

The utility of a psychological approach to human behaviour in applied conservation practice

“Men at some time are masters of their fates” – Cassius

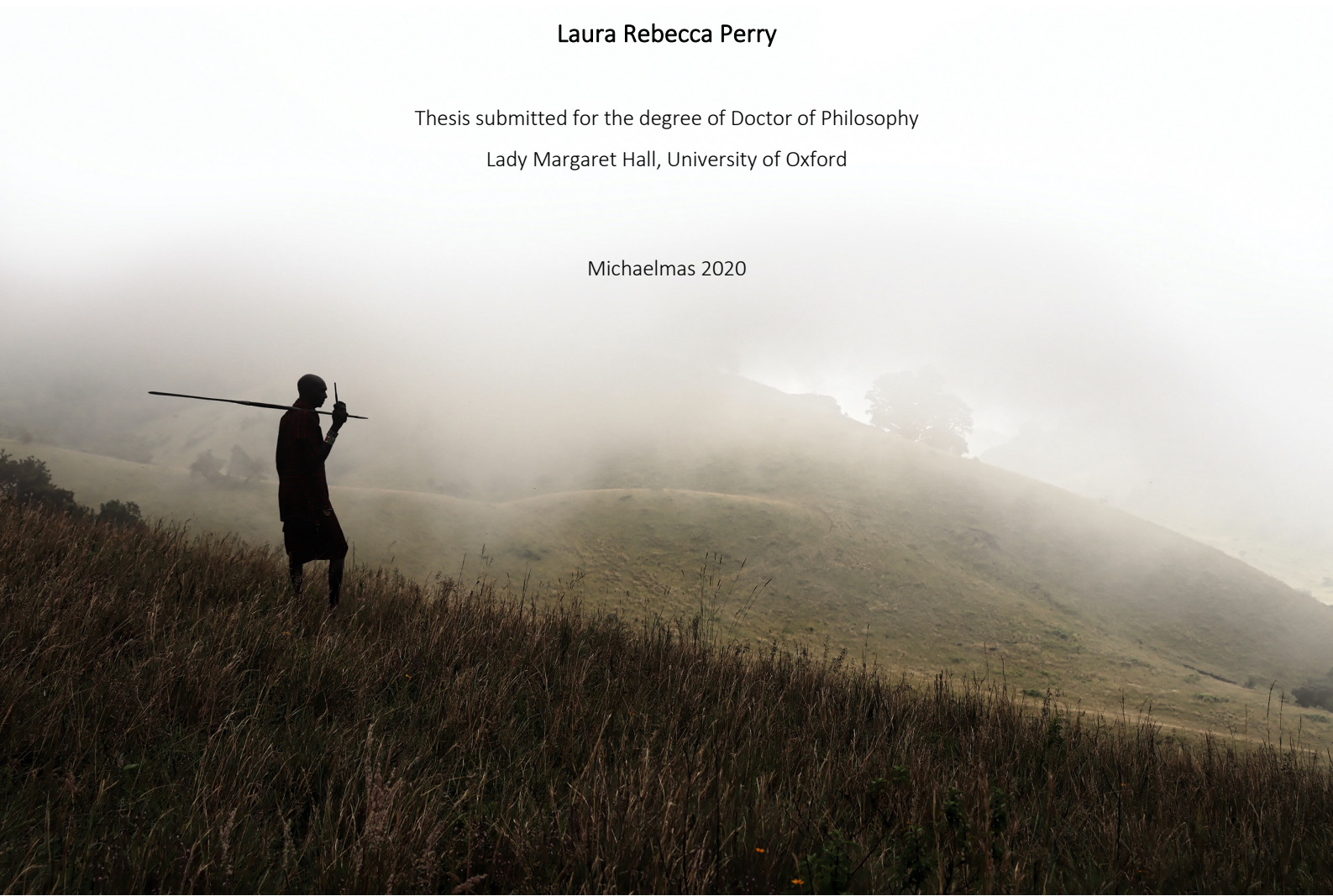
*Julius Caesar*, William Shakespeare

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## Thesis Abstract

With increasing awareness of the scope for social science techniques to be tools for delivering conservation impact, it is timely that conservation psychology be developed as an applied discipline.

In seeking to understand why people behave in the ways that they do, tools and techniques from applied psychology can be used to encourage pro-conservation behaviour, and emphasising these practical outputs is key to the urgently needed wider uptake of this currently fringe discipline. At present, few studies within the field of conservation research adopt social psychology frameworks and apply them to *in situ* conservation problems. This is a damaging omission: as a discipline which revolves around the many undesirable outcomes of human behaviour, conservation would do well to capitalise upon these approaches. Currently, good, clear examples of the application of social psychology frameworks to conservation problems, to serve as guides or blueprints for developing the subject, are rare. The aim of this thesis is to use select concepts which have been shown to effectively articulate the reasons behind human behaviour, and apply them to conservation problems in eastern and southern Africa. Focussing on livestock management, predation, and land management issues, I use a social psychology framework to explore the reasons underlying certain conservation-relevant behaviours, and identify how these behaviours might be influenced to achieve conservation ends.

I show that a simple theory of planned behaviour framework can explain variation in livestock management behaviour across a socially and ecologically diverse landscape in southern Kenya. I also show that attitudes and social norms, independently, have significant impacts on peoples' behaviour. Furthering this line of enquiry, I demonstrate that the structure of social norms regarding predators and livestock predation are consistent between Kenya and Zimbabwe. Intervention tools using social norms may therefore be applied in a variety of contexts with minimal adaptation, and are consequently suitable for non-expert use. In a final social-norm focussed study in Kenya, I use a quasi-experimental approach to illustrate how norms can be influenced using relatively simple priming techniques, and that these manipulations impact behavioural intention. Together these results

demonstrate that social norms are 1) impactful on behaviour, 2) highly conserved, and therefore common approaches can be used across a wide area, and 3) flexible, and can be influenced with relatively basic interventions. I conclude that social norms may provide an easy target for behavioural conservation interventions, and practitioners should consider whether social norms can be used to guide the behaviour of human populations in a range of conservation conflicts. I also examine the sub-structure of attitudes, and conclude that straightforward approaches can be used to break down the 'attitudes' concept into meaningful sub-units; when designing interventions, practitioners may wish to target these sub-components to increase intervention efficacy. Together, this thesis demonstrates that conservation psychology can be a highly applied discipline, and it is only through lack of use by conservation scientists that its many offerings have, until now, been little known in applied conservation practice (although fully recognised in other disciplines such as education and human healthcare). Although this thesis is a brief glimpse into the various useful approaches to behaviour change which may emerge from correct application of social psychology techniques, I hope that my results will encourage future researchers and practitioners that this is an exciting, emerging field which will richly reward far greater emphasis in the sphere of wildlife conservation.

### **Acknowledgements**

It is clichéd but nevertheless true to say that WildCRU has been, to me, like a family. I have been bothering you all since before I knew what RDH – or, indeed, R – was, and have been treated with kindness and encouragement; I hope to continue bothering you for the foreseeable future.

Thank you to my supervisors, who have given me the freedom to do an 'old school' PhD, and learn through exploration, vague deadlines, and complete trust. That I have written a thesis without once hating it is testament to the support, guidance, and academic liberty you have given me throughout.

To David, I feel unusually lucky to have met my hero and not been disappointed.

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## Introduction

As Hamlet rightly summarised, “there is nothing either good or bad, but thinking makes it so” (Shakespeare 1603), and by viewing human-wildlife conflict through this psychological lens, useful insights may emerge. The conservation literature has numerous examples of conflicts which, although between similar actors or under similar circumstances, have very different outcomes (see e.g. Kansky et al. 2016). Tolerance for elephant crop-raiding around Kibale National Park, Uganda, for example, is higher amongst less affluent farmers, and lower in group meeting setups than in other discussion environments (Naughton-Treves & Treves 2005). Yet the differences in individual and group psychology that may substantially explain these outcomes are seldom the focus of applied conservation research.

Traditionally, most conservation biologists have gone into the discipline not because they loved people, but because they loved wildlife, and this predilection for wildlife-centric studies is not only understandable, but has generated the wealth of information available to conservation scientists today. A Google Scholar search returns over 24,000 entries for ‘human-wildlife conflict’, and this rich ecosystem of studies from different locations, taxonomic groups, and socio-economic perspectives provides an invaluable resource to today’s conservation biologists. Perhaps even more importantly, it also highlights areas where knowledge is conspicuously thinner: fewer than 500 results are returned for a search using conservation psychology keywords.

As a relatively young discipline, with the first real ‘conservation psychology’ research emerging in the late 1990s and early 2000s, it may not always be obvious where psychology can add value to conservation work (Saunders 2003). And, indeed, whilst other fields have numerous examples of successful psychology-based interventions (Conner 1998; Perkins & Craig 2006; Silk et al. 2017), the relative sparsity of such studies in conservation does little to demonstrate the huge potential value of psychology to conservation at large. Over the past 30 years, it has generally become accepted in

conservation circles that the social sciences are not only important, but that good, long-term conservation successes cannot be achieved without them (Bennett et al. 2017). However, there remains a shortage of social science specialists working in conservation (*ibid.*), and topics from economics to anthropology are less central to the conservation dialogue than they should be (Bennett et al. 2017). This social science shortfall is particularly acute with regard to psychology, especially given that other social science results may fail to realise their full potential if they are not viewed through the lens of human behaviour and psychology (Selinske 2018). For example, the economics of livestock predation is only meaningful when considered alongside risk aversion (Loch-Temzelides 2020) and the non-market attributes of stock (Ouma et al. 2003); recognising the contribution that psychology makes to these discussions is critical if conservation science is to fully understand the relationship between human behaviour and conservation outcomes.

Numerous authors have pointed out the centrality of human psychology to the discipline of conservation – indeed, the human origin of conservation problems is almost tautological (St John et al. 2013). But while a growing body of text highlights this shortfall (e.g. Bennett et al. 2017; Teel et al. 2018), theoretically-grounded research has been slow to fill the gaps. Further, although some aspects of psychology are increasingly popular in the literature (e.g. attitude), it is critical to their successful use that they are defined clearly and in conjunction with the relevant theoretical background (Browne-Núñez & Jonker 2008). Misapplied frameworks can be dangerous, and data may be fundamentally invalid if researchers’ understanding or application of techniques is lacking. Indeed, incorrect conclusions can have substantial impact on people’s lives (Browne-Núñez & Jonker 2008), so it is critical that individuals with relevant expertise be involved in the development of the field.

Well-designed social interventions can result in huge change in relatively short periods of time (Perkins & Berkowitz 1986; Linkenbach & Perkins 2003). Nowhere is this more apparent than healthcare, where, for example, campaigns using social norms to promote condom use have been

shown to be effective by systematic literature reviews (Wang et al. 2011). Indeed, writing during the 2020 pandemic, one only has to go outside to see that mask wearing and social distancing behaviours have, within a very short space of time, become socially mandated (Van Bavel et al. 2020; van der Westhuizen et al. 2020). Behavioural, psychology-derived interventions can be hugely successful (Linkenbach & Perkins 2003; Perkins & Craig 2006), and have great potential application to conservation problems. With increased research into the practical application of psychology to conservation problems, this emerging discipline may be able to effect lasting human behavioural changes across a variety of conservation conflicts, with benefits to both people and wildlife alike.

## A Review of Conservation Psychology

Psychology is a discipline, and much as I would not expect to cover topics from epigenetics to island biogeography in one thesis, this work can necessarily barely scratch the surface of what psychology has to offer conservation science. At present, however, conservation psychology is a very young discipline, and revolves around relatively few core ideas – and even fewer research studies. An English language literature search using Scopus and Web of Science for the Boolean terms conservation AND psychology; psychology AND wildlife, and psych\* AND wild\* AND conservation between 1990 and 2020 returns the relatively small number of 2,572 results. When refined by title to studies which explicitly deal with conservation psychology<sup>1</sup>, only 462 remain. Of these, most fail to specify a link to a given psychology or wildlife conservation issue, and only 128 studies over this period adequately meet all search criteria. This search is likely to represent a small proportion of the existing literature

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<sup>1</sup> The following titles were removed from the results database:

- a. Titles relating to explicitly non-relevant fields, e.g. engineering, medicine (1,565);
- b. Titles on ecology or biology, with no reference to psychology OR psychological factors (n = 274);
- c. Titles on pure psychology and psychiatry, including the effect of 'nature' on mental health (n = 39);
- d. Titles on environmental, rather than *wildlife* conservation, e.g. water, sustainability (n = 165);
- e. Studies related to zoos or captive wildlife (n = 16);
- f. Studies related to ecotourism, or tourist preference (n = 13);
- g. Studies related to urban planning or the impact of green spaces (n = 34);
- h. Non-English language studies (n = 4).

on the application of psychological approaches to conservation challenges, but the lack of consensus over searchable keywords is illustrative of the infancy of the field. Of the 128 studies, approximately 50 explicitly mention a focus on attitudes; a further 20 discuss theories about the predictors of behaviour (e.g. theory of reasoned action, theory of planned behaviour); and the remainder focus on aspects of belief, values, message framing, social norms, and general drivers of behaviour or perceptions. This demonstrates how few different frameworks have been applied to conservation problems, and that even these frameworks have been studied in relatively few contexts. Below I discuss these core psychological frameworks and the theories which have previously been applied to conservation problems.

### *Theory of Planned Behaviour/Theory of Reasoned Action*

The theory of planned behaviour (TPB) and theory of reasoned action (TRA) both attempt to predict an individual's tendency to perform a given behaviour in a specific context (Kan & Fabrigar 2017). The slightly older of the two frameworks, the theory of reasoned action contains terms for attitudes,

subjective norms, and behavioural intentions (see below for details), and assumes that people are (generally) rational beings, who have control over their behaviour (Fishbein 1979). In practice, this assumption seldom holds true: the disconnect between intended behaviour and actual behaviour is often large, and an unmodified form of the TRA often has relatively low predictive power (Sheppard et al.

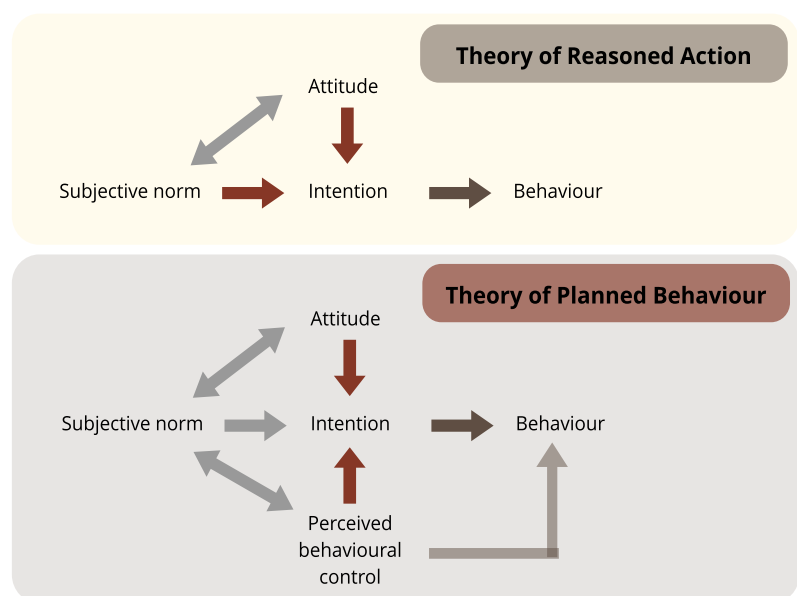


Figure 1: The Theory of Reasoned Action (Fishbein & Ajzen 1977) and Theory of Planned Behaviour (Ajzen 1985) are very similar, with the only modification the addition of perceived behavioural control to the latter. The models include subjective norms, which are norms as dictated by friends and family members, however generally the TBP and TRA are now often used with broader-sense social norms.

1988). The original authors were quick to recognise these limitations, and developed a revised version of the TRA framework, now called the ‘theory of planned behaviour’, which contains a term for perceived behavioural control (see Figure 1, Ajzen 1985). The addition of perceived behavioural control, i.e. how much an individual feels their behaviour is something they have agency over, was critical in improving the predictive power of the framework, and today the theory of planned behaviour is one of the most widely-applied models of human behaviour, in disciplines from public health to education and conservation (Kan & Fabrigar 2017).

The TPB has been applied across varied contexts, and meta-analyses have provided strong empirical support for the theory (Godin & Kok 1996; Armitage 2001; McEachan et al. 2011). In healthcare, for example, the ability to predict and explain health-related behaviours is of substantial importance in increasing or maintaining public health and wellbeing, and increasing the efficacy of particular initiatives. The TPB is perhaps the most widely applied model of behaviour in this field, and benefits from clear, distinct predictors of behaviour, and the ability to target and measure these predictors (Armitage & Conner 2001). Overall, individual studies have found a predictive power of between 40-49 % in intention, or 26-36 % in behavioural variation (Armitage & Conner 2001) on application of the TPB to topics as diverse as smoking, mammogram screening, and exercise (Godin & Kok 1996).

One key criticism of both the TRA and TPB is that they can only be applied to relatively deliberate behaviour: most behaviours are not the result of rational thought – indeed, many of our choices are ‘made’ before we have time to cognitively process the choice (Keim 2008), and neither the TRA nor the TBP can account for these instinctive reactions. The second key criticism of these frameworks is that both fail to adequately articulate all the major determinants of intention (Conner 1998). Indeed, only attitude and norms are truly considered as separate preludes to behavioural intention, and many authors suggest that additional factors, e.g. self-identity, may be additional important predictors (Kan & Fabrigar 2017). Other research shows that behaviours themselves may be a major predictor of

future behaviour, and these models don't account for past performance (Sheeran et al. 1999).

Regardless, of all the psychological frameworks used to describe behaviour, the TPB is doubtless the most commonly applied (Davis et al. 2015). It has a wealth of empirical evidence to support its use and, although it may not be a perfect characterisation of all the processes which determine behaviour, it has been shown to be a practical, useful model (Armitage & Conner 2001). Insofar as it has discrete, readily comprehensible components which can be empirically measured, and an impressive track record in other human behavioural disciplines, the TPB has much to offer conservation and, indeed, has already been used in a variety of conservation contexts (e.g. (Beedell & Rehman 1999; Macdonald et al. 2010; St John et al. 2011; St. John et al. 2018), see below).

One example of the application of the TPB to a conservation problem is its use by St John et al (2018) to understand men's intention to hunt in a protected area critical for Sumatran tiger conservation. By using the randomised response technique (which gives surveyors a sense of what proportion of individuals have engaged in an illegal activity, without the individuals having to actually admit to their behaviour), the authors explored hunting frequency and willingness to hunt alongside other social factors to understand which of these explained behaviour. The authors found that affect, social norms, and behavioural intention were all important in determining behaviour, but that intention was the strongest predictor. Although this study did not implement any subsequent behaviour change intervention, it demonstrates how easily these frameworks can be used to understand conservation conflicts, and in turn recommend solutions.

### *Social Norms*

A key component of both the TRA and TPB, social norms have huge influence on how we all behave. Most simply defined as the socially approved rules which govern a particular behaviour, norms reflect a group's perception of the appropriateness of that behaviour (Cialdini & Trost 1998). As group-living animals with high levels of dependency on other group members, norms underpin many forms of

human social and economic order (Hume 1739), and evidence suggests humans may have an inherited propensity to learn social norms (Ostrom 2000). Norms are coordinated between individuals (e.g. the meaning of words), enforced at a group level through social pressure (e.g. mask wearing), on some level involve a direct or indirect signal (i.e. observable actions or markers e.g. gang tattoos), and often use benchmarks or reference points to inform decisions (e.g. 5pm as an acceptable drinking time) (Young 2015).

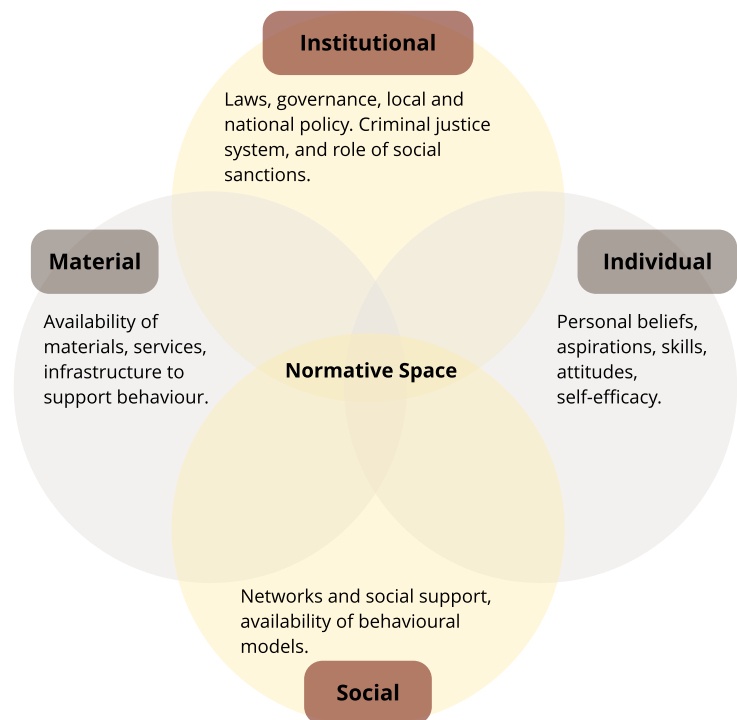


Figure 2: Conditions for social norms influence and the interaction between norms and other social properties. Redrawn from (Cislaghi & Heise 2018).

The earliest work using social norms as the basis for behavioural interventions was carried out in the US in the 1980s, and targeted excess alcohol consumption amongst undergraduate students (Perkins & Berkowitz 1986). By correcting students' overestimation of the amount of alcohol consumed by others, the intervention lowered average alcohol consumption amongst the target groups. This approach has since been replicated around the world, in relation to alcohol, drugs, and tobacco (Arbour-Nicitopoulos et al. 2010), and sexual violence (Cislaghi & Heise 2018). In the late 90s, the field was expanded to include other health outcomes, with some evidence that interventions that included social norms were a crucial component in reducing the prevalence of female genital mutilation in West Africa (Vaitla et al. 2017) and early marriage (Mackie 1996). Norms interact with a variety of social, economic, and practical contextual factors, and the end result of any social norms campaign will be the sum of these interactions; numerous studies have shown that effective interventions can

use norms as part of a composite intervention design, and thereby and encourage desirable behaviour changes (see Figure 2).

Social norms govern behaviour from adolescent smoking behaviour (Eisenberg & Forster 2003) to political corruption (Baez-Camargo & Passas 2017), and are thought to have a substantial impact on many conservation-related behaviours. In environmental sciences, social norms have been widely applied to attempt to rectify detrimental behaviours from towel (over-) use in hotels (Goldstein et al. 2008) to electricity consumption at home (Horne & Kennedy 2017). Indeed, in surveys of beach use in New York (which has the potential to affect ground-nesting birds), a simple 10-minute survey was sufficient to elevate people's perception of the average frequency of pro-conservation behaviours (such as keeping away from bird habitat, removing rubbish), i.e. it invoked stronger social norms (Mengak et al. 2019). This result demonstrates how easily conservation-related social norms can be influenced, and it remains for researchers to capitalise on this behavioural flexibility to achieve conservation outcomes as they have done in public healthcare.

### *Attitudes and Perceptions*

Although they have been defined – and used – in a variety of different, sometimes inappropriate ways (Browne-Núñez & Jonker 2008), attitudes are a relatively simple concept: an attitude is the sum of an individual's thoughts, feelings, and beliefs about an attitude object (Breckler 1984). The sub-components of an overall attitude include cognitive beliefs, for example, that trees produce oxygen, and sentimental or 'affective' emotional reactions, such as a fondness for Cadbury's dairy milk chocolate. Unlike many social science terms, the word 'attitude' has its roots in antiquity (Fleming 1967), but in its more modern sense, 'attitude' entered the lexicon in the 1920s as the field of social psychology began to expand (Fleck 2015). In its early use the term was applied to general internal reasoning, but a modern definition says that attitudes are, in essence, evaluative judgements, which can be based on the opinions of those around you (often parents or family figures, and 'heritability' of

attitudes can be high (Olson et al. 2001)), or your own experience of a given subject (De Houwer et al. 2001). One might like flying because of previous, happy experiences in planes, or because those around you have always maintained a positive attitude towards air travel. Attitude strength also varies hugely: one might like porridge, but *love* mangoes, and the stronger an attitude is, the more cognitively accessible it is – it comes to mind easily, quickly, and without any new evaluative information being processed (Fazio 1990). Generally, in-person experiences result in stronger attitudes, either positive or negative (Fazio et al. 1983).

A classic, commonly used model of attitudes is the ABC model (Jain 2014), which says that overall attitudes are informed by affect (emotional response to an attitude object), behavioural, and cognitive components (Breckler 1984; Millar & Tesser 1989). Each of these combines to generate an overall attitude, and this attitude is typically stronger when the affect, behaviour, and cognitive components all align (Thompson et al. 1995). So if you *like* carrying out environmentally responsible behaviour, e.g. recycling, *know* that it is a good thing to do, and *have previously* carried out these behaviours, your strength of attitude towards recycling is likely to be stronger than that of someone for whom only a subset of the attitude components agree (Thompson et al. 1995).

In conservation, attitude studies are common, but many are poorly executed (Browne-Nuñez & Jonker 2008). Typically, attitude studies may ask people in a human-wildlife conflict situation a series of questions about what they think or feel about a problem, but with no theoretical rationale for the questions, or social-psychology driven underpinning for the interview structure, many of these surveys are fundamentally flawed (Browne-Nuñez & Jonker 2008). However, that is not to say that the attitude concept is never useful in conservation: some authors demonstrate how a well-executed attitude study can lead to important conservation results. For example, Ballouard et al (2012) were able to demonstrate an increase in positive affect towards snakes in schoolchildren as a result of a simple experiential education initiative (Ballouard et al. 2012). Other authors have shown that simple

changes in message framing can result in distinct differences in attitudes towards wildlife conservation in the context of wolf reintroductions (Wilson & Bruskotter 2009). Although the links between attitudes and behaviour can be inconsistent (Godin et al. 2005), there is nevertheless merit in understanding the factors that contribute to overall attitudes, and the conditions under which attitudes can be used to further conservation goals.

Although social psychology is a discipline of considerable scope, relatively few of its applications have, so far, been used in conservation psychology (Saunders 2003). This is not a surprise: it will take time for a substantial body of conservation psychology literature to develop (*ibid.*). Over the past 10 years, social science has become integral to good conservation practice and, although not every tool or technique from the disciplines of healthcare, sociology, education or economics, for example, are appropriate, many are (Bennett et al. 2017). As a very young discipline, conservation psychology needs to prove that it can and does provide practicable solutions to conservation problems. Although the above theoretical foci are only a few of the possible lenses through which to approach conservation psychology studies, they have been amongst the first frameworks applied to conservation problems. Indeed, these frameworks are amongst the most 'proven' approaches for changing public behaviour, and their applicability to conservation should be further investigated.

### **Conservation Psychology and Human-Predator Conflict in East and Southern Africa**

Although all conflict between people and wildlife is, of course, a problem, human-predator conflict can be one of the fiercest sources of animosity between wildlife advocates and local people (Inskip & Zimmermann 2009; Pooley et al. 2017). Indeed, the conflict between people and predators can be a threat not only to livelihoods (Kaswamila et al. 2007; Hampson et al. 2015; Pozo et al. 2020), but also to life (Löe & Röskafth 2004). As many authors have pointed out, human-wildlife conflict is in many senses better thought of as human-human conflict, with different groups of people identifying

different priorities: wildlife advocates, who prioritise the conservation of individuals, populations, or species, and local people or their representatives, who argue that the rights and needs of local people outweigh those of wild animals (Peterson et al. 2010; Redpath et al. 2015). In human-predator conflict, the two main sources of disagreement are threats to livestock, and threats to people themselves. These themes emerge around the world (Inskip & Zimmermann 2009), but are particularly fraught in sub-Saharan Africa (Lamarque et al. 2009).

Africa has more remaining species of large-bodied mammal than any other equivalent geographical region, perhaps because as the place of our evolutionary birth, large African wildlife has evolved to live alongside people (Sandom et al. 2014). However, with ever increasing human populations, wildlife here – as everywhere – is coming into increasing contact, and therefore conflict, with people. Although countries in West and Central Africa hold populations of large-bodied predators, these regions are socially and culturally distinct from East and southern Africa (Bauer et al. 2020), and this thesis is primarily concerned with the latter region<sup>2</sup>.

In eastern and southern Africa (henceforth ESA), populations of large-bodied predators including lions (*Panthera leo*), leopards (*Panthera pardus*), spotted hyaena (*Crocuta crocuta*), cheetah (*Acinonyx jubatus*) and African wild dog (*Lycaon pictus*) remain resident in many areas (Bauer et al. 2015; Durant et al. 2015; Böhm & Höner 2016; Stein et al. 2016; Woodroffe & Sillero-Zubiri 2020). Although some populations are stable or increasing (notably lions in southern Africa (Bauer et al. 2015)), in many regions, and for many large-bodied predator species, populations are under increasing pressure (Ray et al. 2005; Karanth & Chellam 2009). Although this pressure is the result of a combination of factors, two of the key issues for many predator populations are the loss of natural habitat, and the resulting

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<sup>2</sup> This was a choice born out of practicality, rather than scientific justification: I have more personal knowledge and experience of the region, and therefore judged that it would be more efficient to capitalise on this, rather than starting afresh in West Africa.

increased proximity of predators to human populations. All large African predators are known to predate livestock, and retaliatory (or pre-emptive) killing by local livestock producers is a threat to many predator populations (Ikanda & Packer 2008; Hazzah et al. 2014; Loveridge et al. 2017b). If livestock predation can lead to significant mortality for predators, it can also be a source of significant hardship for livestock owners (Holmern et al. 2007; Koziarski et al. 2016). Across ESA, there is a long history of livestock production, and ethnic groups such as the Maasai, who have kept cattle since they moved down from Ethiopia (Hampson et al. 2015), or the Ndebele, who are historically renowned as cattle rustlers and producers (Mabhena 2014), are highly reliant upon their herds for meat, animal-derived products such as milk, and today as a source of income (Hampson et al. 2015). Cows are typically the most valuable species of livestock, but sheep and goats (often kept in mixed flocks of 'shoats') are also common (Quinlan et al. 2016). As in much of the developing world, small stock e.g. chickens are ubiquitous, and although substantial conflict occurs over poultry predation, it is not the focus of this thesis, which instead concentrates on large-bodied mammalian predators, which can be thought of as those which might pose a realistic threat to human life.

Conflict between people and predators can be intense: in the Hwange area, Loveridge et al recorded over 1,500 separate predator attacks on livestock over a five year period (Loveridge et al. 2017a), and found that 67 % of female lion mortality in the region was anthropogenic (Loveridge et al. 2017b). In the Tarangire-Mara ecosystem of northern Tanzania, 68 % of highland and 79 % of lowland residents reported conflict with large carnivores (Koziarski et al. 2016), and in the neighbouring Serengeti region, 27.4 % of households reported livestock losses, with the total cost of these losses equivalent to 19.2 % of their annual cash income (Holmern et al. 2007). Human-predator conflict is thought to be severe across many regions of ESA where large predator populations remain, and is a key driver of large carnivore declines both globally (Woodroffe et al. 2005) and locally, particularly for lion (Frank et al. 2006; Ikanda & Packer 2008), African wild dog, and cheetah (Woodroffe & Ginsberg 1999; Marker & Dickman 2004; Ray et al. 2005). A variety of solutions have been proposed to reduce livestock

predation, and thereby reduce conflict. Some of the most effective examples include the use of livestock guarding dogs to prevent diurnal predation, particularly by cheetah (Potgieter et al. 2016). Reinforced bomas (overnight livestock shelters) have been highly successful in reducing nocturnal predation by lions and hyaena, whether they are fortified with man-made (Mkonyi et al. 2017; Sutton et al. 2017) or natural (Lichtenfeld et al. 2015) materials. Intensive conflict-response programmes are also highly effective at chasing predators away from livestock and reducing the likelihood of predation (Hazzah et al. 2014; Petracca et al. 2019), as are livestock herder training programmes, which aim to increase the skill level of herders, who are then better able to implement high standards of herd care, and reduce the risk of predation (Ogada et al. 2003).

Despite the smörgåsbord of mitigation and conflict reduction options available to conservation programmes, conflict levels very often remain high: local people may fail to appreciate the advantages of a certain approach, and conservation practitioners can be deaf to the constraints, whether practical, social, or cultural, that prevent a high level of local uptake for any given 'solution'. The continuing prevalence of human-predator conflict across ESA suggests that a different approach is needed. Indeed, where interventions have been highly successful, they have typically been designed with full awareness and attention paid to the social and cultural aspects of the suggested programme. One good example is the Lion Guardians programme in southern Kenya's Maasailand, which employs young people who would otherwise be involved in cultural lion killing, and trains them to monitor lions and engage their communities in conservation. The programme employs both experienced community members with social status, and younger men, who benefit from association with older lion hunters and from their employment status. In Maasai culture, to cause difficulties for another community member is socially prohibited, and as the employment of Lion Guardians is contingent on continued lion presence, to carry out lion killings contravenes traditional social mores (Hazzah et al. 2014). This programme is an example of how a little social and cultural knowledge can

go a long way in designing conservation interventions, and it is imperative that conservation practitioners begin to adopt this approach across the board.

For real, meaningful conservation impact, conflict reduction schemes must fully incorporate local people's needs, desires, and concerns (Madden 2004; White & Ward 2011). Using tools from social psychology to understand the psychological landscape of any given conflict is perhaps the simplest way that these social factors can be a) fully integrated into planning and b) scientifically evidenced, so that future projects can understand the value and importance of particular methodologies. In my thesis, I aim to provide the first steps in outlining how such an approach might be undertaken. I explore how different components of psychology can have different impacts on conflict mitigation, and suggest some preliminary mechanisms or topics for consideration which may increase the efficacy of conservation interventions, with a view to reducing livestock loss and human-predator conflict across the region.

### **Thesis Objectives and Structure**

Applied conservation psychology studies are rare, and ones which are easily interpretable by practitioners may be rarer still. The aim of this thesis was to examine which psychological constructs had substantial impacts on behaviour (paper 1), and develop this information to allow subsequent design of behavioural interventions. To be useful, the focus of any such intervention must be generalisable across large areas, and easily influenced (assumptions which were tested by papers 2 and 3 respectively). Although the international effects of COVID-19 prohibited the planned synthesis of these previous studies, I instead examined the conditions under which a second key construct – attitude – can meaningfully inform conservation practice (paper 4).

This research is designed to be practical. My aim has always been to provide practitioners with simple information that can be used to inform conservation practice. As such, research has been published over the course of my studies, and chapters have been published (Chapters 1, 2), accepted for publication (Chapter 4), or resubmitted following review (Chapter 3) at the time of thesis submission.

**Introduction:** Brief overall summary of the state of conservation psychology, its application to human-wildlife conflict, and the key objectives of the thesis. Background on the basic theories and concepts which provide the foundation to this thesis, and very brief history of human-predator conflict and livestock management in eastern and southern Africa.

**Paper 1: The role of psychology in determining human–predator conflict across southern Kenya**

This paper was exploratory by nature, asking what (if any) psychological variables explained differences in the standards of livestock management amongst pastoralists in southern Kenya. While ‘motivation’ was found not to be a significant predictor of behaviour, all other variables were meaningful. In particular, normative beliefs were hugely influential on overall management standards.

[Published *Conservation Biology*]

**Paper 2: Everyone is normal: consistent livestock management norms and demographic clusters in**

**Kenya and Zimbabwe** Given the significant impact of normative beliefs on behaviour (paper 1), this paper sought to explore whether norm structures were conserved between regions. Comparing norm structure in Kenya and Zimbabwe, this research demonstrated that relatively standardised frameworks can be used for understanding norms, and therefore designing targeted interventions. This study also demonstrated an approach to population segmentation which allows for targeted intervention design.

[Published *Conservation Science and Practice*]

**Paper 3: Social referents and normative standards affect perceptions of livestock management**

**behaviours** Given that norms are major behavioural influences (paper 1), and consistent between regions (paper 2), they may provide an effective focus for behaviour-change interventions. But can

they be experimentally manipulated, and do manipulations affect behavioural intention? In the context of Kenyan land management practices, this paper demonstrates that simple social norm manipulations are possible, and result in significant changes to preferred behaviour. We conclude that it may be possible to develop social interventions which modify norms and encourage pro-conservation behaviour.

[Resubmitted *Human Dimensions of Wildlife*]

**Paper 4<sup>3</sup>: More than a feeling: cognitive beliefs and negative affect predict overall attitudes and behaviour towards predators**

Attitudes are popular in the field of conservation psychology, but numerous social psychology studies show that the attitudes concept is most useful when broken down into its constituent parts. In this study, I explore the relationship between positive and negative affect and different specific cognitive beliefs on overall attitudes and behaviour towards predators, and show that various beliefs and negative – but not positive – affect all had significant effects. This result suggests that conservation education programmes and work mitigating negative experiences may be critical in promoting positive attitudes towards wildlife.

