43-0.91). In most models, the variation between individual respondents was largest with regards to enforcement (Appendix 2, Table A2.4) and generally the models explained a high proportion of the total variation (Model Set 2, mean $R^2 = 0.21$).

Respondents' also highlighted the importance of local contextual and multi-faceted interventions (often including stakeholder engagement as a starting point). Of the 166 respondents who gave written feedback, 43% described the need, or benefit, of combinations of interventions. In total 30% of respondents asked for more context or described contextual factors that would influence their decisions. However, only 7% mentioned the geographical location or development level of the conflict country, only 2% referenced the legality of behaviours and only 4% commented on the conflicts framing. Moreover, 7% requested information about the species (such as habitat and conservation status). Other interventions which were suggested included hunting (2%), lethal control (2%), and other forms of non-lethal technical interventions (3%). In total, 23% of respondents outlined the need to prioritise stakeholder-based interventions first, to either increase buy-in (6%), better understand a conflict (7%) (including drawing upon community knowledge) and to help tackle the social roots at the heart of conflicts (4%). Only 4% discussed enforcement.

4.5 Discussion

The results of the experimental survey suggest that particular characteristics of wildlife conflicts and the characteristics of decision-makers influence intervention recommendations. Although it is known that people with different backgrounds and experiences favour different approaches for conservation generally (Sandbrook et al., 2019) and for conflicts specifically (Lute et al., 2018), our results shed further light on these differences and highlight the possible processes and factors influencing how conservationists make decisions.

Our results illuminate the importance of contextual cues on conservation decision-making. Relatively simple changes to the objective description of a conflict, such as the conflict location or whether a behaviour is described as illegal, had large effects on intervention priorities. Likewise, contexts which appear comparable in terms of the general problem – wildlife impacts and retaliatory killing – and which differed only in terms of taxa, types of competing human interests and types of wildlife impacts, promoted different solutions. Impact reduction efforts for instance are widely prioritised for crop-raiding bears, but are largely overlooked for fish-eating otters or lamb-raiding eagles. Such contextual effects could be generated by numerous mechanisms. For instance, they might represent a form of cognitive bias, reflecting fast, intuitive thinking (Papworth, 2017) and the priming effects of specific words (Bargh, 2006). Alternatively, they might reflect respondents' values, assumptions and conceptualisations related to their understanding of specific species, countries, or conflict contexts (Game et al., 2013). For some respondents, their knowledge and experience (both on the ground and through literature) base might inform more deliberative, reflective decisions (Papworth, 2017). Although our study does not illuminate which processes are dominant here, managers generally rely more heavily on experience and intuition than published scientific evidence (Walsh et al., 2015).

Beyond highlighting the general importance of context, we also identify specific associations between conflict characteristics and intervention decisions. Our finding that enforcement and awareness were favoured more for scenarios situated in more highly developed countries, and by respondents from less highly developed countries was unexpected. In a previous review, enforcement appeared to be more commonly recommended by authors for conflicts in less highly developed nations, and awareness

showed no associations (Chapter 3). However, that study was observational and therefore could not account for the additional variation between conflict situations as we did here. Instead, we propose three reasons to account for why enforcement (though generally prioritised the least) was favoured in more developed countries: the possible widespread appreciation of the critiques of militarised and enforcement-based conservation in the Global South (Duffy et al., 2019; Mabele, 2017), perceptions that wildlife-related killings are less legitimate in more highly developed countries (Dickman et al., 2015; Sheil et al., 2016) or the understanding that successful enforcement is contingent upon effective governance (Sundström, 2015). However, enforcement was infrequently discussed in the written feedback. Hence further investigations would be needed to ascertain to what extent different practical and ethical reasons - such as cultural relativism (Dickman et al., 2015) – may account for this effect.

That economic interventions appeared to be more commonly suggested in less highly developed countries, stands in contrast with the finding that conflict-related compensation is more common in highly developed countries (Ravenelle and Nyhus, 2017). However, it is possible that the lack of incentives and compensation schemes in less highly developed nations might be a result of the greater structural challenges in providing them rather than varying priorities (DeMotts and Hoon, 2012), despite the apparently healthy appetite for them among researchers and practitioners identified here. Survey feedback also hinted at the idea, common in the conservation literature (Salerno et al., 2016), that the material costs of conflicts may be relatively greater in less highly developed nations – such as where food insecurity, or dependence on forest resources is high. However, the non-material impacts of conflicts are also clearly significant in the Global South (Barua et al., 2013) and the social roots of conservation conflicts are likely to be just as strong between less and

highly developed countries (Young et al., 2013). Moreover, given that conservation rule breaking everywhere is frequently associated with acts of resistance and not just material incentives (Holmes, 2007) we also suggest a need for further investigation into the reasons why economic interventions were prioritised more when wildlife killing was described as illegal. This is particularly important given that conservation payments can also lead to reductions in previously unrewarded positive conservation behaviours (Fisher, 2012). The lack of the importance of the conflict-framing variable was unexpected, suggesting either different conflict frames are less important than predicted (Chapter 3), or at least less salient than the other factors tested. Further work should explore the extent to which conservation researchers and practitioners might be influenced by perceptions and assumptions made about countries in different stages of development, which are often out-of-date or inaccurate (Rosling and Zhang, 2011).

Our finding that respondent characteristics – such as disciplinary background, age and conflict experience – predict their intervention decisions highlights the importance of socio-demographic influences on conservation decision making (Papworth, 2017). This supports previous findings that conflict management priorities differ across regions and respondents' backgrounds (Lute et al., 2018). We suggest that further work should explore whether disciplinary backgrounds and experience of conflicts on the ground shape the way decision-makers conceptualise conflicts – such as the emphasis placed on social relations (Sandbrook et al., 2013).

Although we cannot provide as clear explanations to account for the apparent effects of age, gender, and development status of respondents' home nation, these factors have also been shown to predict conservation priorities more generally. For instance age, gender, and

regional origin all predict respondent' general conservation rationale and support for market-based conservation (Sandbrook et al., 2019), and gender can predict local management preferences (Keane et al., 2016) and attitudes to particular taxa (Suryawanshi et al., 2014). We also cannot say from our data whether prioritisations were also influenced by the factors not experimentally manipulated: such as taxa, previous knowledge, actual prevalence or likelihood of each described conflict, impact severity or conservation status. Likewise, although we instructed respondents to ignore the issue of resources, it is possible that perceived differences in management costs (Iacona et al., 2018) may have tacitly influenced decisions. Similarly, although our sample size is appropriate, our conclusions are limited to generalisations about largely Anglo-European sample, which reflects the Anglo-European bias in conservation conflict research (Chapter 3; van Eeden et al. 2018), but doesn't represent other voices in conservation decision making (Sandbrook et al., 2019). We could also have included 'no intervention' as an additional option within our scenarios. Indeed the question of when it is best not to actually intervene in conservation conflicts is something certainly worth exploring further.

These results have important implications for wildlife conflict management. First, if context-contingent intervention priorities, such as those identified here, are informed by reasoned thinking and evidence, they may produce effective outcomes (Sutherland and Wordley, 2017). If however, such decisions are more shaped by unknown biases and predispositions, they may not (Papworth, 2017). Hence, decision-makers could benefit both from further personal retrospection (identifying their own biases and assumptions) and from further studies which test prevailing assumptions in conflict management (van Eeden et al., 2018). Second, given that the characteristics of decision-makers also shape intervention priorities, increasing the diversity of those involved in conflict decision-making would not only be

ethical but may improve decisions (Green et al., 2015). For instance, increased female (Leisher et al., 2016), community (Mishra et al., 2017) and interdisciplinary (Bennett et al., 2017) participation, in decision-making has been found to improve a range of conservation outcomes. Furthermore, whilst different conservation managers and stakeholders are unlikely to always agree – for both practical and value-based reasons (Rust, 2017; St John et al., 2018) – better understanding other's positions and increasing dialogue helps fostering more effective collaboration (Game et al., 2013; Lute et al., 2018). Third, both the survey results and feedback were consistent with recent scholarship (Redpath et al., 2017) that highlights participatory and stakeholder-first conflict interventions as best practice and advocates for multi-pronged (Hazzah et al., 2014) and adaptive management strategies (Bunnefeld et al. 2017). Education and awareness programs were often cited in feedback as being necessary additions to any interventions. However, given the failures of many awareness-based conservation programs (Schultz, 2011), a further exploration into why and where conservation decision-makers deem them most appropriate is important. Approaches that are specifically aimed at particular audiences, such as social-marketing (Salazar et al., 2018) may be more effective than simple information provision or – often-problematic – enforcement (Duffy et al., 2019). However, how different interventions compliment, or negate, each other is an area in need of greater exploration (van Eeden et al., 2018)

4.6 Recommendations

- Decision-makers should further consider the assumptions underpinning intervention choices in different contexts whether these are supported by evidence.
- Where intervention is appropriate, conflict managers should consider stakeholder-engagement as the first step in a multi-pronged intervention approach.
- Researchers should further test the efficacy of behavioural informed approaches, such as social marketing, alongside traditional education or incentive-based interventions.
- Researchers should explore whether the decision-making process may benefit from greater decision-maker diversity (both demographic and disciplinary).

Chapter 5: Case study: Enduimet Wildlife Management Area

5.1 Conflict geography

Enduimet Wildlife Management Area (WMA) was established in 2007 as a community-based conservation initiative under the Tanzania Wildlife Policy of 1998 (Nelson, 2007). The area is part of the Amboseli-Kilimanjaro ecosystem, sandwiched between Amboseli (North), Kilimanjaro (East) and Arusha (South) national parks (Figure 5.1). Enduimet is home to a number of large mammal populations, including African elephant (*Loxodonta africana*), and on the northwest boundary of the WMA is a designated wildlife corridor (Henson et al., 2009). The vegetation type is dominated by seasonal grasslands, woodland, bareland and cultivated areas (Figure 5.2). Although people and livestock move freely across the area, the WMA is separated into 11 village settlement zones (formally 9), a photo safari zone, a game hunting zone, a wildlife corridor, a cultural tourism zone, and 5 tourism establishment zones, according to the Resource Zone Management Plan (Figure 5.3) (Bluwstein et al., 2016). All the villages are predominantly inhabited by the Maasai people and are agro-pastoralist, but the environment and associated mix of livelihood activities varies across the area (Homewood et al., 2009) (Figure 5.4). Economically, most Enduimet residents are very poor, with per capita income averaging US$0.16 per day (Homewood, 2017). Local wildlife generates modest tourism revenues (from photo safaris and hunting) which, like those of other WMAs, are split equally between all villages and fund the provision of public services. However, direct financial benefits provided by the WMA to individuals remain small, estimated at only US$0.6 capita per year (Homewood et al., 2015). Like other WMAs,

Enduimet is a government-backed initiative, which was formally created through the formation of a an Authorised Association, which is a community-based organisation (CBO), under the support of village councils and international NGOs (Wright, 2017). Under national policy, all relationships with tourism operators are managed via the WMA, making it untenable for individual villages pursue independent tourism ventures (Wright, 2017).

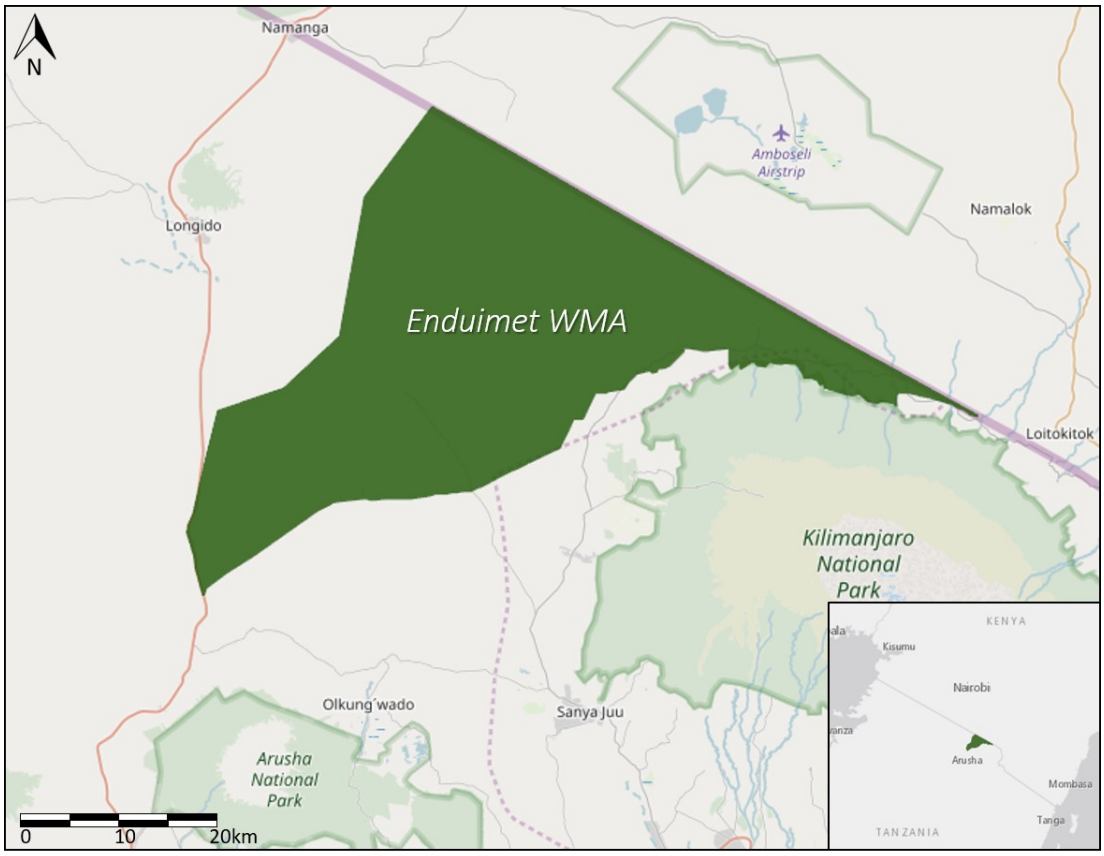

Figure 5.1: Enduimet Wildlife Management Area northern Tanzania, (highlighted in green), bordering Amboseli National Park (Kenya) (north), Kilimanjaro National Park (east) and Arusha National Park (south). Reproduced from protectedplanet.net ©Mapbox and ©OpenStreetMap using ArcGIS.

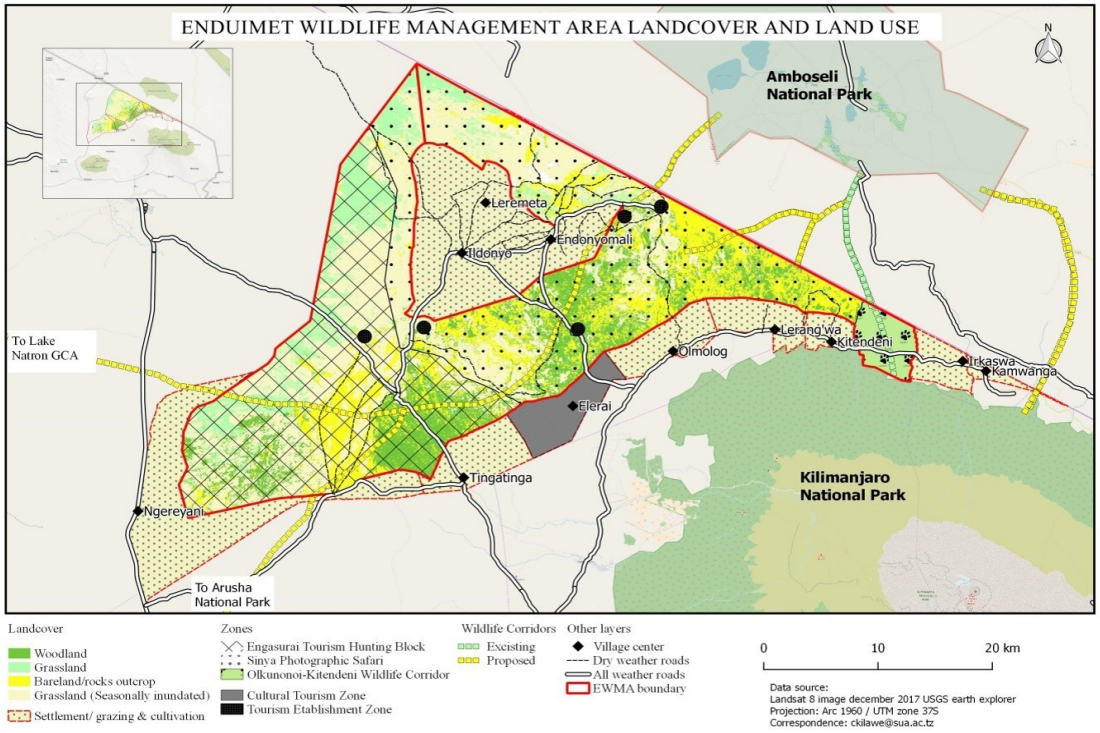

Figure 5.2: Enduimet WMA land-cover and land-use map, reproduced with permission from Enduimet WMA.

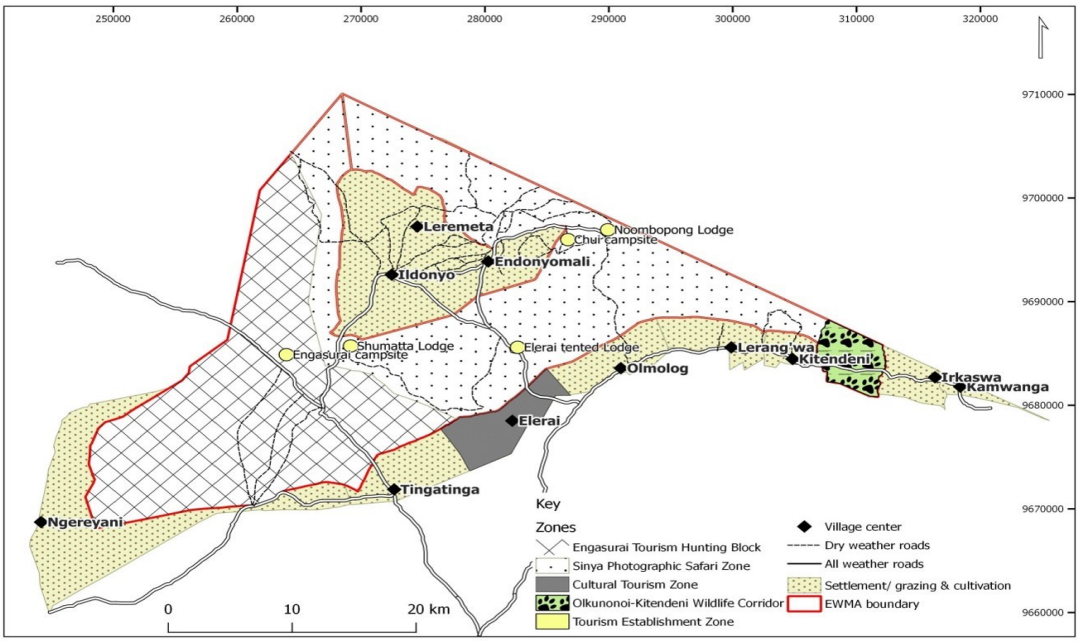

Figure 5.3: Enduimet WMA land-use zoning map (2019), reproduced with permission from Enduimet WMA.

Figure 5.4: Cultivated fields in the settlement zone on the outskirts of Ol Molog village, (August 2016). Author.

The Authorised Association (AA) is comprised of a general assembly of three elected community representatives from each village (33 in total), elected every three years (Figure 5.5), supported by a board of trustees (including one member from each village selected by the AA community representatives), and village, ward and district officials (such as chairpersons and executive officers and district land officers) (Moyo et al. 2016). The general assembly authorise investments and oversee the running of the WMA but only the village representatives on the assembly hold voting rights to make these decisions. The village, ward and district officials are just meant to provide legal and technical assistance the village representatives (Wright, 2017). The AA also oversee the WMA management team, which is comprised of locally employed community members based at the WMA headquarters in Enduimet, who manage the financial, administrative, and anti-poaching

operations, which are undertaken by the WMA rangers: referred to in WMA terminology as the Village Game Scouts and the anti-poaching foot- and dog-patrol units (Bluwstein et al., 2016).

Figure 5.5: Enduimet Authorised Association election (including public speeches from candidates) in TingaTinga village (May 2017). Author.

Although the WMA was democratically endorsed by each member village, its creation was, and maintenance is, largely driven by international wildlife NGOs (Homewood, 2017; Sachedina, 2010). Today, Honeyguide, the acting NGO, provides funding for ranger stations and equipment used to deter wildlife from farms, awareness-raising activities and the anti-poaching teams (Homewood, 2017). One trophy hunting operator, the Northern Hunting Company, and two photo-tourism operators, Shu'mata Lodge, and Kambi ya Tembo (Elerai Tented Lodge) currently are established in Enduimet (Wright, 2017), with one other investor, Hoopoe Tours (Noombopong Lodge), having withdrawn in 2008 (Sulle et al.,

2011). Although any proposed changes to the Resource Zone Management Plan require the majority approval from member village councils, the final say on any changes rests with the Director of Wildlife at the Ministry of Natural Resources and Tourism (Ministry of Natural Resources and Tourism, 1998; Wright, 2017).

5.2 Conflict history

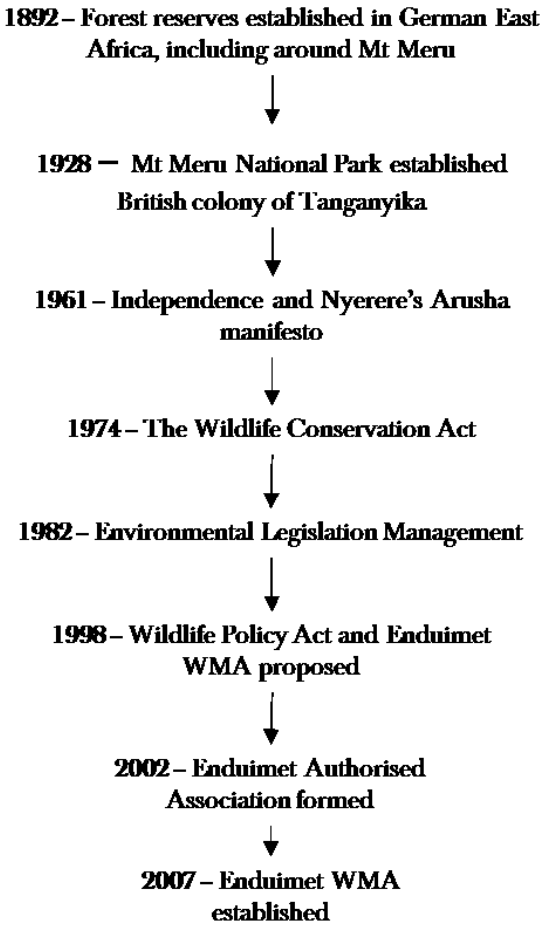

Figure 5.6 Historical timeline of relevant events proceeding the establishment of Enduimet WMA.

5.2.1 Colonial conservation

Understanding contemporary conservation conflicts requires understanding their history (Lambert, 2015; Pooley, 2016). The history of conservation in Tanzania can largely be characterised by a series of land zoning policies by colonial and post-colonial administrations (Anderson and Giblin, 2006; Igoe and Brockington, 2006; Neumann, 1992). In the scientific literature, the area comprising modern-day northern Tanzania (including Enduimet) and southern Kenya was described during the onset of colonial rule in 1885 by British explorers as 'Masai Land', an area "*with a wealth of scenery scarcely surpassed by some of the favourite tourist resorts of Europe*", [with] "*park-like country enlivened by groups of game… great herds of cattle, or flocks of sheep*" [inhabited by] "*the Apollos of Africa*", [whose] "*intelligence is above that of the average African*" [and whose] "*social habits are much what we find among other races of their stage of civilisation*" (Thomson, 1885). Such imperial, supremacist, and romanticised ways of seeing both Africa and the Maasai people paved the way towards the colonial conservation policies which ultimately subjugated them (Neumann, 1995), and which came to dictate numerous enforced relationships between people, wildlife, and spaces in northern Tanzania (Bluwstein, 2018), and elsewhere in eastern and southern Africa (Rust and Taylor, 2016).

From the late 19th century German colonial administrators restricted access to certain lands and access to wildlife by creating the first game and forests reserves, in what was then German East Africa (Gissibl, 2016; Goldstein, 2015). Chief among the reasons for demarcating game reserves was a combination of the desire to protect wild stocks of game for colonial trophy hunting, and to control tsetse fly (sleeping sickness) outbreaks (Prendergast and Adams, 2003). However, the disruption of indigenous methods of tsetse

fly and wildlife management as well as the induction of the rinderpest virus contributed to the catastrophic epidemics of the 1890s, which caused both human and livestock depopulation (Bluwstein, 2018). In part as a consequence of this rapid depopulation, colonial settlers arrived in the area with an artificially enhanced image of vast untouched wildernesses (Neumann, 2001). Following the First World War, Britain took control of what then became Tanganyika and extended the game reserve network, whilst allocating the most fertile lands to colonial settlers (Bluwstein, 2018). Indeed, throughout colonial Africa, strictly protected game reserves became the mainstay of British colonial conservation, which gave hunting rights almost exclusively to settlers and, in effect, sought to re-create larger and more 'pristine' versions of the Victorian country estates back-home (Adams and Hutton, 2007; MacKenzie, 1988).

Hunting was not the only motivation for conservation however. Even by the early 20st century, conservation advocates were acutely aware of role played by over-exploitation in the recent extinction of numerous species, from the great auk (*Pinguinus impennis*) (Cowles, 2012) , to the quagga (*Equus quagga quagga*) (Adams, 2013). Across the British Empire, colonial administrators had long been actively attempting ecological engineering to alleviate environment destruction and 'improve' landscapes (Grove, 1995), and back in the metropole, rapid industrialisation had left people lamenting human expansion and romanticising lost wilderness (Thomas, 1983). Likely as a consequence of all of these motivations, from 1928, conservation advocates in England, connected to the Society for the Preservation of the Flora and Fauna of the Empire (SPFFE) (now Flora and Fauna International) pushed for the creation of national parks around Ngorogoro Crater, Mount Meru, and Kilimanjaro (Neumann, 1992). By 1937, the British-administered Tanganyika government agreed to create the Serengeti Park, which was gazetted in 1940 and formally

declared in 1951 (Shetler, 2007). One of the prominent defenders of the Serengeti (from truncation) in 1960, former director general of The United Nations Educational, Scientific and Cultural Organization (UNESCO) and co-founder of IUCN, Sir Julian Huxley declared Africa's parks as a "*world asset"* offering any visitor "*a priceless enrichment of experience and a unique glimpse of the world of nature as it was before the coming of man. They must be at all costs preserved*" (Schwarzenbach, 2011:14).

Even from the outset, colonial administrators feared that such parks could threatened political stability in the region and that they would "*pay no regard to native interests*" and would infringe upon people's rights (Neumann, 1992). These fears were realised when violent confrontations followed between park authorities and predominantly Maasai communities (who had been largely ousted from the park). According to the District Commissioner at the time, the "*Maasai were openly denying the Park laws, and the political situation has consequently become explosive*", with rhino routinely speared in protest (Neumann, 1992). Similar conflicts rooted in colonial land-conflict legacies still play out in northern Tanzania today (Mariki et al., 2015; Vedeld et al., 2012) and elsewhere in the East African rangelands (Evans and Adams, 2016; Fox, 2018).

5.2.2 Post-colonial conservation

Post-independence, conservation activities and the gazetting of land continued, but these activities took new directions. From the first decades of independence in 1961, a steady process of centralising control over wildlife proceeded and was built around the 'fortress discourse' which emphasised the need to enclose conservation areas, evict previous users, and police these areas against the illegal hunting of wildlife (Adams and Hulme, 2001;

Benjaminsen and Bryceson, 2012). In his 1961 'Arusha Manifesto', the first president of Tanzania, Julius Nyerere, outlined his vision, declaring that "*in accepting the trusteeship of my wildlife we solemnly declare that we will do everything in our power to make sure that our children's grand-children will be able to enjoy this rich and precious inheritance"* (Nyerere et al., 1961). Under Nyerere (who was a staunch advocate for the environment), the majority of Tanzanian national parks, and species protection policies were established. However, these policies were also heavily influenced by international actors. Mount Meru, the national park bordering what later became Enduimet WMA, was established by land purchases made by World Wildlife Fund in 1960 (Adams, 2013). Indeed, the same figures who led the WWF in this endeavour – the so called 'London Preparatory Group' for their English, aristocratic and largely male make-up – even helped Nyerere draft his 'Arusha Manifesto' (Schwarzenbach, 2011). Illuminating their vision for conservation, Sir Peter Scott, co-founder of the WWF, began his 1963 WWF 'Strategy for Conservation' address by declaring: "*The principal pioneers in conservation were Americans. The first National Park was established in the United States and it was here that the value to mankind of wild nature and wilderness as a source of spiritual refreshment was first recognised*" (Scott, 1963).

Tanzania enacted its first comprehensive wildlife conservation laws in the 1970s, which maintained conservation as primarily a top-down, rather than participatory, enterprise. In particular, in 1974 Wildlife Conservation Act was passed. Under this law all wildlife resources belonged to the government. The management of wildlife – still referred to as 'game' – was controlled by the Division of the Ministry of Natural Resources and Tourism, who were empowered to declare any land a game-controlled area and enforce access restrictions, which often did not attend to the interests of local community members or

subsistence hunters (Mkumbukwa, 2008). From the early 1980s however, local communities were given greater consideration. For instance, 1981 saw the first Maasai representative to be included in the management of the Ngorogoro Game Controlled Area (which was founded in 1962), and 1982 the Environmental Legislation Management was established which aimed to reduce conflicts over protected area management by increasing community participation (Mkumbukwa, 2008).

In the 1990s, following global calls for more participatory 'community-based conservation' (Adams, 2013), Tanzania embarked upon a process of creating Wildlife Management Areas (WMAs) (Wright, 2017). This community-conservation discourse also reflected the 'win-win' logic underpinned by a widely endorsed perception of the complimentary relationship between development and environmental conservation (Homewood, 2017), calls for more 'people-friendly' conservation, the adoption of neoliberal economic policies across Tanzania and globally, and the demand for landscape-scale conservation by NGOs (Benjaminsen and Bryceson, 2012). These ideas were enshrined in the 1998 Wildlife Policy of Tanzania (Mkumbukwa, 2008). Since then, 19 WMAs have been established in Tanzania, covering 7% of the total land area of the country, with 19 more planned (Lee and Bond, 2018). Although such a process was originally celebrated as characterising the shift towards a decentralised, 'bottom-up' conservation approach, critical scholars argue that in reality the spread of WMAs represents a huge shift towards the centralised governance of Tanzania's rural populations (Wright, 2017). Indeed, these WMAs are associated with the creation of 'environmentalities' – modes of governance aiming to influence individuals and groups to protect and manage the material environment (Fletcher, 2010) – which in this case aim to transform agro-pastoral lands into conservation 'territories' (Bluwstein, 2017). Rather than be focussed primarily on the interest of the communities themselves, these

projects are seen as helping bolster the wider national-park network and the 'heartlands' (African Wildlife Foundation, [AWF]) or 'ecoregions' (WWF) aspirations of NGOs (Benjaminsen and Bryceson, 2012). Furthermore, where once crop-raiding elephant populations were controlled by colonial administrators and then game wardens even up until the 1990s, the shift towards community-based conservation was accompanied by the strict protection of elephants in northern Tanzania (Bluwstein, 2018). Lastly, during this same period the regional environment experienced both climatic change – notably, higher temperatures particularly in the dry season (Altmann et al., 2002) – and land-use change – notably, from increased agriculture (Msoffe et al., 2011).

5.2.3 Contemporary conflict

Following the trend towards community-based conservation, in 1997 a WMA was proposed for Enduimet by the national government and backed by the international conservation NGO, African Wildlife Foundation (AWF) (Benjaminsen and Bryceson, 2012). The original plan for Enduimet WMA comprised of nine villages and was conceived in stakeholder workshops held in 1997 (Nelson, 2007). At this time, wildlife surveys had recorded locally recovering elephant populations amid widespread illegal hunting of wildlife (Nelson, 2007). Nonetheless, a community-based organisation (CBO) did not form in Enduimet until 2002 after the release of the WMA regulations. During this time and in the following years, the land-zoning plan was contested, namely by Sinya village, who owned the land most abundant with wildlife and who already had developed working relationships with local safari operators (Nelson, 2007). Due to the benefit sharing structure of the WMAs, Sinya stood to lose tourism income as a result of the WMA and consequently Sinya's leaders initially refused to participate when the process was launched in 2004 (Nelson, 2007). Anti-

WMA sentiments were also already present in other villages due to fears over land-grabbing restrictions on resource-use (Benjaminsen and Bryceson, 2012). This opposition was demonstrated by the defacing of WMA beacons placed to demarcate the boundaries of the WMA and call made by community members to withdraw from the WMA (Nelson, 2007).

