Paying for the presence of predators: conservation performance payments in theory and practice

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I confirm that the work submitted is my own, except where work which has formed part of jointly authored publications has been included. My contribution and the other authors to this work have been explicitly indicated below. I confirm that appropriate credit has been given within the thesis where reference has been made to the work of others. Parts of this thesis have been published in, or submitted to, the following:

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These publications all arise from my PhD research, with contributions from my supervisors Professor George Holmes and Professor Julia Martin-Ortega, and other co-authors as detailed here.

Chapter Two was conceived and written by me, with supervision and edits from my supervisors.

Chapter Three was designed in conjunction with my supervisors and Dr Mathew Bukhi Mabele, a collaborating researcher at the University of Dodoma. I collected and analysed the data, and led on project administration and writing. Supervision and edits were provided by my supervisors and Dr Mabele.

Chapter Four was again designed in conjunction with my supervisors and Dr Mabele. Data collection and project administration was led by me and Rose Mawenya, who was employed as a research assistant. Supervision was provided by my supervisors and Dr Mabele. I conducted the analyses and led the writing, with reviews and edits contributed by all other co-authors.

Rationale for thesis by alternative format

This thesis explores the theory and practice of economic incentives, specifically conservation performance payments (CPPs), for large carnivore conservation. CPPs are becoming more widespread, yet research on them remains limited. This thesis has three primary objectives:

1) To establish the importance of equity in economic incentives for human-carnivore coexistence, and to explore the possible relative merits of CPPs in this regard.
2) To determine how CPPs are designed and to identify recurring challenges associated with these choices, with a focus on eastern and southern Africa as regions absent from the literature.
3) To evaluate how certain design choices may affect the effectiveness and equitability of CPPs, using a case study in Tanzania's Ruaha-Rungwa ecosystem.

These objectives are addressed conceptually, then through comparative explorative analysis, and finally through a mixed-method case study. There is significant and growing interest in CPPs (with many recently implemented and more in development), yet there has been little research on issues of their design and equitability. The research presented in this thesis is therefore particularly timely, as it is important that the implementation of future CPPs is informed by evidence. As this thesis presents research which is likely to shape the development of this field – both on the ground and in terms of scholarship – the alternative format is more appropriate as it enables findings to be published during the project, rather than after its conclusion.

This thesis is comprised of an introductory chapter which situates the research within the broader literature, identifies the research gaps that are addressed, and outlines the overarching methodological approach. The three following chapters, corresponding to three journal articles, address the research objectives outlined above. The final chapter synthesises the research findings with the broader literature and considers the possible direction of future work.

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Abstract

Large carnivores can be difficult and dangerous to live alongside, and so they are often killed by people. Economic costs – such as through livestock depredation – can be a key driver of this persecution, which has contributed to significant reductions in the population of many species and threatens their long-term persistence. In response, conservationists have employed a number of economic tools in an attempt to reduce the killing of large carnivores. One such approach is conservation performance payments (CPPs), where payments are contingent on the presence or abundance of certain species. The number of CPPs in operation has grown rapidly in recent years, yet they remain subject to little research.

This thesis addresses key research gaps concerning CPP design and how this may relate to their equitability and perceived effectiveness. A tiered approach is taken, with Chapters Two, Three, and Four exploring the theory, design, and practice of CPPs in turn. Chapter Two identifies a number of mechanisms through which inequity arises in payments to encourage human-carnivore coexistence, and highlights the theoretical potential for CPPs to promote more equitable conservation. Chapter Three is explorative and uses key informant interviews to answer questions regarding the design and management of nine CPPs across eastern and southern Africa. It reveals significant variation in how CPPs operate, and challenges the prevailing conceptualisation of CPPs as entirely results-based. Difficulties in ensuring equitable governance is identified as a recurring challenge, alongside determining appropriate payment levels and securing long-term funding. Chapter Four adopts a mixed-methods case-study approach, exploiting differences in the design of two CPPs in Tanzania's Ruaha-Rungwa ecosystem to assess how scheme design affects a CPP's equitability and perceived effectiveness. It finds that some design choices (i.e. collective sanctions and looser rules on expenditure) incurred a trade-off between effectiveness and equitability, and that using a relative payment system was both ineffective and inequitable. Concerningly, the perceived primary driver in reducing carnivore-killing behaviour was the fear of being pictured on the camera-traps used to record carnivore presence, rather than the payments themselves.

This thesis furthers our understanding of CPPs in efforts to encourage coexistence between people and large carnivores. It demonstrates that their potential to deliver equitable and effective conservation is mediated through their design, which varies greatly even across similar contexts. Whilst CPPs are a promising tool, only careful forethought will ensure that they contribute towards international commitments for a more equitable conservation.

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List of abbreviations and acronyms

AICc	Akaike Information Criteria corrected for small sample sizes
CBD	Convention on Biological Diversity
COSTECH	Tanzania Commission for Science and Technology
CPP	Conservation Performance Payment
df	Degrees of freedom
DNA	Deoxyribonucleic acid
eDNA	Environmental DNA
GLMM	Generalised linear mixed model
GPS	Global Positioning System
IUCN	International Union for Conservation of Nature
MBOMIPA	Matumizi Bora ya Malihai Idodi na Pawaga
MNRT	Ministry of Natural Resources and Tourism
$MtCO_2$	Million tonnes of carbon dioxide
NASCO	Namibian Association of Community Based Natural Resource Management
NGO	Non-governmental organisation
PEC	Payments to encourage coexistence
PES	Payments for ecosystem services
TAMISEMI	Ofisi ya Rais - Tawala za Mikoa na Serikali za Mtaa
TAWIRI	Tanzania Wildlife Research Institute
TZS	Tanzanian Shilling
US	United States
USD	United States Dollar
USFWS	United States Fish and Wildlife Service
WMA	Wildlife Management Area

Chapter One - Introduction, objectives, and methodology

1.1 Research context

A mass extinction event is unfolding (Ceballos et al., 2015; 2017) and the ongoing loss of biodiversity is a pervasive and major global challenge (Dirzo et al., 2014; Young et al., 2016). Terrestrial large carnivores are faring particularly poorly, as their requirement for large prey and expansive ranges often brings them into competition with people over space and resources (Ripple et al., 2014; Ceballos et al., 2017), particularly livestock (Treves, 2009; Van Eeden et al., 2018). Carnivores are therefore often killed to prevent (or retaliate to) livestock loss, and this, combined with low population densities and relatively slow rates of reproduction, has seen them undergo substantial reductions in population and geographic range (Inskip and Zimmermann, 2009; Di Marco et al., 2014; Ripple et al., 2014; Wolf and Ripple, 2017).

Living alongside large carnivores can be dangerous. Fatal attacks occur across the globe (Bombieri et al., 2023), and fear can play a big role in people's attitudes (Jacobsen et al., 2021) and behavioural intentions towards large carnivores (Marchini and Macdonald, 2012). In many places, dangerous wildlife threatens food security (Barua et al., 2013; Gemeda and Meles, 2018) and the loss of a cow can also be a loss of savings, creditworthiness, transportation, and ability to plough fields (Zabel and Engel, 2010). As such, material and non-material costs of conflict are frequently interwoven and associated with hidden losses in cultural identity, social bonds, and psychological health (Barua et al., 2013; Jadhav and Barua, 2012; Thondhlana et al., 2020).

Conflict such as this, however, is only one aspect of human-carnivore relations (Dickman, 2010; Pooley et al., 2017; Pooley, 2021). Large carnivores are highly charismatic (Macdonald, 2001) and cultural perceptions of them are shaped by various factors including admiration and utilitarian considerations (Karanth and Chellam, 2009), as well as through broader social experiences and cultural norms (Dickman, 2010; 2014). Large carnivores can even fulfil symbolic roles for differing worldviews and politics (Pooley et al., 2017; Pettersson et al., 2021; 2023; Almarcha et al., 2022; Kutal et al., 2025), and some human-carnivore conflict could be more accurately considered "human-human conflicts" between different groups of people seeking different futures for humans and carnivores (Madden and McQuinn, 2014; Redpath et al., 2015: 222; Hill, 2021; Venumière-Lefebvre et al., 2022).

Reflecting this complexity, there has been a push to reframe discussions away from conflict – which may imply that it is the only possible outcome – towards coexistence (Frank et al., 2019; Glikman et al., 2021; Pettersson et al., 2022). The meaning of 'coexistence' in this context, however, is contested (Knox et al., 2021; Fiasco and Massarella, 2022), with its meaning typically hinging on context and interpretation (Bruskotter et al., 2015). Often, different understandings – such as existing in the same time or place, versus living in harmony – are conflated (Harihar et al., 2013; Knox et al., 2021). Some see this plasticity as a strength, arguing that a premature definition may impede the ability of the concept to drive radical change in the study of human-wildlife relations (e.g. Pooley, 2021), but others argue that its vagueness precludes its usefulness (e.g. Marchini et al., 2021). In this thesis I consider coexistence to be a desirable and dynamic state in which human and large carnivores persist in shared spaces, and where effective governance addresses disputes as they arise (Carter and Linnell, 2016; Pettersson et al., 2021; Pooley, 2021). This framing highlights that coexistence is not passive, nor is it the opposite or absence of conflict (Jolly and Stronza, 2025). This latter point is an important distinction, as even under conditions of coexistence, large carnivores can still impose a wide variety of costs on the people they live alongside (Pettersson et al., 2021). Non-economic costs such fear, poor mental health, and cultural losses all shape human-carnivore relations (Thondhlana et al., 2020; Jacobsen et al., 2021; Tan, 2021), and economic costs – for example, through livestock predation – particularly incentivise the killing of large carnivores (Ogada et al., 2003; Holmern et al., 2007; Zabel and Holm-Müller, 2008; Lindsey et al., 2013). Ensuring that such incentives are reduced or removed is therefore crucial in addressing human-wildlife conflict (Madden, 2004).

To this end, conservationists have implemented a number of "payments to encourage coexistence" (PEC) such as compensation, insurance, revenue-sharing initiatives, and conservation performance payments. These aim to improve the local cost-benefit ratio of living alongside large carnivores (Dickman et al., 2011: 13937) and increase peoples' attitudinal tolerance of them (Bruskotter and Wilson, 2014; Treves and Bruskotter, 2014; Slagle and Bruskotter, 2019). Similarly, payments can change social norms around conservation (Chen et al., 2012; Kerr et al., 2017). Such norms can predict carnivore-killing behaviour (St John et al., 2015; Harvey et al., 2017) and social norms and attitudinal tolerance are theorised to influence individuals' motivation to kill large carnivores (Ajzen, 1985; Marchini and Macdonald, 2012; Reddy et al., 2017).

The goal of all PEC is explicitly coexistence, and they all represent attempts to correct for "coexistence inequalities" – where the costs and benefits of living alongside carnivores are shared unequally across geography and society (Dickman et al., 2011; Jordan et al., 2020: 804). However, not all PEC are equal: their mechanisms,

conditionality, and contexts for adoption all vary. This thesis focuses on one type of PEC: conservation performance payments (CPPs). These are a relatively novel, results-based approach where payments are contingent on species presence or abundance. Interest in CPPs is rapidly growing, but they remain the subject of relatively little research, particularly regarding their design and equitability. It is these research gaps that this thesis aims to address. First, however, I present a brief overview of PEC, to better situate CPPs within their wider theoretical background.

1.1.1 Ex-post compensation

The most common form of PEC is ex-post compensation (Ravenelle and Nyhus, 2017), which typically takes the form of retrospective monetary or in-kind reimbursement for costs incurred by carnivores. Ex-post compensation schemes are typically narrow in scope, and concern damages inflicted only by specific species or small groups of species, often ones that are large and legally protected (Nyhus et al., 2005). In fact, such protection often paves the way for the implementation of compensation initiatives, particularly when the right for individuals to use legal methods of lethal control of carnivores has been removed (de Klemm, 1996).

Ex-post compensation is tied to those individuals who have suffered damage (Milheiras and Hodge, 2011). This targeting is likely to reduce individual anger, which is important as the actions of even a small number of people can reduce the viability of carnivore populations (Woodroffe and Frank, 2005; Dickman et al., 2011). Additionally, compensation can be seen to signify a broader societal acknowledgement of human-wildlife conflict (Macon, 2020) – something that can often be lacking (Rakotonarivo et al., 2021).

However, ex-post compensation suffers many flaws. Finding carcasses and having predation verified, for example, is often difficult or impossible (Swenson and Andrén, 2005; Sommers et al., 2010; Heikkinen et al., 2011). This is particularly true for those living in remote or rugged areas (DeMotts and Hoon, 2012; Nickerson et al., 2024) and for owners of small-bodied stock such as goats or sheep (as seen in Figure 1.1), as these are more often eaten in their entirety or cached away (Miller et al., 2016). There are also a number of more fundamental criticisms. Consensus on the effectiveness and efficacy of ex-post compensation is lacking (Ravenelle and Nyhus, 2017), and questions regarding its long-term financial sustainability are persistent - particularly regarding the impact of any funding withdrawals on local attitudes and conservation (Gadd, 2005; Nyhus et al., 2005; Leslie, 2019; Braczkowski et al., 2020).

Figure 1.1: Large carnivores such as spotted hyenas (*Crocuta crocuta*) can impose significant costs on the people they live alongside, such as through livestock predation, as seen here. Image credit: Lion Landscapes.

Ex-post compensation also fails to account for indirect economic costs such as lower reproductive success, reduced weight gain, loss of genetic potential, and important non-economic elements such as the investment of time and emotion (Naughton-Treves et al., 2003; Ramler et al., 2014; Macon, 2020). These indirect impacts can be viewed by livestock producers as more costly than actual predation (Nickerson et al., 2024). Moreover, ex-post compensation schemes can function as perverse incentives ("moral hazard"), as compensation for losses makes individuals less likely to invest time or money in techniques (e.g. fencing, herding, or guarding) that reduce said losses (Bulte and Rondeau, 2005: 15; Rondeau and Bulte, 2007). In a similar vein, compensation incentivises higher livestock stocking rates (Dickman et al., 2011; Skonhoft, 2017), prompting some to argue that it simply functions as an agricultural

subsidy which may even exacerbate human-carnivore conflict (Bulte and Rondeau, 2005; Rondeau and Bulte, 2007).

One way of addressing the concern around moral hazard is to require a degree of input conditionality, such as minimum requirements for enclosures or the use of livestock guarding dogs (Nyhus et al., 2005). A second is to reimburse losses at below market price, thereby ensuring that there is no incentive for individuals to incur losses. This, however, provides no economic incentive for individuals to tolerate the presence of large carnivores (Dickman et al., 2011).

1.1.2 Insurance

Insurance programmes are similar to ex-post compensation in that they aim to reduce the costs associated with living alongside large carnivores, are conditional on livestock loss, and frequently incorporate a degree of input conditionality. Insurance programmes differ from compensation schemes in that they pool the burden of risk through the participation of members, who themselves provide (at least part of) the insurance fund by contributing premiums (Leslie, 2019; Alexander et al., 2021). Insurance schemes therefore need significant community engagement in order to be successful (Mishra et al., 2016), but this sharing of costs does reduce the risk of moral hazard (Chen et al., 2013) and the likelihood of fraudulent claims (Nyhus et al., 2003).

In practice, however, many insurance schemes are not entirely community-based, but instead operated in partnership with NGOs (Leslie, 2019) or government and private insurance brokers (e.g. Chen et al., 2013). These outside parties provide the external funds that are needed to increase tolerance of carnivores; after all, in a closed system where the level of risk is homogenous, participants' premiums simply cover costs of the losses they are likely to incur (Hussain, 2000). Insurance suffers from many of the same fundamental issues as ex-post compensation: it requires external funding; fails to account for indirect and non-economic costs; suffers from verification issues; and fails to make large carnivore presence a net economic asset at the local level (Dickman et al., 2011).

1.1.3 Revenue-sharing initiatives

In contrast to ex-post compensation and insurance schemes, some types of PEC attempt to foster tolerance of large carnivores not by reducing their cost, but by

increasing the benefits associated with them. This acknowledges that people tend to be loss averse, and therefore the emphasis should be placed on maximising the benefits derived from carnivores (Köbberling and Wakker, 2005; Carpenter, 2022). One such approach is the sharing of the revenue that large carnivores can attract to an area.

Non-consumptive tourism (e.g. ecotourism) in many parts of the world depends upon charismatic carnivores (Lindsey et al., 2007a; Nelson, 2009) and can be worth many millions of US dollars to regional economies (e.g. Tortato et al., 2017). Similarly, consumptive tourism such as trophy-hunting can also generate large annual revenues (Lindsey et al., 2007b), with large-bodied carnivores commanding particularly high hunt fees (Mihalik et al., 2019). In some places these revenues have been credited with the recovery and conservation of carnivore populations (Norton-Griffiths, 1998; Nelson, 2009; NASCO, 2013), but often the money bypasses local communities and accrues instead with private companies and central governments (Honey, 2008; Leader-Williams et al., 2009). Ensuring that such revenue does not leach out of local areas is seen as crucial to addressing coexistence inequalities (Jordan et al., 2020).

Tourism-dependent revenue sharing is an unviable approach in many regions due to remoteness, lack of infrastructure, and harsh climates (Walpole and Thouless, 2005; Winterbach et al., 2015). Similarly, the weaknesses inherent in an approach that relies on significant overseas visitors has been exposed by the Covid-19 pandemic (Lindsey et al., 2020). Even where is it possible, revenue-sharing initiatives based on conservation may still represent an opportunity cost due to limitations on resource use or livestock grazing (Dickman et al., 2011). Furthermore, wildlife-imposed costs may continue to outweigh such revenue in contexts where human-wildlife conflict is high (Drake et al., 2021). Lastly, the revenue is not dependent upon the provision of a particular ecosystem service or measurable conservation benefit. This can result in a situation where the revenues received fail to provide incentives for effective conservation actions, such as reduced carnivore persecution (Nelson, 2009; Sachedina and Nelson, 2010; Dickman et al., 2011).

1.1.4 Conservation performance payments (CPPs)

Conservation performance payments are a specific kind of payment for ecosystem service, typically conceptualised as being contingent on species presence or abundance (Zabel and Holm-Müller, 2008; Nelson, 2009; Persson et al., 2015; Herzon et al., 2018). For this reason, they are sometimes described as “outcome-based” or “result-oriented” payments (Burton and Schwarz, 2013: 630). An illustrative example

of a CPP is a scheme in which indigenous Sámi communities are paid by the Swedish government for lynx (*Lynx lynx*), wolverine (*Gulo gulo*), and wolf (*Canis lupus*) reproductions on their village lands. The Sámi are traditionally herders of reindeer (*Rangifer tarandus*) and lose on average 20% of their herd to carnivores each year (Zabel and Holm-Müller, 2008). Payments are tied to carnivore reproductions, and these are estimated annually in accordance with specific regulations and conducted in cooperation between rangers and herders using techniques including snow tracking, natal den location, and DNA analysis (Zabel et al., 2014; Persson et al., 2015; Pettersson, 2025). The payments are made every 6 months to 51 Sámi reindeer herding co-operatives who decide on the internal distribution of the money.

A number of theoretical advantages over other forms of PEC have seen CPPs increasingly viewed as an attractive option for encouraging human-carnivore coexistence. Because CPPs are independent to livestock losses, they are not vulnerable to moral hazard (Zabel et al., 2011; Persson et al., 2015) and do not incentivise increased livestock stocking rates (Suvantola, 2013; Skonhoft, 2017). CPPs are considered more cost-effective than less direct payments (Ferraro and Kiss, 2002; Ferraro and Simpson, 2002; Ferraro, 2001; Drechsler, 2017) and are the only type of PEC that "directly incentivizes" human−wildlife coexistence (Dickman et al., 2011). Tying payments to carnivore presence enables participants to use their situated knowledge to maximise this outcome (Gibbons et al., 2011; White and Hanley, 2016) and insures against a version of "empty-forest syndrome", where a focus on inputs like habitat quality or prey abundance obscures the ongoing persecution of carnivores (Redford, 1992; Wilkie et al., 2011: 122).

With their focus on results, CPPs may more effectively embed ecological objectives into social and cultural consciousness (Burton and Schwarz, 2013) and can be viewed favourably by communities living alongside large carnivores (Amit and Jacobson, 2018). In areas unable to benefit from revenue streams like trophy hunting or ecotourism, CPPs may represent the only viable economic incentive for carnivore conservation (Nelson, 2009). For these reasons, a number of scholars have called for the greater uptake of CPPs (e.g. Breck et al., 2011; Ravenelle and Nyhus, 2017: S3; Muriuki et al., 2017; Khosravi et al., 2022). Table 1.1 highlights some of the differences between CPPs and other PEC.

Table 1.1. Some key features of the various types of PEC.

Type of PEC	Conditionality	Target	Advantages	Disadvantages
Ex-post compensation	On damages (i.e. livestock loss)	Livestock-owners	- Targeted to those who incur economic costs	- Moral hazard - Verification issues - Does not address indirect costs - Carnivores remain a net cost
Insurance	On damages (i.e. livestock loss)	Livestock-owners	- Targeted to those who incur economic costs - Reduced requirement for external funding	- Verification issues - Does not address indirect costs - Carnivores remain a net cost
Revenue-sharing	None	Wider community	- Can make carnivores net assets - Includes non-livestock owners	- Vulnerable to external shocks (e.g. travel restrictions) - Not conditional on tangible conservation - Benefits often bypass the people suffering most costs
Conservation performance payments	On species presence	Service-provider(s)	- Considered most cost-effective - Can make carnivores net assets - Can be used in areas with no other wildlife-derived revenue - Can include non-livestock owners	- Requires careful consideration of governance and equitability issues

Despite this, research on CPPs is very limited in comparison to other types of PEC, and it is even unclear whether CPPs actually succeed in encouraging coexistence between people and large carnivores. For example, evidence from Laos suggests a CPP resulted in fewer infractions against protected area regulations and a reduction in hunting pressure when judged against comparison areas (Eshoo et al., 2018), but a CPP in Belize is not thought to have reduced participants' motivation to kill jaguars (*Panthera onca*) (Harvey et al., 2017). In northern Sweden, a state-run CPP was considered instrumental in the recovery of the wolverine population, but this may have been due to the extensive monitoring method (identifying natal dens in the spring)

reducing opportunities for illegal killing, rather than the payments *per se* (Persson et al., 2015). Such uncertainty regarding the effectiveness of CPPs is surprising, given the need for conservationists to justify continued funding (Selinske et al., 2021) and to optimise decision-making (Law et al., 2017; Travers et al., 2019).

The CPP literature consists of theoretical economics (e.g. Zabel and Roe, 2009; Drechsler, 2017; Heydinger et al., 2022), a small number of geographically biased case studies (i.e. Zabel and Holm-Müller, 2008; Persson et al., 2015; Sjoegren and Matsuda, 2016; Harvey et al., 2017; Eshoo et al., 2018; Chen et al., 2022; Kaiser et al., 2025; Pettersson, 2025), and broader discussions of their potential advantages and limitations (e.g. Nelson, 2009; Dickman et al., 2011). This thesis advances the scholarship by focusing on the equitability of CPPs, the logic underpinning their designs, and the impact of these design choices. By doing so, it furthers our understanding of CPPs and aims to inform efforts to encourage coexistence between people and large carnivores.

Before describing the objectives and exact research questions of this thesis, I briefly outline how equity is conceptualised here.

1.2 Conceptualising equity

Equity can be understood and conceptualised in a number of different ways (Klein et al., 2015). At its simplest, it is often considered what is fair and just (Crosman et al., 2022), especially for those with less power (Martin et al., 2014). It is a spectrum which includes positive and negative possibilities (Pascual et al., 2014) and can act differentially as an input and output of conservation interventions (Klein et al., 2015).

The framework proposed by McDermott et al. (2013) establishes the multidimensionality of equity in the context of payments for ecosystem services, and is therefore highly relevant for this thesis. Specifically, the framework outlines how equity can be considered to comprise *procedural* elements (e.g. inclusion in decision-making), *distributional* elements (e.g. of costs and benefits; rights and responsibilities), as well as the historical and *contextual* elements which influence them. Some scholars augment this with another aspect: that of appropriate *recognition* of various identities, knowledges, values, and norms (Pascual et al., 2014; Friedman et al., 2018).

This emphasis on the multidimensional nature of equity is important, as a focus on only one element risks negative consequences in others (Mabele, 2019; 2020; Tan,

2021). Moreover, such a perspective can help policy-makers to gain a broad understanding of the equity implications of payments for conservation (McDermott et al., 2013). However, it is necessary to emphasise that the usefulness of any specific conceptualisation of equity is limited by its subjective (Calvet-Mir et al., 2015) and context-dependent nature (Dietz and Atkinson, 2010; Martin et al., 2014; Law et al., 2018).

1.3 Objectives and research questions

The following subsections briefly outline the research rationale and research gaps that are addressed in this thesis. These relate in turn to the theory, design, and practice of CPPs. Specifically, the three primary objectives of this thesis are:

Objective 1: Establish the capability of PEC to be inequitable and to explore the possible merits of CPPs in this regard.

Just as the impacts of wildlife are unequally felt (Jordan et al., 2020; Prins et al., 2022; Braczkowski et al., 2023), so too are the impacts of conservation interventions (Klein et al., 2015; Friedman et al., 2018). As such, the equitability of conservation is under increasing scrutiny (Friedman et al., 2018; Law et al., 2018; Crosman et al., 2022; Dawson and Suich, 2025) and commitments to equitability are emphasised in global conservation agreements (CBD, 2022; Hampton-Smith et al., 2024).

Despite this, no work has explored the equitability of PEC as a conservation approach. Chapter Two does so by identifying a number of mechanisms through which inequity arises, thereby interrogating the simplified 'win-win' discourse which often surrounds economic incentives for conservation (Igoe and Brockington, 2007; Corbera, 2012). In this chapter, the potential for CPPs to deliver a more equitable alternative is expounded, and a number of recommendations provided. Specifically, I asked the following:

1) Through what mechanisms do inequalities arise in PEC?
2) How do CPPs compare in terms of their equitability?
3) How could the equitability of PEC be improved?

Objective 2: Determine how CPPs are designed across eastern and southern Africa, the rationale behind this, and identify recurring challenges associated with these choices with a focus on equity.

Whilst Chapter Two highlights the theoretical potential for CPPs to deliver more equitable conservation, little is known about their implementation on the ground. As far as I have been able to identify, only five CPPs for carnivores are represented in the peer-reviewed literature and issues of design and management choices are largely overlooked. As such, little is known about how they operate and how this relates to theory. This matters because the design of CPPs is likely to relate to their effectiveness and equitability, and because improving outcomes requires moving beyond purely theoretical understandings. This is particularly relevant given the normative nature of conservation research and the capability of CPPs to impact people and wildlife (Wienhues et al., 2023). As such, I aimed to answer:

1) How are CPPs designed?
2) How does this vary, and why?
3) How does this compare with prior theoretical assumptions?
4) What challenges are associated with these design choices?

Objective 3: Evaluate how certain design choices affect the equitability and perceived effectiveness of a CPP.

The results from Chapter Three revealed significant variation in how CPPs operate on the ground, even in similar contexts. Chapter Four explores how some of these design choices impact a CPP's equitability and perceived effectiveness. This research ties in to the broader payments for ecosystem services (PES) literature, where the ability of PES to deliver equitable and effective outcomes remains a matter of debate (Pascual et al., 2010; 2014; Corbera and Pascual, 2012; Wunder et al., 2018), despite the fact that any trade-off is likely to reduce their long-term sustainability (Martin et al., 2014a; Lliso et al., 2021). Understanding how design choices influence this relationship in a novel tool, such as CPPs, is therefore of particular interest. Specifically, I asked:

1) What is the relationship (if any) between the equitability and perceived effectiveness of a CPP?
2) How do certain design choices affect this?

By answering these questions, this thesis advances our understanding of the theory, design, and implications of CPPs.

1.4 Research approach

Conservation interventions are social endeavours which typically aim to change human behaviours, yet the conservation community has traditionally been guided primarily by the natural sciences (Mascia et al., 2003). A growing literature highlights that engaging with the social elements inherent in conservation efforts is crucial to inform more effective, legitimate, and socially just conservation (Ban et al., 2013; Moon and Blackman, 2014; Bennett et al., 2017a; 2017b; Massarella et al., 2021; Mabele et al., 2023a). The value of an interdisciplinary perspective is also increasingly recognised in the study of human-carnivore relations (Beck et al., 2019; Hartel et al., 2019; Zimmermann and Stevens, 2021), but a lack of engagement with the social and political sciences is a continuing impediment to the translation of research into policies for human-carnivore coexistence (Lozano et al., 2019; Gray et al., 2020). To this end, this thesis employs a social science approach and draws from the ecological and economic literatures. Such an approach is necessary to understand the wide variety of factors that influence human-carnivore relations and to contribute solution-oriented research (Beck et al., 2019; Hartel et al., 2019).

1.5 Methodology

The methodology of the following three chapters represents a tiered approach, reflecting the different objectives identified in section 1.2. In turn, these represent the theory, design, and practice of CPPs.

Because CPPs are relatively novel, no research has directly addressed their equitability. It is therefore necessary to first consider this at a theoretical level. Chapter Two does this by identifying dimensions through which inequity arises in broader PEC and by exploring the possible equitability of CPPs at a conceptual level. By doing so, this research highlights the importance of equity considerations in such interventions, enables an understanding of the mechanisms and consequences of inequity, and establishes a base from which the relative merit of CPPs can be assessed.

As Chapter Three seeks to establish how CPP design varies and how this relates to theory, a broad and explorative methodology was required. By incorporating multiple CPPs, this approach maximised the opportunities for learning, and significantly increased the number of CPPs represented in the peer-reviewed literature. The

literature on CPPs is overwhelmingly biased towards the Global North - particularly Fennoscandia (e.g. Zabel and Holm-Müller, 2008; Suvantola, 2013; Hiedanpää and Borgström, 2014; Zabel et al., 2014; Sjoegren and Matsuda, 2016; Åhman et al., 2022; Pettersson, 2025; Kaiser et al., 2025). This literature base provides valuable insights into the legal, economic, and social elements of these CPPs in their specific contexts, but strategies for human-carnivore coexistence which work in the Global North are not always easily transferable (Lozano et al., 2019).