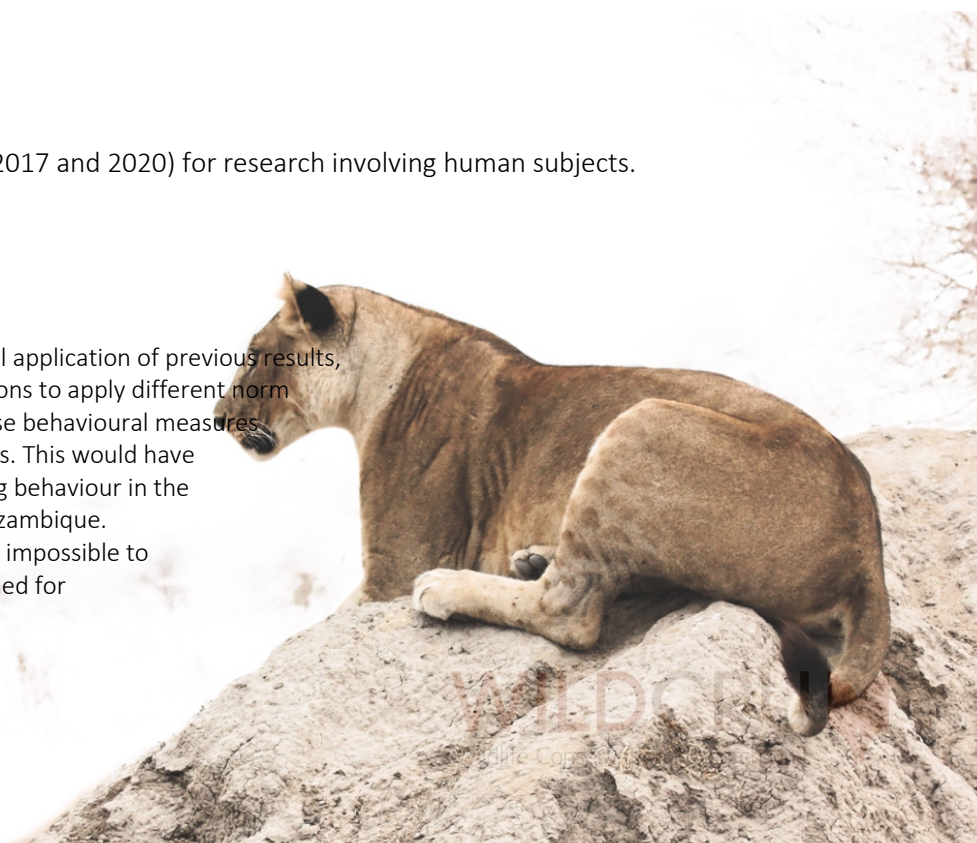
[Accepted *Cons. Sci. & Practice*]

**Discussion** Synthesis of results, and emergent conclusions from the thesis. Discussion of the key and auxiliary results, and how the different results of each paper hang together. Implications for conservation practice and recommendations to practitioners. Future directions for research, including my own plans to extend this work.

**Appendix** CUREC approvals (2017 and 2020) for research involving human subjects.

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<sup>3</sup> Paper 4 was intended to be a practical application of previous results, which used quasi-experimental conditions to apply different norm treatments to different villages, and use behavioural measures to assess the efficacy of said treatments. This would have been carried out in relation to poaching behaviour in the Niassa Special Reserve in Northern Mozambique. Unfortunately, due to COVID-19, it was impossible to carry out the study, which is now planned for post-doctoral work.





Map illustrating the study sites included in this thesis. Large map: continent of Africa, with Kenya (top) and Zimbabwe (bottom) highlighted. Smaller inserts (right): the exact location of data collection sites in Kenya (top) and Zimbabwe (bottom).

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# The role of psychology in determining human–predator conflict across southern Kenya

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**Abstract:** Conflict between people and carnivores can lead to the widespread killing of predators in retaliation for livestock loss and is a major threat to predator populations. In Kenya, a large, rural, pastoralist population comes into regular conflict with predators, which persist across southern Kenya. We explored the social and psychological backdrop to livestock management practices in this area in a process designed to be easy to use and suitable for use across large areas for the study of conflict and transboundary implementation of wildlife conflict reduction measures, focusing on community involvement and needs. We carried out fully structured interviews of livestock managers with a survey tool that examined how social and psychological factors may influence livestock management behavior. We compared survey responses on 3 sites across the study area, resulting in 723 usable responses. Efficacy of individuals' livestock management varied between and within communities. This variation was partially explained by normative and control beliefs regarding livestock management. Individual livestock managers' self-reported management issues were often an accurate reflection of their practical management difficulties. Psychological norms, control beliefs, and attitudes differed among sites, and these differences partially explained patterns associated with conflict (i.e., variation in livestock management behavior). Thus, we conclude that a one-size-fits-all approach to improving livestock management and reducing human–predator conflict is not suitable.

**Keywords:** African carnivores, comparative methods, conservation psychology, human–wildlife conflict, livestock management, livestock predation

El Papel de la Psicología en la Determinación del Conflicto Humano – Depredador en el sur de Kenia

**Resumen:** El conflicto entre las personas y los carnívoros puede derivar en la cacería extendida de los depredadores como consecuencia de la pérdida del ganado, además de ser una amenaza importante para las poblaciones de depredadores. En Kenia, una gran población rural y pastora entra en conflicto regularmente con los depredadores, que son muy comunes en el sur del país. Exploramos el trasfondo social y psicológico de las prácticas de manejo de ganado en esta área en un proceso diseñado para ser fácil de usar y adecuado para grandes áreas para el estudio del conflicto y la implementación transfronteriza de medidas de reducción del conflicto con la fauna. Nos enfocamos particularmente en las necesidades y en la participación de la comunidad. Realizamos entrevistas estructuradas a los manejadores del ganado con una herramienta de censo que examinó cómo los factores psicológicos y sociales pueden influir sobre el comportamiento del manejador del ganado. Comparamos las respuestas del censo en tres sitios del área de estudio, lo que resultó en 723 respuestas útiles. La efectividad del manejo de ganado realizado por los individuos varió entre y dentro de las comunidades. Esta variación estuvo explicada parcialmente por las creencias normativas y de control en relación al manejo del ganado. Los temas de manejo reportados por los mismos manejadores individuales de ganado casi siempre fueron un reflejo acertado de sus complicaciones prácticas en el manejo. Las normas psicológicas, las creencias de control y las actitudes difirieron entre sitios, y estas diferencias explicaron parcialmente los patrones asociados con el conflicto (es decir, la variación en el comportamiento del manejador del ganado). Por lo tanto, concluimos que una estrategia igual-para-todos para mejorar el manejo del ganado y reducir el conflicto humano – depredador no es la adecuada.

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**Article impact statement:** Understanding the psychology of livestock management is key to determining the best strategy for mitigation of wildlife–livestock conflict.

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**Palabras Clave:** carnívoros africanos, conflicto humano – fauna, depredación del ganado, manejo de ganado, métodos comparativos, psicología de la conservación

**摘要:** 人类与食肉动物之间的冲突会导致人类大范围捕杀食肉动物, 以报复其造成的家畜损失, 这对食肉动物种群构成了重大威胁。在肯尼亚存在一个庞大的农村游牧民族, 时常在整个肯尼亚南部地区与食肉动物发生冲突。通过一种易于使用且适用于在大尺度上研究冲突和实施跨境冲突减缓措施的方法, 我们探讨了这一地区畜牧业管理实践的社会和心理背景, 其中特别关注了社区参与及社区需求。我们对家畜管理者进行了全面的结构化访谈, 并利用调查工具分析了社会和心理因素如何影响其家畜管理行为。接下来, 我们比较了研究区域三个地点的调查结果, 得到了723条有效记录。结果显示, 社区之间和社区内部个体家畜管理的有效性均有所不同。对家畜管理的规范信念和控制信念可以部分解释其中的变异。个体家畜管理者自我报告的管理问题往往准确地反映了他们实际的管理困难。不同研究地点的心理规范、控制信念和态度各不相同, 这些差异部分解释了与冲突相关的模式 (即家畜管理行为的差异)。因此, 我们认为用一刀切的方法来改进家畜管理和减少人与食肉动物的冲突是不合适的。**翻译:** 胡怡思; **审校:** 聂永刚

**关键词:** 保护心理学, 家畜管理, 对比法, 人兽冲突, 对家畜的捕食, 非洲食肉动物

## Introduction

Human-wildlife conflict is a multidisciplinary problem (Thirgood & Redpath 2008), and successful conflict mitigation draws on fields from education (Espinosa & Jacobson 2012) to economics (Nyhus et al. 2005). The social sciences often inform conservation but can be misused or underutilized (Bennett et al. 2017). Recent focus has been on the need for social psychology to be more widely integrated into conservation science (Selinske et al. 2018). This is especially true for human-wildlife conflict issues, where psychology influences tolerance (Bruskotter et al. 2015; Kansky et al. 2016) and conflict behavior (Beedell & Rehman 2000). Thoughtful applications of psychology to conservation have shown that, for example, behavioral control can predict hunting behavior (St. John et al. 2018), and social motivations are important determinants of conflict behavior (Marchini & Macdonald 2012). Psychology offers powerful insights into various conservation problems, not least human-wildlife conflict, and may provide a useful perspective for understanding and developing tools to address conflict.

Although environmental psychology is well established, emerging as a subdiscipline in the 1950s, the concept of conservation psychology is recent. The term appeared in the late 1990s and is defined as the study of “relationships between humans and the rest of nature, [focusing] on how to encourage conservation” (Saunders 2003). Psychological components are often central to frameworks for understanding human-wildlife conflict (Kansky & Knight 2014; Kansky et al. 2016), but there is increasing focus on using explicitly psychological theories to understand conservation problems. The most widely applied of these psychological models is Ajzen’s (1991) theory of planned behavior, which argues that social norms, individual agency, and attitudes determine an individual’s behavior (Ajzen 1991) (Fig. 1). The theory of planned behavior has been used to understand numerous human-wildlife conflict problems, from light pollution around turtle nesting beaches (McDonald et al.

2014) to farmers’ wildlife management practices (Beedell & Rehman 1999). Wider application of the theory of planned behavior is likely to prove useful in understanding and developing approaches to reduce conflict.

Many instances of human-wildlife conflict occur in agricultural and pastoral systems. These issues are notably severe in sub-Saharan Africa, where agricultural systems are being extended alongside relatively intact megafauna assemblages (Sillero-Zubiri & Switzer 2001). For livestock producers, predators can be major sources of livestock loss (Ogada et al. 2003; Kuiper et al. 2015). The costs of livestock predation are high for smallholders (Holmern et al. 2007), and even where actual costs are small, perceived loss can cause high levels of conflict between livestock owners and predators (Koziarski et al. 2016). Various approaches to conflict reduction have been attempted: bomas or kraals (overnight livestock pens), which can be supplemented with vegetation (Lichtenfeld et al. 2015), chain link mesh (Sutton et al. 2017), and flashing LED lights (Lesilau et al. 2018). Livestock-guarding dogs (Marker et al. 2005) and general improvement in husbandry practice (Hazzah et al. 2014) also reduce losses. But none of these approaches are completely effective, nor have they been rigorously tested across different sites (van Eeden et al. 2018). Even where evidence-based strategies have been implemented, problems remain. In particular, enabling or motivating livestock owners to act on these recommendations is a consistent barrier to reducing conflict (Loveridge et al. 2010).

If poor management practices exacerbate human-wildlife conflict, understanding the psychology of livestock management may be key to encouraging improved husbandry. We used a theory of planned behavior model to explore the factors influencing livestock management performance. At its core, the theory of planned behavior separates 3 distinct psychological components: normative beliefs—perceptions regarding the social appropriateness of behaviors (Ajzen & Fishbein 1972); control beliefs—beliefs regarding an individual’s agency over behavior or outcomes (Ajzen & Driver 1991); and

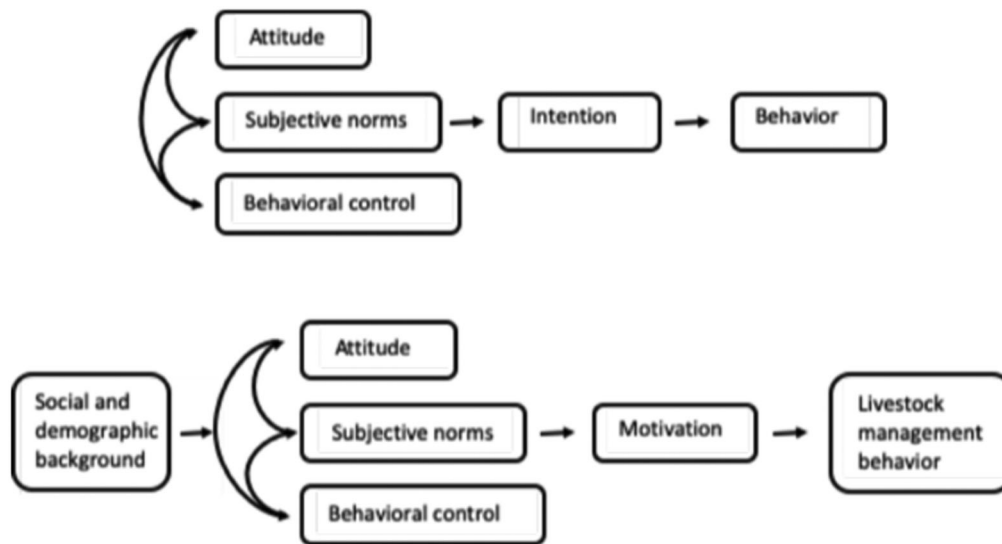


Figure 1. (a) Simplified depiction of the theory of planned behavior and (b) the study model, which considered the social and demographic background of participants in the design of the survey and had a survey module on motivation to examine behavioral intention.

attitudes—an individual’s judgements about an object (Katz & Stotland 1959). Separating these components has proven useful for behavior-change interventions, notably in health behavior (Conner & Sparks 2005), so we employed the same approach. In addition to the core theory of planned behavior modules, we used another psychological module to explore motivation, following on from the work of Pinder (1984) in industrial psychology. If a “psychological landscape” can be defined as “the suite of attitudes, beliefs, and intentions an individual possesses in relation to a particular object, problem, or behavior,” we expect these landscapes to have a strong influence on an individual’s conflict-related behavior (Daigle et al. 2002; St. John et al. 2018). We asked how different components of individuals’ psychological landscapes correlate with their livestock management performance and how these factors vary locally with a view to developing focused conservation interventions.

Southern Kenya has high levels of human–predator conflict, which varies across the region (Hazzah et al. 2009; Schuette 2012). Communities, generally traditional Maasai pastoralists, are highly dependent on livestock, making the area suitable to study patterns and variation in livestock management psychology. We wished to explore how these psychological landscapes related to human–predator conflict across southern Kenya. Higher standards of perceived norms (i.e., expectations of the behavior of friends and neighbors) were expected to be associated with better individual management performance. Various nongovernmental organizations (NGOs) are highly involved with the communities we surveyed, so we expected control beliefs—individual agency over management standards—to have relatively little effect on the outcomes because most individuals are thought to

have access to the resources required to perform livestock care. We also expected livestock managers’ motivations to positively correlate with performance.

We created a survey with the following objectives: determine the structure of normative beliefs, control beliefs, attitudes, and motivation in livestock-owning communities in southern Kenya; study the relationship between psychological landscapes and livestock management, specifically whether more positive psychology or components thereof promote better management; and explore whether livestock management behavior explains differences in livestock predation.

## Methods

### Study Areas

Research was conducted across 3 sites in southern Kenya (Fig. 2) from March to November 2018. Sites are part of a contiguous transboundary arid rangeland system that extends across southern Kenya and northern Tanzania, where wildlife is free to move across much of the landscape. The region has resident populations of lions (*Panthera leo*), leopard (*Panthera pardus*), spotted hyena (*Crocuta crocuta*), and cheetah (*Acinonyx jubatus*) (Bohm & Höner 2015; Durant et al. 2015; Bauer et al. 2016; Stein et al. 2016).

The South Rift, in Kajiado county (36.21°E, 1.58°S), consists of 2 Maasai group ranches (GR): Shompole and Olkiramatian. Land is communally owned; ~200 km<sup>2</sup> are community-managed conservation area (Western 2017). Livestock management is traditional and for subsistence. Shoats (mixed herds of sheep and goats) and cattle are present at moderate to high densities (Schuette 2012).

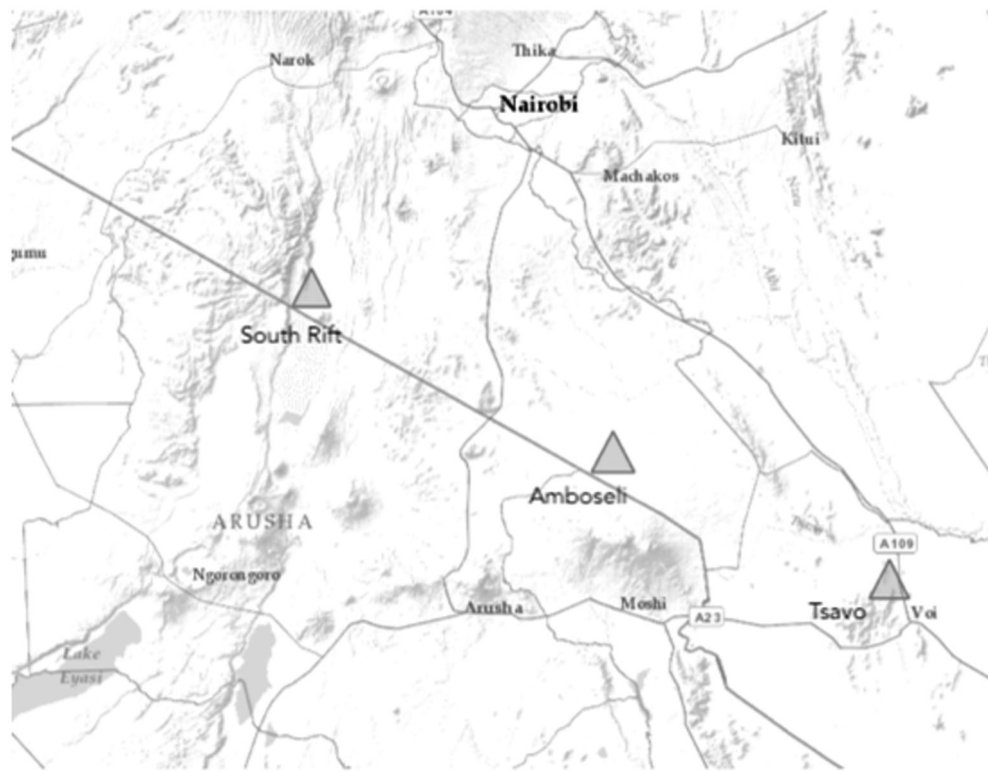


Figure 2. Approximate locations (triangles) of study sites in southern Kenya.

The Amboseli area, in Kajiado county, includes Amboseli National Park and 6 GRs, across which >75% of the population derive their livelihood from livestock (Manoa & Mwaura 2016). Work was conducted on 2 Maasai GRs: Mbirikani (1229 km<sup>2</sup>, 37.59°E, 2.51°S) and Rombo (~520 km<sup>2</sup>, 37.7°E, 2.9°S). Livestock husbandry is largely traditional (MacLennan et al. 2009), and a fund exists on Mbirikani to provide recompense for livestock predation. Although there are some differences between GRs, social, cultural, and conflict backgrounds are similar, so the Amboseli area was considered a single study region (Amboseli Ecosystem Stakeholders and Kenyan Wildlife Service [Kenyan Wildlife Service] 2008).

The Tsavo ecosystem, in Taita Taveta County, covers 2 large national parks and the Kasigau Carbon Credit REDD+ project. Surveys were conducted in the Voi region (38.7°E, 3.4°S), which is surrounded to the north, west, and south by national parks. Both communally owned and private ranches are present in the area, and 14 of 28 smaller ranches are involved in the REDD+ project.

### Survey Participants and Collection Protocol

Survey protocol was approved by the University of Oxford Social Sciences and Humanities Interdivisional Research Ethics Committee (reference number R53944/RE001). Key regions and core communities

(those most typical of each region) were identified through discussion with NGOs and local people. We concentrated on the core communities in each region and chose not to include responses from more widely dispersed—and less typical—community members. Once key regions were identified, research assistants were each allocated a study area. Choice of participants within these regions was opportunistic, through door-to-door surveying or interactions at communal locations (e.g., markets). Study participants were livestock owners or managers over the age of 16. Only individuals who were responsible for either herding or managing livestock were surveyed. Questions were translated into Maa and Kiswahili via a group discussion process, with translate-retranslate methodology where there was poor consensus over the translation. Each survey was administered as a face-to-face interview by local research assistants. Responses were recorded using the Qualtrics offline survey application (Qualtrics 2015), a survey platform designed to be used as an app. Pilot surveys were timed, and a minimum realistic duration measured. Because most questions followed an identical format, participants were able to respond rapidly, and the minimum survey time was set at 20 min. Surveys that took less than this minimum were excluded from analysis. Overall, 207, 286, and 230 usable surveys were collected from the South Rift, Amboseli, and Tsavo, respectively.

## Survey Design

In psychology, underlying explanatory variables—psychological constructs—are not directly observable, so on surveys multiple questions on the same theme are proxies for these underlying constructs. Our survey (Supporting Information) consisted of ~175 questions, although the exact number varied because question inclusion was contingent on previous answers. The survey was split into 6 modules: social and demographic properties (19 questions on age, education, positions of leadership, etc.); livestock management practices (31 questions on herding, kraaling, veterinary care, etc.); normative beliefs (31 questions on perceptions regarding the social appropriateness of behaviors); control beliefs (16 questions on beliefs regarding an individual's agency over behavior or outcomes); attitudes (31 questions on an individual's judgements about an object, including emotional and cognitive components); and motivation (18 questions on willingness of managers to carry out livestock-related activities).

Most responses were on a 5-point Likert scale: strongly agree, agree, neither agree nor disagree, disagree, and strongly disagree, although some questions had different 5-point scales (e.g., extremely likely to extremely unlikely). Because Likert scales operate in a nonlinear, ordered manner, analysis requires ordinal approaches.

## Data Analyses

We wished to explore the psychological landscape of livestock managers and to understand the relationship between psychology and livestock management standards. All analysis was carried out using the free statistical software R version 3.5.1 (R Core Team 2018). To explore the psychological landscape required metrics that captured different components of individuals' latent beliefs. As these properties cannot be measured directly, we used exploratory factor analysis, a form of principal components analysis (R packages: psych [Revelle 2018] and lavaan [Rosseel 2012]) to identify clusters in the survey responses for each of the 6 modules; each cluster was treated as a proxy for an underlying psychological factor (an approach common in psychology studies [e.g., Andriotis & Vaughan 2003]). Only the subsets of survey questions that gave clustered responses were used for further analysis. Using the theoretical background employed in survey design, we developed 2–3 psychological factors for each module (Table 1). Confirmatory factor analysis was carried out on each of these factors ( $n = 12$ ) to test how the measured variables represented underlying psychological constructs (Floyd & Widaman 1995). To test the fit of all factors to each of the 6 modules, we used the comparative fit index (CFI), standardized root mean square residuals (SRMSR), and root mean square error of approximation (RMSEA) (Hooper et al. 2008). To test

the internal validity of each individual factor, Cronbach's alpha was used (Table 1). Because we were not aiming to measure one specific property, but rather form a broad psychological overview of particular topics, we used a low alpha threshold of 0.5. Two factors failed to reach this threshold and were omitted from further analysis. Having established the structure of factors within each module and the validity of individual factors, we created variables from these constructs for use in analysis. Each factor contained 2–8 survey questions. For a psychological factor to be used as an explanatory variable in the model, it was necessary to compile responses into one metric for each factor. Because all questions were scored on the same 5-point scale, the responses were summed to create a single equally weighted numeric value for each factor. These numeric measures were then converted into a 2- (poor and good) or 3-level ordered qualitative score (poor, medium, and good), depending on the variation in the metric (Table 1).

To create a model exploring psychology in relation to livestock management performance, we needed a response variable for performance. A composite measure of self-assessed performance was created by combining Likert scale responses to questions concerning good livestock management behavior, including measures of boma use, herding practices, veterinary care, livestock loss in the 12 months prior to surveying, and other indicators of good management. This metric produced an approximately normal distribution, showing that the composite reflected variation in livestock management performance (Fig. 1 & Supporting Information). This metric was converted into categorical response with 3 levels (poor, medium, and good), with approximately the same number of samples in each category. A second management performance metric, which excluded terms for livestock losses, was created to evaluate the effect of management practice on losses. We wanted to include a term for affluence in the model. Because the study communities are largely outside monetary economies, we again needed a composite measure. This composite included numerous variables to measure relative affluence in rural communities (e.g., regularity of meat eating and number of wives [Supporting Information]).

Overall, we had 12 separate psychological factors (Table 1), site, and affluence variables. Because it was possible for these factors to have interdependence, correlation tests were run for all variables using R package arm (Fig. 2 & Supporting Information). Two pairs of factors were highly correlated ( $>0.68$ ), so the factor in each pair with the lowest Cronbach's alpha was dropped from further analysis. This left 8 psychological factors (Table 1), site, and affluence as variables. To understand the influence of each of the 10 variables on livestock management performance, we carried out an ordinal (for nonlinear Likert responses) logistic regression analysis. Akaike's information criterion (AIC) was used to distinguish the best-fitting

**Table 1. Psychological-factor structures used in all models<sup>a</sup> of livestock management performance and details on overarching psychological modules, specific factors, and factor properties.**

| <i>Module</i>     | <i>Factor<sup>b</sup></i>      | <i>Definition</i>                                                                                                                  | <i>Example quotation</i>                                                                  | <i>No. of questions;<br/>response levels</i> | <i>Comparative<br/>fit results</i>         | <i>CA<sup>c</sup></i> | <i>Reference</i>        |
|-------------------|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|----------------------------------------------|--------------------------------------------|-----------------------|-------------------------|
| Normative beliefs | Perception norms*              | Expectations regarding perception (i.e., How do people perceive the behavior of others, and think others perceive their behavior?) | "My friends think it is important to herd their livestock during the day."                | 8; good, poor                                | CFI = 0.97<br>SRMSR < 0.01<br>RMSEA < 0.05 | 0.88                  | Ajzen and Fishbein 1972 |
|                   | Behavioral norms*              | Expectations of actual behavior (e.g., How often does a respondent think a behavior occurs?)                                       | "How many successful Kenyans do herd their livestock during the day?"                     | 3; good, poor                                |                                            | 0.61                  |                         |
| Control beliefs   | Management performance*        | How easy or difficult would the respondent find improving management behavior?                                                     | "To improve my boma would be very easy."                                                  | 3; good, mid, poor                           | CFI = 0.69<br>SRMSR = 0.095                | 0.65                  | Ajzen and Driver 1991   |
|                   | Management agency*             | Extent to which respondents control management decisions and can perform those actions                                             | "If I wanted to, I could improve my boma."                                                | 6; good, mid, poor                           | RMSEA = 0.105                              | 0.53                  |                         |
|                   | Management difficulties*       | Assessment of how difficult or easy the respondent finds carrying out a management behavior                                        | "To kraal my livestock every night is difficult."                                         | 3; good, mid, poor                           |                                            | 0.60                  |                         |
| Attitudes         | Positive affect*               | Positive attitudinal response toward management activities                                                                         | "Livestock management makes me feel calm."                                                | 3; good, mid, poor                           | CFI = 0.76                                 | 0.79                  | Katz and Stotland 1959  |
|                   | Negative affect*               | Negative attitudinal response to livestock management activities                                                                   | "Livestock management makes me feel angry."                                               | 3; good, mid, poor                           | SRMSR = 0.081                              | 0.72                  |                         |
|                   | Self-assessment                | Perception of individual's own livestock management skill                                                                          | "I am good at managing my livestock."                                                     | 2; good, poor                                | RMSEA = 0.087                              | 0.62                  |                         |
|                   | Cognitive beliefs*             | Beliefs about good livestock management techniques                                                                                 | "Employing an adult or trained herder is more effective . . . than using a child herder." | 4; good, poor                                |                                            | 0.67                  |                         |
| Motivation        | Positive management properties | Positive aspects or perceptions of livestock management work                                                                       | "Livestock management gives me a lot of independence and freedom."                        | 6; good, mid, poor                           | CFI = 0.96                                 | 0.77                  | Vroom 1964              |
|                   | Social importance              | Perceived social importance of carrying out livestock management                                                                   | "Livestock management allows me to provide everything my family needs."                   | 2; good, poor                                | SRMSR = 0.038                              | X                     |                         |
|                   | Outcome agency                 | Extent to which respondent feels control over outcomes of livestock management                                                     | "How I manage my livestock has a large effect on the number that are predated."           | 2; good, mid, poor                           | RMSEA = 0.056                              | X                     |                         |

<sup>a</sup>Models show importance of different psychological factors in determining livestock management performance.

<sup>b</sup>Factors with an asterisk passed all tests and were retained for the model. Other factors were excluded.

<sup>c</sup>Cronbach's Alpha. Entries marked 'X' had low alpha scores, and were removed from subsequent analysis.

Abbreviations: CFI, comparative fit index; SRMSR, standardized root mean square residuals; RMSEA, root mean square error of approximation.

combinations of explanatory variables. Interaction terms were not included because we had no prior reason to expect interactions between the variables. All combinations of the explanatory variables were tested. Models with  $\Delta_i \leq 2$  were considered to have substantial support (Burnham & Anderson 2004). Conditional model averaging of this subset of models using R package MuMIn was used to create the top overall livestock management model, and one for each of the 3 sites. Plots were created using R package effects. To test whether livestock management influenced differences in predation outcomes, we used a *t* test and a generalized linear model with a Poisson distribution to compare count data of livestock losses and our management composite.

## Results

### Descriptive

Across the region, the median household had 6–10 cows and 21–50 shoats. Self-reports of livestock management behavior indicated that most participants regularly—but not always—implemented good practices (e.g., bringing animals into a boma overnight or herding during the day). Most households (94.9%) had access to a boma. Herders were commonly used, with unpaid adults, paid adults, and children primarily used by 45.0%, 34.9%, and 20.2% of households, respectively. Labor, including herders, was hired by 42.0% of households, and 50.0% of households provided supplementary feed for animals. Veterinary care was uncommon and 52.6% of households used no veterinary services. Combining all sources of mortality in the previous year, livestock deaths were a mean of 5.67 (SD 16.9) cows and 15.6 (46.4) shoats; this was unusually high because of a severe drought.

In the 12 months prior to the survey, 40.8% of households reported livestock predation and 42.2% of households had livestock predated while in a boma. During this period, mean household livestock depredation was 1 cow (SD 3.7) and 4.1 shoats (9.6); however, only 21.7% and 37.8% of households experienced depredation of shoats and cows, respectively. Thus, mean losses for each affected household were much higher: 4.6 (6.7) cows and 10.8 (13.1) shoats.

### Analytical

We explored how psychological factors affected livestock management behavior, including the relative contribution of different factors, and whether these factors were the same across sites. Our preconceived factor structures were an acceptable fit to the latent psychological constructs (normative beliefs: CFI = 0.97, Standardised Root Mean Square of Residuals = 0.0027, and RMSEA = 0.049; control beliefs: CFI = 0.69, SRMSR = 0.095,

and RMSEA = 0.105; attitudes: CFI = 0.76, SRMSR = 0.081, and RMSEA = 0.087). Twelve AICc models were within  $\Delta_i \leq 2$  and were considered top models (Table 2). Livestock management behavior was affected by site and affluence, with all of the 12 best models containing both terms. Overall, normative and control factors appeared particularly important. Two control factors were generally retained by each model (management difficulty,  $n = 12$ ; management agency,  $n = 10$ ), although management performance was less important ( $n = 5$ ). Most models also had one normative factor (normative behavior,  $n = 8$ ; normative perceptions,  $n = 3$ ). The only attitude factor retained by any top model was positive attitude ( $n = 5$ ). The averaged model (Table 3) contained terms for site, affluence, normative behaviors and perceptions, all control variables, and positive attitude. There was strong evidence for a positive relationship between reported management difficulty levels and livestock management performance. Management performance was also positively associated with normative behaviors, and negatively associated with management agency, but these were only weakly supported (Supporting Information). There was very strong evidence for effects of affluence (Fig. 3) and site. To explore this further, we broke the analysis down by study site.

There were 10, 6, and 8 models within AIC  $\Delta_i \leq 2$  for Tsavo, South Rift, and Amboseli, respectively, with no overlap in models between sites (Supporting Information). The averaged models contained different terms ordered by importance: affluence, normative perceptions, normative behavior, management performance, positive attitude, and management agency for Tsavo; affluence, normative behavior, management agency and difficulties, positive attitude, management performance, and normative perceptions for South Rift; and affluence, positive attitude, normative behavior, management agency, and normative perceptions for Amboseli.

For Tsavo, 1 or both normative terms appeared in 80% of the top models, falling to 66% and 50% for South Rift and Amboseli, respectively. Control beliefs terms were present in 100% of models in South Rift, in 80% of models in Tsavo, and in 38% of models in Amboseli. Management performance occurred in 80% of models in Tsavo, compared with only 38% for agency and none for difficulties. By contrast, management agency and difficulties were present in all South Rift models. Positive attitude was a term in all top models for Tsavo, but seldom retained on other sites.

The index of livestock management behavior was normally distributed across all sites. This index varied significantly with predation outcomes; livestock owners who experienced any predation of cows, shoats, or donkeys in the previous 12 months had a lower management behavior score than those who experienced no predation (*t* test,  $p = 0.0019$ ). Our generalized linear regression revealed a small but significant relationship between

**Table 2. Top-ranking models ( $\Delta AIC \leq 2$ ) of the influence of different combinations of psychological factors on livestock management performance across 3 study sites in southern Kenya.**

| Rank | Model                                                                                                                                             | $\Delta AIC^*$ | Likelihood | Weight |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------|----------------|------------|--------|
| 1    | Site + affluence + behavioral norms + management performance + management agency + management difficulties + positive attitude                    | 0              | 1          | 0.079  |
| 2    | Site + affluence + behavioral norms + management agency + management difficulties + positive attitude                                             | 0.0910         | 0.951      | 0.075  |
| 3    | Site + affluence + behavioral norms + management agency + management difficulties                                                                 | 0.163          | 0.922      | 0.072  |
| 4    | Site + affluence + behavioral norms + management agency + management difficulties                                                                 | 0.363          | 0.834      | 0.065  |
| 5    | Site + affluence + management performance + management agency + management difficulties                                                           | 0.916          | 0.633      | 0.050  |
| 6    | Site + affluence + management agency + management difficulties                                                                                    | 1.007          | 0.604      | 0.047  |
| 7    | Site + affluence + behavioral norms management difficulties                                                                                       | 1.579          | 0.454      | 0.036  |
| 8    | Site + affluence + management performance + management agency + management difficulties + positive attitude                                       | 1.663          | 0.435      | 0.034  |
| 9    | Site + affluence + perception norms + behavioral norms + management performance + management agency + management difficulties + positive attitude | 1.732          | 0.421      | 0.033  |
| 10   | Site + affluence + perception norms + behavioral norms + management agency + management difficulties + positive attitude                          | 1.785          | 0.410      | 0.032  |
| 11   | Site + affluence + management difficulties                                                                                                        | 1.854          | 0.396      | 0.031  |
| 12   | Site + affluence + perception norms + behavioral norms + management agency + management difficulties                                              | 1.871          | 0.392      | 0.031  |

\*Difference between the Akaike information criterion values for 2 models.

**Table 3. Averaged Akaike information criterion (AIC) for the top model, showing the role of site, affluence, and psychological factors in determining overall livestock management performance on sites across southern Kenya.**

| Model term              | Estimate | SE     | z     | p                    |
|-------------------------|----------|--------|-------|----------------------|
| Site                    |          |        |       |                      |
| South Rift              | -0.7509  | 0.2252 | 3.330 | 0.000869             |
| Tsavo                   | 1.9800   | 0.2595 | 7.620 | $<2 \times 10^{-16}$ |
| Affluence               | 0.7333   | 0.1148 | 6.377 | $<2 \times 10^{-16}$ |
| Perception norms        | -0.1331  | 0.2463 | 0.539 | 0.589605             |
| Behavioral norms        | 0.2961   | 0.1679 | 1.760 | 0.078393             |
| Management performance  | 0.2512   | 0.1765 | 1.420 | 0.155467             |
| Management agency       | -0.2785  | 0.1440 | 1.931 | 0.053442             |
| Management difficulties | 0.3357   | 0.1279 | 2.620 | 0.008803             |
| Positive attitude       | -0.1869  | 0.1314 | 1.419 | 0.155811             |

livestock management behavior and livestock predation ( $p = 0.036$ ) (Supporting Information).

## Discussion

### Overall Findings

We found that various psychological constructs can partially explain differences in predation outcomes for livestock managers in southern Kenya. Normative belief factors consistently appeared in averaged models, with the behavioral norms factor approaching significance in the overall averaged model (Table 3). The behavioral norms term contained questions on the livestock management behavior of various groups (e.g., How many people in nearby communities manage their livestock well?). We expected livestock managers to assume that their own management performance was average (i.e., poor managers assumed everyone else was performing poorly,

etc.). However, we found that as the normative behavior score increased (i.e., as respondents reported higher perceived standards in other groups), it became less likely that the respondent themselves performed good livestock management (Supporting Information). This suggests respondents had an accurate sense of their own relative performance. Good livestock managers reported relatively poorer performance in other groups and vice versa. Although normative perceptions did not explain a large amount of variance, in the low- and mid-standard management classes there was a tentative positive correlation between performance and perceptions (Fig. 3 & Supporting Information), so those people who thought their friends, elders, and family valued good livestock management more deeply appeared to perform better. This needs further research, but if confirmed, community campaigns that highlight the local importance and value set by good livestock management may prove effective. We found that the lowest performers in a community are

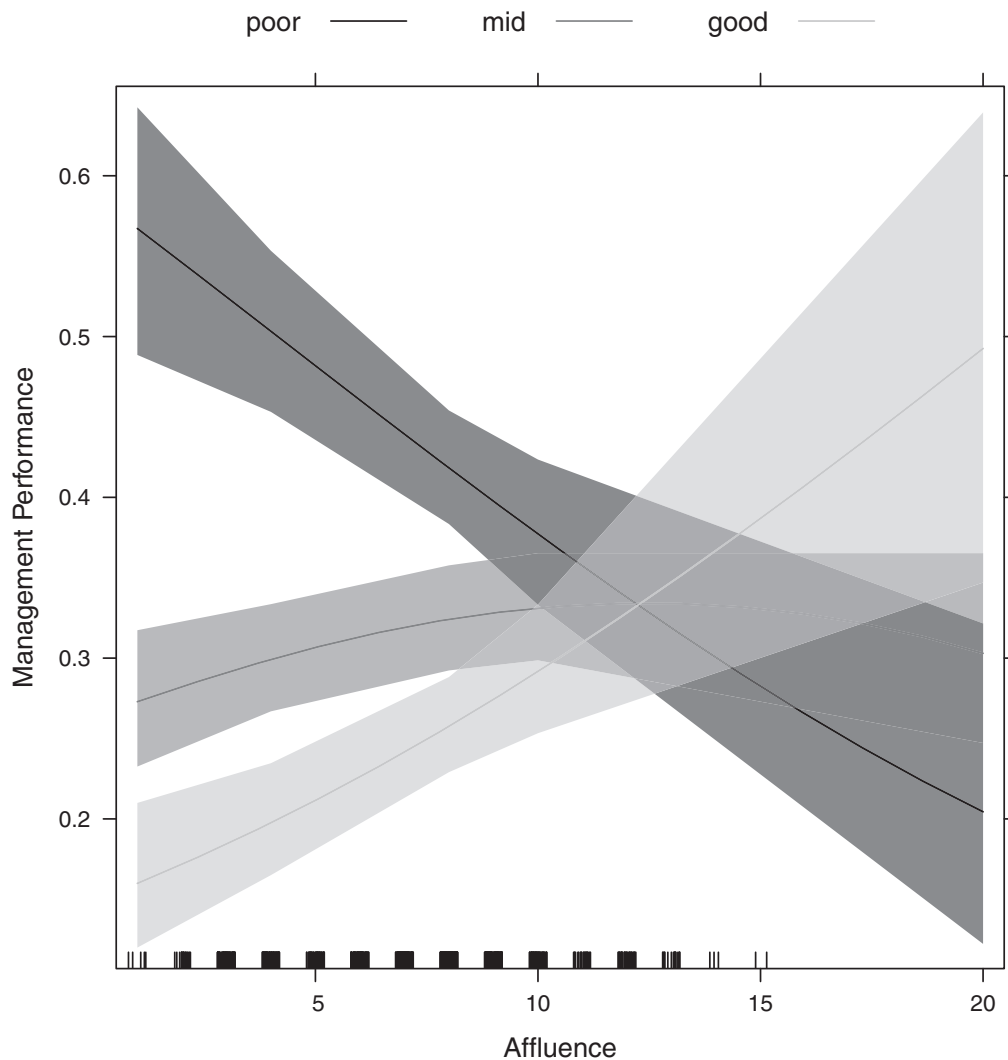


*Figure 3. Results of ordinal logistic regression model of effect of affluence on livestock management performance (good, mid, and poor) (y-axis, probability of performance level; x-axis, composite affluence score).*

aware of their own position and may be susceptible to the influence of their peers, so psychology-based public opinion campaigns could prove a workable intervention.