Conflict in Enduimet has not just played out between villages and the WMA. Since the late 1990s villages in Enduimet have been embroiled in sometimes violent conflict with a succession of tourism operators (Homewood et al., 2009; Honey, 2008). In 2005 a Tanzanian court awarded rights to a hunting company to operate in Enduimet, which was considered by Sinya village to be an affront on their efforts to replace all trophy-hunting with photographic tourism on their land, as the hunting operator was perceived to be corrupt and negatively affecting wildlife population (Wright, 2016). As a consequence of the court-battle, the photographic tourism company relocated to a neighbouring village, leading to lost revenue for Sinya (Benjaminsen and Bryceson, 2012). However, after opposing the hunting operator for numerous years, Sinya then agreed to join the WMA in 2009, in part to more effectively resist trophy hunting. These ambitions were realised in 2011 when the previously contentious hunting area in Sinya was replaced with a photographic tourism zone (Wright, 2016). At this same time, the member villages of the WMA were negotiating a new land-zoning plan and were successful in their efforts to remove the inhibiting (and largely ignored) grazing restrictions of the previous plan (Wright, 2017). During this time Sinya was also split into three separate villages (Figure 5.3).

In Enduimet some of the photographic tourism operators are also sources of conflict. Wright (2017), reports that in 2007 a German photographic tourism operator, Shu'mata

camps, allegedly appropriated land in suspicious circumstances, leading to years of community resentment and hostility. Wright cites how the community claimed ill-treatment at the hands of the camp, broken promises, a lack of transparency over the initial agreement, and the refusal to enter re-negotiations. This community-led battle mobilised some influential elites to support the case, which culminated in an eviction noticed made by the CBO in 2014 and a consequent ongoing court battle (Wright, 2016, 2017).

As elsewhere in the East African rangelands (Evans and Adams, 2016), in Enduimet, there have been numerous concurrent conflicts between different groups of stakeholders. Indeed, the retaliatory killing of elephants has been attributed as being associated to opposition to the WMA (Mariki et al., 2015), as well as to widespread crop-raiding and elephant-incurred human injury or death (Figure 5.7) (Salerno et al., 2016; Wilfred, 2010). Some authors have identified grievances over the lack of promised compensation or material benefits, and resource-use restrictions (Homewood, 2017). Others have highlighted conflict arising from the WMA governance and decision-making process, which is perceived by some as not transparent and unrepresentative (Bluwstein et al., 2016). Furthermore, the negative impacts of elephants on well-being and food security are also thought to disproportionally affect women in Enduimet, who are also those with the least political voice to exert their interests (ESPA, 2017; Mariki, 2016). The original participatory mapping consultations with communities, which helped derive the land-use plan, have also been problematized as producing multiple different 'final' version of the plan, leading to confusion, misunderstanding, and conflict (Homewood, 2017). Indeed, representatives from two different NGOs – African Wildlife Foundation (AWF) and the International Institute for Environment and Development (IIED) – both led separate and parallel processes of participatory mapping, using different mapping techniques and producing

different outputs (Homewood, 2017). Moreover, the appropriateness of these outputs have been questioned given that they were derived from small numbers of local individuals, chosen *ad hoc* without warning or experience of the process and were meant to represent the wider population of 50,000 people (Homewood, 2017).

Figure 5.7: The roadside in the arid seasonal grassland and woodland around TingaTinga village, where I was told by a village official that a woman was killed by an elephant the previous year (August 2016). Author.

At times, conflict over conservation in the area surrounding Enduimet has been reported to have turned violent. Just beyond the border of the WMA in the nearby village of Engare Nairobi, Mariki et al. (2015) report that one night in 2009, a large crowd of villages surrounded a herd of elephants, and using torches, fire, noises and motorcycles they chased them towards, and over a cliff, killing six of them. The WMA rangers are also armed and one particular unit are equipped with specially trained dogs to help chase down and

catch those suspected of illegally killing wildlife, with arrests commonly made (Honeyguide, 2017). There have been reports of hostility between some rangers, tourism operators and community members, and the use of physical protests such as roadblocks (Homewood, 2017; Mariki et al., 2015; Wright, 2017). Lastly, beyond the historical legacies of colonial conservation, and local contestations, a number of authors have identified wider governance systems which act to produce conflict in Enduimet. These include neoliberal policies which are intended to achieve a combination of tourism and conservation via market incentives (Bluwstein, 2018), national conservation governance regimes which act to recentralise state control over conservation (Wright, 2017), and the conservation narrative of 'wilderness' which can help promote the exclusion of people from conservation areas (Bluwstein, 2017).

Chapter 6: Wicked elephants: unpicking multi-level wildlife conflicts

6.1 Abstract

Conservation conflicts are both socially and environmentally damaging and occur when people clash over conservation objectives. They are shaped by various socio-ecological drivers which are thought to operate at multiple levels, from local human-wildlife interactions to national policy debates. However, explorations of conservation conflicts rarely consider how interactions across multiple levels produce conflicts and associated behaviours, and how these factors constrain the efficacy of different management interventions. We address this gap by assessing the multiple levels at which conflict over elephant conservation is produced in a Community Wildlife Management Area (WMA) in Tanzania, and by identifying implications for management. We undertake a mix of structured and unstructured interviews with stakeholders and an appraisal of relevant policy documents, grey literature, and WMA-related reports. We find that beyond human-elephant, and stakeholder interactions, conflict-related behaviours are shaped by wider market governance structures related to national policies, conservation markets, and the objectives of NGOs. We find that current interventions largely target behaviour at the level of human-elephant interactions through enforcement and technical fixes, combined with efforts to realign local stakeholder interests with conservation objectives through eco-tourism. We suggest that in such wildlife conflicts, stakeholder engagement and trust-building approaches could help manage the social conflict between local stakeholders. However, we suggest that the efficacy of collaborative local decision-making may be challenged by seemingly non-negotiable, or non-local, conservation objectives.

6.2 Introduction

Conservation conflicts are widespread and are both socially and environmentally damaging (Redpath et al., 2013). Conflicts can revolve around any conservation objective, but those involving negative human-wildlife impacts (Pooley et al., 2016) are particularly prevalent. Wildlife conflicts are hard to define and are often interpreted and framed differently by authors, managers, and stakeholders (Chapter 3). One approach explores human-wildlife interactions, such as crop-raiding and retaliatory killing, through concepts such as 'human-wildlife conflict', 'tolerance' and 'coexistence' (Lute et al., 2018; Treves et al., 2009). In this framing, wildlife conflict is produced through range overlap, resource competition, and behavioural patterns. Associated interventions focus around separating wildlife from humans, mitigating the cost of wildlife damage, changing attitudes towards wildlife, changing livelihood practices, or increasing enforcement to prevent illegal killings (Nyhus, 2016; van Eeden et al., 2017). Other authors conceptualise conflicts though the lens of impairment and competing human objectives – one of which is related to conservation (Redpath et al., 2013). This human-human conflict approach focuses on how conflict is produced through differences in stakeholder objectives, interests, and values and plays-out through particular behaviours and interactions between stakeholders (Hodgson et al., 2019; Young et al., 2010). Here, stakeholders are considered as "*any group or individual who can affect or is affected by the achievement of an organisation's objectives*" (Colvin et al., 2015), and such conflicts are seen as 'wicked problems' involving complexity, uncertainty, and feedback loops (Mason et al., 2018). Suggested interventions tend to be stakeholder-based, with greater emphasis placed on consultations, mediation, participation, trust-building, or collaborative governance (Madden and McQuinn, 2014; Redpath et al., 2017; Sterling et al., 2017).

Like other socioecological problems (Ostrom, 2009; Sayre, 2005), conservation conflicts can also be conceptualised as being produced across geographically different scales (García-Frapolli et al., 2018; Kronenburg García, 2017; Rechciński et al., 2019) and from wider governance structures related to the state, the market, and civil society (Bixler et al., 2015; Hansson-Forman et al., 2018). Here governance is defined as "*the practice of decision-making occurring jointly between government and civil society through collaborative and deliberative methods*" (Colvin et al., 2015). How local conservation objectives are set and enforced will depend upon the interactions and power differences between policymakers, institutions, and actors (Sterling et al., 2017), but also the mode of governance in action – ranging from centralised, decentralised, public-private, interactive, and self-governance (Hansson-Forman et al., 2018). For instance, elected national governments typically set conservation objectives in line with international agreements and global goals – such as the Convention of Biological Diversity (Hansson-Forman et al., 2018). However, on the ground these may be shaped somewhat by conservation organisations who may be more concerned with regional conservation objectives, and local 'place-based' stakeholders (Sterling et al., 2017) who may be more considered with wildlife impacts, their livelihoods, and maintaining their culture (Ceauşu et al., 2018; Young et al., 2010). Local conflicts over conservation objectives are also shaped by market forces (Margulies and Karanth, 2018), prevailing conservation narratives (Benjaminsen and Svarstad, 2010; Masse, 2016; Nesbitt and Weiner, 2001), and coupled conflicts such as those revolving around class, race, or politics (Hodgson et al., 2019; Pellis et al., 2018). Indeed, viewed through a political-ecology lens, conservation conflicts can been seen as products of particular ways of governing people's interactions with each other and their environment (Fletcher, 2017) – including the mediation of human and non-human violence and deaths (Margulies, 2019; Srinivasan, 2017).

In the conservation conflict management literature this complexity and issue of scale has been embraced in the calls for wicked problem thinking and holistic, adaptive, conflict management (Bunnefeld et al., 2017; Mason et al., 2018). Moreover, multi-level stakeholder engagement has been assessed in other areas of environmental governance (Hellström, 2001; Newig and Fritsch, 2009; White et al., 2018) and in conservation specifically (Bixler et al., 2015; Westholm, 2018), and new systems-based conservation approaches, such as 'convivial conservation' (Büscher and Fletcher, 2019) have been advanced. However, despite a wide literature documenting the socio-political contexts of environmental management (Adams, 2015; Colvin et al., 2015), conservation conflicts still tend to be analysed at only one level – such as the human-wildlife or stakeholder level (García-Frapolli et al., 2018) – and analyses of how such multi-level conflict dynamics influence the efficacy of different conflict management options in wildlife conflicts are still in their nascent phase (Hansson-Forman et al., 2018; Lischka et al., 2018; Redpath et al., 2017).

The purpose of this article is to further explore the relationship between multi-level wildlife conflicts and their management for a case-study around elephant conservation in northern Tanzania, and to try to draw out practical recommendations for conservation researchers and practitioners. Using a mixed-methods approach we examine how conflict is produced at three different levels and assess the implications of these factors for different conflict interventions types. Combining conservation conflict frameworks (Madden and McQuinn, 2014; Rechciński et al., 2019) with the environmental governance literature (Hansson-Forman et al., 2018; Newig and Fritsch, 2009), these three levels relate to human-wildlife interactions, stakeholder interactions, and governance structures (Table 6.1).

Study location

Enduimet Wildlife Management Area (WMA) (Figure 5.1) was established in 2007 as a community-based conservation initiative. The area which is mainly home to Maasai agro-pastoralists is part of the Amboseli-Kilimanjaro ecosystem, sandwiched between Amboseli, Kilimanjaro, and Arusha national parks. Enduimet is home to a number of large mammal populations, including African elephant (*Loxodonta africana*), and it borders a designated wildlife corridor (Henson et al., 2009). The WMA is separated into 11 village zones, a photographic tourism zone and a hunting zone. Wildlife tourism generates modest tourism revenues which, like other WMAs, is split equally between all villages, and is estimated at only USD$0.5 per capita per year (Homewood, 2017), providing some funds for public services. Like other WMAs, Enduimet was established through the formation of the Authorised Association (a community-based organisation) under the support of village councils (Wright, 2017). However its creation and maintenance have been criticised as being largely driven by international wildlife NGOs (Mariki et al., 2015; Sachedina, 2010). Today, Honeyguide, the acting NGO sponsor, provides funding for an anti-poaching team, ranger stations, the equipment used to deter wildlife from farms, and for awareness-raising activities at the local level. One trophy hunting operator, the Northern Hunting Company, and two photo-tourism operators, Shu'mata Lodge, Kambi ya Tembo (Elerai Tented Lodge), currently are established Enduimet (Wright, 2017), with one other investor, Hoopoe Tours, having withdrawn in 2008 (Sulle et al., 2011).

As elsewhere in the East African rangelands (Evans and Adams, 2016), conflicts between local communities and elephant conservation in Enduimet are rife and damaging. Negative human-elephant interactions revolve around crop-raiding, human injury, and retaliatory killing (Salerno et al., 2016; Wilfred, 2010). Conflicts between stakeholders – which

disproportionally affect women (Mariki, 2016) – revolve around contests over land zoning, tensions between villages over tourism income distribution, grievances over unpaid compensation, and conflict arising from the WMA decision-making process (Homewood, 2017). Numerous tourism operators in Enduimet (both past and present) have been reported as being involved in some sort of tension (ranging from disagreements, protests and legal battles) with individual villages and/or the WMA Authorised Association (Sulle et al., 2011; Wright, 2017). Furthermore, wider governance structures are thought to produce conflict in Enduimet, including national policies intended to achieve a combination of tourism and conservation via market incentives (Bluwstein, 2018), national conservation regimes which recentralise conservation (Wright, 2017), and exclusion of people from conservation areas, promoted by the narrative of wilderness (Bluwstein, 2018). Conflict with conservation, both in Enduimet WMA and across Tanzania, is also shaped by historical legacies of local opposition to exclusionary colonial and post-colonial conservation policies (Brockington, 2008; Igoe and Brockington, 2006; Neumann, 1992).

6.3 Methods

Primary data collection

We conducted a mixture of structured and unstructured interviews with a variety of stakeholders in Enduimet WMA over the course of two research trips between July and September 2016, and April and June 2017. We interviewed key informants from institutions and organisations in the local area including: village and district officials (n=11), WMA staff (n=14), NGO staff (n=5), village elders (n=12) and tourism operators (n=2).

Table 6.1: The different levels at which wildlife conflicts are described as being produced, with the interacting factors that produce them at each level, and examples from the wider literature and Enduimet Wildlife Management Area (WMA) specifically.

Conflict level	General examples	Enduimet WMA examples
Human-wildlife interactions Wildlife damage, Retaliatory killing, Hunting, Poaching, Fear, Attitudes, Interests, Values, Identities, Tolerance	(Kansky et al., 2016; Lute et al., 2018; Nyhus, 2016; Pooley et al., 2016; Treves et al., 2009; van Eeden et al., 2017)	(Salerno et al., 2016; Wilfred, 2010)
Stakeholder interactions Perceptions, Relations, Disputes, Decision-making processes, Interests, Values, Identities, Power	(Evans and Adams, 2016; Madden and McQuinn, 2014; Mason et al., 2018; Redpath et al., 2013; Young et al., 2010)	(Benjaminsen and Bryceson, 2012; Homewood, 2017; Mariki, 2016; Sulle et al., 2011; Wright, 2017)
Governance structures State, Market, Civil Society, Policies, Institutions, Power, Narratives (at local, national levels)	(García-Frapolli et al., 2018; Hansson-Forman et al., 2018; Kronenburg García, 2017; Margulies, 2019; Colvin et al., 2015)	(Benjaminsen and Bryceson, 2012; Bluwstein, 2018; Wright, 2017)

These interviews were largely unstructured and opportunistic and varied from formal meetings (30 minutes to two hours), to longer, casual discussions during other activities (such as when walking, attending village ceremonies or joining ranger patrols). The interview discussion points included an overview of the WMA, problems and conflicts in the WMA, and interventions implemented or suggested. Where necessary, interviews were conducted and translated through a research assistant, and most where transcribed *in situ*. Where permitted, formal interviews were recorded and later transcribed. Casual discussions were recorded using notes.

To try and capture a wider range of (non-elite) experiences and perspectives, we also carried out non-random, opportunistic semi-structured individual (n=60) and small group (n=10) interviews with community members from different sociodemographic backgrounds and genders across the nine villages in Enduimet WMA (Box 6.1). These were conducted wherever convenient, in homes, public spaces, eateries, markets and out herding, and most were translated and transcribed from Swahili and Maa to English at source with the help of two research assistants. For these informal interviews, which were typically around 20 minutes in duration but were sometimes longer, we did not follow a prescribed sampling technique besides attempting to cover the widest possible range of ages, occupations, and household locations, and maintaining a balanced split across genders and villages. The total number of interviews was dictated by time available in the field rather than reaching saturation (Saunders et al., 2018). The interviews referenced in this chapter are described and coded in Table 6.2.

Box 6.1: Semi-structured interview guide

Semi-structured interview guide

1. *What do you know about the WMA?*
2. *Do you see any advantages or disadvantages of the WMA?*
3. *Do you know of any actions the WMA takes to help any problems?*
4. *What would you suggest that would help any problems?*

Table 6.2: List of interviews, interviewees and relevant contextual information. Short interviews = <15 minutes, Medium = 15-30 minutes, Long = 30-60 minutes, Extended = repeated or continuous discussion, >60 minutes. Interviews are listed only by the order they are referenced in this article.

Interview	Age category	Gender	Occupation	Interview style	Size	Length	Language	Recorded	Context	Date
1	Middle Elder	Male	Agriculturalist	Semi-structured	Individual	Medium	Swahili	No	Opportunistic, residential	August 2016
2	Senior Elder	Male	WMA official	Structured	Individual	Extended	English & Swahili	Yes	Formal meeting, residential	August 2016
3	Moran Moran Moran Moran	Male Male Male Male	Pastoralist Pastoralist Pastoralist Pastoralist	Semi-structured	Group	Medium	Maa	No	Opportunistic, eatery	August 2016
4	Moran Moran Moran	Male Male Male	Pastoralist Pastoralist Pastoralist	Semi-structured and informal	Group	Extended	Maa, Swahili, English	No	Opportunistic, herding	May 2017
5	Moran	Male	Pastoralist	Semi-structured	Individual	Short	Maa	No	Opportunistic, residential	July 2016
6	Moran Moran	Male Male	Pastoralist Pastoralist	Informal	Group	Short	Swahili	No	Opportunistic, village centre, prior to night patrol	June 2017
7	Middle elder	Male	Village official	Semi-structured	Individual	Medium	Maa	No	Formal meeting, residential	August 2016
8	Middle	Female	Housekeeper	Semi-structured	Individual	Medium	Maa	No	Opportunistic, residential	August 2016
9	Middle	Female	Agriculturalist	Semi-structured	Individual	Medium	Maa	No	Opportunistic, residential	August 2016

10	Middle Elder Junior Elder	Male Male	WMA ranger WMA ranger	Semi-structured and informal	Group	Extended	English & Swahili	Partially	Formal meeting, workplace, and observation	August 2016
11	Middle elder	Male	NGO official	Semi-Structured	Individual	Medium	Swahili	No	Formal meeting, workplace	August 2016
12	Middle	Male	NGO official	Semi-Structured	Individual	Long	English	Yes	Formal meeting, workplace	Sept 2016
13	Junior elder	Male	WMA ranger	Semi-structured, informal	Individual	Extended	Maa, Swahili	No	Formal meeting and observation	August 2016
14	Middle-Senior	Male (8) Female (3)	Village leaders	Feedback session	Group	Medium	Swahili, English	No	Research feedback session, village hall	Jan 2019
15	Middle elder	Male	Pastoralist	Semi-structured	Individual	Medium	Swahili	No	Opportunistic, residential	August 2016
16	Middle	Female	Hotel owner	Semi-structured	Individual	Medium	Swahili	No	Opportunistic, workplace	August 2016
17	Moran Moran Moran	Male Male Male	Pastoralists	Semi-structured	Group	Medium	Swahili, English	No	Opportunistic, eatery	August 2016
18	Middle elder	Male	Village official	Semi-structured	Individual	Long	Swahili, English,	Partially	Formal meeting, residential	August 2016
19	Middle	Male	Schoolteacher	Semi-structured	Individual	Medium	English	Yes	Formal meeting, school	August 2016
20	Middle	Female	Schoolteacher	Semi-structured	Individual	Medium	English	Yes	Formal meeting, school	June 2017

21	Middle	Male	Schoolteacher	Unstructured	Individual	Short	English	No	Opportunistic, informal discussion, school	May 2017
22	Senior elder	Male	Village leader	Semi-structured	Individual	Medium	Maa	No	Formal meeting, residential	August 2016
23	Middle elder	Male	Village Leader	Semi-structured	Individual	Medium	Maa, Swahili	No	Formal meeting, administrative building	August 2016
24	Middle	Male	Tourism operator	Semi-structured	Individual	Long	English	Partially	Formal meeting, tourism camp	August 2016
25	Middle	Male	Tourism operator	Semi-structured	Individual	Long	English	Partially	Formal meeting, tourism camp	August 2016
26	Middle	Male	NGO official	Informal	Individual	Extended	English	No	Extended informal discussions	June 2017
27	Junior elder	Male	Agriculturalist	Semi-structured	Individual	Medium	Maa	No	Opportunistic, residential	August 2016
28	Middle	Female	Hotel owner	Semi-structured	Individual	Medium	Swahili	No	Opportunistic, workplace	August 2016
29	Middle Elder	Male	Village official	Semi-structured	Individual	Medium	Swahili, English	No	Opportunistic, marketplace	August 2016
30	Senior Elder	Male	Village elder	Semi-structured	Individual	Medium	Maa	No	Opportunistic, residential	August 2016
31	Middle	Female	Business owner	Semi-structured	Individual	Medium	Swahili	No	Opportunistic, workplace	May 2017
32	Middle elder, Middle Moran	Male Female Male	Agriculturalists	Semi-structured	Group	Medium	Swahili, Maa	No	Opportunistic, residential	August 2016
33	Junior Elder	Male	Agriculturalist	Semi-structured	Individual	Medium	Swahili	No	Opportunistic, village centre	May 2017

34	Middle	Male	Village official	Semi-structured	Individual	Medium	Swahili, English	Partially	Formal meeting, administrative building	August 2016
35	Junior elder Junior elder	Male Male	Agriculturalists	Semi-structured	Group	Short	Swahili	No	Opportunistic, village centre	May 2017
36	Middle	Female	Housekeeper	Semi-structured	Individual	Medium	Maa	No	Opportunistic, residential	August 2016
37	Junior	Female	Business owner	Semi-structured	Individual	Medium	Swahili	No	Opportunistic, workplace	July 2016
38	Senior	Female	Elder	Semi-structured	Individual	Medium	Maa	No	Opportunistic, village centre	July 2016
39	Moran Moran Moran Moran	Male Male Male Male	Pastoralists	Semi-structured	Group	Medium	Maa, Swahili	No	Opportunistic, village centre	August 2016
40	Junior-Senior	Male (10) Female (2)	Village leaders	Feedback session	Group	Long	Maa, Swahili, English	No	Research feedback meeting, village hall	Jan 2019
41	Middle Middle Junior	Male Male Male	WMA officials	Informal	Individual and Group	Extended	English	No	Series of informal discussions and feedback meetings	Jan 2019

We also conducted a structured survey with 212 randomly selected male community members from three villages (of mixed age and occupations), who were participants in an adjoining study (Chapter 7). In that experimental study we only recruited males as cultural norms prevented gender mixing (Smith 2015) and rather than split the experiment across male and female-only samples (Keane et al. 2016), we opted to maximise predictive power and the sample size of one group – males – who were also much more easily recruited (via mobile phones). In this survey, we asked participants questions related to their perceptions of the WMA and elephants. Survey questions related to elephant tolerance were adapted from Kansky et al., (2016) (Appendix 4, Survey sheet). Due to male-sample survey bias, whilst staying in the villages we actively sought additional formal and informal interviews and casual discussions with female community members from a range of backgrounds. Following data analysis, we then revisited the WMA to hold mixed-gender feedback sessions – involving results presentation and group discussions – with both community members and leaders (in three villages), WMA officials and NGO staff in January 2019.

Ethics statement

This study received ethical approval from the University of Edinburgh, School of GeoSciences Ethics Panel. Ethical best-practice guidelines for conservation social science were followed (John et al., 2016). All research participants were required to give their informed consent orally before participating in either interviews or the survey. For interviews this was achieved via introductory statements and translations where necessary. For the survey an information sheet (Appendix 4) was provided – and administered orally. For interviews, a voice recorder was only used for key-informant interviews when informed consent was given. To protect respondents' identities we did not collect names and have anonymised both the raw data and in-text quotations – which includes not reproducing any

personal information which could be traced back to individuals (St John et al., 2016). Further, we have presented the list of interviewees (Table 6.2) such that the specific timing of interviews, location (such as village) and individuals cannot be identified. Given there was the possibility for unequal power dynamics – efforts were made to reiterate and emphasise to participants that they did not have to continue with any interview or study if they did not feel comfortable (Tindana et al., 2006). For transparency, the lead authors' position as a student researcher (i.e. not a policy-maker or NGO staff worker) was emphasised to avoid raising any expectations of possible outcomes (from the perspective of research participants). The lead author also returned to the field-site to thank the communities who participated in this research and to share and receive feedback.

Secondary data collection

To identify the conservation narratives used by the organisations involved in the governance of the WMA, in September 2018, we conducted a directed content analysis (Hsieh and Shannon, 2005) of the web pages and published reports related to Enduimet of the NGOs Honeyguide, African Wildlife Foundation (AWF) and The Nature Conservancy (TNC), as well as the Tanzanian Tourist Board, the Tanzanian Wildlife Research Institute (TAWIRI). For this analysis, we sought to identify any text which we interpreted as reproducing conservation narratives identified previously in the literature (Benjaminsen and Svarstad, 2010; Bluwstein, 2017; Igoe, 2010; Nesbitt and Weiner, 2001), including relating to 'coexistence', 'wilderness', 'pristine nature', or conservation-development 'win-wins'. We also reviewed Tanzanian WMA and wildlife-related policy documents and undertook an online literature search using Google Scholar to locate additional grey literature related to Enduimet in September 2018 (Appendix 3, Literature search).

Data analysis

We analysed the data from interviews using the software package 'NVivo'. Again, using a directed content analysis approach (Hsieh and Shannon, 2005), we first grouped responses according to three pre-determined themes – human-elephant interactions, stakeholder interactions and governance structures (Table 6.1). We derived these main themes using a grounded theory approach during an analysis of the published conflict literature. We also recorded any conflict intervention types that were described as being implemented or suggested by respondents. To analyse the survey data relating to perceptions of the WMA and elephant tolerance, we calculated the frequency of respondents who gave answers in each given category within the survey questions.

6.4 Results

Human-elephant interactions

Residents of Enduimet reported high direct economic and well-being costs incurred from living alongside elephants. Across the 212 male community members in our survey 96% participated in agriculture, and of these, 98% claimed to have experienced some form of elephant crop-raiding in the last year (median: 10 crop bags lost, IQ range: 8), 83% claimed to experience some or high fear of elephants, 13% had experience elephant-caused injury within their families, and 3% reported an elephant-caused death within their families. In interviews, we were frequently informed of the high material costs associated with living near elephants. For example, one middle elder explained: *"I tried to bring myself out of poverty by planting crops, but the elephants came and destroyed everything*" (Interview 1). Attributing a high degree of agency to individual elephants, one WMA official recounted the particular 'tactics' employed by certain elephants to avoid detection or overcome crop-protection measures, stating *"elephants are very technical – they learn new tricks each day*"

(Interview 2). One group of young men of the 'Moran' age-set (who are the traditional guardians of the village) saw their role as defending farms against marauding elephants and other wildlife (Interview 3). These respondents, and other Moran (Interviews 3-6), reported that that they no longer had the agency to protect their village from elephants. Indeed, we were told about (Interviews 7-9), and then shown (Interview 4), a bull elephant that had remained in the outskirts of the village after allegedly killing two villagers and two cows in recent weeks.

We also found clear variation between individuals and villages over how many elephants residents were willing to accept in Enduimet. From our survey of 212 male community members, we found that 39% of respondents were willing for the elephant population size to stay the same, 34% were willing to accept only a reduced population, 15% were not willing to accept any elephants and 13% were willing for the population to increase. During the survey, justifications given to support these answers ranged from preserving elephants for future generations of Tanzanians, to maintaining local tourism and removing elephants to reduce their devastating effects on their livelihoods. This variation seemed to differ across villages, with respondents who were willing for larger elephant populations coming almost exclusively from one village (Figure 6.1). Respondents also showed variation in when they considered lethal control of an elephant by the WMA to be acceptable (Figure 6.2) – although for over half of the respondents (53%) lethal control was only acceptable in response to an elephant killing a human.

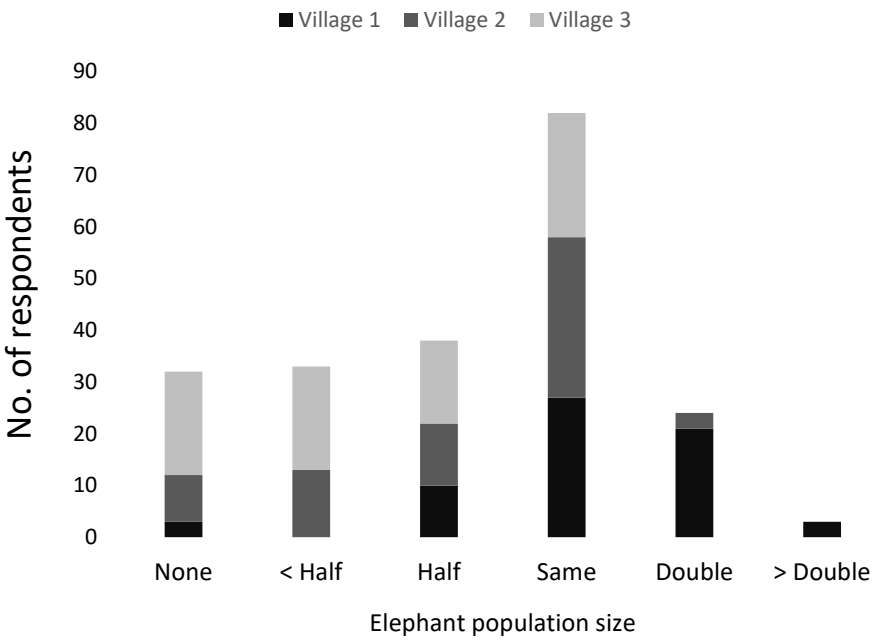

Figure 6.1: The hypothetical elephant population size respondents were willing to accept (n=212)

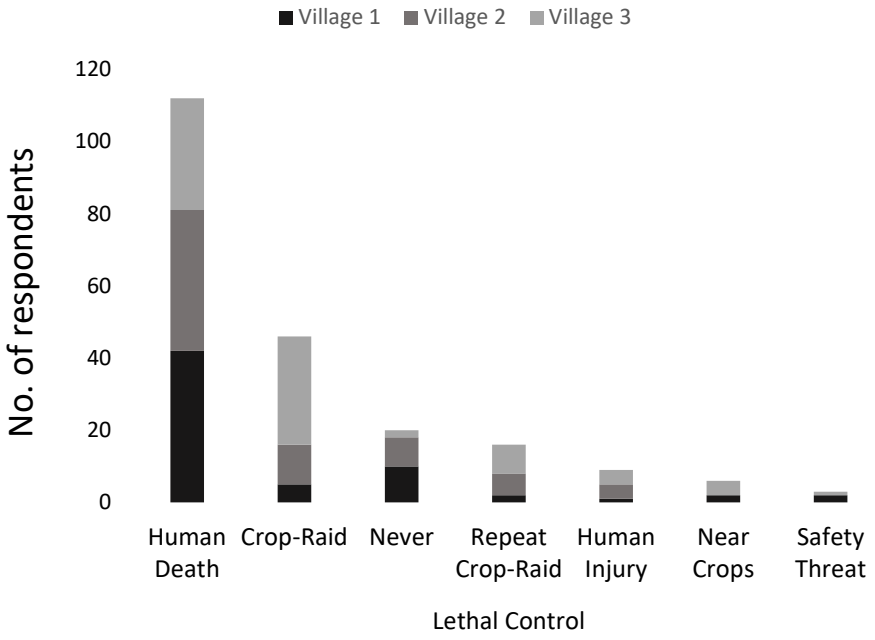

Figure 6.2: The hypothetical situation perceived by respondents as appropriate for the WMA to undertake lethal control of elephants (n=212).

We found that both the WMA rangers and villagers intervene to reduce elephant impacts, but that these mitigation techniques are insufficient. From our survey, 77% of respondents reported that during the harvest season they spend three or more nights a week guarding village crops (median: 7 nights, IQ range: 4). Residents of all three villages attempt this by deterring elephant with loud noises, chilli bombs, and electric torches. These materials are supplied to each village by the NGO Honeyguide as part of their 'human-elephant conflict toolkit' (Interviews 10-13) and 52% of respondents reported the provision of such equipment, but only 13% of these respondents reporting that this equipment was sufficient to deter elephants. A nightly ranger team also responds to villagers' phone calls and messages about crop-raiding elephants (Interviews 10-13), and 45% of respondents reported such activities in their area, but of these only 18% reported that the patrols were sufficient to deter elephants. Suggestions for feasible interventions given by respondents included compensation, fencing, the creation of elephant-only waterholes, a new wildlife-only zone away from villages, and a reduction in the elephant population. In one meeting, both male and female village leaders (Interview 14) pointed to the seemingly successful zoning and compensation schemes across the border in Kenya to ask why these could not be rolled out in Enduimet – a sentiment also mirrored by other community members (Interviews 15-17). Furthermore, we learned that in each village the NGO Honeyguide had also previously screened an education wildlife-related film, which 56% of our survey respondents recalled watching.