To address this knowledge gap, Chapter Three focuses on eastern and southern Africa. These regions have been historically successful in maintaining populations of large carnivores, yet have high levels of human-carnivore conflict which contributes to recent population declines (Ripple et al., 2014; Bauer et al., 2015; Wolf and Ripple, 2017). Additionally, these regions are unrepresented in the CPP literature, despite the recent establishment of a number of CPPs targeting a consistent carnivore guild (namely lion *Panthera leo*, leopard *Panthera pardus*, spotted hyena *Crocuta crocuta*, and wild dog *Lycaon pictus*). Chapter Three adopts an explorative approach and harnesses the insights of 12 key informants (identified through snowball sampling) who represent nine CPPs across five countries. Whilst not the largest sample, it nearly triples the number of CPPs represented in the peer-reviewed literature. In any case, the strength of this approach is not in absolute sample size, but in accessing the relevant individuals with the specialist knowledge and insights (Newing, 2011). This is especially true here, as these individuals are at the forefront of conservation practice, interpreting and adapting a relatively novel intervention across contexts (Martin-Ortega and Waylen, 2018). These practitioners are the medium through which these CPPs impose themselves on reality and through which reality imposes itself on these CPPs; their insights regarding CPP design are therefore particularly valuable.

Just as Chapter Two focused on the theory of CPPs, and Chapter Three on their design, Chapter Four focuses on CPPs in practice. Specifically, it explores how specific design choices mediate the relationship between their effectiveness and equitability. As such, Chapter Four takes the form of an in-depth case study, because understanding the drivers of conflict and barriers to coexistence requires situated knowledge regarding local conditions, values, and processes (Rust et al., 2017; Salvatori et al., 2021; Pettersson et al., 2022). Since human-carnivore relations are incredibly varied, case study research is not well suited to informing coexistence strategies at a broader scale, but it does enable a better understanding of each conflict in its unique context – a requirement for the implementation of effective local coexistence strategies (Zimmermann et al., 2021).

I selected a case study site – the Ruaha-Rungwa ecosystem of south-western Tanzania – in which two different CPPs operate (the study site and design of these

CPPs are described in detail in Chapter Four). I believe this to be the only location where two different CPPs operate. This methodology enables a comparative exploration of how the design of a CPP influences its effectiveness and equitability, whilst loosely controlling for many socioecological confounders (e.g. carnivore guild, agricultural practices, political systems). Most importantly, a case study approach is consistent with the normative nature of conservation research, as it ensures that research findings are directly applicable and translatable into locally relevant practice.

In Chapter Four, qualitative and quantitative data are integrated (i.e. both contribute towards the same research objectives (Vogl, 2019)), with initial (qualitative) findings informing a second stage of (qualitative and quantitative) data collection – what Kinnebrew et al. term "unidirectional synthesis" (2021: 130). This mixed-method approach is well suited to facilitating an understanding of the equity impacts of conservation interventions amongst heterogeneous groups, as it combines multiple sources of knowledge and more effectively encompasses nuanced sociocultural and contextual elements such as power dynamics (Blundo-Canto et al., 2018; Ward, 2018). Mixed-methods are particularly well-suited to empirical analyses of the relationship between the effectiveness and equitability of payments for ecosystem services (Calvet-Mir et al., 2015), and their value is increasingly recognised in the conservation literature (Teel et al., 2018). These methods were adopted in Chapter Four to maximise the internal validity of the results by facilitating a deeper understanding of how site-specific elements are influenced by (and influence in turn) CPP design (Drury et al., 2011). This reduces the generalisability of the findings, but maximises their ability to inform a specific conservation practice within the study context.

1.6 Positionality and ethics

As knowledge production is mediated through human interpretation, the positionality of the researcher is an important epistemological consideration (Bourke, 2014; Koot et al., 2023). Despite this, the practice of reflexivity is underutilised in conservation science (Beck et al., 2021). It is therefore worth acknowledging that this research was primarily conceived and conducted by a white British man with a multidisciplinary background and that it is possible some unconscious biases influenced the framing, execution, or interpretation of this research. For example, a romanticised view of overseas conservation remains prevalent in public consciousness, despite distasteful links to neocolonial ideals such as that of the 'white saviour' (Tan, 2021; Hart et al., 2021; Archer et al., 2022). Furthermore, it is worth noting that despite all efforts to

maintain objectivity, conservation scientists are invested stakeholders in conservation practice (Redpath et al., 2015).

Moreover, just as human-wildlife interactions are shaped by a broader political economy and political ecology (Margulies and Karanth, 2018), so too is the research on it (Fletcher and Toncheva, 2021). Conservation science is characterised by structural inequities; research is often conducted in the Global South by researchers from the Global North (Asase et al., 2022; Mabele et al., 2023a; Miller et al., 2023), and the field is dominated by Western perspectives (Kaechele et al., 2024). It is typically easier for researchers from former colonial powers to gain access to study sites in former colonies than vice versa (Koot et al., 2025) and conservation remains a discipline embedded in historical and neo-colonial structures (Nelson, 2003; Garland, 2008; Corbera et al., 2021).

The production and dissemination of conservation knowledge is particularly unequal in Tanzania (Mabele et al., 2023a), despite the (presumably recent) requirement for foreign researchers to formally collaborate with a Tanzanian researcher as a condition of their research permit. Recognising that such collaborations can still be unidirectional, extractive and highly unequal (Tilley and Kalina, 2021) – characteristics of 'parachute science' (Asase et al., 2022; Miller et al., 2023) – I was keen to ensure a genuine and equitable partnership. A key part of this was ensuring that the research could be co-designed from its earliest stages (Urassa et al., 2021), as having a diverse set perspectives at the outset of a project helps to guide culturally sensitive and legitimate research (Mpakairi et al., 2025).

In 2021, Dr Kate Massarella – a previous PhD student at the University of Leeds – put me in touch with Dr Mathew Bukhi Mabele, a lecturer at the University of Dodoma with whom she worked on the Convivial Conservation project. Dr Mabele has expertise in using critical social science to explore the equitability of conservation (e.g. Massarella et al., 2021) and in the political ecology of human-wildlife relationships in the Ruaha-Rungwa ecosystem (e.g. Kiwango and Mabele, 2022; Fletcher et al., 2023). Moreover, I felt that this project would benefit from Dr Mabele's wider insights regarding decolonising conservation science (e.g. Collins et al., 2021; Corbera et al., 2021; Mabele et al., 2023a; 2023b). Fortunately, he agreed.

This thesis also benefitted from the contributions of Rose Mawenya, who was employed as a research assistant for Chapter Four. Rose has a masters' degree in natural resource management from the University of Dodoma and, like Dr Mabele, has previous experience of mixed-method conservation research in the Ruaha-Rungwa ecosystem (e.g. Ibbett et al., 2023a; 2025; Dorward et al., 2024). Rose was often asked by research participants where she was from, and her ethnicity. The answers –

Moshi, in northern Tanzania, and Mchaga – highlighted her 'outsider' nature, but were helpful in enabling us to explore the social complexities of human-carnivore conflict as external and neutral parties. Rose's presence and expertise provided an "embodied authentication" which increased our approachability and enhanced the credibility of the research (Mayorga-Gallo and Hordge-Freeman, 2017: 864 ; LaRocco et al., 2020).

I received logistical support in the field from Lion Landscapes, the NGO operating the two focal CPPs in Chapter Four. This support (e.g. accommodation, food, a motorbike) was crucial for the execution of the research, but came with two notable risks. The first was that I would be seen as associated with Lion Landscapes. To minimise this risk I repeatedly emphasised my independence from Lion Landscapes throughout the data collection process, and avoided Lion Landscapes branding as much as possible (i.e. on clothing). It was not, however, always possible to avoid travelling in a Lion Landscapes-branded car, as some journeys were too dangerous to make by (non-branded) motorbike.

The second risk of this logistical support was that it could open up the framing or interpretation of the research to an outside influence. As collaborators with lots of relevant local knowledge, Lion Landscapes staff provided useful information, but it was agreed from the outset that they would have no influence on research design, data collection, nor the content of – and decision to publish – the manuscript. Both parties were prepared to sign a memorandum of understanding confirming this arrangement, but this was never formalised due to overzealous bureaucracy from the University of Leeds. In any case, the Lion Landscapes staff were keen to get a more objective understanding of the CPPs strengths and weaknesses, as they recognised that their perspectives and the information they received were influenced by their proximity to the schemes.

As is the case with many Global North-South partnerships in Africa (Tilley and Kalina, 2021), I was in charge of the research budget. As a result of this, I wanted to make sure that the use of these funds was equitable. Rose was paid a good salary in acknowledgement of her skills and experience and had her taxes, pension, health insurance contribution, and student loan repayments covered on top. The research budget also covered the costs of her attending a two-day social science workshop (*"Exploring relationships between people and protected areas around the Ruaha-Rungwa Landscape"*) to help further her professional development, networking opportunities, and to build in-country capacity. In this regard, I also briefly mentored Justine Robert, a masters' student from the Nelson Mandela African Institution of Science and Technology, who was based at the research site for his fieldwork.

Considerations of positionality, however, must go beyond the research team. Interactions between the researcher and the researched are inherent in many social science methods (Moon et al., 2019), and research can have widely felt and long-lasting local consequences (Ibbett et al., 2023b). For example, Chapter Four took place in traditionally pastoralist settings. Pastoralist communities in Tanzania have suffered a long history of marginalisation which has included forced resettlement (Kimaro and Hughes, 2023) and the continuing alienation of them from their lands by both the state and private capital (Kipuri and Sørensen, 2008). These parties frequently portray pastoralist practices as economically unproductive and environmentally harmful (Kimaro and Hughes, 2023), and evidence from other parts of the world shows that research based on such misunderstandings of pastoralist ecology can result in work that compounds existing inequalities and favours dominant governance approaches (Benjaminsen et al., 2015). As such, it was important that I remained cognisant of my position within this broader political ecology.

Similarly, previous work in this landscape has used ethnicity as a proxy for pastoralism (e.g. Dickman et al., 2014; Kimaro and Hughes, 2023), but such an approach is overly simplistic and risks the disproportionate representation of certain groups in academic work and policy. Instead we, in conjunction with others, developed a different way to categorise pastoralists and non-pastoralists in analyses, which better reflected the local practices and customs of our study site (see Appendix A). Nevertheless, ethnicity remained a useful lens through which to better understand pastoralist relations with wildlife – but one that entailed ethical difficulties. For example, during the data collection for Chapter Four, we identified that one traditionally pastoralist group in particular was implicated in the killing of lions for social status. The risk of the Tanzanian National Parks Authority targeting this group for mistreatment, while considered low, meant that despite wanting to avoid inaccurate generalisations, we described this group only in terms of being 'pastoralists'. This example highlights that even when participants' data are anonymised at the individual level, conducting robust and ethical conservation research in the context of a highly politicised and heavily enforced conservation can be difficult (St John et al., 2016).

Parts of this thesis required research permits from the Tanzania Commission for Science and Technology (COSTECH; 2023-053-NA-2023-1067) and the Tanzania Wildlife Research Institute (TAWIRI; AB.235/325/01/135). As a condition of the research permit, TAWIRI must approve a manuscript before it can be published in a journal. Such approval may be difficult to come by if the research is critical of the state's management of wildlife, and anecdotes abound of researchers becoming *persona non grata* after publishing critical research. The requirement to obtain TAWIRI approval prior to publication may lead to researchers to self-censor, and

compounds the biases that shape what kind of research is granted permits in the first place (Koot et al., 2025). For example, the Ngorongoro Conservation Area in the north of Tanzania is currently "under restriction from any … research activities" (TAWIRI, personal communication: 19th June 2023) – likely a result of the ongoing dispossession of land and evictions of the resident Maasai in the name of conservation (The Guardian, 2023).

At a local level, permission letters were also required and obtained from the President's Office of Regional Administration and Local Government (TAMISEMI), and the Regional Administrative Secretary and District Executive Director. Approval was also requested in person and provided by the village chairperson or village executive officer in all villages where data collection occurred. All research in this thesis was approved by Faculty Research Ethical Committees at the University of Leeds (AREA FREC 2022-0157-146; Appendix B), including two amendments which reflected updated research approaches, such as the inclusion of participant observation (AREA FREC 2023-0157-692 and BESS+ FREC 2023-0157-933; Appendices C and D). Key concerns included: the discussion of sensitive topics; possible disclosure of illegal behaviour (i.e. carnivore-killing); ensuring suitable anonymity; and possible association with the NGO operating the CPPs. Due to low literacy rates, free prior informed consent was sought verbally (Appendix E). The data management plan (Appendix F) associated with data collection were approved by the University of Leeds.

1.7 Limitations

This thesis contributes to the scholarship by identifying a number of research gaps regarding economic incentives used to encourage human-carnivore coexistence, and by advancing our understanding of the theory, design, and implications of CPPs. Nevertheless, it is necessary to acknowledge some of the limitations of this work.

1.7.1 Data collection and analysis

Despite earlier work revealing high rates of carnivore-killing in the Ruaha-Rungwa ecosystem (Dickman, 2015), recent research has shown that people are often unwilling to disclose such sensitive information, even when specialised questioning techniques are used (Ibbett et al., 2022; Ibbett et al., 2023a). Whilst the use of focus groups is likely to have helped – as participants are more likely to divulge sensitive

information in group settings (Ibbett et al., 2023b) – it is possible that continued exposure to conservation researchers and organisations in this area has influenced how participants choose to respond to such questions (Sargent, 2021; Ibbett, 2022).

In terms of quantitative analyses, the two CPPs in Chapter Four operated in different villages that were not matched statistically, so the data may suffer from some hidden bias (Schleicher et al., 2020). For qualitative analyses, the grounded approach taken reduced the chance that novel themes would emerge as a result of any prior-dictated frame of analysis (Attride-Stirling, 2001; Mabon et al., 2021) and also enabled an early interweaving of findings, theory, and future coding structures (Strauss and Corbin, 1994). However, any inductive analysis always requires a level of interpretation from the researcher, which risks the influence of subconscious biases (Connell and Lowe, 1997; Timmermans and Tavory, 2012).

Lastly, whilst I had the opportunity to learn some basic Swahili prior to data collection, Chapter Four depended on Rose's translation of Swahili. Working across languages risks the loss of nuance and detail (Smith, 1996), in part because the process of translating research interviews is such a cognitively demanding task (LaRocco et al., 2020). To ensure that the questions were well phrased and understood, they were independently back-translated by bilingual Lion Landscapes staff for verification before being piloted and further refined. However, it is worth noting that many (if not most) survey respondents spoke Swahili as a second, commonly shared language, and so the potential for loss of detail and nuance was compounded (Smith, 1996).

1.7.2 Use of perceptions

Chapter Three harnesses the perceptions of key informants – those individuals interpreting and designing CPPs – and Chapter Four focuses on the perceived effectiveness of two CPPs in Tanzania. The use of perceptions as evidence in conservation decision making is sometimes criticised on the grounds that they are subjective and cannot establish causality, yet measuring and understanding perceptions is integral to conservation success (Bennett, 2016). Perceptions are shaped by social norms, past experiences, and cultural beliefs - all factors that influence how people interact with wildlife (Dickman, 2010). Perceptions are well-suited to the 'how' and 'why' questions involved in exploring the socioecological impacts of interventions like CPPs (Ward, 2018) and are particularly adept at providing understandings of the legitimacy, process, and equitability of conservation interventions (Martin et al., 2014b; Bennett, 2016), as well as their effects on people's well-being (Woodhouse et al., 2015). Encouraging coexistence requires

understanding the perceived drivers and impacts of conflicts (both between groups of people and between people and wildlife) in order to foster more sustainable solutions (Madden, 2004; von Essen and Allen, 2019). Nevertheless, Chapter Four assesses the effectiveness of two CPPs through the lens of perception, which means the literature continues to lack a robust ecological counterfactual analysis of CPP effectiveness.

This thesis does not attempt a counterfactual evaluation – despite consideration at an early stage – because the non-random implementation of existing CPPs and an inability to control for socioecological confounders made it unviable (Zabel and Holm-Müller, 2008; Adams et al., 2019; Schleicher et al., 2020). This is often the case for evaluations of conservation interventions targeting large carnivores (Khorozyan, 2022). Nevertheless, such a study would be a very welcome addition to the literature.

1.8 Structure of the thesis

The three following chapters take the form of journal articles. Chapter Two identifies the mechanisms through which inequity arises in PEC, explores the relative merits of CPPs in this regard, and provides recommendations to improve the equitability of PEC. In doing so, it moves the PEC literature beyond the dominating concerns of cost-efficiency. Chapter Three provides the first comparative analysis of the choices and rationale underpinning CPP design by focusing on the unrepresented CPPs of eastern and southern Africa. Chapter Four provides the first evaluation of how the design of a CPP influences its equitability and perceived effectiveness, through a mixed-methods case study of two CPPs in Tanzania's Ruaha-Rungwa ecosystem. Chapter Five concludes the thesis by synthesising the findings of the preceding three chapters with the broader literature and by considering the possible direction of future research.

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Chapter Two - The importance of equity in payments to encourage coexistence with large mammals

2.1 Abstract

Large mammals often impose significant costs such as livestock depredation or crop foraging on rural communities, and this can lead to the retaliatory killing of threatened wildlife populations. One conservation approach—payments to encourage coexistence (PEC)—aims to reduce these costs through financial mechanisms, such as compensation, insurance, revenue sharing, and conservation performance payments. Little is known about the equitability of PEC, however, despite its moral and instrumental importance, prevalence as a conservation approach, and the fact that other financial tools for conservation are often inequitable. We used examples from the literature to examine the capability of PEC—as currently perceived and implemented—to be inequitable. We recommend improving the equitability of current and future schemes through the cooperative design of schemes that promote compensatory equity and greater consideration of conservation performance payments and by changing the international model for funding PEC to reduce global coexistence inequalities. New and existing programs must address issues of equitability across scales to ensure that conservation efforts are not undermined by diminished social legitimacy.

2.2 Paying for coexistence

Large mammals are often considered charismatic and attributed with significant existence value by many, particularly those who do not live alongside them (Dickman et al., 2011; Macdonald, 2001; Vasudev & Goswami, 2020; Vasudev et al., 2020). Such species, whether carnivorous or herbivorous, also perform a highly influential role in maintaining biodiversity and in wider ecosystem dynamics, yet they have seen severe reductions in population and range (Malhi et al., 2016; Ripple et al., 2014). These declines are often ascribed, at least in part, to competition between large mammals and humans over space and resources (Denninger Snyder & Rentsch, 2020; Nyhus, 2016; Van Eeden et al., 2018).

Human−wildlife conflict is one aspect of human−wildlife relations (Dickman, 2010; Pooley et al., 2017). Understandings of it vary (Pooley et al., 2021), but its effects on

human communities and wildlife populations are well documented (Bauer et al., 2022; Thirgood et al., 2005). People living alongside large mammals often face increased personal risk, fear, cultural losses, and negative effects on health associated with this proximity (Jacobsen et al., 2021; Jadhav & Barua, 2012; Tan, 2021). They may also face economic losses through livestock predation and damage to crops and property (Dickman et al., 2011; Nyhus, 2016). Although indirect factors are also important (Dickman, 2010; Jacobsen et al., 2021; Kansky & Knight, 2014), these economic losses can result in antagonistic behaviours—such as the pre-emptive or retaliatory killing of threatened wildlife—being viewed more favourably (Holmern et al., 2007; Karanth et al., 2013; Marchini & Macdonald, 2012; Nyirenda et al., 2015; Ogada et al., 2003; Romañach et al., 2007).

There are various approaches that aim to reduce the economic costs associated with living alongside large mammals. These “payments to encourage coexistence” (PEC) are diverse and include compensation, insurance, revenue-sharing initiatives, and conservation performance payments (CPPs) (Dickman et al., 2011: 13937). They seek to rectify the “market failure,” whereby the high global valuation of large mammals has failed to translate into effective local cost reduction (Macdonald, 2001; Nelson, 2009: 381). By offsetting some or all of the economic costs of human−wildlife conflict, PEC aim to encourage human−wildlife coexistence. Although the meaning and usefulness of the concept is plastic and contested (Fiasco & Massarella, 2022), human−wildlife coexistence is generally seen as a desirable, dynamic, and locally grounded state, in which human and wildlife populations persist in shared spaces at an acceptable level of friction and cost to both (see Pooley et al., 2021).

Although the cost-efficiency of the different types of PEC has been debated (e.g., Bulte & Rondeau, 2005; Skonhoft, 2017; Zabel et al., 2011), an overriding focus on their economic efficiency may overlook other important factors, including nonmaterial values (Chan et al., 2012), broader ecosystem functioning (Palmer & Filoso, 2009), and social equity (Corbera, 2012; Corbera & Pascual, 2012; Pascual et al., 2014).

We focused on the latter because, whereas the literature on the equitability of broader incentives for conservation is well developed (e.g., Calvet-Mir et al., 2015; Pascual et al., 2014), little has been written in the context of PEC. We interrogated the simplified discourse that suggests economic incentives, such as PEC, work well for both nature and people. We do so because left unchallenged, this conceptual “win-win” underplays trade-offs and risks ill-informed conservation strategies that lack legitimacy and reproduce local inequalities (Corbera, 2012: 615).

2.3 Conceptualising equity

Equity in conservation can be conceptualised in different ways. We followed Crosman et al. (2022) in considering equity as what is fair and just, particularly for the less powerful. Importantly, we viewed equitability as a spectrum, and considered positive and negative factors.

2.3.1 Equity as a moral imperative

Conservation tools cannot address all social wrongs, but it is imperative that the use of economic incentives does not exacerbate them (Adams et al., 2004; Tan, 2021). Despite this, evidence suggests that economic tools for conservation may struggle to deliver both equitable and efficient outcomes (Calvet-Mir et al., 2015; Pascual et al., 2010, 2014). They can also deepen existing inequalities through mechanisms such as elite capture, whereby wealthy or powerful groups benefit disproportionately at the cost of others (Dickman et al., 2011; Hayes et al., 2019).

Inequitable conservation risks the erosion of cultures and the marginalisation of vulnerable people (Holland & Roe, 2021). Some argue that equitable participation is not just a vital component of well-being (Prilleltensky, 2013), but a basic human right for those affected by conservation actions (Dietsch et al., 2021).

2.3.2 Equity as an instrumental concern

Concerns over equitability can also come from an instrumental viewpoint. For example, communities are less likely to engage with conservation measures if they are unfairly burdened or excluded from their design and implementation (Martin et al., 2015; Vucetich et al., 2018). Inequity can fuel antagonism toward conservation entities and have negative consequences for people and wildlife (Dietsch et al., 2021; Rakotonarivo et al., 2021a). Correspondingly, greater levels of social equity can make conservation interventions more effective (Rakotonarivo et al., 2021a) and aid the resolution of many conflicts over conservation, for example by increasing social engagement and collaboration, promoting unity within the community, and increasing trust between participants and conservation authorities (Rakotonarivo et al., 2021b; Young et al., 2016).

Using examples from the literature, we explored the equitability and inequitability of PEC, and provide three recommendations to inform a fairer and more legitimate conservation approach.

2.4 Methods

We conducted a non-systematic review of PEC as defined by Dickman et al. (2011) (i.e. compensation, insurance, revenue-sharing initiatives, and conservation performance payments). A non-systematic approach was chosen as we sought to establish the capability of PEC to be inequitable and explore the possible merits of CPPs in this regard, rather than provide any kind of synthesised answer (Munn et al., 2018; Naeem et al., 2023). Specifically, we wanted to explore the particular ways in which PEC might implicate equity as conceptualised in section 1.2 (i.e. comprising recognition, procedure, distribution, and context), in the same manner as similar studies (e.g. Friedman et al., 2018).

Peer-reviewed articles which discussed PEC and implicated equity were compiled into a spreadsheet where the type of PEC, country, funder, target species, and other details were noted. We identified mechanisms of inequity in PEC both inductively and deductively: some were observed in the literature and guided the development of theory, whilst others - such as the role of gender - were already explicitly situated within specific frameworks and therefore guided the analytical process (Braun and Clarke, 2006; Elo & Kyngäs, 2008). We used thematic analysis as this versatile technique can provide insights using both inductive and deductive approaches (Majumdar, 2019). Initial focused coding identified the most common themes and was guided by the use of memos (Charmaz, 2006; Holton, 2007). For the deductive elements, we used theoretical coding - also referred to as theoretical thematic analysis (Braun and Clarke, 2006; Naeem et al., 2023) - to braid the data into existing theory (Strauss and Corbin, 1994).

We populated the spreadsheet with rich verbatim text in an attempt to ensure that identified themes originated from the literature and not from the researcher, but as outlined in section 1.7.1, thematic analysis always requires a level of interpretation and therefore risks being influenced by subconscious preconceptions (Connell and Lowe, 1997; Timmermans and Tavory, 2012). Furthermore, our review was limited to peer-reviewed articles written in English, which means the examples provided in this chapter are likely to be geographically biased (Nuñez & Amano, 2021). However, this

is less of a limitation given that our goal was to be illustrative of the capability of PEC to be inequitable, rather than representative.

2.5 Dimensions of inequity in PEC

In some contexts, PEC—as currently conceived and implemented—may exacerbate social inequalities and even contribute to the conflict they seek to address. These dimensions of inequity fall broadly into six themes: wealth, gender, land-rights, location, legitimacy, and trustworthiness. These last two themes – legitimacy and trustworthiness – are interrelated, but distinct (Stupak et al., 2021; Saif et al., 2022). By maintaining this separation we avoid conflating trustworthiness in a management agency or governing body with the legitimacy of the conservation intervention within its broader socioecological and political context (Turner et al., 2016; Bruskotter & Wilson, 2014). Additionally, by analysing trustworthiness as an individual theme we remain consistent with other work on human-wildlife relations, such as the wildlife hazard acceptance model (Bruskotter & Wilson, 2014; Slagle & Bruskotter, 2019).

2.5.1 Wealth

Engagement with PEC can be costly, and disproportionately so for those with lower incomes. For example, a majority of sheep owners in central Italy refused to engage with an insurance scheme for livestock lost to wolves (*Canis lupus*) because they were first obliged to dispose of carcasses—an expensive requirement (Marino et al., 2016). Similarly, the €250 personal excess income fee in a Finnish compensation scheme is a more significant barrier to engagement for poor reindeer (*Rangifer tarandus*) herders than it is for their wealthier counterparts, because the fee represents a larger proportion of their income (Heikkinen et al., 2011).

In some contexts, the requirement or expectation to pay bribes to “help officials arrive at expedient conclusions” is frequently noted as a similar obstacle (Johnson et al., 2018; Madhusudan, 2003: 315). Some schemes seem more overtly inequitable with regard to wealth. One Kenyan compensation scheme reinforced existing social inequalities by excluding people who did not own livestock from the fund, but they were still saddled with associated community-wide obligations. These individuals were some of the poorest members of the community—where wealth was measured primarily in terms of livestock ownership—and were underprivileged in terms of access

to other possible forms of income generation. Their exclusion from this PEC, therefore, compounded this inequality (Anyango-van Zwieten et al., 2015).

2.5.2 Gender

In many contexts, women are more vulnerable to predators, perceive them as more dangerous, and are less tolerant of them than men (Dickman et al., 2013; Harvey et al., 2017; van der Meer & Dullemont, 2021). Despite this, women are less likely to report conflict with wildlife to local authorities (Johnson et al., 2018), and female heads of households can struggle to access compensation without male support (Jadhav & Barua, 2012; Ogra, 2009; Ogra & Badola, 2008).

In many places, caring responsibilities mean that women are less able to perform conflict-minimising work or travel great distances to file the required reports for compensation claims (DeMotts & Hoon, 2012; Ogra & Badola, 2008). Institutional biases and low self-confidence combine to further hinder women's participation in PEC (Kimanzu et al., 2021; Ogra, 2009; Ogra & Badola, 2008). Moreover, some schemes may not adequately represent women (Anyango-van Zwieten et al., 2015) or may exclude them explicitly (Bandara & Tisdell, 2002).

2.5.3 Land-rights

Proof of land-rights is another common obstacle in PEC schemes. In India, a significant proportion of compensation for crop and livestock losses goes unclaimed due to a lack of official land-rights. The insistence on producing this proof is “without basis” and effectively functions to impede access to compensation for most households (Madhusudan, 2003: 473). Tenant farmers can also get a bad deal when compensation is instead paid to landowners (Ogra, 2009; Ogra & Badola, 2008). In other cases, they may be excluded from compensation altogether on the basis that they are only leaseholders, despite their eligibility under wider law (Bhattacharjee & Parthasarathy, 2013). Issues of land-rights closely intertwine with those of wealth and gender. Ogra (2009) notes that tenant farmers on the periphery of Rajaji National Park tend to be women and that they face greater difficulties when attempting to claim compensation due to a lack of proof of land-rights or details of the sharecropping arrangement.

The matter of land ownership is not only an issue for people who might wish to claim compensation, but also for the authorities responsible. In South Africa, multiple government departments have unclear responsibilities for various species inside and outside of Kruger National Park (including a department specifically for the border fence). Additionally, the lands where most conflict occurs are under unclear ownership, even though they ought to have been officially returned to local communities according to the Communal Land Rights Act (number 11 of 2004) (Anthony et al., 2010). This type of bureaucratic complexity—stemming from ambiguous or contested land tenure—can seriously impede individuals' engagement with PEC.

2.5.4 Location

Because compensation payments often do not reimburse travel costs, claimants in remote regions incur higher transaction costs, sacrificing time and paid work to travel across isolated areas (Jadhav & Barua, 2012; Madhusudan, 2003; Sengupta et al., 2020). Furthermore, these locations often lack public transport infrastructure, and it is likely that this results in lower initial compensation claim rates (Pozo et al., 2021).