Of the psychological modules, control factors appeared the most important; management agency and difficulty control terms (Table 3) featured in the global model, although they were less consistent on a local level. The management performance variable (e.g., To hire a herder for my livestock would be easy.) appeared in 80% of the models for Tsavo, whereas both management agency and difficulties appeared in all the South Rift models. Management difficulty (e.g., To herd my livestock is difficult.) was the most important control term across sites, and was highly correlated with management performance (Supporting Information) (i.e., those livestock managers who performed most poorly reported highest levels of difficulty and vice versa). This term was designed to detect inability to access resources (e.g., adequate fencing

materials), so its significance in the model demonstrates that local people for whom there were barriers to good livestock management reported this proportionate to their need. Integration of local knowledge into landscape planning or ecosystem impact assessments is widespread (e.g., Kwiatkowski & Ooi 2003) and increasingly common in conflict mitigation (White & Ward 2011). Our findings confirm that variation in need within communities can be captured by a simple survey, and we suggest that identifying community sectors in need of support may help conservation interventions succeed.

Affluence was a highly significant term in both the overall and site-specific models (Fig. 3), a similar finding to those of other studies (Zimmermann et al. 2005). As affluence increased, so did the probability of better livestock management performance. This was true for all livestock management standards and sites. There were also major significant differences between sites, with no

overlap in the top-ranking models for each site (Supporting Information).

### Site-Specific Findings

In Tsavo normative terms for perceptions and behavior were highly important. This was the only site not to include management difficulty in the averaged model. Our metric suggested that farmers in the Tsavo area had the highest management standard. This ran counter to our expectation because although the Maasai have a long history of cattle management, the Tsavo area has the lowest proportion of Maasai people and has had a large influx of other ethnic groups over the past 30 years (Muriuki et al. 2011). The more sedentary approach to livestock management taken in Tsavo is fundamentally less risky than traditional Maasai husbandry, which may be reflected in the metric. Similarly, migrants who move to Tsavo to farm and choose to undertake this work may be expected to practice a very high standard of care. That normative terms were locally important could reflect the novelty or diversity of communities, with studies suggesting that conforming to norms can be relatively more important in recently formed or more varied communities (Hogg & Reid 2006; Schultz et al. 2008).

In the South Rift, the averaged model contained normative behavior, followed by management agency and difficulties. These control belief terms were more important here than elsewhere, with all 3 terms appearing. The management agency term measures respondents' sense of control over livestock management (e.g., If I wanted to, I could improve my kraal.), whereas the management difficulties term measures the perceived difficulty of the same aspects of management (e.g., To bring my livestock into the kraal [...] would be difficult.). This was the only site where both agency and difficulties were important. Both factors had a positive relationship with management performance: actors who believed they had more control and fewer difficulties practiced more successful livestock management. Farmers in the South Rift had the most challenges to livestock management including low affluence levels, a serious drought the previous year, and high local density of predators in farming areas (Schuette 2012). Livestock managers here have arguably the most difficult task and the greatest risk of bad outcomes where management is poor. There may be a trade-off between the high productivity of large-scale mobility and more difficult management. Agency and difficulties were relatively less important on other sites, so variation should be tested and, when high, targeted interventions implemented.

Amboseli is a world famous national park and draws international attention (Kibicho 2006). Consequently, there are numerous conservation organizations working in the area. There was relatively little variation in livestock management standards in Amboseli and very little

impact of control terms in the models. This may suggest that most livestock managers' basic needs were being fulfilled. The most important psychological model terms were positive attitude and normative behavior, and both had positive relationships with performance. The positive attitude term measured affective states, for example, how much does managing your livestock make you feel content. The importance of positive attitude in the models perhaps shows that once serious threats to management have been removed, the individual preferences of livestock managers—and interest in farming—become a much more important factor in their performance.

Interventions based on a psychological understanding of human behavior have been practiced across a growing range of disciplines, not least conservation (e.g., Kinsky et al. 2016; St. John et al. 2018). We found that various psychological constructs explained differences in the outcomes of livestock management in southern Kenya, but that the most important psychological components varied among sites. This result demonstrated that our survey mapped psychological constructs relevant to human–predator conflict and is therefore useful for understanding conflict. Southern Kenya is a large area, and our results reflect differences across the region, which suggests our approach may work across broad spatial scales. The intersite variation we documented shows that assumptions about belief structure should not be made, and practitioners seeking to use psychology to change behavior must carry out local surveys to understand the psychological landscape of their region. We call for wider implementation of both psychology in the study of human–wildlife conflict and comparative approaches similar to our survey. Our results showed such surveys can capture site-specific nuances and may be key to providing fast, evidence-based information with which to tailor conflict-reduction interventions.

### Acknowledgments

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### Supporting Information

The survey (Appendix S1), management composite scores (Appendix S2), details on the affluence composite (Appendix S3), a correlation matrix of the variables (Appendix S4), a linear model of livestock loss and management performance (Appendix S5), additional graphs

from specific sites (Appendix S6), livestock management performance relative to normative behaviors and management difficulties (Appendix S7), and top-ranking models of the influence of psychological factors on livestock management performance at individual sites (Appendix S8) are available online. The authors are solely responsible for the content and functionality of these materials. Queries (other than absence of the material) should be directed to the corresponding author.

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## Chapter 1 Erratum

Page 3: Figure should be labelled as **a** (above), and **b** (below). *Simplified depiction of the theory of planned behavior and (b) the study model, which considered the social and demographic background of participants in the design of the survey and had a survey module on motivation to examine behavioral intention.*

Page 7: Predation rates on different study sites were largely consistent.

In the 12 months prior to the survey, 40.8% (45.2% South Rift; 42.3% Amboseli; and 37.5% Tsavo) of households reported livestock predation and 42.2% (47.3% South Rift; 41.1% Amboseli; and 39.8% Tsavo) of households had livestock preyed while in a boma.

Page 31: Figure 3.

The X axis reflects affluence, and the Y axis the *probability* of falling into each of the three groups, separated by the quality of their livestock management behaviour (poor – dark; mid – medium; and good – light). For example, the probability of falling into the light band, i.e. good management, increases moving right on the X axis, so it becomes more probable that an individual will perform good management as their affluence increases.

Page 32: Concluding sentences.

The intersite variation we documented shows that assumptions about belief structure should not be made, and practitioners seeking to use psychology to change behavior must carry out local surveys to understand the psychological landscape of their region. We call for wider implementation of both psychology in the study of human–wildlife conflict, and comparative approaches similar to our survey. In this study, although all three sites experienced similarly high levels of conflict with predators, the psychological responses of local people differed substantially. In practice, this means that different conservation approaches are likely to be suitable in these differing psychological contexts, which highlights the value of this approach. Our results showed such surveys can capture site-specific nuances and may be key to providing fast, evidence-based information with which to tailor conflict-reduction interventions.

# Supplementary Materials

## Supplementary Materials

### 1. Survey Materials



### 2. Appendix S2

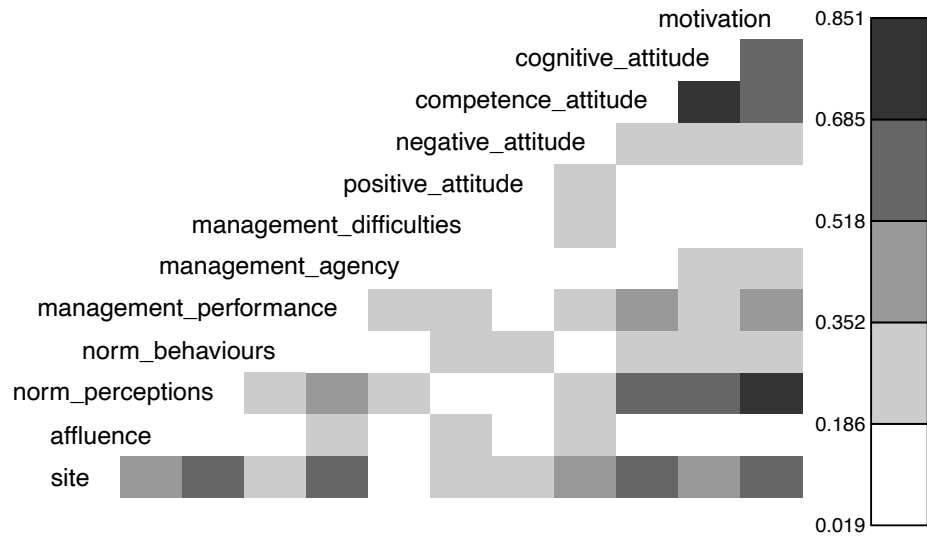
**Figure 1:** Livestock management composite scores across all sites. Scores follow an approximately normal distribution.

### 3. Appendix S3

**Affluence composite** contains terms for supplementary feeding of livestock (yes/no); additional livestock management labour hired (yes/no); meat per week (no. days); skipped meals (yes/no); number of wives; position of leadership in community (yes/no).

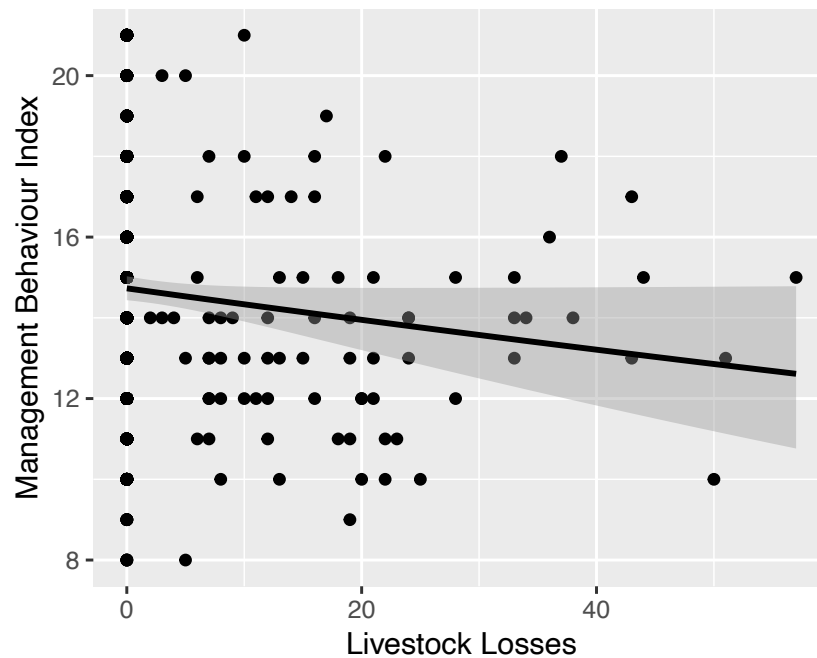
#### 4. Appendix S4

**Figure 2:** Correlation matrix of all variables from the factor analysis. Competence\_attitude and cognitive\_attitude; norm\_perceptions and motivation were found to be highly correlated. In each pair, the variable with the lowest alpha (competence and motivation) were dropped from further analysis.



#### 5. Appendix S5

**Figure 3:** Livestock losses and livestock management performance. Generalised linear model using Poisson distribution ( $p = 0.036$ ). Outlier values (individuals who had >75 animals predated) were removed from analysis.



## 6. Appendix S6

**Figure 4:** Normative perceptions and livestock management performance. Data from Tsavo only (n = 230).

Poor and mid performance livestock managers improved performance as perceptions of norms improved.

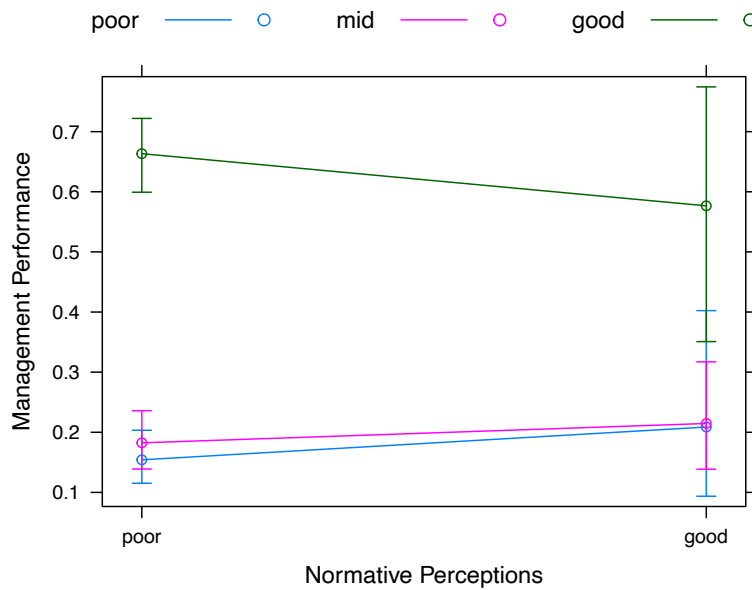
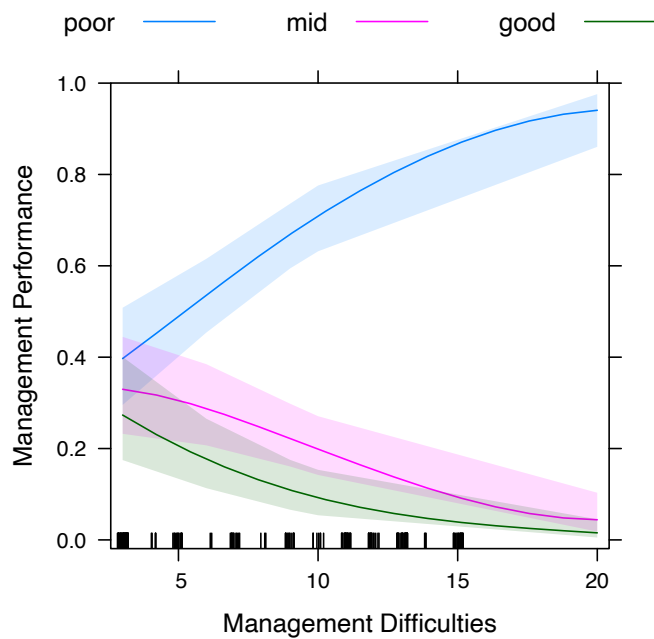


**Figure 5:** Management difficulties and performance. Data from South Rift only (n = 207). Reported

livestock management difficulties correlate negatively with performance.



# Survey 26.03.18

## Start of Block: M1. Background

**Q1.1** Who did the survey?

Satia (1); Peter (2); Unknown (3)

**Q1.2** What is your age set?

<18 (1)            18-23 (2)  
24-36 (3)        37-50 (4)  
51-68 (5)        69-81 (6)        82+ (7)

**Q1.3** WHAT IS THE PARTICIPANT'S SEX?

Male (1)        Female (2)

**Q1.4** Does your family own livestock?

Yes (1)        No (2)

**Q1.6** Are you the main person who decides how your family's livestock is managed?

Yes (1)        No (2)

**Q1.7** Do you physically go out to manage your family's livestock?

Yes (1)        No (2)

**Q1.8** Do you physically go out to manage other people's livestock?

Yes (1)        No (2)

**Q1.9** Are you in a position of leadership?

Yes (1)        No (2)

**Q1.10** What is the furthest you have gone in school?

None (1)        Primary (2)  
Secondary (3)    Tertiary (4)

**Q1.11** For how many years have you lived in the Olkiramatin/Shompole community?

**End of Block: M1. Background**

**Q1.12** What is the main language you speak?

Kiswahili (1)    English (2)    Kikuyu (3)  
Maasai (4)       Other (5)

**Q1.13** How many people are there in this family?

Adult men : \_\_\_\_\_ (1)

Adult women : \_\_\_\_\_ (2)

Children : \_\_\_\_\_ (3)

Total : \_\_\_\_\_

**Q1.14** In the last 12 months, were there times when your family did not have enough food?

Yes (1)        No (2)

**Q1.15** In the last 2 weeks, how many times have you [THE RESPONDENT] gone without food?

**Q1.16** In the last 1 week, on how many days did your family consume meat?

**Q1.17** What are your family's main sources of livelihood? [TICK ALL THAT APPLY]

Livestock production and related products (hides, milk, meat etc.) (1)

Farming of crops (2)

Casual labour (3)

Small business (arts and crafts, shop, other) (4)

Tourism-related industries (photographic or hunting) (5)

Money sent from family elsewhere (6)

Regular employment not otherwise specified (7)

Other (specify) (8)

## **Start of Block: M2. Behaviour**

**Q2.1** How many cattle does your family own?  
None (1) ; 1-5 (2); 6-10 (3); 11-20 (4); 21-50 (5);  
51-150 (6); 151-300 (7); 301+ (8)

**Q2.2** How many donkeys? [1-5]; 51+ (6)

**Q2.3** How many shoats? [1-8]

**Q2.4** How many pigs? [1-6]; 151+ (7)

**Q2.5** How many horses? [1-4]; 21+ (5)

**Q2.6** In the last 12 months, how many of your family's [X] died? Cattle (1) Donkey/mule (2)  
Horse (3) Goat/sheep (4) Pig (5)

**Q2.7** In the last 12 months, has your family sold any livestock? Yes (1) No (2)

**Q2.8** In the last 12 months, has your family sold any produce from your livestock? Y/N

**Q2.9** Why are you keeping livestock? [TICK ALL]  
Sale of animals (1) Manure (5)  
Sale of LS products (2) Transport (6)  
Food for the family (3) Culture/status (7)  
For cultivation (4) Savings (8)

**Q2.10** Has your family always owned LS? Y/N

**Q2.11** For how many years has your family owned livestock?

**Q2.12** Does your family have/use a boma? Y/N

**Q2.13** In the past 1 month, how many nights have your livestock slept in the boma?  
Every night (1); Most (2); About half the time (3);  
Some nights (4); Never (5)

**Q2.14** How many of the livestock are brought into a boma overnight? All (5); Most (6); About half (7); A few (8); None (9)

**Q2.15** In the last 1 month, how many days did an adult go herding? Always (1); Most (2);  
About half (3); Sometimes (4); Never (5)

**Q2.16** In the last 1 month, how many days did a child go herding? Always (1) [...] Never (5)

**Q2.17** In the last 1 month, how many days were the livestock accompanied by dogs? A (1)/N (5)

**Q2.18** Who herds the LS most of the time?  
Adults (not paid)/Children/Employed herders

**Q2.19** In the last 12 months, did you hire any labour to do livestock-related work? Y/N

**Q2.20** In the last 12 months, did you buy your livestock supplementary feed? Y/N

**Q2.21** In the last 12 months, did your livestock receive any medicine or veterinary care? Y/N

**Q2.22** How many of your LS are vaccinated?  
All (1) Some (2) None (3)

**Q2.23** How often do you graze your livestock on communal land? Always (1) [...] Never (5)

**Q2.24** In the last 12 months, were any of your family's livestock killed by predators? Y/N

**Q2.25** Did you report this livestock killing to anyone? Yes - who? (1) No (2)

**Q2.26** Which predators were responsible?  
Lions (1); Leopard (2); Spotted hyaena (3); Wild dogs (4); Jackals (5); Don't know (6); Other [?] (7)

**Q2.27** In the last 12 months, how many of your family's livestock were killed by predators?  
Cattle (1); Donkeys (2); Shoats (3); Other (specify) (4)

**Q2.28** Have your family's livestock ever been killed whilst in a boma? Y/N

**Q2.29** In the last 12 months, how many animals have been killed in a boma?

**Q2.30** Have you ever killed or attempted to kill a predator? Y/N NOT WILLING TO RESPOND (3)

**Q2.31** In the last 5 years, how many times have you killed or attempted to kill a predator?

## **End of Block: M2. Behaviour**

**Start of Block: M3. Normative Beliefs**

**Q3.1** My community feels I should bring my livestock into a boma every night.

Strongly agree (1) [...] Strongly disagree (5)

**Q3.2** People expect me to bring my livestock into a boma every night. [1-5]

**Q3.3** The people I care about bring their livestock into a boma every night. [1-5]

**Q3.4** My community feels I should herd my livestock every day. [1-5]

**Q3.5** People expect I will herd my livestock every day. [1-5]

**Q3.6** The people I care about herd their livestock every day. [1-5]

**Q3.8** Community elders think it is very important for me to manage my LS well. [1-5]

**Q3.9** My friends think it is very important for me to manage my livestock well. [1-5]

**Q3.10** How many people in your community manage their livestock well?

All (1)            A lot (2) A moderate amount (3)  
A little (4)    None (5) DON'T KNOW (6)

**Q3.11** How many people in other areas manage their livestock well? [1-6]

**Q3.12** How many wealthy/successful Kenyans manage their livestock well? [1-6]

**Q3.13** My community feels I should kill any predators that kill livestock. [1-5]

**Q3.14** The people I care about do not kill predators that kill livestock. [1-5]

**Q3.15** People expect that I will kill any predators that kill my livestock. [1-5]

**Q3.16** My community feels I should not kill predators that kill livestock. [1-5]

**Q3.17** The people I care about kill predators that kill livestock. [1-5]

**Q3.18** People expect that I will not kill predators, even if they kill livestock. [1-5]

**Q3.19** In the last 5 years, how many times did you kill or try to kill predators that had killed LS?

**Q3.20** My community feels I should kill predators to prevent livestock killing. [1-5]

**Q3.21** The people I care about do not kill predators to prevent livestock killing. [1-5]

**Q3.22** People expect me to kill predators to prevent livestock killing. [1-5]

**Q3.23** My community feels I should not kill predators to prevent livestock killing. [1-5]

**Q3.24** The people I care about kill predators to prevent livestock killing. [1-5]

**Q3.25** People expect me not to kill predators to prevent livestock killing. [1-5]

**Q3.26** In the last 5 years, how many times did you kill or try to kill predators to prevent livestock killing?

**Q3.27** Community elders think it is very important for me to control predators. [1-5]

**Q3.28** My friends think it is very important for me to control predators. [1-5]

**Q3.29** How many people in your area control predators?

All (1)            A lot (2) A moderate amount (3)  
A little (4)    None (5) DON'T KNOW (6)

**Q3.30** How many people in other areas of Kenya control predators? [1-6]

**Q3.31** How many successful/wealthy Kenyan livestock owners control predators? [1-6]

**End of Block: M3. Normative Beliefs**

#### **Start of Block: M4. Control Beliefs**

**Q4.1** To kraal my livestock every night for the next two weeks would be:

Extremely easy (1)

Somewhat easy (2)

Neither easy nor difficult (3)

Somewhat difficult (4)

Extremely difficult (5)

**Q4.2** To improve my kraal would be:

EE (1) [...] ED (5)

**Q4.3** For an adult to accompany my livestock when grazing every day for the next 2 weeks would be:

EE (1) [...] ED (5)

**Q4.4** In the next 12 months, for me to reduce livestock deaths from disease or poor body condition would be:

EE (1) [...] ED (5)

**Q4.5** In the next 12 months, for me to reduce livestock deaths to predators would be:

EE (1) [...] ED (5)

**Q4.6** If I wanted to, I could bring my livestock into the kraal every night for the next 2 weeks.

Definitely true (1)

Probably true (2)

Neither true nor false (3)

Probably false (4)

Definitely false (5)

**Q4.7** If I wanted to, I could improve my kraal to reduce losses to predators and livestock breakouts.

DT (1) [...] DF (5)

**Q4.8** If I wanted to, an adult could accompany my livestock when grazing every day for the next 2 weeks.

DT (1) [...] DF (5)

**Q4.9** If I wanted to, I could reduce livestock deaths to disease or poor body condition in the next 12 months.

DT (1) [...] DF (5)

**Q4.10** If I wanted to, I could reduce livestock deaths to predators in the next 12 months.

DT (1) [...] DF (5)

**Q4.11** I can get materials to improve my boma. Strongly agree (1) [...] Strongly disagree (5)

**Q4.12** I can access vaccination and veterinary services for my livestock.

Strongly agree (1) [...] Strongly disagree (5)

**Q4.13** For me to kill predators that kill my livestock would be:

EE (1) [...] ED (5)

**Q4.14** For me to kill predators without getting into trouble with the authorities would be:

EE (1) [...] ED (5)

**Q4.15** If I wanted to, I could kill the predators that kill my livestock.

DT (1) [...] DF (5)

**Q4.16** If I wanted to, I could kill predators without getting into trouble with the authorities.

DT (1) [...] DF (5)

#### **End of Block: M4. Control Beliefs**

### **Start of Block: M5. Global Attitudes**

**Q5.1** For me to herd my livestock every day in the forthcoming month would be:

Harmful (1)                      Slightly harmful (2)  
Neither harmful nor beneficial (3)  
Slightly beneficial (4)    Beneficial (5)

**Q5.2** For me to herd my livestock every day in the forthcoming month would be:

Enjoyable (1)  
Somewhat enjoyable (2)  
Neither enjoyable nor unenjoyable (3)  
Somewhat unenjoyable (4)  
Unenjoyable (5)

**Q5.3** For me to kraal my livestock overnight every night in the forthcoming month would be:

Harmful (1) [...] Beneficial (5)

**Q5.4** For me to kraal my livestock overnight every night in the forthcoming month would be:

Enjoyable (1) [...] Unenjoyable (5)

**Q5.5** The presence of predators in this area is:

Harmful (1) [...] Beneficial (5)

**Q5.6** The presence of predators in this area is:

Enjoyable (1) [...] Unenjoyable (5)

**Q5.7** The interaction between predators and people in this area is:

Harmful (1) [...] Beneficial (5)

**Q5.8** The interaction between predators and people in this area is:

Enjoyable (1) [...] Unenjoyable (5)

**Q5.9** Generally, the presence of wildlife in this area is:

Harmful (1) [...] Beneficial (5)

**Q5.10** Generally, the presence of wildlife in this area is:

Enjoyable (1) [...] Unenjoyable (5)

**Q5.11** For me to kill predators that kill my livestock would be:

Harmful (1) [...] Beneficial (5)

**Q5.12** For me to kill predators that kill my livestock would be:

Enjoyable (1) [...] Unenjoyable (5)

**Q5.13** For all predators in this area to be killed in the next 5 years would be:

Harmful (1) [...] Beneficial (5)

**Q5.14** For all predators in this area to be killed in the next 5 years would be:

Enjoyable (1) [...] Unenjoyable (5)

**Q5.15** If predators were to kill 1 livestock animal in the next 3 months, for my family this would be:

Extremely bad (1)              Somewhat bad (2)  
Neither good nor bad (3)  
Somewhat good (4)              Extremely good (5)

**Q5.16** If disease were to kill 1 livestock animal in the next 3 months, for my family this 'ld be:

Extremely bad (1) [...] Extremely good (5)

**Q5.17** If predators were to kill 10 livestock animals in the next 12 months, for my family this would be:

Extremely bad (1) [...] Extremely good (5)

**Q5.18** If disease were to kill 10 livestock animals in the next 12 months, for my family this 'ld be:

Extremely bad (1) [...] Extremely good (5)

### **End of Block: M5. Global Attitudes**

**Start of Block: M6. Affect and Cognition****Q6.1** How much do activities to do with livestock management make you feel: \_\_\_\_

|                | None (1) | A little (2) | Medium (3) | A lot (4) |
|----------------|----------|--------------|------------|-----------|
| Interested (1) |          |              |            |           |
| Excited (2)    |          |              |            |           |
| Upset (3)      |          |              |            |           |
| Strong (4)     |          |              |            |           |
| Proud (5)      |          |              |            |           |
| Calm (6)       |          |              |            |           |
| Afraid (7)     |          |              |            |           |
| Angry (8)      |          |              |            |           |

**Q6.2** How much do activities to do with predators and predator control make you feel: \_\_\_\_

|                | None (1) | A little (2) | Medium (3) | A lot (4) |
|----------------|----------|--------------|------------|-----------|
| Interested (1) |          |              |            |           |
| Excited (2)    |          |              |            |           |
| Upset (3)      |          |              |            |           |
| Strong (4)     |          |              |            |           |
| Proud (5)      |          |              |            |           |
| Calm (6)       |          |              |            |           |
| Afraid (7)     |          |              |            |           |
| Angry (8)      |          |              |            |           |

**Q6.3** I am good at managing my livestock.

Strongly agree (1)

Somewhat agree (2)

Neither agree nor disagree (3)

Somewhat disagree (4)

Strongly disagree (5)

**Q6.4** I am good at preventing predators from killing livestock.

Strongly agree (1) [...] Strongly disagree (5)

**Q6.5** It is important to kraal my livestock.

Strongly agree (1) [...] Strongly disagree (5)

**Q6.6** It is important to herd my livestock.

Strongly agree (1) [...] Strongly disagree (5)

**Q6.7** Improving my kraal would reduce the killing of livestock by predators.

Extremely likely (1)

Somewhat likely (2)

Neither likely nor unlikely (3)

Somewhat unlikely (4)

Extremely unlikely (5)

**Q6.8** Sending an experienced adult instead of a child to herd my livestock would reduce livestock killing by predators.

Extremely likely (1)

Somewhat likely (2)

Neither likely nor unlikely (3)

Somewhat unlikely (4)

Extremely unlikely (5)

**Q6.9** Killing predators would decrease the number of my livestock that are killed by predators.

Extremely likely (1)

Somewhat likely (2)

Neither likely nor unlikely (3)

Somewhat unlikely (4)

Extremely unlikely (5)

**Q6.10** Killing predators is a more effective way of protecting livestock than herders or kraals.

Strongly agree (1) [...] Strongly disagree (5)

**Q6.11** If I report predation of my livestock to the authorities, they will respond appropriately.

Extremely likely (1)

Somewhat likely (2)

Neither likely nor unlikely (3)

Somewhat unlikely (4)

Extremely unlikely (5)

**Q6.12** I will receive some kind of compensation for any livestock killed by predators

Extremely likely (1)

Somewhat likely (2)

Neither likely nor unlikely (3)

Somewhat unlikely (4)

Extremely unlikely (5)

**Q6.13** Vaccinating livestock against diseases or veterinary assistance would reduce livestock deaths.

Strongly agree (1) [...] Strongly disagree (5)

**End of Block: M6. Affect and Cognition**

### **Start of Block: M7. Motivation**

**Q7.2** Livestock management is very challenging.  
Strongly agree (1) [...] Strongly disagree (5)

**Q7.3** I feel safe when managing livestock.  
Strongly agree (1) [...] Strongly disagree (5)

**Q7.4** The conditions of managing my livestock are good.  
Strongly agree (1) [...] Strongly disagree (5)

**Q7.5** Livestock management allows me to plan how to do my work.  
Strongly agree (1) [...] Strongly disagree (5)

**Q7.6** Livestock management gives me a lot of independence and freedom.  
Strongly agree (1) [...] Strongly disagree (5)

**Q7.7** The way I manage my livestock has a large effect on the number that die of disease.  
Strongly agree (1) [...] Strongly disagree (5)

**Q7.8** How I manage my livestock has a large effect on the number that are killed by predators.  
Strongly agree (1) [...] Strongly disagree (5)

**Q7.9** I use my skills when managing livestock.  
Strongly agree (1) [...] Strongly disagree (5)

**Q7.10** I feel that livestock management is important.  
Strongly agree (1) [...] Strongly disagree (5)

**Q7.11** Other people need me to manage my livestock effectively.

Strongly agree (1) [...] Strongly disagree (5)

**Q7.12** Preventing livestock predation is very challenging.  
Strongly agree (1) [...] Strongly disagree (5)

**Q7.13** I feel safe when carrying out predator control.  
Strongly agree (1) [...] Strongly disagree (5)

**Q7.14** I enjoy being involved in predator control.  
Strongly agree (1) [...] Strongly disagree (5)

**Q7.15** Predator control allows me to make a lot of decisions on my own.  
Strongly agree (1) [...] Strongly disagree (5)

**Q7.16** The way I do predator control has a large effect on the number of my livestock that are killed by predators.  
Strongly agree (1) [...] Strongly disagree (5)

**Q7.17** I use my skills when controlling predators.  
Strongly agree (1) [...] Strongly disagree (5)

**Q7.18** I feel that predator control is important.  
Strongly agree (1) [...] Strongly disagree (5)

### **End of Block: M7. Motivation**

**Start of Block: M8. Schemas**

**Q8.1** It is rewarding to practice good livestock management. SA (1) [...] SD (5)

**Q8.2** Livestock management requires skill.  
Strongly agree (1) [...] Strongly disagree (5)

**Q8.3** If I manage my livestock well, I can support everything my family needs. SA (1) [...] SD (5)

**Q8.4** Livestock is very important to me and my community. SA (1) [...] SD (5)

**Q8.5** If you are a livestock owner, you are respected more in my community than those who do not own livestock. SA (1) [...] SD (5)

**Q8.6** If my livestock are in poor condition, my community will disapprove. SA (1) [...] SD (5)

**Q8.7** Leader/authority figures in Kenya understand that livestock is very important to people in this community. SA (1) [...] SD (5)

**Q8.8** I have enough land for my livestock.  
SA (1) [...] SD (5)

**Q8.9** The Kenyan government treats livestock owners well. SA (1) [...] SD (5)

**Q8.10** Livestock and wildlife can coexist, if managed correctly. SA (1) [...] SD (5)

**Q8.11** The wildlife in this area has no effect on the way I manage my livestock. SA (1) [...] SD (5)

**Q8.12** A lot of livestock in this region is killed by predators. SA (1) [...] SD (5)

**Q8.13** If livestock is managed correctly, it is not killed by predators. SA (1) [...] SD (5)

**Q8.14** Conflict with predators is a threat to livelihood in this area. SA (1) [...] SD (5)

**Q8.15** I am afraid predators will kill my livestock. SA (1) [...] SD (5)

**Q8.16** My community benefits from tourism.  
SA (1) [...] SD (5)

**Q8.17** Predators are an important part of the natural environment. SA (1) [...] SD (5)

**Q8.18** Predator killing is important in my culture. SA (1) [...] SD (5)

**Q8.19** If someone in my community kills a predator, they will be respected more than if they did not. SA (1) [...] SD (5)

**Q8.20** If I kill a predator, I can also sell its body parts. SA (1) [...] SD (5)

**Q8.21** Wildlife in this area belongs to the community. SA (1) [...] SD (5)

**Q8.22** Predators are the responsibility of the community. SA (1) [...] SD (5)

**Q8.23** Predators are the responsibility of the government. SA (1) [...] SD (5)

**Q8.24** Kenya benefits from the presence of wildlife. SA (1) [...] SD (5)

**Q8.25** My community benefits from the presence of wildlife. SA (1) [...] SD (5)

**Q8.26** I benefit from the presence of wildlife.  
SA (1) [...] SD (5)

**End of Block: M8. Schemas**

# Everyone is normal: Consistent livestock management norms and demographic clusters in Kenya and Zimbabwe

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## Abstract

Human behavior often determines the success of conservation projects, and the emerging discipline of conservation psychology focuses on understanding and influencing this behavior. Social norms (a group's perception of the appropriateness of behaviors) are a key influence on human behavior, and social norms campaigns can often engender population-wide behavior changes. Human-predator conflict is a major conservation issue, and one in which human behavior plays a substantial role: high standards of livestock management can considerably lower predation levels. In this paper, we use factor analysis to show that the livestock management normative belief structure of rural livestock owners is highly conserved between populations in Kenya and Zimbabwe. Through cluster analysis, we also show that qualitatively distinct attitudinal groups can be identified, and that some of these groups are common to both regions. Researchers often assume that social landscapes are unique, but we show that this is not the case for livestock management norms. People's attitudes are also generally assumed to be site-specific, but we found commonalities across different regions, indicating that certain attitude sectors may be present in all livestock-owning populations. If livestock management norms and attitude groups are indeed highly conserved between regions, it may be possible to develop standardized tools with which to understand the norms that influence livestock management behavior, and identify population sectors for targeted interventions. Often, conservation projects have little in-house social science expertise, and social studies are avoided despite the benefits they bring. Here, we demonstrate that standardized approaches may be possible, and could aid the implementation—and success—of conservation interventions.

## KEYWORDS

conservation psychology, livestock management, human–wildlife conflict, livestock predation, social norms

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## 1 | INTRODUCTION

Various factors govern how people behave, and social and behavioral psychology explore these factors. Growing bodies of work outside psychology are also devoted to exploring decision-making as it relates to specific activities: behavioral economics, for example, explores individual decision-making (Earl, 1990), sociological research examines how culture influences social behavior (Giddens, Duneier, Appelbaum, & Carr, 1991); and market research focuses on people's preferences and the reasons behind them (Sarstedt & Mooi, 2014). Although human decision-making and behaviors impact everything from recycling to poaching, relatively little research in the conservation realm has explored the psychological and social processes that impact conservation issues.