Stakeholder interactions

From our key informant and semi-structured interviews with stakeholders we identify numerous different stakeholder groups (including agriculturalists, tourism operators, NGO staff, WMA staff and local government) each with different interests in the conservation of

Enduimet's elephants. However, whilst 71% of survey respondents described the WMA as 'very legitimate' when asked directly, interviews provided a more critical picture, citing conflict over land, higher than expected costs, low transparency and unmet promises. One village official (Interview 18) explained that for those reliant on agriculture, elephant crop-raiding poses a severe threat to their income and food security. Three different schoolteachers (Interviews 19-21) described how children's fear of elephants impacts their education, but that the WMA income also helps pay for some children's school fees as well as other social services. Whilst we did not find any respondents who thought negatively of tourism *per se,* we did experience negative sentiment towards particular operators and the WMA regulations. Two village leaders felt aggrieved that since the creation of the WMA they had to share tourism-income generated from their land with each of the other villages, which previously had no tourism operations (Interviews 22-23). One tourism operator (Interview 24) outlined how livestock grazing in the wildlife zones was bad for their business and the WMA overall, whereas another highlighted conflict between the pastoralists and wildlife, and with the hunting industry (Interview 25). The local wildlife NGO Honeyguide described how their objective was in providing services to help establish a self-sustaining community-led model for Enduimet and other WMAs (Interview 26). One agriculturalist identified the WMA as an entity separate from the community, with a specific wildlife-focused agenda as *"the herders of elephants"* (Interview 27). A female business owner shared similar sentiments, identifying the WMA as "*the people who protect the forest and wildlife to not cut down any trees and not kill any wild animals*" (Interview 28). Among residents, the different perceived principle beneficiaries of the WMA ranged from the tourism operators (Interview 29), to the WMA staff themselves (Interview 30), the NGO, (interview 31) to the government (Interview 32), to community members themselves (Interview 33). One WMA official summed up these differences by stating that there are

four broad perceptions of the WMA within the community – those who (claim) that they do not to know about the WMA, those who see benefits in school fees and income it provides, those who see it as only for the benefit of wild animals, and those who some advantages of the WMA, but who may "*blame it without fully understanding it*" (Interview 2).

Conflicting interests and perceptions manifest themselves in ongoing negative interactions between stakeholders. One tourism operator (Interview 24) recounted a history of hostility with a neighbouring village, situated around access to grazing lands. One village official (Interview 34) described how aggrieved residents perceive the WMA to have been unfaithful by not providing the compensation for crop-damage they had promised and by not coming to protect their crops when they said they would. One agriculturalist described how the WMA "*does not feel our pain*" (Interview 35). One mother (from a pastoral household) stated "*I don't want to talk about the WMA. I hate the WMA*" (Interview 36, Enduimet, August 2016). A female business owner found that the WMA was perceived by some to focus more on wildlife than people: *"the WMA is an organisation for wildlife. I just know they usually go around town and look for anyone who attacks animals and wildlife and punish them for laws they have broken, but I have never seen people who have been hurt by wildlife followed up seriously"* (Interview 37). Some residents, such as one female community elder, felt like the promised benefits of the WMA initially failed to come to fruition or that the true costs were not explained: *"we just received the WMA but we did not know the impact of [the] WMA. Before, if we knew the impact, we would [have] not accepted it here*" (Interview 38). Similarly, a farmer, stated, "*the WMA has been saying there will be benefits of wild animals and it has been 10 years now and people [have] just been taking GPS and photos of wild animals but nothing has changed. So where and how will these people get help for the destruction?*" (Interview 39). Beyond a one-off mobile

cinema, occasional village meetings and workshops (organised by Honeyguide), we were not told specifically about other stakeholder-based conflict-management interventions, such as trust-building, mediation or participatory decision-making offered by the WMA or Honeyguide. Lastly, during one feedback workshops, residents in one village jointly lamented a perceived reduction in the amount of community consultation over recent years (Interview 40).

Governance structures

From our interviews and from appraising relevant grey literature and online materials, we find that stakeholder conflict within Enduimet is also produced the interactions of national policy, conservation NGOs and the WMA – and competing aims, narratives and structures.

At the national level the Tanzanian Wildlife Conservation Act (2009) aims: "*to protect and conserve and administer areas… to enable Tanzania to effectively contribute and benefit from international efforts and measures to protect and enhance global bio-diversity*". Specifically regarding WMAs, a subsequent objective is to "*enhance the conservation of wildlife and its habitats outside wildlife protected areas*" (United Republic of Tanzania, 2009). Similarly the conservation aims of NGOs operating in Enduimet are both national and international in scope. Honeyguide describe how "*between 2009- 2014, Tanzania lost 60% of its elephant population to poaching*"(Honeyguide, 2018). Likewise, another NGO which is involved in projects across the region, The Nature Conservancy, presents Enduimet as part of a wider conservation plan, as *"an important elephant corridor that sits between Amboseli National Park in southern Kenya and Kilimanjaro National Park in northern Tanzania*" (The Nature Conservancy, 2018). Furthermore, Enduimet was initially presented in a similar fashion by another big international NGO, the African Wildlife Foundation

(AWF,) as part of their 'Africa Heartlands' project (Africa Wildlife Foundation, 2018). Another cross-border conservation project, 'Connekt', associated with the NGO Oikos, has also begun to operate in the area (The Citizen, 2019). By contrast, those in the Enduimet WMA and local village administrations understandably have a much more local conservation outlook. Indeed, from the perspective of the NGO (Interview 26) and the WMA staff (Interviews 41), the strategy for Enduimet long-term is in creating a self-sustaining income and impact reduction model, financed completely by the WMA through eco-tourism and student research visits

In line with these different aims, within Enduimet WMA there exists competing governance structures. For instance, although the governance structure of the WMA includes elected village representatives in the WMA Authorized Association (Community Based Organisation), in reality national-level Wildlife Management Areas Regulations (2012) dictate the WMA formation process and procedures. These regulations include, among other things, rules relating to the application for hunting quotas, income distribution, NGO partnerships and commercial partnerships. These WMA-specific regulations also compliment the national-level policy on the management of elephants (with regards to hunting, self-defence or problem animal control)(United Republic of Tanzania, 2012). Although in principle residents in Enduimet agree to the WMA regulations, they do not set the rules regarding their interactions with elephants. This reality seems not to be lost on one senior female elder who declared that "*the WMA are the responsible organisation [for elephant caused fatality] because if responsibility was given to the village even the young boys could kill the animals, but the WMA does not let them do this*" (Interview 38). Again, although the village councils can vote on changes to the land-zone plan, the final decision rests with the Director of Wildlife at the Ministry of Natural Resources and Tourism (United

Republic of Tanzania, 2012). By contrast, the operating NGO Honeyguide plays an influential role in the running and strategic planning of the WMA and derives its funding internationally from a mix of small, institutional and high-net worth donors, including The African Wildlife Foundation, The Nature Conservancy and USAID (Honeyguide, 2017).

Across these different institutions, different conservation narratives are also projected. For the government establishing Wildlife Management Areas was *"for the purposes of effecting community based conservation*" (United Republic of Tanzania, 2009). In interviews, such narratives of community conservation were espoused by those administrating the WMA (Interview 41). By contrast, within the online marketing materials for tourism in Enduimet we also find the reproductions of much more wilderness-based conservation narratives. As the WMA website describes *"Untamed, [west Kilimanjaro] remains comparatively unchanged since man and beast first set foot into its interior. For centuries the Maasai have co-existed in the area."* (Enduimet WMA, 2018). From our interviews with tourist operators we saw how these narratives play-out in practice, with some tourists reportedly perceiving that too many livestock in the wildlife area or signs of development *"disrupts their wilderness experience"* (Interview 24). Finally, in their online materials Honeyguide characterises the conflict as revolving around how "*human populations grow, natural areas are reduced, and human-wildlife conflict increases*" (Honeyguide, 2018). These narratives are similar to those presented online by other NGOs, such as The Nature Conservancy who describe conflict arising from "*grazing cattle and insatiable goats*", "*human encroachment*" and "*unplanned expansion of agriculture*" (The Nature Conservancy, 2018).

6.5 Discussion

In Enduimet WMA we find that although most management effort is focused at the local level, such as in trying to reduce elephant impacts or change attitudes, much of the conflict is shaped by processes at larger scales. These include the interactions of different stakeholders with varying interests, regional conservation governance structures, national policy and locally-acting NGOs. These interacting levels of conflict production, behaviours and interventions are visualised in Figure 6.3.

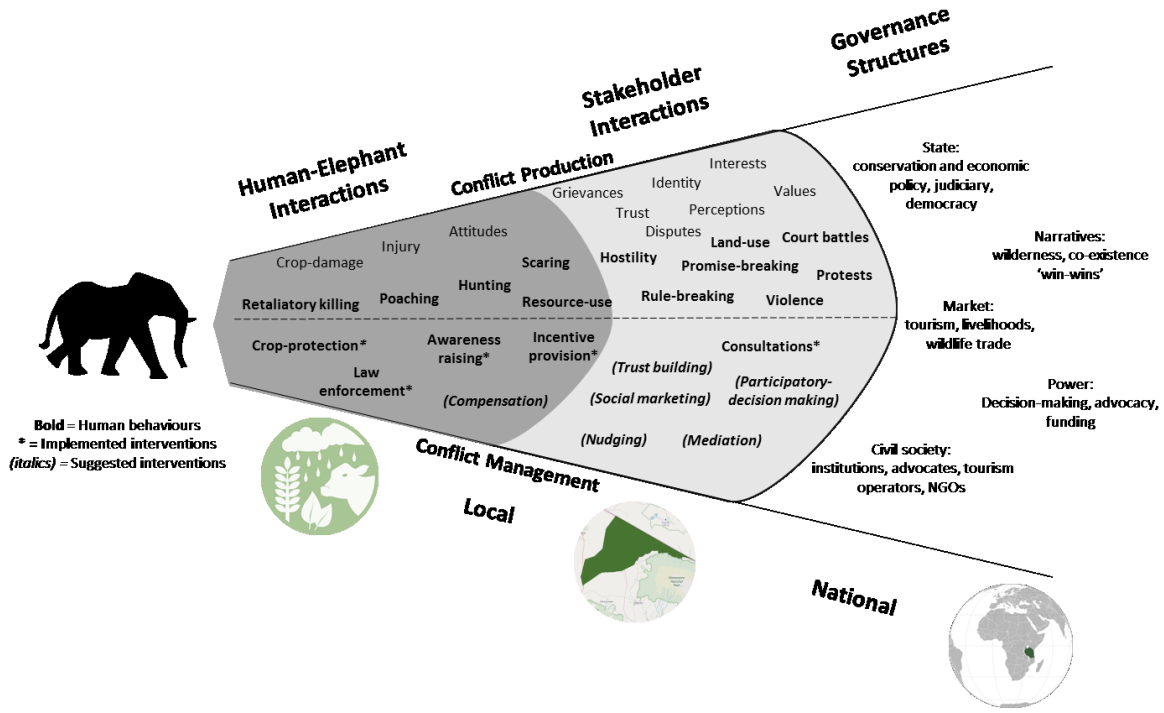

Figure 6.3: Different levels at which elephant conflict is produced in Enduimet WMA and examples of the interacting factors and behaviours within each level that produce and manage conflicts – with implemented and recommended interventions denoted.

Our finding that elephant-related conflicts and behaviours at the local level are in part produced by wider governance structures is to be expected given the inherently political underpinning of environmental management (Adams, 2015; Colvin et al., 2015) and previous findings in both Enduimet (Bluwstein, 2017) and elsewhere in East Africa (Evans and Adams, 2016; Fletcher, 2017; Kamau, 2018). For instance, changes in agrarian economies and land-use on a wider scale have been found to shape human-wildlife interactions and conflict at a local scale (Margulies and Karanth, 2018; Roucouz et al. 2017). In Tanzania, market demand for eco-tourism, trophy hunting (Wright 2016), and accumulation of wilderness areas (Bluwstein, 2018) have all been presented as drivers in the creation of WMAs and the continuation of conflict within them (Benjaminsen and Bryceson, 2012). As we and others find, the negative interactions between people and elephants, and between stakeholders in Enduimet are produced by the implementation of the WMA governance structure, which was devised nationally and imposed locally through both local and international institutions (Bluwstein et al., 2016; Moyo et al., 2016). Indeed, the formation of Enduimet was not a local policy solution to a local problem.

As Wright (2017) finds, particular elite actors in and around Enduimet, from tourism operators, to NGOs and politicians, have played pivotal role in dictating how this conflict plays-out. Hence, under the governance mode framework proposed by Hansson-Forman et al., (2018), elephant conflict in Enduimet WMA is produced through a mix of centralised state governance and public-private governance, with little local self-governance and through interactions between policy, institutions and actors at local, regional and national levels. Although Tanzanian state-governance structures have mediated human-wildlife interactions since colonial times (Anderson and Giblin, 2006; Bluwstein, 2018; Neumann, 1992), this particular governance structure is new in aiming to mitigate conflicts through a

tourism-driven, market-based conservation economy and sustainable development agenda (Homewood, 2017). But as this study confirms, this apparent win-win narrative – embodied the NGO and WMA online reports and communications – has not yet materialised. Moreover, we also find that other conservation related narratives found in the external communications of the WMA and NGO (which focus around wilderness, policing and human-wildlife conflict), differ to those described by the WMA and NGO staff working on the ground (who focused more around community support, trade-offs, human-human conflict and service provision). These discrepancies may somewhat be explained by the disjuncture between conservation organisations needing to appeal to international donors through particular narratives, whilst solving problems on the ground which may not always align with these narratives (Igoe, 2010; Nesbitt and Weiner, 2001)

Beyond wider governance structures, we also find that conflict around elephants in Enduimet is produced through differences in local stakeholder interests, perceptions, and resulting behaviours – again corroborating previous findings in Enduimet (Homewood, 2017; Mariki et al., 2015; Wright, 2017) and East Africa (Evans and Adams, 2016). Like elsewhere in Tanzania, we find that it is not just a lack of technical fixes that is continuing the conflict, but also broken promises (Mabele, 2017), perceived lack of care, lost control over village lands, and reduced autonomy (Goldman, 2011; Mariki et al., 2015). These insights add to findings describing conflicts in Enduimet over land-allocation for tourism operators (Wright, 2016), those rooted in confusion over the original land-zoning plan (Homewood, 2017), and those stemming from non-participatory and non-transparent decision-making processes (Bluwstein et al., 2016). Indeed, such factors have been considered inevitable given the potentially unattainable promises made during the creation of WMAs (Moyo et al., 2016).

Despite the influential roles of both governance and stakeholder interactions, it is also clear that negative perceptions of both elephants and the WMA are also produced directly via negative interactions with elephants. Like other findings in Enduimet (Salerno et al., 2016; Wilfred, 2010) and in similar contexts in East Africa (Kamau, 2018), we identify significant economic and well-being impacts resulting from living alongside elephants. A robust assessment of these interactions would require more comprehensive measures of factors such as tolerance, retaliatory killings, and wildlife impacts (e.g., Pozo et al. 2017) and would test the independent relationships between them (Kansky et al., 2016). However, we are confident in concluding that stakeholder conflict over elephants – and the associated killing of wildlife – in Enduimet is likely shaped by these negative interactions, even if not everyone incurs the direct costs. Indeed, such relationships between impacts, behaviours and conflicts have been widely identified in many other similar contexts (Young et al., 2010; Evans and Adams 2008).

These finding have important implications for conflict management and contribute to the growing literature highlighting the existence of multi-levels in conservation conflicts (Ceaușu et al., 2018; Lischka et al., 2018; Rechciński et al., 2019). Firstly, given that conflict over elephants are likely (at least in part) to be shaped by negative human-elephant impacts, we suggest that interventions to mitigate those impacts locally are appropriate, but currently insufficient. Indeed, the strategies adopted by the NGO and WMA organisation who provide interventions in Enduimet, revolving around livelihood protection and deterrence, have been found to be effective in reducing wildlife impacts and increasing tolerance in other contexts (Kansky et al., 2016; van Eeden et al., 2017). Likewise, making good on the promise of compensation for crop-damage, and increasing the transparency of

decision-making might increase trust and reduce hostility towards the WMA (Mabele, 2017; Young et al., 2016a) – particularly as in this context grievances around unfulfilled promises are especially pertinent (Homewood, 2017). Similarly, placing a higher focus on protecting people from elephants, not just elephants from people, might help alleviate tensions (ESPA, 2017). Market-based mechanisms for incentivising local protection of problematic species can be successful (Lindsey et al., 2014; Nelson et al., 2013). Indeed, Tanzanian WMAs have been shown to have had a positive impact on wildlife numbers (Lee and Bond, 2018). However, the high level of tax on tourism-derived income remains prohibitive (Sulle and Banka, 2017), and as we and others find, these mainly technical and financial interventions struggle to alleviate the social and governmental roots of elephant conflict (Brehony et al., 2018). Mapping out the different interacting drivers, behaviours and levels of conflict (such as attempted here in Figure 6.3) might also help inform where best to target behaviourally-informed interventions. These could also include social marketing approaches (Veríssimo et al., 2019), such as promoting wildlife guardians (Hazzah et al., 2014), and timely 'nudges' (Reddy et al., 2017; Thaler and Sunstein, 2008) such as SMS-based elephant warning systems (Sarkar et al., 2016).

Given the sustained social conflict, more stakeholder-engagement (Redpath et al., 2017), mediation (Reed and Ceno, 2015) and participatory decision-making (De Vente et al., 2016; Fletcher, 2017) might also prove effective. However, in any situation where national-level policy conservation interacts with local interests, stakeholder-engagement approaches are known to be subject to the nature of within-state democratic institutions and governance structures (Hansson-Forman et al., 2018; Newig and Fritsch, 2009). In Enduimet, the WMA structure provides potential space for deliberative and participatory decision-making in the form of the Authorized Association representing village councils. However, in Enduimet this

process clearly is not working seamlessly, given the history of physical protests, non-compliance, court battles, and general levels of resentment towards the WMA (Homewood, 2017; Wright, 2017). In large group feedback meetings with village leaders and community members, Enduimet residents themselves identified the need for more community-WMA meetings and communication. Indeed, such consultations, more effective collaborative decision making, and even professional mediation (de Vente et al., 2016), might help resolve these conflicts (prior to legal battles). These process may enable member villages to restructure some of the WMA systems, such as revenue sharing and access restrictions, and introduce adaptive management plans (ESPA, 2017), which have proved effective in other contexts (Nuno et al., 2014). However, any locally-agreed solutions may be constrained by not only local governance capacity (Balint and Mashinya, 2006), but variations in external markets, such as for wildlife tourism and hunting (Wright, 2016), and the preferences of donors and NGOs who co-fund operations within the WMA. For instance, even if local stakeholders in Enduimet came to an agreement on the population size or management of elephants, this agreement may not reconcile with the conservation objectives or narratives of those outside of Enduimet (including donors and NGOs) (Sterling et al., 2017), and with international political agreements (Reed and Ceno, 2015). Local decisions may therefore not go unchallenged (López-Bao et al., 2017). This is important because the ability for local stakeholders to influence local environmental governance is essential for effective participatory decision-making (De Vente et al., 2016; von Essen and Hansen, 2015). Moreover, elsewhere the role of NGOs in maintaining, or exacerbating conflict elsewhere has been well documented (Hodgson et al., 2018; Veríssimo et al., 2015). Indeed, in some instances it is possible that non-intervention is more appropriate. Furthermore we suggest the role of narratives presented in donor-facing NGO communications in shaping conflicts

deserves further exploration, as does the potential for interventions to target at actors outside of the local context (such as donors, advocates or policy-makers).

In short, we suggest that in Enduimet, and likely in many places globally, conflict management and behaviour change is attempted more via efforts to realign stakeholder interest with conservation objectives through incentives and wildlife impact mitigation, and less via efforts to realign conservation objectives with stakeholder interests through collaborative governance. Hence, alongside the type of local decision-making process (De Vente et al., 2016; Sterling et al., 2017), the wider governance mode (Colvin et al., 2015; Hansson-Forman et al., 2018) is likely to constrain both the nature and efficacy of stakeholder engagement and behaviour change in wildlife conflicts.

6.6 Recommendations

- Researchers should consider the multi-level drivers which shape conflict behaviours.
- Both researchers and decision-makers should explore how influences from outside the local context may constrain local management possibilities.
- Conflict managers could consider how, and when, management decision-making could be made more participatory.
- Researchers could better incorporate behavioural insights into intervention design and explore the appropriateness of non-intervention in some contexts.

Chapter 7: Intervener trustworthiness predicts cooperation with conservation interventions in an elephant conflict public goods game

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7.1 Abstract

Conservation conflicts exist in complex socio-ecological systems and are damaging for both people and wildlife. Accordingly, there is much interest in designing interventions to manage them more effectively, change behaviour, and achieve better ecological and social outcomes. Conflict management is influenced by levels of stakeholder trust in both natural resource managers and organisations, which in turn is shaped by perceptions of their trustworthiness. However, experimental studies of how the different facets of trustworthiness shape behavioural responses to management interventions are rare in conflict settings, and are important in providing evidence to inform interventions. Here, we develop an experimental, framed public goods game to test how support for otherwise identical elephant conflict interventions varies with perceptions of the trustworthiness of two different intervening groups – a community group or a conservation organisation – and compare game behaviour to pre- and post-game interviews. Results from three agro-pastoral communities (n= 212 participants) in northern Tanzania show that participants

cooperate more with interveners they perceive to be more trustworthy. Results also suggest that different aspects of trustworthiness matter differentially – with perceptions of interveners' integrity and benevolence more strongly predicting cooperation than perceptions of their ability. The findings suggest that trust-building, and greater consideration of who is best placed to intervene in conflicts, may help improve natural resource management, increase stakeholder support for interventions, and more effectively change conflict-related behaviours. This study also further demonstrates how experimental games offer opportunities to test responses to management interventions and help inform evidence-based conservation.

7.2 Introduction

Conservation conflicts are damaging for biodiversity, livelihoods and human well-being globally (Pooley et al., 2016; Redpath et al., 2013). Accordingly, there is much interest in developing more effective interventions to address them and more effectively change human behaviour (Chapter 3). Conservation conflicts can occur wherever conservation and other human objectives clash (Redpath et al., 2013), and although they often revolve around wildlife impacts or resource-use restrictions, they exist within complex socio-ecological systems (Mason et al. 2018), which are shaped by evolving ecological processes and stakeholder relations (Elston et al., 2014; Mason et al., 2017). Consequently, different stakeholders respond differently to different actors and interveners within conservation conflicts (Marshall et al., 2007; Mishra et al., 2017) and one important factor known to mediate these relationships is trust (Sharp and Curtis, 2014; Stern, 2008b; Young et al., 2016a). In particular, levels of stakeholder trust – in other resource users, managers and institutions – have been shown to influence many aspects of conservation management,

from cooperation (Davenport et al., 2007; Raymond, 2006; Rudolph and Riley, 2014; Smith et al., 2013) and compliance (Hamm et al., 2016; Rudolph and Riley, 2017; Schroeder et al., 2017) to support for interventions and resolution (Cvetkovich and Winter, 2003; Sjölander-Lindqvist et al., 2015; Young et al., 2016b). These conservation-specific examples complement a rich wider literature demonstrating the importance of trust in shaping cooperation with interveners and institutions (e.g., Siegrist 2000; Hough et al. 2010; Pirson & Malhotra 2010; Terpstra 2011).

Conceptualisations of trust vary by approach and context (Colquitt et al., 2007; Thielmann and Hilbig, 2015). However, a widely accepted definition in conservation (Riley et al., 2018; Young et al., 2016a) describes trust as a product of social relationships whereby actors *"accept vulnerability based upon positive expectations of the intentions or behaviours of others"* (Rousseau et al. 1998:395). This definition draws specific attention to the role of trustworthiness, which is itself defined in terms of an actor's beliefs about others (Sharp et al., 2013). Trustworthiness encompasses perceptions of an actor's ability to carry out an action, their benevolence (i.e., their intention to act in the interest of the trustor) and their integrity (i.e., their adherence to an acceptable set of principles) (Mayer et al., 1995). Alongside risk, these perceptions of trustworthiness are thought to shape levels of trust in both individuals (interpersonal trust) and organisations (organisational trust) (Davenport et al., 2007; Pirson and Malhotra, 2010; Riley et al., 2018). In an additional framework, Stern & Coleman (2015) identify four forms of trust: dispositional trust (i.e., the general tendency to trust others), rational trust (i.e., trust based on calculated decision-making), affinitive trust (i.e., trust based on relationships between trustor and trustee) and procedural trust (i.e., trust based on interactions and systems governing between trustor and trustee).

These trust-related concepts have been operationalised and explored widely in natural resource management research (Hamm, 2017; Sharp and Curtis, 2014). For instance, regarding trustworthiness specifically, perceptions of a resource managers' ability are considered formative in assessments of rational trust, whereas perceptions of their integrity and benevolence tend to inform assessments of affinitive trust (Stern and Coleman, 2015). Likewise, trustworthiness is considered an important determinant of perceptions of procedural justice, which alongside perceptions of competence, is thought to dictate levels of organisational trust (Riley et al., 2018; Rudolph and Riley, 2017). In one study, perceptions of the trustworthiness of fishery management (including perceptions of deception) predicted rates of compliance (Shirley and Gore, 2019), and in another, trust in a state wildlife agency was more strongly predicted by perceptions of procedural fairness than technical competence (Riley et al., 2018). Hence it appears likely that the different components of trustworthiness influence trust and conflict-related behaviours differentially. However, experimental evidence testing the relationship between trustworthiness and behavioural responses to interventions remains rare in wildlife conservation settings. Such studies are important for testing behavioural theory and management assumptions whilst providing much needed evidence to inform conservation interventions (Pollard et al., 2019; St. John et al., 2014; Sutherland and Wordley, 2017).

The purpose of this study is to experimentally test the importance of three components of trustworthiness – ability, benevolence and integrity (Stern and Coleman, 2015) – in shaping stakeholder support for conflict-reducing interventions in a conservation context. To do so, we use a novel experimental public goods game, framed around elephant conflict interventions, in a Tanzanian Community Wildlife Management Area (WMA). We test whether cooperation with interventions is linked to the identity of the intervening group

(organisation), and perceptions of their trustworthiness measured using Likert-type questions in pre-game surveys. These results are then contextualised using post-game individual and group debrief interviews to help inform conflict intervention best practice. By drawing upon classic games in behavioural economics (Cookson, 2000; Hasson et al., 2010) and recent games in conservation research (Redpath et al. 2018), we also demonstrate a novel means to study conflict interventions.

Study Area

We conducted our study across three villages in Enduimet Wildlife Management Area (WMA), northern Tanzania (Figure x.1) – part of the Amboseli-Kilimanjaro ecosystem where conflicts between local communities and elephant (*Loxodonta africana*) conservation are rife and damaging (Bluwstein et al., 2016; Homewood, 2017). Here, communities derive some material benefits from conservation-related income, and a local conservation organisation works with the government to administer the WMA (Wright, 2017). Conflict interventions range from WMA officers using vehicles to deter wildlife, to them distributing torches and firecrackers to local young men of the 'Moran' age-set – who in Maasai culture are the traditional defenders of villages from both people and wildlife. Moran frequently form small groups to guard village crops from elephants and other herbivores at night, but crop-raiding is still common. Compensation payments have been promised for wildlife-related damage or human deaths, but none have been delivered (Homewood, 2017) and there is a history of distrust and resentment towards tourism operators and the WMA amongst some residents (Wright, 2017).

7.3 Methods

Game Design

To ease game and participant organisation in the rural field setting and maximise statistical power, our experimental public goods game employed a within-subject design (n=212) with four players assembled around a physical board. Following classic public-good games (Cookson 2000), players were instructed that the total amount of tokens they each amassed during each game would determine their earnings. In each of five rounds, participants were endowed with five crop-tokens, and one additional token that they could choose to a) contribute towards elephant-guarding (at a personal cost in income, but to a group benefit in reduced crop-loss) or, to b) keep for themselves (personal benefit, group cost). The two treatments differed only in the description of the group providing the elephant guarding: government-led WMA or community-led Moran (Supporting Information, Game design). Although per-round there was a 50% chance each player incurred crop-raiding, the damage incurred (i.e. number of tokens lost) decreased in proportion to the total elephant-guarding contribution (Equation 1).

$$Equation\ 1: C = P(5 - N)$$

C = Expected loss from crop-raiding
P = Probability of crop-raid (0.5)
N = Number of cooperators (represented as number of guarders)

For any one player, the expected personal benefit from cooperating – public marginal per capita return ($MPCR_{public}$) (Hasson et al., 2010) – was half a token, which was less than the expected personal benefit of not cooperating ($MPCR_{private}$), which was one token. Both were less than the total group benefit of any one player's cooperation ($n \times MPCR_{public}$) which

was two tokens. Hence, the game satisfies the conditions for a social dilemma (Equation 2), since for rational individuals, it pays less to cooperate (Table 7.1).

$$Equation\ 2: MPCR_{public} < MPCR_{private} < n \times MPCR_{public}$$

n= Number of players

Each group played the game twice (with the order of the treatment rotated). Players were allowed to communicate, but not in regards to their decisions, which were made anonymously, and which were never disclosed (Aswani et al., 2013). Players were compensated 5,000Tsh (approximately 2.20USD) for participating, and received an additional 100Tsh per token amassed (max 6,000Tsh). The games themselves were often were played in a relaxed manner within the local meeting hall in each village (Figure 7.1). Due to the fact that laughter was common throughout the game and that a few participants likened the game to a local game played in their youth, we are confident that the exercise was understood by most players to be what we presented it as – game, rather than a test.

Figure 7.1: Players receiving instructions from a research assistant in a village meeting room where games were played.

Data collection

Between April and June 2017, male participants from three villages in Enduimet WMA were recruited from randomly ordered lists of inhabitants known to be present in each village, created in consultation with village chairpersons (Appendix 5, Participant recruitment). As cultural norms prevented gender mixing (Smith, 2015), rather than split the experiment across male and female-only samples (e.g., Keane et al. 2016), we opted to maximise the sample size within one group – males – who were also more dominant in wildlife guarding (Homewood et al., 2009) and more easily recruited (via mobile phones). We thereby maximised statistical power to detect effects within this group at the cost of possibly richer information and greater generalisability. Participants were interviewed before and after each game with an orally-administered pre-game survey and a structured post-game debrief interview.

The individual pre-game survey included a range of socio-demographic questions including age, education, wealth and occupation. Three components of trustworthiness – ability, integrity and benevolence – were each measured using 4-point Likert-type questions. We also recorded self-reported levels of wildlife damage, fear of elephants, and four measures of elephant tolerance. Post-game structured debrief interviews with groups (20 groups, 80 participants) and individuals (n=132) explored participant understanding and the factors influencing their cooperation decisions.

Table 7.1: Game pay-off table showing that each player (in groups of four) were given five tokens representing crops, and one token representing resources which they could choose to a) contribute towards elephant guarding (at a personal cost in income but group benefit in reduced crop loss), or to b) keep for themselves (personal benefit, group cost). For any one player, regardless of what others do, the individual pay-off from cooperation was half a token (realised by reduced crop loss risk), but the cost of cooperation was one token (MPCR = 0.5). Accordingly a Nash equilibrium is formed at no cooperation, which is less than the Pareto Optimum (full cooperation)

No. other cooperators			Cooperate (i.e. contribute to crop protection)					Don't cooperate (i.e. don't contribute to crop protection)				
	Endowment Crops (5) Resources (1)	Risk of crop-raid	Cost of cooperation	Cost of crop-raid	Expected Loss	Individual Pay-off	Group Pay-off	Cost of cooperation	Cost of crop-raid	Expected Loss	Individual Pay-off	Group pay-off
0	6	0.5	-1	-4	-2	3	15	0	-5	-2.5	3.5	14
1	6	0.5	-1	-3	-1.5	3.5	16	0	-4	-2	4	15
2	6	0.5	-1	-2	-1	4	17	0	-3	-1.5	4.5	16
3	6	0.5	-1	-1	-0.5	4.5	18	0	-2	-1	5	17

Data analysis

We conducted our analyses in 'R' (R Development Core Team, 2016) using the statistical package 'lme4'. As individual levels of cooperation did not vary substantially between rounds (Appendix 4, Figure A4.1) we summed the cooperation score for each player over the five rounds of each treatment. To test whether cooperation differed between intervening groups, *a priori* predictors of cooperation and socio-demographic variables, we ran a series of generalised linear mixed effect models with binomial errors (Table 7.2). Unique identifiers for groups (n=53) and participants (n=212) were modelled with independent random intercepts reflecting the grouping structure within the data. The three items of trustworthiness (Cronbach's alpha 0.77, 0.95 CI: 0.73-0.80), and four items of tolerance (Cronbach's alpha 0.65, 0.95 CI: 0.57-0.71), were each aggregated by summation using their weighted factor scores generated from factor analysis with the 'R' packages 'nFactors' and 'psych' (Appendix 4, Data analysis). To identify the frequency of prevailing reasoning themes in the post-game interviews, we used directed content analysis (Hsieh and Shannon, 2005).

Table 7.2: List of explanatory variables included in each model (inclusion marked by 'x'), the source of data, and descriptive summaries.