Similarly, individuals' access to compensation may depend on their proximity to protected areas. For example, while crop losses do not differ significantly between households inside and outside the buffer zone around Kanha Tiger Reserve, India, those outside were less likely to claim and obtain compensation, and received lower sums on average (Karanth et al., 2012). It may simply be that the governing authorities are reluctant to disburse funds in areas where charismatic megafauna (i.e., tigers [*Panthera tigris*]) are absent (Miller et al., 2016).

2.5.5 Legitimacy

The perceived legitimacy of a conservation approach is likely to relate to its environmental success (Witter, 2021). As the following examples show, however, PEC schemes are sometimes seen as illegitimate by potential participants due to different understandings at a core level. In Arizona (United States), for instance, most livestock producers believe that compensation is simply a publicity stunt by environmental organisations (Vynne, 2009). In Italy, insurance and compensation are perceived by some as illegitimate; a significant minority of farmers do not engage with insurance as a matter of principle (Marino et al., 2016: 233). They believe it unjust that they should have to insure their livestock against damage from wolves, which they view as state

property. Some of these farmers oppose compensation of any type on the grounds that it would legitimise wolf presence (Marino et al., 2016). Likewise, a majority of Botswanan farmers, questioned by McNutt et al. (2017), believe the government owns and benefits most from wildlife, yet does not adequately support those who incur the costs.

2.5.6 Trustworthiness

Trust is widely considered fundamental to conservation management and success (Dietsch et al., 2021). Trust—whether in institutions or in individuals—mediates perceptions of equitability (Nyaupane et al., 2009). Mistrust in PEC can be attributed to various factors, including corruption (Ogra & Badola, 2008), procedural exclusion (Marino et al., 2016), uneven access to information (Anthony et al., 2010), perceived lack of political will (Marino et al., 2016; Vynne, 2009), and broken promises (Anthony, 2021). In one Finnish compensation scheme, reindeer herders must spend time attempting to find and prove livestock losses (Heikkinen et al., 2011). Their perspective is frequently ignored, despite their local ecological knowledge, and relations with hunters and environmentalists are characterised by mistrust (Heikkinen et al., 2011).

2.6 Recommendations

Given the diversity of PEC, the negative aspects we highlight are unlikely to be exhaustive; rather, they illustrate the capability of PEC to be inequitable. Crucially, however, this is not an inherent characteristic; PEC can function as vehicles of social good too. Based on examples from the literature, we make three broad recommendations to improve the equitability of PEC: cooperatively design PEC with compensatory equity in mind; increase consideration of CPPs and the technologies to guide their implementation; and source PEC funding from the Global North to reduce global coexistence inequalities.

2.6.1 Compensatory and cooperative approaches

The equitability of PEC should be a principal consideration of scheme designers. By taking a more active role in ensuring social equity, PEC can increase community engagement, improve collaboration, and promote unity among participants—even when they are required to contribute financially (Alexander et al., 2021; Rosen et al., 2012). For example, an insurance scheme in Pakistan provides access to primary education for girls in participating villages (Rosen et al., 2012). This compensatory equity approach (Nyaupane et al., 2009) recognises the stark gender inequality in terms of access to, and quality of, education in the local context (Aslam, 2009; Khan et al., 2015). Factors such as gender, therefore, do not function simply as dimensions of inequity, but rather as complex elements that can be used to fulfill social goals.

Cooperative participation is also crucial, because it can help to increase trust between participants and the organisation or authority implementing it. This is the case in a CPP in northern Sweden, where Sami reindeer-herding villages are paid based on the number of lynx (*Lynx lynx*) and wolverine (*Gulo gulo*) reproductions on village lands. There, carnivore numbers are monitored cooperatively by the authorities and reindeer herders. This reduces mistrust between the groups because people more readily accept estimates and data that they helped produce (Persson et al., 2015).

2.6.2 Greater consideration of CPPs

CPPs avoid the moral hazard associated with other PEC—where people may be incentivised to reduce livestock protection to claim financial compensation—and are the only PEC that "directly incentivizes" human−wildlife coexistence (Dickman et al., 2011: 13942). Some scholars argue that such payments are likely to be more efficient because "you get what you pay for" (Ferraro & Kiss, 2002: 1719). They also frame conservationists and the people living alongside wildlife as equals, building trust through reciprocal obligation (Hussain, 2019: 83−84).

Furthermore, while ex post compensation and insurance schemes—which comprise the vast majority of PEC (Ravenelle & Nyhus, 2017)—target livestock owners by default, some of the costs associated with living alongside large mammals, such as fear, are not experienced solely by livestock owners (Jacobsen et al., 2021). Conversely, because CPPs can be paid to collectives, they may incorporate previously excluded or marginalised groups in a more equitable manner. This is particularly promising because it is known that some demographic sectors, such as women, may

value wildlife-derived benefits more than other groups (Keane et al., 2016), and that once appropriately engaged, can contribute to more equitable conservation (Alexander et al., 2022). Indeed, a shift from compensation and insurance-based schemes to CPPs has been widely recommended (Ravenelle & Nyhus, 2017).

Although CPPs provide many opportunities to improve the equitability of PEC, they are not inherently equitable. As with all PEC, care must be taken to ensure that governance systems are suitably cooperative and well-adapted to the local context. In particular, caution must be taken to avoid elite capture, especially where votes on collective decision-making remain proportionate to livestock ownership, or where land-rights are unclear (Zabel & Holm-Müller, 2008; Zabel et al., 2014).

This latter problem is important because well-delineated group boundaries are crucial in ensuring that payments go to those bearing the costs of coexisting with wildlife (Zabel & Holm-Müller, 2008). This can, however, be difficult to ensure in contexts where the target species is particularly wide-ranging. Fortunately, recent advances in technology may be able to overcome this obstacle. For example, telemetry data from radio-collared lions (*Panthera leo*) has recently been used to estimate the cost of lion presence across communal conservancies in Namibia (Heydinger et al., 2022). This approach would enable differentiated payments to be made that more accurately reflect the unequal and dynamic distribution of lions and their impacts across the landscape. In a similar vein, advances in environmental DNA sampling (Booth et al., 2023) and acoustic monitoring (Markova-Nenova et al., 2023) may provide another way in which species presence can be established and equitable payments guided.

2.6.3 Reducing global coexistence inequalities

The equitability of PEC is also a problem at the global level. Recognising the "coexistence inequality" whereby the costs of living alongside wildlife are disproportionately borne by rural people in the Global South (Jordan et al., 2020; Macdonald, 2001: 803; Braczkowski et al., 2023), some argue that the costs of implementing PEC should be borne by the international community (Dickman et al., 2011).

The potential for the wider adoption of PEC, funded by the Global North, to reduce these broad-scale coexistence inequalities should therefore be explored further. Scholars suggest that similar approaches could incorporate diverse funding streams, such as conservation credits, donor grants, and state-based levies, which could include a substantial carbon tax (Dickman et al., 2011; Fletcher & Büscher, 2020).

Such a model could potentially be less vulnerable to shocks, such as the Covid-19 pandemic, but would face difficulties regarding scalability (Lindsey et al., 2020). Similarly, while this type of approach could form part of a transformative economic reconstruction (Sandbrook et al., 2022) and help rich countries increase their relative conservation effort (Lindsey et al., 2017), there are concerns that such an approach would simply represent a continuation of a neoliberal paradigm which risks entrenching power imbalances and undermining conservation effectiveness (Corbera, 2012; Fletcher & Büscher, 2017; Kolinjivadi et al., 2019). The details of such a shift in funding and framing are, therefore, crucial in determining its effectiveness and equitability.

2.7 Concluding remarks

Ensuring that conservation actions are equitable is not only a moral imperative, but an instrumental one. Despite this, it is evident that PEC can exacerbate as well as ameliorate social inequalities. It is imperative that schemes are developed in a participatory manner because this can integrate issues of equity, governance, and norms in a way that has the best chance to achieve socially and ecologically sustainable outcomes (Amit & Jacobson, 2018). Scheme designers should consider how PEC affect preexisting inequities (and vice versa) and how the impacts of PEC may vary across social groups and time (Crosman et al., 2022). There is a need for compensatory approaches in PEC, for greater consideration of CPPs, and for global funding patterns to better reflect current global coexistence inequalities (Figure 2.1).

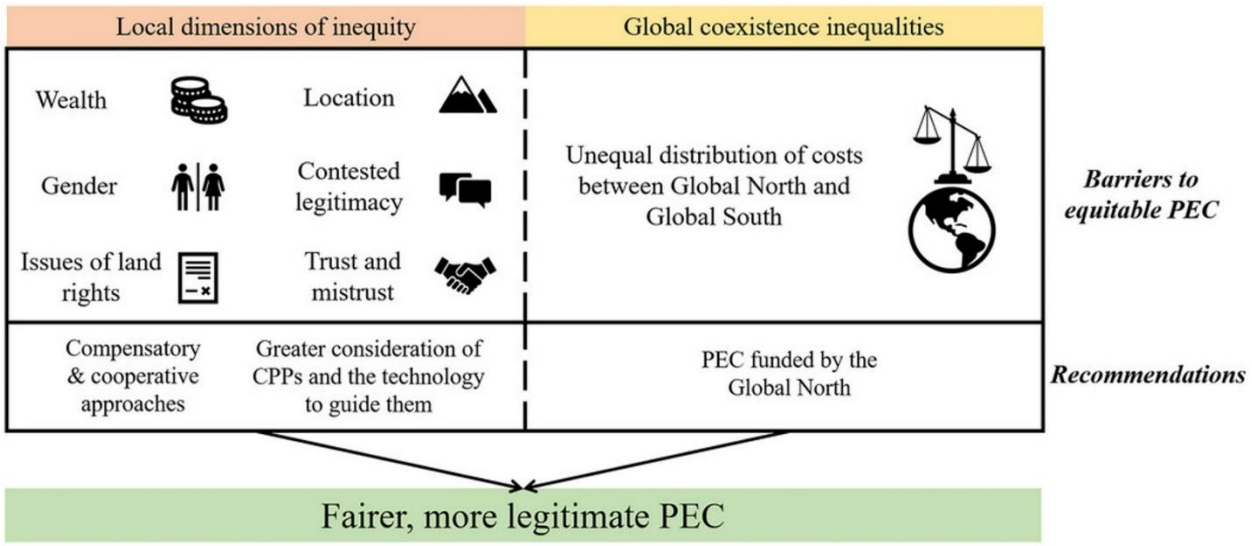

Figure 2.1: Current barriers to equitable payments to encourage coexistence (PEC) and recommendations to overcome them, which include conservation performance payments (CPPs).

Future research should explore how the costs and benefits associated with living alongside wildlife influence people's behaviour. Additionally, little is known about the psychological and social mechanisms by which PEC influence different groups, and how this may relate to effectiveness and equitability. A failure to ensure the fairness of PEC at both local and global scales diminishes its legitimacy and jeopardises the sustainability of conservation efforts.

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Chapter Three - “Milking the lions”: An analysis of conservation performance payments in eastern and southern Africa

3.1 Abstract

Conservation performance payments (CPPs) aim to encourage coexistence between humans and large carnivores by tying payments to species presence or abundance. While there is growing interest in the development of these programs, they remain the subject of little empirical research. Furthermore, there is no literature on CPPs for carnivores in Africa, despite the continent's global importance in carnivore conservation and the fact that multiple such schemes are currently in operation. This research establishes where and how these schemes function and identifies recurring challenges associated with their implementation. We conducted semi-structured interviews with representatives of nine conservation performance payment programs operating across five countries in eastern and southern Africa. We find that despite their theoretical simplicity, local complexities and pragmatism mean there is significant variation in how CPPs operate. This includes differences in monitoring methods, governance, and all aspects of payments. The inclusion of input conditionality (i.e., fines or bonuses for certain actions) in a majority of schemes also challenges the prevailing conceptualisation of CPPs as entirely results-based. Recurring challenges include securing long-term funding, setting suitable payment levels, and ensuring equitable governance. Practitioners view performance payments as a promising approach for carnivore conservation, but their roll-out risks moving faster than our understanding of them.

3.1 Introduction

Large carnivores have undergone a dramatic global decline in population size and range (Ripple et al., 2014; Wolf & Ripple, 2018). This is partly due to competition over access to space and resources between them and the human populations they live among (Inskip & Zimmermann, 2009; Nelson, 2009). This competition imposes a variety of negative impacts on people, which in many contexts incentivises the persecution and killing of large carnivores (Dickman et al., 2011; Inskip & Zimmermann, 2009; Nelson, 2009; Zabel & Holm-Müller, 2008). Conservationists have

tried to address this with economic incentives such as compensation, insurance, and performance payments (Dickman et al., 2011).

Conservation performance payments (CPPs) are a relatively novel type of payment for ecosystem service, where payments are tied to the presence or abundance of species (Zabel & Roe, 2009). This results-based approach is thought to make them more cost-effective than less direct payments (Drechsler, 2017; Ferraro, 2001; Ferraro & Kiss, 2002; Ferraro & Simpson, 2002), and has seen them implemented for a wide variety of species, including plants, butterflies, turtles, and farmland birds (Ferraro & Gjertsen, 2009; Herzon et al., 2018). CPPs are of particular interest for carnivore conservation because, unlike compensation and insurance—which relate only to dead livestock—performance payments can directly incentivise coexistence with living carnivores (Dickman et al., 2011).

The current literature on performance payments for carnivore conservation mainly consists of research on the economic theory underpinning their mechanism (Drechsler, 2017; Heydinger et al., 2022; Zabel & Holm-Müller, 2008; Zabel & Roe, 2009) and broader theoretical discussions of their potential and challenges (Dickman et al., 2011; Hamm et al., 2024; Nelson, 2009). To our knowledge, only five such schemes appear in the peer-reviewed literature, and while there exists a number of individual case studies (e.g., Chen et al., 2022; Eshoo et al., 2018; Harvey et al., 2017; Hiedanpää & Borgström, 2014; Persson et al., 2015), no previous work has comparatively analysed the choices and challenges facing CPP operators.

Here, we address this knowledge gap, using case studies from across eastern and southern Africa. We focus on these regions because, while they have largely succeeded in maintaining populations of large carnivores, they have significant human–carnivore conflict and ongoing species declines (Bauer et al., 2015; Di Marco et al., 2014; Gebo et al., 2022; Gray et al., 2020; Lyamuya et al., 2014; Ripple et al., 2014). Furthermore, multiple CPPs for carnivores are currently in operation in these regions but remain absent from the peer-reviewed literature. We contribute to the scholarship by answering the following research questions: how do these schemes operate, how does this compare with prior theoretical assumptions, and what challenges do they face?

3.2 Methods

We interviewed 12 individuals, representing nine CPPs across five eastern and southern African countries. We used a purposive “snowball sampling” approach to

identify interviewees. Some individuals were initially identified as possible participants through social media and non-governmental organisation (NGO) reports that indicated that their organisations were involved in a CPP. These individuals were then asked to recommend potential others. This approach can produce a non-representative sample, as interviewees may select others who share perceptions on the topic of interest (Salganik & Heckathorn, 2004), but it is an effective way to access a small population and explore a topic in depth (Newing, 2011; Parker et al., 2019; Rust et al., 2017).

Two interviewees described their roles as primarily research-focused, and another as a development economist and community elder. The remainder were program directors or project coordinators of their organisations' broader conservation work. Exploring these professionals' insights and perspectives is critical because they are the people who are interpreting, shaping, and implementing a novel conservation tool in response to on-the-ground needs, in the absence of a relevant body of literature (Martin-Ortega & Waylen, 2018).

Semi-structured interviews were conducted with between one and three people per scheme, as the CPPs were typically overseen by just one or two staff members within the organisations' broader structure. Schemes were represented by more than one interviewee only when it was convenient, relevant, and when the individuals performed different roles regarding the scheme. Two CPPs were represented by the same two individuals, as the schemes are operated in the same place and by the same organisation. Interviews were conducted online or by telephone, with the exception of one scheme, which was conducted in person as part of a separate and in-depth case study. Each participant was interviewed once, for approximately 1 h, between June and November 2023. We do not link interviewees' roles with specific schemes, countries, or regions in order to maintain their anonymity as per the informed consent agreement.

We took an explorative approach to interviews in order to identify those issues believed by participants to be important, without dictating any prior frame of analysis (Mabon et al., 2021). These perspectives were subsequently used to adapt data collection in a dynamic process that guided subsequent interviews (Pettersson et al., 2021; Rust et al., 2017). The exact questions asked of each interviewee, therefore, varied, but all were asked to explain the decisions underpinning scheme design, as well as questions relating to funding, equity, theories of change, challenges, successes, and context-specific issues (see Appendix G).

This approach meant that we could interweave our findings into existing conceptual research (Mabon et al., 2021; Strauss & Corbin, 1994), particularly relating to the design (Dickman et al., 2011; Nelson, 2009; Zabel & Engel, 2010; Zabel & Roe, 2009)

and broader socio-political contextualisation of CPPs (Hiedanpää & Borgström, 2014; Sjoegren & Matsuda, 2016; Åhman et al., 2022; Hamm et al., 2024). A potential drawback with this approach is that important themes may only be incorporated later in the data collection process (Potgieter et al., 2017); no such pattern was observed here. Data were analysed thematically in the qualitative analysis software NVivo 12 (QSR International UK Ltd.), with an initial coding structure comprising three categories relating to the implementation of CPPs, namely: scheme design, governance, and challenges (Attride-Stirling, 2001). These organising themes were added to and populated with data-derived re-occurring basic themes, iteratively revised to produce a logical narrative that reflected interviewees' responses and the process of CPP development (Attride-Stirling, 2001; Mabon et al., 2021; Pettersson et al., 2021, 2022).

Ethical approval was provided by the University of Leeds (AREA FREC 2022–0157-146; AREA FREC 2023–0157-692). Research in Tanzania was supported by research permits from the Tanzania Wildlife Research Institute (TAWIRI; AB.235/325/01/135) and Tanzania Commission for Science and Technology (COSTECH; 2023-053-NA-2023-1067), and was conducted with permission from all relevant regional and local governments.

3.3. Results

Before the results of the thematic analysis, we provide a brief overview of the schemes.

3.3.1 Overview

The interviews revealed that three of the nine CPPs represented were trials that had concluded between 2020 and 2023. The other six began between 2015 and 2023. All are operated by NGOs, with a single NGO operating four. In all cases, the CPP is not used as a standalone tool, but rather as one component of broader attempts to encourage coexistence between people and wildlife. All but three schemes are at least partly funded by the Lion Recovery Fund, a grant-making body managed by the Wildlife Conservation Network, a US-based NGO.

Five schemes operate in areas with some degree of protection for wildlife (i.e., game management area, conservation area, reserve, wildlife management area, or

community conservancy), and three are adjacent to such areas (including private game ranches). The carnivore guild is largely consistent, with lion *Panthera leo*, leopard *Panthera pardus*, spotted hyena *Crocuta crocuta*, and wild dog *Lycaon pictus* all present (although rare in some). Striped hyena *Hyaena hyaena* are present in four, and cheetah *Acinonyx jubatus* in five—although typically in low numbers. Only one scheme pays for a single species (lion), with the rest paying for most or all of the large carnivore species present.

Interviewees overwhelmingly perceived their respective CPP as achieving greater behavioural tolerance of large carnivores, but there has been no robust evaluation in any of them. Knowledge sharing between schemes is limited, with one interviewee noting “we're all so isolated … I wish there was more sharing between projects about what we're learning.”

A recurring theme was that of the threats facing large carnivores, with interviewees identifying multiple. Snaring was repeatedly implicated, although mostly as unintentional bycatch in snares set for subsistence hunting, targeting ungulates like impala *Aepyceros melampus* and bushbuck *Tragelaphus scriptus*. Deliberate spearing or poisoning (where a carcass is laced with a highly toxic pesticide such as carbofuran) were also identified as serious threats. Such actions were perceived as typically being done in response to, or as an attempt to prevent, livestock depredation. While poisoning events were considered infrequent, their impact is disproportionately large due to the potency of the chemicals and their indiscriminate effects (Dunford, 2022; Masenga et al., 2013). Land-use changes, livestock encroachment, and direct killing for the illegal trade of body parts (e.g., lion teeth and claws) were also considered threats, but by fewer interviewees. Traditional killings, where carnivores are killed as a “symbol of strength and power of a young warrior” were not considered a current threat, but had been an issue in three schemes in recent years.

3.3.2 Scheme design

3.3.2.1 Payment systems

Three different payment systems are used by these CPPs. Four use a continuous system, whereby the recorded presence of a target carnivore is worth a specific, pre-agreed amount of money. Those schemes which pay for multiple species in this manner equate their different “values” using points-based systems, where points equate to a monetary value. The number of points assigned varies across species and

schemes, with large carnivores tending to score highest. Many interviewees noted the difficulty of assigning a suitable value to species, with one noting: “we had wild dogs come through, and we were not expecting that … the corresponding amount skyrocketed and we didn't have enough funds to cover that.”

Two schemes use a relative payment system, whereby participating units compete against one another and receive payments based on relative performance. Interviewees considered this to provide an element of budgetary stability, as the total payment amounts remain constant each cycle. Another scheme alternated between a continuous and relative payment system during different phases of the trial. The remaining two schemes use threshold payment systems, where payments are set at staggered levels. Both relative and threshold payment systems also assign point “values” to species in order to gauge overall performance, but use these points as units of comparison (to other participating units or specific benchmarks) and not as monetary equivalents.

3.3.2.2 Payment amounts

Species are valued differently across schemes. For example, the presence of a lion was worth just as much as the presence of a wild dog in one country, but twice as much in another, and 25% less than one in a third. There were also differences in absolute valuation. For example, a lion was valued at ~USD 25, ~USD 60, and ~USD 180 in three different countries. Interviewees justified the relative and absolute valuation of species with reference to their local and global abundance (with higher value assigned to endangered and/or locally rare species), propensity to kill livestock (particularly cattle), and likelihood to defend such kills (rather than be pushed off, so that any remaining meat can be harvested).

These varying payment amounts mean that the CPPs are framed differently. For instance, in one scheme, the payments are “not really to offset the costs” but “to acknowledge the costs of coexistence.” Similarly, in another, the goal is not “to match up the value of a goat [lost to a carnivore],” but to “give them some incentive not to reach for the gun straight off.” In another, the payments are “nothing” compared to the economic costs imposed by carnivores. In contrast, the payments disbursed by one scheme were considered by all three interviewees to be greater than the cost of livestock lost to lions (the only species paid for). One interviewee, a Maasai elder involved in implementing the scheme, described how “the people are speaking about milking the lions. They are our cows, they are our milking cows because we are getting benefits from them … we cannot kill a cow that gives us milk.” The payment (~USD

180 per lion, per month) aimed to offset the cost of livestock killed, but was considered an overestimate by the three interviewees, as it had been based on predation data from a lone male lion, and “if you have a group [of lions] … they're not going to take a cow each,” so the actual cost per lion was considered to be less. While unintentional, this perceived discrepancy was viewed positively, with interviewees noting that it helped to address the indirect costs of large carnivores, such as time spent protecting livestock.

This was the only scheme considered to more than offset the cost of livestock lost to the relevant carnivore species, with multiple interviewees noting that setting higher payment amounts was unfeasible due to the difficulty of obtaining and synchronising short-term grants across funding cycles. Two schemes even started without sufficient funding in place. Across all schemes, the total amounts of money disbursed, and their regularity, varies widely (see Table 3.1).

Table 3.1. The conservation performance payments of eastern and southern Africa vary widely in their operation. NB: “village” should be considered to mean different things (e.g., a small collection of households, up to a large settlement of multiple sub-villages).

Scheme	Country	Number of interviewees	Payment system	Payment amount	Payment frequency and recipient	Monitoring	Input conditionality	Years
A	1	3	Continuous	~USD 180 per lion, per month. Capped at ~USD 10,800 per ward, per year	Every 4 months, to wards (2 in total, formed of 3 villages each)	Spoor presence, playbacks, and telemetry data	Fines	2020-2023
B	1	2	Relative	Certain species are allocated specific 'points'. Payments from ~USD 400-1600	Every 3 months, to villages (11 in total, in groups of 3 or 4)	Camera traps	None	2015 - present
C	1		Threshold	A base payment of ~USD 500. The performance element is tied to 'points' and set to thresholds, which differs across the two sites but range from ~USD 60-400. Overall payments are capped at minimum (~USD 100) and maximum (~USD 1000) amounts, regardless of additional inputs	Site 1: every 3 months, to villages (2 in total). Site 2: every 2 or 3 months to villages (3 in total)	Camera traps, telemetry data, and spoor presence	Fines and bonuses	Site 1: 2021-present Site 2: 2022-present
D	2	1	Threshold	A base payment of ~USD 200. The performance element is tied to 'points' and set to thresholds (~USD 410, 510, and 680). Overall payments are capped at minimum (~USD 68) and maximum (~USD 880) amounts, regardless of additional inputs	Every 3 months, to villages (5 in total)	Camera traps	Fines and bonuses	2022-present
E	2	1	Continuous	A base payment of ~USD 920. The performance element consists of allocating certain species 'points', which have an equivalent monetary value. Overall payments are capped at minimum (~USD 200) and maximum (~USD 2700) amounts, regardless of additional inputs	Every 2 months, shared between 12 villages	Camera traps	Fines	2023 - present
F	3	2	Relative	Varied across different phases, but finished with payments ranging from ~USD 100-200	Every 1-3 months, to up to 8 villages	Alternated between spoor presence and camera traps	None	2020-2021
G	3	1	Alternated between continuous and relative	Varied, but ranged from ~USD 540-770 per village per cycle	Every 3 months, to villages (2 in total)	Camera traps	Fines	2020-2021
H	4	1	Continuous	~USD 25 for lion, leopard, and spotted hyena, ~USD 13 for wild dogs. Various payments for ungulates. Capped at ~USD 5650 per village per year.	Every 3 months, to villages (10 in total)	Camera traps	Bonuses	2021 - present
I	5	1	Continuous	~USD 60 for lion, ~USD 30 for wild dog and cheetah, ~USD 6 for leopard	Monthly, to individuals (17 in total)	Camera traps	None	2021-present

3.3.2.3 Monitoring of carnivores

There is further variation in how the focal species are monitored. Camera traps are the most common tool, with six schemes using them in isolation and another in conjunction with telemetry data. Additionally, one scheme alternated between using camera traps and sand pits (for spoor). Most schemes allow participants to move the cameras at specified intervals, but one fixes them permanently in place. This means that the data can also be used for long-term ecological monitoring, but it does reduce participants' ability to maximise carnivore encounters across seasons.

The images collected by camera traps are utilised differently. For example, one scheme pays only once per species, per day (e.g., a single elephant *Loxodonta africana* seen once and an entire herd seen twice are equivalent). Another scheme in the same country will only pay once per day if it is “clearly the same individual,” but does pay for multiple individuals of the same species in the same day. Others differ in how they define independent events. One scheme has no cut-off period and simply pays per picture. In contrast, another did not want to pay “for 50 pictures of the same leopard,” but would pay again “if you could show that it was a separate [individual] coming through.” Four other schemes use cut-off periods ranging from 15 to 30 min.

One scheme targets lions alone, and is the only one that does not use camera traps. Instead, lion occurrence is determined by spoor presence, complemented by telemetry data and playbacks (where animal noises are played through a speaker in order to attract individuals). One interviewee described “a lot of weaknesses” in this monitoring approach. These include being unable to account for variation in spoor presence and persistence across different substrates, and difficulties in determining the number of individuals: “it relies a lot on my judgement … females and the juvenile lions can be near impossible to distinguish.” When there is doubt over the number of individuals, they “don't pay for the extra lion.”

There was agreement that using spoor requires significant survey effort, as information is readily lost to rain and other disturbances, whereas camera traps can be left in situ for extended periods. While the use of telemetry data can help to guide more accurate and equitable payments (Hamm et al., 2024; Heydinger et al., 2022), the money, expertise, and bureaucratic engagement required made it unfeasible for most schemes.

3.3.2.4 Input conditionality

While CPPs are typically considered to be based on outcomes (i.e., species presence), most (six) of the studied schemes incorporate some element of input conditionality (i.e., fines or bonuses for certain actions). Some fines take the form of "points" deductions, for example, for every snare found, for every fire caught on a camera trap, for placing camera traps outside of pre-agreed areas, or for carnivore killing events. Fines can be less direct, too: in one scheme, snared animals pictured on a camera trap earn zero points, regardless of their original "value." Fines also take the form of withdrawal of payments, with longer periods for the most serious offenses, such as carnivore killing. For example, one scheme implements a policy whereby if a lion is speared to death illegally, payments are withheld for 6 months. If one is poisoned, this period is doubled.

In another scheme, the performance payment is augmented with bonus "points" for the participating units that obtain "the most lion pictures, the best picture, and the rarest picture…in terms of biodiversity." Participants also receive ~USD 470 up-front as a bonus upon signing the agreement. Other schemes add (or deduct) "points" depending on the quality of livestock enclosures, while another also has bonus payments for "lion bed-nights," where a lion spends the night on village land.

Relatedly, schemes differ in how they respond when camera traps are destroyed, lost, or stolen. These events are a common occurrence, and interviewees attributed them to opposition to the presence of camera traps from those illegally hunting wildlife, who were mostly considered to come from outside the area of performance payment implementation. Some schemes replace the camera traps but wait between 1 and 6 months to do so. This can be considered an indirect fine (due to a lack of monitored wildlife) and is typically intended to reduce the rate of camera vandalism through inducing social pressure. One scheme waits 4 months to replace any cameras and also imposes a ~USD 660 reduction in payments. In another, if cameras are lost to natural causes (e.g., floods or wildfires) they are replaced, but if stolen, they are not—although participants can choose to use their performance payment earnings to buy replacements.