One of the key psychological influences on human behavior are social norms, which can be defined as a group's perceptions of the social appropriateness of behaviors: how people believe others behave, and in turn how others perceive their own behavior (Cialdini & Trost, 1998). At their core, norms influence behavior by indicating to individuals that a particular choice is common (and therefore desirable), or uncommon (and therefore undesirable). These social standards have pervasive impacts across all arenas of life, often with serious consequences: men with rigid perceptions of masculinity are more likely to be violent towards their partners (Barker, Ricardo, Nascimento, Olukoya, & Santos, 2010), and public acceptance of military force is leading to a gradual proliferation of private military companies (Krahmann, 2013). Campaigns to influence social norms can be effective at eliciting behavior change, and have been credited with reducing drinking (Perkins & Berkowitz, 1986); decreasing sexism (Kilmartin et al., 2008); and reducing risk of suicide (Silk, Perrault, Nazione, Pace, & Collins-Eaglin, 2017). As a powerful tool for understanding and influencing behavior, norms have huge applicability to conservation issues, and have been successfully used to promote energy conservation (Wong-Parodi, Krishnamurti, Gluck, & Agarwal, 2019) and charitable giving (Lindersson, Guntell, Carlsson, & Agerström, 2019).

For predator conservation in many parts of Africa, livestock predation and the associated conflict with predators lead to various human-wildlife conflict (HWC) issues: predation of livestock is a significant source of hardship for families (Thirgood, Woodroffe, & Rabinowitz, 2005), and retaliatory killings can have significant impacts of predator populations (Kissui, 2008). Poor livestock management practices often contribute to

these issues, and a variety of management techniques including daytime herding, overnight shelters, and live-stock guardian animals have been shown to reduce losses to predators (Loveridge et al., 2017; Ogada, Woodroffe, Ouge, & Frank, 2003; Potgieter, 2011). However, despite the benefits brought by these approaches, communities can be resistant to implementing them, and mechanisms to increase uptake are needed. Previous work has shown that live-stock management decisions can be modelled using a psychological framework, and suggested that normative beliefs may influence individuals' livestock management decisions (Perry, Moorhouse, Loveridge, & Macdonald, 2019). In this paper, we explore whether studying the normative beliefs of livestock managers can provide information that is useful in the design of effective interventions to improve husbandry and reduce conflict with predators. To establish how easily norm surveys can be used in different locations, we first investigate regional variation in normative belief structure. Understanding norm stratification may be key to designing effective social norms campaigns, which identify and target different sectors of a population. To understand if—and how—populations can be stratified in this way, we then explore clustering in the survey population, to understand how different demographic, social, and attitude factors may influence individuals' normative beliefs.

## 2 | METHODS

### 2.1 | Study areas

Two regions were selected for this study: western Zimbabwe, on communal land adjacent to Hwange National Park (HNP), and southern Kenya, along the Tanzanian border. The area around HNP is characterized by low fertility soils and erratic rainfall. Subsistence farming of maize (*Zea mays*), sorghum (*Sorghum bicolor*) and millet (*Pennisetum glaucum*) are the main agricultural activities (Guerbois, DUFOUR, Mtare, & Fritz, 2013). This area has historically benefitted from wildlife tourism, but Zimbabwe's ongoing economic and political crises have vastly diminished the tourism industry (Guerbois et al., 2013). Culturally, the people are a mix of Ndebele, Nambya, and some Tonga, and have been politically and socially marginalized in Zimbabwe (Eppel, 2008). People around Hwange keep cattle (*Bos taurus*), donkeys (*Equus asinus*), and some small stock, and the Ndebele people in particular have a long history of livestock production (Loveridge, Kuiper, et al., 2017). The largest national park in Zimbabwe, HNP has populations of lion

(*Panthera leo*), leopard (*Panthera pardus*), and other predators.

In Kenya, data were collected across the South Rift area and the Tsavo-Amboseli ecosystem, which lie along the Tanzanian border. Across the region, rainfall is low and bimodal, and soil types range from swamp and waterlogged grumosols to sandy and arid; overall, the area can be described as arid to semi-arid (Schuette, Wagner, & Creel, 2013). Traditionally, people in the area are pastoralists, and make use of shifting wet/dry season grazing patterns to accommodate the seasonal landscape. However, sedentarization and land fragmentation have been occurring since the 1960s, and influx of immigrant crop farmers contributes to the changing landscape (Kioko & Okello, 2010). The area is predominantly Maasai, and livestock management is largely traditional. Southern Kenya holds some of the country's most visited national parks, including the Maasai Mara, Amboseli, and Tsavo. The area is a largely contiguous rangeland system, with resident populations of predators.

Southern Kenya and western Zimbabwe experience locally high levels of conflict with predators, typically as a consequence of livestock predation (Hazzah et al., 2014; Loveridge, Valeix, Elliot, & Macdonald, 2017; Western, 2017). Both regions have strong cultural ties to livestock production, but traditional livestock management techniques are notably different, as are modern changes to management, with agro-pastoralism and sedentarization the primary changes in Zimbabwe and Kenya respectively. In both areas, a significant proportion of livestock predation occurs at night; to reduce the vulnerability of livestock animals, they are often brought into overnight shelters (here referred to as “bomas”). For the purposes of this study, the regions have enough similarity (in their history of livestock production, and exposure to conflict) to be comparable, and sufficient differences (ethnic backgrounds, models of livestock management, and adaptations to the 21st century) that conclusions which can be drawn across both sites—or tools which perform well in both areas—should be readily applicable to livestock management conflict situations across sub-Saharan Africa.

## 2.2 | Survey participants and collection protocol

Survey protocol was approved by the University of Oxford Social Sciences and Humanities Interdivisional Research Ethics Committee (Reference No. R53944/RE001). Survey questions were pre-translated into Maa, Kiswahili, Ndebele, and Nambya through group discursive processes, with translate-retranslate methodology

where translations were imprecise or there was poor consensus (Lucas & Ware, 1977; Perry et al., 2019). Each survey was conducted as a face-to-face structured interview by trained local research assistants, in the preferred language of the respondent. Survey responses were recorded using the Qualtrics offline survey application (Qualtrics, 2013), which formats surveys to be administered as a mobile application. Research assistants operated in their local area, using door-to-door surveying or opportunistic meetings at communal spaces, for example, markets. As this study concentrated on livestock management, all participants were or had previously been involved in livestock management, through owning, herding, or otherwise attending to livestock, and were over the age of 16. Although livestock management is relatively gendered in both Kenya and Zimbabwe, and it is uncommon for women to be responsible for livestock, in this study all participants are or were livestock managers; often, female respondents were the heads of their respective households as either single parents or widows. Data used in this paper were collected as part of a larger survey, which was conducted between March and September 2018 in Kenya, and October 2018 and January 2019 in Zimbabwe. Data collection was constrained by the field seasons in each location, and sample sizes were not representative of the total population size. Overall, we collected 740 and 242 usable sets of data from Kenya and Zimbabwe, respectively.

## 2.3 | Survey design

The principal survey components used in this study related to demographic and social attributes, and normative beliefs. Demographic components ( $n = 6$ ) were age, sex, ownership of livestock, education, social standing, and access to food. Normative components ( $n = 14$ ) concerned perceptions of herding, use of an overnight shelter (boma), local livestock management standards, and persecution of predators. For normative questions, responses took the form of either a 5-point Likert scale (strongly agree, agree, neither agree nor disagree, disagree, strongly disagree), or a 5-point quantity scale (all, a lot, a moderate number, a few, none; see Table 1). Normative belief questions covered the core normative belief types: injunctive norms (socially demanded/forbidden; (Cialdini & Trost, 1998)); descriptive norms (prevalence of behavior; (Cialdini & Trost, 1998)) and subjective norms (behavior or opinions of key actors or groups; (Ham, Jeger, & Frajman Ivković, 2015); here we consider family, friends, community leaders, and wealthy citizens of the respective countries as key

**TABLE 1** Normative belief questions

| Statement                                                                  | Norm type   | Response code |
|----------------------------------------------------------------------------|-------------|---------------|
| My community feels my livestock should be brought into a Boma every night. | Injunctive  | Likert        |
| People expect me to bring my livestock into a Boma every night.            | Descriptive | Likert        |
| The people I care about bring their livestock into a Boma every night.     | Subjective  | Likert        |
| My community feels my livestock should be herded every day.                | Injunctive  | Likert        |
| People expect I will herd my livestock every day.                          | Descriptive | Likert        |
| The people I care about herd their livestock every day.                    | Subjective  | Likert        |
| Community elders think it is important for me to manage my livestock well. | Subjective  | Likert        |
| My friends think it is very important for me to manage my livestock well.  | Subjective  | Likert        |
| How many people in your community manage their livestock well?             | Descriptive | Quantity      |
| How many people in other areas manage their livestock well?                | Descriptive | Quantity      |
| How many wealthy/successful Kenyans manage their livestock well?           | Descriptive | Quantity      |
| My community feels I should kill any predators that kill livestock.        | Injunctive  | Quantity      |
| The people I care about kill predators that kill livestock.                | Subjective  | Quantity      |
| People expect that I will kill any predators that kill my livestock.       | Descriptive | Quantity      |

*Note:* Injunctive norms relate to behavior that a group considers obligatory: *should/should not*. Descriptive norms relate to behavior that a group believes is taking place: *do/do not*. Subjective norms relate to the behavior or opinions of key individuals/groups, for example, family or community elders. Likert codes: strongly agree; agree; neither agree nor disagree; disagree; strongly disagree. Quantity codes: all; a lot; a moderate number; a few; none. Response codes were tested in both regions for comprehension and meaning.

referents). Survey components regarding control beliefs ( $n = 10$ ) were also used in part A (see supplementary materials).

## 2.4 | Data analysis

All analysis was carried out using the free statistical software R, version 3.5.1 (Team, 2015). R packages which were used are noted where relevant.

### 2.4.1 | Part a: Normative belief structures in Kenya and Zimbabwe

We wished to explore whether the structure of normative beliefs was the same in Kenya and Zimbabwe, using data on livestock management norms and control beliefs. Psychological beliefs cannot be measured directly; instead survey questions are mapped against underlying latent beliefs using Factor Analysis, a form of Principal Components Analysis (“psych”, (Revelle & Revelle, 2015)). For this analysis, we used a subset of the normative belief survey questions that excluded the predator control questions, which we expected to vary more between regions, and were not central to the core norms survey ( $n = 11$ ). We determined the factor structure of normative beliefs in the Kenyan data using a Factor Analysis with varimax rotation, which rotates the factors in multi-dimensional space to identify the simplest factor mapping. To compare belief structures, we constrained each data set to a standardized number of factors, and then compared the characteristics of these factors between the two different data sets. As four factors fitted the Kenyan data best, and this was the larger data set, we also constrained the Zimbabwe data to four factors. The factor sets from the Kenyan and Zimbabwean data were then compared for attribute similarity using a Tucker coefficient test (R package “RegularizedSCA,” (Gu & Van Deun, 2017)). With this test, a similarity of  $\geq 0.95$  indicates factor structures are virtually identical; 0.85–0.94 is considered a fair fit, and  $< 0.85$  indicates no significant similarity. We also carried out the same process with the control belief data ( $n = 10$ ) from both Kenya and Zimbabwe, to examine whether all psychological factor structures had a comparable level of similarity between regions.

### 2.4.2 | Part B: Normative belief clusters in Kenya and Zimbabwe

In this analysis, we wished to examine whether social, demographic, or attitude-based attributes could be used to describe qualitatively different normative attitude types. To do so, we used all normative questions from the survey ( $n = 14$ ), and applicable demographic questions ( $n = 6$ ). Data units were then scaled, and a cluster analysis performed (“cluster”, (Maechler, Rousseeuw, Struyf,

Hubert, & Hornik, 2012)). To determine the optimal number of clusters, we ran all suitable methods for determining optimal cluster number (“factoextra,” (Kassambara & Mundt, 2017); “NbClust,” (Charrad, Ghazzali, Boiteau, & Niknafs, 2012)). Across 23 different methods, seven approaches recommended using two clusters, and five recommended six clusters; however, averaging across all methods, a higher number of clusters was statistically recommended (mean cluster recommendation = 6.6). We therefore deemed six the most appropriate number of clusters. Data were clustered using the Partitioning Around Medoids method.

Using R package “compareGroups” (Subirana, Sanz, & Vila, 2014), we performed a univariate analysis, with cluster allocation as the response variable, to explore the statistical importance of different terms in allocating observations to each cluster. We also described each cluster qualitatively, and performed *t*-tests, where relevant, to understand the differences between individual clusters.

### 3 | RESULTS

#### 3.1 | Part A: Normative belief structures in Kenya and Zimbabwe

To understand regional variation in normative beliefs, we compared belief structures in Kenya and Zimbabwe. Our survey recorded participants' responses to normative statements such as “my community feels I should bring

my livestock into a boma every night.” Factor analysis of the Kenyan data revealed that normative questions mapped onto four factors (see Table 2). Factor analysis was then performed on the Zimbabwean data, with the analysis was constrained to produce four factors. A Tucker coefficient test showed a similarity of 0.95 between the two factor structures. This is highly similar, and these livestock management normative belief structures can be considered virtually identical. The same analytical approach was carried out using control beliefs, and yielded a Tucker coefficient of 0.79, so control belief structures between the two sites have no measurable similarity. We conclude that normative belief structures are unusually conserved, and therefore approaches using norms to promote effective livestock management may be highly transferrable.

#### 3.2 | Part B: Normative belief clusters in Kenya and Zimbabwe

Individual normative beliefs are not homogenous within a community; we used cluster analysis to understand whether our respondents could be classified into groups of like-minded individuals. Compiling all normative beliefs from Zimbabwe and Kenya, our cluster analysis revealed six relatively distinct clusters, each with different normative beliefs (see Figure 1). To understand the factors that most differed across the clusters, we ran a univariate analysis. All terms, including demographic, social, and normative terms ( $n = 21$ ) emerged as

**TABLE 2** Attitude factors

| Factor   | Description                                                             | Example                                                                         |
|----------|-------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| Factor 1 | Herding and perceptions of community management                         | People expect I will herd my livestock every day.                               |
| Factor 2 | Perceptions of livestock management locally, regionally, and nationally | Community elders think it is very important for me to manage my livestock well. |
| Factor 3 | Boma use norms                                                          | My community feels my livestock should be brought into a Boma every night.      |
| Factor 4 | Perceived behavior of loved ones                                        | The people I care about herd their livestock every day.                         |

*Note:* Factor mapping of normative livestock management behavior questions, using all Kenyan data. Each factor represents a distinct attitude dimension, onto which a set of specific questions map.

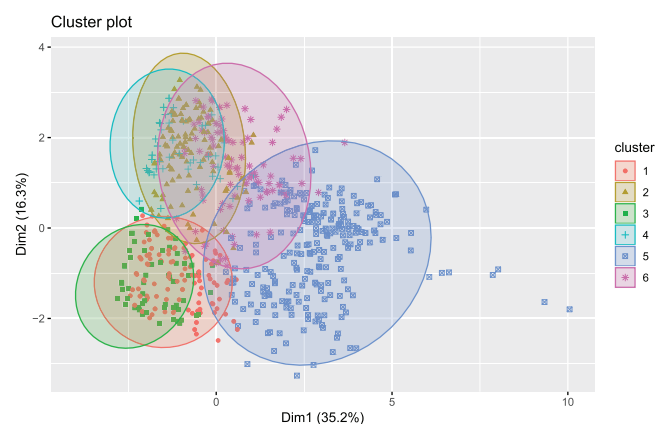


**FIGURE 1** Normative belief clusters. A total of  $n = 980$  samples, from across southern Kenya and north-western Zimbabwe are plotted using a partitioning around medoids approach. Dimensions 1 and 2 account for a total of 51.5% of total variation; other dimensions not shown on plot. Clusters named as follows: 1—Kenyan traditionalist leaders; 2—Educated modernists; 3—Disadvantaged defenders; 4—Alternative livelihoods; 5—Disadvantaged and disgruntled; 6—Educated, sceptical women

significant ( $p < .05$ ); however, predator killing (both subjective and descriptive terms), country, sex, leadership, and access to food were all highly significant ( $p < .001$ ). Due to the statistical favorability of a smaller number of factors, the "country" term should be viewed proxy for all the social and cultural differences between Kenya and Zimbabwe which are otherwise unaccounted for. In individual clusters, terms had varying importance in their ability to characterize the group. We compared cluster characteristics and performed  $t$ -tests to understand how these salient characteristics differed by cluster.

### 3.2.1 | Cluster 1: Kenyan traditionalist leaders

Slightly older, mostly Kenyan men (92.1% male, vs 76.0% in the overall data,  $t$  test:  $p < .001$ ; 98.4% Kenyan; 12.1% of respondents 69–81, vs 7.4% in the general data), often in positions of leadership (46.3% vs 31.4% in overall data,  $t$ -test:  $p < .001$ ). These individuals strongly agreed with all predator-killing norms (e.g., 96.3% agreed or strongly agreed that "my community feels I should kill any predators that kill livestock" vs. 51.3% overall,  $t$ -test:  $p < .001$ ). All predator-killing norms were statistically stronger in this cluster than the general population. This cluster may represent individuals who practice traditional Maasai pastoralism and predator control, who may often be in positions of local esteem.

### 3.2.2 | Cluster 2: Educated modernists

This cluster had an approximately even number of Zimbabweans and Kenyans (Zimbabweans = 55.9%). This group was relatively educated, and only 20.6% of members had never attended school (compared to 38.1% in the general population;  $t$ -test:  $p < .001$ ); there was also a greater instance of higher education, with 28.7% of respondents having attended secondary school (vs 21.0% overall;  $t$ -test:  $p < .001$ ), and 6.6% having attended university (2.5% overall;  $t$ -test:  $p = .03$ ). However, despite this, they hold relatively few leadership roles (19.9%, vs 31.4% overall;  $t$ -test:  $p < .001$ ). They were cautious in their judgement of livestock production standards, and agreed less than average with statements such as "Kenyans/Zimbabweans carry out good livestock management" ( $p < .001$ ). They were also less accepting of predator control norms than average; for example, only 11% of respondents agreed or strongly agreed that "people expect that I will kill any predators that kill my livestock," compared to 45.7% at large. All predator control norms were less supported by this group than the

overall population (all  $t$ -test:  $p < .001$ ). We believe this cluster represents individuals with somewhat educated, modern values, who place relatively little value on traditional livestock management, and may understand the benefits wildlife—including predators—can bring to communities.

### 3.2.3 | Cluster 3: Disadvantaged defenders

This cluster was Kenya- and male-skewed (95.4% men, compared to 75.6% overall;  $t$ -test:  $p < .001$ ), with lower education levels (71.1% never attended school, compared to 35.6% at large;  $t$ -test:  $p < .001$ ). This group had very strong beliefs that local, regional, and national livestock management are of high standard: 93.4, 89.5, and 90.1% thought that all members of each respective group "manage their livestock well", compared to the general population results of 43.5, 33.1, and 36.3%, respectively (all  $t$ -test:  $p < .001$ ). In a perhaps related component of their psychology, this cluster also exhibited strong support for predator killing, strongly agreeing with the injunctive (should: 87.5%), descriptive (do: 80.9%), and subjective (key people/groups: 71.1%) norms regarding "kill[ing] predators that kill livestock," compared to 31.4, 26.8, and 25.8% of the sample overall. Although similar to Cluster 1, this group did not benefit from the advantages of the first group, for example, leadership roles. With their strong normative traditional practices, we characterize this group as typical male community members in traditional roles, who are defensive of their way of life, and may be unable access to other opportunities.

### 3.2.4 | Cluster 4: Alternative livelihoods

This group had a near-even split between Zimbabweans (56.2%) and Kenyans. Despite few members being in positions of leadership (17.1% vs 31.4% overall;  $t$ -test:  $p < .001$ ), members of this cluster experienced significantly fewer incidences of food shortage than participants overall (20 vs 51.7%;  $t$ -test:  $p < .001$ ), but lower livestock ownership rates (12.4% had no livestock at all, vs 3.8% overall;  $t$ -test:  $p < .001$ ); this may indicate that they produce their own crops, or have secure alternative sources of employment. They were broadly against predator control, and in answer to the same questions regarding injunctive, subjective, descriptive, and norms about predator killing, only 26.7, 6.7, and 1.0% of people respectively strongly agreed with normative statements, compared to 31.4, 25.8, and 26.8% in across all the data (all differences

$t$ -test:  $p < 0.001$ ). These individuals are similar to those in Cluster 2, but overall have lower educational levels, higher food security, and lower levels of livestock ownership.

### 3.2.5 | Cluster 5: disadvantaged and disgruntled

This group had a higher than expected proportion of women (37.5 vs 24% overall;  $t$ -test:  $p < .001$ ), were slightly younger than average (mean age group of 3.6, rather than 3.8;  $t$ -test:  $p = .12$ ), and experienced elevated food shortages (69.1 vs 51.7% overall;  $p < .001$ ). Their normative beliefs regarding livestock management practices and standards were less strict than the overall results. For example, strong agreement with the injunctive statements such as “my community feels my livestock should be brought into a boma every night” (22.0%), or descriptive norms such as “people expect I will herd my livestock every day” (11.3%) were much lower than on the overall sample (which supported these examples at 71.8 and 63.0%, respectively). All herding and boma use statements ( $n = 6$ ) had statistically significantly less support from this group ( $t$ -tests, all  $p < .001$ ). We suggest that this cluster has relatively weak ties to, but are necessarily still reliant on, traditional livestock management. They have similarities with Cluster 3 in terms of social disadvantage, but showed relatively less defense of their existing lifestyles, so may be more open to alternative employment or management approaches.

### 3.2.6 | Cluster 6: Educated, skeptical women

With the highest proportion of women of all clusters (42.6 vs 24.0%); and a similarly elevated proportion of Zimbabweans (64.8 vs 24.6% overall), this group was highly distinct. They were overall more educated (school was bracketed; mean of 2.3 vs 1.9 overall;  $t$ -test:  $p < .001$ ) than the respondents at large. Similarly to Cluster 5, they showed low confidence in local livestock management practices, and all norms were less strict (e.g., low agreement with statements such as “my community feels my livestock should be herded every day”) than in the overall population (all  $t$ -test:  $p < .001$ ). They also had low confidence in management standards, with significantly lower estimates of the proportion of individuals who carried out good livestock management locally, regionally, and nationally than the overall survey population ( $t$ -test:  $p < .001$ ). They also showed less acceptance or support for predator killing norms than expected, with only 13.9,

13.0, and 6.5% agreement with injunctive, descriptive, and subjective predator-killing norms, versus 51.3, 45.7, and 42.3%, respectively, for the entire sample ( $t$ -tests, all  $p < .001$ ). This group condemned local livestock management the most strongly of all clusters; with high education levels and more female participants, we suggest this group may be modern in outlook, and may either wish to have greater support in their livestock management, or find livelihood alternatives.

## 4 | DISCUSSION

To achieve conservation aims, human behavior change is often necessary; despite this, behavioral psychology is seldom integrated into conflict mitigation activities (Baynham-Herd, Redpath, Bunnefeld, Molony, & Keane, 2018). Even where psychology is integrated into intervention planning, achieving behavioral change is difficult. Normative beliefs are one of the key psychological factors that influence behavior, and therefore understanding norms may be critical to designing effective behavioral interventions. In this study, we investigated the structure of normative beliefs in two different populations of livestock owners, to explore whether interventions using norms may be useful in the context of livestock management in sub-Saharan Africa. For most conservation projects, planning, conducting, and analyzing a survey to understand local norms may not be within their in-house capability, so standardized tools are needed if such an approach is to be recommended. We found that livestock management normative belief structures were virtually identical on two very different sites, suggesting that relatively little work is needed to develop semi-standardized tools for exploring local norms.

Another challenge in designing effective conflict interventions is understanding the different social and psychological properties of a population. Human communities are highly heterogeneous, and understanding these nuances may improve the success of conservation initiatives by facilitating targeted interventions. In this study we sought to understand the factors that differentiate sectors of a population, and define psychologically distinct groups using the same normative survey across both study regions. Compiling all normative and demographic questions in the survey, we found that six clusters emerged from the data: “Kenyan traditionalist leaders,” who had traditional perspectives on predator killing and husbandry; “educated modernists,” who were well-qualified and had little interest in predator control; “disadvantaged defenders,” who were defensive of their way of life, but socially disadvantaged; “alternative livelihoods,” who kept few livestock, and engaged with

alternative opportunities; “disadvantaged and disgruntled,” who had access to few opportunities, but were disenfranchised from traditional lifestyles; and “educated sceptical women,” who had little enthusiasm for traditional approaches to livestock husbandry. All core survey questions ( $n = 21$ ) were marginally significant in distinguishing groups, but six terms were highly significant: sex, country, positions of leadership, access to food, and both descriptive and subjective normative beliefs regarding predator killing; in this study, these attributes were key to characterizing the normative belief position of individual respondents.

Overall, two core groups—“traditional leaders,” and “disadvantaged defenders”—were dominated by Kenyan individuals. This may be a result of a distinctly larger Kenyan sample, but regardless, these groups are representative mostly of Kenyan social clusters; with a larger sample size from Zimbabwe, similar groups may emerge. Many Maasai practices, for example seasonal grazing, have considerable conservation value, however modernization of the Maasai—and loss of some of their traditions—is to some extent assumed to be inevitable. Yet the strength of these groups demonstrates how strong Maasai culture remains in the areas included in this survey. Indeed, reinforcing and reinterpreting traditional Maasai practices can be a powerful tool for conservation, for example lion guardian programs, where individual *morans* (warriors) are employed to monitor and protect lions, rather than spearing them (Goldman, de Pinho, & Perry, 2013). Similarly, many conservation entities encourage “cattle banking” (Bote, Mago, & Hofisi, 2014) where individuals can “deposit” their livestock in a “cattle bank,” i.e., a central herd, which is then managed away from conservation areas, with the aim of reducing overgrazing and livestock-related conflicts. The strength of the normative groups in this study suggests that culture and historic practices still play a huge role in identity and behavior, and interventions should seek to integrate these traditional beliefs and behavior into conservation initiatives.

Two groups—“educated modernists” and “alternative livelihoods” had access to non-livestock sources of livelihood. Overall, these groups were critical of traditional livestock management, including predator control. This may in part be due to the “low status” of livestock management as a profession in many populations, an effect which may be exacerbated where people have received more education, as here. However, we cannot disentangle the cause and effect of low reliance on livestock and negative perception of the tasks involved in livestock production: some evidence suggests that a change of behavior may itself lead to a change of attitude (Verplanken & Wood, 2006). In other

words, respondents who themselves have moved to alternative livelihoods may have only subsequently developed poor perceptions of their former, traditional practices. Regardless, the attitudes in these groups suggest that however they came to their alternative livelihoods, they have no desire to return to livestock management. This suggests that transition to alternative livelihoods can result in long-term, sustained attitude change, which itself prevents a reversion to livestock management. Ephemerality of behavior change is a common limitation of interventions, but this result suggests that reduced reliance on livestock may be self-perpetuating, and programs which encourage this transition may have sustained impacts.

We found variation in the level of education received by different groups. Most notable was the presence of a distinct group of more educated Zimbabwean women, which may reflect Zimbabwe's enlightened education policies of the 1980s and 1990s (Chung, 2008). This group had a strongly negative attitude towards traditional livestock management, which may stem from its low status, or simply from the—often unmet—expectation that education would allow individuals access to professional opportunities. Another group which had a high proportion of women (“disadvantaged and disgruntled”) had a similarly negative attitude towards traditional models of livestock management. Whether women in general favor more modern livestock management strategies, dislike livestock management, or are more averse to conflict—including predator control efforts—remains to be determined. Women in the study populations traditionally have little control over livestock management decisions, and may feel low levels of ownership of this activity (Kristjanson et al., 2010). The notable difference in attitudes between female- and male-dominated clusters suggests that livestock management interventions should be adapted to specific groups. In particular, female-headed households may be amenable to using improved management techniques or alternative sources of livelihood.

Communities are often viewed as monolithic entities, but this study has illustrated that distinct social clusters are present within communities, and that these clusters have different social, demographic, and attitude-based attributes. One-size-fits-all conservation interventions are a myth, and a growing body of work shows that adapting interventions to local social conditions is critical to their success (St John, Edwards-Jones, & Jones, 2011; Waylen, Fischer, McGowan, Thirgood, & Milner-Gulland, 2010). Understanding how to divide a population into discrete units, whose members have different attitudes towards interventions may substantially improve the efficacy of said programs. From

even this brief study, certain salient results emerge: Maasai culture still has very deep roots in the attitudes of people across southern Kenya; conservation interventions must work with these beliefs to be effective, but can also target the distinct population sectors who feel there are shortcomings in the traditional lifestyle model, who emerged in Cluster 5 of this analysis. Women and female-headed households also had a distinct set of attitudes, and little appreciation of traditional livestock management; programs to provide either alternative sources of livelihood for women's groups, or encourage and support modern approaches to livestock management may prove particularly effective. While these suggestions are broad, we use them as examples to illustrate the insights that can be generated from even relatively limited social studies. The needs and issues experienced by different segments of a community are different, and therefore so are their interactions with conservation schemes; multiple approaches are needed to address the needs of these different societal groups, and targeted approaches informed by social studies are highly recommended.

A recent review of HWC interventions found that only 40% of studies recommended implementation approaches with a cognitive (i.e., behavioral psychology) component (Baynham-Herd et al., 2018). This is surprising, given the growing body of evidence which shows that psychology, particularly normative beliefs, can influence individuals' conservation-related behavior. An understanding of normative behavior is likely to be useful in designing conservation interventions. Previous research into human-predator conflict has shown that norms can partially explain intention to kill jaguars (Marchini & Macdonald, 2012), support for mountain lion protection (Davenport, Nielsen, & Mangun, 2010), and willingness to prevent conflict with leopard (Jhamvar-Shingote & Schuett, 2013). With this study, we have shown that normative beliefs relating to livestock management are highly similar between different regions, and that the same survey tool was effective in capturing local norms in both populations. In practice, this means that studies or interventions seeking to use norms to understand HWC may be able to make use of normative study "templates" to aid in the design of their approaches. While we recognize that further work is required to understand the mechanisms and optimal design of norm-based interventions, our results indicate that relatively simple, standardized norm surveys may provide critical information on the social dynamics of communities, and that integrating the resulting data into intervention design may ultimately result in more successful conservation outcomes.

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## CONFLICT OF INTEREST

The authors declare no conflict of interest.

## AUTHOR CONTRIBUTIONS

Laura R. Perry and David W. Macdonald conceived of the idea. Laura R. Perry designed and carried out data collection, aided by Lovemore Sibanda and funded by a grant held by Andrew J. Loveridge. Laura R. Perry wrote the manuscript with substantial input from Andrew J. Loveridge, and further input from all co-authors.

## DATA AVAILABILITY STATEMENT

All data deposited on Open Science Framework, under DOI: 10.17605/OSF.IO/WX6UE. Data accessible at [https://osf.io/wx6ue/?view\\_only=85f41855508545b6ae292920f47f9a39](https://osf.io/wx6ue/?view_only=85f41855508545b6ae292920f47f9a39).

## ETHICS STATEMENT

All research was carried out under University of Oxford Social Sciences and Humanities Interdivisional Research Ethics Committee (reference number R53944/RE001).

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## Chapter 2 Erratum

Page 6 of 11: Cluster 3

Summary: this group had strong norms surrounding their traditional livestock management practices. Mostly male, we consider this cluster as typical community members, who are strongly psychologically attached to their existing traditional practices, and may be either unable or unwilling to access alternative sources of livelihood or improved management techniques.

Acknowledgements, penultimate sentence.

Typo corrected: *Finally, we would like to thank all the livestock owners in Kenya and Zimbabwe who gave their time to answer our questions.*

# Supplementary Materials

## Zimbabwe Survey 26.03.18

### Start of Block: M1. Background

**Q1.1** Who is carrying out this survey?

**Q1.2** What is your age category?

<18 (1)      18-23 (2)      24-36 (3)      37-50 (4)      51-68 (5)      69-81 (6)      82+ (7)

**Q1.3** WHAT IS THE PARTICIPANT'S SEX?

Male (1)      Female (2)

**Q1.4** Does your family own livestock?      Yes (1)      No (2)

**Q1.6** Are you the main person who decides how your family's livestock is managed?

**Q1.7** Do you physically go out to manage your family's livestock?

**Q1.8** Do you physically go out to manage other people's livestock?

**Q1.9** Are you in a position of leadership?

**Q1.10** What is the furthest you have gone in school?

None (1)      Primary (2)      Secondary (3)      Tertiary (4)

**Q1.11** For how many years have you lived in the Vic Falls/Mabale/Tsholotsho area?

**Q1.12** What is the main language you speak?

What should options be?

**Q1.13** How many people are there in this family?

Adult men : \_\_\_\_\_ (1)

Adult women : \_\_\_\_\_ (2)

Children : \_\_\_\_\_ (3)

Total : \_\_\_\_\_

**Q1.14** In the last 12 months, were there times when your family did not have enough food?

**Q1.15** In the last 2 weeks, how many times have you [THE RESPONDENT] gone without food?

**Q1.16** In the last 1 week, on how many days did your family consume meat?

**Q1.17** What are your family's main sources of livelihood? [TICK ALL THAT APPLY]

Livestock production and related products (hides, milk, meat etc.) (1)

Farming of crops (2)

Casual labour (3)

Small business (arts and crafts, shop, other) (4)

Tourism-related industries (photographic or hunting) (5)

Money sent from family elsewhere (6)

Regular employment not otherwise specified (7)

Other (specify)

~~~~~  
**Q2.1** How many cattle does your family own? None

**Q2.2** How many donkeys does your family own?

**Q2.3** How many shoats does your family own?

**Q2.4** How many pigs does your family own?

**Q2.5** How many horses does your family own?

**Q2.6** In the last 12 months, how many of your family's [X] died?

Cattle (1) Donkey/mule (2) Horse (3) Goat/sheep (4) Pig (5)

**Q2.7** In the last 12 months, has your family sold any livestock? Yes (1) No (2)

**Q2.8** In the last 12 months, has your family sold any produce from your livestock?

**Q2.9** Why are you keeping livestock? [TICK ALL]

Sale of animals (1) Manure (5)

Sale of LS products (2) Transport (6)

Food for the family (3) Culture/status (7)

For cultivation (4) Savings (8)

**Q2.10** Has your family always owned livestock?

**Q2.11** For how many years has your family owned livestock?

**Q2.12** Does your family have/use a kraal?

**Q2.13** In the past 1 month, how many nights have your livestock slept in the boma?

Every night (1); Most (2); About half the time (3); Some nights (4); Never (5)

**Q2.14** How many of the livestock are brought into a boma overnight?

All (5); Most (6); About half (7); A few (8); None (9)

**Q2.15** In the last 1 month, how many days did an adult go herding?

Always (1); Most (2); About half (3); Sometimes (4); Never (5)

- Q2.16** In the last 1 month, how many days did a child go herding?
- Q2.17** In the last 1 month, how many days were the livestock accompanied by dogs?
- Q2.18** Who herds the LS most of the time? Adults (not paid)/Children/Employed herders
- Q2.19** In the last 12 months, did you hire any labour to do livestock-related work?
- Q2.20** In the last 12 months, did you buy your livestock supplementary feed?
- Q2.21** In the last 12 months, did your livestock receive any medicine or veterinary care?
- Q2.22** How many of your LS are vaccinated?  
All (1)                      Some (2)                      None (3)
- Q2.23** How often do you graze your livestock on communal land?
- Q2.24** In the last 12 months, were any of your family's livestock killed by predators?
- Q2.25** Did you report this livestock killing to anyone? Yes – who?
- Q2.26** Which predators were responsible?  
Lions (1);                      Leopard (2);                      Spotted hyaena (3);                      Wild dogs (4);  
Jackals (5);                      Don't know (6);                      Other [?] (7)
- Q2.27** In the last 12 months, how many of your family's livestock were killed by predators?  
Cattle (1); Donkeys (2); Shoats (3); Other (specify) (4)
- Q2.28** Have your family's livestock ever been killed whilst in a boma?
- Q2.29** In the last 12 months, how many animals have been killed in a boma?
- Q2.30** Have you ever killed or attempted to kill a predator?  
NOT WILLING TO RESPOND
- Q2.31** In the last 5 years, how many times have you killed or attempted to kill a predator?

- ~~~~~
- Q3.1** My community feels I should bring my livestock into a boma every night.  
Strongly agree, Agree, Neither agree nor disagree, Disagree, Strongly disagree
- Q3.2** People expect me to bring my livestock into a boma every night.
- Q3.3** The people I care about bring their livestock into a boma every night.
- Q3.4** My community feels I should herd my livestock every day.
- Q3.5** People expect I will herd my livestock every day.
- Q3.6** The people I care about herd their livestock every day.
- Q3.8** Community elders think it is very important for me to manage my LS well.

**Q3.9** My friends think it is very important for me to manage my livestock well.

**Q3.10** How many people in your community manage their livestock well?

All (1)            A lot (2)            A moderate amount (3)

A little (4)    None (5)            DON'T KNOW (6)

**Q3.11** How many people in other areas manage their livestock well?

**Q3.12** How many wealthy/successful Zimbabweans manage their livestock well?

**Q3.13** My community feels I should kill any predators that kill livestock.

**Q3.14** The people I care about do not kill predators that kill livestock.

**Q3.15** People expect that I will kill any predators that kill my livestock.

**Q3.16** My community feels I should not kill predators that kill livestock.

**Q3.17** The people I care about kill predators that kill livestock.

**Q3.18** People expect that I will not kill predators, even if they kill livestock.

**Q3.19** In the last 5 years, how many times did you kill or try to kill predators that had killed livestock?

**Q3.20** My community feels I should kill predators to prevent livestock killing.

**Q3.21** The people I care about do not kill predators to prevent livestock killing.

**Q3.22** People expect me to kill predators to prevent livestock killing.

**Q3.23** My community feels I should not kill predators to prevent livestock killing.

**Q3.24** The people I care about kill predators to prevent livestock killing.

**Q3.25** People expect me not to kill predators to prevent livestock killing.

**Q3.26** In the last 5 years, how many times did you kill or try to kill predators to prevent livestock killing?

**Q3.27** Community elders think it is very important for me to control predators.

**Q3.28** My friends think it is very important for me to control predators.

**Q3.29** How many people in your area control predators?

**Q3.30** How many people in other areas of Zimbabwe control predators?

**Q3.31** How many successful/wealthy Zimbabwean livestock owners control predators?

~~~~~  
**Q4.1** To kraal my livestock every night for the next two weeks would be:

Extremely easy (1)    Somewhat easy (2)    Neither easy nor difficult (3)

Somewhat difficult (4)    Extremely difficult (5)

**Q4.2** To improve my kraal would be:

**Q4.3** For an adult to accompany my livestock when grazing every day for the next 2 weeks would be:

**Q4.4** In the next 12 months, for me to reduce livestock deaths from disease or poor body condition would be:

**Q4.5** In the next 12 months, for me to reduce livestock deaths to predators would be:

**Q4.6** If I wanted to, I could bring my livestock into the kraal every night for the next 2 weeks.

Definitely true (1)      Probably true (2)      Neither true nor false (3)

Probably false (4)      Definitely false (5)

**Q4.7** If I wanted to, I could improve my kraal to reduce losses to predators and livestock breakouts.

**Q4.8** If I wanted to, an adult could accompany my livestock when grazing every day for the next 2 weeks.

**Q4.9** If I wanted to, I could reduce livestock deaths to disease or poor body condition in the next 12 months.

**Q4.10** If I wanted to, I could reduce livestock deaths to predators in the next 12 months.

**Q4.11** I can get materials to improve my boma.

**Q4.12** I can access vaccination and veterinary services for my livestock.

**Q4.13** For me to kill predators that kill my livestock would be:

**Q4.14** For me to kill predators without getting into trouble with the authorities would be:

**Q4.15** If I wanted to, I could kill the predators that kill my livestock.

**Q4.16** If I wanted to, I could kill predators without getting into trouble with the authorities.