Explanatory Variables	Levels	Source	Descriptive summary (n)	Model				
				1	2	3	4	5
Treatment	Moran, WMA	Group framed as delivering guarding intervention (factor)	Moran (n=212), WMA (n=212)	x	x	x	x	x
Order	Moran first, WMA first	Treatment order (factor)	Moran first (n=104), WMA first (n=108)	x	x	x	x	x
Time	First, Second	Village cohort (factor)	First (n=104), Second (n=108)	x				
Trustworthiness: Aggregated		Weighted summation (factor scores) of Ability, Benevolence and Integrity trustworthiness (numeric)	Moran (Mean= 0.725, SD = 1.69), WMA (Mean= -0.725, SD = 1.60), Range = -1-1		x			
Trustworthiness: Ability		Survey, 4-point Likert scale, (numeric)	Moran (Mean= 2.94, SD = 1.09), WMA (Mean= 2.26, SD = 0.96), Range = 1-4			x	x	x
Trustworthiness: Benevolence		Survey, 4-point Likert scale, (numeric)	Moran (Mean= 3.21, SD = 1.12), WMA (Mean 2.08, SD = 1.03), Range = 1-4			x	x	x
Trustworthiness: Integrity		Survey, 4-point Likert scale, (numeric)	Moran (Mean= 2.95, SD = 1.17), WMA (Mean= 2.46, SD = 1.19), Range = 1-4			x	x	x
Agriculturalist		Survey, self-reported proportion of livelihood that is agriculture, converted to 1-5 scale (numeric)	Mean: 3.07, Range = 1-5, SD = 1.13				x	x

Elephant tolerance		Weighted summation (Factor Scores) from 4 survey questions (Kansky and Knight, 2014) (numeric)	Mean= 0.00, Range = -1-1, SD = 1.52	x	x
Crop loss		Survey, self-reported annual crops loss to elephants (number of bags) (numeric)	Mean= 16.87, Range: 1-90, SD = 0.87	x	x
Fear	None, Some, Frequent	Survey, self-reported (factor)	None (n= 36), Some (n=97), Frequent (n=79)	x	x
Age	Moran, Junior Elder, Middle Elder, Senior Elder	Survey, by traditional Maasai age sets (factor)	Moran (n=45), Junior Elder (n=78), Middle Elder (n=56), Senior Elder (n=33)		x
Wealth	Very Poor, Poor, Not Poor, Rich	As determined by village leaders with reference to livestock, houses, and other assets (Keane et al., 2016) (factor)	Very Poor (n=35), Poor (n=79), Moderate (n=78), Rich (n=20)		x
Education	None, Primary, Secondary	Survey, self-reported (none, primary or secondary) (factor)	None (n=72), Primary (n=124), Secondary (n=16)		x
Village	1, 2, 3	Survey, (factor)	Village 1 (n=80), Village 2 (n=68), Village 3, (n=64)		x

7.4 Results

In the framed public goods game, the proportion of participants cooperating was consistently higher in the local group treatment ("Moran") than the Wildlife Management Area ("WMA") treatment. In the absence of other covariates, treatment was a significant predictor of cooperation, and the odds that participants cooperate with the Moran were 60% greater than for the WMA ($p < 0.01$, odds ratio 0.41, 0.95 CI: 0.32-0.54) (Model 1).

Levels of cooperation corresponded closely to perceptions of the trustworthiness of each group. When our aggregate trustworthiness score was included alongside treatment (Model 2), the effect size of treatment was no longer distinguishable from zero – suggesting that the effect of treatment is mediated by perceived levels of trustworthiness (Appendix 4, Figures A4.4-A4.4). When aggregate trustworthiness was replaced as a predictor in the model by the three component measures (Model 3), benevolence and integrity were found to be significant predictors of cooperation, but ability was not. Integrity was the stronger predictor of cooperation (odds ratio 1.88, 0.95 CI: 1.55-2.28), with an odds ratio 25% greater than for benevolence (odds ratio 1.50, 0.95 CI: 1.20-1.87).

To explore the robustness of this finding, we ran further models which included a range of *a priori* predictors of cooperation and socio-demographic variables (Table 7.2). Assessments of the intervener's benevolence and integrity continued to be the strongest positive predictors of cooperation. Elephant tolerance, experience of crop loss, and elephant fear, did not predict cooperation. The extent to which participants self-identified as agriculturist (livelihood) positively predicted cooperation in Model 4, but this effect was removed when other socio-demographic variables (age, village, education) were included in Model 5 (Figure 7.2). No interaction effects were observed for any variable with treatment. In Model

5, the variables which predicted cooperation levels included: benevolence (odds ratio, 1.63, 0.95 CI: 1.31-2.03), integrity (odds ratio, 1.78, 0.95 CI: 1.46-2.18) and education (primary) (odds ratio, 3.48, 0.95 CI: 0.54-22.10; positive associations) and order (WMA first) (odds ratio 0.29, 0.95 CI: 0.12-0.71) and wealth (rich) (odds ratio 0.14, 0.95 CI: 0.02-0.80; negative associations) (Figure x.1). These results suggest that, accounting for every other variable, the estimated probability of cooperation increases 1.78 times per unit increase in integrity-related trustworthiness, which is 9% greater than the 1.63 increase in likelihood of cooperation per unit increase of benevolence-related trustworthiness.

In post-game individual debriefs (n=132), respondents most often justified their game decision by referring to the perceived effectiveness of the intervening group (55% of respondents), compared to perceived benevolence (17%), integrity (17%), general benefits of cooperation (20%), wildlife conservation (2%) and game strategy (2%). Reasoning related to the effectiveness of the WMA, and the Moran as guarders was given in equal measure, but benevolence- (13% more people) and integrity-based reasoning (6% more people) was biased towards the Moran (Figure 7.3).

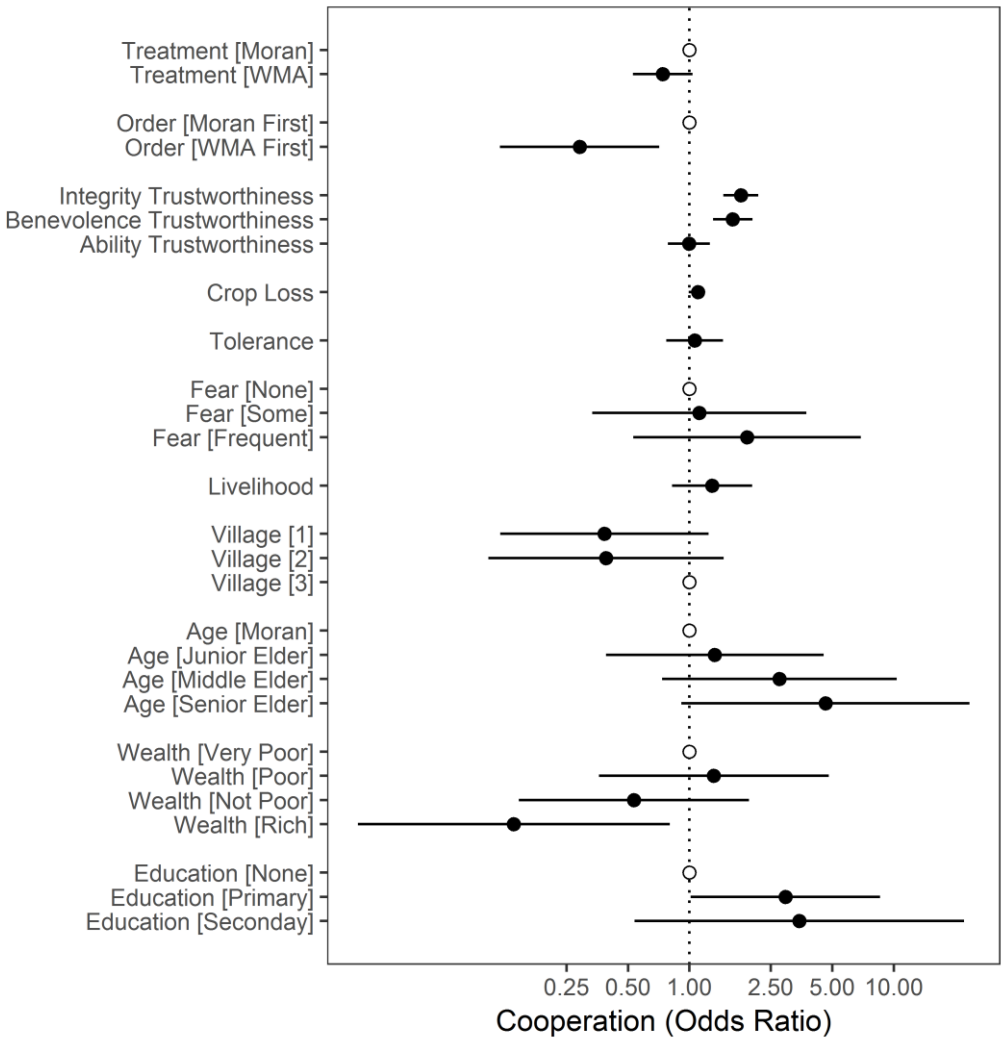

Figure 7.2: Results from a generalised linear mixed effects model (Model 5), showing the estimated conditional effects of each predictor variable on cooperation within games. Filled dots represent model coefficient estimates converted to odds ratios, which show the expected change in likelihood of cooperation when each continuous variable increases by a unit of one, or when each factor variable changes level from a baseline (unfilled dots). Whiskers represent standard errors (95% CI), and variables with whiskers that do not cross zero are those predicted by the model to associate with cooperation (effect size is distinguishable from zero). Larger odds ratios indicate greater predicted strength of association.

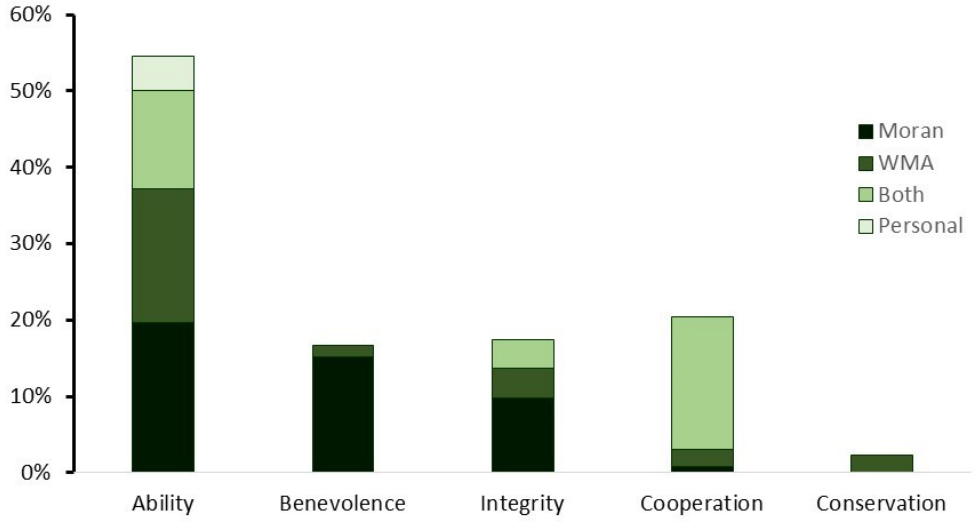

Figure 7.3: The proportion of participants in individual post-game debriefs (n=132), who justified in-game cooperation with reasoning related to: the ability, benevolence or integrity of themselves or the intervening groups (bar colour), the benefits of cooperation generally, or concerns related to wildlife conservation.

7.5 Discussion

This study of agro-pastoralists in Tanzania affirms that the perceived trustworthiness of the group delivering a conservation conflict intervention predicts levels of stakeholder cooperation, and that different components of trustworthiness may differ in their influence.

Our finding that trustworthiness predicts cooperation was unsurprising given previous findings and the nature of public-goods games. Indeed, in both public goods games (Bouma et al., 2008) and natural resource management (Davenport et al., 2007), cooperation is known to vary with levels of trust held between participants. Trust is also known to heavily shape stakeholder responses to wildlife management efforts, including where these efforts are contested (Riley et al., 2018; Schroeder et al., 2017; Young et al., 2016a). However, in some cases, higher trust actually leads to reduced engagement with interveners, as individuals have confidence that the interveners will act competently, and in their interest, without their involvement (Smith et al., 2013; Terpstra, 2011). In such situations, individuals are exercising vulnerability (and thus displaying organisational trust) (Pirson and Malhotra, 2010; Riley et al., 2018) by *not* engaging. By contrast, in our game, participants exercised vulnerability (regarding expected earnings) by cooperating. Furthermore, through triangulation with debrief interviews, we are confident that greater cooperation in the games did reflect more confidence in the competence and intentions of each intervening group.

What was unexpected however, was our finding that perceptions of integrity and benevolence were stronger predictors of cooperation than ability. From previous studies, (Riley et al., 2018; Rudolph and Riley, 2017) it is clear that beyond rational outcome-based assessments, perceptions of intervener integrity and benevolence are also important in dictating behavioural responses to wildlife interventions, but the relative importance of each construct is less clear. For instance, perceptions of managers' trustworthiness (including perceived levels of deception) have been shown to influence stakeholder compliance (Shirley and Gore, 2019) and cooperation or support for interventions (Hamm, 2017; Ordoñez-Gauger et al., 2018). In, some quantitative (Hamm et al. 2016), and

qualitative (Wald et al., 2018) studies of the different measures of trustworthiness, the relative importance of each construct has been found to be equally important. However, in other related studies, perceptions of procedural justice – which are in turn shaped by perceptions of trustworthiness, notably benevolence, (Rudolph and Riley, 2017) – have overshadowed perceptions of managers' technical competence in predicting levels of cooperation or engagement with management interventions (Rudolph and Riley, 2014; Smith et al., 2013). Hence, both our results and those from the wider literature suggest that the relative importance of different trustworthiness-constructs on responses to conflict interventions may be context-dependent.

From our interviews, and from previous studies in the region, there appear to be numerous factors which are likely to shape the (often negative) perceptions of the trustworthiness of the local conservation managers studied here. In this study location (Homewood, 2017), and across Tanzania, trust in conservation has been depleted by community displacement, resource restrictions, and broken promises (Bluwstein et al., 2016; Davis and Goldman, 2019; Moyo et al., 2016; Wright, 2017). Elsewhere, interpersonal trust in natural resource managers has been found to be shaped by perceptions of their responsiveness, honesty, and dedication (Davenport et al., 2007). In our interviews, respondents commonly identified a lack of transparency, compassion and accountability within the WMA. Such experiences might explain the greater importance placed on perceptions of benevolence and integrity, which inform affinitive-trust based assessments (Stern and Coleman, 2015). Nonetheless, conceivably our analysis failed to capture the effect of ability – perhaps due to the relatively lower variation observed for this component. Indeed, in debrief interviews interveners' ability was by far the justification most commonly used by participants to explain their game behaviours. However, we cannot ascertain to what extent post-game

justifications reflect post-hoc rationalisations or actual drivers of game behaviour. Likewise, extrapolations from our male-only sample are limited given that intervention preferences (Keane et al., 2016), wildlife risk perceptions (Gore and Kahler, 2012) and institutional trust (Xiao and McCright, 2015) have previously been shown to differ between genders, and that, where wildlife-related gender roles are pronounced, there is significant influence and interplay between genders on wildlife-related behaviours (Lowassa et al., 2012). Hence, rather than confidently identifying which trustworthiness constructs generally matter more, this study highlights that they likely matter differentially.

Our experimental approach offers a novel avenue for exploring the facets of trust in conservation conflict interventions. Previous studies (Hamm et al., 2016; Smith et al., 2013; Wald et al., 2018) have gained rich insights into stakeholder cooperation or support using surveys or interviews, whereas here we measured behaviour within a stylised game. Games enable experimental manipulation, but unrealistic incentives can lead to poor external validity (i.e., low correspondence to real-world behaviour) (Redpath et al., 2018). Here, this pitfall is minimised as our conclusions rest on relative, not absolute, differences in cooperation between groups. Likewise, although within-game behaviour can be influenced by other factors (e.g., group dynamics, or game-order, or game-understanding) (Aswani et al., 2013; Cookson, 2000), here the lack of variation in cooperation across rounds demonstrates consistency in decision-making throughout the game, and our mixed-effects model accounted for between-group variation. Moreover, when using experimental games to study behaviour it is good practice to draw upon qualitative data to validate and contextualise the experimental results (Redpath et al., 2018). Previous analyses of trustworthiness have used multiple measures of each component, which is more reliable than relying on single measures as we did here (Hamm & Hoffman 2016). However,

triangulation between pre-game interviews, game behaviour and post-game debriefs gives us confidence that players were making their decisions based upon their own experiences with each group and were interpreting the target concepts in the intended manner. Moreover, the negative association of the rich wealth category, and positive association of primary education, with game cooperation should be interpreted carefully due to the wide confidence intervals of their estimated effects, however similar demographic effects have been found elsewhere to shape trust-base responses to resource managers (Shirley and Gore, 2019).

Our findings have several important implications for conservation policy and practice. First, we show that perceptions of intervener's trustworthiness may mediate differential levels of support for conflict interventions. This finding adds to previous work identifying how responses to conservation interventions are shaped by the relationships between interveners and recipients of interventions (Rizzolo et al., 2017; Sjölander-Lindqvist et al., 2015), including levels of stakeholder trust (Davenport et al., 2007; Riley et al., 2018; Smith et al., 2013). Those designing conservation conflict interventions should therefore closely consider the importance of the intervener – including the messenger (Dolan et al., 2012). Specifically, particular individuals, third parties or local institutions might be more effective in delivering interventions than others if they are trusted more or more highly trained in stakeholder engagement (Riley et al., 2018; Sommerville et al., 2010; Young et al., 2016a).

Second, our findings that beliefs about an intervener's integrity and benevolence were stronger predictors of cooperation than beliefs about their ability suggest that technical interventions or enforcement (such as efforts to reduce crop-raiding or illegal killing) might benefit from accompanying efforts to improve perceptions of trustworthiness and build

greater affinitive-based trust between resource-users and resource-managers (Rudolph and Riley, 2017; Stern and Coleman, 2015). Whilst these findings need to be tested across genders, in numerous other conservation conflict contexts, levels of protest, illegal harvest, and active opposition to conservation have been found to be associated with perceptions of managers' honesty and fairness (linked to integrity) (Shirley and Gore, 2019; Stern, 2008b), perceptions of care and community-mindedness (linked to benevolence) (Hamm et al., 2016) and general levels of affinitive trust (Stern and Baird, 2015). Moreover, higher perceptions of the competence, benevolence and integrity of conservation organisation staff also lead to higher trust in the organisation itself, but not in all cases (Sharp and Curtis, 2014).

Improving perceptions of trustworthiness and building affinitive-based trust in conservation conflict contexts is challenging (Davenport et al., 2007; Young et al., 2016a), but may be realised in several ways. Firstly, to increase trustworthiness specifically, managers could give greater, and more clear, justifications for how they reached decisions and chose certain options over alternatives (Rudolph and Riley, 2017). Increasing communication, more reliably keeping to promises (such as those around compensation), and avoiding the use of force and coercion will also be beneficial (Mabele, 2017). Secondly, to build affinitive-based trust and increase perceived procedural fairness more generally, conservation organisations might do well to appreciate that they themselves are stakeholders in a conflict (Young et al., 2016a). They could then consider mediation (Madden and McQuinn, 2015), more collaborative decision-making (Mishra et al., 2017; Young et al., 2016a) and encourage ways for communities members to share their voice (Shirley and Gore, 2019). Simply being more visibly active in communities, transparent and personally engaging with stakeholders more effectively (Davenport et al., 2007; Riley et al.,

2018) can reduce social distance and increase trust, as can being more forthright with one's intentions or failures (Stern, 2008a). However, other factors such as the extent to which stakeholders share similar values can constrain trust-building (Manfredo et al., 2017; Riley et al., 2018; Rizzolo et al., 2017), and in some cases levels of trust in non-local actors or institutions (such as national wildlife bodies) may be more influential and are harder to address at the local level (Schroeder et al., 2017). Lastly, conservationists should also be aware that wildlife impacts (Cusack et al., 2018) and trust (Stern, 2008a) can shift over time, and that continued engagement and responsive approaches may be required for long-term conservation success (Butler et al., 2015). Future work could explore the relative importance of other types of trust, such as negative trust and systems-based trust (Stern and Baird, 2015), uncertainty (Pollard et al., 2019), how perceptions of trustworthiness are shaped by gender, cultural affiliations and norms (Rizzolo et al., 2017), and how insights from experimental games correspond to those derived from other methods.

7.6 Recommendations

- Researchers should further explore how different interveners produce different behavioural responses in conflicts.
- Practitioners should consider which groups or individuals may be best-placed to intervene in conflicts.
- Researchers and practitioners should further explore ways to build stakeholder trust.
- Researchers should further explore how the results from games differ to those from other research methods.

Chapter 8: Polarised conservation: trophy hunting, politics, and Twitter

8.1 Abstract

Conservation practice and policy can be polarising, leading to conflict which impinges upon human well-being and biodiversity. Unpicking the roots and nature of polarisation is important in better understanding and managing such conflicts. But, whilst polarisation has been studied with regards to broad environment topics such as climate change, it remains less explored within conservation. Here we consider a polarising conservation topic – the trophy hunting of African megafauna – and explore how factors explaining polarisation in other environmental topics such as political ideology, environmental values, and networks, might also apply to this context. We collect a sample of United States (US) based users posting about trophy hunting on the social media platform Twitter (n=3,254), and test whether pro, neutral and anti-trophy hunting positions are predicted by their estimated political ideology along a one-dimensional liberal-conservation axis – derived using a previously calibrated method based on user-follower networks. We find that positions associate with political ideology: pro-trophy hunting users are over seven times more likely be of conservative than liberal orientation (Odds Ratio (OR) 7.41, $p<0.01$), and users more commonly interact with others of similar political ideology than would be predicted by random interactions. Those espousing anti-trophy hunting positions were also more commonly hostile and used more moralistic language than pro-trophy hunting users, who used more utilitarian language focused on the economic and social benefits of hunting. These results suggest that political orientation can predict positions in conservation conflicts and that the role of polarisation in influencing behaviours and driving conflicts deserves further exploration.

8.2 Introduction

Individuals and organisations frequently clash over conservation policy and practice, and where one party is perceived to exert their position over others, conflict can develop (Redpath et al., 2013). Whilst all conflicts involve opposing positions, the more that such different positions on an issue diverge or are unyielding, the more polarised an issue is said to be (Coffey and Joseph, 2013; Guber, 2013). For example, little middle ground exists between those who see recreational hunting as an essential, culturally-important wildlife management tool, and those who see hunting as a morally objectionable, culturally-exclusive practice with no conservation value (Hodgson et al., 2018; Manfredo et al., 2017; Veríssimo et al., 2015). Importantly, not only can the extent of polarisation dictate the intensity of a conflict itself (Dimaggio et al., 1996; Mollinga, 2010), but it can constrain the effectiveness of management interventions and behaviour change. For example, increasing polarisation can increase hostility between groups (Iyengar and Westwood, 2015) and limit dialogue and management options (Redpath et al., 2013), making harder for conflicts to be deescalated or resolved (Hutton and Leader-Williams, 2003; Mollinga, 2010). The appearance of new evidence (Hodgson et al., 2019) or counter-arguments (Meadow et al., 2005) often act to reinforce existing positions, and an individuals' receptiveness to interventions may be predicted by, not only the group that they identity with (St John et al., 2018), but also by the group that they associate the intervener or messenger with (Hafner et al., 2017; Young et al., 2016a). Hence, identifying the extent and source of polarisation in conflicts is therefore important in informing conservation conflict management and more effectively changing behaviour.

Typically, polarisation occurs when prevailing positions on an issue disperse and cluster around different modes, or when they become associated with other positions, issues, or

identities (Dimaggio et al., 1996). For example, public attitudes in the United States (US) towards governmental spending on environmental protection have become increasing divergent over recent decades (McCright et al., 2014), and institutions and actors engaged in conflict over recreational hunting can often be categorised into discrete identity-based clusters (Hodgson et al., 2018; Veríssimo et al., 2015). Moreover, contrasting positions in some conservation conflicts have been thought to act as proxies for wider social conflicts, such as those revolving around colonial legacies in East Africa (Fox, 2018; Mkono, 2019) or the backlash to cultural modernisation in the US (Manfredo et al., 2017). Indeed, one important source of polarisation is the existence of competing value systems. For instance, differences in environmental value-orientations, such as between mutualism (which promotes coexistence and the intrinsic rights of wildlife) and utilitarianism (which promotes the management wildlife for human benefits), often predict contrasting positions in debates over recreation hunting and sustainable use (Jacobs et al., 2014b; Manfredo et al., 2016; St John et al., 2018). Where such hunting debates become associated with animal welfare discourse for instance, polarisation can increase (Campbell and Veríssimo, 2015).

Polarisation can also be shaped by how information is distributed across populations. Due to the combination or socio-geographical separation and self-selected homophily (self-selected association with like-minded others) individuals may share, and receive information within their networks (particularly online) which is often more confirmatory than contradictory of prevailing within-group beliefs (Barberá et al., 2015; Evans and Fu, 2018). Whist this apparent online 'echo-chamber' effect has been challenged (Bruns, 2017), in wildlife-specific contexts, both levels of exposure to information and levels of trust in particular messengers, appear to mediate positions on conservation issues (Arbieu et al.,

2019). Furthermore, within groups the desire to conform and prove group-allegiance can lead to the proliferation of more extreme positions (Furth-Matzkin and Sunstein, 2016).

Another confounding source of polarisation is politicisation – the process by which an issue becomes associated with a particular political party or ideology (Dimaggio et al., 1996). Numerous analyses, particularly in the US, have shown how positions on environmental issues such as climate change have become more polarised in recent decades, with increasing positional divergence between those with opposing political ideologies (on a liberal-conservative axis) (Coffey and Joseph, 2013; Corner et al., 2012; Guber, 2013; McCright et al., 2014). In part, these trends are explained by the 'party sorting theory', which contends that political activists drive a process of ideological separation among political elites, which filters down to electorates through elite cues and the media coverage (Guber, 2013; McCright et al., 2014). For instance, behaviours such as recycling or energy conservation, are associated with particular political identities, and influenced by news exposure (Coffey and Joseph, 2013). However, whilst politicisation has been used to account for polarisation in some environmental domains, it remains underexplored within the context of wildlife-specific conflicts.

The purpose of this study is to further explore whether the factors thought to explain polarisation generally, may also help account for the apparent polarisation in conservation conflicts. Specifically, we consider the possible associations between positions on an issue, political ideology, environmental value-types, and interactions within social networks. We analyse posts from the social media platform Twitter because it provides publicly accessible, relatively naturalistic data about how people interact on given issues (Arlt et al., 2018) including those relating to conservation (Hawkins and Silver, 2017; Lunstrum, 2017; Toivonen et al., 2019). Specifically, we focus on US public engagement with the debate over

the recreational 'trophy' hunting of African megafauna – carnivores that weigh over 15 kg and omnivores and herbivores that weigh over 100 kg) (Lindsey et al., 2017). Building upon recent work on the polarised domestic hunting debate in the US (Manfredo et al., 2017), we explore this international issue because it appears to be similarly highly polarised conflict (Hutton and Leader-Williams, 2003) with important implications for the viability of many endangered species and conservation areas (Bunnefeld et al., 2013; Lindsey et al., 2007). Indeed, there is fierce debate both within and outside of the conservation community with regards to the morality, efficacy, and appropriateness of conservation organisations supporting or engaging with trophy hunting (Batavia et al., 2018; Nelson et al., 2013). Furthermore, at the time of study, the issue was receiving high levels of engagement on social media – both in the US and in East Africa (Mkono, 2019) – following the 2018 US policy reversal in the import of elephant trophies from certain countries (Batavia et al., 2018) and the highly publicised illegal hunt of Cecil the Lion by US national in Zimbabwe in 2015 (Macdonald et al., 2016). Lastly, by using Twitter data we were able to use an established method to predict user's political ideology (along a liberal-conservative axis) from their follower networks (Barberá, 2015).

We first collect a sample of posts about trophy hunting, from which we infer user positions on the issue, before testing these against users' predicted political ideologies. We also test whether interactions are more common between actors of closer political ideological alignment, whether greater political ideological distance predicts hostility, and whether different positions on the issue are supported by different value-based reasoning types – which previously have been linked to attitudes towards other forms of hunting (St John et al., 2018). Lastly, we consider the implications of polarisation for conflict management, as well as the utility of using social media data to research conflicts.

8.3 Methods

Data collection

To collect a sample of individuals' positions on trophy hunting, we used an online data-trawling package to collect freely and publicly available posts (tweets) made on the social media platform Twitter. For this, we used the 'twitteR' package in the 'R' statistical programming software (R Development Core Team, 2014) to conduct a series of key-word searches with the Twitter application programming interface (API). We searched for "trophy hunting" only, and filtered the search to include only US-based tweets and original posts (rather than those re-posted by other users). We restricted our analysis to US-based users because the tool we use to estimate political ideology (from Twitter follower networks) had been calibrated for US-based users of Twitter (Barberá et al., 2015). To capture responses to the proposed US policy change on elephant trophy imports, we collected the sample between January and March 2018, when the policy was receiving widespread media coverage. In total, we ran three searches, which collected a sample of 5,263 tweets from 30 out of 50 days in the sampling period.

We manually filtered the sample to include only tweets relevant to the hunting of terrestrial, African megafauna species. Any media, imagery or emoticons accompanying each tweet were also considered to contextualise the tweet, as were posts that the user was responding to, and other related tweets posted by the user (such as threads or replies). The filtered sample size of users (n=3,254) was deemed sufficient as it exceeded the estimated sample size that a power calculation predicted was required to detect the hypothesized effect (Appendix 5, Data collection).

Data analysis

To categorize the different positions taken on trophy hunting, we used directed content analysis (Hsieh and Shannon, 2005) and assigned tweets to one of three pre-determined categories: 'pro-', 'neutral-' or 'anti-'trophy hunting. 'Pro' tweets were those that were unequivocally positive, supportive in principle, or those that highlighted the utility of trophy hunting despite other concerns. 'Neutral' tweets were those that were purely descriptive (e.g., statements about policy changes), or those that offered no discernible opinions or apparent ambivalence. 'Anti' tweets were those that outlined unambiguously negative opinions towards trophy hunting, overall negative assessments of trophy hunting, or those advocating the prohibition of trophy hunting. Only one position was recorded per unique user in the final sample. Where multiple tweets from the same user appeared in the sample and reflected different or ambiguous positions, either the most common position was taken or other tweets from the user were consulted to determine their most consistent position. The few remaining ambiguous cases were omitted from analysis.

To estimate the political ideology of each user, we used the 'tweetscores' package in 'R', which estimates political ideology based on Twitter follower networks under the assumption of political homophily – that users are more likely to follow other users who share similar views and ideologies to themselves (Barberá, 2015; Barberá et al., 2015). By creating matrixes of users who follow a set of known politically-active accounts (such as politicians), this method produces a one-dimensional political latent space, upon which each unique user is mapped with a score from -4 (more liberal) to +4 (more conservative). We used this method to estimate the political ideology of the authors of the tweets in our sample, as well as the political ideology of any other user they were replying to. Following Barberá et al., (2015) we also separated users into ideology groups (liberals < -0.5,

moderates -0.5-0.5, conservatives > 0.5). We confirmed that this method produces a normal distribution for the general US Twitter population (as intended), by applying the method to a snap-shot subset of US Twitter population (n=8,323) (Appendix 5, Figure A5.1).

We also manually categorised tweets as 'hostile' if they included aggressive or offensive content, and we used text-mining package 'tm' in 'R' to identify tweets using profanities included in a corpus of profane English-language words (https://www.cs.cmu.edu/~biglou/resources/bad-words.txt). We also recorded tweets that encouraged or celebrated violence towards people. To test whether political ideology, trophy hunting position or political distance predicts hostility in tweets, we used generalised linear mixed effects models with binomial errors. Unique identifiers for repliers (n=1,219) and tweet authors (n=621) were modelled with independent random intercepts to account for user-level variation, and the follower count of the tweet author was included in models to account for user visibility. Lastly, we used the package 'tm' to identify the 100 most commonly used words by those for and against trophy hunting, and recorded (based upon our interpretation) whether the words in each list corresponded to the any of different human values for nature outlined by Kellert, (1993) and used by (Estévez et al., 2015) (Table 8.1).

Table 8.1. Typology of human values of nature, from Estévez et al. (2015), based on Kellert (1993).

Value	Definition
Aesthetic	Physical attraction and appeal of nature
Dominionistic	Mastery and control over nature
Humanistic	Emotional, spiritual, or symbolic affection for nature
Moralistic	Moral concern about the right and treatment of nature
Naturalistic	Exploration of nature and outdoor recreation
Negativistic	Fear or aversion toward nature
Scientific	Systematic and empirical study of nature
Utilitarian	Practical value or material benefit of nature

8.5 Results

Our sample captured a broad range of views about trophy hunting, covering a spectrum from strongly against, to strongly in favour, but it was heavily skewed towards anti-hunting views. Of the 3,354 users in our sample, 75% were classified as anti-trophy hunting, 16% as neutral, and 9% as pro-trophy hunting. Political ideology estimates were bimodal, with a larger proportion of study subjects towards the liberal (left-wing) of the spectrum (average ideology estimate -0.25, range -2.46, 2.44) (Figure 8.1), which compares to the more normally distributed general twitter population (Figure A5.1).

In total, 49% of users in the sample were classed as liberals, 18% moderates, and 35% conservatives. Of the pro-trophy hunting users, 78% were classed as conservative

compared to 8% as liberal. In contrast, 57% of anti-trophy hunting users were liberals and 25% were conservatives. In chi-squared tests of independence, positions on trophy hunting were found to be significantly associated with political ideology. Pro-trophy hunting users were over seven times more likely to be conservative than liberal (Odds Ratio (OR) 7.41, $p<0.01$) and over six times more likely to be conservative than moderate (OR 6.77, $p<0.01$). On average, the political ideology estimates of those expressing positive positions on trophy hunting (mean, 1.07, SD, 0.99) were more conservative than of those expressing neutral positions (mean, 0.27, SD, 1.21), and those expressing anti positions (mean, -0.53, SD, 1.24) (Figure 8.2). A three-way ANOVA, followed by the Tukey post-hoc test, found significant differences in mean ideological estimates between each group pairing (pro-anti, 1.6 0.95 CI: 1.42, 1.77; pro-neutral 0.81 0.95 CI: 0.61, 1.02), neutral-anti 0.79 0.95 CI: 0.65, 0.93) (Appendix 5, Figure A5.2).