Of the schemes that use camera traps, most collect evidence of illegal activities, such as people "walking with a gun and a dog, and then two hours later walking back with a sack-full of meat." Interviewees associated with performance payments in two countries noted that state conservation agencies had asked them to hand over such images (both refused these requests—"despite their big disgust with us!"). There is a fear that these government agencies perceive the NGOs as "not cooperating," and

such a situation is “difficult to navigate” due to the need for government permissions, such as research permits. Most interviewees were keen to highlight that they delete any such pictures at the first opportunity and referenced the need to maintain participants' trust. Two interviewees noted that it would be difficult for an organisation to implement a conservation performance payment if they have a history of working in conservation enforcement, as “camera traps are very scary,” and there can be “a lot of suspicion.” Where this is the case, “the cameras don't stay out there for long until people put a spear into it.” This is because of a perceived fear that the images will be used “as a tool of persecution,” where individuals are punished for behaviours seen as incompatible with conservation. Alternatively, where trust is greater, “communities … are very protective over them.” It was suggested that permanently fixing the cameras in specific locations may have helped to reduce mistrust regarding their purpose.

3.3.3 Governance

Agreements are typically signed by representatives of local governance structures (e.g., village chairmen and village/ward executive officers) and/or traditional leaders (e.g., chiefs and elders). Only one of these schemes pays individuals; the rest pay groups. In these, decisions on how the money should be spent are most commonly made through pre-existing local governance structures (e.g., village councils), although one scheme constructed its own elected committee.

Most interviewees acknowledged some shortcomings or inequities inherent in their governance system. For example, one interviewee noted how “village leaders need something for their personal benefit. So if you don't [give] the personal benefits to them, sometimes their cooperation can be not 100%.” Schemes typically persist with their chosen system for two reasons. Firstly, because some prioritise “building the capacity in the communities for the leadership,” even if this comes at the cost of some inequities. Secondly, because working through pre-existing structures (where inequities often arise) provides schemes with legitimacy and avoids antagonising locally important people (e.g., politicians).

One CPP, operating in a protected area, must have its expenditure approved by the relevant government conservation authority. This has presented a barrier to the use of funds, as some decisions (i.e., the extension of a water pipe and the repair of a school roof damaged by a storm) have been rejected on conservation grounds. Restrictions on expenditure are also imposed by some performance payment operators, but these tend to be “rather broad, because it is anything that is anti-conservation.” For instance,

the operator of one scheme is “very bullish” that participants have the right to choose: “it's their money, they decide … as long as [they] don't do anything like buy an AK-47.” So far, they have only chosen to buy food, typically in the form of sacks of maize, “which shows you how food-stressed they are.” In this area, crop losses from floods and a violent insurgency have made many participants' livelihoods even more precarious, but the interviewee believes that the CPP has “helped them hugely.” Food has also been chosen in another scheme, despite the fact that the interviewee originally wanted expenditure to be on more “tangible” items, so that the link between the benefits and conservation performance would be more apparent. In any case, they considered it a great success that participants have since chosen items likely to reduce human–carnivore conflict, such as “fence-posts and cement for bomas.”

Some CPPs mandate that certain proportions of the earnings are spent on specific sectors. In one, participants “had to spend a quarter on health care or education, because otherwise that never would have happened,” and it was “what would have the highest impact.” In two others, either 70% or 100% must be spent on certain sectors (education, veterinary medicines, and health insurance), with the perception that “these benefits get spread wide, both on a societal and individual or household level.”

3.4 Discussion

While some scholars argue that payments for inputs alone (like maintaining agreed land-use zones) constitute CPPs (e.g., Dickman et al., 2023), the prevailing conceptualisation is that they focus completely on outcomes (Zabel & Holm-Müller, 2008, p. 247; Zabel & Roe, 2009). This distinction matters because the directness of payments is likely to relate to their cost-effectiveness (Drechsler, 2017; Ferraro, 2001; Ferraro & Kiss, 2002; Ferraro & Simpson, 2002). However, we find that such a distinction might not be so clear-cut, because most of the schemes analysed here complement their results-based payments with elements of input conditionality (i.e., fines and bonuses). Researchers and practitioners should therefore be explicit in their discussions of “performance payments” as the terminology is open to interpretation and is already being used to refer to fundamentally different things, such as aspects of conservation bonds (Karolyi & Tobin-de la Puente, 2023, p. 244).

There is significant variation in how these CPPs function in practice, despite the fact that they all broadly target the same species and are operated by NGOs, in contrast to the state-run performance payments of the Global North (e.g., Chen et al., 2022; Hiedanpää & Borgström, 2014; Zabel et al., 2014). The CPPs analysed here use

different payment systems and pay different amounts at different regularities. Furthermore, while most schemes used camera traps to monitor carnivore presence, there is no consistency in how such data is used to guide payments. There are a number of possible reasons for this variation. It could be that their nascency means the relative merits of the different approaches are not yet known, or that their near-simultaneous implementation and limited knowledge sharing have precluded adaptation. The current lack of empirical research on CPPs limits our ability to make external comparisons, but it could simply be that there is no “best” approach, with different socio-ecological contexts meaning that what works in one site may not work in another.

For example, each payment system has advantages and disadvantages. Schemes using a relative payment system, for instance, benefit from the fact that the amount of money disbursed each cycle is always the same. This allows the operator to more accurately budget and gives an element of security to participants, who know how much money is available each cycle. Relative payments may be better when external influences outside of participants' control (e.g., drought) are a concern (Zabel & Roe, 2009), but less so when the presence of carnivores is strongly influenced by actions on neighbouring lands (Drechsler, 2017). Additionally, because such schemes pay for relative carnivore numbers, there is a risk that participants may collude or even sabotage others' performances (Zabel & Engel, 2010). The big drawback of relative payment systems is that even if carnivore numbers were to decline, the operator would continue to pay the same amount: relative payments dilute the results-based nature of performance payments. Conversely, because continuous payment systems tie payments directly to carnivore numbers, they incentivise the “delivery” of this service until a cap (if present at all) is reached. In any case, interviewees' choice of payment system was not driven by such considerations but primarily by budgetary concerns.

These budgetary concerns meant that only one scheme made payments greater than the cost of livestock lost to the relevant carnivore species (as judged by interviewees). This is slightly surprising, given that this is theoretically a key strength of CPPs over similar schemes, such as compensation. This finding echoes previous research, which shows that even state-operated schemes may struggle to take full advantage of the strengths of performance payments. For example, a Swedish scheme that pays for carnivore reproductions in reindeer-herding areas has not increased payment amounts since 2002, despite rising costs (Åhman et al., 2022). CPPs will fail to incentivise tolerance when they are perceived to be less than the costs of large carnivores, and significant and sustainable funds are required to maximise their broad-scale equitability and reduce global “coexistence inequalities” (Jordan et al., 2020, p. 804;

Hamm et al., 2024). Unexpected financial shortfalls (or scheme termination) may also result in antagonism toward conservation entities and goals.

One area of interest is alternative funding arrangements. One CPP in Laos is entirely funded by ecotourism fees (Eshoo et al., 2018), and a scheme under development in Botswana aims to be partially funded by local photo-tourism operators, as an acknowledgment of the contribution it would be expected to make to wildlife presence (J. Isden, personal communication, June 28, 2023). At a larger scale, representatives of schemes within and beyond our study regions are hopeful that the sale of biodiversity credits may fund their CPPs (J. Hamm, personal observation), although this risks further commodifying nature (Martin-Ortega et al., 2023).

It is important to be explicit in terms of behaviour change because different threats (e.g., intentional poisoning and unintentional snaring) have different drivers (Gandiwa, 2011), and this should inform the targeting and modality of payments. It may also influence the monitoring approach taken. For example, in some parts of southern Africa, poisoning has, in the last decade, become the most common way to kill lions (Everatt et al., 2019). In these contexts, camera traps are probably the most suitable carnivore monitoring method because indiscriminate killing methods (such as poisoning) are unlikely to be reduced if only one species has value tied to its presence (Pettigrew et al., 2012), and monitoring multiple species is easier with camera traps than with telemetry or spoor data.

The use of camera traps does mean that “human bycatch” (the unintentional capture of images of people) must be considered (Sandbrook et al., 2018, p. 493). Mistrust and suspicion regarding the use of such images result in camera traps being destroyed or stolen, which makes CPPs less effective and more expensive. Schemes may be able to increase trust by having a trusted community representative present during the download of camera images, or through increased communication and interactions with participants (Kansky et al., 2021), as was reported in a Swedish CPP (Persson et al., 2015). This may also contribute to a greater perception of benefits associated with the target species (Bruskotter & Wilson, 2014), but such trust-building is difficult when those destroying the cameras are from outside the area of scheme implementation (as was reported here). Regardless, it is imperative that scheme operators follow guidelines for the ethical use of camera traps (Sharma et al., 2020) and ensure that their use does not contribute to any data injustices (Pritchard et al., 2022).

Only one of the schemes analysed here was implemented prior to 2020, and four more remain in development across eastern and southern Africa: in Botswana, Kenya, and Namibia. Combined with interest from further afield—including Cameroon, the United States, Nepal, and Pakistan (J. Hamm, personal observation)—there is a risk that their

roll-out is moving faster than our understanding of them. First and foremost, it is still unknown if and how CPPs alter behaviour (Persson et al., 2015), and how scheme design may influence this. This information is required to ensure that CPPs are evidence-based (Sutherland et al., 2004) and not just another conservation “fad” (Redford et al., 2013, p. 437). Secondly, work is required to assess how their effectiveness relates to their equitability, and how this might vary across contexts.

3.5 Conclusions

By acknowledging the costs of living alongside dangerous animals, CPPs have the potential to make conservation fairer at the global scale (Dickman et al., 2011; Hamm et al., 2024; Jordan et al., 2020). In some contexts, CPPs can also help to ensure that basic human needs are met. However, local inequities can arise despite thoughtful governance; scheme designers should be mindful of factors that may reduce the compatibility of social and environmental goals in the context of their CPP.

We recommend that researchers and practitioners pool their knowledge so that lessons learned once need not be learned again. Progress is being made in this regard, with the inaugural meeting of a CPP “coalition” having taken place in January 2024. Here, operators of CPPs met with others considering their implementation to share insights and develop a network to discuss all aspects of design and management.

Most importantly, without understanding if and how CPPs reduce carnivore-killing behaviour, their continuing roll-out risks being misguided. It is critical that greater importance is given to evaluations of their effectiveness and mechanism of action to ensure the efficient use of conservation funds. Although CPPs are seen as a promising tool, enthusiasm should be tempered by the current lack of evidence for causal behaviour change.

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Chapter Four - Equitability, effectiveness, and the design of conservation performance payments for human-carnivore coexistence

4.1 Abstract

1) Equity is important in conservation, but the relationship between the equitability and effectiveness of conservation interventions is complex and context-dependent. Here, we provide the first assessment of the relationship between these goals in a specific and relatively novel type of payment for ecosystem service – conservation performance payments (CPPs). These are an increasingly popular economic tool used to encourage coexistence between people and wildlife, where payments are contingent on the presence or abundance of certain species.

2) We analysed two CPPs which aim to reduce the killing of large carnivores in Tanzania's Ruaha-Rungwa ecosystem. We explored the influence of certain design choices (collective sanctions, expenditure patterns, and adoption of a relative performance payment system) on the equitability and perceived effectiveness of these schemes. We conducted key-informant interviews (n=37), focus groups (n=5), participant observation, and surveyed CPP participants (n=375).

3) We find that collective sanctions are perceived to reduce carnivore-killing, but at the cost of equity. Adopting a relative performance payment scheme was seen as both ineffective and inequitable, and fully mandating sectors of expenditure was ineffective and had mixed equitability. We also find that the primary driver of behaviour change was not the payments themselves, but the fear of being observed on the camera-traps used to monitor carnivore presence.

4) We caution that trade-offs between effectiveness and equitability may undermine the long-term viability of CPPs, and emphasise the need for practitioners to incorporate contextual understandings into CPP design. Our results also question the simplistic economic rationale that surrounds CPPs.

4.2 Introduction

There is a growing wealth of research on the moral and instrumental importance of equity in conservation (Halpern et al., 2013; Klein et al., 2015; Friedman et al., 2018; Law et al., 2018; Crosman et al., 2022). Additionally, there are calls for the effectiveness of conservation interventions to be more rigorously assessed (Sutherland et al., 2004; 2019). Despite this, the relationship, if any, between the effectiveness and equitability of payments for ecosystem services (PES) remains unclear, despite their seeming potential to address both environmental and social problems (Pascual et al., 2010; 2014; Corbera and Pascual, 2012; Wunder et al., 2018). This lacuna is particularly glaring considering the emphasis placed on ensuring the equitability of conservation in the Kunming-Montreal Global Biodiversity Framework (CBD, 2022). Here, we contribute to this debate by providing what we believe to be the first such analysis of a specific and relatively novel type of PES – conservation performance payments (CPPs).

Conservation performance payments (CPPs) are an economic tool used to encourage coexistence between humans and wildlife, with payments contingent, to some extent, on species presence or abundance (Zabel and Roe, 2009). They often relate to large carnivores (Dickman et al., 2011; Hamm et al., 2025) because many such species have undergone drastic declines in range and population (Ripple et al., 2014) and can impose a range of negative costs on the people they live alongside (e.g. livestock depredation and even human injury and death) (Thirgood et al., 2005; Jacobsen et al., 2021). These costs incentivise the pre-emptive and retaliatory killings of carnivores (Ogada et al., 2003; Zabel and Holm-Müller, 2008; Marchini and Macdonald, 2012; Inskip and Zimmermann, 2009) and contributes to their threatened status (Van Eeden et al., 2018).

With their conditionality on carnivore presence, CPPs are considered the only economic tool “that directly incentivizes human-carnivore coexistence” (Dickman et al., 2011: 13942). They are considered more cost-effective than other approaches (Ferraro and Kiss, 2002; Drechsler, 2017) and so some experts have recommended their increased uptake (see Ravenelle and Nyhus, 2017). Enthusiasm and interest in CPPs is high: many have been recently established, including eight since 2020 in eastern and southern Africa alone (Hamm et al., 2025). More remain in development in Nepal, Botswana, the US, and Namibia (J.H., personal observation).

Most research on CPPs consists of broader analyses of their challenges and potential (Nelson, 2009; Dickman et al., 2011), economic modelling (Zabel and Roe, 2009; Zabel and Holm-Müller, 2008; Drechsler, 2017; Heydinger et al., 2022), and case

studies with ecological (Persson et al., 2015) or attitudinal foci (Harvey et al., 2017; Chen et al., 2022; Kaiser et al., 2025). There is no empirical research on how the design of a CPP may affect its equitability and effectiveness. This is surprising given the highly unequal nature of human-carnivore conflict (Dickman et al., 2011; Braczkowski et al., 2023), the need for conservation interventions to achieve targeted behavioural change (Veríssimo, 2013), and the potential for CPPs to act differentially within communities (Hamm et al., 2025). Here, we address these research gaps through a mixed-methods case study analysis of two CPPs operated by Lion Landscapes (a conservation NGO) in Tanzania's Ruaha-Rungwa ecosystem. We exploit differences in the design of these two CPPs to evaluate how key design choices affect their effectiveness and equitability.

4.3 Materials and methods

4.3.1 Methodological approach

Because equity is multidimensional (McDermott et al., 2013; Zafra-Calvo et al., 2017; Mabele, 2020), subjective (Calvet-Mir et al., 2015), and context-dependent (Dietz and Atkinson, 2010; Martin et al., 2014; Law et al., 2018), it can be conceptualised in a number of ways (Klein et al., 2015). Here, we follow Crosman et al. (2022) by considering equitability as what is fair and just – especially for those with less power (Martin et al., 2014). We view equitability as a spectrum which includes positive and negative possibilities (Pascual et al., 2014; Hamm et al., 2024).

Effectiveness is similarly context-dependent (Lliso et al., 2021). Here, we consider it to be any reduction in anthropogenic carnivore mortality compared to what would have happened without the implementation of the CPP (i.e. additionality to a hypothetical counterfactual) (Martin et al., 2014). Because the behaviours that result in such carnivore mortality are complex and often covert, and thus difficult to measure (Gavin et al., 2010; St John et al., 2012), we equate perceived reductions in these behaviours with CPP effectiveness. Whilst we acknowledge the limitations of such an approach, given that perceptions are subjective and cannot establish causality, they can nevertheless provide understandings of ecological outcomes and of the process, legitimacy, and equitability of conservation interventions (Bennett, 2016). They are therefore well-suited to answering our research question, although we consider the potential of ecological counterfactual approaches in our conclusion.

We adopted a mixed-method approach to maximise the internal validity of our results and to develop a better understanding of how processes, values, and relationships shape – and are shaped by – CPP design (Drury et al., 2011). Mixed-methods are well suited to identifying how power dynamics and issues of equity relate to payments to heterogeneous groups, as they enable a better understanding of social, cultural, and contextual elements that are difficult to capture in isolation (Blundo-Canto et al., 2018). Case study research like this is not particularly well suited to informing broader conservation efforts, but it is crucial to understand and adapt local coexistence strategies (Zimmermann et al., 2021).

We collected data regarding two CPPs in Tanzania's Ruaha-Rungwa ecosystem in two stages between September and December 2023. The first stage consisted of 37 key informant interviews with Lion Landscapes staff, village officials, and representatives of key groups, as well as participant observation at five village meetings. This informed the second stage of data collection, which comprised 375 surveys with scheme participants and five focus groups formed of pastoralist men. The surveys included both closed and open-ended questions, enabling qualitative and quantitative analysis.

4.3.2 Study site

The Ruaha-Rungwa ecosystem spans around 50,000km^2 in central south-western Tanzania (Abade et al., 2020). It is a mosaic of semi-arid *Acacia-Commiphora* and miombo woodland, with an average annual rainfall of 600mm in central areas, falling mostly between November-January and March-April (Sosovele and Ngwale, 2002). The larger landscape includes numerous protected areas (Kiwango and Mabele, 2022) (Figure 4.1), and approximately 60,000 people live in the village lands around them, with livelihoods primarily based on subsistence agriculture and livestock rearing (Abade et al., 2020).

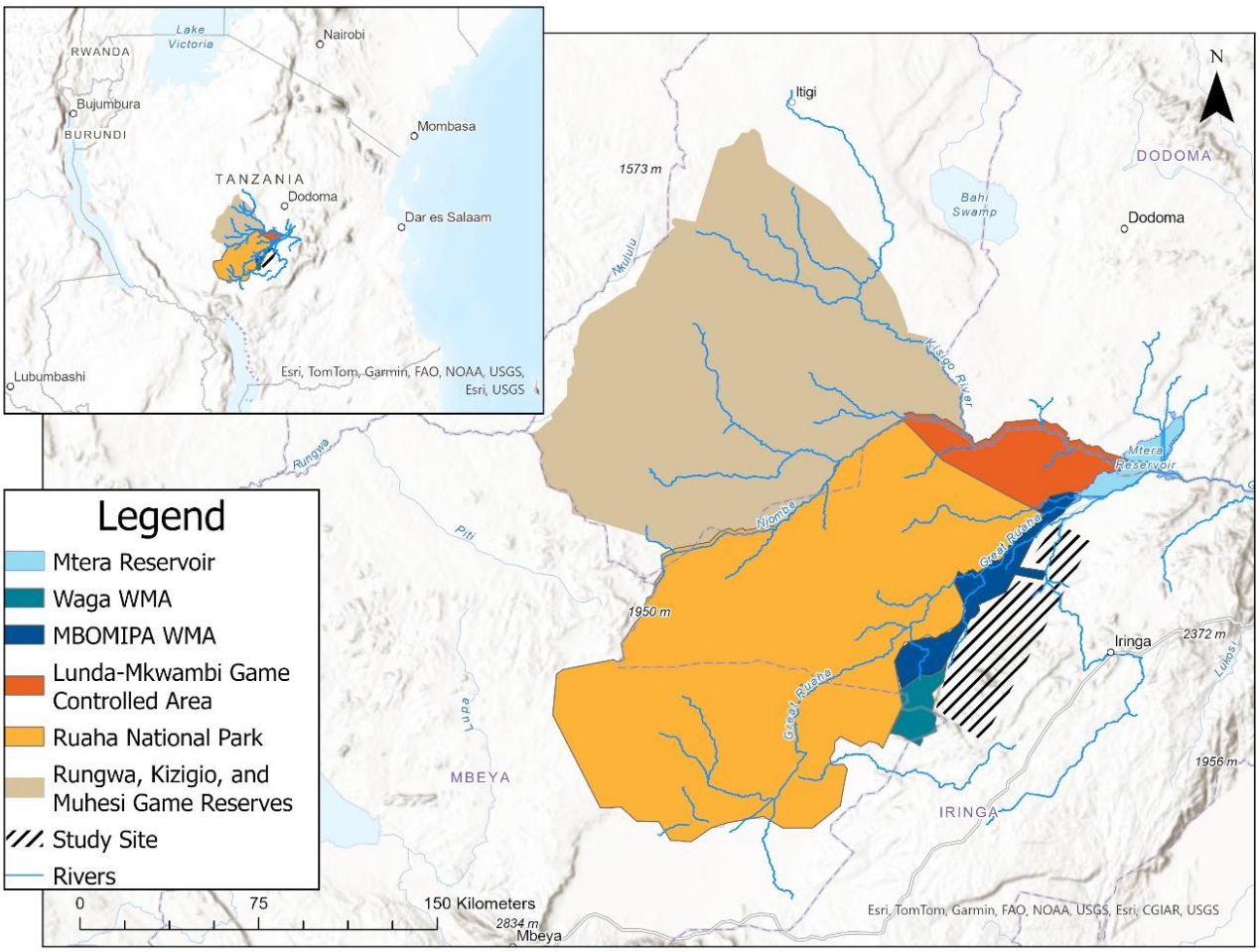

Figure 4.1: The study site in relation to protected areas and major towns. We do not disclose the exact location of study villages for ethical reasons.

The landscape is a priority for large carnivore conservation (Mills et al., 2001; Riggio et al., 2013; Dickman et al., 2014), but there is significant conflict between people and wildlife (Abade et al., 2014a; 2018; Dickman, 2015). No fences separate the protected areas and village lands, and wildlife moves freely between them. Large carnivores such as lions (*Panthera leo*) and spotted hyenas (*Crocuta crocuta*) cause serious economic losses through livestock depredation, and occasionally injure or kill people (Dickman, 2009; MNRT, 2020). They are therefore often killed in retaliation or for prevention (Abade et al., 2014b; Dickman, 2015). We focus specifically on 13 villages bordering Idodi-Pawaga (MBOMIPA) and Waga wildlife management areas, on the south-eastern flank of Ruaha National Park. We do so because these villages participate in two CPPs operated by Lion Landscapes. We use differences in the design of these two CPPs to explore the impact of certain design choices on their equitability and perceived effectiveness.

4.3.3 Study schemes

In both schemes, one-year agreements are signed between Lion Landscapes and the councils of participating villages. Participating villages are each provided with three camera-traps, and they receive payments based on how much wildlife is pictured over three-month periods. Two people are elected by each village council to place the cameras and check on them weekly. These camera-trap officers are paid a salary by Lion Landscapes, and are joined on their checks each month by Lion Landscapes staff so that images can be downloaded and batteries replaced. Species presence is equated to point values, with large, threatened carnivores tending to score highest (e.g. an image of a lesser kudu [*Tragelaphus imberbis*] equates to 1000 points; an image of a lion equates to 15,000 points). If an animal is pictured wearing a GPS/radio-collar, points are doubled to further disincentivise its killing. Points are tallied every three months, and these determine payment amounts – although exactly how differs between the schemes (Table 4.1).

Table 4.1: The design and key differences between the two CPPs in operation in the Ruaha-Rungwa ecosystem. One scheme pays participating villages for their relative performance. The other pays according to four thresholds of wildlife presence, and also incorporates bonuses and sanctions.

	Relative Scheme	**Threshold Scheme**
Participants	11 villages (in groups of three or four)	2 villages (individually)
Performance payment system	Relative to the other villages in their group	According to four points-based thresholds (<250,000; 250,000-500,000; 500,001-1,000,000; >1,000,000 points)
Payment amounts	Staggered between TZS 1-4 million (~USD 375-1500) each payment cycle.	A base payment of TZS 1.25 million (~USD 470), to which performance payments are added. These performance payments are set to thresholds (see above), and are TZS 350,000; 500,000; 750,000; and1,000,000. There are absolute minimum (TZS 250,000, ~USD 94) and maximum (TZS 2.5 million, ~USD 940) payment levels per payment cycle.
Rules on expenditure	Fully mandated (health insurance and to youth, pastoralist, and education committees).	Partially (70%) mandated, with 30% of expenditure decided by the village council.
Bonuses	No	Yes
Sanctions	No	Yes

One of the programmes – referred to here as the Relative Scheme – pays set amounts of money to each village depending on their performance relative to two or three other villages. The second scheme pays a base amount, to which performance payments are added. These performance payments are set to four points-based thresholds (see Table 4.1), and is therefore referred to here as the Threshold Scheme. Unlike the Relative Scheme, the Threshold Scheme includes bonuses and sanctions. Bonuses are paid for well-maintained bomas (to reduce the risk of livestock predation) and for lion 'bed-nights' – where a collared lion spends the night on village land. Sanctions are payment deductions imposed for illegal hunting activity, the discovery of snares, and for depredation events in poorly maintained bomas (e.g. those with gaps). Community staff employed by Lion Landscapes are responsible for conducting boma checks and snare sweeps.

Expenditure is fully mandated across different sectors in the Relative Scheme, but only partially mandated in the Threshold Scheme, with the remaining 30% decided by each village's council. The Relative Scheme began in 2015, and all villages participated in this scheme until 2021, when one village transitioned to the Threshold Scheme. Lion Landscapes made this change in an attempt to improve the effectiveness and local viability of the CPP. This village was chosen because it had the most carnivore-killing, and the agreement was altered for its next renewal. A second village followed in 2022 (chosen because it was the closest to Lion Landscapes' base).

We exploit the differences in the design of these schemes to analyse three factors that are theorised to influence the effectiveness and equitability of CPPs. Namely: i) the use of a relative payment system, because the merits of such an approach are thought to vary across contexts, yet have been subject to little empirical research (Zabel and Roe, 2009); ii) rules on expenditure (i.e. fully versus partially mandated), because this is theorised to effect distributional equitability and the likelihood of elite capture (Dickman et al., 2011; Zabel et al., 2014); and iii) the inclusion of sanctions. Sanctions are of interest because they may reinforce social norms (Kaczan et al., 2017) and improve ecological outcomes (Ezzine-de-Blas et al., 2016), but can be socially challenging to implement (Milne and Niesten, 2009). Despite this, we are not aware of any research on the effects of sanctions in the context of a CPP. Additionally, we examine if and how the inclusion of sanctions relates to the development of community enforcement, as this itself has been found to incur trade-offs between effectiveness and equity in other PES (Naime et al., 2022).

4.3.4 Data collection

Our first key informant interviewees were senior Lion Landscapes staff overseeing the schemes (n=5) and the community staff in charge of camera-trap placements, snare sweeps, and boma inspections (n=11). Interviews with senior staff took place at Lion Landscapes' camp and lasted 1-2 hours, whereas we job shadowed community staff based on their availability, with participant observations and interviews conducted sporadically over periods of up to 2.5 hours. Such an approach helps to provide rich narratives that are built on connections to the landscape (Evans and Jones, 2011). Other key informants were elected village executive officers (n=3) and representatives of the sectors and groups where CPP expenditure is mandated, namely education (n=5), pastoralist (n=5) and youth committees (n=8). We intended to interview more village executive officers, but the typical response was that they were too busy. Interviews were typically short (~15mins) as all interviewees had other demands on their time.

We wished to avoid imposing any prior frame of analysis and so took an adaptive and explorative approach to these key informant interviews, allowing those issues deemed important by the participant to come to the fore (Mabon et al., 2021) and to inform subsequent interviews (Rust et al., 2017; Pettersson et al., 2021). The exact questions asked therefore differed between key informants, but all were asked questions relating to the context, operation, and equitability of the CPPs. We also conducted participant observation at village council meetings (n=5), where decisions regarding the schemes are made.

Verbal surveys were conducted with 375 residents of the villages in which the schemes operate (n=25 per village in the Relative Scheme; n=50 per village in the Threshold Scheme). As we were interested in the perceptions of scheme participants from across a large landscape, we followed similar studies in the area and used convenience sampling (e.g. Ibbett et al., 2022; 2023; 2024), with respondents recruited based on availability (Newing, 2011). Representative sampling was not possible due the lack of reliable village household registers. In the course of obtaining permission to conduct this research, village leaders would often offer to provide a group of potential respondents; we always politely refused. Instead, potential respondents were approached at their household or boma, at markets, and in village centres. There is therefore the risk for some self-selection bias in our sample, although only one person chose not to participate when offered. We aimed to survey no more than one person per household, but our sampling strategy cannot guarantee it. Guided by the first stage of data collection, we included an element of purposive diversity sampling and

attempted to obtain a similar number of men and women, and pastoralists and non-pastoralists. This non-random approach maximises the internal validity of this data, but makes its less generalisable to other contexts (Drury et al., 2011).

Survey questions included both closed and open-ended components, and focused on the perceived impact and fairness of the relevant CPP, as well as respondents' preferences for expenditure and its distribution (Appendix A). Questions were developed in English and translated into Swahili. They were then back-translated independently for verification, before being piloted and refined for ease of comprehension. Swahili is a commonly shared language in the study area, but three respondents were more comfortable in their first language, and had a family member assist with translation. Surveys took about 15 minutes. Responses were recorded using KoboToolbox data collection software on encrypted mobile phones (KoboToolbox, 2023). Respondents comprised 193 men and 182 women between the ages of 18-85, representing 28 ethnicities, with the largest groups being Hehe (n=134), Maasai (n=67), and Barabaig (n=51).

In some quantitative analyses, we distinguish between pastoralists and non-pastoralists. Whilst previous studies in this landscape have used ethnicity alone as the basis for this distinction (e.g. Dickman et al., 2014; Kimaro and Hughes, 2023), this approach is simplistic and may result in the misrepresentation of some groups in academic discussions and policy. Here, in partnership with a respected pastoralist leader and Lion Landscapes staff with significant experience of the area, we developed a basic index of five questions which reflect local pastoralist practices and customs (Appendix A). Each question was scored as 0 or 1; survey respondents scoring $\geq$3 were considered pastoralists in analyses. Of the 375 survey respondents, we categorised 173 as pastoralists, and 202 as non-pastoralists.