~~~~~  
**Q5.1** For me to herd my livestock every day in the forthcoming month would be:

Harmful (1)      Slightly harmful (2)      Neither harmful nor beneficial (3)

Slightly beneficial (4)      Beneficial (5)

**Q5.2** For me to herd my livestock every day in the forthcoming month would be:

Enjoyable (1)                      Somewhat enjoyable (2)                      Neither enjoyable nor unenjoyable (3)  
 Somewhat unenjoyable (4)                      Unenjoyable (5)

**Q5.3** For me to kraal my livestock overnight every night in the forthcoming month would be:

**Q5.4** For me to kraal my livestock overnight every night in the forthcoming month would be:

**Q5.5** The presence of predators in this area is:

**Q5.7** The interaction between predators and people in this area is:

**Q5.9** Generally, the presence of wildlife in this area is:

**Q5.11** For me to kill predators that kill my livestock would be:

Harmful (1) [...] Beneficial (5)

**Q5.13** For all predators in this area to be killed in the next 5 years would be:

Harmful (1) [...] Beneficial (5)

**Q5.15** If predators were to kill 1 livestock animal in the next 3 months, for my family this would be:

Extremely bad (1)                      Somewhat bad (2)                      Neither good nor bad (3)  
 Somewhat good (4)                      Extremely good (5)

**Q5.16** If disease were to kill 1 livestock animal in the next 3 months, for my family this would be:

**Q5.17** If predators were to kill 10 livestock animals in the next 12 months, for my family this would be:

**Q5.18** If disease were to kill 10 livestock animals in the next 12 months, for my family this would be:

~~~~~

**Q6.1** How much do activities to do with livestock management make you feel: \_\_\_\_

|                | None (1) | A little (2) | Medium (3) | A lot (4) |
|----------------|----------|--------------|------------|-----------|
| Interested (1) |          |              |            |           |
| Excited (2)    |          |              |            |           |
| Upset (3)      |          |              |            |           |
| Strong (4)     |          |              |            |           |

Proud (5)

Calm (6)

Afraid (7)

Angry (8)

**Q6.2** How much do activities to do with predators and predator control make you feel: \_\_\_\_

**Q6.3** I am good at managing my livestock.

**Q6.4** I am good at preventing predators from killing livestock.

**Q6.5** It is important to kraal my livestock.

**Q6.6** It is important to herd my livestock.

**Q6.7** Improving my kraal would reduce the killing of livestock by predators.

Extremely likely (1)

Somewhat likely (2)

Neither likely nor unlikely (3)

Somewhat unlikely (4)

Extremely unlikely (5)

**Q6.8** Sending an experienced adult instead of a child to herd my livestock would reduce livestock killing by predators.

**Q6.9** Killing predators would decrease the number of my livestock that are killed by predators.

**Q6.10** Killing predators is a more effective way of protecting livestock than herders or kraals.

**Q6.11** If I report predation of my livestock to the authorities, they will respond appropriately.

**Q6.12** I will receive some kind of compensation for any livestock killed by predators

**Q6.13** Vaccinating livestock against diseases or veterinary assistance would reduce livestock deaths.

~~~~~  
**Q7.2** Livestock management is very challenging.

**Q7.3** I feel safe when managing livestock.

**Q7.4** The conditions of managing my livestock are good.

**Q7.5** Livestock management allows me to plan how to do my work.

**Q7.6** Livestock management gives me a lot of independence and freedom.

**Q7.7** The way I manage my livestock has a large effect on the number that die of disease.

**Q7.8** How I manage my livestock has a large effect on the number that are killed by predators.

**Q7.9** I use my skills when managing livestock.

**Q7.10** I feel that livestock management is important.

**Q7.11** Other people need me to manage my livestock effectively.

**Q7.12** Preventing livestock predation is very challenging.

**Q7.13** I feel safe when carrying out predator control.

**Q7.14** I enjoy being involved in predator control.

**Q7.15** Predator control allows me to make a lot of decisions on my own.

**Q7.16** The way I do predator control has a large effect on the number of my livestock that are killed by predators.

**Q7.17** I use my skills when controlling predators.

**Q7.18** I feel that predator control is important.

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**Q8.1** It is rewarding to practice good livestock management.

**Q8.2** Livestock management requires skill.

**Q8.3** If I manage my livestock well, I can support everything my family needs.

**Q8.4** Livestock is very important to me and my community.

**Q8.5** If you are a livestock owner, you are respected more in my community than those who do not own livestock.

**Q8.6** If my livestock are in poor condition, my community will disapprove.

**Q8.7** Leader/authority figures in Zimbabwe understand that livestock is very important to people in this community.

**Q8.8** I have enough land for my livestock.

**Q8.9** The Zimbabwean government treats livestock owners well.

**Q8.10** Livestock and wildlife can coexist, if managed correctly.

**Q8.11** The wildlife in this area has no effect on the way I manage my livestock.

**Q8.12** A lot of livestock in this region is killed by predators.

**Q8.13** If livestock is managed correctly, it is not killed by predators.

**Q8.14** Conflict with predators is a threat to livelihood in this area.

**Q8.15** I am afraid predators will kill my livestock.

**Q8.16** My community benefits from tourism.

**Q8.17** Predators are an important part of the natural environment.

**Q8.18** Predator killing is important in my culture.

**Q8.19** If someone in my community kills a predator, they will be respected more than if they did not.

**Q8.20** If I kill a predator, I can also sell its body parts.

**Q8.21** Wildlife in this area belongs to the community.

**Q8.22** Predators are the responsibility of the community.

**Q8.23** Predators are the responsibility of the government.

**Q8.24** Kenya benefits from the presence of wildlife.

**Q8.25** My community benefits from the presence of wildlife.

**Q8.26** I benefit from the presence of wildlife.

## **Social referents and normative standards affect perceptions of livestock management behaviours**

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Social influence impacts the behaviour of individuals through norms - the perceived appropriateness of behaviours – and through social referents, who model behaviour which is then copied by others. Interventions using social influence may help promote conservation-friendly behaviours. We explore how perceptions are influenced by descriptive norms (what people do) and social referents (who does it) in relation to livestock management conflict in Kenya. Using vignettes to present participants with different livestock management scenarios in a 2x3 between subjects design, we explore how two descriptive norms (high versus low standards of livestock management) and three social referents (individuals who influence behaviour, here neighbour, community leader, and father) influence participants' perceptions of livestock management behaviour. Ordinal logistic regression models showed that treatment significantly affected perceptions of behaviour. More senior social referents had greater impact on perceptions, and age influenced message susceptibility, with greater social influence effects on younger respondents. It may therefore be effective for conservation interventions to target socially senior groups, who exert community-wide influence on behaviour.

Keywords: behaviour change; human-wildlife conflict; conservation psychology; human dimensions; social norms; livestock; predators

## Introduction

Individuals' behaviour is influenced by the behaviour of their peers in almost all aspects of life, from voting decisions (Montgomery 1989) to safe sex (White et al. 1994; Lapinski & Rimal 2005). These subconscious social influences exerted by the perceptions and behaviour of others in turn shapes the behaviour of individuals, most notably through 'social norms', i.e. behaviours which are collectively approved or disapproved by society (Cialdini & Trost 1998; Lapinski & Rimal 2005), and social referents or 'influencers', who model particular behaviours which are then copied by others (Abrahamse and Steg, 2013). Typically, norms are split into injunctive norms (what you *ought* to do), and descriptive norms (what people *actually* do) (Lapinski & Rimal 2005), and both types of norm have been shown to impact behaviour (Cialdini et al. 1990; Smith & Louis 2008). In environmental science, descriptive norm interventions have been shown to consistently influence behaviour (Farrow, Grolleau, & Ibanez, 2017), and examples include the work of Niemiec et al (2016), who showed that individuals' efforts to control invasive species on private land in Hawai'i were strongly related to their perceptions of social norms. Similarly, social norms approaches have been shown to impact conservation behavioural intentions, for example to reduce light pollution in relation to turtle hatchlings (McDonald et al. 2014), or reduce the negative impact of foot traffic on ground-breeding birds (Schoenleber 2019).

Social networks and interpersonal relationships are relevant to both the formation and maintenance of norms, and local norms are more likely to emerge in closer groups (Hechter & Opp, 2001). It is not surprising, then, that certain 'social referents', i.e. known persons or groups with whom the individual in question has an existing relationship, can exert a strong social influence on individual normative perceptions or adherence to norms (Brechwald & Prinstein, 2011; Paluck & Shepherd, 2012). It is thought that individuals form ideas about what is socially normative by observing the behaviour of others, and judging the extent to which that particular behaviour is universally (or locally) endorsed (Prentice & Miller, 1993). Given this, it is reasonable to consider *whose* behaviour contributes to individuals' perceptions of the social norm in a given context (Paluck & Shepherd, 2012). Socially

proximate referents e.g. close family or peers have been shown to have far greater influence on individual behaviour than more socially distant referents (Bamberger & Biron, 2007; Brown & Reingen 1987), as have referents in leadership positions (Turner 1956; Carmeli & Schaubroeck 2007).

Peer referents have been shown to be influential in practice, as well as theory: Willy and Holm-Müller (2013) showed that social referents have a significant effect on participation in soil conservation initiatives in Kenya, with “those [people] who are important to them” substantially influencing individuals’ behaviour. Similarly, by providing participants with information about their peers’ average energy consumption, Schultz et al (2007) found a significant decrease in the energy consumption of formerly high-use households. In a meta-analysis and categorisation of the role and mechanisms by which social influence can impact environmental behaviour, Abrahamse and Steg (2013) argue that behavioural role models (either pre-recruited volunteers who informed their social network about, or study confederates who demonstrated given behaviours) were particularly effective in encouraging pro-environmental practices. Both socially comparative feedback and social norms were also effective in instigating behaviour-change, although with a smaller effect size (*ibid.*).

If social influence can be used to modify behaviour – as it is in the fields of public health [EX] and [EX], then it may also be useful in implementing conservation interventions. Indeed, human behaviour is thought to be a significant driver of conflict between people and predators [REF], so interventions to encourage behaviours that are compatible with living alongside large carnivores are particularly needed.

Human-predator conflict across Africa is a major threat to predator populations, and much of this conflict stems from livestock predation (Van Eeden et al. 2018) which, in turn, is exacerbated by variable standards of livestock management (Hazzah et al. 2014). These livestock management practices also contribute to ecosystem degradation as a result of overgrazing on fragile landscapes; this is likely to become an increasing threat to lives, livelihoods, and wildlife populations if livestock management

practices continue in their current form (Boles et al., 2019). Numerous conservation interventions are designed to help livestock owners improve their management behaviour by making protection of livestock easier and land usage more sustainable (Sibanda et al., 2020), but little focus has been devoted to making such activities more desirable. However, recent work has shown that a theory of planned behaviour framework can explain individual variation in predator-friendly livestock management (PERRY 1), and that social norms play a large, consistent role in determining livestock management behaviour across eastern and southern Africa (PERRY 2). In the Tsavo-Amboseli landscape of southern Kenya, traditional approaches to livestock management are increasingly incompatible with both land and predator conservation. With a loss of traditional anti-predator livestock management techniques and increasing numbers of livestock grazing the land, it is imperative that more sustainable, wildlife-friendly management practices be implemented if a complete collapse of grazing and wildlife populations is to be avoided.

In this paper, we explore the potential of social influence, specifically norms and social referent-based interventions to change individuals' perceptions of livestock management behaviour, with a view to informing the design of conservation behaviour-change interventions and reducing human-predator conflict and over-grazing across the region. Using a quasi-experimental approach, we explore the role of social referents and simple social influence vignettes on the perceived norms of livestock managers in southern Kenya. The use of vignettes to study norms in culturally mixed or non-Western societies is considered effective in minimising assumptions or misunderstandings (Jeffries & Maeder, 2006), and vignette-based experiments have previously been used to study local norms (Knutson et al., 2010; Krumhuber, Tsankova, & Kappas, 2018). We used experimental vignettes to examine how social influence and basic demographic factors affected the perceptions of a diverse group of traditional livestock owners in the Tsavo-Amboseli landscape, and whether any of the above factors influenced the susceptibility of participants to social influences.

## Methods

### 2.1 Target behaviour and study area

This study aimed to explore how different normative standards and social referent groups might affect the perceptions of individuals in relation to livestock management practices in the Tsavo-Amboseli landscape.

In this region, local people come into substantial conflict with predators over livestock predation. Certain management behaviours reduce the risk of predation: sending a trained, experienced herder with grazing livestock during the day; maintaining a high-quality ‘boma’ (overnight shelter), which presents a barrier to predators; and regularly checking livestock health with a veterinary technician. As a fragile, semi-arid area, the landscape is also vulnerable to over-grazing (Boles et al., 2019). Failure to secure enough food for their herds can be disastrous for local people, and have severe economic and subsistence consequences. However, with increasing human pressure on the area and accelerating land subdivision, the risk of overgrazing is substantial (*ibid.*). Behaviours which reduce the risk of overgrazing include making informed decisions about where livestock are sent to graze (and thereby avoiding previously grazed areas); and resting of grazing areas (Western et al., 2020).

The study’s focal topics were determined over a course of one-to-one semi-structured interviews with senior local people (n = 15) and with practitioners who have been working in the area for 10 + years (n = 10). These interviews were also supplemented with community meetings and focus groups (n = 4) to validate the interview content. Interviewees identified livestock management behaviours including herding, grazing management, and land resting as key components of traditional management, and boma maintenance and herding as key techniques which have been used to reduce depredation risk.

Local elders also identified age as a consideration affecting individuals’ livestock management practices. In Maasai culture, individuals belong to ‘age-classes’, which are more important than the exact age of individuals. Local elders believed that younger community members were performing livestock

management more poorly. Although the translation of age-classes is not precise, participants under the age of approximately 30 were thought by the elders to be the group of primary concern.

In addition to presenting a pressing conservation issue – and one which is important across much of eastern and southern Africa – the Tsavo-Amboseli landscape has various attributes which make it suitable for a norms study of this kind. The population exhibits common behaviour (livestock management), with variation in how effectively it is performed; there are some regional cultural, ethnic, or other sociological differences which mean that results are likely to be generalisable; and, although individuals may speak a variety of languages, there is one common language (Swahili), so translation and the associated errors are minimised.

This area includes or borders a number of protected areas, including strict national parks (Amboseli, Tsavo West, the Chyulu Hills NP), and otherwise protected regions such as conservation areas on community-owned group ranches. Rainfall across the region is low and bimodal, and the area can be described as arid to semi-arid (Schuette et al, 2013; Kioko and Okello, 2010). The region contains an ethnic mixture of people: there are large numbers of Maasai, who practice traditional livestock management with seasonal grazing patterns. They collectively own a number of group ranches, and livestock grazing is typically on communal land. The other major ethnic group is Kamba, who traditionally practice mixed agro-pastoralism, with smaller proportions of Taita, Kikuyu, and other ethnic groups.

### ***2.3 Survey participants and collection protocol***

Survey protocol was approved by the University of Oxford Social Sciences and Humanities Interdivisional Research Ethics Committee (Reference No. R53944/RE001). Surveys were translated into Kiswahili through a group discursive process, with expert discussion in cases where translations were

imprecise or there was poor consensus. Although participants may have a different mother tongue, Swahili is the most commonly used language in Kenya, and although research assistants were trained to exclude participants who were not fluently conversant, no such individuals were encountered.

Nine survey enumerators were hired and trained, and each survey was conducted as a face-to-face interview. All enumerators were technologically literate men in their 20s, which minimised any possible impact of enumerator demographics on participant responses, and were hired through a local partner organisation, which circulated a suitable job description throughout the study area, and supported the interview and recruitment process. Survey responses were recorded using the Qualtrics offline survey application (Qualtrics, 2015), which formats surveys to be administered as a mobile application. Research assistants operated in their local area to facilitate interviews, increase trust in the process, and reduce the risk of accessibility issues. The geographic location of individual samples and the survey enumerator were therefore linked, and it was not possible to include these factors in the analysis, but we considered this a worthwhile trade-off for higher comprehension and access to participants (see Appendix for further information).

Due to practical limitations on data collection, a convenience sample was used. The nature of the convenience sample introduces a possible limitation on the representativeness of the survey. Although we acknowledge that this may introduce error, efforts were made to select participants at random, to introduce a minimum of bias.

Culturally, women are very seldom involved in livestock management, and initial site surveys and interviews indicated that female participants would be unlikely to meet the participant suitability requirements regarding involvement in livestock management; women were therefore not included in this study.

Enumerators were responsible for recruiting participants, and used door-to-door surveying, or opportunistic meetings at communal spaces, e.g. markets, to recruit. Before initiating an interview, enumerators administered pre-determined participant suitability tests, which consisted of “*Have you been involved in livestock management in the past three weeks?*”; “*Do you live in [the local area]?*”, and “*Do you or anyone in your immediate family work for [the local conservation NGOs]?*”. Individuals who were not involved in livestock management, who did not live locally, or who worked for local charities were excluded from the study. In carrying out these tests, the enumerators also checked for linguistic fluency, although no candidates failed this test. After passing these tests, participants were allocated a treatment at random using the Qualtrics inbuilt randomisation software. Surveys were collected between January and March 2020. In total, 996 usable responses were collected, with partial records ( $n = 6$ ) excluded from the analysis.

## **2.2 Study design**

We used six different treatments in the study, in a 2 x 3 between-subjects design (see Table 1). One variable was the standard of livestock care (two levels: low standards and high standards), with the ‘high standards’ treatment describing a relatively more demanding set of behaviours which are considered desirable from a conservation perspective (e.g. greater effort regarding anti-predator behaviour and sustainable grazing management). The other variable concerned the social referent (three levels: ‘your father’, ‘your community leader’, and ‘your neighbour’), which were chosen to explore differences in social influence. Typically, socially proximate referents (e.g. ‘father’) or leadership figures (‘community leader’) perform best as social influences, and community members (‘neighbour’) are easily generalisable as less proximate, typical actors (Brown & Reingen 1987; Carmeli & Schaubroeck 2007). We also stratified by age, and responding to the pre-survey data chose to group participants into 18-30, and 31+ age classes.

**Table 1:** Study design and final number of participants in each group (total n = 996). Participants were randomly allocated to one of 6 experimental groups, in a 2 x 3 design. The first factor was a high or low livestock management standard; the second was the referent group ('your father', 'your community leader', or 'your neighbour').

| <i>Treatment</i>   | <i>Father</i> |            | <i>Leader</i> |            | <i>Neighbour</i> |            |
|--------------------|---------------|------------|---------------|------------|------------------|------------|
|                    | <i>High</i>   | <i>Low</i> | <i>High</i>   | <i>Low</i> | <i>High</i>      | <i>Low</i> |
| <i>Men 18 - 30</i> | 88            | 77         | 82            | 76         | 74               | 97         |
| <i>Men 30 +</i>    | 79            | 80         | 78            | 77         | 99               | 89         |

Surveys were carried out face-to-face in Kiswahili; the interviewer read all survey components aloud to each participant. First, each participant was read a brief introductory segment to explain the survey process, and the Likert scales along which they would be asked to respond. The interviewer confirmed with example questions that the respondent understood the use of Likert scales, and recorded the interviewee's age set. Participants were next read the experimental vignette assigned to their treatment group (see Table 2). After being read the vignette, each participant answered a series of follow-up questions, five relating to each of the specific vignette topics, and two relating to overall perceptions of the importance of livestock management. The only aspect of the survey that varied between treatments was the exact phrasing of the experimental vignette (see Appendix 1). Enumerators were trained to check respondent attentiveness, and where there were concerns that comprehension was low or respondents were unable to focus on the survey at hand, the interview was terminated prematurely and data not included in the sample (n = 9).

The two vignettes were designed to reflect high and low standards of livestock management, and were paired sentence for sentence covering each of the five key themes, e.g. low standard: "[REFERENT GROUP] sometimes sends a herder out with the animals, and has a boma which they can sometimes use at night." versus high standard: "[REFERENT GROUP] always sends a trained and experienced herder

*with the livestock; he has a very strong boma for them to use every night*". The vignettes were designed to be simple to understand, and easy to administer. They were piloted in training sessions with the enumerators, to ensure that they were clear and made sense in the local context, and where necessary adjusted to reflect the desired meaning (see Table 2).

In total, each participant was asked seven follow-up questions regarding their perception of the importance of various livestock management practices. Respondents were asked to rate the importance of five management variables in total (boma use, herding, veterinary care, grazing management, and resting grazing land, see Table 2); higher rankings indicated higher normative perceptions regarding standards of livestock management. The two additional follow-up questions concerned overall perceptions of the livestock management of self and others. All questions were answered on a 10-point Likert scale to capture subtle differences in response.

**Table 2:** Specific livestock management variables included in this study. These five key topics emerged as the critical variables as a result of unstructured interviews and informal discussions with community members. The 'High standards' and 'Low standards' columns contain comparable excerpts regarding each practice, which were included in the high and low standard vignettes, respectively. Using a 10-point Likert scale, participants then responded to each 'Follow-up statement'.

| Topic                                                             | High standards                                                                                                                                                               | Low standards                                                                                     | Follow-up statement                                                 |
|-------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| <b>Grazing</b> – managing livestock grazing patterns              | <i>He is very careful about where [his livestock] graze, and takes them to the best pasture that he can access.</i>                                                          | <i>He lets [his livestock] graze wherever they want, and go wherever they want.</i>               | It is important for livestock owners to decide where animals graze. |
| <b>Land resting</b> – maintaining land condition, grazing quality | <i>He understands that rotational grazing, and resting different areas are important for maintaining the grass in the long-term, and preventing degradation of the land.</i> | <i>He thinks resting grazing areas is unimportant; and knows the grass will always grow back.</i> | It is important to rest grazing areas.                              |

|                                                                                    |                                                                                                                                         |                                                                                                                                                                                             |                                                                         |
|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| <b>Herder use</b> – standards for whoever tends the livestock during the day       | <i>He always sends a trained and experienced herder with the livestock.</i>                                                             | <i>He sometimes sends a herder out with the animals</i>                                                                                                                                     | It is important to send a trained, experienced herder with livestock    |
| <b>Boma use</b> – standards for the overnight pen for livestock                    | <i>He has a very strong boma for them to use every night, which he keeps well-maintained.</i>                                           | <i>He has a boma which they can sometimes use at night. His boma is old, but he does not think it needs to be improved.</i>                                                                 | It is important to regularly spend time and money maintaining a boma    |
| <b>Veterinary care</b> – standards for veterinary treatment, level of intervention | <i>He regularly gets a vet to visit his animals, and pays for vaccinations and medicine to keep his animals as healthy as possible.</i> | <i>When there is a vet in the village, he sometimes gets a few of the livestock vaccinated if it is free, but he does not think vaccination or veterinary treatment are very important.</i> | It is important to get veterinary care for livestock, even if expensive |

Before carrying out any subsequent analysis, we performed a manipulation check to confirm that the vignettes were interpreted appropriately by respondents. In particular, this check was necessary to confirm that the ‘high standards’ vignette was perceived to reflect better, more intensive management than the behaviours described in the ‘low standards’ vignette. We tested whether vignettes conveyed the correct information in both an intensive pre-test and in the survey itself. In the pre-test, the vignettes were read to 20 community members, who were then asked open-ended follow-up questions about their perceptions of the behaviour described; these individuals were not subsequently included in the main manipulation test. This was a strict test of meaning and local perception, and responses showed the vignettes were suitable. To test the manipulation over the course of the survey itself, we compared answers to one of the overall, follow-up questions “how well do you think [REFERENT GROUP] takes care of their livestock” between both treatments. Although this is a weaker test of the manipulation given the survey context and the lowered salience of its placement as the final question (to prevent it from affecting other responses), this follow-up check was designed to confirm that there was no context-specific loss of meaning. Management standards were considered significantly greater in the high standards treatment (mean high standards = 7.1; mean low standards = 6.5; Wald test:  $z = 3.717$ ,  $p < 0.001$ ). Consequently, we considered phrasing of the vignettes and the experimental manipulation successful.

## **2.4 Analysis**

We aimed to explore 1) how participants' perception of individual management variables and overall livestock management practices were affected by the treatment; 2) the effect of referent group on overall livestock management perceptions; 3) the interaction of age and norm treatment on responses. The livestock management follow-up questions were designed to measure proxies of respondents' underlying social perceptions. We first made ordinal logistic regression models with perceptions of each of the individual livestock management practices (livestock grazing, land resting, use of a herder, veterinary care, and boma use) as the response variables.

A composite of these measures was then developed by adding each participant's responses to the five specific management behaviour questions, all of which were answered on the same 10-point Likert scale (Boone & Boone 2012), and this composite was used as the response variable in a global ordinal logistic regression model. Although composites introduce some subjectivity with regard to the relative influence of different components, they can also be useful in summarizing information from a variety of measures. When designing the study, we phrased all specific management questions consistently with a view to creating a composite that condensed responses to each of the management practices into one variable. This was preferred from a data collection perspective as it reduced participant fatigue from repeatedly answering similar questions, and from an analytical perspective, as it allowed us to control the weighting of different management variables in the overall composite. In the planning phase, we predetermined that asking participants for a single overall management response would be significantly affected by the salience of different activities, e.g. more weight given to boma use in the evenings, or to herder presence if questions about herders immediately preceded the overall management summary question. Although it would be valid to allow salience to affect this overall management score, for the purposes of this analysis we decided that a more average, static measure was preferable, and that all components of livestock management should be equally weighted in the overall measure. We therefore created a composite measure by combining each of the specific management activity answers.

In all models, explanatory variables were as follows: norm, age, referent group, and an interaction term for norm\*age, and enumerator. Age was a categorical variable (18-30 or 31+) based on information regarding approximate age classes, and the concerns raised by community leaders. Location was initially included as a binary factor (East and West) as it was previously thought that two distinct sub-sites may exist. However, initial models showed no statistical difference between samples from the supposed regions, and we removed this factor from analysis as the low level of geographic granularity was not thought to reflect real social or cultural difference. Separate models were constructed to test the interaction between enumerator and norm. All analysis was carried out using the open source statistical software R, version 4.0.0.

## Results

We recorded participants' perceived importance of five different management parameters: livestock grazing, land resting, use of a herder, veterinary care, and boma use, and ran separate ordinal logistic regression models to understand whether treatment had a significant effect on perceived importance of any specific management practices. Treatment with the high standards vignette significantly increased the perceived importance of two management variables: livestock grazing (Likelihood Ratio Test, LR = 5.11, df = 1, p = 0.0238; Table 3A), and resting grazing land (LR = 3.45, df = 1, p = 0.0311; Table 3B). Norm treatment had no significant effect on perception of the other management variables (see Table 3 and Fig. 1). Odds ratios for the effects of norms on perceived importance of grazing and resting were 1.270, and 1.236 respectively, so when respondents were treated with the high standards vignette, they were ~ 1.3 x more likely to report a 1-point higher perceived importance of grazing management and land resting than those in the low standards vignette treatment.

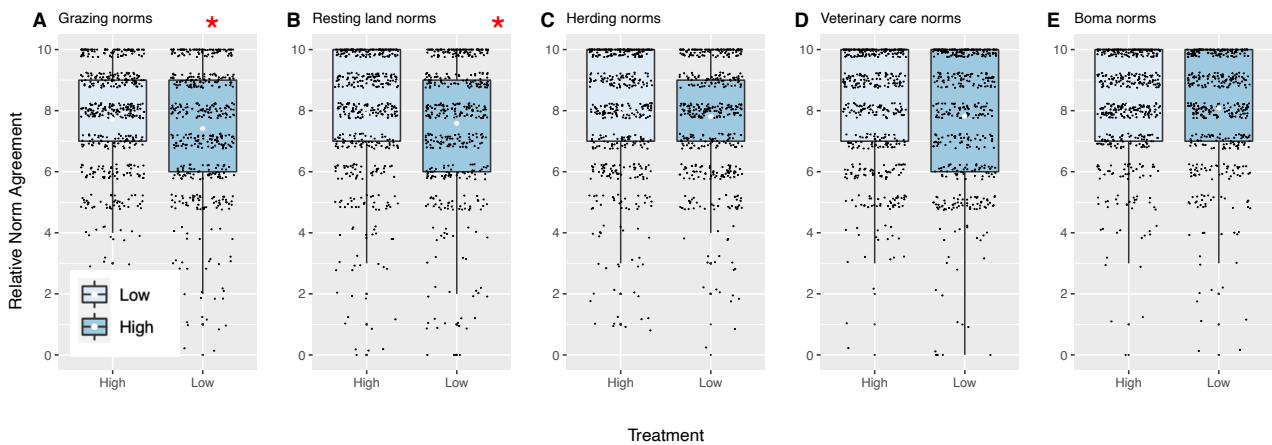
Which enumerator carried out a survey had a significant effect in all models (see Table 3). From separate models for each variable (A – E) in which the interaction between norm and enumerator was

tested, however, there was no evidence that the effect of norm treatment differed between enumerators (LRT effect of norm\*enumerator < 10,  $p > 0.15$  across all models).

**Table 3:** Main effects of logistic regression models of separate livestock management variables. Models A-E show the effect of vignette treatment on respondent's perception of the importance of each livestock management activity (see Table 2 for details of individual management parameters).

| <i>Variable</i>                 | <i>d.f</i> | <i>Likelihood<br/>Ratio Test<br/>statistic</i> | <i>P</i> | <i>N for<br/>model</i> |
|---------------------------------|------------|------------------------------------------------|----------|------------------------|
| <b>A: Grazing norms</b>         |            |                                                |          | 994                    |
| <i>Norm</i>                     | 1          | 5.105                                          | 0.0238   |                        |
| <i>Age</i>                      | 1          | 8.539                                          | 0.0035   |                        |
| <i>Referent</i>                 | 2          | 39.29                                          | 2.94e-08 |                        |
| <i>Enumerator</i>               | 6          | 194.4                                          | 2.2e-16  |                        |
| <b>B: Resting land norms</b>    |            |                                                |          | 995                    |
| <i>Norm</i>                     | 1          | 3.454                                          | 0.0311   |                        |
| <i>Age</i>                      | 1          | 3.371                                          | 0.0664   |                        |
| <i>Referent</i>                 | 2          | 27.72                                          | 9.54e-07 |                        |
| <i>Enumerator</i>               | 6          | 292.7                                          | 2.2e-16  |                        |
| <b>C: Herding norms</b>         |            |                                                |          | 996                    |
| <i>Norm</i>                     | 1          | 1.60                                           | 0.2057   |                        |
| <i>Age</i>                      | 1          | 6.53                                           | 0.0106   |                        |
| <i>Referent</i>                 | 2          | 18.54                                          | 9.43e-05 |                        |
| <i>Enumerator</i>               | 6          | 385.8                                          | 2.2e-16  |                        |
| <b>D: Veterinary care norms</b> |            |                                                |          | 995                    |
| <i>Norm</i>                     | 1          | 1.24                                           | 0.2662   |                        |
| <i>Age</i>                      | 1          | 1.84                                           | 0.1750   |                        |
| <i>Referent</i>                 | 2          | 28.48                                          | 6.54e-07 |                        |
| <i>Enumerator</i>               | 6          | 373.5                                          | 2.2e-16  |                        |
| <b>E: Boma norms</b>            |            |                                                |          | 996                    |
| <i>Norm</i>                     | 1          | 0.11                                           | 0.7403   |                        |
| <i>Age</i>                      | 1          | 7.630                                          | 0.0057   |                        |
| <i>Referent</i>                 | 2          | 16.12                                          | 0.0003   |                        |
| <i>Enumerator</i>               | 6          | 338.6                                          | 2.2e-16  |                        |

**Figure 1:** Agreement with normative statements for each of the five key response variables: grazing norms, norms for resting land, herding norms, norms of veterinary care, and boma norms, for high norm (dark blue) or low norm (light blue) treatments. All statement responses were on the same 10-point Likert scale. Each participant was treated with one of two normative two vignettes (X axis), one describing a high standard of livestock management (dark blue), and one describing a low standard of management (light blue). Larger white dots represent group means. Red asterisks (upper right of plot) indicate that responses were significantly higher in the high standards than the low standards treatment groups.



Using the composite response variable, which included responses to all 5 management variables, we constructed a global model to explore the effect of norms on participants' perception of livestock management standards overall (see Table 4). Wald tests of the treatments' a priori contrasts showed that the low standards treatment significantly reduced respondents' perceived importance of livestock management behaviours (n for test = 993,  $z = 2.049$ ,  $p = 0.0405$ .) The odds ratio for the effect of norms on overall livestock management perceptions was 1.23.

Again, enumerator had a significant overall effect ( $p < 0.001$ ), but a separate model in which the interaction between enumerator and norm was tested showed no effect: LRT of enumerator\*norm  $< 1.5$  and  $p = 0.28$ .

The global model was also used to explore the effect of referent group on responses (see Fig. 2). The three social referents used in this study were ‘father’, ‘leader’, and ‘neighbour’. The referents had differing impact on participants’ responses, with higher responses to both the father (Wald test:  $n$  for test = 993,  $z = 6.704$ ,  $p < 0.0001$ ), and leader referent (Wald test:  $z = 4.566$ ,  $p < 0.0001$ ) than the neighbour treatment. The odds ratios for the father and leader treatments respectively were 2.50 and 1.84, so respondents were roughly twice as likely to attribute a higher importance to livestock management when ‘father’ or ‘leader’ were used as references.

**Table 4:** Main effects of the overall ordinal logistic regression model for the effect of vignette treatment on respondent’s perception of the importance of livestock management activities. N for the test was 993.

| <i>Variable</i>   | <i>d.f</i> | <i>Likelihood Ratio Test statistic</i> | <i>P</i> |
|-------------------|------------|----------------------------------------|----------|
| <i>Norm</i>       | 1          | 4.200                                  | 0.0404   |
| <i>Referent</i>   | 2          | 48.03                                  | 3.72e-11 |
| <i>Age</i>        | 1          | 13.51                                  | 0.000237 |
| <i>Enumerator</i> | 6          | 425.7                                  | 2.2e-16  |

Composite Management Norms

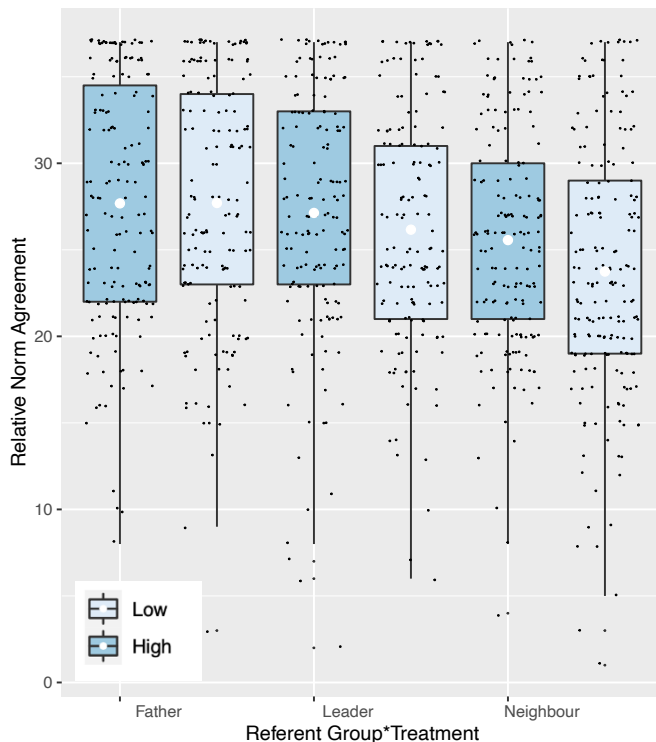


**Figure 2:** Differences in response to normative statements with different referent treatments. All five management variables had responses on the same 10-point Likert scale, so responses were added to create a general management composite (Y-axis). Referent groups (X axis) were ‘your father’, ‘your community leader’, and ‘your neighbour’. Dark blue represents the high norms treatment, and light blue the low norms treatment. Larger white dots represent group means.

In the global model, age also significantly moderated the effect of the norm treatment, with younger participants less likely to consider livestock management behaviours as highly important than older participants (Wald test:  $z = 3.669$ ,  $p = 0.0002$ ). We hypothesised that there would be an interaction between norm treatment and participant age, and that norm treatments would have more effect in younger respondents. The interaction between age and norm in the global model was statistically significant ( $F$ -test:  $LR = 4.375$ ,  $df = 1$ ,  $p = 0.0365$ ), with younger participants showing greater differences in their perception of livestock management based on the norm treatment they received (composite perception scores: mean high standards vignette = 26.9; mean low standards vignette = 24.7) than older participants (mean high standards = 26.7; mean low standards = 26.8).

## Discussion

In this study, we found that our experimental manipulation of social norms had significant impacts on participant's perception of appropriate livestock management behaviour. In particular, we found that the high versus low standards norm treatments and the choice of referent group had significant effects on participants' responses. This suggests that appropriate social influence messaging may be a useful tool for encouraging behaviour change in applied conservation contexts.