Interactions between users about trophy hunting were found to be associated with political ideologies; with more interactions between users with closer political alignments (shorter distance between estimated ideologies) than would be predicted if pairwise user-replier interactions were randomly distributed (null model) (Figure 8.4). Results from a bootstrapped two-tailed t-test found that the ideological distance between users was significantly lower in the observed sample than a randomly distributed null sample (t = -4.883, $p<0.01$).

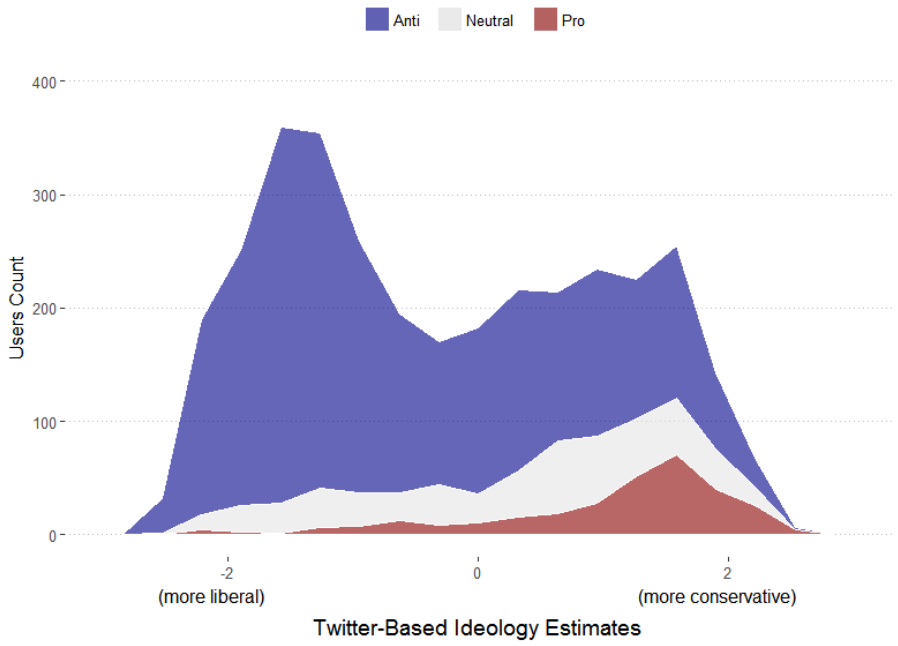

Figure 8.1: Area plot of the estimated political ideology of users by positions on trophy hunting. Positive estimates indicate more conservative ideology.

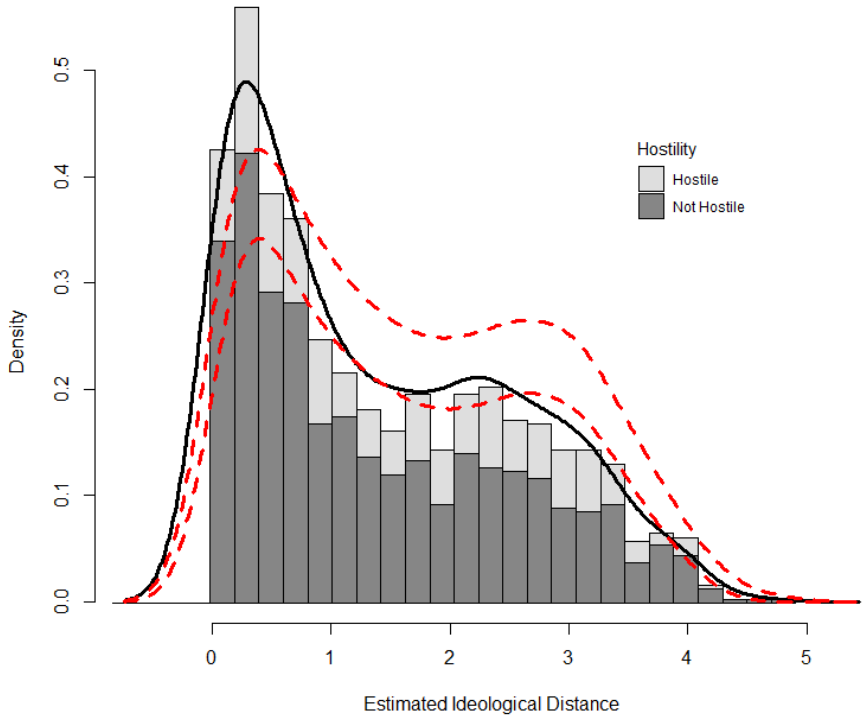

Figure 8.2: Histogram (bars) and density plot (black line) showing the estimated political ideology distance between users interacting (replying) about trophy hunting on Twitter, the distribution of hostile interactions and also the 95% confidence intervals of the estimated distribution of random encounters between users and repliers (red dashed lines).

Of the 1,237 observed interactions between original tweet authors and repliers, 46% occurred between users from the same political ideology group (17% liberal-liberal, 3% moderate-moderate, 27% conservative-conservative) (Figure 8.3). This amounts to significantly more within-group interactions than would be expected if interactions were distributed randomly across users with different political ideologies (Appendix 5, Figure A5.4). A large proportion of replies from liberals were to conservatives (53%), but fewer of conservatives' replies were to liberals (19%).

Of the same 1,237 observed interactions, 27% of replies were recorded as hostile, of which 29% were directed at the specific author of a tweet (as opposed to something, or someone else). Of the 1,237 observed replies, 27% used profane language and 3% of users advocated for, or celebrated, the death of trophy hunters. In generalised linear mixed effects models, the hostility of interactions was not predicted by political distance, the political ideology of the replier, or the follower count of the author, but was predicted by the replier's stance on trophy hunting – with those pro-trophy hunting ($p < 0.01$, odds ratio 0.07, 0.95 CI: 0.07-0.19) and those neutral ($p < 0.01$, odds ratio 0.21, 0.95 CI: 0.14-0.40) being significantly less likely to reply with a hostile tweet than anti-trophy hunting users (Appendix 5, Figure A5.3). Similarly, those adopting pro ($p<0.01$, OR, 0.47, 0.95 CI, 0.19-0.75), or neutral ($p<0.01$, OR, 0.52, 0.95 CI, 0.19-0.81) positions on trophy hunting, were significantly less likely to use profane language than those anti-trophy hunting.

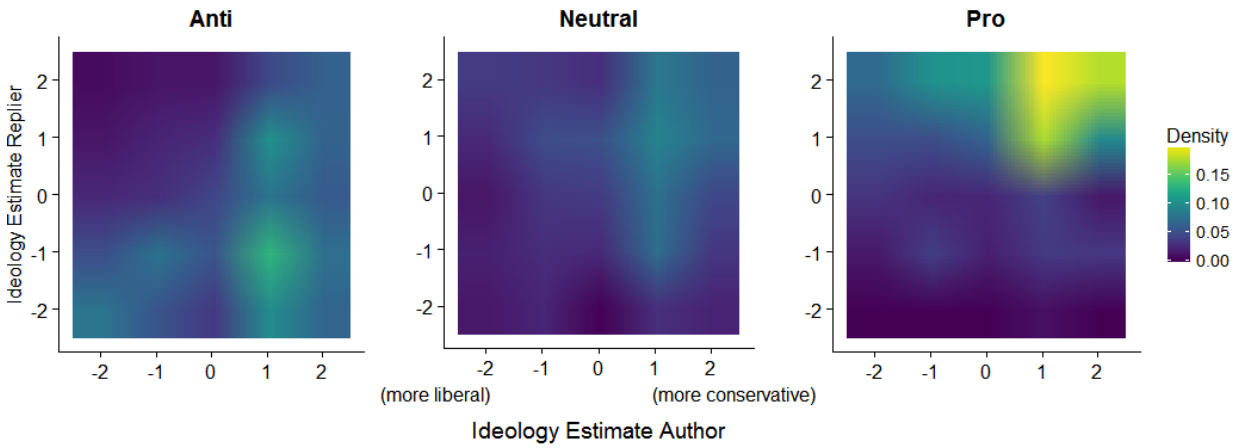

Figure 8.3: Heatmaps showing the relationship between the estimated political ideology of the replier and the author they are replying to, with tweet density indicated by colour, for users categorised as taking anti, neutral and pro trophy hunting positions. Positive ideology estimates indicate more conservative ideology, and negative estimates indicate more liberal ideology.

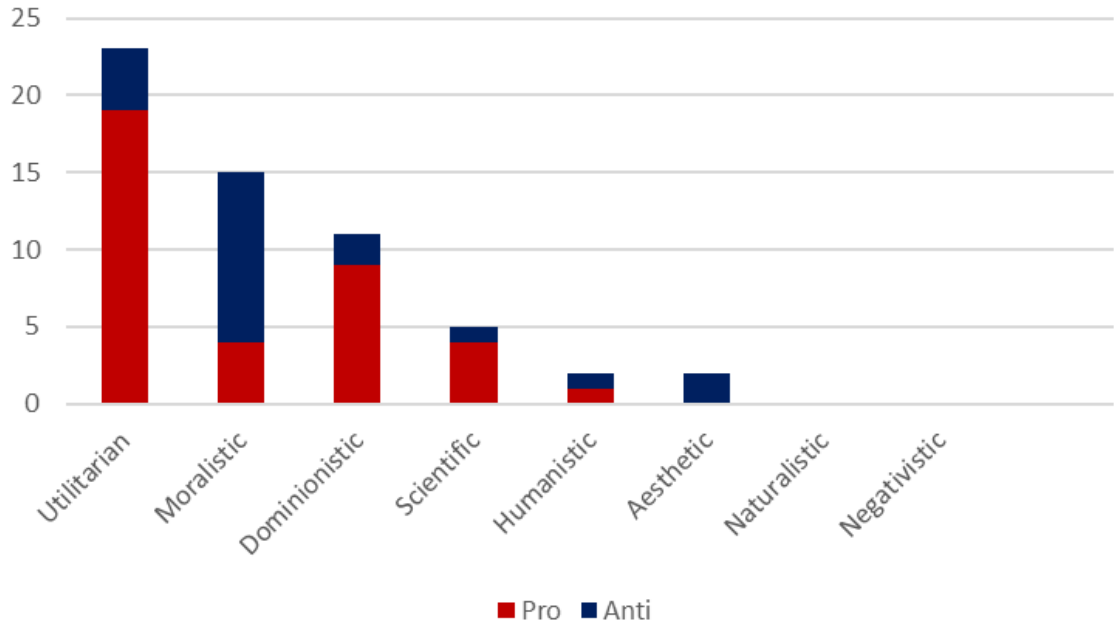

Figure 8.4: The proportion of the 100 most commonly used words in pro- and anti-trophy hunting tweets which related to each of the eight different human values for nature, based on Kellert (1993).

The focus of tweets, and the value judgments made within them, differed substantially between users taking different positions. Those supporting trophy hunting used a higher proportion of utilitarian, dominionistic and scientific language to justify their positions, whereas those against used more moralistic and aesthetic language (Figure 8.4). Those against trophy hunting were largely advocating a ban on the practice, or reacting to a proposed policy related to trophy hunting (Appendix 5, Figure A5.3). Many users against trophy hunting focused their attention on either the characteristics of the people doing the hunting (such as their race, gender, nationality or perceived level of wealth) or the characteristics of the animals being hunted (such as their aesthetic beauty, innocence, rarity or 'wildness'). In contrast, those in favour of hunting often focused on the population-level or economic outcomes.

8.6 Discussion

This study finds that a large majority of US Twitter users engaging with the debate of African trophy-hunting express anti-trophy hunting positions, but that pro-trophy hunting tweets are strongly associated with conservative ideology and are usually justified by utilitarian and dominionstic reasoning. In contrast, anti-trophy hunting tweets are associated more with liberal ideology, moralistic reasoning and are more likely to be hostile in nature. Furthermore, it finds that interactions were more common among those of closer political ideology.

Although we do not attempt to assess the extent of polarisation, we identify large variation in the prevalence of opposing positions and the value-based reasoning underpinning them,

and a high level of hostile interactions. Hence, this study offers some, but limited, evidence to support the notion that this is a highly polarised conservation debate (Hutton and Leader-Williams, 2003; Lindsey et al., 2007), which complements the more well-established accounts of high polarisation within the US domestic hunting debate (Manfredo et al., 2017). Indeed, that most Twitter users in our sample expressed negative sentiments towards trophy hunting, is consistent with recent polling data which finds that 75% of Americans are against the trophy hunting of elephants (Remington, 2018). Our findings are also consistent with other studies that have shown how large online reactions against trophy hunting have occurred in recent years – particularly the online outrage that emerged following the illegal hunting of Cecil the lion in 2015 (Macdonald et al., 2016). However, it is our exploration of the factors associating with the possible nature of polarisation which offers the more important contribution towards better understanding conflicts.

The association found between positions on trophy hunting and political ideology suggests that this particular conservation conflict is polarised along political lines, much like other environmental issues (Guber, 2013; Kahan et al., 2012). There are several interconnected processes which may account for this observed association, and each of these may influence the process of polarisation. Under 'party sorting theory', political activists can drive a process of ideological separation among political elites, which filters down to electorates through elite cues and exposure to different information from sources (Guber, 2013; McCright et al., 2014). We don't have the historical data required to determine if positions on trophy hunting have diverged among both party elites and the public over time. However, a large proportion of tweets specifically referenced the Republican President Donald Trump – a highly polarising figure (Barber and Pope, 2018) – whose

proposed elephant-trophy import policy change may have acted as an elite cue. Moreover, individuals' propensity to seek and reward in-group social conformity can encourage opinion sharing based upon identity-signalling and can increase polarisation in any topic which becomes associated with political identities or elites (Evans and Fu, 2018; Strandberg et al., 2018). It is also possible that the greater support for trophy hunting among conservatives may reflect the cultural backlash to modernisation (and metropolitan progressive liberalism) observed among many conservatives in the US (Inglehart et al., 2016), which has been proposed as accounting for the polarised debate around domestic hunting (Manfredo et al., 2017).

Polarisation can also be driven by differences in values, and here we find some evidence to suggest that the opposing positions in this conflict are supported by different environmental value types. Indeed, contrasting value types can act as barriers for individuals with opposing positions or to understand each other or reach a compromised position (Estévez et al., 2015; Mattson et al., 2006). However, issue positions, political ideology, and underlying value-systems often align (Carvalho, 2007). Indeed, both dominionistic and utilitarian reasoning has been found to be associated more with conservative ideology (Hannikainen et al., 2017) and attitudes to recreational hunting (St John et al., 2018). Here we find that such reasoning types were also more common among those supporting trophy hunting – who tended to also be conservative. Such values are in direct contrast with the rights or interests of specific individual animals advocated by those against trophy hunting, both in our sample and in the literature (e.g., Batavia et al., 2018). Hence, delineating the individual role of values in driving position formation on this issue requires further exploration.

Issue position formation is also linked to information and experience, and although we do not test these factors specifically, we do find that most interactions were between users of similar political ideology. This is important because any interacting effects between political ideology and values on of trophy hunting position formation may be compounded by differential exposure to information. For instance, attitudes to hunting are linked to proximity to hunters and rural areas (Heberlein et al., 2005; Karns et al., 2015) – where conservative representation in the US is also higher (McKee, 2008) – and differ according to how hunting messages are framed (Blascovich and Metcalf, 2019). Hence, consistent with the echo-chamber hypothesis (Bruns, 2017), if conservatives are more likely to be pro-trophy hunting, and conservatives are more likely to interact with other conservatives (Barberá et al., 2015), then a conservative Twitter user is likely to see a higher proportion of pro-trophy hunting messages than a liberal user (and *vice versa*). However, the evidence for such echo-chambers and their effect on opinion formation is limited (Barberá et al., 2015; Bruns, 2017; Shin et al., 2017). Indeed, one experimental study found that exposure to opposing political views online may actually increase polarisation (Bail et al., 2018). Hence, without also analysing which tweets users were exposed to but did not reply to, we cannot scrutinise this relationship further. Moreover, whilst hostility on Twitter is commonly directed towards political outgroups (Oc et al., 2018), we do not have further evidence to explain why hostility was not predicted by political distance, but was predicted by trophy hunting position. However, we suggest the possible links between moralistic reasoning, opposition to a policy or practice and hostility should be explored.

This study has numerous limitations, many of which are inherent in using social media data to draw general conclusions. For instance, Twitter users tend to be younger, more highly educated and more liberal than the general population, although users from particular

demographic do reflect the same political leanings of those not on Twitter (Mellon and Prosser, 2017). Furthermore, whilst social media posts can be good predictors of real-world behaviour, such as voting patterns (Tumasjan et al., 2011), and participation in violence (Won et al., 2017), the increased anonymity of online networks may also increase hostility (Bollinger, 2016) and, and more emotive messages tend to proliferate on social media (Brady et al., 2017). This could result in the over-representation of more extreme, or polarising, messages in our sample, as well as the prevalence of anti-trophy hunting users (who may be more motivated to post). Further research is required to establish whether the lack of pro-trophy hunting liberal tweeters in our sample reflected the lack of actual pro-trophy hunting liberals, or whether such individuals do exist but instead choose not to reveal their positions online, or are not represented on Twitter. We also do not include demographic information, such as age, ethnicity, religion or gender, which are known shape positions on other partisan issues, such as climate change (McCright and Dunlap, 2011) and which may also interact with both political ideology and positions on trophy hunting. Our study is also limited to a snap-shot in time with US-based users, but it could be replicated consistently over time and with different sub-sets of users. Lastly, the only interactions we consider are public replies, which overlook other forms of offline and online interaction (e.g., private messages) and relevant behaviours.

Our study has numerous implications for understanding and managing conservation conflicts. Firstly, polarisation in this conflict appears to be at least in part shaped by underlying environmental values, which change slowly (Manfredo et al., 2016), and which when clashing, can make effective dialogue hard to reach (Mason et al., 2018; St John et al., 2018). Secondly, if this, or other conservation conflicts, are polarised along political lines, then they will also be influenced by wider in trends in political polarisation (Inglehart et al.,

2016; McCright et al., 2014), such as those thought to be shaping the debate over climate change and domestic hunting in the US (Guber, 2013; Manfredo et al., 2017). Furthermore, our findings suggest that, as elsewhere (Batavia et al., 2018; Mkono, 2019), *who* is doing the trophy hunting (and their socio-demographic characteristics), *why* they are hunting (perceived as for recreation, prestige or domination), and *what* is being hunted (charismatic megafauna) appear all to be key factors in shaping positions on this issue, rather than simply the conservation outcomes. Hence, better understanding such socio-political drivers of any conflict will likely help inform conflict management (Hodgson et al., 2018; Pooley et al., 2016; St John et al., 2018). For instance, those trying to influence positions on trophy hunting might benefit from tailoring messaging to different audiences (Maibach et al., 2011). Conflict researchers could also consider forecasting how conservation values may shift within populations over time, particular with regards to trends in urbanisation and modernisation (Bruskotter et al., 2017; Manfredo et al., 2017). Lastly, social media analyses might also be used measure such shifts in sentiment and the changing intensity of conservation conflicts. For instance, automated sentiment analysis tools are being developed which might be able to track shifting perceptions and discourses within conflicts (Ladle et al., 2016; Toivonen et al., 2019). However, the relationship between online conservation activity and offline behaviours needs further investigation (Büscher et al., 2017; Hawkins and Silver, 2017; Macdonald et al., 2016). Further work is also needed to explore whether the aspects of social media known to be shaping other social conflicts (Dwyer and Molony, 2019) are also shaping conservation debates, such as increased connectivity, anonymization and disinformation (Brady et al., 2017; Lazer et al., 2018; Zeitzoff, 2017). Hence, conflicts over conservation now certainly represented online, but the extent to which such clashes provide useful sources of information for researchers, and new sources conflict, requires further consideration.

8.6 Recommendations

- Researchers should further explore the interactions between positions in conservation conflicts, values, politics and related behaviours.
- Researchers could explore how messages could be framed in different ways to be tailored towards different audiences in conflicts.
- Researchers should try to devise new ways to measure and track levels of polarization, possibly using social-media data.
- Researchers should consider media platforms as new arenas of conservation conflict.

Chapter 9: Discussion

9.1 Background

As the Swahili proverb quoted at the beginning of this thesis states: when elephants fight, it is the grass that suffers. Likewise, where people clash over conservation, it is often the well-being of surrounding people and wildlife which suffers. Indeed, behaviours associated with conflicts negatively impact some of the world's most impoverished people (Adams and Hutton, 2007; Barua et al., 2013) as well as the viability of some of the world's most endangered species (Woodroffe et al., 2005a). Due to such negative outcomes of conservation conflict, in Enduimet WMA (Chapters 5-7) and globally (Chapter 3), conservation researchers and practitioners are highly concerned with designing and implementing more effective conflict interventions (Pooley et al., 2016; van Eeden et al., 2017), which often aim to manage or mitigate conflicts by trying to change human behaviour (Redpath et al., 2013).

Conservation interventions are thought to be more effective when they are designed and implemented according to robust theory and evidence (Sutherland and Wordley, 2017). Yet, although particular conflict interventions, or particular contexts, have been well-studied, there remains a dearth of general conservation theory and evidence to inform conflict interventions across contexts (Eklund et al., 2017; van Eeden et al., 2018). Moreover, research on both the roots of conflict, and the effectiveness of interventions, has historically focused mainly on human-wildlife interactions and attitudes (Peterson et al., 2010) and less on behaviour change (Nilsson et al., 2019). Recently, the need to better understand the complex social roots of conflict over conservation, and the ways in which

these can be managed, has also been identified (Madden and McQuinn, 2014; Pooley et al., 2016). Likewise, within specific contexts, different conflict interventions are prioritised by different actors (Lute et al., 2018; Rastogi et al., 2013), but the reasons for the differences, and their predicted outcomes (Redpath et al., 2017), remain underexplored. Better understanding this variation, and the factors which influence conservation decision-making more broadly (Papworth, 2017), is important in informing evidence-based interventions (Bunnefeld et al., 2017; Sutherland and Wordley, 2017). Accordingly, this thesis incorporates a range of studies and research approaches, which together aim to inform more effective conflict interventions by trying to better understand both the roots of conflict, and the factors which constrain the choice and effectiveness of different interventions.

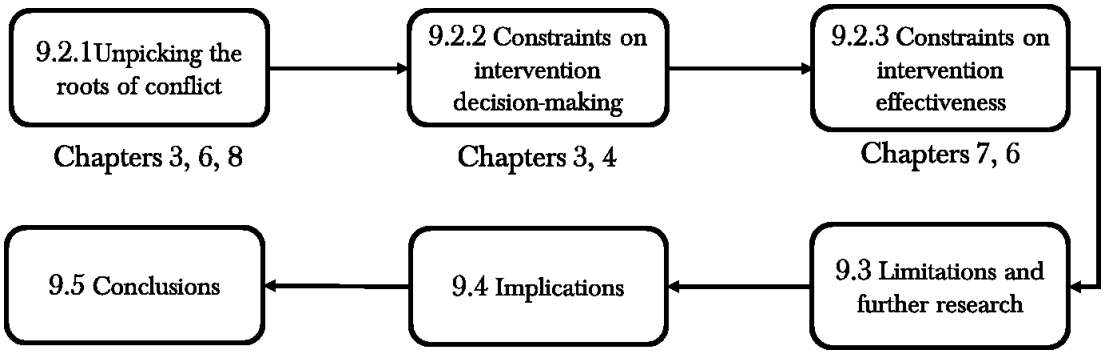

Figure 9.1: Structure of this discussion and the contributions of each chapter.

9.2 Contributions

9.2.1 Unpicking the roots of conflict

The first contribution this thesis makes to our understanding of the roots of conservation conflict comes from broadening the scope of conflict, considering previously disparate literatures together, and highlighting the different proximate human behaviours which drive conflicts. Drawing upon a review of the conflict literature, Chapter 3 demonstrates how the umbrella of conservation conflict extends far beyond human-wildlife interactions, to include clashes over resources, culture, land, ethics, and regulations. Chapter 3 argues that individuals or groups who actively participate in conservation rule-breaking, such as protected area infringement (De Pourcq et al., 2015), may as much be in conflict with conservation as those who poison livestock-raiding predators (Marquez et al., 2013), or those who lobby against hunting policies online (Hodgson et al., 2018). In this way, Chapter 3 suggests analysing and comparing a range of different conflict contexts and associated behaviours together, particularly when exploring interventions.

The next contribution this thesis makes to our understanding of the roots of conflict is in further highlighting how conflict and related behaviours can be produced at many interacting levels. Drawing upon academic and grey literature, and qualitative fieldwork in Tanzania, Chapter 6 identifies the various interacting levels producing conflict over elephants in Enduimet WMA. Chapter 6 shows how, like elsewhere (Young et al., 2010), conflict at the local level is produced through negative human-wildlife interactions, characterised by widespread elephant crop-raiding, human injury, and retaliatory killings (Mariki et al., 2015; Moyo et al., 2016). However, Chapter 6 also build on previous findings locally (Homewood, 2017; Mariki et al., 2015; Moyo et al., 2016; Wright, 2016) and

elsewhere (Redpath et al., 2013; Veríssimo et al., 2015), by showing how this conflict is also produced by negative interactions at the stakeholder level, largely characterised by conflicting interests, unmet promises, breakdowns in trust, hostile enforcement, resentment towards resource and land restrictions, and non-participatory decision-making (findings which are also supported by Chapter 7). Adding to existing literature (Bluwstein and Lund, 2018; Newig and Fritsch, 2009; Wright, 2017), Chapter 6 then documents how these clashes are themselves produced by wider governance structures, such as involving national-level conservation policy, particular conservation narratives (related to 'win-wins' and 'wilderness'), and the related objectives of NGOs. In doing so, Chapter 6 further highlights how stakeholders from beyond the local context can act to mediate local human-wildlife impacts, local stakeholder relations, and policy (Adams, 2015; Colvin et al., 2015; Sterling et al., 2017), and hence the dynamics of conservation conflicts.

Thirdly, this thesis also contributes to our understanding of how political ideology, environmental values and networks contribute towards polarisation in conservation conflicts. Chapter 8 draws upon polarisation theory (Coffey and Joseph, 2013; Guber, 2013) to highlight how factors which have been shown to drive polarisation in other environmental topics – including political ideology, environmental values and networks – apply to the online conflict over the trophy hunting of African megafauna (Lindsey et al., 2016; Macdonald et al., 2016). Chapter 8 finds that US pro-trophy hunting Twitter users are more likely to be of conservative than liberal orientation, and use more utilitarian and dominionistic language compared to those that espouse anti-trophy hunting positions, who use more moralistic and aesthetic language. Hence, Chapter 8 suggests that like other environmental issues (Guber, 2013; Kahan et al., 2012), conservation conflicts may be polarised along political lines and are likely shaped by contrasting environmental values

(Estévez et al., 2015; Manfredo et al., 2017; St John et al., 2018). It also builds upon previous work to further highlight how clashes over conservation now occur online (Büscher, 2014; Hawkins and Silver, 2017; Macdonald et al., 2016), which may also be shaped by changing experiences of nature (Lorimer, 2015).

9.2.2 Constraints on intervention decisions

The first contribution this thesis makes to our understanding of conflict intervention decision-making is in identifying the different types of interventions and the assumptions underpinning them. The literature review in Chapter 3 builds-upon the environmental behaviour change (Heberlein, 2012b) and conflict intervention literature (Agrawal et al., 2014; Nyhus, 2016; Treves et al., 2006), to identify five conservation conflict intervention types. It finds that technical interventions attempt to reduce retaliatory killings and alleviate conflicts by targeting wildlife impacts such as crop-raiding and livestock depredation, typically through barriers, deterrents, or diversionary feeding (Nyhus, 2016; Osipova et al., 2018), whereas cognitive interventions attempt to change conflict-related behaviours through information dissemination, including livelihood education and conservation awareness campaigns (Baruch-Mordo et al., 2011; Holmes, 2003). In contrast, it highlights that economic interventions – including incentives, compensation or alternative livelihoods – aim to alleviate the costs incurred by wildlife or resource restrictions, or to shift resource use (Kremen et al., 2000; Ravenelle and Nyhus, 2017), and enforcement interventions aim to increase compliance or discourage certain behaviours such as illegal resource use (Agrawal et al., 2014; Keane et al., 2008). Lastly, stakeholder engagement interventions, such as mediation programmes and participatory decision-making, are identified as aiming to alleviate the social roots of conflicts and transform

conflicts through co-management, mediation, and consultations (Madden and McQuinn, 2014; Redpath et al., 2017).

Next, this thesis contributes to our understanding of conflict intervention decision-making by demonstrating the extent to which the geographical context of a conflict, the kinds of human behaviours described, and conflict framing, shapes intervention priorities. In particular, Chapter 3 finds that technical interventions tend to be prioritised more by authors adopting the human-wildlife conflict frame and by those describing retaliatory killing, whereas stakeholder interventions are recommended more by those using the human-human conflict frame and those describing acts of active opposition to conservation. In contrast, enforcement tends to be suggested more by authors focussing on less highly developed countries – supporting another finding for protected area conflict management (Soliku & Schraml 2018) – and where illegal conservation-related behaviours are reported. However, in contrast to the review (Chapter 3), the experimental study of conservation professionals (Chapter 4) finds that enforcement is prioritised over stakeholder engagement more (rather than less) in more highly developed countries, that economic interventions (but not enforcement) associate with illegal behaviours and no effect of conflict framing on intervention priorities. These discrepancies might reflect the observational nature of Chapter 3 in contrast to the experimental nature of Chapter 4, but also suggest the need to further explore the context-specific drivers of intervention priorities.

This thesis also contributes experimental evidence to demonstrate how the personal characteristics and experiences of decision-makers predicts their intervention priorities. Chapter 4 finds that enforcement and awareness are prioritised over stakeholder more by

younger respondents, as well as those with more scientific backgrounds, those with less experience of conflicts, and those from less highly developed countries. These results accompany previous findings that respondent's personal, geographical, and professional backgrounds shape perceptions of conflict intervention solutions (Lute et al., 2018) and conservation priorities more generally (Sandbrook et al., 2019). These findings also support the need to further explore the possible roles of heuristics (Papworth, 2017), predispositions (Sheil and Meijaard, 2010), disciplinary silos (Pooley et al., 2014), personal experiences (Pullin et al., 2004; Walsh et al., 2015) and group affiliation (St John et al., 2018; Furth-Matzkin and Sunstein, 2016), in shaping conservation decision-making. Chapter 3 also identifies the (low) extent to which intervention recommendations in the published literature are rarely supported by scientific evidence or Theories of Change (Margoluis et al., 2013), hence better understanding the possible barriers to evidence-use (Addison et al., 2016) in conflict management is therefore also important. Lastly, the findings of Chapter 5 indicate how resource and governance constraints are also likely to influence local management options, which is an area also highlighted in the feedback from survey respondents (Chapter 4), and which could be also considered further.

9.2.3 Constraints on intervention effectiveness

This thesis provides experimental evidence to demonstrate how perceptions of interveners – specifically of their benevolence and integrity – are important in shaping support for conflict interventions. Using an experimental game in Enduimet WMA, Chapter 7 finds that participants cooperate more with interveners they perceive to be more trustworthy, and that perceptions of interveners' integrity and benevolence are more important in eliciting cooperation than perceptions of their ability. This finding corroborates previous studies which have shown that stakeholders respond differently to different actors and interveners

within conservation conflicts (Davies and White, 2012; Marshall et al., 2007; Mishra et al., 2017), and that levels of stakeholder trust may govern conflict-related interactions – from compliance or cooperation (Gray et al., 2012; Hamm et al., 2016; Stern, 2008a), to support for interventions and resolution (Estévez et al., 2015; Sjölander-Lindqvist et al., 2015; Young et al., 2016a). This finding also highlights the importance of affinitive forms of trust, such as perceptions of benevolence and integrity (Stern and Coleman, 2015), which have been previously highlighted as mediating responses to conservation interventions (Riley et al., 2018; Shirley and Gore, 2019).

This thesis also provides evidence to suggest that the efficacy of conflict interventions, in particular stakeholder engagement, may be constrained by conflicts with multi-level dynamics. Chapter 6 identifies how variation in national policy and conservation markets may constrain local management strategies, and how conflict management through stakeholder engagement may prove more difficult where the conservation objective is perceived as non-negotiable, or pursued by influential non-local actors. These findings build on previous work which suggests that the effectiveness of co-management and participatory decision-making is constrained by the ability for conservation objectives to be flexible and determined collaboratively (Butler et al., 2011; Pooley and Redpath, 2018), that economic interventions may be constrained by levels of effective governance and corruption (Hansson-Forman et al., 2018; Smith et al., 2015), and that wildlife impact interventions can be constrained by agrarian and livestock markets (Masse, 2016). Furthermore, as Chapter 8 highlights, shifts in public sentiment, even internationally, may act to shape conservation policy locally (Carpenter and Konisky, 2017; Lindsey et al., 2016), but, how such processes may constrain the effectiveness of conflict interventions (such as co-management or sustainable-use), remains to be explored.