Lastly, we conducted five focus groups with Barabaig and Maasai men (average group size n=8) across three villages, as early findings suggested these were demographics of particular interest (see Results). Focus groups represented both the Relative Scheme (n=2) and Threshold Scheme (n=3). Participant recruitment was complicated by the illegal killing of two elephants during this stage of data collection, which raised local tensions around conservation. However, Barabaig and Maasai community staff with whom we had already established relationships helped to reassure and recruit potential participants (but were not themselves present during the focus groups). Discussions centred around people's awareness of and engagement with the CPPs, as well as their relationships with wildlife and other groups of people.

All data were collected in person by two of the authors. All potential research participants (other than councillors at village meetings) were offered a small, culturally appropriate gift (a TZS 1000 phone voucher for a provider of their choice).

4.3.5 Analysis

To understand how the three focal design choices (collective sanctions, rules on expenditure, and use of a relative payment system) influence the effectiveness of these CPPs, we first had to ascertain the primary threats to large carnivores in the study site, and analyse if and how the CPPs are considered to influence carnivore-killing behaviour. We then analysed the equitability impacts of the three design choices. For both parts, we transcribed key informant interviews, focus groups, and meeting observations, and digitised our participant observation notes. We then coded these using a thematic network analysis approach (Attride-Stirling, 2001). Focused coding identified the most common and significant themes, before we conceptualised the relationships between them using theoretical coding (Charmaz, 2006). We used memos – notes on the nature and connection of themes – alongside the coding process to guide reflexive analysis (Holton, 2007). This enabled us to start interweaving the data into existing theory and inform future coding (Strauss and Corbin, 1994). All coding was conducted in NVivo 14 (QSR International, 2022).

We complemented this with descriptive quantitative analyses of the survey data, conducted in R (R Core Team, 2021), with blanks or "unsure" responses omitted unless otherwise stated. This also included identification of the factors which influenced the likelihood of a respondent being aware of the CPP running in their village, as this is an important part of a CPP's ability to enact behaviour-change. We did so through multivariable binomial generalised linear mixed models (Appendix A).

4.4 Results

We present our results in two sections. First, we provide the context required to understand the effectiveness of the schemes: what are the threats to large carnivores, who do the schemes target, and through what mechanism(s) are the CPPs perceived to act? Second, we explore how three key design choices (collective sanctions, rules on expenditure, and use of a relative payment system) impact scheme equitability and

effectiveness, and how these outcomes interact. We intertwine qualitative and quantitative results as most relevant for these questions.

4.4.1 Threats to carnivores, scheme targeting, behaviour-change

Key informants identified a number of threats to large carnivore populations in our study site. These threats included both intentional and unintentional sources of carnivore mortality, and were consistently implicated across both schemes. Carnivores are killed intentionally in retaliation for livestock loss, and lions (and other dangerous animals, namely elephants and buffalo) are killed to demonstrate bravery and improving social standing – gifts of livestock are often given. Unintentional mortality was as by-catch in snares set to harvest wild meat and through loss of natural prey due to these snares. This prey loss is perceived to exacerbate retaliatory killings, as carnivores are then driven towards taking livestock.

Due to livestock ownership patterns, retaliatory killings are conducted almost entirely by pastoralists. The most common method is by spearing. Poisoning of livestock carcasses does occur, but much less frequently. Snares are sometimes set around the carcass in an attempt to catch the carnivore returning to eat, but these are only left for around 12 hours before being removed; pastoralists strongly dislike snares because their livestock get caught. Snares set for wild meat are mostly set by non-pastoralists. The killing of lions for social status is done primarily by young pastoralist men. There was no consensus from our key informants on the relative severity of these threats.

Senior Lion Landscapes staff described how the two CPPs are explicitly targeted at pastoralists “because they’re the ones who bear the biggest burden of carnivores”, and carnivore-killings “are almost always the pastoralists”. Our survey data suggests that pastoralists do perceive greater personal benefits (in terms of equivalent number of goats) from both the relative (one-sided Wilcoxon rank-sum test: $W=6064$, $p=0.002$) and Threshold Schemes than did non-pastoralists ($W=973$, $p<0.001$). They also perceived greater household benefits than non-pastoralists from the threshold ($W=1010.5$, $p<0.001$), but not the Relative Scheme ($W=5067$, $p=0.386$). Though pastoralists tended to perceive more benefits, they were not significantly more likely to be aware of the scheme operating in their village. Instead, being male, younger, and having attended primary school were significant positive predictors, as was the number of children living in the respondent’s household (Appendix A: Table A.1).

A majority of survey respondents aware of the CPP operating in their village believe that it reduces carnivore-killing (90%, n=250). However, the primary reason was not perceived to be because of the payments (26%, n=64), but due to fear of being pictured on the camera-traps (67%, n=168). This perception did not differ across the two schemes (Pearson's chi-squared test: X^2=1.21, df=1, p=0.258). Whilst Lion Landscapes do not pass images with evidence of illegal hunting activities to the authorities (something acknowledged by members of one focus group), the perception of camera-traps as a tool of conservation enforcement was widespread.

4.4.2 Design choices and their implications for effectiveness and equitability

4.4.2.1 Sanctions & village responses

Key informants and focus group participants described how people hunting illegally destroy camera-traps because they fear their images may result in punishment by the authorities. In both schemes, if a camera-trap is stolen or destroyed, it is not replaced for six months. This incurs a reduction in points and therefore potentially payments. In the Threshold Scheme, there is also a deduction of TZS 150,000 per camera-trap lost. Other actions that incur payment deductions in this scheme include illegal hunting activity, depredation events in poorly maintained bomas, and the discovery of snares (Table 4.2).

Table 4.2: The sanctions included in the Threshold Scheme.

Events incurring payment deduction	Amount deducted
Depredation event in a poorly-maintained boma	TZS 15,000
Snare found	TZS 25,000 (per snare)
Camera-trap lost or stolen	TZS 150,000
Images of illegal wildlife hunting behaviour	TZS 150,000-500,000 (depending on number of instances within 3 months)
Wildlife killed with spears or snares	TZS 250,000 if Lion Landscapes alerted within 24 hours; TZS 350,000 if not
Carnivore killed with poison	TZS 500,000 if Lion Landscapes alerted within 24 hours; TZS 1 million if not

Community staff are joined for snare sweeps every three months by a senior Lion Landscapes staff member and a representative of the village office – sometimes an employee of a nearby wildlife management area. One key informant described how this can create "blurred lines" between the operation of a CPP and state enforcement of conservation policy, but that these sanctions are important in promoting positive behaviour-change. This perception received some evidential support, including at one village meeting where a councillor exclaimed "we are losing money for bad bomas and snares – we need to talk to our people!"

Whilst they were largely seen to be effective at reducing carnivore-killing, these sanctions can also reflect and magnify pre-existing inequalities. For example, in many of the participating villages "there is a fair amount of prejudice that non-pastoralists have towards pastoralists", because the latter typically speak shorthand Swahili with a thick accent or not at all, have lower educational attainment, and live further from the village with little access to running water. Pastoralists – especially Barabaig – are poorly represented in village government, and suffer from overt discrimination. For example, village governments charge residents "a contribution towards the development of the village"; pastoralists are typically charged around TZS 100,000, compared to only around TZS 10,000 for non-pastoralists. This extra money was seen as being lost to corruption. Within this context, Lion Landscapes staff described how they feared the inclusion of sanctions could have negative social consequences for pastoralist communities: "my biggest hesitation…was that the village would say 'killing carnivores, retaliation, poison - who's doing this? The pastoralists - let's run them out of our village, that solves our problem!'". Another senior staff member recalled how in one village, a spate of elephant killings by pastoralists, and the concomitant sanctions, had resulted in non-pastoralists threatening to burn pastoralists' bomas.

The inclusion of sanctions did not prevent the development of community-led fines in the Threshold Scheme. These fines are usually imposed on somebody for killing a lion, and whilst they can be monetary, they were most often described in terms of the person's father having three cows taken, killed, and eaten communally (reflecting the tendency for pastoralists to be the targets of such fines). The inclusion of sanctions did not prevent the development of these fines, nor was it a requirement – at least seven of the eleven villages participating in the Relative Scheme developed similar fines. These fines result in social pressure: one focus group member described how "because when they kill the lion, their father is the one who is told to pay the fine … the father says, 'I have to warn my son to stop that behaviour'". This sentiment was echoed by a senior Barabaig Lion Landscapes staff member, and it was seen as important that this social pressure came from within the family, because "if Lion Landscapes or the government tells them to stop, they won't, unless their elders tell

them in a harsh way, then they will stop". Another staff member feared that the community-imposed fines merely displace carnivore killings ("their parents, they tell them to change the area. Instead of…Ruaha, maybe they may go to kill in another area, like in Mikumi National Park, far away"). However they were seen by focus group members and other key informants as effective at reducing carnivore-killing in the study area.

Much like the scheme-led sanctions, however, these community-imposed fines can be inequitable. In one instance, for example, a lion killed a cow and the pastoralists – who were "hungry and not happy" – gave chase. During the pursuit, the lion got caught in a snare set by a non-pastoralist for wild meat. One of the pastoralists then speared the lion to death. Afterwards, nine pastoralists living in that area were ordered by the village government to each pay a fine of TZS 200,000. Two people refused to pay, and were jailed. Notably, the pastoralist who speared the lion was not amongst the nine people fined, nor was the non-pastoralist who set the snare. This angered many pastoralists, who, according to community staff, felt "angry - if there is to be a fine, all should pay it, including non-pastoralists," because "the benefits are shared". Senior staff described these kind of events as "a tightrope to walk", as they want to see the village government "use their own internal systems to deal with it", but acknowledged that this may incur a trade-off with equitability: "we wish society was really equitable, but it's not…those contextual factors, whether we like them or not, are real." Just like the scheme-led sanctions, these community-imposed fines were seen as effective at reducing carnivore-killing, but inequitable.

4.4.2.2 Rules on expenditure

In both schemes Lion Landscapes imposes rules on expenditure, and these reflect an attempt to balance the legitimacy gained by working through local governance systems with the chance that these systems risk inequitability and elite capture: "we don't want, as an organisation, to be dictating nor policing … the flip side of that coin is then saying: 'what happens when…village governments are not fully engaged in ensuring that benefits are distributed equitably?'" Both schemes therefore impose some level of mandatory expenditure which reflects this compromise (Table 4.3). In the Relative Scheme all expenditure is mandated, with items chosen by the relevant subcommittees (i.e. youth, pastoralist, education) and approved by the village council. Lion Landscapes then purchases and delivers these items. In the Threshold Scheme 30% of expenditure is non-mandated, and decided by the village council.

Table 4.3: The schemes differ in their expenditure patterns; only the Threshold Scheme includes an element of non-mandated expenditure.

	Relative Scheme	**Threshold Scheme**
Mandated expenditure	• TZS 100,000 for youth committee • The rest divided equally between health insurance, education and pastoralist committees	• 10% for youth committee • 30% pastoralist committee • 30% health insurance
Non-mandated expenditure	None	30% decided by the village council

In both schemes, health insurance is distributed to households via a lottery, and is divided equally between pastoralist and non-pastoralist households. The fact that the relatively smaller population of pastoralists receive half the allocation of health insurance was seen by pastoralist committee members as "very fair…because we suffer more human-wildlife conflict". Interestingly, no non-pastoralist participants in this research considered this an unfair system of distribution. Senior staff were very proud of how this aspect of the scheme "runs in an amazing, transparent, and equitable way - but we don't talk about this as much as the more challenging aspects".

Some of these more challenging aspects arise as a direct consequence of other mandated expenditure. For example, youth committees receive a guaranteed share of the payments in both schemes. However, the youth committees are mostly male, and have only ever purchased football-related items with their earnings. Young women benefit little from this allocation of the payments. Given that young male pastoralists are the target demographic of the schemes, this inequity may seem a compromise that aims to maximise behaviour-change (one youth committee representative described how football reduces illegal wildlife hunting by "distracting them"). However, senior staff described how one of the drivers of carnivore-killing is "young [pastoralist] girls inciting the guys" by saying things like "'you are a coward if you cannot kill a lion, and I will not be with you if you do not kill a lion'". It seems likely that this inequity therefore reduces CPP effectiveness, as young women have less incentive to push for a reduction in carnivore-killing. Overall, therefore, the choice to mandate expenditure was ineffective and had mixed equitability.

In the Threshold Scheme, allowing 30% of expenditure to be decided by the village council resulted in suspicions of elite capture – one youth committee representative

described how this 30% was simply seen as the village leadership's cut. This perception was disputed by senior staff (whilst they suspect it, "there is no proof"), but they acknowledged that concerns of elite capture have been relayed to them, and that village leaders' requests are sometimes "not representative of the community". However, they argued that the support of local governance structures is of crucial importance for the scheme's continued viability. The choice to partially delegate decisions on expenditure therefore had a positive impact on the scheme's effectiveness (increased legitimacy and local political support), at the expense of its equitability (elite capture). One senior staff member noted that working within an imperfect system such as this is "something that a lot of western perspectives just find very difficult", and that "it's tough to say with western donors" that there exists a point at which "the equitability question ends".

4.4.2.3 Relative performance payments

Our data suggests that relative payments are unlikely to maximise behaviour-change as the inherent biogeographical characteristics of participating villages – rather than participants' tolerance of wildlife – seems to be the primary determinant of their relative performance. For example, one group of four villages finished in the exact same order 16 times in a row – a period of four years. This issue was acknowledged by Lion Landscapes staff ("that [group] is not very fair, considering [village names] are never going to win") and participants ("[village name] always loses!") alike. Similarly, due to administrative changes, one village was moved from competing with others relatively nearby (~25km), to others further away (~60km). Before this change, it had the best relative performance six times in a row. Immediately afterwards, it had the worst – twelve times in a row and counting. Whilst one senior staff member described that even the lowest payments "make [people] have this passion of loving the wildlife", the adoption of a relative payment system is likely to have limited the scheme's effectiveness, because participants have little incentive to tolerate carnivore presence when they feel their village is destined to always receive the lowest payment.

Additionally, the relative payment system compounded pre-existing inequalities. Participating villages had previously contributed varying amounts of land to nearby wildlife management areas, but because financial benefits arising from wildlife management area land must be shared with all 21 associated villages (Kiwango et al., 2018), CPP camera-traps are not allowed to be placed there. Those villages which contributed their 'best' lands for wildlife therefore tended to perform poorly in the relative CPP – effectively receiving a penalty for previous pro-conservation actions.

4.5 Discussion

We find that the inclusion of sanctions was perceived to reduce carnivore-killing, but resulted in threats of arson against pastoralists' bomas (i.e. they were effective but inequitable). Interestingly, the inclusion of sanctions did not prevent the development of community-led fines, nor were they a requirement. These community-led fines were also seen as effective but inequitable, with individuals unfairly punished for the snaring and spearing of a lion by others. A similar trade-off has been observed regarding peer enforcement in broader PES (Naime et al., 2022), yet inequity risks contributing to greater conflict within communities (Hayes et al., 2019) and increasing resistance to a conservation which is perceived to favour some groups over others (Kimaro and Hughes, 2023). Whilst the promotion of agency and self-organisation are crucial for equitable conservation (Tan, 2021), practitioners must critically reflect on how conservation interventions – and responses to them – may perpetuate or exacerbate unequal power dynamics, as happened here (Woodhouse et al., 2015).

The choice to partially delegate decisions on expenditure to village councils in our case study also incurred a trade-off between effectiveness and equitability: the scheme gained viability and political legitimacy, but at the cost of elite capture. This finding is consistent with broader PES, where scheme operators may work through local governance institutions in the interests of pragmatism (Pascual et al., 2014), even though this is not always the most equitable approach (Calvet-Mir et al., 2015). In this case, elite capture was a risk because payments were made to heterogenous groups mediated by local governance institutions with competing interests. When elite capture is a significant concern, payments to individuals – rather than collectives – may be a more suitable option (Zabel and Engel, 2010). For example, individual landowners have been paid for carnivores in Belize (Harvey et al., 2017), Mexico (Nistler, 2007), and the US (Huggins et al., 2021), but such an approach was not viable here due to a spatial mismatch between carnivore ranges and participants' land-rights. This is one reason why most CPPs described in the literature pay collectives rather than individuals (Zabel and Holm-Müller, 2008; Suvantola, 2013; Hamm et al., 2025).

We found that mandating expenditure in certain sectors was ineffective and had mixed equitability. Positively, the explicit inclusion of pastoralist communities in our case study helped to avoid the further marginalisation of those lacking formal land rights, as has occurred in other PES (García-Amado et al., 2011; Haas et al., 2019) and in similar payments to encourage coexistence with wildlife (Hamm et al., 2024). However, expenditure patterns – particularly those decided through youth committees

– prioritised male preferences and failed to address one driver of carnivore-killing behaviour, namely social pressure from young women. Women were also significantly less likely to be aware of the schemes. CPP designers should ensure that they adequately involve women, as this can better align livelihood and environmental goals (Bell et al., 2023), and catalyse locally-driven conservation action and more sustainable coexistence (Alexander et al., 2022). This is particularly important in sites like ours, where female participation in previous conservation efforts has been limited (Kiwango et al., 2018).

We also found that the adoption of a relative payment system was both ineffective and inequitable. Whilst it makes budgeting easier for the operator and provides a level of security to participants, our findings support Zabel and Roe's (2009) theory that a relative payment system is less suitable when there are only few participating units, or when these units markedly differ in their ability to 'produce' carnivores. Here, participating villages' performance was compared to only two or three others, sometimes across areas with markedly different climates, ecologies, topographies, and agricultural practices (Green, 2016). This weakened the supposedly results-based nature of the Relative Scheme, and failed to maximise behaviour-change. Additionally, by failing to recognise the pre-existing inequities that characterise local wildlife management areas (Kiwango et al., 2018), the CPP effectively penalised those villages which had previously contributed their 'best' land in the name of conservation. Designers of CPPs should ensure that they have a thorough understanding of such contextual factors prior to scheme implementation.

Overall, we find that these design choices strongly influence the effectiveness and equitability of these CPPs, and that some decisions incur a trade-off between the two. Concerningly, we also find that the fear of being observed on a camera-trap was the perceived primary driver of behaviour change (rather than the payments associated with either scheme), despite the fact that images of people are not passed on to the authorities. This echoes Persson et al.'s (2015) finding that it could be the monitoring system – rather than the payments – that made a Swedish CPP effective at reducing carnivore-killing. However, our finding contrasts with evidence that PES can help to replace fear-based motivations for conservation (Martin et al., 2014), although this likely reflects the history of top-down 'fortress' approaches in our study site (Sirima, 2016; Kiwango and Mabele, 2022). Whilst camera-trap images could inform social monitoring – which can help to maximise the effectiveness of collective PES (Kaczan et al., 2017) – conservationists' use of camera-traps and other surveillance technologies can have unintended social consequences (Sandbrook et al., 2018) and overcoming gossip and rumour in conservation contexts can be very difficult (Holmes, 2022). Scheme operators must be aware that economic considerations form only one

part of a complex system in which different values and incentives interact, sometimes unpredictably.

Conservation performance payments show promise in encouraging human-carnivore coexistence, but our findings highlight the need for caution. Sacrificing equitability for short-term effectiveness may reduce their long-term sustainability (Martin et al., 2014; Lliso et al., 2021), challenging the simplified 'win-win' discourse which often surrounds economic incentives for conservation (Igoe and Brockington, 2007; Corbera, 2012). Conservationists must acknowledge that communities living alongside large carnivores are not homogenous, that interventions will influence different groups in different ways, and that ensuring equity is difficult but important (Mabele, 2020).

4.6 Conclusions

Here, for the first time, we show that the design of a CPP has significant implications for its equitability and perceived effectiveness, and that these goals may sometimes be put at odds. Collective sanctions were seen to reduce carnivore-killing at the cost of the scheme's equitability, whilst the adoption of a relative performance payment scheme was seen as both ineffective and inequitable. Whilst CPPs represent a mechanism by which to redistribute the uneven costs and benefits of living alongside large carnivores, if they are inequitable at a local level they risk imposing a conservation which lacks legitimacy, erodes autonomy, and which contributes to the very conflicts it seeks to address. We recommend that future research focuses on how the design of CPPs influences their effectiveness and equitability across other contexts. Finally, our findings relate specifically to perceived CPP effectiveness because socioecological confounders – as well as ethical and practical issues – make other methods of estimating effectiveness (e.g. quasi-experimental counterfactuals of ecological variables) difficult. We emphasise that such research would be a very informative and welcome addition to the literature.

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Chapter Five - Discussion and conclusion

This thesis aimed to advance our knowledge of conservation performance payments (CPPs) in the context of large carnivores. Specifically, it set out to establish how they may compare to other payments to encourage coexistence (PEC) in terms of their equitability, how they are designed and why, and what these design choices mean for their equitability and perceived effectiveness. These objectives are highly relevant to

conservation policy, given the recent proliferation of CPPs, lack of knowledge regarding them, and the need to ensure the equitability of conservation interventions.

5.1 Revisiting the research objectives

Objective 1: Establish the capability of PEC to be inequitable and explore the possible merits of CPPs in this regard.

Chapter Two examined the capability of PEC to be inequitable, identified a number of mechanisms through which this inequity arises, and explored the possible relative merits of CPPs in this regard. The findings suggest that CPPs – at least theoretically – present an opportunity to increase the local equitability of PEC, as they can be paid to collectives which incorporate previously excluded or marginalised groups. However, the research in this chapter showed that empirical data on the equitability of CPPs is scarce and that it is imperative that lessons are learnt from the inequity that characterises much of other PEC, particularly regarding issues such as gender and wealth. Furthermore, this chapter highlighted the importance of ensuring CPP participants' land rights are suitably well delineated, in order to ensure that payments go to those people coexisting with wide-ranging carnivore species. Advances in monitoring methods (e.g. eDNA or bioacoustics) could more accurately inform carnivore presence and therefore guide more equitable payments, but the use of technology comes with privacy risks, taxonomic biases, and other issues (see section 5.2.2). Likewise, this chapter described how the greater adoption of CPPs could help to reduce global coexistence inequalities, but this would depend on the details of the specific funding models and integration with the wider political economy.

Objective 2: Determine how CPPs are designed across eastern and southern Africa, the rationale behind this, and identify recurring challenges associated with these choices with a focus on equity.

Chapter Three's explorative approach nearly triples the number of CPPs represented in the peer-reviewed literature. This chapter provided the first comparative analysis of the choices and challenges facing CPP operators, and investigated the rationales underpinning scheme design choices. By harnessing the expertise of key informants, this chapter outlined significant variation in the design of CPPs, with carnivore monitoring methods, governance, and payment system, amount, frequency, and

recipient varying across schemes. Ensuring equitable governance was identified as a recurring challenge, alongside setting appropriate payment levels and securing long-term funding. Of particular interest was the inclusion of input conditionality (i.e. sanctions or bonuses) in a majority of the CPPs analysed. This runs counter to the prevailing conceptualisation of CPPs as entirely results-based payments, and raises questions regarding their supposed cost-effectiveness. Similarly, only one scheme made payments greater than the cost of livestock killed by the relevant carnivore species (as judged by interviewees). Given that their ability to make carnivores net financial assets at a local level is one of their theoretical strengths (and frequently, a selling point for the organisations operating them), the results of this chapter question whether CPPs work as intended, and whether they currently live up to the hype that surrounds them.

Objective 3: Evaluate how certain design choices affect the perceived effectiveness and equitability of a CPP.

Chapter Four exploited the different designs of two CPPs operating in Tanzania's Ruaha-Rungwa ecosystem to evaluate how the design on a CPP relates to its equitability and perceived effectiveness. This mixed method case study used key-informant interviews, focus groups, participant observation, and 375 surveys with CPP participants. We conclude that certain design choices – namely collective sanctions and looser rules on expenditure – are seen as effective at reducing carnivore-killing, but are inequitable. The use of a relative payment system was seen as both ineffective and inequitable, and fully mandating expenditure had mixed effects on both. Interestingly, the primary driver of behaviour-change was the fear of being observed on a camera-trap, rather than the payments themselves. This finding, and the seeming existence of an effectiveness-equitability trade-off, should be of concern to practitioners.

5.2 Implications for academia and conservation policy

The theoretical and empirical contributions of this thesis have relevance to conservation policy, as outlined below.

5.2.1 Be aware of indirect and unexpected mechanisms of action

Chapter Four found that the killing of carnivores to improve social standing was typically conducted by young pastoralist men, and that a key driver of this behaviour was pressure from young women. That this finding surprised the NGO operating the CPPs may explain why young men's preferences were prioritised in the mandated expenditure patterns. A better understanding of the contextual drivers of carnivore-killing (i.e. social pressure from young women) could have informed better CPP design (i.e. where the presence of large carnivores was made more valuable to young women). Similarly, the CPPs analysed in Chapter Four were explicitly targeted towards pastoralists, yet significant carnivore mortality was ascribed to the activities of non-pastoralists. Specifically, the setting of snares for ungulate wild meat, which reduces natural prey availability, sees carnivores caught as bycatch, and may increase conflict by pushing carnivores towards predating livestock (Khorozyan et al., 2015). The misalignment between the threats identified and the groups targeted by these CPPs hampered their effectiveness. These two findings emphasise the importance of understanding the social context of a CPP and of the need for an evidence-based theory of change.

This is further reinforced by the finding that the perceived primary driver of reduced carnivore-killing was not the payments themselves, but rather the fear of being observed on the camera-traps. This result mirrors a Swedish CPP which was adjudged to have been a success, but through an unanticipated mechanism (Persson et al., 2015). Whilst this Swedish CPP is credited with a reduction in the illegal killing of wolverines and a concomitant increase in their population, it may have been due to the extensive monitoring method (identifying natal dens in the spring) reducing opportunities for illegal killing, rather than the payments themselves. The authors conclude that "it is unclear how this program would perform if monitoring would not require an extensive presence in the field around den sites" (Persson et al., 2015: 349). In this example and in the two Tanzanian CPPs analysed in Chapter Four, the monitoring methods chosen (natal den location and camera-traps) resulted in people avoiding certain areas; it can be argued these CPPs therefore functioned less as external positive economic incentives and more as situational crime prevention that increased the risks associated with carnivore-killing activity (Clarke, 1995).

5.2.2 CPP monitoring: use technology with caution

Chapter Two identified that technological advances in monitoring methods could help to improve the local equitability of CPPs by ensuring that payments go to those people living alongside carnivores. One such example is the use of telemetry data to inform

differentiated payments, as developed by Heydinger et al. (2022) for the desert lions of northwest Namibia. CPPs could also use DNA monitoring (Booth et al., 2023) or eco-acoustic monitoring (Markova-Nenova et al., 2023). Indeed large carnivores may be a good test case for a CPP to use eco-acoustics, given that individual lions (*Panthera leo*) (Wijers et al., 2021), spotted hyenas (*Crocuta crocuta*) (Lehmann et al., 2022), leopards (*Panthera pardus*) (Growcott et al., 2024), and tigers (*Panthera tigris*) (Ji et al., 2013) can each be identified from their vocalisations.

However, as the findings from Chapter Four show, even low-tech monitoring methods like camera-traps can have unintended social effects. For example, there are fears that location data from collared carnivores could be exploited by authorities to use more lethal control in an attempt to reduce conflict, even if this did not form part of the rationale for obtaining telemetry data, nor the research permit (Cooke et al., 2017). Similarly, the collection of eco-acoustic data raises ethical questions regarding privacy, particularly with regards to human speech. There are some steps around this, given that acoustic data can be anonymised through blurring techniques (Cohen-Hadria et al., 2019), but automatically detecting human speech in biodiverse environments can be difficult (Cretois et al., 2022). Moreover, the use of eco-acoustics may enable the militarisation of conservation and even facilitate increased capitalist speculation (Ritts et al., 2024).

Chapter Four found that the presence of camera-traps in the landscape made some participants fearful. More inconspicuous monitoring approaches that are less evocative of conservation enforcement may therefore be better. DNA monitoring is one such possibility. Such an approach is being piloted in a Swedish CPP for wolverines, as it is less sensitive to poor weather than locating dens in the snow, but it does require significant monitoring effort, and the results may not be seen as reliable by participants (Pettersson, 2025). Sampling environmental DNA (eDNA) from soil, water, or sediment can reduce the monitoring effort required, and has been shown to be more effective and cheaper than camera-traps at establishing the presence of many mammal species (Lyet et al., 2021), but how CPP participants would feel about eDNA as a monitoring method is unclear. In any case, eDNA monitoring can struggle to detect carnivores due to their low population densities (Sales et al., 2020; Lyet et al., 2021). This limits its practical suitability as a monitoring method for the kind of CPPs discussed here, but it could still be used for CPPs in fishery settings, for example (Booth et al., 2023).

Moreover, as demonstrated in Chapter Four, convincing participants that any monitoring method – whether camera-traps, DNA monitoring, telemetry, or eco-acoustics – is (or is not) used for a specific purpose can be very difficult. Rumour and gossip are important, if often overlooked, factors which can influence the success or

failure of conservation projects, and can be difficult for conservationists to influence and control (Holmes, 2022). Scepticism, suspicion, and fear are likely to be particularly prevalent in locations where conservation has a history of violent enforcement, such as the Ruaha-Rungwa ecosystem (Sirima, 2016; Kiwango and Mabele, 2022; Kimaro and Hughes, 2023). Such suspicion is probably well-founded, considering that Chapter Three showed that conservation authorities in two countries have asked for images of illegal activities caught on CPP camera-traps.