The high and low standards vignettes in this study characterised two different levels of livestock management performance, which were characterised through discussions with local people. These differences are meaningful to the people carrying out livestock management, and they are also meaningful from a conservation perspective, with the high standards vignette describing behaviours which were more compatible with conservation goals. Studies have found that vignettes can be successfully used in a between-participants design to understand participants' perceptions of various behaviours (Finch 1987; Torres 2009), and they have been used to explore complicated topics from online piracy (Hardy et al. 2013) to sexual violence (Thaler 2012). In particular, vignette-based techniques are thought to be particularly appropriate for studying culturally mixed communities, and behaviours for which there is a

complex social context (Finch 1987; Torres 2009). In this study, across all management practices, the high standards treatment engendered significantly higher preferred standards of livestock care than the low standards treatment ( $p < 0.0001$ ), as expected, demonstrating that the vignettes were constructed appropriately. Further work is needed to understand how such vignette-based manipulations can be translated into real-world behaviour change programmes.

Although we found a significant effect of norm treatment on perceptions of appropriate behaviour overall, this was not consistent across all management variables: for livestock grazing and resting of grazing areas (i.e. whether a livestock manager should carefully control the area in which his animals are grazing, and whether areas of pasture should be rotationally rested, respectively), individuals' perceptions of those specific management activities were significantly affected by their norm treatment. The other management variables (use of a herder, use of a boma, and veterinary care) did not show activity-specific effects of the vignette treatment. Of the specific management activities, grazing and land resting were also the only two which affected public resources (use of a herder, boma, and veterinary care primarily affect an individual's own livestock, whilst grazing and resting behaviour affects the local grass bank and common grazing resources). Norm activation theory gives that norms are more likely to be influential in situations in which actors are aware of the consequences of their actions for others, and take responsibility for these actions (Schwartz 1970; Onwezen et al. 2013). Given that performance of grazing and resting behaviours is likely to impact an individual's community, these results tentatively support these prior findings. An alternative explanation could be the extent of behavioural variability with regard to different practices: grazing and resting behaviour vary substantially, whereas bomas are consistently used across the region and veterinary care has consistently low uptake, so boma and veterinary norms may have sufficiently little behavioural variation to be affected by normative messaging. Further research is needed to explore the influence of behaviour variance and norm activation on the impact of normative treatments on behaviour.

Although the odds ratios for changes in perceptions as a result of different norm treatments may not appear high (at  $\sim 1.3$  for grazing, land resting and overall management, and  $\sim 2$  for father and leader referents), in the context of manipulating perceptions, these are significant. They are comparable to odds ratios for other social norms-based behavioural perception changes, including self-reported weight control intention amongst teenagers (overall odds ratio of effect of norms on intended dieting behaviour = 1.47 (Eisenberg, Neumark-Sztainer, Story, & Perry, 2005), and likelihood of attending a mammogram (odds ratio effect of subjective norms = 1.16, Allen, Stoddard, & Sorensen, 2008). Indeed, in the context of social norms surrounding work drinking culture, a reduction in the odds ratio of 0.07 with regard to self-reported alcohol consumption was considered an important result (Barrientos-Gutierrez, Gimeno, Mangione, Harrist, & Amick, 2007); however, the drinking study used a proxy for actual behaviour change (alcohol consumption self-reporting, which can itself be flawed), and further work is required to understand if the perception differences identified here can be translated into actual changes to behaviour. In our study, levels of agreement with the survey statements were relatively high across the board, so even participants treated with the low standards vignette mostly agreed with response statements. This may represent a generally positive perception of livestock management across the area (and participants in the region do typically practice good livestock care), acquiescence bias ('yea-saying'), or an information salience effect, which would be unlikely to impact real behaviour. In this study, we chose to use behavioural vignettes and immediate follow-up questions (with a time lag of approx. 10 minutes between the primer and the end of the follow-up questions), to establish whether norm treatments had any significant effect on perceptions; future studies building on this result may choose to leave more time between treatment and effect measurement, to reduce any temporal exaggeration of effects. We also chose to phrase all statements positively to increase simplicity of the survey tool and reduce translation issues; it may be beneficial for future authors to examine the effect of acquiescence with reverse-scored, negatively phrased survey items.

In this study, we chose typical social referent groups which have been used in a range of previous studies (e.g. see Brown & Reingen 1987; Carmeli & Schaubroeck 2007), and used ‘father’, ‘community leader’, and ‘neighbour’ as referents. As predicted from work in other fields, social proximity and authority resulted in stronger social influence, with referents of ‘your father’ (social proximity AND authority) and ‘your community leader’ (authority only), both resulting in roughly twice the chance of respondents increasing their perceived importance of livestock management (odds ratios = 2.245 and 1.741 for father and leader, respectively). Although unsurprising, this result does demonstrate that public information campaigns or interventions should be very careful to maximise the effect of their messaging, and that what may seem like minutiae can have very real impacts on the efficacy of a conservation intervention. Interventions to increase uptake of conservation-friendly behaviour should use older, senior community members as behavioural ‘influencers’, to increase the impact of an intervention. Due to similar social and cultural structures, we believe that father and community leader may be appropriate authority figures across much of eastern and southern Africa, and we encourage authors designing similar studies or interventions to consider which socially proximate authority figures can be used as referents or key ‘change-makers’ in similar behavioural studies or interventions.

We found a significant effect of enumerator in all models. This is unsurprising: while ‘location’ was not retained as a model term due to low granularity, enumerators operated in their local area, so the enumerator term captured variation from spatial, social (different information on the survey was communicated by community leaders in different regions) and individual differences. We had nine different individuals working in this study, and yet the overall significance of normative, referent, and age terms was still apparent, despite the diversity in the survey team. We therefore conclude that whilst the personality and socio-demographic attributes of individual enumerators is likely to have a significant overall effect, and enumerators should be chosen carefully, variation in the enumeration team is unlikely to create challenges in the application of norm-based social interventions.

One notable study limitation is the use of a convenience sample. Although this was necessary due to fieldwork constraints, it introduces potential bias in the selection of participants. We simply do not know the extent to which the sample in this study is representative of individuals across the area. Future work should consider using a more stratified approach to participant inclusion to ensure fairness and representativeness of the results.

We hypothesised that there would be an effect of age on the efficacy of the norm treatment, and that younger participants would be more susceptible to social messaging. This is consistent with previous work on social stratification of pastoralist communities in the region, which suggested that younger groups have greater behaviour flexibility regarding livestock management activities (Perry et al., 2020). Similarly, other work on social norms has suggested that they can have a cohort-specific effect (Keyes et al. 2012), with greater social influence on younger participants (Albarracín et al. 2004; Cestac et al. 2011). In this study, we found an interaction between age and the effect of norm treatment on perceived importance of livestock management overall, with a difference in mean between high and low treatment groups of only 0.1 in older participants, compared to 2.2 in the younger participants, which was a significant difference ( $p < 0.04$ ). That younger participants were more influenced by messaging than older participants has practical implications for conservation practitioners, and we suggest that younger, behaviourally malleable groups should be the target of most behaviour-change interventions – except in situations where it is possible to influence older, more senior community members, under which circumstances these older groups should be prioritised.

Social norms interventions have a long history of successful application to societal concerns (Cialdini & Trost 1998). In scenarios where behaviour change is considered desirable, such as undergraduate drinking (Perkins & Berkowitz 1986) or where a certain behaviour is to be encouraged, e.g. control of invasive species (Niemic et al 2016), interventions using norms have provided effective mechanisms by which participants can be subtly encouraged to behave in a certain way. In this study, we 21

found that both the content of a normative standard and the social referent group described in the standard had effects on the perceived appropriateness of behaviour, with high norms and socially proximate authority figures increasing the perceived importance of wildlife-friendly livestock management behaviour. We also found that age interacted with the treatment, so younger participants were more susceptible to normative messaging. Against a backdrop of numerous successful norm-based interventions in other disciplines, with this study we show that these techniques may be successfully applied to conservation issues. Although our study only focussed on the impact of a manipulation on perceptions, and further work is needed to understand the impact on actual behaviour, we believe our results are promising. In this instance, suggesting a strong social norm of conservation-compatible behaviour, using an appropriate authority group referent, and targeting younger community members was sufficient to encourage significantly different perceptions of behaviour. Resolving many conservation conflicts ultimately requires some form of behaviour change, but traditional conservation theory does not provide the right tools or theoretical background for practitioners to develop effective behaviour-change programmes. Here we show by applying relatively simple social norms approaches, it is possible to significantly alter behavioural perceptions, and we encourage practitioners to explore the possibilities offered by such an approach.

**Appendix 1:** Full survey, inc. demographic questions, sample demographic characteristics, vignettes, follow-up questions, and translations.

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# Supplementary Materials

## Appendix 1: Norms Survey and Translation

### Surveyor codes

#### East

- 1: Victor Musyaki
- 2: Lucy Muia
- 3: Regina Ndungwa
- 4: Shadrack Ndetei

#### West

- 5: Koinary Thomas
- 6: Joshua Kiroshi
- 7: Michael Munturua
- 8: Evalyne Lenku
- 9: Newton Hamsini

### Pre-survey Questions

- |                                                                                           |                            |          |
|-------------------------------------------------------------------------------------------|----------------------------|----------|
| 1. WHAT SEX IS THE RESPONDENT?                                                            | Man                        | Woman    |
| WEWE NI NJINSIA GANI                                                                      | Mwanaume                   | Mwanamke |
| 2. How old are you?                                                                       | Umri gani?                 |          |
| 3. How many years of school did you attend?                                               | Miaka mingapi shuleni?     |          |
| 4. Did you and your family experience food shortages in the last year?                    |                            |          |
| Wewe na jamii yako mmewaipata ukosefu wa chakula kwa mwaka uliopita?                      |                            |          |
| 5. Are you in a position of leadership e.g. village elder, church leader, area chief etc. |                            |          |
| Wewe uko uongozini kama mzee wa kijiji, mzee wa kanisa, au chief.                         |                            |          |
| 6. Does your family keep cows or shoats?                                                  |                            |          |
| Wewe na jamii yako mnafuga n'gombe, mbuzi au kondoo?                                      |                            |          |
| 7. Are you responsible for managing your family's livestock?                              |                            |          |
| Wewe ndie unaofuga mifugo ya jamii yako?                                                  |                            |          |
| 8. How many cows do you have?                                                             | Una n'gombe ngapi?         |          |
| 9. How many shoats do you have?                                                           | Una mbuzi na kondoo ngapi? |          |

### Follow-up Questions

All follow-up questions were 10-pt Likert scales.

- 1. How good is your own livestock management?  
Ubora wa ufugaji wa mifugo yako?
- 2. It is important for livestock owners to decide where animals graze  
Ni muhimu kwa wafugaji kuamua mahali ama sehemu ya kufuga mifugo yao.
- 3. It is important to rest grazing areas.  
Ni muhimu kuacha ama kutenga sehemu zingine.
- 4. It is important to send a trained, experienced herder with livestock at all times.  
Ni muhimu kutuma mfugaji mwenye ujuzi na kuelewa kufuga mifugo wakati wowote.
- 5. It is important to regularly spend time and money maintaining a boma.  
Ni muhimu kutumia wakati na pesa kurekabisha boma.

6. It is important to get veterinary care and medicine for livestock, even if it is expensive.  
Ni muhimu kutumia daktari wa mifugo na madawa, ata kama ni ghali.
7. Do you think that [REFERENT GROUP] takes the right amount of care of his livestock?  
Unafikiri [REF] wanawapa mifugo yao dhamana inaiyofaa?

### Experimental Vignettes

**Low norm:** [YOUR FATHER; YOUR COMMUNITY LEADER; SOMEONE IN THE NEXT VILLAGE] has a small herd of livestock, which he manages. He is proud of these animals, and tries to make sure they are healthy and safe. He lets them graze wherever they want, and go wherever they want. He thinks they should be allowed to graze as they wish, and does not believe different areas should be off-limits to hungry livestock. He thinks resting grazing areas is unimportant. He sometimes sends a herder out with the animals, and has a boma which they can sometimes use at night. His boma is old, but he does not think it needs to be improved. When there is a vet in the village, he sometimes gets a few of the livestock vaccinated if it is free, but he does not think vaccination or veterinary treatment are very important. [YOUR FATHER; YOUR COMMUNITY LEADER; THE PERSON IN THE NEXT VILLAGE] likes looking after livestock, and is proud when his animals do well.

[Baba yako; kiongozi wajamii; jirani yako wa kijiji nyingine] ako na mifugo kidogo, anaiofuga. Ana jivunia mifugo yake, na anajaribu kuona wako na afya nzuri na salaama. Ana waruhusu kula popote wanapotaka, na kwenda popote wanaopenda. Anafikiri ni lazima waruhusiwe kula popote wanaopenda, na anafikiri sio vizuri sehemu zingine mifugo wenye njaa wasuiwe kula. Anafikiri kutenga sehemu zenye chakula kwa mifugo sio lazima. Saa zingine anatuma mchungaji na mifugo, na ako na boma, ya mifugo kupumzika usiku. Boma yake ni mzee, lakini anafikiri kama inahitaji kurekabishwa. Wakati daktari wa mifugo yuko kijijini, saa zingine anapata mifugo wachache wamepewa chanjo kama ni mbure, lakini afikiri chanjo na madawa ya mifugo ni muhimu. [Baba yako; kiongozi wajamii; jirani yako wa kijiji nyingine] anapenda kufuga mifugo, na anafuraha na kujivunia mifugo yake wako na afya nzuri.

\*\*\*

**High norm:** [YOUR FATHER; YOUR COMMUNITY LEADER; SOMEONE IN THE NEXT VILLAGE] has a small herd of livestock, which he manages very well. He is very proud of these animals, and works very hard to make sure they are healthy and safe. He lets is very careful about where they graze, and takes them to the best pasture that he can access. He understands that rotational grazing, and resting different areas are important for maintaining the grass in the long-term, and preventing degradation of the land. He always sends a trained and experienced herder with the livestock. He has a very strong boma for them to use every night, which he keeps maintained. He regularly gets a vet to visit his animals, and pays for vaccinations and medicine to keep his animals as healthy as possible. [YOUR FATHER; YOUR COMMUNITY LEADER; THE PERSON IN THE NEXT VILLAGE] likes looking after livestock, and puts a lot of time, money, and energy into ensuring his animals do as well as possible.

[Baba yako; kiongozi wajamii; jirani yako wa kijiji nyingine] ako na mifugo kidogo, anaiofuga vizuri. Ana jivunia mifugo yake, na anajaribu sana kuona wako na afya nzuri na salaama. Ako makini na mahali mifugo yake wanakula, na anawalisha sehemu ama chakula kizuri kwa mifugo yake. Anaelewa mizunguko ya malisho na umuhimo wa kutenga sehemu zingine kwa ubora wa chakula na kuzuia mmomonyoko wa udongo na ukosefu wa nyasi. Kila siku anatuma mfugaji mwenye ujuzi kufuga mifugo yake. Ako na boma nzuri kwa mifugo yake kulala kila usiku, na kuirekebisha kila wakati inapo aribika. Umuita daktari wa mifugo mara kwa mara, na analipa kwa chanjo na madawa kwa mifugo yake, kuwafanya wawe na afya nzuri. [Baba yako; kiongozi wajamii; jirani yako wa kijiji nyingine] anapenda kufuga mifugo, na anatumia wakati, pesa, na nguvu yake yote kuwafanya mifugo yake wawe na afya mbora zaidi.

More than a feeling: cognitive beliefs and negative affect predict overall attitudes and behaviour towards predators

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**Running title:** Beliefs and negative emotion predict behaviour

**Keywords:** conservation psychology; behaviour; human wildlife conflict; conflict mitigation

**Type of article:** contributed paper

**State:** Accepted by Conservation Science and Practice

**Target audience:** All conservation practitioners. We hope this paper reaches a wide audience of on-the-ground practitioners, and that it will encourage them to incorporate more conservation psychology techniques into their ongoing monitoring and evaluation processes.

## Abstract

Attitudes are one of the most basic psychological constructs, and inform how people interact with the world around them. Understanding attitudes towards objects, problems or behaviours may be key to promoting more desirable behaviour, and attitudes studies should be part of any comprehensive social science-based approach to behaviour-change. The most commonly used framework for understanding attitudes is the ABC model, which says that affect (emotional response), previous behaviour, and cognition (e.g., beliefs) are the basis for an individual's attitude towards a given attitude object. However, despite the ubiquity of this framework, relatively few studies break down the 'attitude' monolith into these more usable components. In this study, we sought to understand how these different components of attitude relate to overall attitude towards predators across Kenya and Zimbabwe. Using an ordinal logistic regression, we found that negative (but not positive) affect, and all cognitive terms were significant explanatory factors in overall attitude towards predators. Negative affect, i.e. negative emotional reactions towards predators, was a significant explanatory factor, which suggests that previous negative experiences with predators can have a pervasive, long-lasting effect on overall attitudes. In the model, we included cognitive terms for the following: social norm beliefs (what people think others believe about predator killing); harms and benefits (impact of local predator population on livelihoods); and predator killing benefits (perceived benefits of lethal control). All cognitive terms were significant, suggesting that either initiatives which actually change the underlying conflict rate or severity, or education programmes which gradually change beliefs (e.g. inflated estimations of conflict rate) could have significant impact on the formation of overall attitudes. Overall, we demonstrate that there are practical benefits to studying the sub-components of attitude, which can allow managers to design targeted programmes to increase the effectiveness of conservation activities.

## Introduction

Although there is debate concerning which parts of human behaviour are predicted by attitudes, and under what circumstances (Forward 1997; Friese et al. 2008), it is generally true that attitudes inform behaviour (Ajzen & Fishbein 2000; Ajzen 2001; Wallace 2005), and therefore that interventions which focus on improving attitudes can be used to encourage or discourage certain behaviours (Sparks & Shepherd 2002; Hunecke et al. 2007). In conservation, where human behaviour is perhaps the biggest cause of threats to biodiversity, from trade in exotic wildlife to predator persecution, understanding how to modify attitudes to encourage pro-conservation behaviours is of major importance. But what are attitudes? And how can we use the umbrella concept of ‘attitudes’ to design targeted interventions which encourage conservation-friendly behaviour?

An attitude can broadly be summarised as a person’s overall evaluation of an object or topic, with both emotional and evaluative dimensions (Ajzen & Fishbein 2000; Ajzen 2001). In other words, your attitude is the sum of all your thoughts, feelings, judgements and opinions about a particular thing (Petty et al. 1997; Ajzen 2001). Although there are numerous theoretical models which seek to explain how attitudes are structured, most models suggest that cognition, affect, and behaviour are the three key pillars on which overall attitudes rest (Breckler 1984; Millar & Tesser 1989; Jackson et al. 1996; Wolff et al. 2011). ‘Affect’, although a multi-layered concept, is generally used to refer to the overall favourability of an attitude object, which includes emotions, degree of emotional arousal, and general mood in relation to that object (Watson et al. 1988; Ajzen 2001). In attitude models, ‘cognition’ generally refers to all the functional processes by which an attitude object is judged, which includes evaluations, beliefs and perceptions, i.e. all the factual or perceived factual information available to an individual (Haddock & Zanna 1999; Ajzen 2001). Different people rely upon different ratios of affect to cognition to form their individual, overall judgement of an object, and different objects elicit different ratios of these constructs in individuals’ judgements (Haddock & Zanna 1999).

Attitudes are complicated, and studies have shown that the socio-psychological constructs underlying affect and cognition are very different: in some cases affect can be a more important predictor of behaviour than cognition, and vice versa (Yang & Yoo 2004). Understanding whether interventions should target feelings or evaluations in a given situation may be the difference between an intervention succeeding or failing. In advertising, we see that consumers can be ‘primed’ with either affective or cognitive messages, depending on the product, and different ‘primers’ are more effective in different contexts (Minton et al. 2017). In health research, authors have shown that increasing the positive affect of exercise-related behaviours makes individuals more likely to persevere with them (Van Cappellen et al. 2018; Rice et al. 2019; Fredrickson et al. 2020). By contrast, cognitive beliefs are thought to have more impact on diet-based interventions and healthy eating (Ogden et al. 2007; Prestwich et al. 2011).

In conservation there is a substantial literature on attitudes, but many studies suffer from a lack of engagement with the core theoretical background to the study of attitudes. Few articulate the hypothesised links between attitudes and behaviours, and different components of attitude are typically grouped together. We argue that – as in the field of health interventions – there are obvious benefits to understanding how the building blocks which contribute to an overall attitude relate to one another. This is particularly true with regard to specific conservation issues, where targeted interventions may not be able to impact an overall attitude (and where overall attitudes may have limited impacts on behaviour), but where a focus on specifics such as affect, cognitive beliefs, or harm/benefit evaluations may facilitate meaningful changes in attitude components, and in turn have beneficial impacts on given conservation-related behaviours.

Attitudes towards predators are some of the most commonly studied in conservation, and numerous interventions designed to improve attitudes have been implemented around the world. Some of these interventions have been highly targeted and very successful (Marchini & Macdonald 2020), but others

have struggled to find links between overall attitudes and specific behaviours. We argue that attitudes towards predators can be (but are not always) important factors which influence predator persecution, and that the design of outreach campaigns to reduce this behaviour would benefit from an understanding of the sub-components of attitude. In this paper, we explore the relationship between affective and cognitive attitudes towards predators in livestock managers across Kenya and Zimbabwe. We aimed to understand the impact of different attitude components on overall attitudes and behaviour towards predators, and to identify which components (if any) had a stronger influence on overall behaviour and therefore were a more suitable focus for future conservation interventions.

## **Methods**

### *2.1 Study Areas*

Data from two countries, totalling four different regions, was used in this analysis: in Zimbabwe, areas around Hwange National Park; in Kenya, the South Rift on the southern edge of the Rift Valley, community lands around Amboseli National Park, and the greater Tsavo area. In Zimbabwe, the Hwange area has historically benefitted from wildlife through the CAMPFIRE programme (Frost & Bond 2008) and eco-tourism, although this has more recently been severely impacted by Zimbabwe's ongoing economic collapse (Guerbois et al. 2013). A mix of Ndebele, Nambya, Tonga, and other ethnicities, the people in the area have a long history of livestock ownership (Loveridge et al. 2017a). As the largest national park in Zimbabwe, Hwange has large resident populations of lion, hyaena, leopards, and other smaller carnivores, and conflict between people and predators can be severe (Loveridge et al. 2017b).

All three Kenyan regions which were included in this study are situated along the southern border with Tanzania. This part of the country is rich in wildlife, and contains some of the world's most popular national parks, including the Maasai Mara, Amboseli, and Tsavo. The landscape still has relatively few barriers to wildlife movement, and the area has contiguous populations of large-bodied predators

including lion, leopard, cheetah, and spotted hyaena (Western 2017). Similarly to the Zimbabwe study region, livestock production is a critical source of livelihood for these Kenyan communities, who are primarily Maasai, with some Kikuyu and Kamba people. People in this region are traditional pastoralists, and keep large numbers of goats and cows. With resident predator populations, predation of livestock can be a substantial source of hardship for livestock producers; Maasai people also practice traditional predator killing which, although declining, still has strong cultural and social roots (Hazzah et al. 2014).

## *2.2 Survey*

### *2.2.1 Survey Participants and Data Collection*

Survey protocol was approved by the University of Oxford Social Sciences and Humanities Interdivisional Research Ethics Committee (Reference No. R53944/RE001). Surveys were pre-translated into a selection of the local languages (Kiswahili, Maa, Ndebele and Nambya) through a group discursive process, with translate-retranslate methodology where there was low consensus over the translation (Lucas & Ware 1977; Perry et al. 2020). As we were unable to satisfactorily meet translation requirements for some minority languages (e.g. Tonga in Zimbabwe, which makes up a small but appreciable proportion of the local population), respondents who preferred languages into which the survey had not been translated (e.g. Tonga, Kamba) were excluded from the sample; as very few participants speak only minority languages, this resulted in the exclusion of only a tiny number ( $n < 10$ ) of participants.

All surveys were conducted as face-to-face structured interviews, carried out by trained local research assistants, in the language preferred by the interviewee. Responses were logged in the Qualtrics offline survey application, which formats surveys for use with smartphones, and allows surveyors to show participants visually simplified scales to illustrate the required response parameters, to aid comprehension (Qualtrics 2013). Each local research assistant operated in their home region, using door-to-door surveying and opportunistic surveying at busy communal spaces, e.g. churches, although

participants did not select for interview individuals to whom they were personally known. Once willing participants were identified, they were asked to move to an area where they could be interviewed privately; no observers were present for any interview in this data-set. All participants in the survey were involved in livestock management, and were 18 years or older. The data used in this analysis were collected as part of a larger survey. In total, 1,285 usable interviews were collected.

### *2.2.2 Survey Design*

In this analysis, a subset of data from the original survey was used; the data-set was refined in the same manner for all samples. The core survey questions concerned attitudes, behaviours and beliefs regarding predators and predator control. The behavioural questions, which came towards the beginning of the survey, concerned actual predator-related behaviour, i.e. killing or attempting to kill predators (e.g. “In the last five years, how many times have you killed or attempted to kill a predator?”). These questions were not asked using specialist approaches for eliciting sensitive information (e.g. randomized response technique), and so can only be used as a proxy for attitude towards the social permissibility of predator killing, rather than a metric of behaviour itself (see Knyazev 2004; Ulloa et al. 2008; Bavarian et al. 2013). We then collected perception data, which were split into separate blocks for ‘global’, overall attitudes towards predators ( $n = 5$ , e.g. “Conflict with predators is a threat to livelihood in this area”), affect ( $n = 15$ , e.g. “How much do activities to do with predators and predator control make you feel proud?”), and cognitive beliefs ( $n = 13$ , e.g. “For all predators in area to be killed in the next 5 years would be beneficial”), all of which were measured on 5-point Likert scales (see Appendix 1) (Perry et al. 2020).

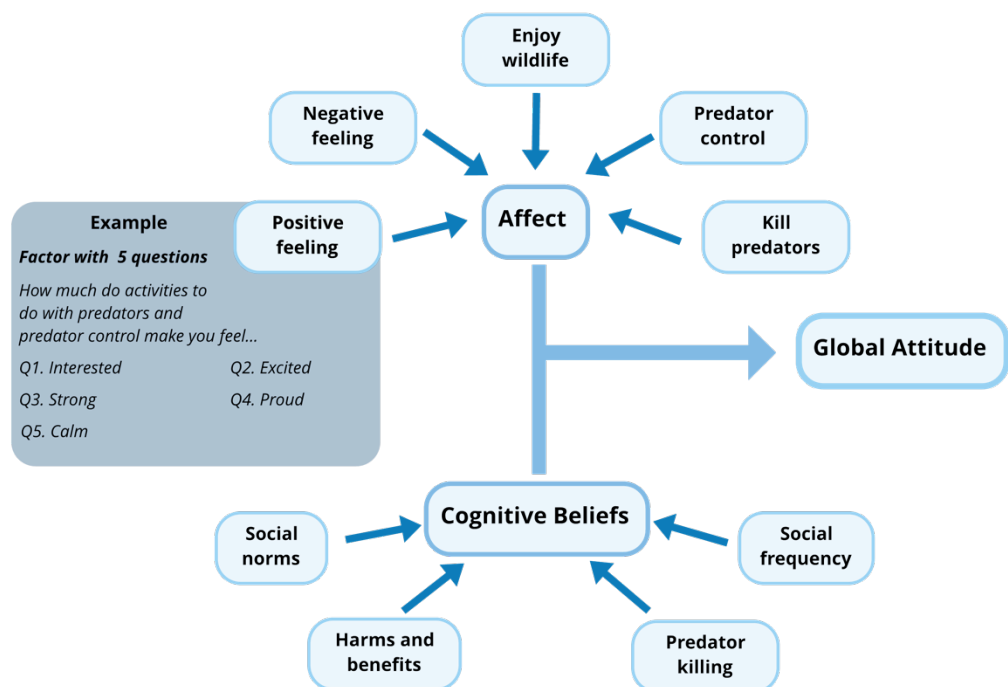
### *2.3 Data Analysis*

We aimed to explore how the respondents’ attitudes towards predators were structured, and how both affective and cognitive components of attitude contributed to individuals’ overall perception of predators. All analysis was carried out using the statistical software R, version 4.0.2 (R Core Team, 2020).

### 2.3.1 Construction of Psychological Factors

Attitudes cannot be measured directly, but by asking respondents a series of questions which were designed to capture different aspects of their latent beliefs, we developed proxies for affect and cognitive beliefs. Initially, exploratory factor analysis (which is similar to principal components analysis, but more commonly used with human survey responses) was used to identify the approximate structure of affect and cognitive beliefs (Perry et al. 2020b). This technique identifies how participants' responses to sub-sets of questions cluster together, and therefore suggests the factor structure onto which all of the questions map. Based on these clusters, and the theoretical background used when developing the survey (see Figure 1 and Table 1), we then developed five factors for affect, and four for cognition, onto which the survey questions mapped. Confirmatory factor analysis was subsequently used to test the statistical validity of each of these factors ( $n = 9$ ), and ensure they adequately represented the underlying psychological variables. We used the comparative fit index (CFI), standardized root mean square of residuals (SRMSR), and root mean square error of approximation (RMSEA) to test factor structure fit (Appendix 2).

**Figure 1.** Structural schematic of the link between cognitive beliefs, affect, and global attitude, and factor breakdown. Details of all questions in each factor are included in the Appendix 2. (Rosenberg et al. 1960).



To confirm the internal validity of the factors, we used Cronbach's alpha (see Table 1). Because we wanted factors to reflect distinct components of individual psychology, high internal factor consistency was needed, and a relatively high Cronbach's alpha threshold of 0.7 was used. This means that all the questions in each factor had highly correlated responses, and it can be assumed that they map closely onto one underlying psychological construct. Two factors – one affective factor, and one belief factor – failed to meet this threshold, and were excluded from further analysis. Correlation tests using R package 'arm' (Gelman et al. 2020) were then run to check that all factors were sufficiently independent to be meaningful. Two factors were considerably correlated ( $> 0.59$ ; see Appendix 2). The factors had similarly high Cronbach's alpha scores, so the factor which was considered to be least central to the paper's focus (i.e. which was composed of less targeted questions) was dropped, leaving six psychological factors (see Table 1). Once we had determined which questions were to be included in each factor, a composite was made for each factor containing between two and five separate questions. All responses were scored on the same 5-point Likert scale, so simple addition of the individual question responses was used to generate the composites. Although composites are relatively arbitrary by nature, previous work has shown that composite measures can effectively be used to represent psychological variables (Bollen & Bauldry 2011; Perry et al. 2020; Rhemtulla et al. 2020).

**Table 1:** Psychological factor structures underlying attitudes towards predators, with details on factor properties.

**In bold**, the factors which were retained for the final analysis.

<sup>1</sup> The Cronbach's alpha for factors failed to meet the pre-determined threshold for validity, and they were excluded from subsequent analysis.

<sup>2</sup> These two factors were considerably correlated (> 0.59); the cognitive belief component was considered more valid given the survey design, so 'enjoy wildlife' was dropped from further analysis.

<sup>a</sup> Qualitative description of the individual factor.

<sup>b</sup> Cronbach's alpha, which measures the internal consistency of each factor.

<sup>c</sup> Measures of fitness, including comparative fit index (CFI), standardized root mean square residuals (SRMSR) and root mean square error of approximation (RMSEA).

| Module | Factor <sup>a</sup>               | Definition                                                  | Example                                                                                | No. of questions | CA <sup>b</sup>   | Fit <sup>c</sup> |
|--------|-----------------------------------|-------------------------------------------------------------|----------------------------------------------------------------------------------------|------------------|-------------------|------------------|
| Affect | <b>Positive feeling</b>           | Positive emotional responses to predator-related behaviours | How much do activities to do with predators and predator control make you feel strong? | 5                | 0.81              | CFI: 0.93        |
|        | <b>Negative feeling</b>           | Negative emotional responses to predator-related behaviours | How much do activities to do with predators and predator control make you feel afraid? | 3                | 0.81              | SRMSR: 0.05      |
|        | Enjoy wildlife                    | Sense of wildlife-related enjoyment                         | The presence of predators in this area is enjoyable.                                   | 3                | 0.83 <sup>2</sup> | RMSEA: 0.07      |
|        | <b>Predator control enjoyment</b> | Sense of predator-control related enjoyment                 | I enjoy being involved in predator control.                                            | 2                | 0.78              |                  |
|        | Kill predators                    | Positive emotional responses to actual predator killing     | For me to kill predators that kill my livestock would be enjoyable.                    | 2                | 0.6 <sup>1</sup>  |                  |
|        | <b>Social norm beliefs</b>        | Perceptions of socially sanctioned predator-killing         | My community feels I should kill any predators that kill livestock.                    | 3                | 0.86              | CFI: 0.91        |
|        | <b>Harms and benefits</b>         | Perceptions of the local impact of predator populations     | The presence of predators in this area is harmful.                                     | 3                | 0.77 <sup>2</sup> | SRMSR: 0.07      |

|                 |                              |                                  |   |                  |                |
|-----------------|------------------------------|----------------------------------|---|------------------|----------------|
| <b>Predator</b> | Perceived benefits from      | Killing predators would decrease | 4 | 0.73             | RMSEA:<br>0.09 |
| <b>killing</b>  | killing predators            | the number of my livestock that  |   |                  |                |
| <b>benefits</b> |                              | are killed by predators.         |   |                  |                |
| Social          | Perceptions of the frequency | How many people in your area     | 2 | 0.6 <sup>1</sup> |                |
| frequency       | of predator-killing in their | control predators?               |   |                  |                |
| beliefs         | community                    |                                  |   |                  |                |

### 2.3.2 Construction of Response Variable

We wished to examine how affect and cognition explain participants' behaviour towards predators. Self-reported behaviour – particularly for illegal activities – is hard to measure, so we included both behavioural and general attitude terms in the composite response variable (see Appendix for details). Five global attitude questions were incorporated into this composite with equal weighting ('Predators are an important part of the natural environment'; 'Livestock and predators can coexist, if managed correctly'; 'If livestock is managed correctly, it is not killed by predators'; 'Predator killing is important in my culture'; 'Conflict with predators is a threat to livelihood in this area'). One behavioural measure was also included ('Have you ever killed or attempted to kill a predator?', with equal weight to the combined attitude questions, which we felt was appropriate given the direct relevance of self-reported behaviour.

### 2.3.3 Model Construction

As Likert scales are strictly ordinal, rather than linear, an ordinal approach was taken to model construction. Due to data collection limitations, we chose to control for only a select few variables, which were thought to be highly important. We performed ordinal logistic regression analyses using package 'ordinal' (Christensen & Christensen 2015), implemented in R (R Core Team, 2020), to test the effect of the six psychological factors, site, and age on overall attitude towards predators. Assumptions of ordinal regression models include lack of multi-collinearity and proportional odds, which were also checked using 'ordinal' (Christensen & Christensen 2015). We tested for main effects of all combinations

of explanatory variables, and Akaike's Information Criterion was used to distinguish the best-fitting combination of explanatory variables. Interactions terms were not included as there was no prior reason to expect particular combinations of variables to interact in meaningful ways. Models with  $\Delta < 2$  were considered to have substantial support, and only those models were considered further (see Table 2; (Burnham & Anderson 2004)). We then performed post-hoc tests of each prior-formulated explanatory variable (Song et al. 2009; Burnham et al. 2011; Dixon 2013).

## Results

We explored how different aspects of affect and cognitive beliefs explained variation in overall attitudes and behaviours towards predators. The factor structures we developed using EFA and our hypothesised theoretical question clusters were good fits to the underlying data (affect: CFI = 0.93, SRMSR = 0.05, RMSEA = 0.07; cognition: CFI = 0.91, SRMSR = 0.07, RMSEA = 0.09; see Table 1). In total six psychological factors (positive feeling, negative feeling, predator control enjoyment, social norm beliefs, harms and benefits, and predator killing benefits) were used as explanatory factors in subsequent modelling. On carrying out the model testing, we found that no model was within  $\Delta < 2$  of the best-fitting model, which carried a model likelihood of 1 and weight of 0.992. This model was considered the only good fit to the data, so model averaging was not carried out (Table 2). The top model contained terms for site, age, and all six psychological factors (Table 3). Of these, negative feeling was the only significant affective term, but it was highly significant ( $z = 3.645$ ,  $p = 0.0003$ ). Amongst the cognitive components, beliefs about social norms ( $z = -2.92$ ,  $p < 0.01$ ), harms and benefits ( $z = -4.66$ ,  $p < 0.0001$ ), and predator killing ( $z = -4.79$ ,  $p < 0.0001$ ) were all highly significant (Table 3).