9.3 Implications

Better understanding the variation in intervention priorities is important in helping to establish how, and why, different decisions are made, and to inform more effective management (Lute et al., 2018; Papworth, 2017). This thesis identifies that conservation conflict intervention priorities are not only predicted by the geographical and behavioural characteristics of a conflict, but by the characteristics of decision-makers (Chapter 4). Hence, it is possible that effective interventions are overlooked perhaps because managers are not aware of them, because of their predispositions, or possibly due to barriers to using evidence (Addison et al., 2016). Increasing the diversity of voices involved in the decision-making process and promoting multi-disciplinarity (Pooley et al., 2014) might increase the range, and quality of intervention suggestions, and also provide a more inclusive process (Foster et al., 2014; Vercammen and Burgman, 2019). Likewise, including stakeholders more in the decision-making process, might not only improve stakeholder relations and build trust (Redpath et al., 2017; Young et al., 2016a), but may facilitate knowledge-sharing and more effective interventions as a result (Butler et al., 2015). However, by including more voices in the decision-making process the potential for conflict over decisions and disagreement over sources of evidence may increase (von Essen and Hansen, 2015). Moreover, as highlighted in Chapter 3, is a lack of evidence-based conflict intervention recommendations, particularly around education and awareness programs. Consequently, drawing upon Theories of Change (Biggs et al., 2017), and behavioural science frameworks (Staddon et al., 2016; Veríssimo et al., 2019), will likely improve the effectiveness of conflict interventions.

Furthermore, given perceptions of an intervener's integrity and benevolence may be more important than beliefs about their ability in predicting cooperation with interventions

(Chapter 7), consideration should be given as to who are the most suitable interveners, and how greater trust may be fostered. Indeed, demonstrating effectiveness alone (e.g., success in reducing crop-raiding) will not necessarily lead to greater support for conservation. Instead, improving stakeholder relationships and establishing greater affinitive trust is likely to be important in fostering collaboration (Stern and Coleman, 2015). Indeed, building trust and dialogue between all parties is likely key to effectively managing conflicts (Schroeder et al., 2017; Young et al., 2016a). This can include creating space to make small positive decisions that both sides can agree on, and potentially using impartial mediators to co-ordinate consultations and decision-making (Marshall et al., 2007; Rudolph and Riley, 2014). Likewise, making good on promises of compensation for wildlife damage, and increasing the transparency of decision making, might increase trust and reduce hostility towards conservation activities and organisations (Mabele, 2017; Young et al., 2016a). Similarly, being perceived to place a higher focus on protecting people from wildlife, not just wildlife from people, might help alleviate tensions between stakeholders and conservation organisations (ESPA, 2017). Furthermore, given the importance of interveners, it may also be profitable to map out and scrutinize the precise roles of different interveners (including organisations) during the intervention planning process (Barnes and van Laerhoven, 2015).

As shown throughout this thesis, effective stakeholder engagement is considered key to managing conflicts and changing behaviours. Yet as Chapter 6, and other analyses identify (Colvin et al., 2015; Sterling et al., 2017), the capacity for stakeholder approaches is context dependent. Specifically, the efficacy of local stakeholder engagement approaches may be constrained by multi-level factors including uneven power dynamics, markets and non-local conservation objectives. This is in addition to the importance of which actors initiate the

stakeholder-engagement process and the ways in which it is conducted (Reed and Ceno, 2015; Sterling et al., 2017). However, despite these constraining factors, it may be possible to pursue collaborative approaches within pre-determined boundaries (Redpath et al., 2017) and through the utilisation of adaptive management (Bunnefeld et al., 2017). Nonetheless, conflicts may well endure. This may particularly be the case where the costs and benefits of conservation are unequally distributed (DeMotts and Hoon, 2012), where objectives are non-negotiable (Pooley and Redpath, 2018), and where stakeholders' beliefs, identities and ways of seeing the world are challenged (St John et al., 2018) – such as in the case of trophy hunting (Chapter 8). It may therefore be beneficial to try and identify the extent to which stakeholders perceive a conflict to be one of intractable, mutually exclusive positions, or instead one of problems which can be overcome to the benefit of all.

Lastly, the findings presented in this thesis suggest that it would be useful to incorporate the multi-level drivers of conflict (Chapter 6) and the dimensions of polarization (Chapter 8) into conceptual frameworks of conservation conflicts and their management (Dickman, 2010; Madden and McQuinn, 2014; Rechciński et al., 2019). This would require further interrogation into the nature of polarisation across these different levels – such as the extent to which the objectives of specific groups and organisations diverge and the likelihood that they can reach consensus (Veríssimo et al., 2015), or the extent to which policy positions, values, or attitudes towards an issue diverge across citizens within wider populations (Colvin et al., 2015; Manfredo et al., 2017; McCright et al., 2014), including internationally.

9.4 Limitations and further research

One general limitation to the findings presented in this thesis, is the broad and varied scope of analysis. For instance, Chapter 3 expands the lens of conservation conflict to include a variety of contexts (such as illegal resource use) which previously have not been considered within conflict frameworks. Chapter 6 is similarly wide-reaching in considering how conflict is produced at a variety of different scales. Moreover, throughout this thesis, a range of different intervention types are considered alongside each other, rather than individually, as seen in other analyses (Osipova et al., 2018; Ravenelle and Nyhus, 2017; Sterling et al., 2017). This broad approach has clear benefits in terms of considering conflict more holistically (Mason et al., 2018), bringing together insights from across disciplines (Pooley et al., 2014), and contributing to much needed general theory on human behaviour and decision-making in conservation (Papworth, 2017; Schultz, 2011; Sutherland and Wordley, 2017). However, the consequential reduced level of detail and depth into a specific intervention or behaviour may limit the immediate applicability of these findings to practitioners working on the ground. Similarly, whilst the broad scope taken in this thesis has provided insights into a range of different aspects shaping conflicts and their interventions, these individual insights may have been richer if any one of them had the sole focus of this thesis. Moreover, this thesis applies a number of emerging research methods to the study of conservation conflict, which brings the challenge of interdisciplinarity. I have had to learn and apply a range of research techniques which means that for any given technique, I likely had reduced expertise compared to if I had specialised only in that technique. Interdisciplinarity also involves grappling with various different literatures, theories and ways of producing and presenting knowledge, which can make it challenging to situate a given piece of research within a particular literature. Furthermore, as shown by the somewhat contrasting results of the literature review

(Chapter 3) and framing experiment Chapter 4), as well as the differences found between game behaviours and stated preferences in Chapter 7, different research approaches can produce varying insights, which presents an additional interpretation challenge.

Specifically, a key area that has received insufficient attention in this thesis, but which requires greater consideration, is the application of behavioural insights to conflict intervention design (Veríssimo et al., 2019). For instance, the extent to which decision-makers take into account the different psychological levers of behaviour (Papworth, 2017; Schultz, 2011) is likely to influence the options which are deemed as suitable, as well as their effectiveness. Future studies could apply behaviour change frameworks to conflict interventions. These include the behaviour change wheel (Staddon et al., 2016), 'MINDSPACE' (Dolan et al., 2012) and 'EAST' (Valatin et al., 2016) – which promote interventions which make target behaviours easier, more attractive, more social and which are more timely (Rare and The Behavioural Insights Team, 2019). Indeed, behavioural 'nudges' – small variations in the way choices are presented or framed (Thaler and Sunstein, 2008) – have been applied to successfully change various forms of conservation-relevant behaviours (Reddy et al., 2017), from reducing food-waste (Kallbekken and Sælen, 2013) to introducing bird-friendly fishing gear (Santangeli et al., 2016), and should be applied to conflict contexts. For instance, the 'intervener' effects demonstrated in Chapter 7 may be comparable to the 'messenger effects' observed for conservation fundraising (Duthie et al., 2017) or awareness campaigns (Hafner et al., 2017; Mackeracher et al., 2018), and these could therefore be tested for awareness-based conflict interventions. Other behavioural insights, such as how trust in authority figures is shaped by the uniforms that their wear (Albert et al., 2008) and economic decisions are shaped by framing of losses or gains (Kahneman et al., 1991) could also be tested with regards to conflict interventions.

Similarly, social marketing approaches (Salazar et al., 2018; Veríssimo, 2019), including the use of audience segmentation (Jones et al., 2019; Maibach et al., 2011) and network analysis (De Lange et al., 2019), are considered more effective approaches than traditional information provision (Smith et al., 2010; Wright et al., 2015), and require further attention in conflict research.

With behaviour change in mind, whilst the effectiveness of conflict interventions is a major area of focus, this thesis also does not explore the ways in which the effectiveness of interventions, is being, or could be, assessed. This is also a limitation across the conflict literature. For instance, it is commonly asserted that conflicts are increasing (Laverty et al., 2019; Treves and Karanth, 2003). However, such statements usually reflect measures of impacts (Teixeira et al., 2015), land-use changes (Balmford et al., 2001), or the number of conflict-related studies (Anand and Radhakrishna, 2017), and rarely the social nature of conflict. These measures also often fail to account for the importance of other factors shaping conflicts, such as whether species are expanding in range (Arbieu et al., 2019) or receiving tighter protection (Bluwstein, 2018), variation in the capacity for democratic protest (Holmes, 2007; Kashwan, 2017), trends in urbanisation (Sanderson et al., 2018), and the changing ways people experience nature (Büscher et al., 2017; Lorimer, 2015). Hence, there is clearly a need to develop a better set of measurements and understanding of how exactly conflicts – and related behaviours – are changing in frequency and intensity over time. Drawing inspiration from the fields of armed conflict studies (Hegre et al., 2016) and natural resource management (Yasmi et al., 2006), one framework (which colleagues and I have been developing) identifies multiple levels of increasing conflict intensity, from pre-conflict disagreements, to breakdowns in dialogue, to purposeful actions, to aggression. Other methods include measuring issue polarisation (McCright et al., 2014) or assessing the

likelihood that different groups can form a consensus on management options (St John et al., 2018; Veríssimo et al., 2015). Nonetheless a big challenge is in accounting for the multiple-levels (Chapter 6) and complex networks of actors in conflicts (Colvin et al., 2015; Yasmi et al., 2006).

Lastly, by conceptualising conflict through an ostensibly human behavioural lens, 'more than human' conflict dynamics are possibly overlooked. Although useful for exploring human-human conflict dynamics, focusing solely on human antagonists neglects the potential importance of individual animals as actors in conflicts. Indeed, the role of animal agency in producing conflict has been identified (Evans and Adams, 2018) and as highlighted in Chapter 6, people attribute varying levels of agency and consciousness to particular animals. The intense and varied public reaction to the illegal hunt of Cecil the lion in Zimbabwe in 2015, in both the Global North (Lindsey et al., 2016; Pooley et al., 2016) and East Africa (Mkono, 2019), reflected the cultural relevance of the event and narratives of human-wildlife interactions more than the conservation outcome. Hence, better understanding human-animal relations and narratives (Dhee et al., 2019) is likely important in better understanding conservation conflicts and the factors which constrain interventions. To this end, conservation conflict researchers might benefit from engaging with the human geographical, ethological and anthropological explorations of 'more-than-human' relations (Garlick, 2018; Srinivasan, 2017), which comprise the emerging fields of 'multispecies studies' (van Dooren et al., 2016) and 'extinction studies' (van Dooren et al., 2017). However, one challenge with embracing broader concepts of conflict, will be the added difficulty of assessing the intensity of different conflicts, and determining intervention priorities, particularly when the 'interest' of individual animals may conflict with that of people or animals (Oommen et al., 2019; Pooley and Redpath, 2018).

9.5 Conclusion

Conservation conflicts are wicked problems in which clashes over conservation objectives are reflected through particular human behaviours. Whilst in some instances conflicts represent healthy democratic processes, more commonly they are products of social dysfunction. Conflicts are often managed via interventions seeking to achieve better outcomes for people and wildlife by changing people's behaviour. Accordingly, this thesis aims to help better inform interventions and promote positive behaviour change. It finds that the effectiveness of conflict interventions may be hampered by untested assumptions and the underuse of scientific evidence and Theories of Change. It also finds that intervention decision-making is likely influenced by particular geographical features of conflicts and the characteristics of decision-makers. Testing the assumptions underpinning different intervention priorities, and further interrogating the factors shaping priorities, will be therefore key to achieving evidence-informed interventions. The findings presented in this thesis also suggest that conflict-related behaviour change will stem from not only reducing wildlife impacts, but from widening participation in decision-making, and better addressing the social roots conflict, including those related to stakeholder distrust, values and politics. However, this thesis also shows how the effectiveness of local management approaches will be constrained by both the characteristics of those doing the intervening, and by the wider socio-political and governance structures shaping the conflict. In particular, it suggests that collaborative local decision-making may be prove illusionary where wildlife management decisions are seemingly non-negotiable and determined by non-local conservation objectives. In short, conflicts over conservation are socially created and socially resolved: both the choice of interventions and their effectiveness at changing behaviour will depend on the people making them.

9.6 Recommendations

- Researchers should consider conflict and interventions more through the lens of human behaviour.
- Decision-makers should be aware that their backgrounds and biases may shape their assumptions and intervention decisions.
- Practitioners should consider that behavioural responses to interventions will be influenced by who is doing the intervening.
- Researchers should further explore how local interventions and collaborative management may be constrained by the multi-level dynamics of conflicts.
- Researchers should further explore the dimensions of polarisation in conflicts, particularly regarding politics and values, and how these influence behaviour.

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Appendix 1

Literature searches:

Search 1 (preliminary search):

ISI Web of Science search December 2015
Results: 431
(from Web of Science Core Collection)
You searched for: TS=(("human-wildlife conflict" OR "human-animal conflict" OR "conservation conflict" OR "biodiversity conflict")
AND [excluding] DOCUMENT TYPES: (REVIEW OR BOOK CHAPTER)
Timespan: 2005-2015. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC.

Search 2 (final search):

ISI Web of Science search October 2016
Results: 897
(from Web of Science Core Collection)
You searched for: TS=(("conservation conflict*") OR ("conservation" AND "illegal") OR ("conservation" AND "conflict" AND ("stakeholder*" OR "human-wildlife")))
Refined by: TOPIC: (("prevent*" OR "mitigat*" OR "reduc*" OR "resolv*" OR "resolution*" OR "solv*" OR "solution*" OR "manag*" OR "interven*" OR "improv*")) AND [excluding] DOCUMENT TYPES: (REVIEW OR BOOK CHAPTER)
Timespan: 2011-2016. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC.

We only searched in the English language as this was the only language the author collecting the data was fluent in. Following the preliminary search, we adapted our search terms to more accurately capture the variation in conflict contexts we were looking for. We dropped the search terms 'human-animal conflict' and 'biodiversity conflict' as these produced only a small number of results (less than 20 each). We added search terms related to illegal behaviours and stakeholders to capture a wider range of contexts, such as those covering natural-resource use. We did not include search terms related to 'natural resource' conflict because although these terms produced many relevant results specific to conservation, they also produced a high proportion of results not specific to nature conservation – such as those over rare earth mining, or taxonomy. Similarly, we avoided using more context-specific search terms such as 'fisheries', 'agriculture', or 'human-elephant conflict'. This was to avoid generating bias to particular contexts and to keep the search process simple and broad. Given each search produced hundreds of results (e.g. "natural resource" AND "conflict" produced over 300 results), we deemed it too time intensive to identify all individual papers which described conflicts related to nature conservation, but did not use the term 'conservation'. Hence we kept the term 'conservation' in our final search. We also wanted to include literature from across a range of journals, hence we did not specify journal type.

Sample selection:

To produce a representative random sample for analysis, we used a random list generator (www.random.org/lists/ accessed 07/03/2018) to sort an alphabetically-ordered list of articles into a randomly ordered list. We then analysed articles in turn from the beginning of this random list. The randomness comes from atmospheric noise and uses the same mechanism as the R package 'random'. We deemed our random sample size representative of the full sample. Table A1.1 (below) outlines the breakdown of a key word search (in article titles, abstracts and keywords) for both the not-analysed sample, and the analysed sample. Note that there are no significant differences between the proportions of key words between samples. We excluded papers from analysis is they were deemed to be either a) a review paper, b) conservation conflict not the focus of the study c) inaccessible d) a method paper, e) not a case study, or f) presented no intervention recommendations.

Table A1.1: proportion of articles analysed and not-analysed which used given key words in their titles, abstracts or keywords

Key word	Not-analysed (n=740)	Analysed (n=157)	Significant difference using tailed Z test (P value)
"human-wildlife"	187 (25%)	33 (21%)	No (0.26)
"stakeholder"	164 (22%)	38 (24%)	No (0.57)
"resource"	202 (27%)	45 (29%)	No (0.73)
"illegal"	393 (53%)	95 (61%)	No (0.09)
"conflict"	334 (45%)	76 (48%)	No (0.45)

Conflict Variables:

Region: As categorized by the International Union for the Conservation of Nature (IUCN). http://www.iucnredlist.org/technical-documents/data-organization/countries-by-regions (accessed 11/02/2018)

Conservation status: The conservation status of any species specifically mentioned in articles, as categorised by the IUCN Red-List http://www.iucnredlist.org/ (accessed 11/03/2018). 'Listed' included articles in which at least one species mentioned is included on the Red-List (critically endangered, endangered, threatened, vulnerable, near threatened). 'Non-listed' included articles in which no species mentioned were included on Red-List (least concern, data deficient). If no specific species were mentioned, the paper was also designated as 'non-listed'.

Development status: As categorised by the Human Development Index (HDI) (2016) http://hdr.undp.org/en/content/human-development-index-hdi (accessed 11/03/2018). Following the HDI, countries were categorised as 'very high development' (n=40), 'High development' (n=20), 'Medium development' (n=31) and 'Low development' (n=9). Each category was assessed independently, but due to the unequal representation of each category and given that the 'Very high development' category seemed to differentiate most from the other categories with respect of our conflict variables (Table A1.8), we collapsed the three other categories in the rest of our analysis to compare 'Very high development' against 'High, Mid and Low development'.

Protected Area: Our variable 'Protected Area' include all articles which described a protected area (IUCN categories I-V) within the article, as being either the site of, or adjacent to, a study area. https://www.iucn.org/theme/protected-areas/our-work/world-database-protected-areas (access 11/03/2018)

Illegal: Our variable 'illegal' included all articles in which the authors described any activity as being explicitly illegal, or described the breaking of the law, Papers which described no illegal activities, or did not explicitly identify them as such, were recorded as 'non-illegal'.

Journals and affiliations:

We recorded the geographical region (following Estévez et al., (2015)) corresponding to the first author's affiliation given in each paper. We also recorded the affiliation name (such as research department or institution). From the total list of affiliations, we attempted to devise categorise (such as 'conservation science', 'social science' or 'natural resource management'. However, due to the often broad, and interdisciplinary nature of institutions we abandoned this approach. Likewise, we also attempted to categorise journals by their disciplinary focus and scope. To do this, we first used the Web of Knowledge categorisation system to separate journals (in our sample) into 'Sciences' (n=86), 'Social Sciences' (n=19), and 'Arts and Humanities' (n=0). Due to the bias towards 'Sciences' we also attempted to develop a categorisation system to more accurately distinguish between disciplines represented in our sample (e.g., ecology, policy and management, or anthropology), by drawing upon the 'scope and aims' of each journal, as published on their online website. However, after collecting the data and trying to devise categories, we found this approach unsatisfactory due to the highly interdisciplinary nature of conservation and environmentally-focussed journals - so we did not take it forward. However, we do report the geographical focus of journals represented in our sample (Table A1.10).

Further results:

Table A1.2. Proportion of articles within each variable category which recommend each intervention type, PA = Protected Area

Variable	Articles*(N)*	Technical	Cognitive	Economic	Enforcement	Stakeholder
All	***100***	**0.38**	**0.40**	**0.47**	**0.54**	**0.37**
Wildlife control	*32*	0.66	0.44	0.47	0.41	0.34
Resource use	*59*	0.31	0.37	0.51	0.68	0.27
Environment change	*26*	0.12	0.38	0.50	0.54	0.62
Indirect damage	*34*	0.24	0.41	0.44	0.74	0.35
Active opposition	*33*	0.36	0.36	0.39	0.24	0.67
Human-wildlife conflict	*30*	0.67	0.47	0.60	0.40	0.30
Illegal resource use	*41*	0.24	0.44	0.46	0.78	0.12
Human-human conflict	*29*	0.28	0.28	0.34	0.34	0.79
Illegal	*66*	0.30	0.39	0.48	0.70	0.30
Non illegal	*34*	0.53	0.41	0.44	0.24	0.50
Very high development	*40*	0.48	0.40	0.30	0.38	0.58
High, Mid & Low development	*60*	0.32	0.40	0.58	0.65	0.23
Listed	*48*	0.44	0.44	0.54	0.60	0.17
Non-listed	*52*	0.33	0.37	0.40	0.48	0.56
PA	*61*	0.36	0.43	0.52	0.54	0.33
Non-PA	*39*	0.41	0.36	0.38	0.54	0.44

Table A1.3. Results of Pearson's Chi-squared tests of independence between intervention types and conflict variables, with odds ratios presented with P-values in parenthesis and only statistically significant associations displayed. HWC = Human-wildlife conflict, IRU = Illegal resource use, HHC = Human-human conflict, PA = Protected Area, '***' 0.001 '**' 0.01 '*' 0.05 denotes significance level

	Wildlife control	Resource use	Environment change	Indirect damage	Active opposition	IRU	HWC	HHC	Very high development	High, Mid & Low development	PA	Listed	Illegal
Technical	2.63 (<0.001***)		0.24 (0.001**)	0.52 (0.032*)		0.51 (0.019*)	2.59 (<0.001***)						0.57 (0.027*)
Cognitive													
Economic									0.51 (0.005**)	1.94 (0.005**)			
Enforcement		1.99 (<0.001***)		1.67 (0.005**)	0.35 (<0.001***)	2.09 (<0.0001***)		0.56 (0.012*)	0.58 (0.006**)	1.73 (0.006**)			2.96 (<0.001***)
Stakeholder		0.53 (0.014*)	2.17 (0.003**)		2.98 (<0.001***)	0.22 (<0.001***)		4.02 (<0.001***)	2.46 (<0.001***)	0.41 (<0.001***)		0.29 (<0.001***)	

Table A1.4: Frequency of articles in each conflict variable category, by framing category. HWC = Human-wildlife conflict, IRU = Illegal resource use, HHC = Human-human conflict

Frame	(N)	Wildlife control	Resource use	Environment change	Indirect damage	Active opposition	Wildlife impacts	Groups identified	Illegal activity
HWC	(30)	24	11	4	6	10	30	2	13
IRU	(41)	4	37	9	20	1	7	2	41
HHC	(29)	4	11	13	8	22	8	23	12

Table A1.5: Results of Pearson's Chi-squared tests of independence between intervention type and Theories of Change (ToC), evidence and journal type, with odds ratios presented with P-values in parenthesis and only statistically significant associations displayed. '***' 0.001 '**' 0.01 '*' 0.05 denotes significance level

	ToC	Strong evidence	Partial evidence	Weak evidence
Technical				
Cognitive		NA		
Economic	1.94 (0.006**)	2.13 (0.004**)		0.46 (0.008**)
Enforcement				1.58 (0.037*)
Stakeholder				0.18 (0003**)

Table A1.6: Results of Pearson's Chi-squared tests of independence between conflict variables, with significant P-values presented, and colour-coded by association (blue (+) = positive, red (-) = negative). HWC = Human-wildlife conflict, IRU = Illegal resource use, HHC = Human-human conflict, PA = Protected Area,)

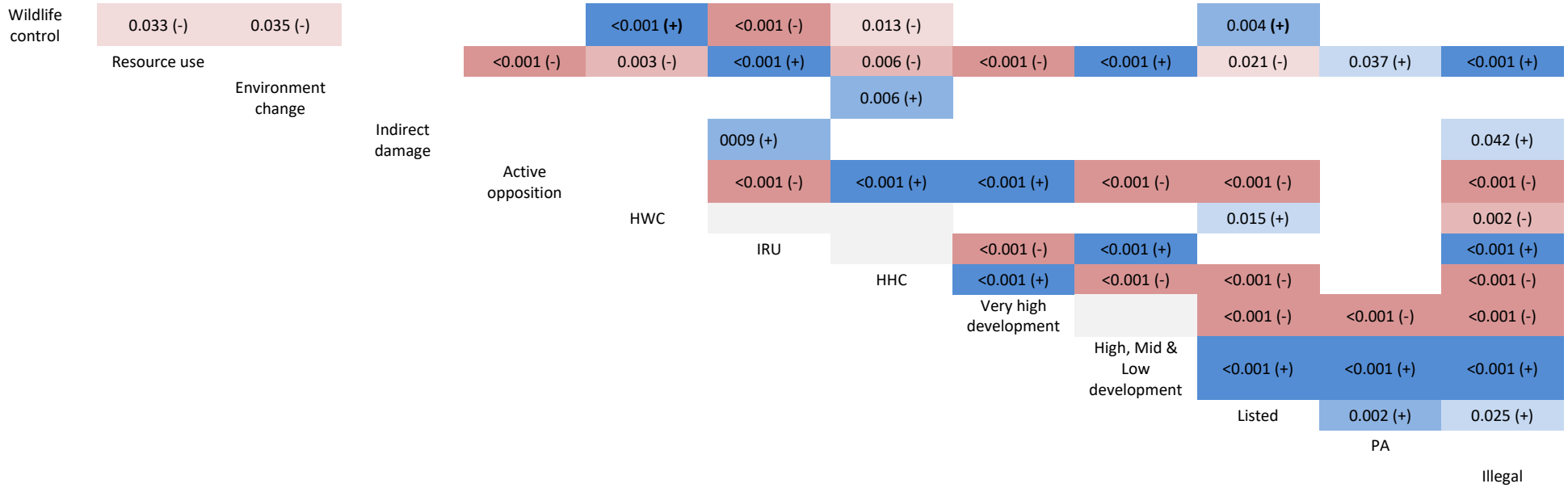

Table A1.7: Results of Pearson's Chi-squared tests of independence between intervention types, with odds ratios presented with P-values in parenthesis and only statistically significant associations displayed. '***' 0.001 '**' 0.01 '*' 0.05 denotes significance level

	Technical	Cognitive	Economic	Enforcement	Stakeholder
Technical					
Cognitive					
Economic					
Enforcement					OR: 0.54 (0.004**)
Stakeholder				OR: 0.46 (0.004**)	

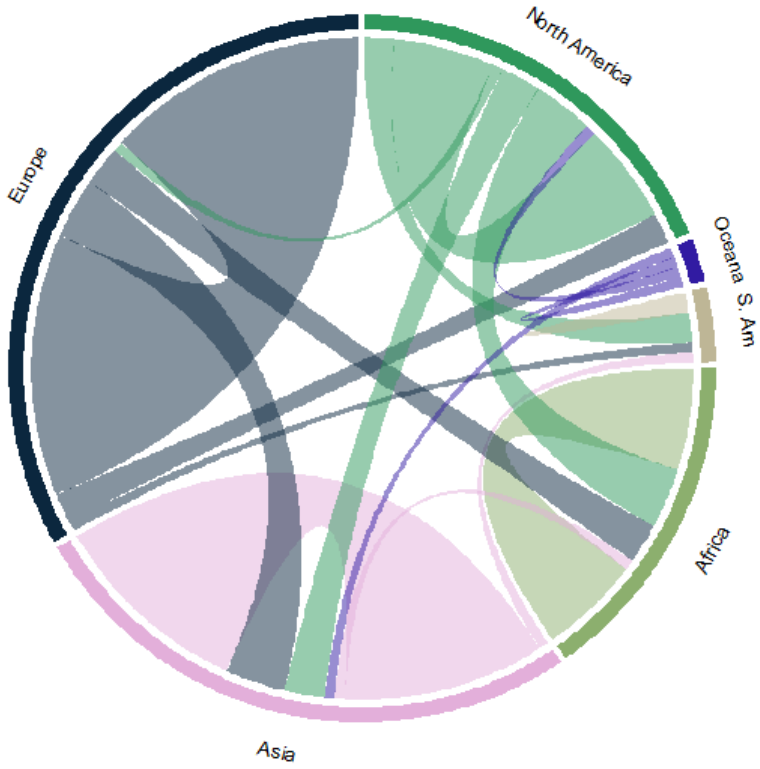

Figure A1.1: Chord diagram showing the relationship between author affiliation region (outside rim) and study regions (inner flows). The width of each outer rim depicts the proportion of total articles with first-author affiliation in each region. The direction and width of the inner flows show the proportion of articles focussed on conflicts within each region, and the proportion of author's from one region, that study a conflict in other regions. S. Am = South America.

Development status

Table A1.8: Proportion of articles in each development category, which were also categorised into other conflict variables. HWC = Human-wildlife conflict', IRU = Illegal resource use, HHC = Human-human conflict, and PA = Protected Area.

Human Development	*(N)*	HWC	IRU	HHC	PA	Red Listed	Illegal activity
Very high	*40*	0.33	0.18	0.50	0.33	0.15	0.43
High	*20*	0.25	0.45	0.30	0.75	0.60	0.85
Mid	*31*	0.36	0.58	0.07	0.81	074	0.74
Low	*9*	0.11	0.78	0.11	0.89	0.78	1.00

Intervention types

Table A1.9: Frequency of intervention types recommended by articles categorised by evidence strength

		Intervention types					
Evidence	*(N)*	1	2	3	4	5	Mean (0.95, CI)
Weak	*25*	7	14	4	0	0	2..23 (2.00, 2.46)
Partial	*65*	14	29	15	7	0	2..4 (1.80, 3.00)
Strong	*10*	1	5	3	1	0	1.88 (1.61, 2.15)

Journals

Table A1.10: Frequency of journals represented, by region, and by scope

Region	*(N)*	**Scope**	*(N)*
Global	88	Global	79
Tropical	4	Marine	8
Africa	3	Fish	2
Europe	3	Herpetology	2
Asia	1	Birds	1
Polar	1	Coastal	1
		Commons	1
		Pastoral	1
		Polar	1
		Rural	1
		Tropical	1
		Ursus	1
		Wetlands	1

Appendix 2

Sample:

We did not collect meta-data associated with the survey web-links to ensure that respondent anonymity was preserved. Nonetheless, given the high proportion of (seemingly legitimate and non-duplicate) emails provided (78%), and the demographic data provided, we have confidence that our sample reflected our target audience – conservation researchers and practitioners of various backgrounds with some experience of conflicts in theory or in practise. From our question 'do you work in conservation' we were also able to exclude any respondents who did not self-identify as working in conservation. Of our final analysed sample (n=411), 273 respondents followed the link given in emails and on paper flyers at the European Congress for Conservation Biology (ECCB) 2018 and 138 followed the link via Twitter. Of those who followed the link by Twitter, we expect a large proportion of which were either at the ECCB conference themselves – as the papers flyers pointed participants towards the authors' Twitter account for the survey link. In total 136 Twitter accounts retweeted (shared) the original survey link – the vast majority of which describe links to conservation practise or research in their Twitter user biography. Of the 411 respondents in the final analysed sample, 400 revealed their nationality and 52 different nationalities were represented. However, the respondents were largely Anglo-centric, with a low representation from Latin America and East Asia in particular. Nonetheless, this clearly biased sample does reflect the Anglo-European bias of authors in conservation conflict research (Chapter 3) and conflict study-locations (van Eeden et al., 2018).

ISI web of science search:

Date: 01/07/2018 Results: 453

You searched for: TOPIC: ("human-wildlife conflict" OR "conservation conflict" OR "biodiversity conflict") (from Web of Science Core Collection)

Timespan: 2015-2018. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC.

Of the 453 results we were able to email 336 lead authors individually using their correspondence email provided with the paper. The only results omitted were those in which the lead author was repeated, or those which did not have a listed, or viable, email address.

Table A2.1: Nationality of respondents

Nationality	Count	Nationality	Count	Nationality	Count
UK	78	Switzerland	3	Botswana	1
South Africa	56	Kenya	3	Japan	1
US	47	Nepal	3	Namibia	1
Australia	23	Ireland	3	Uganda	1
Canada	21	New Zealand	3	Sri Lanka	1
Spain	18	Greece	2	Poland	1
Germany	16	Serbia	2	Argentina	1
Italy	15	Chile	2	Denmark	1
Finland	12	Indonesia	2	Norway	1
France	12	Belgium	2	Croatia	1
India	11	Mozambique	2	Czech	1
Sweden	10	Turkey	2	Luxemburg	1
Brazil	8	Ethiopia	1	Madagascar	1
Zimbabwe	6	Singapore	1	Mauritius	1
Portugal	5	Russia	1	Romania	1
Netherlands	5	Bulgaria	1	Nigeria	1
Mexico	3	Estonia	1		
Philippines	3	Costa Rico	1		

Additional results:

Table A2.2: Results from multinomial logit regression models (Model Set 1), showing the estimated conditional effects of each predictor variable on likelihood of choosing each intervention type compared to the reference level in each model. Effects are presented as odds ratios (OR), showing the expected change in likelihood of choosing different interventions when each continuous variable increases by a unit of 1 or when each factor variable changes level from a baseline. The values in parentheses are 95% CI. The larger the OR the greater the predicted strength of association. Only significant associates are shown. Probability: *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

	Awareness [Stakeholder]	Enforcement [Stakeholder]	Impacts [Stakeholder]	Economic [Stakeholder]	Awareness [Enforcement]	Impacts [Enforcement]	Economic [Enforcement]	Awareness [Impacts]	Economic [Impacts]	Awareness [Economic]
Conflict HDI		OR 1.20* (1.00-1.44)				OR 0.80** (0.96-0.66)	OR 0.77** (0.63-0.93)			OR 1.17* (1.02-1.35)
HWC Frame										
Illegal Behaviour									OR 1.39* (1.03-1.86)	

Table A2.3: Results from multinomial logit regression models (model set 2) (Table 4.2) of estimated conditional effects of different predictor variables (related to the description of conflict scenarios and respondents' characteristics) on the likelihood of respondents' prioritising different conflict intervention types, compared with other choices (in brackets), across the conflict scenarios presented. Effects are presented as odds ratios (OR), showing the expected change in likelihood of choosing different interventions when each continuous variable increases by a unit of 1 or when each factor variable changes level from a baseline. The values in parentheses are 95% CI. The larger the OR the greater the predicted strength of association. Only significant associates are shown. Probability: HDI = Human Development Index, HWC = Human-wildlife conflict frame.