More fundamentally, the finding in Chapter Four that the fear of being observed on camera-traps was the primary driver of behaviour change emphasises the importance of following the principles laid out by Sharma et al. (2020), Sandbrook et al. (2021), and Pritchard et al., (2022), which aim to address some of the ethical issues associated with the implementation of these useful but consequential technologies. Technology, by accident or design, can alienate people from the decision-making process and place more power in the hands of outside 'experts' (Adams, 2019; Oberhauser, 2019) – equity implications should therefore be given serious consideration.

5.2.3 Money, money, money – but not enough?

As discussed in Chapter One, payments can change social norms around conservation (Chen et al., 2012; Kerr et al., 2017), including those which predict carnivore-killing behaviour (St John et al., 2015; Marchini and Macdonald, 2012; Harvey et al., 2017). More commonly, however, financial incentives like CPPs are explained as functioning through a "reasoning pathway", whereby they alter the precursors of behaviours such as attitudes (Reddy et al., 2017: 252). The idea is that people's attitudinal tolerance of large carnivores will increase if the cost-benefit balance of living alongside them is improved (Bruskotter and Wilson, 2014; Treves and Bruskotter, 2014; Slagle and Bruskotter, 2019). According to Ajzen's Theory of Planned Behaviour (1985), this improved attitudinal tolerance reduces individuals' motivation to kill large carnivores (Marchini and Macdonald, 2012; but see: Harvey et al., 2017). This thinking underpins Nelson's (2009) and Dickman's (2011) conceptual contributions in which the case to make large carnivores net financial assets at the local level – including through the use of CPPs – is developed. Yet only one of the nine CPPs analysed in Chapter Three actually did so (by paying more than the cost of livestock killed). This is surprising, given that this ability is a theoretical strength of CPPs over other PEC like compensation and insurance. More pertinently, it raises questions regarding their mechanism of action: if carnivores remain costly, can CPPs

still reduce carnivore-killing? If participants act economically rationally (i.e. kill costly carnivores) then these eight CPPs may represent a poor use of conservation funds.

Nor is this 'underpaying' a problem limited to NGO-operated CPPs in Africa – a state-run CPP in Sweden has not increased payment rates since 2002, despite inflation, which undermines the effectiveness of the scheme (Åhman et al., 2022; Pettersson, 2025). Whilst economic considerations are far from the whole picture when it comes to the killing of large carnivores (Marchini and Macdonald, 2012; St John et al., 2012; Harvey et al., 2017), it is notable that CPPs solely aim to address the economic component of human-carnivore conflict, yet mostly fail to do so. Proponents of CPPs argue that reducing the costs of living alongside large carnivores is not enough – they must be outweighed (Dickman et al., 2023; 2025). A mismatch between the theory, description, and practice of other PES has already been documented (Martin-Ortega et al., 2013); the gap between the idealised description and current execution of CPPs could see them labelled as just another conservation "fad" (Redford et al., 2013: 437).

5.2.4 Options and issues for CPP funding

Of those carnivore-focused CPPs I am aware of, four are funded by governments (in Sweden, Finland, Taiwan, and the US) and two are joint NGO-government partnerships. Most (14), however, are funded by NGOs (Hamm et al., in prep). Whilst philanthropic funding may be more resilient to geopolitical shocks like the Covid-19 pandemic than other funding sources, like tourism (Dickman et al., 2025), Chapter Three shows that relying on grants and philanthropy is difficult, especially over short funding cycles. Two CPPs analysed in that chapter even began without enough funding in place. The socioecological consequences of a CPP pausing or stopping due to funding shortfalls is unknown, but evidence from other PES suggests that feelings of betrayal, confusion, and disappointment could arise – even if it was originally described as a pilot project (Massarella et al., 2018; Chambers et al., 2022). Government funds are also not a guarantee of success – the state-operated CPP in Sweden has not increased payments since 2002 because human-carnivore conflict is not considered a government priority (Åhman et al., 2022; Pettersson, 2025).

Chapter Three found that new sources of funding are of significant interest to CPP operators. It is possible that novel market-based financial approaches could help stimulate the investment of more private funds in conservation work (CBD, 2023), and some have explicitly argued that biodiversity credits or conservation bonds could be used to fund CPPs (i.e. Dickman et al., 2025). Carter et al. (2025) argue that large carnivores could particularly stand to benefit from these funds, given their public

appeal (Macdonald et al., 2015) and ability to function as a biodiversity indicator species (Natsukawa and Sergio, 2022). Moreover, carnivore conservation can deliver climate 'wins' as well – a national tiger conservation intervention in India reportedly avoided emissions of 1.08 (± 0.51) $MtCO_2$ with a carbon offset value of US$6.24 (± 2.94) million (Lamba et al., 2023).

As described in Chapter Three, biodiversity credits are already of interest to organisations operating CPPs, and some are now taking more concrete steps towards operationalising this approach (e.g. Lion Landscapes, 2024). Conservation bonds are also of interest to CPP operators (e.g. Dickman et al., 2025), and in 2022 the world's first conservation bond was issued for USD 150 million (focused on black rhinoceroses [*Diceros bicornis*]) (Medina and Scales, 2023). Reports last year suggested that South Africa's Rand Merchant Bank would issue a similar bond for lion and wild dog conservation by November 2024 (e.g. Sguazzin, 2024), but there seems to have been no further news after this significant free press coverage. The United Nations Development Bank is supposedly developing a "tiger recovery bond", but details remain scarce (Gambetta, 2023; Sills and Kramer, 2023: 970).

Even if, as Dickman et al. (2025) argue, these financial mechanisms could fund CPPs, the future demand for these novel financial mechanisms is uncertain – despite some optimistic projections from the usual suspects (e.g. World Economic Forum, 2023). In any case, a number of concerns have already been articulated regarding additionality, the choice of metric(s), and ensuring their equitability (Swinfield et al., 2024; Wauchope et al., 2024; Carter et al., 2025). These equitability considerations echo the same themes identified throughout this thesis: inclusion in decision-making, avoiding elite capture, ensuring that the distribution of rights and responsibilities is fair, and appropriate recognition of people and their land-rights (Carter et al., 2025).

As noted in Chapter Three, there are also concerns about the marketisation of nature that these novel funding mechanisms would promote. A CPP funded by biodiversity credits, for example, would see a price put on nature twice over – once for the credits, and again for the CPP payments. The commodification of nature risks corrupting its inherent value (Martin-Ortega et al., 2023; Panitch, 2023) and also risks the expansion of the commodification frontier (Kosoy and Corbera, 2010; Gómez-Baggethun and Ruiz-Pérez, 2011). Some argue that this kind of approach fails to recognise the inherent contradiction that is attempting to solve the problems of neoliberal capitalism with more neoliberal capitalism (Fletcher and Büscher, 2017). Moreover, the explicit commodification of 'marketable' species may diminish the importance of healthy socio-ecological systems and the resilient, biodiverse ecosystems within them (Igoe, 2010; Oberhauser, 2019).

In any case, biodiversity credits and conservation bonds are not yet a viable alternative to more established conservation funding sources like tourism, philanthropy, and state aid (Carter et al., 2025). If, as discussed in Chapter Two, CPPs are to maximise their global equitability by helping to reduce the global "coexistence inequalities" caused by the unequally distributed costs of living alongside large carnivores (Jordan et al., 2020: 804; Braczkowski et al., 2023), a transformative change in conservation funding is needed (see: Sandbrook et al., 2022). What such a change would look like remains unclear, but could include a substantial carbon tax (Fletcher and Büscher, 2020). Regardless, a diverse revenue stream which blends private finance, government grants, and philanthropy is likely to remain pragmatic and desirable (Dickman et al., 2011; 2025).

5.2.5 CPPs: results-based (mostly)

The prevailing conceptualisation of CPPs is that they are results-based (Zabel and Holm-Müller, 2008: 247; Zabel and Roe, 2009; Persson et al., 2015), with synonyms such as "outcome-based" or "result-oriented" sometimes used (e.g. Burton and Schwarz, 2013: 630). However, the IUCN's Guidelines on Human-Wildlife Conflict and Coexistence describe CPPs in the context of "maintaining agreed land-use zones, damage prevention actions or not snaring or poisoning wildlife" (Dickman et al., 2023: 198). These are not the desired conservation goal – they are inputs. As noted in Chapter One, this distinction is important. The results-based nature of CPPs is a core part of their appeal because it is considered more cost-effective to pay for results than for actions (Ferraro, 2001; Ferraro and Kiss, 2002), and because it allows participants to use contextual knowledge to maximise the delivery of the desired result without having external requirements mandated (Gibbons et al., 2011; White and Hanley, 2016). Tying payments only to inputs – as the IUCN's description does – risks a version of "empty-forest syndrome" (Redford, 1992; Wilkie et al., 2011: 122), where a focus on habitat quality, livestock enclosure quality, or prey abundance could obscure the ongoing persecution of carnivores.

It is interesting, then, that six out of the nine CPPs analysed in Chapter Three are augmented by some degree of input conditionality in the form of bonuses or sanctions. This tendency is not limited to eastern and southern Africa, either. In a CPP in Arizona and New Mexico, payments for wolf presence are higher when conflict avoidance measures have been taken (USFWS, 2014), and a bonus of ~USD 335 is paid to participants who adopt wildlife-friendly farming practices in a CPP for leopard cats (*Prionailurus bengalensis*) in Taiwan (Taiwan Forestry Bureau, 2019; Chen et al.,

2022). A CPP which just began in Florida pays for camera-trap images of Florida panthers (*Puma concolor coryi*), and also pays an acre-based payment according to habitat quality (Florida FWC, 2025). Inversely, if local protected area regulations are flouted in a CPP in Laos, participants' payments are reduced by 25% for the first infraction, 50% for the second, and fully for the third, with the killing of a tiger equating to an immediate third infraction (Eshoo et al., 2018; P. Eshoo, personal communication, February 2025). These examples contrast with the conceptualisation of CPPs as purely results-based, an idea typified by the CPP for golden eagles (*Aquila chrysaetos*) in Finland, where participants retain the payment even if confirmed eagle nests are destroyed (Hiedanpää and Borgström, 2014; T. Ollila, personal communication, 2023).

Chapter Four identified that the inclusion of input conditionality – namely, sanctions – in one of the CPPs in the Ruaha-Rungwa ecosystem was effective in reducing carnivore-killing (if inequitably so). It may be that other elements of input conditionality – specifically regarding the quality of bomas – may also be effective at reducing conflict. To briefly recap: in this CPP, predation events that occur in poorly maintained bomas incur a 15,000 TZS reduction in payments, and well-maintained bomas earn between 8000-10,000 TZS when they are checked every three months or so. Recent studies – which took place in the same study system as Chapter Four – suggest that well-maintained bomas reduce predation of livestock by large carnivores by 94% in the short-term, and by 60% in the long-term (Grau et al., 2025). Furthermore, these well-maintained bomas provide a positive spillover effect, reducing livestock predation in nearby households which lack reinforced bomas (Salerno et al., 2025). If we assume that reduced livestock predation will translate to a reduction in carnivore-killing, these results seem to justify Lion Landscapes' decision to incorporate this specific input conditionality in this CPP (even if the equitability concerns raised in Chapter Four remain).

Half of CPPs for carnivores around the world are augmented by some aspect of input conditionality like this (Hamm et al., forthcoming). Furthermore, two CPPs analysed in Chapter Three adopted a relative payment system that stretches the definition of results-based, as there is no direct link between the presence of large carnivores and the payments earned by participants. In these schemes it could even be the case that absolute wildlife abundances decrease whilst payments remain the same. So, whilst I argue that the IUCN's characterisation of CPPs is incorrect and unhelpful, it seems that the description of CPPs as purely results-based should probably be a bit more nuanced.

5.3 Directions for future research

In this section I propose three areas of future research which would build upon the contributions of this thesis.

5.3.1 How effective actually are CPPs?

CPPs tend not to be cheap. A pilot in northern Tanzania paid out around USD 70,000 over three years (Pekor et al., 2024), whilst a CPP in the plains of Montana (US) pays individual participants each up to USD 6000 per year (American Prairie, 2025), and Sámi reindeer herding villages in northern Sweden are paid over USD 50,000 per wolf reproduction (Åhman et al., 2022). And these are only the payments themselves: staffing and administration double the cost of operating the Relative Scheme analysed in Chapter Four (Dickman et al., 2025). Despite these financial outlays (in what is a pretty cash-strapped field), the actual effectiveness of CPPs remains unclear. For example, the 3-year CPP pilot in northern Tanzania improved attitudes towards lions and was credited with a reduction in retaliatory killings (Pekor et al., 2024), but a CPP in Belize is not thought to have reduced participants' motivation to kill jaguars (*Panthera onca*) (Harvey et al., 2017).

As discussed in Chapter One, this thesis does not include a robust counterfactual analysis of CPP effectiveness due to an inability to control for socioecological confounders (Zabel and Holm-Müller, 2008; Adams et al., 2019; Schleicher et al., 2020), but it does provide evidence that most CPP operators (Chapter Three) and participants (Chapter Four) believe that their CPPs reduce local carnivore-killing. Interestingly, however, some data in Chapter Four suggests that the focal CPPs merely displace carnivore-killing to other areas (i.e. Mikumi National Park), raising doubts about the level of additionality, if any, they deliver. To my knowledge, this is the first suggestion of leakage in the context of a CPP. Due to the causal uncertainties involved (de Lima et al., 2017) a lot of research on leakage in other PES focuses on economic factors such as relative market prices and mobility of capital (e.g. Börner et al., 2017), but the findings from Chapter Four show the importance of being cognisant of the social drivers of leakage, as they are likely to influence CPP effectiveness.

In summary, more research is required to evaluate the actual (rather than perceived) effectiveness of CPPs, and an ecological counterfactual would be a very informative and welcome approach. Any evaluation of CPP effectiveness, however, must also account for the risk that carnivore-killing is simply displaced; further research should

investigate the drivers of any leakage and how this may vary. Moreover, future CPP evaluations must account for any indirect non-economic mechanisms such as those discussed in section 5.2.1, as they may in fact be the primary driver of behaviour change.

5.3.2 Motivation-crowding

Motivation-crowding theory suggests that external incentives such as CPPs can undermine ('crowd-out') or reinforce ('crowd-in') individuals' intrinsic motivations (Gneezy and Rustichini, 2000; Frey and Jegen, 2001; Akers and Yasué, 2019). The implications of this effect are commonly explored in the PES literature (e.g. Rode et al., 2015; Akers and Yasué, 2019; Ezzine-de-Blas et al., 2019; Hayes et al., 2022), but are rarely considered in the context of human-carnivore coexistence.

In one exception, Kansky et al. (2021) found that higher tolerance of lions and hyenas in parts of the Kavango-Zambezi Transfrontier Conservation Area was not a direct result of the monetary benefits associated with them, but instead due to these benefits 'crowding-in' people's intrinsic motivations to tolerate wildlife. It stands that if a CPP can leverage participants' intrinsic motivations to conserve large carnivores, then its effectiveness and long-term sustainability may be improved. Research to establish the conditions under which this occurs would be of significant value to CPP designers.

Inversely, there is the risk that CPPs 'crowd-out' intrinsic motivations. For example, as previously discussed, eight of the nine CPPs analysed in Chapter 3 did not cover the costs of the relevant large carnivore species. This runs counter to the idea of "pay enough or don't pay at all", whereby insufficient payments can displace intrinsic motivations and counterintuitively result in a net reduction in overall motivation (Gneezy and Rustichini, 2000: 791). In the context of a CPP, the result could be lower tolerance of large carnivores.

There are also uncertainties about what happens if the money stops. Evidence from PES suggests that the displacement of intrinsic motivations causes more environmentally damaging behaviour if payments cease (Chervier et al., 2019), but that this effect can be mitigated if the payment aligns with participants' values and social norms (Hayes et al., 2022) and if trust is high and efforts are made to reduce economic inequalities (Andersson et al., 2018). These findings have clear relevance to the contributions of this thesis (and equity considerations more generally), but research is required to understand the implications of this in the context of CPPs. This

thesis is unable to provide evidence for or against motivation-crowding in the context of CPPs, but it nonetheless merits further attention.

5.3.3 Unintended consequences

Motivation-crowding aside, CPPs could have other unintended consequences which warrant further research. Some of these could be positive – for example, poisoning has become an increasingly common method of killing lions (Everatt et al., 2019; Almeida et al., 2025), and any reduction in these incidents could have human health benefits (this is an area that merits urgent research attention). Some unintended consequences could be negative; for example a CPP could have a magnet effect and draw people to the area, thus increasing anthropogenic pressure on carnivore populations. Research on this may also be of value to scholars exploring the potential for a conservation basic income (e.g. Fletcher and Büscher, 2020).

Some unintended consequences may be more complex, and could even raise uncomfortable questions. For example, in the CPPs analysed in Chapter Four, a significant proportion of the payments were spent on veterinary medicines. Considering that far more livestock in this area are lost to disease than to large carnivores (Salerno et al., 2025), this is understandable. Given the importance of livestock to pastoralist communities (Homewood et al., 2012), it is likely that in other contexts, payments would be used to purchase more livestock. In either case (reduced livestock mortality or more livestock), greater grazing pressure and an increased ratio of livestock to wild prey could exacerbate human-carnivore conflicts - thus jeopardising the effectiveness of the CPP (Carter et al., 2025). In this hypothetical scenario, food security and cultural preferences could be at odds with conservation goals, raising an important moral question – what do CPP operators (and conservationists in general) prioritise? Would such a CPP run afoul of the refrain that conservationists care more about wildlife than people? More research – particularly that which harnesses a political ecology lens – is required to establish the conditions under which such a situation could arise, and to identify solutions.

5.4 Non-academic impacts of this thesis

Chapter Three found that there was very little knowledge sharing between those people already operating CPPs. In order to improve this, I helped to co-found a ‘CPP

Coalition' of organisations operating, or interested in operating, CPPs. This coalition now meets online a few times a year, and provides a platform through which lessons, information, and documents can be more readily shared. The coalition is mostly comprised of practitioners from eastern and southern Africa, but has attendees from countries as diverse Nepal, the US, the Central African Republic, and Sweden. The level of interest and engagement with this initiative testifies to the timeliness of the research presented in this thesis and the wider interest in CPPs more generally. It is also demonstrative of the role my own work has had in stimulating this knowledge exchange.

Additionally, one of the findings of Chapter Four (that a relative payment system was both ineffective and inequitable) contributed to eight of the participating villages moving from the Relative to the Threshold Scheme. This is likely to be a more effective use of conservation funds, but it remains unclear what steps, if any, Lion Landscapes have taken to address the inequities associated with the Threshold Scheme's collective sanctions.

Lastly, thanks to the White Rose Doctoral Training Partnership's Overseas Institutional Visit scheme I was able to travel to Montana (US), where I designed a new CPP targeting grizzly bears (*Ursus arctos horribilis*) and wolves (*Canis lupus*). That work was directly informed by this research and by the broader process of completing this thesis.

5.5 Conclusion

Conflict between people and carnivores is a pressing conservation concern. Similarly, the need to ensure the equitability of conservation interventions is increasingly recognised in international commitments and in academia. This thesis has advanced our understanding at the nexus of these two issues by focusing on the equitability of CPPs. It has done so by taking a tiered approach, investigating the theory, design, and practice of CPPs in turn.

It identified the dimensions through which inequity arises in other PEC, and highlighted the theoretical potential for CPPs to more equitably deliver human-carnivore existence at local and global scales. It has found that in reality, ensuring equitable governance is a recurring challenge across CPPs, alongside determining suitable payment levels and securing long-term funding. These issues were consistently implicated across CPPs, despite the finding that they vary massively in their operation – even when targeting the same species. Some of these design choices – namely collective sanctions and

looser rules on expenditure – were found to incur a trade-off between the equitability and perceived effectiveness of a CPP, whilst the adoption of a relative payment system was seen as both ineffective and inequitable. In contrast to what was expected from theory, only one of the CPPs analysed here made large carnivores a net financial asset, and most were not purely results-based. Moreover, fear – not the payments – was found to be the perceived primary driver of behaviour-change in one CPP. These findings raise doubts about the economic rationale underpinning CPPs, and question whether they currently live up to the hype that surrounds them.

This thesis contributes to a growing literature on the equitability of conservation and on place-based understandings of the conditions that facilitate or impede human-carnivore coexistence. The results presented here emphasise the importance of incorporating social considerations into CPP design, as it is through their design that the potential for CPPs to deliver equitable and effective conservation is mediated. Conservation interventions that aim to encourage coexistence need to ensure that they work well for both carnivores and people. CPPs are a promising tool, but only careful forethought will ensure that they contribute towards a more equitable conservation.

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Appendix A

Supplemental Information for Chapter Four

Pastoralist index

In some analyses we delineate between pastoralists and non-pastoralists. Whilst previous studies in this landscape have used ethnicity alone as the basis for this distinction (e.g. Dickman et al., 2014; Kimaro and Hughes, 2023), this approach is simplistic and may result in the misrepresentation of some groups in academic discussions and policy. So, in partnership with a respected pastoralist leader and Lion

Landscapes staff with significant experience of the area, we developed a basic index of five questions which reflect local pastoralist practices and customs. Each question was scored as 0 or 1; survey respondents scoring ≥3 were considered pastoralists. The questions were:

- "What ethnic group are you part of?"
    - Barabaig/Maasai/Mgogo/Sukuma/Iraqw = 1; Other ethnicities = 0
- "Do you always live with your livestock?"
    - Yes = 1; No/unsure = 0
- "Do you move your cattle seasonally?"
    - Yes = 1; No/unsure = 0
- For men: "How many wives do you aspire to have?". For women: "How many wives does your husband have?"
    - More than one = 1; One or none = 0
- "Do you identify as a pastoralist?"
    - Yes = 1; No/unsure = 0

Self-identification formed one component of this index, but was not sufficient by itself. This is because we were concerned that respondents would describe themselves as pastoralists on the assumption that it may benefit them (even though the purpose and neutrality of the research had been made clear). Indeed, 20 respondents identified as pastoralists but were not treated as such in the analysis because they typically did not live with their livestock, nor move them seasonally. We do not claim that our index captures all complexities, but it better reflects the cultural understanding of pastoralism in our study site than a simple delineation based on ethnicity. This is important given the uniquely challenging relationship between large carnivores and pastoralism.

Participants' awareness of the CPP operating in their village

We wanted to identify which factors influence the likelihood of a respondent being aware of the CPP running in their village, as this is an important part of a CPP's ability to enact behaviour-change. To do so, we used multivariable binomial generalised linear mixed models (GLMMs) and the *lme4* package (Bates et al., 2015). We pooled awareness data from both schemes, as the villages participating in the Threshold Scheme had previously participated in the Relative Scheme. We first generated a maximum global model which incorporated main effects and interactions that we

considered plausible in our study context (Grueber et al., 2011). We measured pastoralists' wealth in terms of the total value of their livestock, using local market rates (cows at TZS 600,000, donkeys at TZS 300,000, and goats/sheep at TZS 85,000 each). These rates are approximations as there is significant variation, including across seasons. All numeric variables were standardised and centred by subtracting the mean and dividing by the standard deviation. In order for the model to converge, we reduced its complexity by coding education as a yes/no (whether the respondent had attended at least primary school), rather than as an ordinal variable. No collinearity between variables was observed, and respondents' village (n=13) was included as a random effect. Using the package *MuMIn* (Bartón, 2024), we produced a weighted average of 17 models (from a possible 782) with a delta AICc (corrected for small samples) of ≤2 (Burnham and Anderson, 2002).

The results suggest that although pastoralists tended to perceive more benefits, they were not significantly more likely to be aware of the scheme operating in their village. Instead, being male, younger, and having attended primary school were significant positive predictors, as was the number of children living in the respondent's household (Table A.1).

Table A.1: Most survey respondents (74%, n=277) were aware of the scheme operating in their village. Our weighted model suggests that respondents were more likely to be aware when they were younger, male, and had attended primary school. The number of children in their household was also a significant positive predictor, but the number of adults was not. Not all averaged models included all interaction terms, and we report full-model averages. For education, gender, and pastoralism status, brackets denote the relevant category for the direction of the estimate. Interactions are denoted with a full colon (:). Significance codes: ***p<0.001, **p<0.01, *p<0.05.

Variable	Estimate	95% CI	Std. Error	Adjusted SE	z value	Pr(>|z|)
(Intercept)	-0.06	-0.83 – 0.72	0. 39	0.40	0.14	0.886
Age	-0.37	-0.72 – -0.03	0.18	0.18	2.12	0.034 *
Education (Yes)	0.96	0.21 – 1.71	0.38	0.38	2.50	0.012 *
Gender (Male)	1.70	0.79 – 2.61	0.47	0.47	3.65	<0.001 ***
No. of children in household	0.60	0.14 – 1.06	0.23	0.23	2.56	0.010 *
No. of adults in household	0.20	-0.20 – 0.38	0.16	0.16	1.27	0.206
Education : Gender	-0.83	-1.33 – 0.77	0.63	0.63	1.3	0.189
Age : Gender	0.38	-0.37 – 0.60	0.32	0.32	1.18	0.238
No. of children in household : Gender	-0.42	-0.76 – 0.44	0.36	0.36	1.16	0.248
Pastoralism status (Pastoralist)	-0.26	-0.28 – 0.23	0.34	0.34	0.77	0.443
Total livestock value	0.13	-0.09 – 0.10	0.17	0.17	0.76	0.450

Survey questions (for Relative Scheme villages)

Date
Survey number
Respondent name
Village
How many children are there in your household?
How many people (in total) are in your household?
How old are you?
(Not asked out loud) What is their sex?
What is your highest education level?
How many cattle and calves do you have?
How many goats and sheep do you have?
How many donkeys do you have?
Has there ever been a large carnivore attack on your household's livestock?
Has there ever been a large carnivore attack on a human in your household?
What ethnic group are you a part of?
Do you always live with your livestock?

Do you move your cattle seasonally?
How many wives do you aspire to have?/How many wives does your husband have?
Do you identify as a pastoralist?
Have you heard of the Relative Scheme in this village?
How much personal benefits do you get from the Relative Scheme?
(None/small/big/very big/not sure)
How many goats do you think these benefits are worth?
How much does your household benefit from the Relative Scheme?
(None/small/big/very big/not sure)
How many goats do you think these benefits are worth?
How do these benefits relate to the costs of large carnivores to your household?
Please rank these benefits in terms of their importance to your household: Items for schools; Veterinary medicines; CHF (health insurance); Items for the youth.
Currently in the CCT: 100,000TSh is given to the youth, and the rest is split equally between CHF, pastoralists, and schools. How happy are you with this split?
How happy are you with how items are chosen within these sectors (i.e. through the village council and pastoralist, teacher, and youth committees)?
Does the Relative Scheme make people in your village more or less likely to kill large carnivores?
Why?
Which of these reasons is most important in this? (Because people important to them tell them not to; Because it gives them benefits; Because it has increased their knowledge of large carnivores; Because they fear being pictured on the camera-traps; Other (please specify); Unsure)
How fair do you think the Relative Scheme is?
Why?
How could the CCT be made fairer?
Who do you think benefits most from the Relative Scheme, and why?
Who do you think benefits least from the Relative Scheme, and why?
Who, if anyone, tells young men in your village not to kill carnivores?
What, if any, are the downsides of the Relative Scheme?

Survey questions (for Threshold Scheme villages)

Date
Survey number
Respondent name
Village
How many children are there in your household?

How many people (in total) are in your household?
How old are you?
(Not asked out loud) What is their sex?
What is your highest education level?
How many cattle and calves do you have?
How many goats and sheep do you have?
How many donkeys do you have?
Has there ever been a large carnivore attack on your household's livestock?
Has there ever been a large carnivore attack on a human in your household?
What ethnic group are you a part of?
Do you always live with your livestock?
Do you move your cattle seasonally?
How many wives do you aspire to have?/How many wives does your husband have?
Do you identify as a pastoralist?
Have you heard of the Threshold Scheme in this village?
How much personal benefits do you get from Threshold Scheme?
(None/small/big/very big/not sure)
How many goats do you think these benefits are worth?
How much does your household benefit from Threshold Scheme?
(None/small/big/very big/not sure)
How many goats do you think these benefits are worth?
How do these benefits relate to the costs of large carnivores to your household?

Please rank these benefits in terms of their importance to your household: Items for schools; Veterinary medicines; CHF (health insurance); Items for the youth.
Currently in the Threshold Scheme: 10% is given to the youth, and 30% each for CHF, pastoralists, and schools. How happy are you with this split?
How happy are you with how items are chosen within these sectors (i.e. through the village council and pastoralist, teacher, and youth committees)?
Does the Threshold Scheme make people in your village more or less likely to kill large carnivores?
Why?
Which of these reasons is most important in this:
Please specify:
How fair do you think the Threshold Scheme is?
Why?
How could the Threshold Scheme be made fairer?
Who do you think benefits most from the Threshold Scheme, and why?
Who do you think benefits least from the Threshold Scheme, and why?

Who, if anyone, tells young men in your village not to kill carnivores?
What, if any, are the downsides of the Threshold Scheme?

Focus group example questions

Ages
Ethnicities
Aware of Relative/Threshold Scheme?
Could you describe it?
What is the purpose of the cameras?
Why are Lion Landscapes running it?
Do you like it? Why/why not?
Does it target any group of people in particular?
Has the Relative/Threshold Scheme changed your relationship with other tribes?
Who eats bushmeat?
Who sets snares?
How do other people in the village feel about having lions on village lands?
How do you feel about having lions on village lands?
What do your elders think about having lions on village lands?
Have these attitudes changed over the last 10 years? If so, why?
Who in your household goes to pick up the veterinary medicines?
Which of the benefits from the Relative/Threshold Scheme are most important to you?
How many of your friends know about the Relative/Threshold Scheme?
Who doesn't know about it?
Who benefits most from the Relative/Threshold Scheme?
Who benefits least from the Relative/Threshold Scheme?
How fair are the village groupings in the Relative Scheme?
What happens if a camera-trap is broken/stolen? And in other villages?
Why do lions sometimes get killed?
What happens when a lion is killed? And in other villages?
How would you feel if your son killed a lion that had killed one of your cows?
Question about rewards.
Who tells young Barabaig/Maasai men not to kill lions and other large carnivores?
Is it more important for young Barabaig/Maasai men to listen to their elders or the village government?
Are the costs of lions in your village greater or lesser than the Relative/Threshold Scheme benefits?
Are there any problems with the Relative/Threshold Scheme?