**Table 2:** Top five models of the influence of psychological factors on overall attitudes towards predators.

| Rank | Model                                                                                                                                  | $\Delta AIC^*$ | Likelihood | Weight   |
|------|----------------------------------------------------------------------------------------------------------------------------------------|----------------|------------|----------|
| 1    | site + age + positive feeling + negative feeling + predator control enjoyment + norms + harms and benefits + predator killing benefits | 0              | 1          | 0.9924   |
| 2    | site + age + positive feeling + negative feeling + norms + harms and benefits + predator killing benefits                              | 9.81427        | 0.00739    | 0.0073   |
| 3    | site + positive feeling + negative feeling + predator control enjoyment + norms + harms and benefits + predator killing benefits       | 17.14989       | 0.00018    | 0.0001   |
| 4    | site + age + positive feeling + negative feeling + predator control enjoyment + harms and benefits + predator killing benefits         | 19.24590       | 6.62E-05   | 6.57E-05 |
| 5    | site + age + positive feeling + negative feeling + predator control enjoyment + norms + harms and benefits                             | 24.29677       | 5.30E-06   | 5.26E-06 |

**Table 3:** Main effects of the top ordinal logistic regression model for the effect of different psychological factors on overall attitude towards predators. N for the test was 1,038.

| Model term                        | Estimate | SE     | z       | p                      |
|-----------------------------------|----------|--------|---------|------------------------|
| <b>Site</b>                       |          |        |         |                        |
| <i>Hwange</i>                     | - 0.5309 | 0.2452 | -2.367  | <b>0.018 *</b>         |
| <i>Olgulului</i>                  | 2.7264   | 0.2257 | 12.079  | <b>&lt; 2e -16 ***</b> |
| <i>Shompole</i>                   | 0.4806   | 0.2038 | 2.358   | <b>0.018 *</b>         |
| <i>Tsavo</i>                      | 0.0136   | 0.2208 | 0.062   | 0.951                  |
| <b>Age</b>                        | 0.0369   | 0.0477 | 0.774   | 0.438                  |
| <b>Affect</b>                     |          |        |         |                        |
| <i>Positive feeling</i>           | 0.0012   | 0.0185 | 0.063   | 0.949                  |
| <i>Negative feeling</i>           | 0.1035   | 0.0284 | 3.645   | <b>0.0003 ***</b>      |
| <i>Predator control enjoyment</i> | 0.0606   | 0.0329 | 1.838   | 0.066 °                |
| <b>Cognition</b>                  |          |        |         |                        |
| <i>Social norm</i>                | - 0.0641 | 0.0219 | - 2.923 | <b>0.0035 **</b>       |
| <i>Harms and benefits</i>         | - 0.0816 | 0.0175 | - 4.658 | <b>3.19 e-06 ***</b>   |
| <i>Predator killing benefits</i>  | - 0.0693 | 0.0145 | - 4.785 | <b>1.71 e-06 ***</b>   |

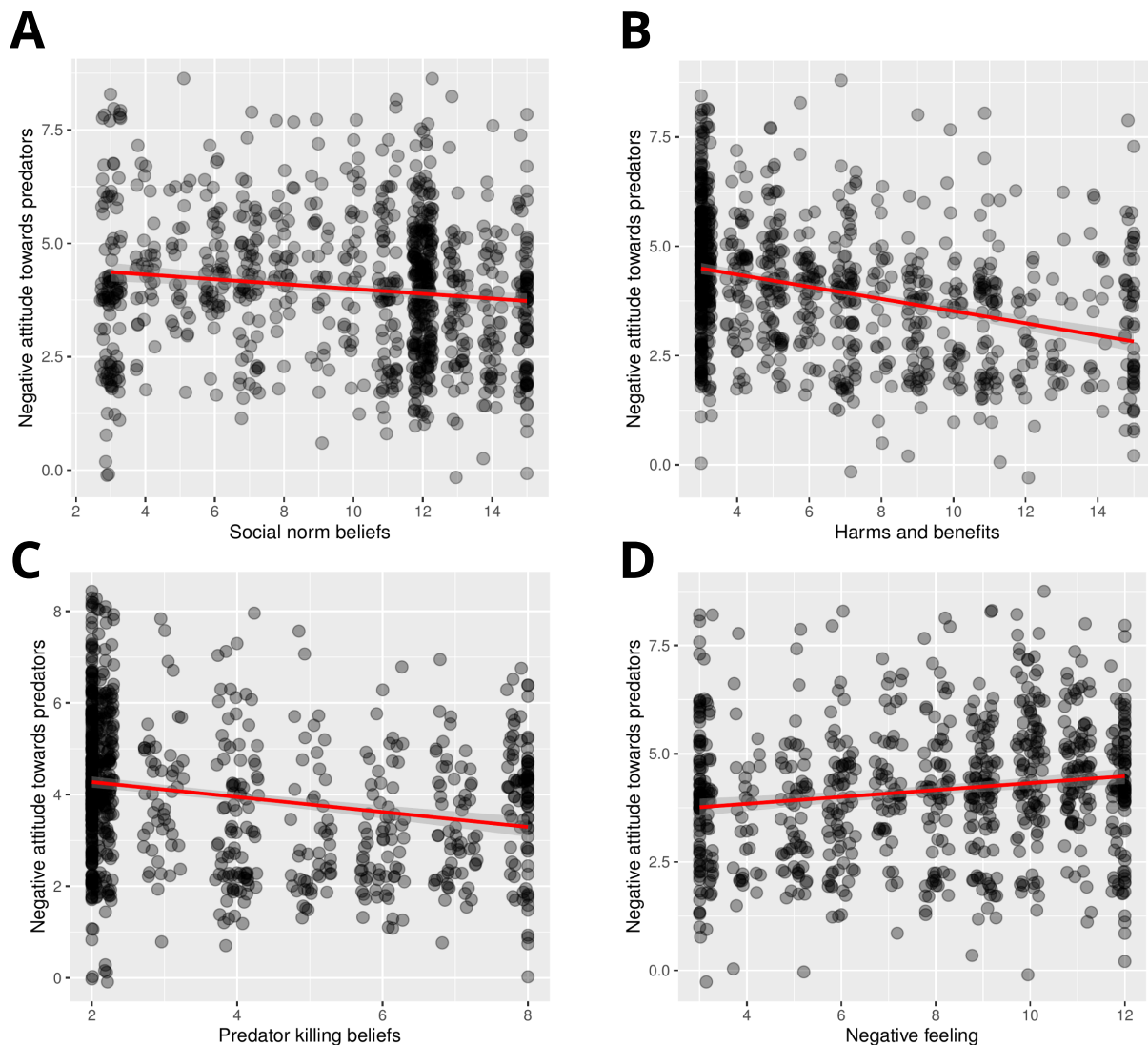
**Figure 2A - D:** Main effects of terms in the top model. These figures are for illustrative and explanatory purposes only, to best show the conclusions of the model detailed above.

**A – Social norm beliefs:** stronger social norms for predator killing (*left*) correlate with more negative overall attitudes towards predators. Lower x axis scores show stronger perceptions that predator killing is acceptable ( $z = -2.92$ ,  $p < 0.01$ ), e.g., “My community feels I should kill any predators that kill livestock”.

**B – Harms and benefits beliefs:** greater perception that predators are harmful (*left*) correlate with more negative overall attitudes towards predators. Lower x axis scores show stronger perception that predators are harmful ( $z = -4.66$ ,  $p < 0.0001$ ).

**C – Predator killing benefits beliefs:** stronger perception that removing predators is important/useful (*left*) correlates with overall negative attitude. More negative x axis scores represent stronger perception that removing predators is important for some purpose ( $z = -4.79$ ,  $p < 0.0001$ ), e.g. “Killing predators is a more effective way of protecting livestock than herders or bomas”.

**D – Negative feeling:** more negative emotional response to predators (*right*) correlates with more negative overall perception. More negative feelings towards predators suggest more negative overall attitude ( $z = 3.65$ ,  $p < 0.001$ ).



## Discussion

Cognitive and affective attitudes are major components of overall attitudes, and we found that both factors partially explained global attitudes towards predators. In our model, all terms were retained. Two terms which were not independently significant – age and positive feeling – were retained by the model, which is unusual but not unheard of for the AIC approach since the threshold for significance in AIC modelling is higher than for the independent post-hoc tests, see (Lindsey & Jones 1998) and Appendix 3 for statistical details. Predator control enjoyment was marginally significant, leaving social norm beliefs, predator killing beliefs, harms and benefits, and negative feeling as the main highly significant model terms.

Social norm beliefs, such as ‘my community feels I should kill any predators that kill livestock’, had a significant effect on global attitudes towards predators. These beliefs relate to individuals’ perceptions of socially sanctioned predator-killing, and we found that greater perceived approval of predator control correlated with stronger overall anti-predator attitudes. This result is consistent with previous research, which has shown that social norms have a strong effect on overall livestock management behaviour (Perry et al. 2020), and that interventions which manipulate social norms can affect individuals’ perceptions of behaviour (Perry et al., *submitted*). Previous work on norms suggests that key opinion-makers can influence community norms on a wide scale (Paluck & Shepherd 2012), and that norms regarding predator killing may be relatively malleable (Marchini & Macdonald 2012; Paluck & Shepherd 2012). Regardless of their impact on attitude, social norms are widely considered a major influence on behaviour, and wherever possible should be integrated into community conservation interventions and behaviour change campaigns (Knight 2016; van Eeden et al. 2020).

Social norms campaigns have been shown time and time again to effectively change behaviour, although often they require extended time periods to change the nature of socially mandated behaviours (Bicchieri & Mercier 2014). Seat belt use, for example, is now reasonably high (~80 %) across the western world, despite low usage up until the late 1970s (Williams et al. 1987). This norm change is a direct result of behavioural change campaigns and shifting norms regarding their use. Through the 1970s and 1980s, many countries made seat belt use compulsory, in other words governments invoked injunctive norms regarding use (Mackay 1985; Williams et al. 1987). This was reinforced by gradually shifting subjective norms, as an increasing proportion of vehicle users also used their belts;

now, across much of western Europe, failure to use a seat belt is uncommon, and non-use would be socially sanctioned by most demographic groups (Steptoe et al. 2002; Vis & Eksler 2008). There are numerous examples of gradual social norm shifts across a range of disciplines, and it is easy to see how changes to conservation-related norms such as consumption of bushmeat, slash-and-burn agriculture, and persecution of predators would be of considerable conservation benefit.

Unsurprisingly, we found that predator-killing beliefs such as ‘killing predators would decrease the number of my livestock that are killed by predators’ had a significant effect on overall attitudes towards predators. Similarly, the harms and benefits associated with living with predators were also significant influences on overall attitudes, and agreement with statements such as ‘the presence of predators in this area is harmful’ was indicative of overall evaluative concerns about the impact of predators on livelihoods. In many instances, this perception is a fair and accurate reflection of the facts: living with predators can be very costly for local people (Holmern et al. 2007; Kissui 2008; Van Niekerk 2010; Loveridge et al. 2017a). Evidence-based perceptions of real harm are indisputable justification for the intolerance many communities show towards predators, and for conservation programmes seeking to preserve predator populations it is critical that the impact of predators on lives and livelihoods is minimised and mitigated. In many situations, however, predators’ impact on livelihoods can be over-estimated (Rasmussen 1999; Amit et al. 2013), or the precise nature of the problem misunderstood by conservationists. Mitigation and compensation measures must target the precise costs of living alongside predators. For example, if the core damaging belief is that compensation for predation undervalues predated livestock animals, solutions that are considered fair compensation for this aspect of the problem are needed. Similarly if, for example, people’s key issue is the potential threat posed by wildlife to individuals using a particular path in the evenings, then strategies to increase local security may be more appropriate. Previous intervention studies in other fields have shown that behaviours can be changed when beliefs are changed (Abraham et al. 2000; Fishbein & Yzer 2003), for example in relation to health beliefs (Kelly et al. 2011), or condom use (Solomon & DeJong 1989), and therefore where suitable conservation solutions can be implemented to minimise actual harm, it is likely that local people’s beliefs and attitudes will also change.

That all of the cognitive terms proved to be significant is a very positive result for conservation actors. Most conservation projects make a considerable effort to engage communities in outreach events and educational presentations e.g. Sibanda et al (2020). This result highlights the importance of these activities, and demonstrates that evaluative judgements can be very important in the field of human-wildlife conflict, which is often thought to be led by emotional reactions (Wilson 2008; Wieczorek Hudenko 2012). However, as explored above, the exact scope of evaluative judgements needs to be understood, and the correct steps put into place to offset those costs. Cognitive beliefs may not always be fully rational, but they do compile all available information and can be changed if individuals are exposed to the right information, in the right manner (Wyer Jr & Albarracín 2005; Gawronski & Bodenhausen 2006). Further work is needed to explore the precise mechanisms by which cognitive beliefs can change over time and to maximise the effectiveness of conservation messaging, but overall this result should be considered positive support for the likely efficacy of these activities.

Of the affective terms, positive feeling contributed to the model but was not independently significant, suggesting that positive attitudes are only important when other variables (e.g. specific cognitive beliefs, or lack of negative beliefs) agree with the positive component. This is similar to attitude salience and strength research, where stronger attitudes are formed when various components agree (Thompson et al. 1995). By contrast, negative feeling was highly significant. This is consistent with the existing literature, which suggests that negative experiences, feelings, and intangible factors have a much greater impact on overall attitudes and behaviours than positive feelings (Jacobsen et al, *in press*; (Jackson et al. 1996; Cohen et al. 2002; Barlow et al. 2012; Conner et al. 2013). In the context of large-bodied predators, it is understandable that feelings of fear and perhaps prior negative experiences can colour people's future judgement. It can be incredibly difficult to reduce or prevent the development of negative affect, either as a consequence of a single negative event or long-term difficulties with a given source of conflict. Various studies suggest that an opportunity to fully discuss concerns, difficulties, or traumatic events, and feel like these have been heard by an authority figure can reduce feelings of negative affect (Ochsner et al. 2002; Leitner et al. 2018), but such follow-up programmes should be evaluated carefully, to ensure they are not cementing existing trauma (Van Emmerik et al. 2002). The impact of negative affect on overall attitudes illustrates the importance of appropriate human-wildlife conflict follow-up, and further studies which

evaluate strategies to either reduce or counter-balance negative affect in a human-wildlife conflict context would be of considerable value.

Attitudes incorporate available information, both good and bad. They are plastic entities, which change over the course of individuals' lives, and adapt to evolving circumstances. One only has to look at the positive associations lions have in the Western world to see how thorough these changes in perspective can be. Whilst the composite, evolving nature of attitudes does leave them vulnerable to change in ways which may have undesirable conservation implications, it also creates opportunities for promoting pro-conservation behaviour. Indeed, understanding attitudes in greater depth is key to addressing local concerns, and making these central to any potential solution.

The relationship between overall attitudes and behaviours is chequered (Barker et al. 1994; Frey & George 2010), but specific, targeted interventions which take advantage of the affective and cognitive components of attitudes and use highly focussed messaging to achieve their aims have a much more promising track record (Parrott et al. 2008; Kothe et al. 2012; Sheeran et al. 2016). In this study, we show that meaningful differences in attitude components can be identified through the use of a relatively simple surveying approach, and that differences in the composition of attitudes may have implications for the design of targeted conservation interventions. We argue that for the minimal cost of a brief attitudes study, projects could benefit significantly from the ability to focus interventions on specific beliefs, positive or negative emotional reactions, and therefore that satisfactory solutions to conflicts are more likely to be found. We found that negative experiences and cognitive beliefs were both impactful on overall attitudes towards predators, and suggest that, where attitude towards predators contributes to conflict, programmes should aim to a) design targeted interventions which either remove the factual basis for negative cognitive beliefs, or implement education programmes to counter false beliefs, and b) work towards mitigating and resolving the quite understandable negative emotions often associated with negative human-predator experiences. Living alongside predators creates many challenges for communities, but with effective mitigation, targeted education, and appropriate benefits, negative attitude towards predators should never undermine an otherwise successful conservation outcome.

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# Supplementary Materials

## Paper 4: Attitude and Cognition – Appendix

### Appendix 1: Full Survey Questions

#### Behavioural Questions:

1. Have you ever killed or attempted to kill a predator?
2. In the last 5 years, how many times have you killed or attempted to kill a predator?
3. In last 5 years, how many times did you kill OR try to kill predators which had already killed livestock?
4. In last 5 years, how many times did you kill OR try to kill predators to prevent them from killing livestock in the future?

#### Global Attitude Questions:

1. Predators are an important part of the natural environment.
2. Livestock and predators can coexist, if managed correctly.
3. If livestock is managed correctly, it is not killed by predators.
4. Predator killing is important in my culture.
5. Conflict with predators is a threat to livelihood in this area.

#### Affect Questions:

1. How much do activities to do with predators and predator control make you feel interested?
2. How much do activities to do with predators and predator control make you feel excited?
3. How much do activities to do with predators and predator control make you feel strong?
4. How much do activities to do with predators and predator control make you feel proud?
5. How much do activities to do with predators and predator control make you feel calm?
6. How much do activities to do with predators and predator control make you feel upset?
7. How much do activities to do with predators and predator control make you feel afraid?
8. How much do activities to do with predators and predator control make you feel angry?
9. The presence of predators in this area is enjoyable.
10. The interaction between predators and people in this area enjoyable.
11. Generally, the presence of wildlife in this area is enjoyable.
12. I feel safe when carrying out predator control.
13. I enjoy being involved in predator control.
14. For me to kill predators that kill my livestock would be enjoyable.
15. For all predators in area to be killed in the next 5 years would be enjoyable.

#### Cognitive Belief Questions

1. My community feels I should kill any predators that kill livestock.
2. The people I care about kill predators that kill livestock.
3. People expect that I will kill any predators that kill my livestock.
4. The presence of predators in this area is harmful.
5. The interaction between predators and people in this area harmful.
6. Generally, the presence of wildlife in this area is harmful.
7. For me to kill predators that kill my livestock would be beneficial.
8. For all predators in area to be killed in the next 5 years would be beneficial.
9. Killing predators would decrease the number of my livestock that are killed by predators.
10. Killing predators is a more effective way of protecting livestock than herders or kraals.
11. Community elders think it is very important for me to control predators.
12. How many people in your area control predators?
13. How many successful/wealthy Kenyan livestock owners control predators?

## **Appendix 2: Factor Structures and Validation**

### ***Affect***

After carrying out the EFA, we hypothesised that the 5 factors below would provide the best fit to the underlying psychological constructs. The factors were as follows.

#### ***Positive feeling***

- Q1. How much do activities to do with predators and predator control make you feel interested?
- Q2. How much do activities to do with predators and predator control make you feel excited?
- Q3. How much do activities to do with predators and predator control make you feel strong?
- Q4. How much do activities to do with predators and predator control make you feel proud?
- Q5. How much do activities to do with predators and predator control make you feel calm?

#### ***Negative feeling***

- Q1. How much do activities to do with predators and predator control make you feel upset?
- Q2. How much do activities to do with predators and predator control make you feel afraid?
- Q3. How much do activities to do with predators and predator control make you feel angry?

#### ***Enjoy wildlife***

- Q1. The presence of predators in this area is enjoyable.
- Q2. The interaction between predators and people in this area enjoyable.
- Q3. Generally, the presence of wildlife in this area is enjoyable.

#### ***Predator control***

- Q1. I feel safe when carrying out predator control.
- Q2. I enjoy being involved in predator control.

#### ***Kill predators***

- Q1. For me to kill predators that kill my livestock would be enjoyable.
- Q2. For all predators in area to be killed in the next 5 years would be enjoyable.

### ***Cognition***

We repeated the above process, this time to understand the cognitive factors.

#### ***Social norm beliefs***

- Q1. My community feels I should kill any predators that kill livestock.
- Q2. The people I care about kill predators that kill livestock.
- Q3. People expect that I will kill any predators that kill my livestock.

#### ***Harms and benefits***

- Q1. The presence of predators in this area is harmful.
- Q2. The interaction between predators and people in this area harmful.
- Q3. Generally, the presence of wildlife in this area is harmful.

#### ***Predator killing***

- Q1. For me to kill predators that kill my livestock would be beneficial.
- Q2. For all predators in area to be killed in the next 5 years would be beneficial.
- Q3. Killing predators would decrease the number of my livestock that are killed by predators.
- Q4. Killing predators is a more effective way of protecting livestock than herders or kraals.

#### ***Social frequency beliefs***

- Q1. How many people in your area control predators?
- Q2. How many successful/wealthy Kenyan livestock owners control predators?

### Validating the factors

Affect: CFI = 0.93; TLI = 0.91; SRMSR = 0.05; RMSEA = 0.07

Cognition: CFI = 0.91; TLI = 0.88; SRMSR = 0.07; RMSEA = 0.09

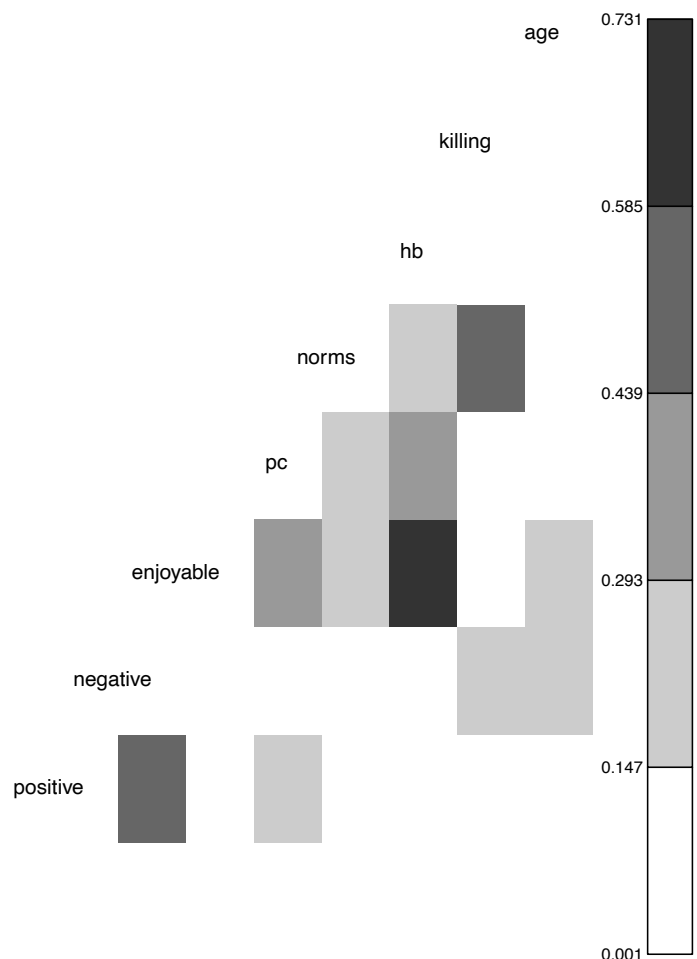
*Comparative Fit Index:* This is a form of 'normed' fit index, which assesses the model by comparing the model's  $\chi^2$  to that of a null model. Any value > 0.9 is considered a good fit, which was true for both models in this study.

*Standardised Root Mean Square Residual:* This is a measure of absolute (rather than relative) fit. An SRMSR of < 0.08 is generally considered a good fit. This was true for both affect and cognition factors.

*Root Mean Square Error of Approximation:* The RMSEA is considered one of the most informative fit indices, and is a measure of how well a model with optimally chosen parameters fits the population. The RMSEA favours models with fewer parameters, and is considered highly sensitive. An RMSEA between 0.05 and 0.1 is considered a fair fit, > 0.1 is considered a poor fit. Both models have RMSEA of < 0.1, and therefore are considered a good fit to the data.

### Correlation test

Harmful-beneficial and enjoyable-unenjoyable were correlated > 0.6, and therefore enjoyable-unenjoyable was removed from the analysis.



### Appendix 3: AIC Statistical Details

The top model contained the following terms:

site + age + positive feeling + negative feeling + predator control enjoyment + norms + harms and benefits + predator killing benefits

Of these, two model terms (age and positive affect) were not independently significant. Although this may intuitively feel wrong for many authors, we believe we have investigated thoroughly, and are comfortable with the result, which is due to the internal AIC calculations. To paraphrase, this is essentially because the internal cut-off for statistical validity of a term is approx. 0.157, which is a higher probability cut off than the post-hoc tests. See Lindsey, J.K. and Jones, B., 1998. Choosing among generalized linear models applied to medical data. *Statistics in medicine*, 17(1), pp.59-68., page 62 for statistical details.

### Appendix 4: Response Composite

#### **Behavioural component**

We gathered four measures of actual predator control behaviour, which were:

5. Have you ever killed or attempted to kill a predator?
6. In the last 5 years, how many times have you killed or attempted to kill a predator?
7. In last 5 years, how many times did you kill OR try to kill predators which had already killed livestock?
8. In last 5 years, how many times did you kill OR try to kill predators to prevent them from killing livestock in the future?

However, many participants chose only to answer question 1, which a) was the least precise measure and therefore the least incriminating, and b) included the answer code option 'prefer not to answer'. We therefore decided to only include question 1 as a behavioural measure in the composite, as this contained the most information and was answered most regularly.

We weighted the behavioural component of the composite heavily, as evidence suggests that previous behaviour is the strongest predictor of future behaviour and overall attitude. We awarded weight as follows:

*Q1. Have you ever killed or attempted to kill a predator?*

Yes = 10 units, 23 % of respondents;

Missing data OR prefer not to say = 5 units, 7 % of respondents

No = 0 units, 70 % of respondents.

#### **Attitudinal component**

In the full survey, one section contained questions about respondents' 'global' attitudes. They were primed with an instruction that 'in this section, we want you to tell us about the overall situation in this region'. The follow-up statements, which were answered on a 5-point Likert scale, were:

14. Predators are an important part of the natural environment.
15. Livestock and predators can coexist, if managed correctly.
16. If livestock is managed correctly, it is not killed by predators.
17. Predator killing is important in my culture.
18. Conflict with predators is a threat to livelihood in this area.

We decided that any question where the mean response did not fall between 1.5 and 3.5 was too skewed to be included; this did not apply to any question, mean responses were, in order above, 1.8, 2.2, 3.3, 1.6, 1.9.

Questions 1, 2, and 3 were phrased such that lower responses indicated more positive overall attitudes towards predators. We retained this scoring. Questions 4 and 5 were phrased such that lower responses indicated more negative overall attitudes towards predators. These questions were reverse scored, to maintain consistent question direction.

All responses were re-scaled, so Likert responses of 1 were scaled to zero, and Likert responses of 5 were scaled to 4, so that respondents who gave the lowest possible score accumulated zero units. For each question, response scores were halved, so respondents were awarded between 0 and 2 units. In total for the attitude component, participants were therefore awarded between 0 and 10 units, which gave the 5 attitude questions equivalent total weight to the behavioural component.

## General Discussion

### Summary of Research

Humans need nature, and evidence suggests that a connection with the natural world is not only good for people's physical health (Hartig et al. 2014), it is also essential for their mental health (Bratman et al. 2012; Hughes et al. 2013). Wildlife is an important part of many people's lives (Naeem et al. 2009; Yerbury & Weiler 2020), and the study of that wildlife is exciting enough that it ranks amongst the childhood wish-list of professions: fireman, astronaut, field biologist<sup>1</sup>. But although people like and need wildlife, that is not to say that living alongside wildlife is easy. From crop raiding elephants (Osborn & Parker 2003), to man-eating tigers (Montgomery 2004), large animals are in many cases very challenging neighbours (Thirgood et al. 2005). Indeed, even smaller, less dangerous wildlife can also come into conflict with people<sup>2</sup>, most notably over access to resources: land, water, and habitat (Hartter et al. 2011; Macdonald et al. 2013). With an ever-growing human population, the needs of people and wildlife come increasingly into conflict, and it is essential that conservation practitioners find better ways to reduce this conflict and facilitate coexistence.

The needs of people and wildlife are not necessarily mutually exclusive, and small modifications to human attitudes or behaviours can facilitate coexistence (Pooley et al. 2017). For example, the financial benefits derived from many community based natural resource management programs (e.g. CAMPFIRE in Zimbabwe, or various initiatives in Namibia) have been shown to change community attitudes towards large, dangerous wildlife like elephants and lions (Frost & Bond 2008; Dube 2019). Similarly, by changing people's patterns of water use and the locations where people access water, conflict between humans

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<sup>1</sup> Indeed, in an exciting demonstration of the changes in little girls' ambitions, last year a conservation research 'Barbie' doll who works in lion research was released.

<sup>2</sup> Although these examples are often considered 'pest control', the body-size distinction between this and conventional human-wildlife conflict is somewhat arbitrary.

and crocodiles can be reduced (Pooley et al. 2020). Understanding where small behavioural changes can facilitate coexistence is key to establishing a secure future for wildlife in human-dominated landscapes. If conservation outcomes are influenced by human behaviour, it follows that the study of that behaviour and the factors which act upon it should be considered central to the study of conservation (Saunders 2003). At present, this is not the case: behavioural psychology in conservation is understudied (Selinske 2018), and a greater emphasis on the practical application of psychology-derived tools may be useful (*ibid.*, Saunders 2003).

Although a well-developed field overall, the human-wildlife conflict literature highlights the relative paucity of studies on the psychology of conflict and human behaviour (Manfredo & Dayer 2004; Lischka et al. 2020). Conservation biologists' understanding of how and when people come into conflict with wildlife is relatively comprehensive (Treves et al. 2006; Nyhus 2016), and various mitigation strategies have been shown to be highly effective (e.g. (Potgieter 2011; Hazzah et al. 2014; Lichtenfeld et al. 2015; Petracca et al. 2019). However, efforts to implement mitigation strategies are often impeded by poor local compliance or engagement with the relevant programmes (Hill 2015; Sterling et al. 2017).

Practitioners' ability to carry out effective mitigation work is hampered by a lack of understanding of the determinants of human behaviour in conflict systems. Livestock predation, for example, is a significant source of hardship for local people (e.g. Holmern et al. 2007), and the use of fortified bomas can reduce depredation (Lichtenfeld et al, 2015). But individuals in positions of management or conservation planning authority often have a poor understanding of the reasons why some livestock owners choose to use their boma every night. The social and psychological factors which shape behaviour are often considered a 'black box' (Harrington & Fine 2000), but work to understand how these factors influence behaviour may help to achieve conservation ends.

Against this conflict background, the need for scientific answers to certain questions is apparent. Can specific applications of behaviour theory be used to understand the choices of people affected by human-predator conflict in rural Africa? If so, what psychological factors are the major determinants of people's conflict-related behaviour? And can an understanding of these psychological factors be used to design standardised tools for measuring, and ultimately manipulating, behaviour? This thesis has provided preliminary information with which to 1) understand the psychological factors which influence human decision-making regarding livestock management and human-predator conflict; 2) map variation in the effect of these psychological factors across spatial and cultural landscapes; and 3) examine the influence of specific psychological factors and the manipulation of these factors on human behaviour, with a view to ultimately improving the social elements of conservation intervention design and reducing human-wildlife conflict.

### *Key Findings*

The approaches used in this DPhil were based on Western survey methodologies and theoretical frameworks. Although such approaches are used globally, and authors have demonstrated the suitability of these techniques for use in different cultural contexts (Singelis 2000; Pressley 2007), the populations studied in this thesis are nevertheless atypical, with low literacy, little or no familiarity with surveying, and non-Western cultural and social history (Flaskerud 2012; Gakobo et al. 2016; Pathak et al. 2020). One important conclusion from my thesis is that these standardised social psychology techniques and frameworks can effectively be applied in the context of rural African human-wildlife conflict situations. I found that the theory of planned behaviour can explain variation in livestock management behaviour (paper 1), that factor analysis and population clustering can be used to study norms (paper 2), that vignettes can be used to manipulate said norms (paper 3), and that an ABC model of attitudes can be used to understand the sub-components of attitude (paper 4), all in semi-literate populations in rural

Kenya and Zimbabwe. In each study, results were consistent with the existing social psychology literature derived from previous work on Western, literate populations (see also Kagee & Van der Merwe 2006; Parmar et al. 2008), and gave meaningful results regarding the relationship between conflict with wildlife and human psychology. This establishes the principles needed to underpin future social psychology work, and demonstrates the applicability of these standardised techniques to the study of human-wildlife conflict in Africa.

My second key conclusion is that social norms exert a strong influence on livestock management behaviour in eastern and southern Africa, and may be a suitable target for behavioural interventions aiming to achieve conservation goals (Perkins & Berkowitz 1986). In paper 1, which used the theory of planned behaviour to examine determinants of livestock management practice in Kenya, social norms emerged as the most consistent predictor of behaviour. A follow-on comparative study (paper 2), which examined how social norms differ between Kenya and Zimbabwe, showed that the structure of normative beliefs was highly conserved between these regions, i.e. that the psychological structure of norms, and the impact of those norms on behaviours and attitudes were consistent in both areas. In practice, this means that approaches using social norms (to either collect information or design interventions) are likely to be effective across wide geographic and cultural landscapes. One expertly designed survey might be applicable in multiple contexts, therefore conservation projects without in-house social science skills may be able to make use of standardized tools. A study measuring the social norms of crop protection against elephants in Uganda might also be applicable to South Africa; an intervention using normative beliefs to nudge poaching behaviour in Kenya might also work in Mozambique. Following on from papers 1 and 2, paper 3 used a quasi-experimental manipulation to understand whether norms can be altered using descriptive framing, and how social referents affect the manipulation. This showed that certain community members can have a disproportionate influence on others' behavioural intention, suggesting

that conservation interventions using ‘social influencers’ may prove effective. Although more research is needed to understand how norms can be used to effect long-term behaviour change, this thesis highlights how a focus on social norms may prove useful in the study of behaviour and design of conservation-focussed interventions.

### *Additional Findings*

Attitudes are one of the most studied aspects of human-wildlife conflict psychology (Browne-Núñez & Jonker 2008), and conservation managers often implement ‘attitudes studies’ because they imagine this research will provide information which can be used as a proxy for community behaviour towards, or tolerance of, wildlife (*ibid.*). An increasing body of work suggests that this is not the case, and further research is needed to establish more clearly the relationship between attitudes and behaviour (Godin et al. 2005), particularly in the context of emotionally charged human-wildlife conflicts. Further, the attitudes concept may often be more useful when broken into its constituent parts (Breckler 1984; Yang & Yoo 2004), but studies explicitly seeking to understand these sub-components of attitude are lacking. This thesis highlights how attitudes can be a major influence on behaviour (paper 1), that cognitive beliefs are important to overall attitudes (paper 4), and that the relationship between affect and overall attitudes can be complex (papers 1 and 4).

Negative experiences can have a long-term impact on overall perception of an attitude object, and a substantial literature highlights how these negative events or emotional reactions can colour an individual’s psychology over a sustained period (Yule et al. 2000; Waysman et al. 2001; Diener & Oishi 2005). Consistent with these studies, I found that negative attitudes towards predators were a major indicator of overall attitudes, whereas positive emotional responses did not indicate a more positive overall perception (paper 4). This is in contrast to paper 1, where positive attitude towards livestock

management was the only attitude variable which significantly influenced behaviour. One explanation for this may be that livestock management is generally regarded as a positive activity, whereas interactions with predators are negative events, so emotional responses work to compound existing attitudes (Schwarz & Clore 1983; Schwarz 2011). These contrasting findings highlight the situational nature of attitudes, and how their effect on overall perceptions (and perhaps behaviour) is context dependent. Many conservation projects use experiential education (e.g. school trips to national parks, Fiallo & Jacobson 1995; Eustace & Gunda 2018) or celebrations designed to elicit positive affect towards conflict-causing species (e.g. wildlife ‘festivals’, HVenEGAARD 2011) to try to reduce or mitigate conflict. Although a worthwhile end in and of itself, this thesis suggests that increasing the positive emotional aspects of attitude towards wildlife may not rehabilitate attitudes overall, whereas failing to provide adequate support for individuals who experienced negative interactions could have far greater impact on overall perceptions of wildlife (McMillen et al. 1997; Smith et al. 2011). By contrast, boosting a positive affective response to already positively-perceived activities may be effective. Work focussing on attitudes must be conducted carefully, and build on pre-existing cultural and emotional bases (Simon & Greenberg 1996; Betancourt 2003). Practitioners trying to improve local perceptions of wildlife, conflict, or conservation must think very carefully about the social and behavioural context in which their activities take place.

The other attitude-based finding of this thesis is the role of cognition in shaping overall attitudes (paper 4). Using an ABC attitude model, cognitive beliefs were shown to influence participants’ overall attitudes towards predators across Kenya and Zimbabwe. Specifically, beliefs regarding social norms around predator killing, perceptions of the impact of predator populations on local people, and the perceived benefits of predator persecution were all significant model terms. These psychological factors were belief-based, and reflected perceived factual statements about the conflict, e.g. *‘Killing predators would decrease the number of my livestock which are killed by predators’*. This finding is consistent with other

work, showing that cognition forms a large role in shaping overall attitudes. (Edwards 1990; Porter & Diefenbach 2009), and is important insofar as it validates many conservation education programmes, for which this relationship between beliefs and attitudes is an underlying (often untested) assumption (Forward 1997; Friese et al. 2008). This result highlights how programs which work to understand local beliefs (including religion and local traditional knowledge), explore the ways those beliefs interact with conservation goals, and subsequently design information campaigns focussing on the most harmful perceptions are likely to be successful (Raymond et al. 2010; Huang et al. 2020).

Social norms and attitudes have a substantial effect on behaviour – perhaps not surprisingly, especially given the literatures from other disciplines which suggest the same (Ajzen & Fishbein 2000; Wallace 2005; Wong-Parodi et al. 2019). But control beliefs – an individual’s ability or lack of ability to perform a desired behaviour – might be expected to have less impact on behaviour where NGOs have invested substantial amounts of time and money in helping communities to mitigate conflict. In Kenya, various NGOs have worked to provide materials, training, and other assistance to help livestock owners implement good management (Radeny et al. 2007; Pellis et al. 2015). Despite this work, control beliefs were a major factor which influenced overall livestock management performance in the region (paper 1). Further, these beliefs were the most consistently important model term explaining variation in management (all control variables were retained by the top model, and were present in the majority of models from specific sites). In other words, people who identified barriers (practical, economic, or other) to themselves carrying out good management were less likely to perform good management. This suggests either that the interventions from local conservation actors are insufficient or poorly directed (Webber et al. 2007), or, if they do successfully change local circumstances and remove practical barriers, fail to adequately change the mindsets of those beneficiaries (Rapeneau 2015). Understanding whether the reported difficulties

reflect real challenges or more nuanced issues with perceived behavioural control is likely to be important in understanding how to help a given community sector to overcome these issues.

## Conservation Implications

Although academia has long understood the importance of good social science to conservation practice (Macdonald et al. 2007; Macdonald et al. 2010), this is often not reflected in on-the-ground conservation practice. This could be a reflection of the priorities of funding organisations (Fox et al. 2006), a reluctance amongst conservation managers to apply unfamiliar social science techniques (Bennett et al. 2017), or a lack of interest in human-centric studies by these parties. Still today, few conservation managers have any experience with – or interest in – the social sciences. They say ‘science advances one funeral at a time’ (Planck, 1950), but conservation practice cannot afford to do so. Below I highlight some key, practical conclusions resulting from my work.

### *Tools and Approaches*

1. ***Structured surveys based on behavioural psychology can provide useful information about rural African populations in a human-wildlife conflict context.*** Although some expertise in survey design, and a theoretical grounding in the topics of focus are needed, the efficacy of these methods in this thesis suggests that practitioners should consider them as part of a conservation toolkit. For example, rather than making assumptions about how and why a community is performing a particular behaviour, e.g. herding cattle, or unsustainable resource harvesting, a well-designed, rapidly conducted survey is likely to be a more valid basis for conservation action (Sibanda et al. 2020). Training a small team of local interviewers, working to translate content into local languages (Lucas & Ware 1977), and collecting a sample of anonymous responses to a targeted survey is likely to be an effective way for conservation

projects to gauge the perceptions of their community partners, and a basis for finding effective solutions to a given conflict (Weladji & Tchamba 2003). For example, in the southern Kenya research, some livestock managers recognised that they were struggling to manage their animals effectively – a perception which was supported by the independent metrics of livestock management performance (paper 1). They knew – and reported – that they were underperforming. Similar information would be valuable for NGOs or conservation actors seeking to target aid towards the most appropriate sectors of the population. Structured surveys are cheap and can convey important information; they should be ubiquitous, rather than an exception to standard practice.