Predictor variable	Awareness [Stakeholder]	Enforcement [Stakeholder]	Impacts [Stakeholder]	Economic [Stakeholder]	Awareness [Enforcement]	Impacts [Enforcement]	Economic [Enforcement]	Awareness [Impacts]	Economic [Impacts]	Awareness [Economic]
HDI		OR 1.31* (1.06-1.63)				OR 0.75** (0.60-0.93)	OR 0.70** (0.56-0.88)	OR 1.18* (1.02-1.36)		OR 1.26** (1.07-1.47)
HWC										
Illegal				OR 1.45* (1.05-1.99)					OR 1.49* (1.07-2.07)	OR 0.66** (0.48-0.89)
Discipline	OR 1.36*** (1.18-1.56)	OR 1.47*** (1.21-1.78)	OR 1.17* (1.01-1.35)				OR 0.75** (0.61-0.91)	OR 1.21* (1.04-1.40)		OR 1.38*** (1.18-1.63)
Ground	OR 0.78** (0.66-0.91)				OR 0.72** (0.58-0.91)			OR 0.80* (0.68-0.95)		
Literature				OR 0.74*** (0.62-0.88)						OR 1.21* (1.01-1.45)
Age	OR 0.77*** (0.68-0.88)	OR 0.63*** (0.52-0.76)	OR 0.84* (0.73-0.96)			OR 1.31** (1.07-1.59)	OR 1.59*** (1.30-1.95)		OR 1.24** (1.06-1.44)	OR 0.75** (0.67-0.90)
Nation HDI	OR 0.71*** (0.62-0.82)	OR 0.74** (0.60-0.90)	OR 0.85* (0.73, 0.99)					OR 0.85* (0.73-0.98)		OR 0.80** (0.68-0.94)

Table A2.4: Standard deviation of the intercept for each intervention type from multinomial mixed logit models (Model Set 2). The model reference intervention type is included (columns) and the amount of variation explained by each model is given by R^2.

	[Awareness]	[Economic]	[Enforcement]	[Impacts]	[Stakeholder]
Awareness	-	0.39	0.51	0.31	0.31
Enforcement	0.54	0.56	-	0.54	0.53
Impacts	0.30	0.34	0.50	-	0.27
Economic	0.39	-	0.55	0.35	0.37
Stakeholder	0.32	0.36	0.51	0.28	-
R^2	0.21	0.21	0.19	0.21	0.19

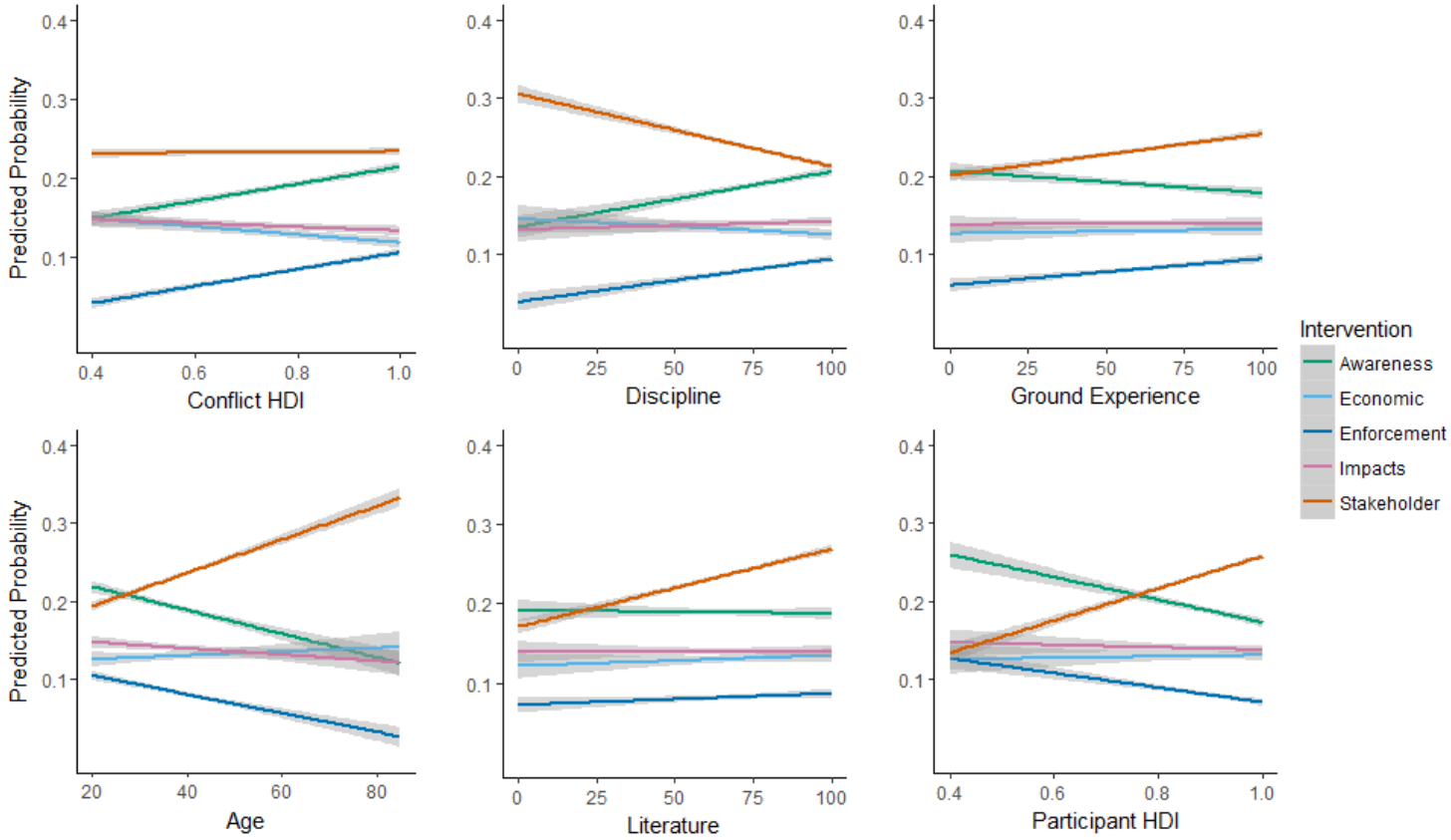

Figure A2.1: Results from a multinomial mixed logit regression model (Model Set 2, reference level 'stakeholder'), showing the predicted probability of choosing each intervention type (colour) with changes in each numerical predictor variable (regression lines with 95% CI). 'HDI' = Human Development Index. 'Discipline' = self-reported disciplinary background (0=Social Science/Humanities only, 100 = Natural Science/Ecology only), 'Literature' = self-reported knowledge of conflict literature

Feedback

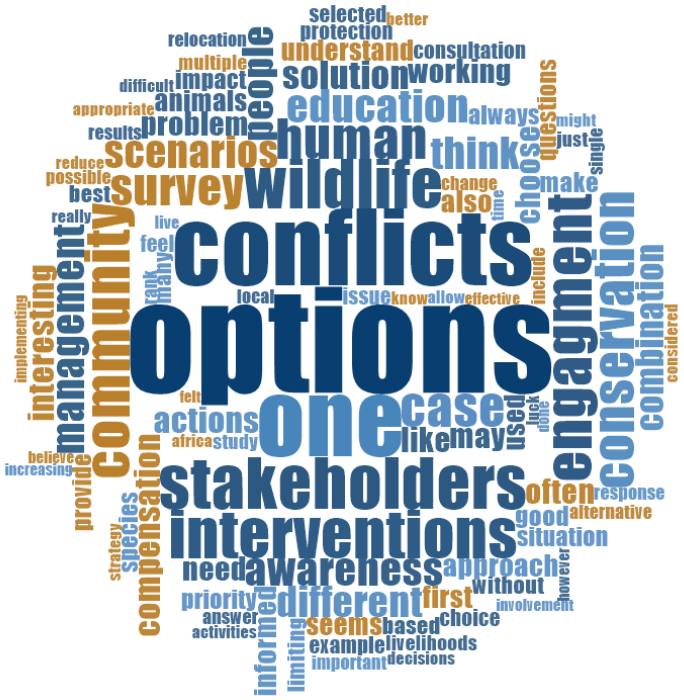

Figure A2.2: Word cloud generated from survey respondents (n=166) who provided written feedback (in the open-ended question), with word size proportional to word frequency

Appendix 3

Tolerance

The survey (Appendix 4) included questions to determine levels of elephant-related damage and four measures of elephant tolerance (spatial, damage, killing and population) adapted from Kansky et al. (2016).

WMA legitimacy

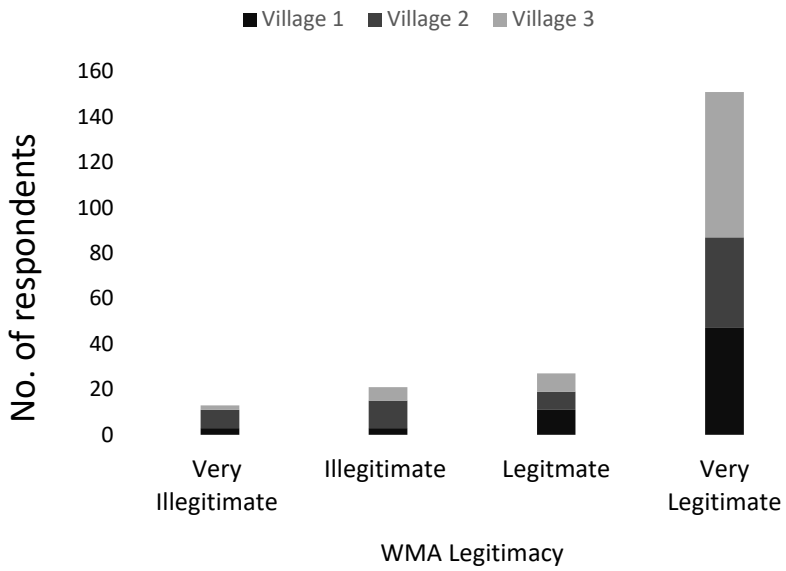

Figure A3.1: Frequency of respondents who assigned each level of legitimacy to the WMA, by village.

Literature search:

Google Scholar search: Keywords: “Enduimet”

Results 64.

Book chapters: 6, Conferences papers: 3, Reports: 12, Published papers: 27, Thesis and dissertations: 16

Website sources:

Honeyguide: https://www.honeyguide.org/news/saving-elephants-simple-solutions/ (accessed 10/10/2018)

The Nature Conservancy (TNC): https://www.nature.org/en-us/about-us/where-we-work/africa/stories-in-africa/keeping-wide-open-spaces-for-elephants/ (accessed 10/10/2018)

Enduimet Tourism: http://enduimet.org/kilimanjaro-amboseli/ and http://enduimet.org/ (accessed 09/10/18),

African Wildlife Foundation (AWF): https://www.awf.org/news/introducing-african-heartlands (accessed 10/10/2018).

Tanzanian Tourist board (http://www.tanzaniatourism.go.tz/destination/enduimet-wma (accessed 09/10/18)

Tanzanian Wildlife Research Institute (TAWIRI) http://tawiri.or.tz/research-documents/reports/ (accessed 09/10/2018)

Appendix 4

Game design

At the start of each game the information sheet was read out to the group of four participants in both English and Swahili (and Maa if necessary). Then, each round, players were endowed with five plastic tokens to represent five bags of crop on their 'farm' on the board. Three elephant figurines were placed on the board to represent the local elephant population. Depending on the treatment, four pawns (green for WMA, red for Moran) were also placed on the board to represent the elephant guarding group (Figure A3.1). Players made their cooperation decisions anonymously and in private by each placing a token into one of two concealed cups. We did not use written decision sheets due widespread illiteracy, and the desire to maximise the speed, simplicity and engagement of the game. The cup representing contributions to the guarding group changed in colour by treatment (green for WMA, red for Moran). Players were allowed to talk to each other during the game, but not with regards to their decisions and not during decision making. After all the decisions were made, the total amount of guarding contribution was made known to the group and represented by the number of guarding pawns moved onto the board. If only one player contributed a token towards the guarding effort, only one guarding pawn would then be moved onto the board. If two players contributed, then two pawns would be moved onto the board and so on.

To determine whether they individually incurred crop-raiding damage, each player then rolled a six-sided dice. This approach follows previous games (e.g., Hasson et al. 2010) in incorporating risk uncertainty into the public good dilemma. A roll of four, five or six incurred no damage, and a roll of one, two, or three incurred damage. The level of damage in terms of lost tokens, was proportional to the total guarding contribution of each round. If no players contributed to the guarding pot (public good), then any player who incurred crop-raiding, would lose five tokens. If one player had contributed to the guarding pot, then any player incurring crop-raiding would lose four tokens. If two players contributed, crop-raiding damage would be three tokens, with three contributors two tokens and if all four players contributed, each would be at risk of losing only one token. Each game was played for five rounds so that cooperation could be compared across rounds, and to see if it responded to crop-loss or the decisions of other players. Group composition was thus known to all players and kept constant. At the end of each round a player could discern how many players in the group cooperated, but at no stage would they know who made which decisions. Players' individual decisions were not disclosed to other participants at an

stage. Participants were paid 5,000Tsh for participating. To include real monetary incentives, participants were also paid an additional amount (max, 6000Tsh) which was linearly proportional to the number of tokens they individually amassed. On average participants left with 8-9000Tsh (3.5-4 USD) which was deemed in consultation with village leaders a suitable amount to compensate for any loss of earnings and time at the market rate – average income per adult in the district is estimated at just 0.16 USD per day (Homewood et al., 2012). Each player played both treatments with a short break in between, and the order of treatments was rotated between groups. The game instructions were kept the same each game except for which organisation was described as carrying out the guarding. The game instructions regarding public-good contribution used a positive externality framing, which focuses on the benefits of cooperating for others rather than the costs of not cooperating for others. In utilizing a framing experiment, our study also builds on previous studies which use framing experiments to explore sensitive support for different groups involved in armed conflict (Blair et al., 2014).

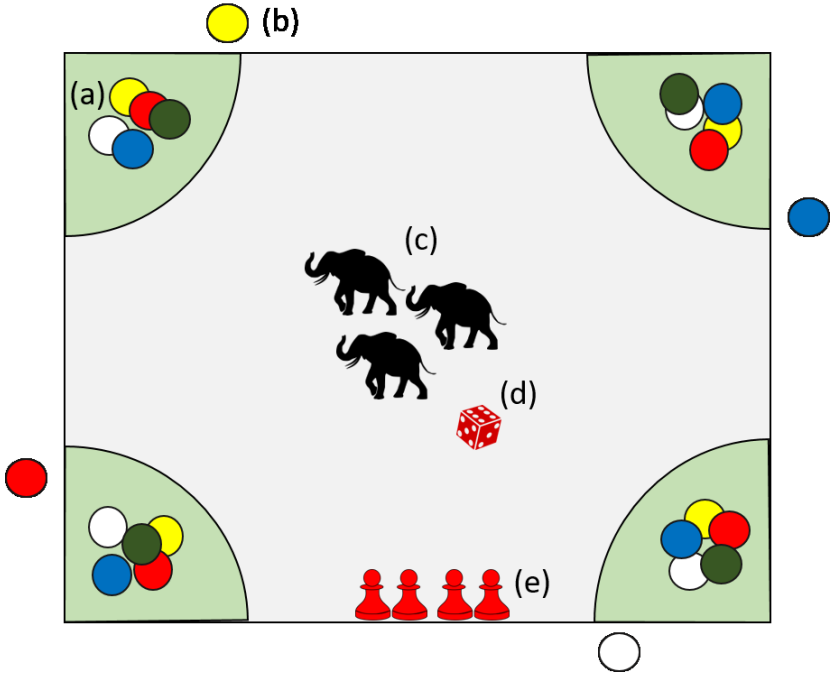

Figure A4.1: A diagram of the game, illustrating the 'crop tokens' (a), the 'resource token' (b), the elephant figurines (c), dice (d), and the guarders (pawns) (e).

Participant recruitment

To minimise variation across sites in the WMA, we chose three, predominantly Maasai villages which display a similar mix of pastoralism and agriculture. The three villages selected were chosen on the basis that they each included both pastoralists and agriculturalist, had suitable facilities in which to play the game, and well represented the range of environments in the region. Time and resources in the field limited the total number of villages and participants. Participants were selected from a village list of inhabitants (n=80-100) known to be present at the time of the study, using a random sequence generator (https://www.random.org/sequences/) to dictate the order of participants. This list was created in consultation with the chairperson and assistant chairperson of each sub-village. Included within each list were people from the full range of age categories and from different families. Whilst participants came from multiple sub-villages, some would have inevitably known each other. Where participants failed to respond or arrive, the next or closest available individual on the list was recruited in their place. In one village participants could only be reached via the village chairperson making randomization harder to achieve, so we relied on the chairperson to ensure that participants were recruited from across the various sub-villages, and from different homesteads.

Data collection

Each participant was surveyed using a structured interview before each game (see Survey Sheet), and we also conducted group and individual debrief interviews after game. The survey included a range of sociodemographic questions including age, education, wealth and occupation, as well as other questions asked background information and to inform other research questions. The three categories of trustworthiness – ability, benevolence and integrity - were each measured using a four-point Likert type questions (following World Values Survey 2008) and these were also aggregated to get an aggregate trustworthiness score. Dispositional trust and perceptions of the WMA legitimacy were also measured in separate questions. All trust-related questions were adapted from the World Values Survey (World Values Survey, 2008) and reflected aspects of positive trust (Stern and Baird, 2015). The survey also included questions to determine levels of elephant-related damage and four measures of elephant tolerance (spatial, damage, killing and population) adapted from Kansky et al. (2016). To ensure that the trust-related questions were consistent across translations (into Maa and

Swahili) the research team (led by a native English speaker with moderate Swahili and two local research assistants fluent in English, Maa and Swahili) used a process of back-translation, deliberation and refinement during the final survey-design process to determine the appropriate wording in each language. During pilot-testing, respondents were asked to elaborate upon how they interpreted the questions (as well as the game instructions) to ensure their appropriateness. The surveys were then administered orally with consistent translations using the same research team throughout. Where respondents asked for clarifications, consistent explanations were used throughout. During both the pre-game survey and post-game interviews, responses were translated orally back into English and recorded by the lead researcher. This meant that any extra detail given by respondents during the survey was captured, which helped contextualise answers and confirm that respondents were addressing the intended concepts (particularly regarding the specific components of trustworthiness). Initially we only carried post-game group interviews with the intention of facilitating discussion of both the realism of the game, the conflict in general, and the different reasons why participants supported guarding from each group. Although these interviews did reveal relevant insights (e.g., Figure A3.8), we found that some individuals dominated discussions and were concerned that some respondents may have been agreeing with the general sentiment of the group rather than sharing their own opinions. Hence, after collecting a sufficient sample of group interviews (n= 20, 80 participants), we switched to carrying out individual post-game interviews (132 participants), which focused on individuals' motivations for their game behaviour.

Data analysis

To analyse game behaviour, we used generalised linear mixed effects models. These estimate the independent effects of each predictor variable (such as treatment, trustworthiness, wealth and age) on the response variable (an individual's summed cooperation over five rounds). Mixed-effects models can also account for the variation expected between different individuals, and between different groups. By including 'group' as a random effect in the models, we can account for the possible effect that, within any one group, the cooperation behaviour of other group members is likely to influence any given participant. The order of treatment and timing of the game were controlled for, and variable covariance was checked. All explanatory variable scores were generated from the survey.

Ability, benevolence and integrity are considered three components of the underling concept of trustworthiness (Stern and Coleman, 2015). Hence, during analysis we aimed to test each both component separately, and test a general trustworthiness score. Pearson's correlation coefficients between each of the three variables (Ability-Benevolence 0.57, Ability-Integrity 0.49, Benevolence-Integrity 0.50) indicate that they are partly, but not

so highly correlated as to prevent inclusion in multiple regression analyses. However, to determine whether the three components also reflected one underlying latent 'trustworthiness' variable, we estimated their internal consistency by calculating Cronbach's alpha (Tavakol & Dennick 2011) (with the R package "ltm") and conducting factor analysis (with the R package 'nFactors'). The Cronbach's alpha found for the three components of trustworthiness (0.77, 0.95 CI: 0.73-0.80) indicates an acceptable level of internal consistency for aggregation, and the results of factor analysis suggest the presence of one underlying latent factor (Figure A3.2). To generate the aggregate score, we first standardised the three individual components (to create 'Z' scores) using the 'scale' function in 'R'. We then 'weighted' each of the three components using the 'loadings' generated for the primary factor during factor analysis (Table A3.1) and then summed these weighted 'factor scores' together.

As the four measures of elephant tolerance were intended to form an index (Kansky et al., 2016) we carried out the same process as above to generate a aggregated tolerance score. The more moderate Cronbach's alpha for tolerance (0.65, 0.95 CI: 0.57-0.71) suggests a lower level of internal consistently but like for trustworthiness, the results from factor analysis (Figure A3.2) suggest the presence of one underling latent factor. Hence, we used the aggregate tolerance score in our analysis, which again was generated from the weighted 'factor scores'. Despite the Cronbach's alpha for tolerance being low, we included tolerance in our models because this score is within the range deemed acceptable by some (Taber 2018) and because the tolerance measures were taken from a previously validated tolerance framework (Kansky et al. 2016). For the purposes of regression analysis, the variable 'crop-loss' reflected the annual number of crop bags lost to elephants plus one (to avoid zero values in predictor variables). There were a few (n= 6) missing response for crop-loss and we deemed this measure a more reliable and useful indicator of crop loss than the question which asked participants to estimate what proportion of their annual crop they lose to elephants. Hence, in Models 3, 4 and 5 the sample size was slightly reduced (n=206) due to these missing responses for crop loss. In all models (Figures A3.4-A3.7), the timing of the game was not significant, but cooperation was significantly lower in games in which the WMA treatment came first ($p < 0.01$, odds ratio 0.32, 0.95 CI: 0.14-0.69) (Model 1).

The scores for dispositional trust and perceptions of the legitimacy of the WMA (an intended proxy for procedural trust) were also included in additional models. However, they were not found to be significant, which may have reflected a low degree of variability in responses to these questions (82% of respondents categorised themselves as generally not trustful of others, and 71% of respondents perceived the WMA as 'very legitimate'). For these reasons and because, upon reflection, we did not have strong confidence that these two simple questions were good measures of either dispositional or procedural trust, we did not include them in our final models. Debriefs were analysed using directed content analysis. New reasoning categories were added until we could no longer add new categories (n=18). We then collapsed this larger list into a small number of

reasoning themes (n=5) which included the three components of trustworthiness (ability, benevolence and integrity). The results of the group-debriefs (Figure A3.8), correspond closely to those of the individual-debriefs (Figure x.2) and pre-game survey which found greater perceptions of the ability, benevolence and integrity of Moran over the WMA (Table x.2).

Table A4.1: Components of aggregated trustworthiness and tolerance scores and their weighting (from Factor Analysis)

Component	Weighting
Trustworthiness	
Ability	0.75
Benevolence	0.76
Integrity	0.66
Tolerance	
Presence	0.64
Crop loss	0.38
Lethal action	0.57
Population size	0.59

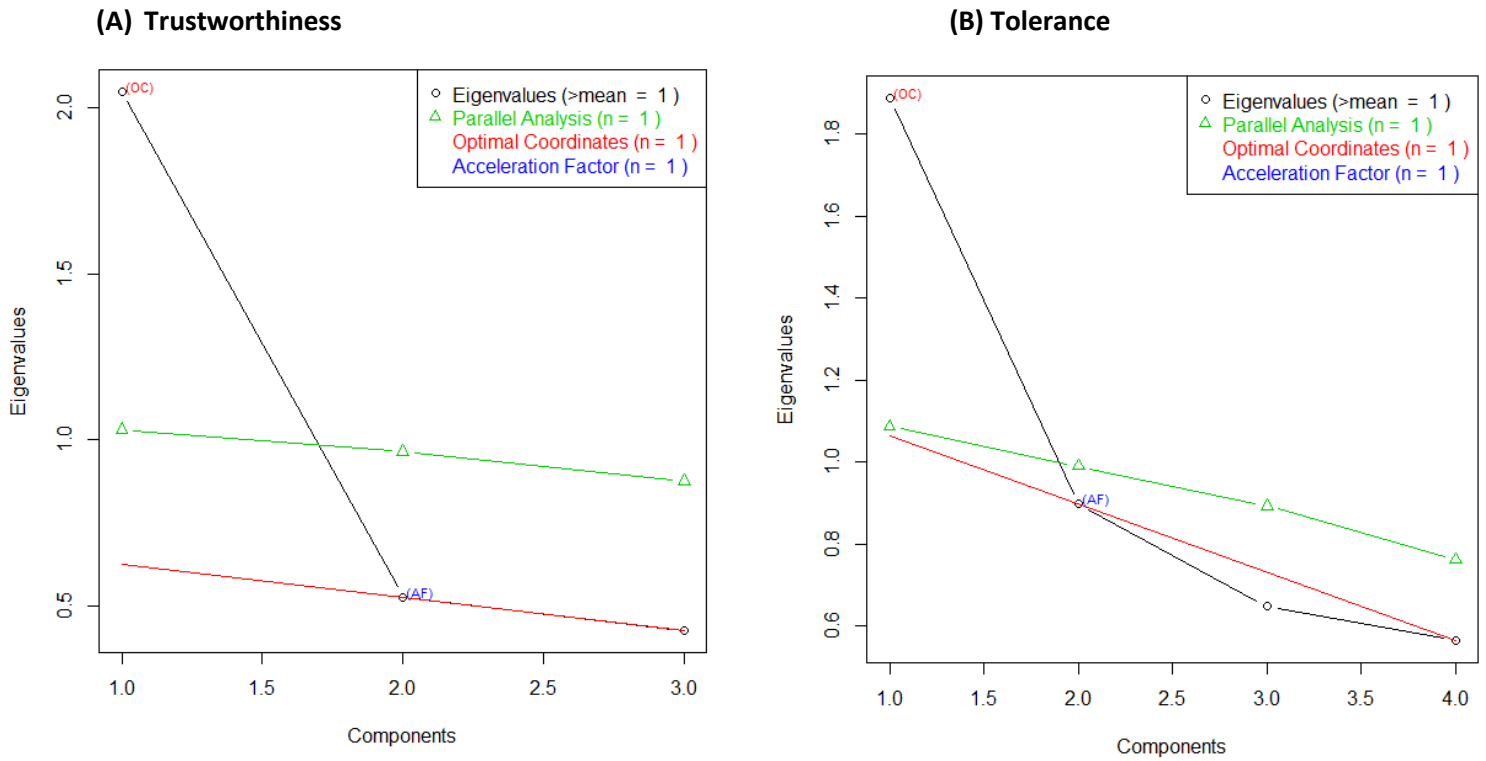

Figure A4.2: Scree test results from Factor Analyses on the three components of trustworthiness, indicating the prevalence of one key underlying latent factor (one factor with eigenvalue > 1) for (A) trustworthiness, and (B) tolerance.

Additional results

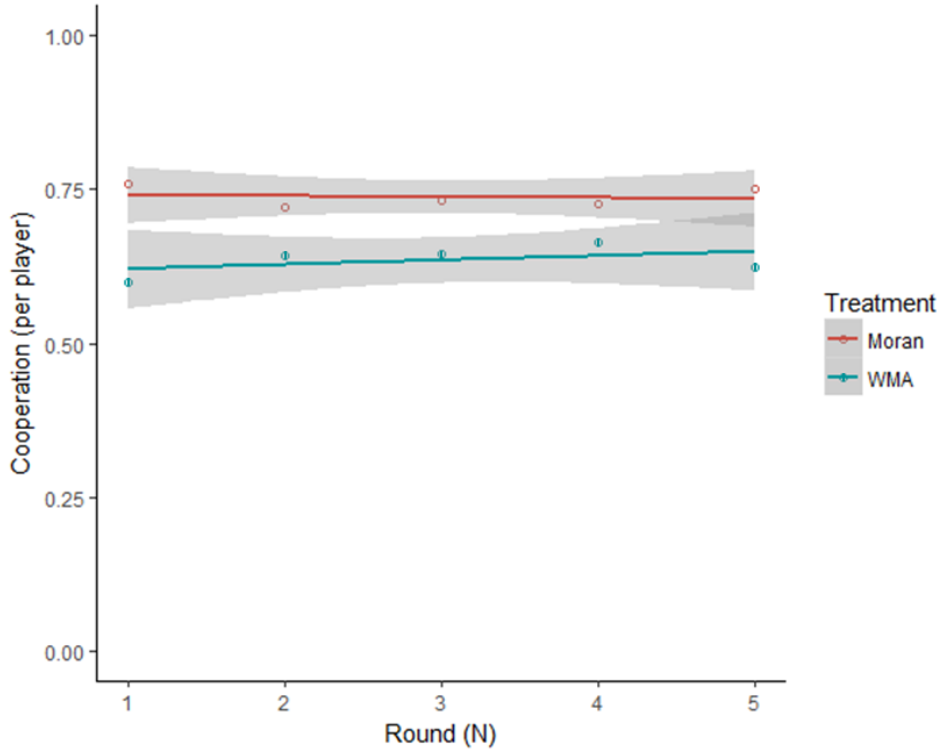

Figure A4.3: Estimated cooperation per player in the public goods game, by treatment (colour, shape) and by round, with shading indicating 95% Confidence Intervals for estimations from linear regressions.

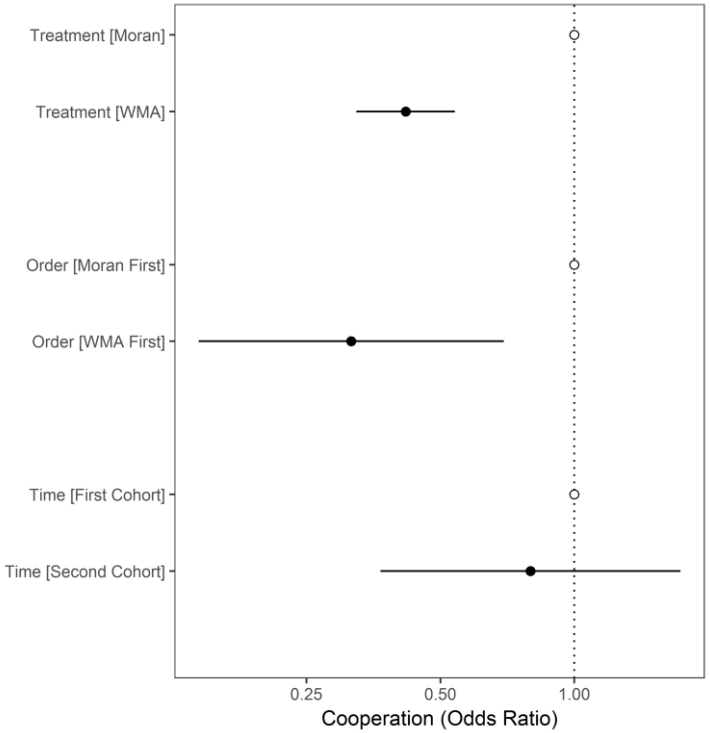

Figure A4.4: Results from a generalised linear mixed effects model, showing the estimated conditional effects of each predictor variable on cooperation within games (Model 1). Filled dots represent model coefficient estimates converted to odds ratios, which show the expected change in likelihood of cooperation when each continuous variable increases by a unit of one, or when each factor variable changes level from a baseline (unfilled dots). Whiskers represent standard errors (95% CI), and variables with whiskers that do not cross zero are those predicted by the model to associate with cooperation (effect size is distinguishable from zero). Larger odds ratios indicate greater predicted strength of association.

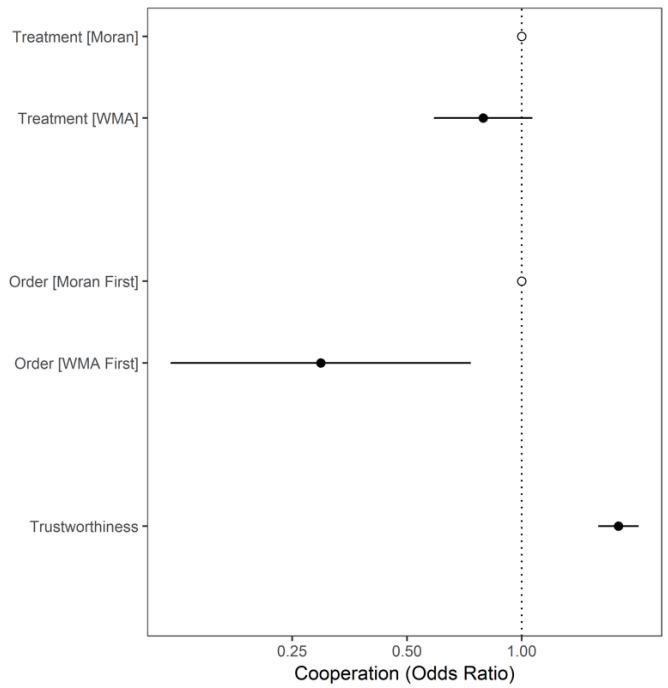

Figure A4.5: Results from a generalised linear mixed effects model, showing the estimated conditional effects of each predictor variable on cooperation within games, with trustworthiness included (Model 2). Filled dots represent model coefficient estimates converted to odds ratios, which show the expected change in likelihood of cooperation when each continuous variable increases by a unit of one, or when each factor variable changes level from a baseline (unfilled dots). Whiskers represent standard errors (95% CI), and variables with whiskers that do not cross zero are those predicted by the model to associate with cooperation (effect size is distinguishable from zero). Larger odds ratios indicate greater predicted strength of association.