Does the Relative/Threshold Scheme reduce the killing of lions and other large carnivores? Why/why not?

Appendix B

Ethics form and approval

Your Logo Here

Main Form

THIS ONLINE ETHICS REVIEW SYSTEM IS BEING PILOTED AND IS ONLY AVAILABLE FOR APPLICANTS FROM THE FACULITIES OF BUSINESS, ENVIRONMENT AND SOCIAL SCIENCES REVIEWED BY THE AREA FREC and submitted on or after Monday 4th July 2022 -any queries, please email EthicsEnquiries@leeds.ac.uk

Which Faculty do you belong to?

Business, Earth & Environment, Social Sciences (AREA FREC)

Which School/Institute/Dept (or other) are you in?

School of Earth and Environment (SRI)

Will the research be conducted using already published data or data in the public domain?

See here for guidance on already published data or data in the public domain.

- ☐ Yes
- ☑ No

Will the project involve the NHS?

- ☐ Yes
- ☑ No

Please answer the following questions:

- ☐ I am a substantive employee
- ☐ I am an undergraduate student
- ☑ I am a PGR
- ☐ I am a taught PG
- ☐ I am visiting or honorary staff

What is the title of the research? (Project title)

Can performance payments deliver good carnivore conservation and conservation for good? A case study in Ruaha, Tanzania.

Intended study start date?

01/01/2023

Intended fieldwork start date:

14/11/2022

Intended fieldwork end date:

13/11/2023

Intended study end date:

31/03/2026

Please note: The review process takes a minimum of 6-8 weeks not including when the action is with the applicant or University closed days. If an expedited and/or Chair's review is necessary due to i.e. funders deadlines, please provide the request rationale below:

Chief Investigator

Title

Can performance payments deliver good carnivore conservation and conservation for good? A case study in Ruaha, Tanzania.

First Name

Joseph

Surname

Hamm

Email

ss20joeh@leeds.ac.uk

Are there other members included in the research team?

- ☐ Yes
- ☑ No

Will the research team include an academic supervisor?

- ☑ Yes
- ☐ No

Academic supervisor

Title

Professor

First Name

George

Surname

Holmes

Email

G.Holmes@leeds.ac.uk

What is the purpose of the application?

- ☐ Research
- ☐ Research involving animals

  To check if any other relevant approvals are required please email : h.o.admin@leeds.ac.uk

- ☑ Educational qualification
- ☐ Educational Research & Evaluation
- ☐ Medical Audit or Health Service Evaluation
- ☐ Module Block Approval for Taught Students

  see here for guidance on block approvals

- ☐ Proportionate Review
- ☐ Other

Please specify programme of study

PhD

Please select all that apply to describe the research from the list below:

- ☐ Research which has potential adverse environmental impact.

  Environmental impact guidance info

- ☑ Research working with data of human participants
- ☑ Research on or with human participants
- ☐ Research working with human tissue samples

Will informed consent be provided by participants?

- ☑ Yes
- ☐ No

Upload Participant Information Sheet and consent form (template can be downloaded here) or a copy of informed consent statement if using anonymous online survey (see here)

Documents

Type	Document Name	File Name	Version Date	Version	Size
Informed Consent / Participant Information Sheet	Verbal consent read-out	Verbal consent information read.docx	11/07/2022	1	14.5 KB

Research working with data of human participants: Please select from list below:

- ☑ New data collected by qualitative methods
- ☑ New data collected by quantitative methods
- ☐ New data collected from observing individuals or populations

  See here for guidance on new data collected from observing individuals or populations

- ☐ Research working with aggregated or population data
- ☑ Routinely collected data or secondary data not publicly available

Is consent for future use of the data for the purpose of research in place?

- ☑ Yes
- ☐ No

Is permission in place from the data-owner to share the data?

- ☐ Yes
- ☑ No

Please state which sources of secondary data you will be using and if the provider or owner of this data has set any restrictions/permissions/requirements for the use of this data

Please note that the project report should not consist of a literature review alone.

The organisation I an working with (an NGO called Lion Landscapes) regular collects data on both ecological and attitudinal variables, some of which are likely to be included in my analyses. We are drawing up a memorandum of understanding to ensure clarity regarding the use and sharing of this data.

Research on or with human participants: Please select any relevant groups from list below:

- ☐ Children under 16
- ☐ Adults with learning disabilities
- ☐ Adults with other forms of mental incapacity or mental illness
- ☐ Adults in emergency situations
- ☐ Prisoners or young offenders

  See here and here for guidance

- ☐ Those who could be considered to have a dependent relationship with the researcher

  e.g colleagues - see here for guidance

  and e.g students - see here for guidance

- ☐ Other 'vulnerable' groups
- ☑ None of the above

Does the research involve external funding?

- ☑ Yes
- ☐ No

Funding Source

ESRC

Funding Reference

White Rose DTP, overseas fieldwork expenses

Grant Holder

Joseph Hamm

Project Ethical Risks

Please indicate any/all of the following that applies to the project:

- ☐ Any elements of deception?
- ☑ Is it possible that any criminal or other disclosures requiring action (i.e. safeguarding) might be raised?
- ☑ Discussion of topics that could be considered sensitive, embarrassing or upsetting (e.g. relationships, sexual activity, drug use, volunteered medical information?)
- ☐ The study will involve intrusive interventions or data collection methods (e.g. the administration of substances; involving physical or emotional stress; potential for harm
- ☐ The study will involve prolonged or repetitive testing
- ☐ The study will involve participatory action research or members of the public in a research capacity
- ☐ Participants will be taking part in the research without their knowledge and consent (e.g. covert observation of people in non-public places)
- ☐ The study will involve social media and participants recruited or identified through the internet.

  See here for guidance

- ☐ Financial inducements (other than reasonable expenses and compensation for time) will be offered to participants.

  See here for guidance

- ☐ Risks to the safety and wellbeing of the researchers, or individuals not directly involved in the research?
- ☑ The study will involve international partners/collaborators or research undertaken outside the European Economic Area where there may be issues of local practice and political sensitivities
- ☐ The study requires in-country ethics approval or permissions (these could be applied for in parallel to University of Leeds ethics approval)*
- ☑ The study will involve anonymised secondary data from an external party
- ☑ The study will involve linking or sharing of data or confidential information beyond the initial consent
- ☐ The study will involve the transfer of identifiable data outside the European Economic Area
- ☐ The study will require DBS checks

  See here for guidance (required for research with children or 'vulnerable' adults)

- ☐ The study will require local managerial or gatekeeper permissions for access to potential participant groups (e.g. Head of School to access school pupils; organisational permission to access staff; University of Leeds permission to access students or staff, including MBChB* gatekeeper permission to access University of Leeds Medical Students)

Please provide details of any ethical issues indicated above and explain how these will be addressed

Lack of written consent to interviews due to high rates of illiteracy in the study area.

- I will obtain verbal consent, and this will be recorded in transcripts of the interview and in the presence of a witness (most likely a research assistant), as the ESRC Framework for Research Ethics recommends this. Verbal consent will be sought again at the end of every interview to reflect its continual nature.

Discussion of a sensitive topic (in Tanzania the killing of lions is only legal under circumstances such as threat to life or livestock. Discussion of past carnivore-killing behaviours may therefore implicate the interviewee or others).

- I will not ask direct questions about past carnivore-killing behaviour. Should such information arise naturally (unprompted), that data will be redacted from the transcript (signified by ...[redacted]...), so as to remove any potentially incriminating evidence. This is because the transcripts will still contain some secondary identifying data such as age range, ethnicity, village that are necessary for the research. Any such information redacted from the transcripts will be stored as a separate document with no other data (i.e. fully anonymised) and used only as anecdotal evidence (direct quotations will not be used). Therefore, no participant could be incriminated should the relevant government body (the Tanzania Wildlife Research Institute) requisitioned my data. I will instead assess attitudes towards carnivore killing by asking questions of hypothetical future behaviour (e.g. "I would kill the next lion that attacks my livestock" etc.), and of others' perceived behaviours (e.g. "I believe others in my village would kill a lion if it attacked their livestock"). This approach is being used by other researchers in the study site and has received previous research permit clearance from the Tanzania Wildlife Research Institute.
- Transcripts will have all direct identifiers removed, although some indirect identifiers will remain due to inclusion in analysis. Only I will have access to the recorded (non-anonymised) recordings of the interviews, and these will be deleted at the date given as the latest opportunity to stop participating in the research (likely to be the predicted end of fieldwork).

Ethical ramifications of results: should my research suggest that this payment scheme is ineffective at changing attitudes and behaviours towards large carnivores, there could be negative consequences. This scheme represents a significant source of income to the members of the participating villages. With most people in the study site living in poverty, any reduction or withdrawal from the scheme would be a financial blow.

- I cannot promise my study respondents that there will be no future changes to the scheme, as that is in the control of the NGO and their funders. Careful study design can limit the extent to which self-interest influences responses (i.e. "I benefit from this payment scheme so I will say that it is successful, even if it perhaps is not"), however informed consent requires that respondents know and understand the purpose of the research. I will emphasise that a main aim of the research is to improve the scheme. I would welcome advice from the Ethics Committee on how to mitigate the potentially detrimental effects of the results of objective research on the participants (i.e. if my results suggest that this scheme is ineffective).

Relatedly, there is also a concern that I am associated with Lion Landscapes by the locals. This is understandable as I will be staying with them and likely seen with them, and I am also a white westerner. Possible issues with this include expectations that I am capable of improving/changing the scheme in the short-term, or even inadvertently messing-up complex relationships between local communities and Lion Landscapes. I will endeavour to avoid this by clarifying my independence from the NGO, and avoiding Lion Landscapes branding as far as possible (e.g. logos on vehicles, clothes, etc.).

Please describe any/all potential benefits and risks to participants in the short and medium terms?

Potential benefits - Short-term: A small gift (e.g. a bag of sugar)
Medium-term: A positive change to the payment scheme as a result of this research.
Potential risks - Short-term: Minor distress during discussion of an emotive topic.
Medium-term: A negative change to the payment scheme as a result of this research.

Summary of Research

Please provide a short summary of the research using language easily understood to the lay person, and cover the main parts of the study proposal/protocol, specifically:

- **The background of the research and why it is important**
- **The questions it will answer and potential benefits**
- **The study design and what is involved for participants**

Around 10% of the world's remaining wild lions live in Tanzania's Ruaha Landscape, but many are killed as a result of conflict with humans. This is because lions impose significant costs on those people they live alongside, such as killing livestock. An innovative project, developed by an NGO called Lion Landscapes, has attempted to address this problem by tying value to these carnivores. A payment scheme has been set up since 2015, whereby camera-traps are deployed on the land of participating villages. These cameras record images of animals when they walk past. In this scheme, the presence of lions results in tangible benefits for the village, including school meals, scholarships, and healthcare: in short, the more lions, the more benefits the village receives. This provides an incentive for local people to conserve large carnivores.

Working alongside Lion Landscapes, I will research how effective this scheme is, and whether it can be improved. I will also examine whether it is more effective at changing attitudes and behaviour towards some species than others, and also how equitable it is. The answers to these questions will inform future management of this and similar schemes. I will be using questionnaires and semi-structured interviews to collect data with villagers living on the periphery of Ruaha National Park. I may also use relevant routinely collected ecological data from Lion Landscapes. Depending on the timing of the scheme's expansion to new villages, a before-after control-intervention (BACI) or simplified control-intervention (CI) study design will be used. This research is funded by the Economic and Social Research Council (ESRC).

Please identify any ethical considerations or issues with the research and clearly state how these will be addressed

1) Lack of written consent to interviews due to high rates of illiteracy in the study area.

2) Discussion of a sensitive topic (in Tanzania the killing of lions is only legal under circumstances such as threat to life or livestock. Discussion of past carnivore-killing behaviours may therefore implicate the interviewee or others).

3) Ethical ramifications of results: should my research suggest that this payment scheme is ineffective at changing attitudes and behaviours towards large carnivores, there could be negative consequences. This scheme represents a significant source of income to the members of the participating villages. With most people in the study site living in poverty, any reduction or withdrawal from the scheme would be a financial blow.

4) Relatedly, there is also a concern that I am associated with Lion Landscapes by the locals. This is understandable as I will be staying with them and likely seen with them, and I am also a white westerner. Possible issues with this include expectations that I am capable of improving/changing the scheme in the short-term, or even inadvertently messing-up complex relationships between local communities and Lion Landscapes. I will endeavour to avoid this by clarifying my independence from the NGO, and avoiding Lion Landscapes branding as far as possible (e.g. logos on vehicles, clothes, etc.).

(see previous answer for full details of how these issues will be addressed):

What the aims of the study (must be comprehensible to a lay person)

To determine if this type of payment scheme is an effective way of conserving large carnivores; how it works (or doesn't); and if it is socially just.

Please describe the methodology of the research

There are currently 12 villages taking part in this payment scheme, and the exact nature of the study design depends on whether and when the scheme is expanded to new villages. If the scheme is expanded at a suitable time, a before-after control-intervention (BACI) study design will be used, with villages matched with controls that share similar socio-economic characteristics. If the opportunity for a before-and-after element does not present itself, a reduced control-intervention study design will be used.

A novel evaluation matrix will be used to determine the effectiveness of the CPP scheme. The elements included in this matrix can be grouped into four categories: ecological, socioecological, psychological, and psychosocial. The variables to be measured include attitudinal and behavioural tolerance, perceptions of costs and benefits of carnivores and conservation, motivation-crowding, and subjective norms, in addition to demographic data.

Data collection will follow similar studies examining human-carnivore conflict in the area, and comprise attitudinal questionnaire surveys and semi-structured interviews with villagers living on the periphery of the Pawaga-Idodi Wildlife Management Area and Ruaha National Park. Pilot interviews will be used to guide questionnaire design, and the results of the questionnaires will inform the semi-structured interviews. Interview questions will concern perceived costs and benefits, fairness/unfairness, and attitudes towards wildlife, the scheme, management authorities. Both interviews and questionnaires will be conducted in Swahili and translated into English by trained enumerators. The questions will be reviewed iteratively during pilot tests to ensure neutrality, comprehension, and clarity, before data collection commences.

Quantitative data analysis will be conducted in the statistical software R. The transcribed interviews will be coded using an inductive approach, ensuring that the themes identified are drawn from respondents' own views. Using the software NVivo, thematic analysis will then be undertaken to explore individuals' perceptions of the CPP, as well as similarities and differences in participant responses.

Please describe specifically what participants will be asked to do in the study (i.e. number of visits, activity undertaken during visit, time / travel required, interviews, survey etc)

Participants will be asked to either answer a questionnaire (verbally, due to low literacy levels), or provide an interview. No individual will be asked for both, to avoid pseudo-replication and fatiguing participants. Similarly, all participants will only be interviewed or asked to answer a questionnaire once (possibly twice if a before-after design is adopted). Interviews and questionnaires will last for less than 1 hour.

Where will the data collection be undertaken? If off campus, a fieldwork risk assessment is usually required – see here for guidance

No travel time is required as participants will be approached at their households. This is suitable for the local context of herders coming-and-going when grazing their livestock.

Upload any required risk assessment here:

Please note: Risk assessments are a University requirement for all fieldwork taking place off campus. The risk assessment forms and further guidance on planning for fieldwork in can be found on the Health and Safety section of the Research Ethics website University's Health & Safety website, along with further information about risk assessment.

Documents

Type	Document Name	File Name	Version Date	Version	Size
Risk Assessment Form	Fieldwork risk assessment	Approved version.docx	11/07/2022	1	153.4 KB
Risk Assessment Form	Collaborator's risk assessment	Tanzania risk assessment_BC.doc	11/07/2022	1	143.5 KB
Risk Assessment Form	Lone_Working_Risk_Assessment	Lone_Working_RA.docx	11/07/2022	1	53.9 KB

Recruitment & Informed Consent Process

How will potential participants (Please describe in detail):

Be identified?

Following similar previous studies in the area, the olmarei (a social grouping, loosely considered a household and typically headed by a man) will be used as the sampling unit. The chairman of each village will be approached, and the research explained to him. The use of this gatekeeper is standard practise and ensures legitimacy and clarity of the research as per local social norms. If accepting, he will then be asked for a list of the households in the village,

The use of a gatekeeper (i.e. the village chairman) to access personal information (e.g. name, location, ethnicity) without that person's prior consent is worth highlighting here. To mitigate any unethical practices, any individuals who, if approached, do not consent to the interview/questionnaire, will have any of their held personal data deleted immediately. Similarly, those individuals/households who are not randomly sampled will have any of their collected personal data deleted at the earliest opportunity once it is clear that no further sampling is required (likely to be at the end of the fieldwork).

A representative sample of gender will be sought, however as the head of households are usually male, additional non-random sampling may be needed in order to achieve a demographic balance. Similarly, a representative sample of four ethnicities – two agro-pastoralist groups (the Bena and Hehe) and two pastoralist groups (the Barabaig and Maasai) will also be sought and may require further non-random sampling

Be approached regarding their potential participation?

A fixed percentage of households in each village will be randomly surveyed via a personal visit to the household by myself and likely a research assistant, and be invited to participate in the research questionnaire. If consenting, data will be collected from the most senior adult member present in the household. The same approach will be used for the interviews, but omitting those individuals who had previously been selected for the questionnaires, to avoid pseudo-replication. No advertisement materials will be used.

Be recruited to the study?

See previous

Undergo the informed consent process and be informed of exactly what is required of them if they agree to participate?

A link to the Research Participant Privacy Notice must be provided in the participant information about the study.

Due to low literacy rates in the study area, participant consent forms or questionnaire introductory paragraphs are not sufficient. Instead, verbal consent will be sought, and this will be recorded in the presence of a witness (most likely a research assistant), and included in the process of verbally conducting the questionnaire, and, in the case of interviews, in the transcripts. Verbal consent will be sought again at the end of every interview to ensure on-going consent.

The initial process of obtaining verbal consent will consist of the following explanation:

A short statement explaining that the participant is being asked to take part in a research project
The title of the research
The purpose of the research, who I am, and who funds it
Why they have been selected
The entirely voluntary nature of participation, throughout the process
What will happen (e.g. interview/questionnaire) and for how long (~1h)
How their personal data will be stored (including plans storing and sharing data), and for how long
That they can have their personal data deleted at any point with no consequence (until it is anonymised, the date that will be probably given is the predicted end of fieldwork)
The plan for anonymising personal data through the removal of direct identifiers, and the limitations to this regarding some indirect identifiers (see answers to C.19 and C.20)
Clarification that permission is granted for interviews to be recorded
A method of contacting myself (i.e. phone number) and also our research camp location.(in case they would like their data deleted). I will inform them that they can also contact a member of Lion Landscapes who can then contact me (for those with no access to a phone).

Continued consent-seeking (e.g. at the end of interviews) will consist of an abridged version of the above.

I will not be including a copy of the Research Participant Privacy notice due to low literacy rates.

If you intend not to receive informed consent, please provide a rationale as to why this is the case below or state not-applicable

Not applicable

Will you be excluding any groups of people and if so, please provide a clear rationale for that?

Participants will be restricted to >18 years old for consent purposes.

Other ethnicities (those who are not Bena, Hehe, Barabaig, or Maasai) will also be excluded. This is because the target ethnicities are traditionally pastoralists (as opposed to agriculturalists), and are therefore more exposed to carnivore-associated conflict – they are also the communities targeted by the payment scheme.

How many participants do you envisage to be required to meet the research aims and objectives? If you have a formal power calculation, please provide it here

There are approximately 60,000 people in the broader study site, split across ~21 villages. Similar studies in this area have conducted between 262-280 interviews. I aim to recruit a similar, if not slightly smaller number of participants (split broadly as ~200 questionnaires and ~50 interviews). In reality, my sample size is partially limited by the number of villages/individuals participating in the scheme, and may therefore be lower.

Will participants be able to withdraw from the study?

- [x] Yes
- [ ] No

Please state at which point in the data collection / research process this would be possible and state any identified time point (i.e. 10 days after an interview)

At my predicted end of fieldwork (the date will be provided).

How long will participants have to decide their participation in the research? Please provide a rationale on the timeframe

Due to the remote nature and low-networked conditions of the field site, potential respondents will be approached at their households and invited to participate then and there. This also acknowledges the social context of people coming and going from herding their livestock. I feel that this approach is justifiable given the low-risk nature of the research .

Are there any arrangements for participants who may have challenges understanding verbal or written information, or whom have particular communication needs that could be addressed to facilitate their involvement in the research?

The low literacy rates in the study site place a significant expectation on verbal explanations being understood. Interviews will be conducted in Swahili – whilst there are multiple local languages spoken in the area, Swahili is widely spoken as a lingua franca, and previous studies in the area have encountered no difficulties conducting surveys in Swahili .

I have been fortunate to receive an extension to learn some Swahili prior to my fieldwork commencing. Whilst this will aid both the research and my experience, I am unlikely to develop a proficiency sufficient for conducting interviews and questionnaires by myself. I will therefore be hiring a research assistant to aid with translation. Lion Landscapes have told me that they have good contacts with potential research assistants (they try to share the employment out so that the income is not too concentrated). As research assistants (as per the conditions of the research permit) are required to have at least a relevant degree, they will have prior knowledge of the importance of scientific protocols and ethical considerations. Despite this, prior to data collection commencing, I will re-emphasise the importance of these. In any case, I will also be present during data collection and I should have developed sufficient Swahili to ensure that ethical protocols are followed at all times.

Research Data Management & Storage

Do you have a data management plan?

See here for guidance

- [x] Yes
- [ ] No

Will you be processing, or have access to, any personal identifiable data during any stage of the study?

See here for guidance

- [x] Yes
- [ ] No

What is the data source?

- [x] New data collected for this research
- [x] Data previously collected for other research
- [ ] Data previously collected for non-research purposes
- [ ] Data already in the public domain
- [ ] Other

How will the data be collected?

- [x] Through one-to-one research interviews
- [ ] Through focus groups
- [x] Self-completion (eg questionnaires, diaries)
- [ ] Through observation
- [ ] Through autoethnographic research
- [ ] Through experiments/ user-testing involving participants
- [x] From external research collaborators
- [ ] Other

Explain what measures will be put in place to protect personal data. E.g. anonymisation procedures, secure storage and coding of data. Any potential for re-identification should be made clear to participants in advance.

See here and here for guidance.

Transcripts of interviews and questionnaire responses will be anonymised, with names and other direct identifiers removed. Some personal data will be retained for analytical purposes relevant to the research (age range, gender, ethnicity, village) although this will be the minimum amount and at the lowest definition required to reduce the chances of indirect identification of participants (e.g. age range instead of exact date of birth, and, depending on actual sample size, a distinction between pastoralist and non-pastoralist instead of exact ethnic group). This limitation to anonymity will be made clear to participants during the consent process. The audio recordings of interviews will be deleted at the date given as the latest opportunity to stop participating in the research (likely to be the predicted end of fieldwork).

During fieldwork, some data will be on physical files (e.g. questionnaire responses). Whilst there is no secure room at the study site, these documents will be secured in a lockable deed box to which only I and other members of the research team will have keys to. Additionally, some data (including the non-anonymised audio recordings of interviews) will be stored directly on a University laptop computer and not on the University's secure N: or M: or Cloud Drives due to the lack of internet access at the study site. The laptop will be password protected, and the folders containing personal data will be further password protected, and only accessible to me. When not at the field site, the University's Microsoft Office OneDrive will be used to store data. Any data transferred electronically (e.g. as a back-up) will be suitably encrypted.

Relevant anonymised data will be shared with Lion Landscapes as part of our collaboration, and this will have been made clear to respondents in the continual process of gaining consent. It should be noted that as the data will be collected outside of the European Economic Area (EEA), with collaborators also outside the EEA, some anonymised data (such as that shared with Lion Landscapes) will remain outside the EEA.

How will you make your research data available to others in line with the University's, funding bodies' and publishers' policies on making the results of publicly funded research publicly available. Explain the extent to which anonymity will be maintained.

See here and here for guidance.

C.20 How will you make your research data available to others in line with: the University's, funding bodies' and publishers' policies on making the results of publicly funded research publicly available. Explain the extent to which anonymity will be maintained. (max 200 words) Refer to http://ris.leeds.ac.uk/ConfidentialityAnonymisation and http://ris.leeds.ac.uk/ResearchDataManagement for guidance.

The University and my funder (ESRC) require a data management and sharing plan, which is currently being developed ready for my transfer process. I will deposit project data in the UK Data Service ReShare Repository, as requested by the ESRC. It will be classified at the 'controlled' data level. Anonymity will be maintained to the extent that all data shared in such repositories will have had direct identifying characteristics removed, and some indirect characteristics needed for analysis will be included only at resolutions which impede any possible identification of participants. Informed consent regarding this limitation will have been obtained from all respondents.

Will the research involve any of the following activities at any stage (including identification of potential research participants)?

Will the research involve any of the following activities at any stage (including identification of potential research participants)?

- [ ] Examination of personal records by those who would not normally have access
- [ ] Access to research data on individuals by people from outside the research team
- [ ] Electronic surveys
- [x] Other electronic transfer of data
- [x] Use of personal addresses, postcodes, faxes, e-mails or telephone numbers
- [x] Use of audio/ visual recording devices
- [x] FLASH memory or other portable storage devices
- [x] Storage of personal data on, or including, any of the following:
    - University approved cloud computing services
    - Other cloud computing services
    - Manual files
    - Private company computers
    - Laptop computers
    - Home or other personal computers (data should be stored on a University of Leeds server such as your M: or N: drive or Office365 where it is secure and backed up regularly. See here for guidance)

Please specify details of mode of data transfer

Suitably encrypted emails

How do you intend to report and disseminate the results of the study?

See here for guidance.

- [x] Conference presentation
- [x] Peer reviewed journals
- [x] Publication as an eThesis in the Institutional repository
- [ ] Publication on website
- [x] Other publication or report
- [x] Submission to regulatory authorities
- [ ] Other
- [ ] No plans to report or disseminate the results

Other publication or report - please state

Academic or environment-oriented news/media organisations such as Mongabay or The Conversation.

For how long will data from the study be stored?

See the UKRI Common Principles on Data Policy and here for guidance.

Students: It would be reasonable to retain data for at least 2 years after publication or three years after the end of data collection, whichever is longer.

Years 2

Months 0

Please explain why this length of time has been chosen

University guidance suggests that 'this time period would allow for investigation of any allegation of academic fraud or for any negligence or compensation claims to be made by research participants'.

University Policy and Protocol Compliance

Information

Please be aware that by agreeing to the statements below, you are confirming that you have read and have understood the relevant University policies and or protocols. It will be evident in your ethics application if this is not the case and if so, your submission may be rejected.

Is a risk assessment required, including for fieldwork or lone working?

See here and here for guidance.

☑ Yes ☐ No

I confirm that I have read and understood the current version of the University of Leeds Research Ethics Policy.

The Policy is available here

☑ Yes ☐ No

I confirm that I have read and understood the current version of the University of Leeds Research Data Management Policy.

The policy is available here

☑ Yes ☐ No

I confirm that research participants will be provided with a copy of the Privacy Notice for Research.

Guidance is available here

☐ Yes ☐ No ☑ Not Applicable

I confirm that I have read and understood the current version of the University of Leeds Information Protection Policy.

The policy is available here

☑ Yes ☐ No

Please indicate with which of the following UoL Protocols your study will comply?

Protocol on the protection, anonymisation and sharing of research data

☑ Yes ☐ No ☐ Not Applicable

Informed consent protocol	☑ Yes	☐ No	☐ Not Applicable
Verbal consent protocol	☑ Yes	☐ No	☐ Not Applicable
Protocol on the reimbursement of research participants	☑ Yes	☐ No	☐ Not Applicable
Low risk observation protocol	☑ Yes	☐ No	☐ Not Applicable

Conflicts of Interest

Will any of the research team or their institutions receive any other benefits or incentives for taking part if this research, over and above their normal salary and/or costs of undertaking the research?	☐ Yes	☑ No	
Is there scope for any other conflict of interest? See here for guidance	☐ Yes	☑ No	
Will the research funder have control of publication of research findings?	☐ Yes	☑ No	☐ Not funded

Sharing information for training purposes

Are you content for information in the application to be used for research ethics and research data management training purposes within the University of Leeds. All personal identifiers and references to researchers, funders and research units would be removed.

- ☑ Yes
- ☐ No

Supporting Documents

Supporting Documents

- ☐ Recruitment materials

  e.g. poster, email text or social media text to be used to invite people to participate in your research project or advertise your study.

- ☐ Letter/email evidencing permission from host/gatekeeper if accessing for recruitment purposes
- ☐ Evidence of managerial permission

  i.e. From Head of Department or School or Line Manager if recruiting staff from the University, or from an external company or organisation

- ☑ Questionnaire/survey questions and/or interview topic guide
- ☑ Data management plan

  see the Collecting Research Data webpage and https://library.leeds.ac.uk/info/14062/research_data_management/62/data_management_planning

- ☐ Other

  e.g. data processing agreement (if personal data being transferred to 3rd party), transcription confidentiality agreement (if internal University staff transcriber is used)

Questionnaire/survey questions and/or interview topic guide

Documents

Type	Document Name	File Name	Version Date	Version	Size
Questionnaire/survey and/or interview guide	Draft survey tool	Draft survey tool.docx	11/07/2022	1	37.7 KB

A data management plan (if applicable)

see the Collecting Research Data webpage and https://library.leeds.ac.uk/info/14062/research_data_management/62/data_management_planning

Documents

Type	Document Name	File Name	Version Date	Version	Size
Data Management Plan	DMP	DMP.docx	11/07/2022	1	36.1 KB

Declarations & Signatures

Declarations

- ☑ The information in this form is accurate to the best of my knowledge and belief and I take full responsibility for it.
- ☑ I undertake to abide by the policies and guidelines stated below, and the ethical principles underlying good practice guidelines appropriate to my discipline.

  University's ethical and https://wsh.leeds.ac.uk/safety-topics policies and guidelines

- ☑ If the research is approved I undertake to adhere to the study protocol, the terms of this application and any conditions set out by the Research Ethics Committee.
- ☑ I undertake to ensure that all members of the research team are aware of the ethical issues and the contents of this application form.
- ☑ I undertake to seek an ethical opinion from the REC before implementing any amendments to the protocol.

  Guidance on amendments

- ☑ I undertake to submit progress/end of project reports if required.
- ☑ I am aware of my responsibility to be up to date and comply with the requirements of the law and relevant guidelines relating to security and confidentiality of personal data.
- ☑ I understand that research records/ data may be subject to inspection for audit purposes if required in future.

  Guidance on auditing

- ☑ I understand that personal data about me as a researcher in this application will be held by the relevant FRECs and that this will be managed according to the principles established in the Data Protection Act 2018 and the principles of the GDPR.

  Guidance on Data Protection Act 2018 and GDPR

Applicant's Signature

Signed: This form was signed by Joseph Hamm (ss20joeh@leeds.ac.uk) on 13/07/2022 16:01

Supervisor's Signature

Signed: This form was signed by George Holmes (G.Holmes@leeds.ac.uk) on 18/07/2022 10:08

Dear Joseph Hamm,

0157 - Can performance payments deliver good carnivore conservation and conservation for good? A case study in Ruaha, Tanzania.

NB: All approvals/comments are subject to compliance with current University of Leeds and UK Government advice regarding the Covid-19 pandemic.

I am pleased to inform you that the above research ethics application has been reviewed by the Business, Earth & Environment, Social Sciences (AREA FREC) Committee and on behalf of the Chair, I can confirm a favourable ethical opinion based on the documentation received at date of this email.

Please retain this email as evidence of approval in your study file.

Please notify the committee if you intend to make any amendments to the original research as submitted and approved to date. This includes recruitment methodology; all changes must receive ethical approval prior to implementation. Please see https://ris.leeds.ac.uk/research-ethics-and-integrity/applying-for-an-amendment/ or contact the Research Ethics Administrator for further information (EthicsEnquiries@leeds.ac.uk)f required.

Ethics approval does not infer you have the right of access to any member of staff or student or documents and the premises of the University of Leeds. Nor does it imply any right of access to the premises of any other organisation, including clinical areas. The committee takes no responsibility for you gaining access to staff, students and/or premises prior to, during or following your research activities.

Please note: You are expected to keep a record of all your approved documentation, as well as documents such as sample consent forms, risk assessments and other documents relating to the study. This should be kept in your study file, which should be readily available for audit purposes. You will be given a two week notice period if your project is to be audited.

It is our policy to remind everyone that it is your responsibility to comply with Health and Safety, Data Protection and any other legal and/or professional guidelines there may be.

I hope the study goes well.

Best wishes.
Rachel De Souza, Lead Research Ethics & Governance Administrator, Secretariat

On behalf of Dr Judith Hanks, Chair, AREA FREC

Appendix C

Amendment to ethical review and approval (1 of 2)

UNIVERSITY OF LEEDS

Amendment form

General Information

Guidance for applicants can be found in the 'Help' tab, then 'templates' then download/open the document. NB this is a live document and as such is subject to regular updates

What is the title of the research? (Project title)

Can performance payments deliver good carnivore conservation and conservation for good? A case study in Ruaha, Tanzania.

Chief Investigator

Title

Can performance payments deliver good carnivore conservation and conservation for good? A case study in Ruaha, Tanzania.

First Name

Joseph

Surname

Hamm

Email

ss20joeh@leeds.ac.uk

Which Faculty do you belong to?

Business, Environment, Social Sciences (AREA FREC)

Which School/Institute/Dept (or other) are you in?

School of Earth and Environment (SRI)

Will the research team include an academic supervisor?

- (•) Yes
- ( ) No

Ethics reference number:

AREA FREC 2022-0157-146

Date study commenced:

24/05/2023

Amendment number

1

Amendment date

25/05/2023

Amendment Detail

Amendment to information previously given on the University of Leeds ethical review application form

- [x] Yes
- [ ] No

Information

Please refer to relevant sections of the FREC application in the "summary of changes" section below.

Amendment to the information sheet(s) and/or consent form(s) for participants, or to any other supporting documentation for the study

- [ ] Yes
- [x] No

Is this a modified version of an amendment previously notified to the FREC/ School REC and given an unfavourable opinion?

- ☐ Yes
- ☑ No

Is this an amendment to a project which underwent NHS ethical review?

- ☐ Yes
- ☑ No

Is sponsor sign off required for the amendment?

- ☐ Yes
- ☑ No

If applicable, has the amendment been submitted for NHS management permission (R&D approval)?

- ☐ Yes
- ☑ No

Summary of changes

Briefly summarise the main changes proposed in this amendment using language comprehensible to a lay person. Explain the purpose of the changes and their significance for the study. In the case of a modified amendment, highlight the modifications that have been made.

If the amendment significantly alters the research design or methodology, or could otherwise affect the scientific value of the study, supporting scientific information should be given (or enclosed separately). Indicate whether or not additional scientific critique has been obtained.

I will now be interviewing additional people, in different areas. These people are in charge of operating the same type of carnivore conservation 'scheme' (conservation performance payments; CPPs) that form the focus of my thesis. I have identified these organisations through personal networking (i.e. at conferences) and snowball sampling. These organisations are all NGOs and operate in five countries across southern and eastern Africa. One or two individuals will be interviewed from each organisation. Most of the interviews (four or five out of the six) will be conducted online, through Microsoft Teams or Zoom. The others will be conducted at my research site or an agreed location elsewhere in Tanzania. The focus of the interviews will be on the challenges and opportunities that these organisations and individuals have encountered in developing and implanting CPPs in their respective contexts.

The primary ethical consideration is the extent of anonymity. The small number of CPPs in existence means that interviewees are relatively identifiable in conditions other than full anonymity. However we wish to avoid full anonymity as being able to compare challenges and opportunities across contexts is a key strength of the research. We therefore plan to reach agreements with interviewees that their responses are only partially anonymised (in that we disclose their job role, the name of the organisation, and/or its place of implementation, but not their name), with the opportunity that they can read and approve the manuscript prior to publication, to let them check what has and hasn't been attributed to them in an semi-identifiable way. This would allow for any steps towards anonymization to be taken. Greater detail (including a list of planned questions) is included in the attached document.

Any other relevant information

Applicants may indicate any specific ethical issues relating to the amendment, on which the opinion of the REC is sought.

n/a

High risk ethical issues, tick all that applies:

(to be completed by applicants who applied for 'light touch' ethical review only)

High risk ethical issues, tick all that applies:

(to be completed by applicants who applied for 'light touch' ethical review only)

- ☐ Does the study involve participants who are particularly vulnerable or unable to give informed consent (eg children, people with learning disabilities, your own students)?
- ☐ Will the study require the cooperation of a gatekeeper for initial access to groups or individuals who are taking part in the study (eg students at school, members of self-help groups, residents of a nursing home)?
- ☐ Will participants be taking part in the research without their knowledge and consent (eg covert observation of people in non-public places)?
- ☐ Will the study involve discussion of sensitive topics (eg sexual activity, drug use)?
- ☐ Are drugs, placebos or other substances (eg food substances, vitamins) going to be administered to the participants or will the study involve invasive, intrusive or potentially harmful procedures of any kind?
- ☐ Will blood or tissue samples be obtained from the participants?
- ☐ Is pain or more than mild discomfort likely to result from the study?
- ☐ Could the study induce psychological stress or anxiety or cause harm or have negative consequences beyond the risks encountered in normal life?
- ☐ Will the study involve prolonged or repetitive testing?
- ☐ Will financial inducements (other than reasonable expenses and compensation for time) be offered to participants?
- ☑ Will the study involve an international collaborator or research conducted overseas?
- ☑ Will the study involve the transfer of data outside the European Economic Area?
- ☐ Are there any potential conflicts of interest?
- ☐ Does the research involve any risks to the researchers themselves, or individuals not directly involved in the research?
- ☐ Will the study require ethical review from the NHS?

  (Refer to http://ris.leeds.ac.uk/NHSethicalreview for guidance in identifying circumstances which require NHS review)

- ☐ None of the above apply

List of enclosed documents

Documents

Type	Document Name	File Name	Version Date	Version	Size
Supplementary documents	Amendment	Amendment.docx	25/05/2023	1	25.0 KB

Declaration

Declaration

- ☑ I confirm that the information in this form is accurate to the best of my knowledge and I take full responsibility for it.
- ☑ I consider that it would be reasonable for the proposed amendment to be implemented.

Applicant Signature

Signed: This form was signed by Joseph Hamm (ss20joeh@leeds.ac.uk) on 25/05/2023 15:36

Supervisor Signature

Signed: This form was signed by George Holmes (G.Holmes@leeds.ac.uk) on 25/05/2023 16:16

Dear Joseph Hamm

AREA FREC 2023-0157-692 – 1 25/05/2023 – Can performance payments deliver good carnivore conservation and conservation for good? A case study in Ruaha, Tanzania.

NB: All approvals/comments are subject to compliance with current University of Leeds and UK Government advice regarding the Covid-19 pandemic.

I am pleased to inform you that the above research ethics application amendment has been reviewed by the Business, Environment, Social Sciences AREA FREC Committee and I can confirm a favourable ethical opinion based on the documentation received at date of this email.

Please retain this email as evidence of approval in your study file.

Please notify the committee if you intend to make any further amendments to the research as submitted and approved to date. This includes recruitment methodology; all changes must receive ethical approval prior to implementation. Please see https://ris.leeds.ac.uk/research-ethics-and-integrity/applying-for-an-amendment/ or contact the Research Ethics & Governance Administrator for further information if required.

Ethics approval does not infer you have the right of access to any member of staff or student or documents and the premises of the University of Leeds. Nor does it imply any right of access to the premises of any other organisation, including clinical areas. The committee takes no responsibility for you gaining access to staff, students and/or premises prior to, during or following your research activities.

Please note: You are expected to keep a record of all your approved documentation, as well as documents such as sample consent forms, risk assessments and other documents relating to the study. This should be kept in your study file, which should be readily available for audit purposes. You will be given a two week notice period if your project is to be audited.

It is our policy to remind everyone that it is your responsibility to comply with Health and Safety, Data Protection and any other legal and/or professional guidelines there may be.

I hope the study continues to go well.

Best wishes

Ms Taylor Haworth, Research Ethics Administrator, Secretariat

On behalf of Business, Environment, Social Sciences AREA FREC

Appendix D

Amendment to ethical review and approval (2 of 2)

Amendment form

UNIVERSITY OF LEEDS

General Information

Guidance for applicants can be found in the 'Help' tab, then 'templates' then download/open the document. NB this is a live document and as such is subject to regular updates

What is the title of the research? (Project title)

Can performance payments deliver good carnivore conservation and conservation for good? A case study in Ruaha, Tanzania.

Chief Investigator

Title

Can performance payments deliver good carnivore conservation and conservation for good? A case study in Ruaha, Tanzania.

First Name

Joseph

Surname

Hamm

Email

ss20joeh@leeds.ac.uk

Which Faculty do you belong to?

Business, Environment, Social Sciences (AREA FREC)

Which School/Institute/Dept (or other) are you in?

School of Earth and Environment (SRI)

Will the research team include an academic supervisor?

- (•) Yes
- ( ) No

Ethics reference number:

AREA FREC 2022-0157-146 [and associated amendment AREA FREC 2023-0157-692]

Date study commenced:

24/05/2023

Amendment number

2

Amendment date

08/10/2023

Amendment Detail

Amendment to information previously given on the University of Leeds ethical review application form

- [x] Yes
- [ ] No

Information

Please refer to relevant sections of the FREC application in the "summary of changes" section below.

Amendment to the information sheet(s) and/or consent form(s) for participants, or to any other supporting documentation for the study

- [ ] Yes
- [x] No

Is this a modified version of an amendment previously notified to the FREC/ School REC and given an unfavourable opinion?

- ☐ Yes
- ☑ No

Is this an amendment to a project which underwent NHS ethical review?

- ☐ Yes
- ☑ No

Is sponsor sign off required for the amendment?

- ☐ Yes
- ☑ No

If applicable, has the amendment been submitted for NHS management permission (R&D approval)?

- ☐ Yes
- ☑ No

Summary of changes

Briefly summarise the main changes proposed in this amendment using language comprehensible to a lay person. Explain the purpose of the changes and their significance for the study. In the case of a modified amendment, highlight the modifications that have been made.

If the amendment significantly alters the research design or methodology, or could otherwise affect the scientific value of the study, supporting scientific information should be given (or enclosed separately). Indicate whether or not additional scientific critique has been obtained.

This amendment does not alter anything in the original application, nor in the first amendment. This second amendment relates to a small addition in data collection methods - specifically, participant observation. I aim to observe participants in specific governance-related activities - primarily village council meetings. This is because this is where decisions are made about how to spend the money earned through the conservation performance payments (the focus of the research). I have already attended a couple of village council meetings (as a learning experience) and people were not obviously bothered by my presence.

Regarding consent, my plan is very briefly explain to the people present:
- who I am and what I'm doing
- that I am not associated with Lion Landscapes (the NGO operating the performance payment scheme)
- that I may use what they say in written work, and that this may be published
- but that anything they do or say will not be attributed to named individuals (Chatham House rule)

I will then ask for verbal consent (literacy rates are very low in the study area). I will not record this verbal consent because I think that this would be culturally inappropriate, and the obvious presence of an audio recording-device is, in my opinion, likely to influence subsequent behaviours at the meeting (i.e. reduce the reliability of the data). This approach has been approved by my local collaborators, who have significant experience in this area.

Any other relevant information

Applicants may indicate any specific ethical issues relating to the amendment, on which the opinion of the REC is sought.

n/a

High risk ethical issues, tick all that applies:

(to be completed by applicants who applied for 'light touch' ethical review only)

High risk ethical issues, tick all that applies:

(to be completed by applicants who applied for 'light touch' ethical review only)

- ☐ Does the study involve participants who are particularly vulnerable or unable to give informed consent (eg children, people with learning disabilities, your own students)?
- ☐ Will the study require the cooperation of a gatekeeper for initial access to groups or individuals who are taking part in the study (eg students at school, members of self-help groups, residents of a nursing home)?
- ☐ Will participants be taking part in the research without their knowledge and consent (eg covert observation of people in non-public places)?
- ☐ Will the study involve discussion of sensitive topics (eg sexual activity, drug use)?
- ☐ Are drugs, placebos or other substances (eg food substances, vitamins) going to be administered to the participants or will the study involve invasive, intrusive or potentially harmful procedures of any kind?
- ☐ Will blood or tissue samples be obtained from the participants?
- ☐ Is pain or more than mild discomfort likely to result from the study?
- ☐ Could the study induce psychological stress or anxiety or cause harm or have negative consequences beyond the risks encountered in normal life?
- ☐ Will the study involve prolonged or repetitive testing?
- ☐ Will financial inducements (other than reasonable expenses and compensation for time) be offered to participants?
- ☑ Will the study involve an international collaborator or research conducted overseas?
- ☑ Will the study involve the transfer of data outside the European Economic Area?
- ☐ Are there any potential conflicts of interest?
- ☐ Does the research involve any risks to the researchers themselves, or individuals not directly involved in the research?
- ☐ Will the study require ethical review from the NHS?

  (Refer to http://ris.leeds.ac.uk/NHSethicalreview for guidance in identifying circumstances which require NHS review)

- ☐ None of the above apply

List of enclosed documents

Documents

Type	Document Name	File Name	Version Date	Version	Size
Supplementary documents	Ethical Approval	Ethical Approval.pdf	07/10/2023	1	123.8 KB
Supplementary documents	Amendment success	Amendment success.pdf	07/10/2023	1	116.1 KB

Declaration

Declaration

- ☑ I confirm that the information in this form is accurate to the best of my knowledge and I take full responsibility for it.
- ☑ I consider that it would be reasonable for the proposed amendment to be implemented.

Applicant Signature

Signed: This form was signed by Joseph Hamm (ss20joeh@leeds.ac.uk) on 08/10/2023 11:16

Supervisor Signature

Signed: This form was signed by George Holmes (G.Holmes@leeds.ac.uk) on 09/10/2023 08:43

Dear Joseph Hamm

BESS+ FREC 2023-0157-933 – 2 08/10/2023 – Can performance payments deliver good carnivore conservation and conservation for good? A case study in Ruaha, Tanzania.

I am pleased to inform you that the above research ethics application amendment has been reviewed by the Business, Environment, Social Sciences BESS+ FREC Committee and I can confirm a favourable ethical opinion based on the documentation received at date of this email.

Please retain this email as evidence of approval in your study file.

Please notify the committee if you intend to make any further amendments to the research as submitted and approved to date. This includes recruitment methodology; all changes must receive ethical approval prior to implementation. Please see https://ris.leeds.ac.uk/research-ethics-and-integrity/applying-for-an-amendment/ or contact the Research Ethics & Governance Administrator for further information if required.

Ethics approval does not infer you have the right of access to any member of staff or student or documents and the premises of the University of Leeds. Nor does it imply any right of access to the premises of any other organisation, including clinical areas. The committee takes no responsibility for you gaining access to staff, students and/or premises prior to, during or following your research activities.

Please note: You are expected to keep a record of all your approved documentation, as well as documents such as sample consent forms, risk assessments and other documents relating to the study. This should be kept in your study file, which should be readily available for audit purposes. You will be given a two week notice period if your project is to be audited.

It is our policy to remind everyone that it is your responsibility to comply with Health and Safety, Data Protection and any other legal and/or professional guidelines there may be.

I hope the study continues to go well.

Best wishes

Ms Taylor Haworth, Research Ethics Administrator, Secretariat

On behalf of Dr Judith Hanks, Chair, BESS+ FREC

Appendix E

Verbal consent read-out

Read by Rose:

My name is Rose Mawenya, I'm with Joseph Hamm, a PhD student from England. You are being invited to answer some questions as part of a research project. This research is exploring the community camera-trapping scheme run by Lion Landscapes, to see if it could be improved. We are independent researchers - we are not from Lion Landscapes.

It is up to you to decide whether or not to take part. You can say no, without it affecting any benefits that you are entitled to in any way. You do not have to give a reason why. If you do agree to take part, it will take around 15 minutes and be recorded with a microphone. The information you provide will be stored securely and deleted two years after this research has finished. Your name will be deleted from our records, but other details such as your ethnicity, village, and approximate age will be kept, as this is needed for the research. This means that you could theoretically be identified from your responses.

If you agree to take part, you will be asked some questions. It is best if we do this where other people cannot overhear, however it is also fine if you would prefer a friend or relative sit with you, although they will not be asked any questions. You can choose to stop taking part, and to have your data deleted, up to [date of end of fieldwork].

You can find me at [research base location] if you have any future questions about this research. You will not be asked to participate again, and you will receive TZS 1000 phone voucher of a provider of your choice as thanks for your time, whether or not you choose to participate in the research. Would you like to participate in this research? If yes, is there somewhere other than here where you would feel more comfortable doing it?

NB: participants were asked an abridged version of the above at the end of the questionnaire/interview, to ensure ongoing consent.

Appendix F

Data Management Plan

Researcher Name	Joseph Hamm
Project Title	Can performance payments deliver good carnivore conservation and conservation for good? A case study in Ruaha, Tanzania.
Faculty	Environment
KRISTAL Reference Number (if applicable)	
Supervisor(s) name (if applicable)	Prof George Holmes & Prof Julia Martin-Ortega
Funder	ESRC
Scheme	White Rose DTP
Research Start Date	01/10/2021
Research End Date	31/03/2026
Ethical review number	Unknown
DMP review due	Unknown

Date	Version	Author	Change notes
20/09/2022	2	Joseph Hamm	n/a

Please provide a brief overview of your project including proposed research methods

Around 10% of the world's remaining wild lions live in Tanzania's Ruaha Landscape, but many are killed as a result of conflict with humans. This is because lions impose significant costs on those people they live alongside, such as killing livestock. An innovative project, developed by an NGO called Lion Landscapes, has attempted to address this problem by tying value to these carnivores. A payment scheme has been set up since 2015, whereby camera-traps are deployed on the land of participating villages. These cameras record images of animals when they walk past. In this scheme, the presence of lions results in tangible benefits for the village, including school meals, scholarships, and healthcare: in short, the more lions, the more benefits the village receives. This provides an incentive for local people to conserve large carnivores.

Working alongside Lion Landscapes, I will research how effective this scheme is, and whether it can be improved. I will also examine whether it is more effective at changing attitudes and behaviour towards some species than others, and also how equitable it is. The answers to these questions will inform future management of this and similar

schemes. I will be using questionnaires and semi-structured interviews to collect data with villagers living on the periphery of Ruaha National Park. I may also use relevant routinely collected ecological data from Lion Landscapes. Depending on the timing of the scheme's expansion to new villages, a before-after control-intervention (BACI) or simplified control-intervention (CI) study design will be used. This research is funded by the Economic and Social Research Council (ESRC).

1. What data will be produced? What data will be used from other sources?

Both qualitative and quantitative data will be collected, mostly concerning people's attitudes towards wildlife. This will be from interviews and questionnaire surveys. Other types of data, such as the number of snares discovered, may also be collected as part of Lion Landscapes' routine sampling.

2. Where will data be stored? How will data be structured? Include file formats and approximate volume.

Interview audio files: (.MP3). ~50, 1hr long interviews
Interview transcription and some questionnaire data: Microsoft Word (.docx). ~200 questionnaires.
Questionnaires (physical files), ~200
Questionnaire data, interview metadata, count data from Lion Landscapes: Microsoft excel (.xlsx)
Images (NB: not of people): (.png, .jpg). ~30 images.
Qualitative analysis files, in NVivo (.nvp) ~50.

Some data will be on physical files (i.e. questionnaire responses). Whilst there is no secure room at the study site, these documents will be secured in a lockable deed box to which only I and other members of the research team will have keys to. Additionally, some data (including the non-anonymised audio recordings of interviews) will be stored directly on a University laptop computer and not on the University's secure N: or M: or Cloud Drives due to intermittent internet access at the study site. The laptop will be password protected, and the folders containing personal data will be further password protected, and only accessible to me. Additionally, as laptops are a high value item, I will also keep encrypted data on a robust external hard-drive – again accessible only to me – so that I would retain the data should my laptop be stolen. When not at the field site, the University's Microsoft Office OneDrive will be used to store data. Any data transferred electronically (e.g. as a back-up) will be suitably encrypted.

3. Access to data during the project. Give details of collaborators and any controls.

Lion Landscapes, as collaborators, will be able to ask for access to this data (excluding the non-anonymised interview audio files). A memorandum of understanding is being drafted which outlines the conditions for such data sharing, and this will be adhered to. Only I will have direct access and data will be shared at my discretion. Consent for this data sharing will be obtained from all participants.

4. Ethics and legal compliance: are there any 'special' requirements for your data? Any contractual or consent issues? Key policies (internal and external)

1) An MoU is being drafted regarding the details of data sharing between myself and Lion Landscapes. The University legal team will be involved in this.
2) Discussion of a sensitive topic (in Tanzania the killing of lions is only legal under circumstances such as threat to life or livestock. Discussion of past carnivore-killing behaviours may therefore implicate the interviewee or others).

I will not ask direct questions about past carnivore-killing behaviour. Should such information arise naturally (unprompted), that data will be redacted from the transcript (signified by …[redacted]…), so as to remove any potentially incriminating evidence. This is because the transcripts will still contain some secondary identifying data such as age range, ethnicity, village that are necessary for the research. Any such information redacted from the transcripts will be stored as a separate document with no other data (i.e. fully anonymised) and used only as anecdotal evidence (direct quotations will not be used). Therefore, no participant could be incriminated should the relevant government body (the Tanzania Wildlife Research Institute) requisition my data. I will instead assess attitudes towards carnivore killing by asking questions of hypothetical future behaviour (e.g. "I would kill the next lion that attacks my livestock" etc.), and of others' perceived behaviours (e.g. "I believe others in my village would kill a lion if it attacked their livestock"). This approach is being used by other researchers in the study site and has received previous research permit clearance from the Tanzania Wildlife Research Institute.

Transcripts will have all direct identifiers removed, although some indirect identifiers will remain due to inclusion in analysis. Only I will have access to the recorded (non-anonymised) recordings of the interviews, and these will be deleted at the date given as the latest opportunity to stop participating in the research (likely to be the predicted end of fieldwork).

5. How will data be documented and described? Methodologies and protocols.

Files will be named systematically, using clear distinctions and folders. File versions will be named and updated accordingly. Tables, spreadsheet headings, and metadata will be clearly and consistently described.
6. Training and support I attended the 'Data Management' online workshop offered by the library. Any further advice will be sought from the Research Data Leeds team.
7. What are the plans for data sharing beyond project partners? Include justification if some of your data needs to be restricted. Include data and code. Include repository. I will deposit project data (excl. non-anonymised audio files) in the UK Data Service ReShare Repository, as requested by the ESRC. It will be classified at the 'controlled' data level. Anonymity will be maintained to the extent that all data shared in such repositories will have had direct identifying characteristics removed, and some indirect characteristics needed for analysis will be included only at resolutions which impede any possible identification of participants. Informed consent regarding this limitation will have been obtained from all respondents.
8. What Intellectual Property will be generated? How will IP be protected and exploited? None
9. Who is responsible for managing the data? What resources will you need? I (Joseph Hamm) am the PhD student and lead for this project; I will need continued access to the University's IT and cloud-based storage systems.
10. Ongoing data curation / data housekeeping - you may find it useful to include a retention table Data will be continually cleaned, backed-up, and have associated metadata curated.

End of Project

At the end of a project and/or before you leave the institution, you should ensure that data and research materials are deposited with the School or a trusted data repository and documented in such a way that they can be found and understood.

Dataset name	Location	Person responsible
Anonymised questionnaire data	UK Data Service ReShare Repository	Joseph Hamm

Appendix G

Supplemental Information for Chapter Three

Because we took an explorative and adaptive approach to interviews (in order to identify those issues believed by participants to be important), the exact questions asked of each interviewee varied. The questions listed here were therefore not necessarily asked of all interviewees, nor were they necessarily asked in this order. We have grouped them here for ease of comprehension.

General

- What is the goal of the scheme?
- What is your role?
- When did it start?
- Is it still running? If not, when and why did it end?
- Is it operated by government/NGO/joint?
- Are any areas the CPP is operating under any protected status? Adjacent to any?
- Did covid affect the CPP?

Scheme design:

- What species are included? Why?
- What large carnivores are in your work area?
- How many participants are there in the scheme? How many participating 'units'?
- Has the design of the scheme altered since its inception? If so, how?
- Are agreements/contracts formally signed (and if so, by who, and why?)

Payments:

- How do payments relate to carnivore presence? (i.e. is it a continuous/relative/threshold/other payment system?). Why?
- Is there a cap?
- To whom are the incentives distributed?
- What are the payment amounts?
- In your opinion, how do these payments relate to the local costs of carnivore presence?
- What is the frequency of payments?
- How are land rights between participating units delineated?
- How are the incentives chosen? By whom? Why?
- Why cash/not cash?
- Are there any limitations on type of expenditure?
- Are there any input requirements to be eligible for the scheme?
- Is there any input conditionality (incl. bonuses and/or fines)?

Monitoring:

- How is carnivore presence monitored (i.e. through camera traps/telemetry/tracks/other?)
    - If camera traps: what qualifies as an independent event, and are there any limitations on where they can be placed (e.g. close to boundary with other participating units, or close to human-made water holes etc.)?
- Do you share the monitoring data with participants, and if so, in what form?

Behaviour change:

- Whose behaviour is the CPP trying to influence (is there any demographic in particular)?
- How are the incentives theorised to change behaviour (i.e. directly through increased perception of benefits or indirectly via changing social norms, etc.)?
    - Do you have any evidence for this?
- Are you monitoring the effect (if any) of the CPP on attitudes or behaviour? How?
- Can you ascribe any changes in behaviour (not just attitudes) to the CPP itself?
- Did/do you do any type of monitoring and evaluation?
- Are you monitoring carnivore population sizes or carnivore mortality events?

Funding:

- How is the CPP funded?
- How long is it planned to last?
- What will happen to payments in the case of an increased carnivore population? Erode, or stay the same? What about in the case of a reduced population?
- Is there any local external contribution of funds (e.g. from tourism operators), or plans for this?

Privacy/ethical issues:

- How do you ensure ongoing consent?
- How often, if ever, do you get images of people on camera traps? Are some demographics pictured more often than others?
    - What's the procedure to deal with this data? Do participants know this?
- Do you ever capture evidence of illegal activities?
    - What's the procedure to deal with this data? Do participants know this?
    - Has any government body ever asked for these images?
- Do people ever attempt to hide their identity (e.g. by covering their face)? Do you think people change their behaviour to avoid the cameras? How?
- Are the camera traps on communal/private/public land?
- Are camera-traps marked with its purpose, organisation name, and contact details?
- Have any camera traps been destroyed/stolen? If so, what do you think the motivation might be?
    - Are there any consequences when this happens?

Miscellaneous:

- Is there any evidence (or fear) of a tipping point of social tolerance (i.e. maximum wildlife acceptance capacity)?
- Has it changed the behaviour of the carnivores in any way? (e.g. spending more time closer to human settlements)?
- Are there any issues with 'problem' individual animals?
- Is there any 'magnet effect' – where people move to the area thinking they can be part of the scheme and gain some money?
- Who benefits most from the scheme (demographic or otherwise)? Who benefits least?
- Is there any risk (or evidence) of unintended consequences (e.g. through the valuation or lack thereof of species, or through making the presence/abundance of certain species known that may be targeted for illegal killing)?

Concluding questions:

- Do you think the scheme is equitable? Why/why not?
- What are the greatest challenges associated with running the CPP?
- What are the greatest successes with running the CPP?
- Is there anything else you would like to tell me about the CPP?