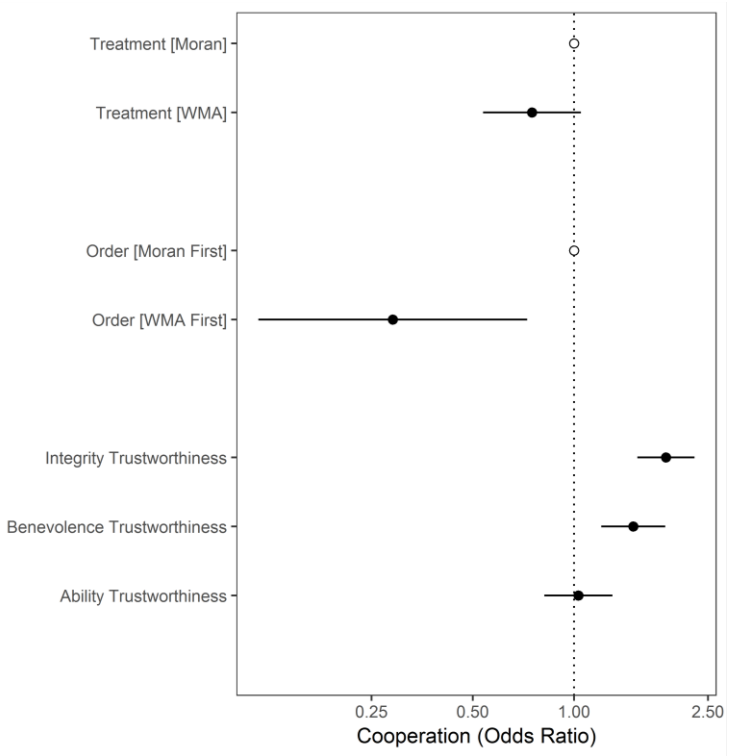

Figure A4.6: Results from a generalised linear mixed effects model, showing the estimated conditional effects of each predictor variable on cooperation within games, with the different components of trustworthiness included (Model 3). Filled dots represent model coefficient estimates converted to odds ratios, which show the expected change in likelihood of cooperation when each continuous variable increases by a unit of one, or when each factor variable changes level from a baseline (unfilled dots). Whiskers represent standard errors (95% CI), and variables with whiskers that do not cross zero are those predicted by the model to associate with cooperation (effect size is distinguishable from zero). Larger odds ratios indicate greater predicted strength of association.

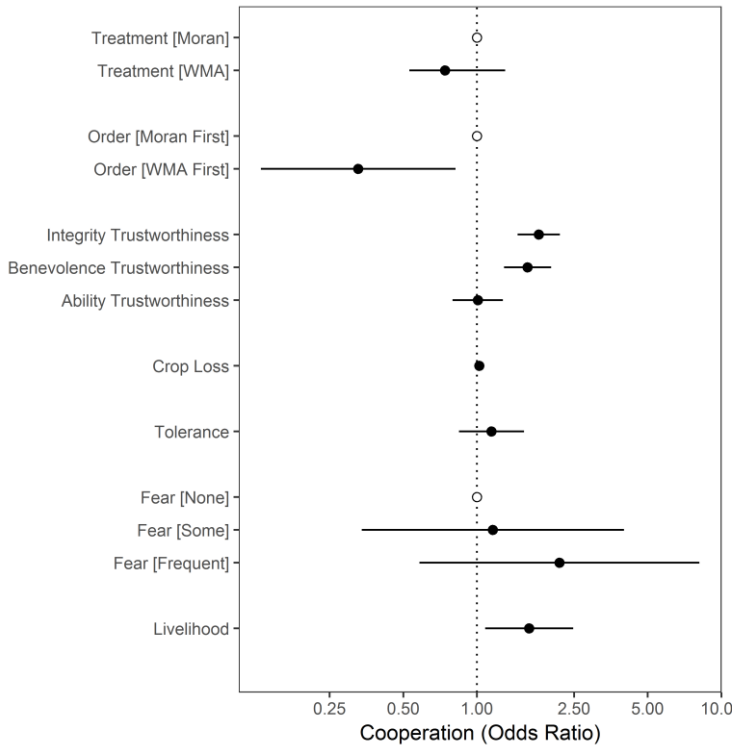

Figure A4.7: Results from a generalised linear mixed effects model, showing the estimated conditional effects of each predictor variable on cooperation within games, with the different components of trustworthiness and *a priori* predictors of cooperation included (Model 4). Filled dots represent model coefficient estimates converted to odds ratios, which show the expected change in likelihood of cooperation when each continuous variable increases by a unit of one, or when each factor variable changes level from a baseline (unfilled dots). Whiskers represent standard errors (95% CI), and variables with whiskers that do not cross zero are those predicted by the model to associate with cooperation (effect size is distinguishable from zero). Larger odds ratios indicate greater predicted strength of association.

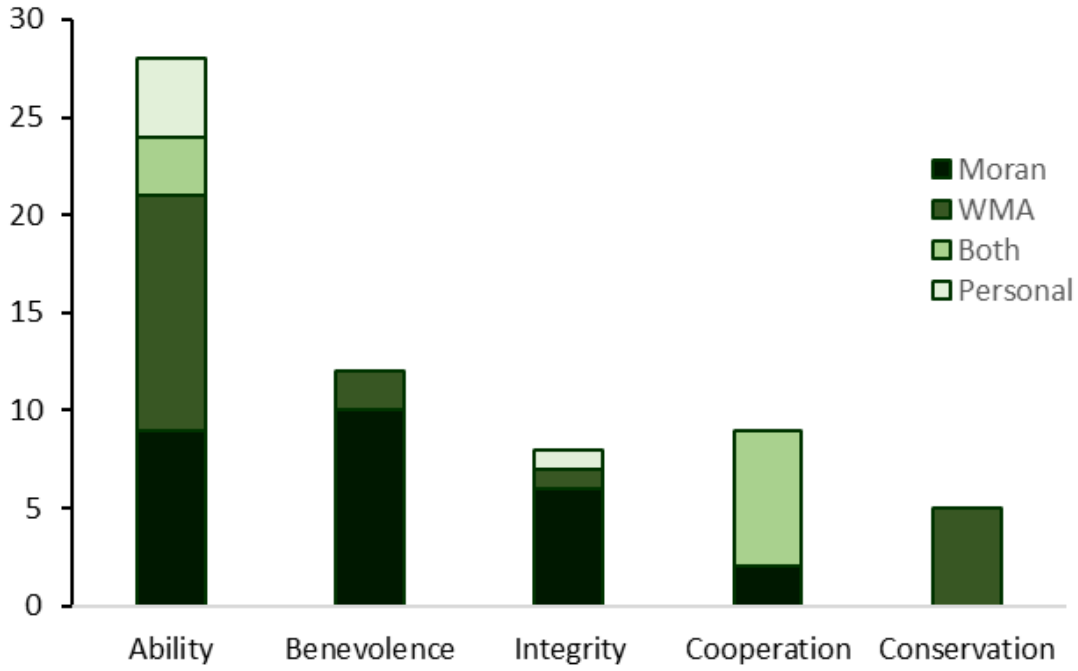

Figure A4.8: The frequency of different reasoning types given during post-game group debriefs (n=20) when discussing the merits of different guarding groups and cooperation with them, related to: the ability, benevolence or integrity of participants or the intervening groups (bar colour), the benefits of cooperation generally, or concerns related to wildlife conservation.

Survey sheet

Demographic

1. Wealth

- ☐ Very Poor
- ☐ Poor
- ☐ Not Poor
- ☐ Rich

2. Age set

- ☐ Moran (18-25)
- ☐ Junior Elders (25-35)
- ☐ Middle Elders (35-55)
- ☐ Senior 55+

3. Formal education

- ☐ None
- ☐ Primary
- ☐ Secondary
- ☐ University or college

4. Livelihood

- ☐ Pastoralist only
- ☐ Pastoralist mainly, some crops
- ☐ Half livestock, half crops
- ☐ Crops mainly, some livestock
- ☐ Agriculturalist only
- ☐ Other

5. Head of household?

- ☐ Yes
- ☐ No

6. Do you use MPESA (or equivalent)?

- ☐ Yes
- ☐ No

7. Do you have a social media account (like Facebook or WhatsApp?)

- ☐ Yes
- ☐ No

8. Community leadership position? (village chairman, sub-village chairman, AA/CBO council members)

- ☐ Yes
- ☐ No

9. Employed by WMA? (management, village game scouts, field assistants)

- ☐ Yes
- ☐ No

Wildlife Impacts

10. Does your household usually lose any crops to elephants each season? If so how many bags?

- ☐ None
- ☐ Number:

What proportion is this?

- ☐ None
- ☐ 1/4
- ☐ 1/2 or less

- ☐ 3/4 or less
- ☐ 3/4 or more

11. Do elephants make you fear for your or your family's safety?

- ☐ Never
- ☐ Sometimes
- ☐ Often

12. Have you or your family ever been injured by elephants?

- ☐ No
- ☐ Yes

13. Did your household received any help from the WMA to protect you and your livelihoods from elephants in the last 12 months?

Equipment (e.g., chili bombs or torches)

- ☐ No
- ☐ Some
- ☐ Sufficient

Wildlife patrols

- ☐ No
- ☐ Some
- ☐ Sufficient

Compensation

- ☐ No
- ☐ Some
- ☐ Sufficient

Trust and Trustworthiness:

14. Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people?

- ☐ Most people can be trusted
- ☐ Need to be very careful

15. Ability: "Generally, how effective are each group at protecting you and your village against elephant damage?"

	Highly effective	Effective	Ineffective	Very ineffective
WMA				
Moran				

16. Benevolence: "How much do you think the following groups care about protecting you from elephants?"

	High care	Some care	Little care	Very little care
WMA				
Moran				

17. Integrity: "When each group says they will help you, how much do you believe what they say?"

	High belief	Some belief	Little belief	Very little belief
WMA				
Moran				

18. Legitimacy: "How legitimate is the WMA?"

	Highly legitimate	Legitimate	Illegitimate	Very illegitimate
WMA				

Wildlife Tolerance

19. Spatial - How many days per week would think it is okay to have elephants around your village?

- ☐ No days
- ☐ 1 day
- ☐ 2 days
- ☐ 3 days
- ☐ 4 days
- ☐ 5 days
- ☐ 6 days
- ☐ 7 days

20. Damage – How many bags of your annual crop would you find acceptable to lose to elephants?

- ☐ None
- ☐ No. bags =

21. Killing – Do you think an elephant should be killed (by the WMA/government) if?

- ☐ 1…..it is seen in the bush far away from any village or houses or livestock or agricultural crops.
- ☐ 2…...it is seen in the vicinity of where agricultural crops are growing.
- ☐ 3…...it has injured or killed a domestic animal or has raided some houses or agricultural crops for the first time.
- ☐ 4……it causes repeated problems for you and your community but has never harmed a person.
- ☐ 5…..it has threatened a child or adult human.
- ☐ 6…..it has injured a child or adult human.
- ☐ 7….it has killed a child or adult human

22. Population – what population size of elephants are you a willing to accept?

- ☐ None
- ☐ Less than half

- ☐ Half
- ☐ Current
- ☐ More than current

Interventions

23. Would resources (money, equipment, training) for guarding village crops and people against elephants be more effective if supporting the:

- ☐ WMA
- ☐ Moran
- ☐ Yourself

24. During the harvest season, how many nights a week do you help guard you own household's crops?

- ☐ Never
- ☐ 1 day
- ☐ 2 days
- ☐ 3 days
- ☐ 4 days
- ☐ 5 days
- ☐ 6 days
- ☐ 7 days

25. During the harvest season, how many nights a week do you help guard village crops besides your own?

- ☐ Never
- ☐ 1 day
- ☐ 2 days
- ☐ 3 days
- ☐ 4 days
- ☐ 5 days
- ☐ 6 days
- ☐ 7 days

26. How much do you think people in your village cooperate with each other to guard each other's crops?

- ☐ Very often
- ☐ Often
- ☐ Not very often
- ☐ Never

27. How willing are you to cooperate with the WMA to help reduce elephant damage and conserve elephants?

- ☐ Not at all
- ☐ Not very willing
- ☐ Willing
- ☐ Very willing

28. Moran would be effective guarders against elephants if they were trained and given more resources

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Agree
- ☐ Strongly agree

29. Are you aware of Honeyguide? (the local operating wildlife NGO)

- ☐ Yes
- ☐ No

30. Have you seen the Honeyguide cinema? (a wildlife mitigation film screened in villages the previous year)

- ☐ Yes
- ☐ No

Information Sheet

Introduction

Thank you for giving up your time today to participate in this research. As mentioned, this group has been randomly chosen from a list of available participants in the village (provided by the village Chairman) and so there is no significance as to who else you are here with. Before we start, we would like to explain the game. We will then play a short practise and we will answer any questions you might have. In total we will play for about one hour. You do not have to play the game and you are free to leave at any time if you wish. You will receive a payment (5,000Tsh) at the end of the game to compensate you for your time. We will also be playing games for cash and so any money that you receive in the game is yours to take home. The extra amount you take home will be up to 6,000Tsh and will be dependent on how many tokens you have left at the end of the game. One token= 100Tsh, thirty tokens = 3,000Tsh. The money for these games has been supplied to undertake scientific research. Now we will explain the rules of the game. If you have heard from others who have already played the game, do not listen to what they have told you as this may not be correct, and the games may be different this time.

Explanation *(insert WMA/Moran depending upon treatment order)*

As you can see you are in a group of four players. This board <point to board> represents the area around your village <point to each corner>. Each corner in green represents your individual farm of crops <Point to elephant figurines in the middle>. These figurines represent elephants <point to elephants>. These five tokens <point to tokens> each represent one bag of crop. This additional one token <point to separate token> represents an additional sum of resources. These figures <point to either WMA or Moran figures> represent <insert WMA or Moran> who help guard your crops from the elephants.You will play the game for five seasons. Each season there is a 50:50 chance that the elephants will raid your crops. To determine whether they do, you each will roll this dice <point to six-sided dice> and if it lands on a one, two or three, <point to numbers> the elephants will come and raid your crops. If it lands on four, five or six <point to numbers>, you will be safe and the elephants will not come <demonstrate dice roll>.

Each season you can make a private and anonymous decision to keep the additional one token of resource for yourself <demonstrate placing token into private pot> or to contribute the resource to the <WMA/Moran> <demonstrate placing token into public pot>. The number of <WMA/Moran> is dependent upon how many tokens in total this group gives to the <WMA/Moran>. One token= one <WMA/Moran>, two tokens = two

<WMA/Moran>, three tokens = three <WMA/Moran> and four tokens = four <WMA/Moran>. The amount of bags of crops that the elephants eat is dependent on how many guarders there are. If there are no <WMA/Moran>, you will lose all 5 bags if the elephant crop-raid. If there is one <WMA/Moran> you will lose four bags. If there are two <WMA/Moran> you will lose three bags. If there are 3 <WMA/Moran> you will lose two bags and if there are four <WMA/Moran> you will lose one bag.

Therefore, each round if you keep the resource for yourself, you will receive the value of it at the end of the game. But, if you contribute it to the <WMA/Moran> you will not keep it, but the damage caused by elephants will be reduced for yourself and each other player due to your contribution. You will make your decision in private, by placing your token in either your private pot or the <WMA/Moran> pot when others cannot see you. Each player will take it in turn to do this, but will not know what the other players have decided to do. We will record your decisions privately and will not reveal them at any stage. The total number of <WMA/Moran> will then be determined according to the total number of contributed tokens. Each player will then roll the dice to see whether elephants come to their farm. If they do, the amount of bags lost will be dependent on how many <WMA/Moran> there are that season. After each player has rolled (and crop-raided tokens removed) each player can harvest their crops and put them into their private pot. We will record how many tokens you harvest, so that we know how much to pay you at the end of the game. But you can also keep the tokens in your private pot so that you can count them privately at the end if you wish to confirm. You are free to talk to each other during the games but please do not talk about your decisions. We will play this game for five seasons. We will then have a short break and then play a different game. We will now practise the process of making your private decision. In the first practise everyone will put in to the <WMA/Moran> pot and in the second everyone will put into their private pots.

[carry out practise]

Before we start the first season, does anyone have any more questions?

[answer questions]

[commence game]

Thank you for playing this first game. Now you can take a quick break. Please refrain from discussing your decisions with each other or talking about how to play in the game. This will compromise the game for the research and if this happens we might have to stop the game early.

Second game

I hope you had a nice break. We will now play the second game. This game is like the first game, but this time you have the choice of either keeping the resource for yourself or contributing it to <WMA/Moran> who are the ones carrying out the guarding from elephants.

<demonstrate same pay-off structure>

[commence game]

[finish game]

Debrief

Thank you very much for playing both of these games. Before we give you your individual payment we would like to have a short discussion with you about the game.

[commence debrief].

Payment

Please wait outside and we will call you in individually to pay you according to how many tokens you accumulated in the game. Please do not share this value with the other players or anyone else and please refrain from telling other people how you played in the game, or how other players should play in the game, as this may compromise our research. Thank you very much again for coming today and if you have any questions please get in touch <show contact details>

Appendix 5

Data collection:

We conducted three key-word searches between January and March 2018. This timing aimed to capture reaction to the changing US policy regarding the import of elephant parts from certain African countries to the US (Batavia et al., 2018). Three searches were conducted in the sampling period, chosen at times to capture reaction to news and media items, rather than conducted randomly. Each search collected tweets from the preceding 10 days. To restrict our sample to just US-based users, we included a location-based filter during the search, and also manually removed any users in the sample who stated their location as non-US based. As the method to estimate political ideology requires each user to follow at least one known US 'political account', users who did not follow at least one such account were removed from the sample.Relevant tweets were classified as those explicitly or contextually referring to the recreational hunting of terrestrial African mega-fauna, or those responding to other tweets, media or petitions, policies covering this topic. 'Non-relevant' tweets included those with a focus that was too ambiguous to decipher, those referring to the hunting of other (e.g. non-African or marine) species and those referring to other topics (e.g., computer gaming).

To calculate the estimated sample size needed to identify the predicted order of effect size, under suitable power, we conducted a power calculation using the 'R' package 'pwr'. Our initial estimation found that we would need to sample at least 322 individuals in each of the three groups, to have at least an 80% probability of finding an effect size of 0.1 (a difference in political ideology estimate means of 0.5). Having found during preliminary analysis that 'anti' tweets appeared approximately at a frequency 10 times greater than 'pro' tweets (and five times greater than 'neutral' tweets) we predicted we would need to analyse a sample in the order of 3,000 individual users. As our final sample of unique users with relevant tweets came to 4,241, we deemed this sample size appropriate.

Searches:

1st search = 30/12/17 – 09/01/18, 1,475 tweets (587 replies)
2nd search = 25/01/18- 15/01/18, 672 tweets (240 replies)
3rd search = 17/02/18 – 07/02/18, 3,116 (1,354 replies)

Analysis

We individually analysed the content and context of each tweet by reading the text and following the hyperlink to the original tweet – which shows any images, links, or images (including emoticons) associated with the tweet, the user profile, and the thread of tweets that the tweet may be included (e.g, replies to other users). We coded tweets firstly as being relevant to the trophy hunting of terrestrial African megafauna (to include in the sample). We then categorised each tweet according to a pre-developed coding system – which we developed using directed content analysis (Hsieh and Shannon, 2005) through analysing the first 300 tweets of the sample (sorted temporally).

Political Ideology Estimation

The general population of Twitter users is normally distributed along the middle of the axis (ideology estimate of zero), and triangulation with known real-world political ideologies, from voting and party record, finds this method is effective at identifying between US-based liberals (more negative scores) and conservatives (more positive scores) for both politically active users and politicians (Barberá et al., 2015). We checked this for ourselves by applying the method to a randomly selected sample of US-bases Twitter users (n=8,323) and found the result to be consistent (Figure A5.1). To generate this sample we used the tweet collector function in the package 'StreamR', filtering all tweets posted at that time for only tweets from the US, and the 'timeout' function so as to collect approximately 10,000 tweets (which we deemed a sufficient sample size for analysis due to the computation demand of analysis). In total we collected 11,432 tweets, of which we were able generate ideology estimates for 8,323 users. We ran the search once during the data analysis phase of the research project, in December 2018 at noon, US Central Time on a weekday – which we have no reason to believe should be unrepresentative of the general population of US Twitter users.

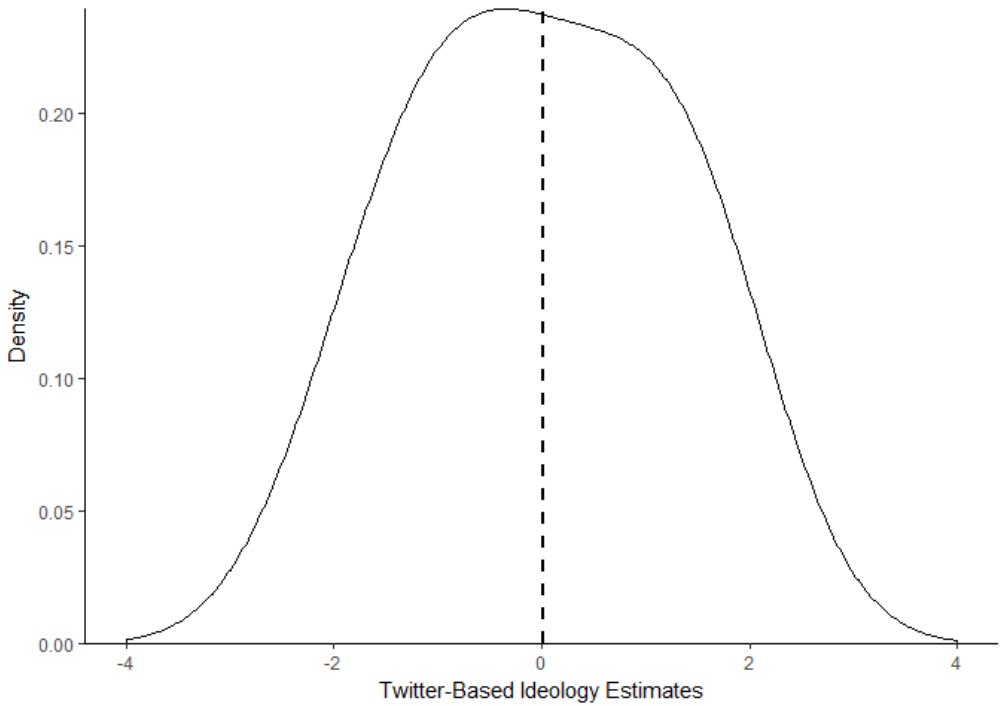

Figure A5.1: Density plot showing the estimated political ideology scores of a randomly selected sample of Twitter users (n=8,323), with average score indicated by the dotted line. Positive estimates indicate more conservative ideology, and negative estimates indicate more liberal ideology.

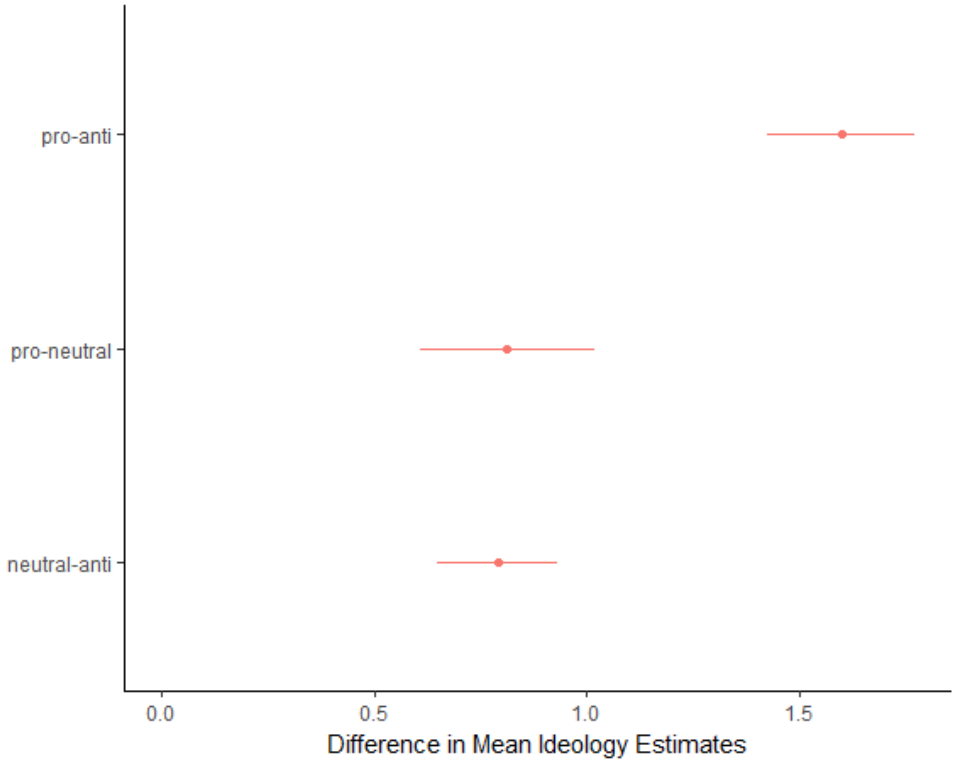

Figure A5.2: Results from Tukey's Honest Significant Difference test indicating the difference in mean political ideology estimates between users grouped by position on trophy hunting (with 95% Confidence Intervals).

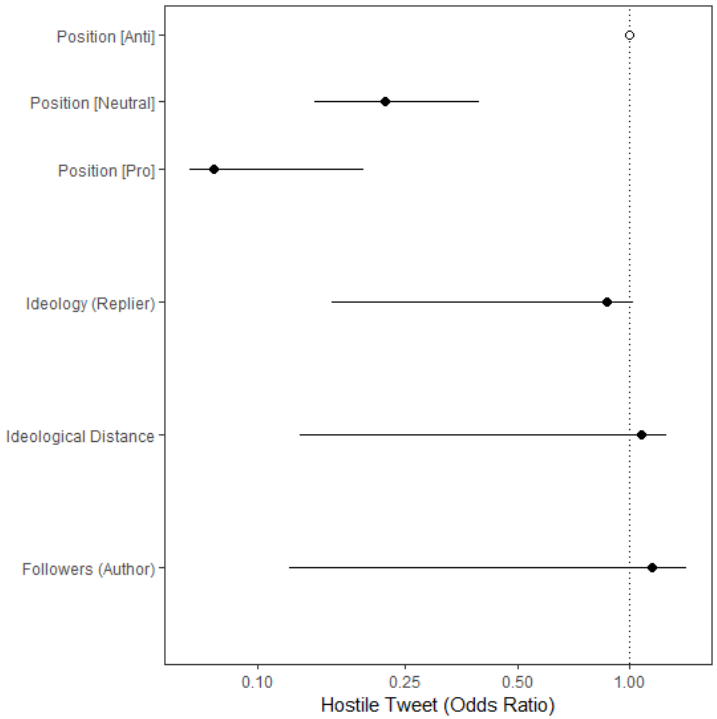

Figure A5.3: Results from a generalised linear mixed effects model, showing the estimated conditional effects of each predictor variable on tweet hostility. Filled dots represent model coefficient estimates converted to odds ratios, which show the expected change in likelihood of a tweet being hostile when each continuous variable increases by a unit of one, or when each factor variable changes level from a baseline (unfilled dots). Whiskers represent standard errors (95% CI), and variables with whiskers that do not cross zero are those predicted by the model to associate with tweet hostility (effect size is distinguishable from zero). Larger odds ratios indicate greater predicted strength of association.

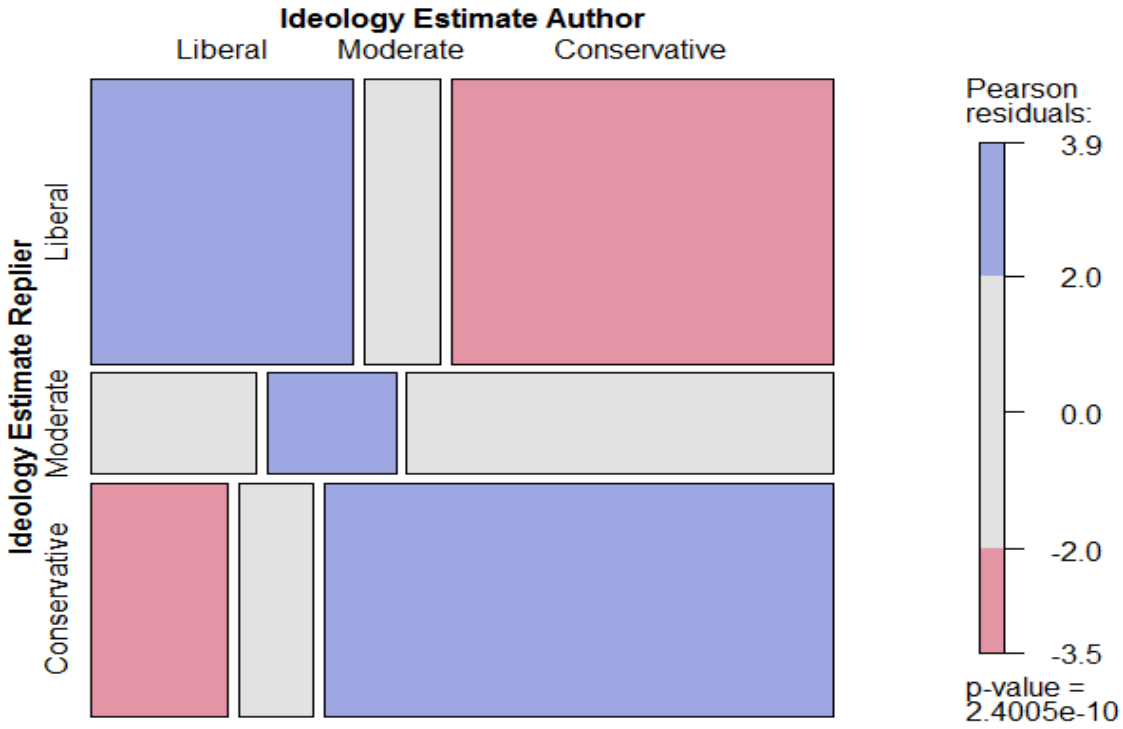

Figure A5.4: A mosaic plot depicting the association between the estimate political ideology (liberal, moderate, conservative) of tweet authors, and repliers colour-coded by Pearson's residual values. Blue cells indicating significantly more observations than would be expected under independence (positive association), red cells indicating fewer observations than would be expected (negative association). Box size is proportional to the observed frequencies of each cross-classification.

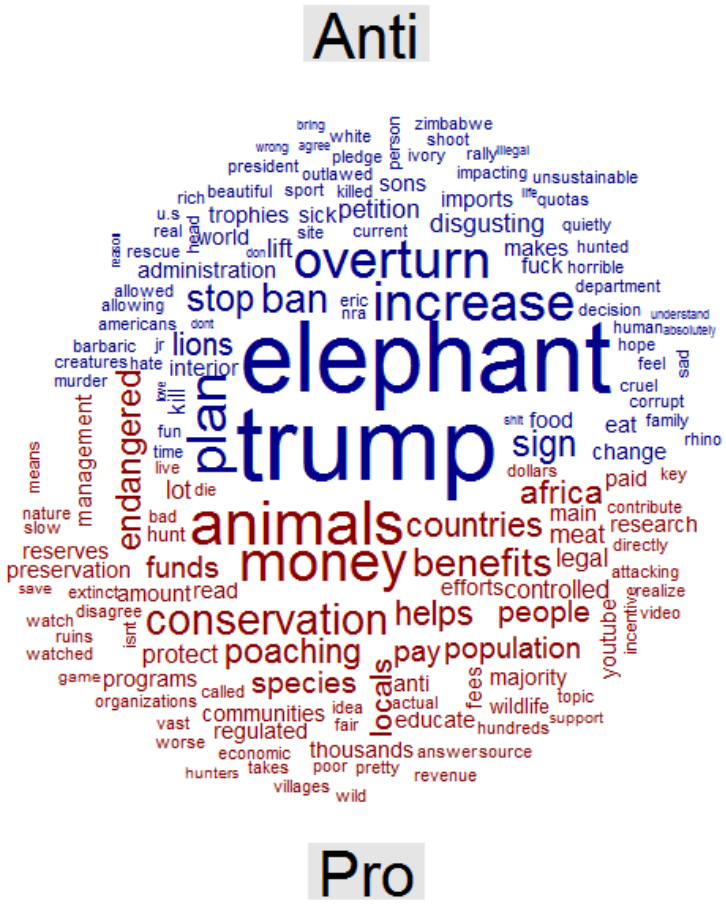

Figure A5.5: Word cloud demonstrating the most popular words used to support tweets in favour of trophy hunting (bottom) and against (top), with word frequency proportional to word size.