**2. *Techniques to segment communities based on attitudes and perceptions may help to identify groups with differing needs and suitability for given interventions.*** By conducting a population segmentation, again using a structured survey, I was able to identify qualitatively different sectors of the population, each of which had different needs and sensitivities (paper 2). Segmentation can provide useful groundwork for later, more intense community dialogues with specific focus groups. Such focus groups are more labour-intensive than population segmentation – but more common in applied conservation practice. Focus groups composed of a varied group of community representatives may not be able to present a clear picture of community needs (Nyumba et al. 2018), in part because the different focus group members represent different sectors of the population and have different priorities (*ibid.*). Effective focus group design segregates the population into like-minded individuals, such that each group represent a unified perspective on the issues facing that particular sector of the population (Freeman 2006). For example, it is desirable to talk with groups of older women and older men separately, as they are likely to have different priorities and concerns, which may be more difficult to air in a mixed setting (Nyumba et al. 2018). By implementing a quantitative, intermediate step – and systematically identifying population sectors *before* establishing the different focus groups – these programmes may be more

effective in understanding the needs, challenges, and opportunities for different sectors of a society. For example, a segment of both Kenyan and Zimbabwean society was relatively more open to alternative livelihoods than their peers (paper 2, Wicander & Coad 2015). The reasons for this difference are unknown (although education and family professions may have played a role) – but also unimportant; the important message is that if these individuals are clumped into a focus group with, say, traditional leaders, they may be unable to publicly express their open-mindedness towards modernisation and alternative livelihood solutions, and therefore both they and the conservation actors miss an opportunity to move forwards. Segmentation is simple, quick, and should tie in with existing social data collection programmes; conservation actors miss an easy win if they overlook such techniques.

**3. *Manipulation studies provide quick background information on the suitability of an approach, before any larger programme is rolled out.*** In this study, a simple vignettes-based design was used to test the immediate effect of different social norms and social influencers on behavioural intention (paper 3). Although the results of this manipulation by no means reflect an expectation of actual behaviour change, they do provide a snapshot into the possible efficacy of an approach (Hone et al. 2015; Ejelöv & Luke 2020), and demonstrate how the minutiae of a given intervention (e.g. the significant differences in effect of referent groups on norms, paper 3) can have far-reaching effects (Prentice & Miller 1992). Many conservation projects implement community outreach or information campaigns, but few pre-test their messaging (Lapka et al. 2008; Whittingham et al. 2008). As Cialdini (2003) reminds us, small mistakes can have a big impact on the take-home message of a campaign. The use of vignettes is generally thought to be effective in cross-cultural contexts (Jeffries & Maeder 2006), but even where vignettes are not appropriate, an emphasis on pre-testing materials is valuable. For example, campaigns warning that lion poaching is illegal could accidentally reinforce a social norm about the high local frequency of predator poaching; a poorly-phrased poster could emphasise that elephants are responsible for a large amount of

crop loss. By experimentally testing variants of a campaign in quasi-experimental conditions, practitioners can identify any unintended effects of a given campaign (e.g. Cho & Salmon 2007). Indeed, in situations where communities or project managers may not understand or be able to articulate why a given resource misses the mark, these experimental trials are likely to be important in avoiding unforeseen consequences.

#### *Psychological Factors*

**4. *Social norms can have substantial influence on behaviour, and conservation interventions should make use of norms and local ‘influencers’ to facilitate conservation outcomes.*** When a group’s social norms shift, large behavioural shifts can follow (Cialdini et al. 1990); the challenge for managers is to find effective, long-term ways to alter these norms. Using social ‘influencers’ to instigate or accelerate change may be an effective way to modify community norms (paper 3), and thereby effect population-wide behaviour change (Bamberger & Biron 2007; Brechwald & Prinstein 2011). As norms are highly conserved (paper 2), intervention approaches may be generally transferrable, and the sharing of successful strategies or tools should be encouraged.

**5. *Affect is highly complex and insensitive to intervention; finding ways to counter the negative affect resulting from conflict is an important topic for future work.*** Positive emotions reinforce positive behaviour; negative emotions reinforce negative experiences (Smith et al. 2014). Conservation managers must therefore work within the existing emotional and cultural landscape to effect change, which comes most easily when community members are involved in the change process. Indeed, actors from outside the community emphasising the aesthetic, spiritual, or cultural value of wildlife cannot offset the negative feelings engendered by conflict. Similarly, if unfavourable activities such as poaching are widespread and held in positive regard by a community, messaging on the risks and dangers involved in those activities

are unlikely to dissuade individuals from carrying out the behaviour in question (Smith et al. 2014; Stea & Pickering 2019). Any attempts to use attitudes to influence behaviour should be done very carefully – this thesis highlights how sensitive these topics can be, and how simple assumptions may be invalid. Approaches used to mitigate negative affect resulting from human-wildlife conflict event are poorly studied and seldom implemented. Although the impact of negative experiences on overall attitudes is often studied in a clinical context (e.g. PTSD, or post-trauma community studies, Wampold et al. 2010), techniques which are suitable for mitigating negative affect in rural Africa are rare (Edwards 2005; Karsberg & Elklit 2012). Developing suitable *in situ* responses to traumatic conflict may be valuable in preventing the formation of negative attitudes towards wildlife, and helping local people to avoid the damaging, long-term impacts of conflict on their own health and happiness.

**6. Cognitive beliefs influence overall beliefs, therefore targeted education campaigns are of great importance in determining overall attitudes towards wildlife.** Research to understand the pre-existing beliefs of a population may be valuable in focussing education campaigns on the most relevant beliefs (Andrews et al. 2004; Matibag et al. 2009). Belief elicitation studies can provide information regarding the facts and perceptions which underlie an individual or community's behaviour, and facilitate the design of education programmes and materials with which to tackle harmful misperceptions (Alzua et al. 2014; Downs et al. 2019). Similarly, such studies can also highlight conflict issues for which mitigation is inadequate or inappropriate, and therefore allow conservation managers to devise suitable strategies with which to tackle the root problem.

**7. Individuals' control over conservation-relevant behaviours may be hampered by practicalities, but appropriate surveys can identify these issues.** Control over an outcome is affected by practicality (can a livestock owner afford chain-link fence for a boma?), and self-belief (does that owner believe he can

take good care of his livestock?) (Ajzen 2002). Many conservation programmes seek to remove the former impediment (Woodroffe et al. 2006; Hazzah et al. 2014; Mkonyi et al. 2017), but do not focus on the latter. Even where work focuses on the former, some community members may still experience barriers to conservation-friendly behaviour. By identifying individuals who are struggling using self-report surveys (paper 1) conservation projects can prioritise and target their activities, to reach the relevant individuals (Harrison et al. 2015; Jones et al. 2019).

## **Conclusion**

Research begets research, and there are certain avenues for future work which I think will be especially fruitful. Research on the following topics may be of particular value:

1. How does affect impact long-term behaviour, and how can negative affect following conflict experiences be mitigated or minimised?
2. Can the tools and theories outlined in this thesis, specifically social norms, be used to influence behaviour, and facilitate long-term behaviour change?
3. Can socially influential individuals be identified using standardized approaches, and how can projects make use of their social influence to alter community norms?
4. How can education programmes maximise their effect on cognitive and overall beliefs, and what nuances and details can increase the efficacy of education materials?

Although the future research directions indicated by this thesis are interesting and important, the more important challenge for myself and other conservation social scientists is to ensure that the correct tools, techniques, and training end up in the hands of those responsible for conservation practice (Cook et al. 2013; Chiawo et al. 2020). This thesis advocates for the use of social psychology techniques in

conservation, and I believe such tools offer valuable insight into the avoidance or mitigation of human-wildlife conflict. However, translating these take-home conservation practice messages into management activities, or encouraging managers to make the most of these insights, are distinct challenges. Over the past 20-30 years, academic conservation science has embraced the social aspects of wildlife conservation, and today most conservation programmes carry out some social or community-based activities (Newing 2011; Sandbrook et al. 2013; Bennett et al. 2017). The translation from theory to practice, then, may be slow, but it seems that the influence of academic thinking is subtly pervasive (Caudron et al. 2012). Although I do not expect this thesis to impact the dialogue surrounding human-wildlife conflict, I hope that these papers encourage other authors to carry out similar studies, and extend the academic reach of conservation psychology. By strengthening the academic discipline, foundations are laid on which practitioners may later build, to apply the tools and insights gained by conservation scientists.

Over the course of this work, my surveys have told me things I didn't already know. Communities, their attitudes and beliefs, and the choices they make are complex, and decisions based on assumptions about these psychological landscapes do not serve conservation well. At its simplest, this thesis was concerned with asking people what they think, and why they do what they do, and using frameworks from social psychology to make sense of their answers. Understanding this behavioural psychology may not prevent people from engaging in conflict-causing behaviours, remove the underlying source of conflict, or reduce the burden that conflict places on local people. However, "all difficulties are but easy when they are known" (Shakespeare, 1603) and using simple tools to understand the psychological roots of thoughts, feelings and behaviours – and design interventions which may influence them – provides us with valuable insight with which to find new, innovative solutions which may partially resolve some of the ongoing conflicts between people and wildlife.

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SOCIAL SCIENCES & HUMANITIES  
INTERDIVISIONAL RESEARCH ETHICS COMMITTEE

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8 November 2017

Laura Perry  
Department of Zoology  
University of Oxford

Dear Ms Perry,

**Research Ethics Approval (CUREC 1A)**  
**Ref No: R53944/RE001**

**Title: Understanding factors that affect boma efficacy and barriers to best-practice implementation**

The above application has been considered on behalf of the Social Sciences and Humanities Interdivisional Research Ethics Committee (IDREC) in accordance with the procedures laid down by the University for ethical approval of all research involving human participants.

I am pleased to inform you that, on the basis of the information provided to the IDREC, the proposed research has been judged as meeting appropriate ethical standards, and accordingly approval has been granted.

Should there be any subsequent changes to the project, which raise ethical issues not covered in the original application, you should submit details to the IDREC for consideration.

Yours sincerely,

A black rectangular box redacting the signature of Claudia Kozeny-Pelling.

Claudia Kozeny-Pelling  
Research Ethics Manager and Secretary SSH IDREC

cc: Prof David Macdonald, Niamh McEntee



The University of Oxford places a high value on the knowledge, expertise, and integrity of its members and their ability to conduct research to high standards of scholarship and ethics. The research ethics clearance procedures have been established to ensure that the University is meeting its obligations as a responsible institution.

They start from the presumption that all members of the University will take their responsibilities and obligations seriously and will ensure that their research on human subjects is conducted according to the established principles and good practice in their fields and in accordance, where appropriate, with legal requirements. Since the requirements of research ethics review will vary from field to field and from project to project, the University accepts that different guidelines and procedures will be appropriate.

- Please check ["Where and how to apply for ethical review"](#) and the [CUREC flowchart](#) first to see if you need ethics approval.
- Please complete this form using a word processor and email it, together with your [supporting documents](#), to your [Departmental Research Ethics Committee \(DREC\)](#) (if applicable). If you don't have a DREC please email this form to [ethics@socsci.ox.ac.uk](mailto:ethics@socsci.ox.ac.uk) using your official **ox.ac.uk** email address. **Only emailed applications will be accepted.**

### WHAT THIS CHECKLIST IS DESIGNED FOR

This **CUREC 1A checklist** is designed largely for research that falls within the Divisions of Social Sciences and Humanities where ethical issues are relatively few and straightforward. Interviews, field work and oral history are also included in the CUREC process.

The **full CUREC 2 application** is only required where certain project characteristics (e.g. type of participants, or procedures) result in a more complex set of ethical issues. It is expected that only in a limited number of cases will it be necessary for researchers to complete a CUREC 2 application. The checklist below will direct you to a CUREC 2 application if needed.

### WHAT THIS CHECKLIST WILL NOT ASSESS

This checklist does not cover research governance, satisfactory methodology, or compliance with the requirements of publishers when administering their tests or questionnaires. As principal researcher, it is your responsibility to ensure that requirements in these areas are met.

CUREC does not review studies classed as **audit** (see [Glossary](#) and [Decision Flowchart for CUREC](#) on our website).

If your study involves **NHS patients, NHS staff / data / facilities, or human tissue**, please check the [Decision Flowchart for NHS approval](#) and contact the [Clinical Trials and Research Governance \(CTRG\) team](#) in the first instance.

Further information on the University's research ethics procedures is available from the [CUREC website](#).

**SECTION A: Filter for CUREC2 application**

This section determines whether your study raises more complex issues which require the completion of a full application for ethical review, known as the CUREC 2 application.

(Please mark 'X' in the Yes/No column as appropriate to indicate your response.)

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|
| 1. Are research participants classed as <a href="#">people whose ability to give free and informed consent is in question</a> ? (This may include those under 18 (though see " <a href="#">competent youths</a> "), prisoners, or adults "at risk".) Your attention is drawn to the University's <a href="#">Safeguarding Code of Practice</a> and its implications for researchers involving children or adults at risk, including the need for the work to be risk assessed and for researchers to undertake related training.<br><br>( <b>Note:</b> If any of your participants are aged 16 or under, please answer 'Yes' here <b>and</b> also answer question 5 below.) | Yes | No X |
| 2. By taking part in the research, will participants be at serious risk of criminal prosecution (e.g. by providing information on drug abuse or child abuse)?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Yes | No X |
| 3. Does the research involve the <a href="#">deception</a> of participants?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Yes | No X |
| 4. Does your research raise issues relevant to the <b>Counter-Terrorism and Security Act (the Prevent duty)</b> , which seeks to prevent people from being drawn into terrorism? Please see advice on this on our <a href="#">Best Practice Guidance web page</a> .                                                                                                                                                                                                                                                                                                                                                                                                         | Yes | No X |

If you have answered 'No' to all of the questions above please go to **Section B**. If you have answered 'Yes' to any question above continue to question 5 below.

|                                                                                                                 |     |    |
|-----------------------------------------------------------------------------------------------------------------|-----|----|
| 5. Is your project covered by a CUREC <a href="#">approved procedure</a> (formerly known as "CUREC Protocols")? | Yes | No |
|-----------------------------------------------------------------------------------------------------------------|-----|----|

If yes, please give research procedure number(s):

If you answered 'Yes' to **ANY** of questions 1-4, **and** answered 'No' to question 5, **please stop completing this checklist and do not submit it for ethical review**. Instead, please complete the [CUREC 2 application form](#) from the CUREC website. Then submit the CUREC 2 form for ethical review.  
If you answered 'Yes' to ANY of questions 1-3, **and** answered 'Yes' to question 5, please go on to **Section B**.

**SECTION B: Contact details and project description (NB: must be typed not handwritten)****Contact details:**

|                                                                                                                          |                                                                        |
|--------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| 1. <b>Principal researcher</b> /supervisor (title and name) (if student research):                                       | Prof. David Macdonald                                                  |
| 2. Name of student (if student research):                                                                                | Ms Laura R Perry                                                       |
| 3. Degree programme, e.g. DPhil, BA, MPhil, BSc, MSc (if student research):                                              | DPhil                                                                  |
| 4. Department or Institute name:                                                                                         | Department of Zoology                                                  |
| 5. Address for correspondence (if different from above):                                                                 |                                                                        |
| 6. University e-mail ( <b>not</b> private email) and telephone:                                                          | <a href="mailto:Laura.perry@zoo.ox.ac.uk">Laura.perry@zoo.ox.ac.uk</a> |
| 7. Name and status of others taking part in the project, e.g. third year undergraduate; postdoctoral research assistant: |                                                                        |

| SECTION B continued                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Project description:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                            |
| 8. Title of research project:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Understanding factors that affect boma efficacy and barriers to best-practice implementation                                                                               |
| 9. List of location(s) where project will be conducted:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Tanzania, Zimbabwe, Cameroon, Botswana, Kenya, Zambia.                                                                                                                     |
| 10. If your research involves overseas travel or fieldwork, by the time the research starts, will you have completed and returned a travel risk assessment form? (This has to be approved by your department before you travel. If you are travelling overseas, you are strongly advised to take out <a href="#">University travel insurance</a> .)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Yes     X<br>No<br>N/A                                                                                                                                                     |
| 11. Anticipated duration of research project overall:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3 years (maximum 5)                                                                                                                                                        |
| 12. Anticipated start and end dates of the research project involving human participants:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | From: (31/11/17)<br>To:    (01/10/20)<br>Please note that you will need ethics approval <b>before</b> you start your research. CUREC1As may take up to 30 days to process. |
| 13. External organisation funding the research (if applicable):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                            |
| 14. Title and very brief and simple lay description of <a href="#">research</a> (about 150 words), plus description (about 200 words) of the nature of participants.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                            |
| a) Title, brief description of research (150 words) in lay language. When describing the research, please include your methodology, how you are applying professional guidelines, and the use to which results/data will be put.<br><b>Please also declare any conflicts of interest here.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                            |
| <b>Title:</b> Understanding factors affecting boma efficacy and psychological barriers to best-practice implementation<br><br><b>Description of Research:</b> This research aims to understand how fencing livestock can be used to reduce conflict between lions and people across sub-Saharan Africa. Using existing data on predation of cows by lions, and the type of enclosure and livestock management practice they were under, this work seeks to understand variation in rates of loss, and relate this variation to environmental and livestock management efforts. Specifically, data on boma (overnight livestock fence) structural properties and livestock attributes will be studied alongside loss data. This work will also focus on the human psychological climate surrounding boma use, including motivation to use and attitudes towards bomas. Tools from social psychology (specifically, structured interviews with questionnaires and focus groups) will be used to understand what factors motivate – or fail to motivate-- livestock owners to use boma technology. Structured and semi-structured questionnaires will be administered to understand the attitudes and behaviours of livestock managers.<br><br>Professional guidelines from the Association of Social Anthropologists and the British Psychological Society Code of Ethics and Conduct will be followed. |                                                                                                                                                                            |

## SECTION B continued

b) Description of participants and [obtaining informed consent](#) (200 words). When describing participants, please include

- criteria for inclusion/exclusion
- method of recruitment
- processes for consent to participate

Please ensure you attach as separate documents (if applicable, in English translation):

- your [recruitment and advertisement material](#) e.g. a poster or brief invitation letter/ email
- information for participants to read (or hear) before they agree to take part e.g. [written information sheets](#) or (only if applicable) [oral information scripts](#).
- a document to record informed consent. Templates for [written consent forms](#) and/or [oral information scripts](#) (in case of an oral consent process) are available from the CUREC website
- a guide to interview questions (this may be a list of questions to be asked, or a preliminary scope of questions), or a sample of other instruments (such as a sample questionnaire)
- (if relevant) debriefing document after participants have taken part

**Description of Participants:** Village sites will be chosen based on existing relationships between communities and on-the-ground partners helping to conduct this work. The local partners will be either conservation NGOs or other similar entities, and will be involved in the planning, but not directly in the research or data collection itself. Translators will be used to modify the survey tools for local use, through a participatory process. Individual staff will be employees of local partner research organisations, and will sign a confidentiality agreement before conducting interviews. Interview questionnaires will be translated prior to data collection. Interviewees will be selected from the pool of adults in each village, which may include women but is likely to mostly include men, chosen on the basis of ownership or management of livestock, and preferentially with experience of boma use. Individuals deemed to have insufficient experience of livestock husbandry or who are not capable of giving informed consent will be excluded. Recruitment will be based on encountering people in villages: trained local personnel will visit villages and enquire if individuals are willing to participate in the survey; there are existing relationships between project sites and village sites, so interviewers are familiar with the communities in question. These personnel will be recruited from the local area, and with only indirect links with the department and no formal training on research ethics. I will train them in techniques and ethical guidelines before data collection begins. As the content is of a non-sensitive nature and levels of literacy are low, oral consent will be obtained and recorded, along with any conditions for consent, prior to the time of interview. Interviews will be conducted where we encounter the participants, likely around their homesteads or villages. Interviews will be conducted in the participant's first language and use pre-formulated structured and semi-structured questionnaires, translated prior to fieldwork as appropriate. Interviews will take place in communal areas or in or near a participant's home. No translator will be present for the actual interview, as these will be pre-translated. Data are focussed on boma use and implementation and are of a non-sensitive nature, with no social or legal implications.

Attached are:

1. Oral consent script
2. Confidentiality agreement
3. Consent record
4. Guide to question content

There are no conflicts of interest.

15. What are the ethical issues connected with your research and what steps have you taken to address them? Please do not answer 'none'. The committee needs to see evidence that you have identified potential ethical issues with respect to your research and have taken steps to address them. These issues could relate to:

- your own physical and psychological safety as a researcher (please see the [University's](#) and [Social Science Division's Safety in Fieldwork](#) guidance
- participant burdens and/or risks, and
- data protection/ confidentiality.

For more guidance on ethical issues, please see <http://researchsupport.admin.ox.ac.uk/governance/ethics/resources>

There are limited ethical issues associated with carrying out this research. Primarily:

1. Health and safety issues associated with the principal researcher accessing remote sites. This will be explored in the fieldwork risk assessment. Further, the principal researcher is aware of the risks and willingly consents to undertaking the work.
2. This study will take place across numerous countries where participants are not regularly exposed to psychological surveys, so ensuring participants have a clear understanding of why the work is being undertaken and can give fully informed consent may present a challenge. This will be overcome by ensuring the oral consent template is properly developed and that all personnel involved in administering surveys understand the importance of informed consent. Although it is highly unlikely that participants will find the interviews distressing, I have taken the various courses, some through the university, which cover dealing with distressing content. The interviews can be paused at any time, and any participants who experience distress will be followed-up with after the initial contact.
3. If a participant or research assistant becomes emotionally distressed, data collection will cease and the interview in question will be destroyed if requested. In the case of a participant, we will make sure that they are safe and remain with the participant until they are under negligible distress or a capable family member is able to look after them. I do not anticipate participants or researchers experiencing emotional distress.

## Section B continued

16. Will you obtain [informed consent](#) according to CUREC guidelines and good practice in your discipline before participation?

Yes  
X

No

If you have marked 'No', please give a brief explanation and justification for this decision here:

17. Will your research involve discussing sensitive issues?

This could be information relating to race or ethnic origin, political opinions, religious beliefs, physical/mental health, trade union membership, sexual life or criminal activities.

Yes

No X

If you have marked 'Yes', please make sure that you have included some **supporting information** (as directed in question 14 of this section) showing the range of questions covering these issues.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                        |    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|----|
| 18. Will you ensure that <a href="#">personal data</a> collected directly from participants or via <a href="#">a third party</a> is held and processed in accordance with the provisions of the <a href="#">Data Protection Act</a> ?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Yes<br>X               | No |
| 19. How will you ensure that any <a href="#">personal</a> and/or <a href="#">sensitive data</a> are captured, transferred and stored securely?<br>In particular if data are to be captured electronically, please consult with the University's research data team ( <a href="mailto:researchdata@ox.ac.uk">researchdata@ox.ac.uk</a> ) and your local IT department and, with respect to University IT security policies, please comment on how you will capture such data in the first instance, how you will transfer them over networks or via portable media and how, where and how long data will be stored. For more information please see the University's web pages on <a href="#">research data management</a> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                        |    |
| <p>Data will be recorded on paper and the files given to the lead researcher at the end of every day. These files will be digitised onto the primary researcher's laptop and backed up to a portable memory device (both password protected), and the original paper copies kept in a secure location whilst still in the field. After this time, the primary written files will be destroyed. The data will be encrypted and password protected on both devices. The information will remain in the possession of the primary researcher. Once data is brought back from the field, physical copies of survey responses will be kept in a secure filing system at my research unit, Tubney House. Copies will be kept for a minimum of three years after publication, in accordance with university policy. Data will be processed on the primary researcher's computer (password protected), and uploaded to a data repository if necessary for publication in journals, as specified by journals; which depository is selected will depend primarily on the journal for publication. Only the primary researcher will have control over that repository. None of the data will be of a personal nature, nor will participants be individually identifiable to external parties. Data will be made available to other researchers in line with appropriate ethical, data sharing and open access principles.</p> |                        |    |
| <b>SECTION C: Methods and procedures to be used</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                        |    |
| <b>Method used:</b> Please ensure you have addressed any potential ethical issues related to these methods in Section 14 and in your Participant Information Sheet                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Please mark 'X'</b> |    |
| 1. Analysis of existing records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | X                      |    |
| 2. Snowball sampling (recruiting through contacts of existing participants)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                        |    |
| 3. Use of casual or local workers e.g. interpreters                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | X                      |    |
| 4. Participant observation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                        |    |
| 5. Covert observation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                        |    |
| 6. Observation of specific organisational practices                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                        |    |
| 7. Participant completes questionnaire in hard copy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                        |    |
| 8. Participant completes online questionnaire or other online task                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                        |    |
| 9. Using social media                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                        |    |
| 10. Participant performs paper and pencil task                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                        |    |
| 11. Participant performs verbal or aural task (e.g. for linguistic study)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                        |    |
| 12. Focus group                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                        |    |
| 13. Interview                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | X                      |    |
| 14. Audio recording of participant (you will generally need specific consent from participants for this)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                        |    |
| 15. Video recording of participant (you will generally need specific consent from participants for this)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                        |    |
| 16. Photography of participant (you will generally need specific consent from participants for this)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                        |    |
| 17. Others (please specify):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                        |    |

| SECTION D: Professional guidelines and training                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                          |                 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| <p>In this section, please mark 'X' against at least one of the following professional guidelines you aim to adhere to.</p> <p>You should use the principles listed in your chosen guideline(s) in conducting your own research.</p> <p><b>Note:</b> this is not an exhaustive list.</p>                                                                                                                                                                                                      |                                                                                                                                                                                                                                          | Please mark 'X' |
| Research specialism/ methodology                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Association and guidance document                                                                                                                                                                                                        |                 |
| Anthropology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <a href="#">Association of Social Anthropologists of the UK and Commonwealth</a>                                                                                                                                                         | X               |
| Criminology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <a href="#">British Society of Criminology: Code of Ethics for Researchers in the Field of Criminology</a>                                                                                                                               |                 |
| Education                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <a href="#">British Educational Research Association Ethical Guidelines for Educational Research</a>                                                                                                                                     |                 |
| Geography                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <a href="#">Association of American Geographers Statement on Professional Ethics</a><br><a href="#">Royal Geographical Society: Research Ethics and Code of Practice</a>                                                                 |                 |
| History                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <a href="#">Oral History Society of the UK Ethical Guidelines</a>                                                                                                                                                                        |                 |
| Internet-based Research                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <a href="#">British Psychological Society: Conducting Research on the Internet</a><br><a href="#">Association of Internet Researchers Ethics Guide</a><br>Also see our <a href="#">Best Practice Guidance on internet-based research</a> |                 |
| Law (Socio-Legal)                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <a href="#">Socio-Legal Studies Association: Statement of Principles of Ethical Research</a>                                                                                                                                             |                 |
| Management                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <a href="#">Academy of Management's Professional Code of Ethics</a>                                                                                                                                                                      |                 |
| Political Science                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <a href="#">American Political Science Association (APSA) Guide to Professional Ethics in Political Science</a>                                                                                                                          |                 |
| Politics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <a href="#">Political Studies Association. Guidelines for Good Professional Conduct</a>                                                                                                                                                  |                 |
| Psychology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <a href="#">British Psychological Society Code of Ethics and Conduct</a><br><a href="#">British Psychological Society: Conducting Research on the Internet</a><br>Also see "Internet-based Research" guidance above                      | X               |
| Social Research                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <a href="#">Social Research Association: Ethical Guidelines</a>                                                                                                                                                                          |                 |
| Sociology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <a href="#">The British Sociological Association: Statement of Ethical Practice</a>                                                                                                                                                      |                 |
| Visual Research                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <a href="#">ESRC National Centre for Research Methods Review Paper: Visual Ethics: Ethical Issues in Visual Research</a>                                                                                                                 |                 |
| Other professional guidelines. Please specify the other guidelines used here:                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                          |                 |
| <p>Please indicate what training in research ethics the researchers involved with this study have received, e.g. the title of the course and date completed (online training available at <a href="http://researchsupport.admin.ox.ac.uk/support/training/ethics">http://researchsupport.admin.ox.ac.uk/support/training/ethics</a>).</p> <p>If no formal training has been undertaken, please indicate any discussions of research methodology between researchers and supervisors here.</p> |                                                                                                                                                                                                                                          |                 |

Research Integrity: Natural and Physical Sciences (passed 29/08/17)

Research Integrity: Social and Behavioural Sciences (passed 29/08/17)

### SECTION E: Signatures

- 'Electronic signatures' sent as email confirmations from a University of Oxford email address can be accepted. Separate emails should come from each of the relevant signatories as outlined below, indicating acceptance of the relevant responsibilities.
- If you have obtained handwritten (wet-ink) signatures, please scan them and the rest of the checklist pages to create a single PDF document and email through.

**Please ensure this checklist is signed by:**

**For staff research:**

1. [Principal researcher](#)
2. **Head of Department (or nominee)**

**For student research:**

1. [Principal researcher](#) (project supervisor)
2. **Head of Department (or nominee)**
3. **Student researcher**

#### 1. Principal researcher signature/supervisor signature (if student research)

I understand my responsibilities as [principal researcher](#) as outlined in the CUREC glossary and guidance on the CUREC website. I declare that the answers above accurately describe the research as presently designed, and that a new checklist will be submitted should the research design change in a way which would alter any of the above responses so as to require completion of CUREC 2 (involving full scrutiny by an IDREC). I will inform the relevant IDREC if I cease to be the principal researcher on this project and supply the name and contact details of my successor if appropriate.

Signature: ...  .....

Print name (block capitals): .....DAVID W. MACDONALD..... Date: .....12.09.2017.....

#### 2. Departmental endorsement signature

I have read the research project application named above. On the basis of the information available to me, I:

- consider the principal researcher to be aware of her/his ethical responsibilities in regard to this research;
- consider that any ethical issues raised have been satisfactorily resolved or are covered by relevant professional guidelines and/or CUREC approved procedures, and that it is appropriate for the research to proceed (noting the principal researcher's obligation to report should the design of the research change in a way which would alter any of the above responses so as to require completion of a CUREC 2 full application);
- am satisfied that: the proposed project design and scientific methodology is sound; the project has been/will be subject to appropriate [peer review](#); and is likely to contribute to existing knowledge and/or to the education and training of the researcher(s) and that it is in the [public interest](#).

**Signed by Head of Department or nominee** (example nominees for student research include the Director of Graduate Studies/ Director of Undergraduate Studies):

Signature: .....

Print name (block capitals): ..... Date: .....

#### 3. Student signature (if student research)

I understand the questions and answers that have been entered above describing the research, and I will ensure that my practice in this research complies with these answers, subject to any modifications made by the principal researcher properly authorised by the CUREC system.

Signed by student:



.....

Date: ...01/09/17.....

Print name (block capitals): .....LAURA PERRY.....

| SECTION F: SUBMITTING THE COMPLETED CHECKLIST                                                                                                                                                                                                                                                                                 | Please mark 'X' |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| 1. Check you have completed all sections (A-E)                                                                                                                                                                                                                                                                                | X               |
| 2. Ensure your application is signed by you, your supervisor (if student) and department                                                                                                                                                                                                                                      | X               |
| 3. <b>Please attach all supporting documents (see section B, question 14b for details).</b> If the appropriate supporting documentation is not included with your application, you will then be asked to provide this separately. <b>This may well delay the ethical review process, and thus the start of your research.</b> | X<br>X          |
| 4. Ensure you have declared conflicts of interest (if any) in Section B, question 14a.                                                                                                                                                                                                                                        | X               |
| 5. If your department has a <a href="#">Departmental Research Ethics Committee (DREC)</a> , submit this checklist and supporting information to the appropriate departmental officer.                                                                                                                                         | X               |
| 6. If your department does not have a DREC, submit the checklist and supporting information to the SSH IDREC (email <a href="mailto:ethics@socsci.ox.ac.uk">ethics@socsci.ox.ac.uk</a> ).                                                                                                                                     | X               |
| 7. Applications must be sent by email from your official ox.ac.uk email account. Please do not send applications by post.                                                                                                                                                                                                     | X               |

NB: This final version of the 2017 CUREC was signed digitally by the head of department. The final CUREC approval notice (see page 144) is reflective of full authorisation by all relevant parties.

## MEDICAL SCIENCES INTERDIVISIONAL RESEARCH ETHICS COMMITTEE

Research Services, University of Oxford, Wellington Square, Oxford, OX1 2JD

Tel: +44(0)1865 616577 Fax: +44(0)1865 280467

[ethics@medsci.ox.ac.uk](mailto:ethics@medsci.ox.ac.uk)



### CONFIDENTIAL

Laura Perry  
WildCRU/Department of Zoology  
University of Oxford  
Zoology Research & Administration Building  
11a Mansfield Road  
Oxford

5 November 2020

Dear Laura,

### Research Ethics Confirmation of Permission to Re-start Research Activities

**Ethics Approval Reference: R68255/RE002**

**Study title: Research into the social and conservation landscapes in and around Luwire conservancy, Niassa, Mozambique**

The above research requiring face-to-face activities with human participants was either paused, or did not commence, due to the COVID-19 pandemic. The request to (re)commence face-to-face activities for this study, and the supplementary information sheet, have been considered on behalf of the Medical Sciences Interdivisional Research Ethics Committee (IDREC) in accordance with the procedures laid down by the University.

I am pleased to inform you that, on the basis of the information provided to the IDREC, the research may (re)commence. **Ethical approval has been extended until 9<sup>th</sup> May 2023.**

Permission to (re)commence is **subject to:**

- a) you obtaining confirmation from the facility that you may now (re)commence research activity**
- b) you adhering to the department-approved COVID-19 risk assessment for this study, as supplied to the MS IDREC**
- c) you following current University and Government COVID-19 guidance, and all other relevant guidelines, for the conduct of your research, including in the event of a local lockdown where the research is being conducted**
- d) you ensuring that all study documentation is updated as guidance evolves, and submitted to the MS IDREC for approval**

### Amendments

Should there be any subsequent changes to the study, you should submit an amendment to the MS IDREC for consideration and approval as per [usual process](#). Details of changes must be listed on an amendment form.

Please do not hesitate to contact me if you have any queries.

Yours Sincerely



Dr. Helen Barnby-Porritt  
Research Ethics Manager, Medical Sciences



The University of Oxford places a high value on the knowledge, expertise, and integrity of its members and their ability to conduct research to high standards of scholarship and ethics. The research ethics clearance procedures have been established to ensure that the University is meeting its obligations as a responsible institution. They start from the presumption that all members of the University will take their responsibilities and obligations seriously, and will ensure that their research involving human participants is conducted according to the established principles and good practice in their field and in accordance, where appropriate, with legal requirements.

**ONLY TYPE-WRITTEN FORMS WILL BE ACCEPTED** – these must be fully-signed with wet-ink signatures, then scanned, and sent by email to [ethics@medsci.ox.ac.uk](mailto:ethics@medsci.ox.ac.uk), together with all supporting documents.

Before completing this form, please work through the [application decision tool on our website](#) to ensure that you do not need to submit a CUREC 2 or CUREC 3 application for full MS IDREC Committee review.

Should you require any assistance in completing this document, please contact the MS IDREC Secretariat.

| SECTION A. RESEARCH DETAILS                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Full title of research                                 | Research into the social and conservation landscapes in and around Luwire conservancy, Niassa, Mozambique                                                                                                                                                                                                                                                                                                                                                               |
| 2. Short title of research                                | Luwire social research                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 3. Principal Investigator (PI) / Student Supervisor       | David Macdonald                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 4. PI's training/experience in research ethics and/or GCP | David Macdonald has not completed research integrity training. However, the graduate student who will be administering this research has previously carried out a large number of similar studies. She has prior permission for quantitative surveys on similar topics, under CUREC reference R53944/RE001. She has also completed the <i>Research Integrity: Natural and Physical Sciences</i> and <i>Research Integrity: Social and Behavioural Sciences</i> courses. |
| 5. Student name and degree programme (if applicable)      | Laura R. Perry, DPhil                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 6. Department/Institute name                              | Department of Zoology                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 7. University email address                               | [REDACTED]                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 8. University telephone number                            | 01865 611 118                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

|                                                               |                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>9. Funding Source</b>                                      | <p>The student is working for a private organisation while data is being collected; this organisation will fund the fieldwork, employ members of staff, and provide them with insurance and healthcare. This organisation is called the Luwire Conservancy, and is a US and UK registered charity based in Mozambique.</p> <p>Her DPhil stipend comes from a scholarship administered through WildCRU.</p> |
| <b>10. Do any researchers have any Conflicts of Interest?</b> | None                                                                                                                                                                                                                                                                                                                                                                                                       |

| SECTION B. RESEARCHERS                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Researcher title and name</b>                                        | Ms Laura Perry                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>2. Department / Institute name</b>                                      | WildCRU, Department of Zoology, University of Oxford                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>3. Role in research</b>                                                 | Will design and conduct research. This will involve questionnaire and interview design and administration, in addition to the training and deployment of research assistants, who will also be involved in data collection. Laura will process all data, and be responsible for the correct collection, storage, and protection of data outlined in this proposal. She will also carry out all data analysis, either alone or with collaborators. |
| <b>4. Training/Experience in research ethics and/or research integrity</b> | Laura has previously carried out research of this kind in Kenya, Zimbabwe, Botswana, and South Africa under CUREC reference R53944/RE001. She has also completed the <i>Research Integrity: Natural and Physical Sciences</i> (29 <sup>th</sup> Aug, 2017) and <i>Research Integrity: Social and Behavioural Sciences</i> (29 <sup>th</sup> of Aug, 2017) courses.                                                                                |

| SECTION C. BASIC INFORMATION                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Brief lay summary of research<br/>(Maximum 300 words)</b>               | With this research, we aim to conduct basic demographic and social surveying of a population living in the L7 concession, in Niassa National Reserve. As part of this, oral histories, attitudes and perceptions, human-wildlife conflict, as well as basic household data will all be collected. This will help reserve management to adapt their conservation and community outreach programmes to fit local needs, and overall enhance the efficacy of the project. |
| <b>2. List all places where research will be conducted (including online)</b> | Niassa National Reserve, Cabo Delgado, Mozambique                                                                                                                                                                                                                                                                                                                                                                                                                      |

|                                                                                                |                                                                                                                                                                                                                                       |
|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>3. Anticipated research start date</b>                                                      | 10/4/2020                                                                                                                                                                                                                             |
| <b>4. Anticipated research end date</b><br>(n.b. A maximum of 5 years approval can be granted) | 01/05/2022                                                                                                                                                                                                                            |
| <b>5. Please list any CUREC Approved Procedure(s) you will follow</b>                          | None                                                                                                                                                                                                                                  |
| <b>6. Please list any CUREC Best Practice Guidance used to develop your research</b>           | <a href="#">BPG: Researcher Safety</a> ; <a href="#">BPG Elite and Expert Interviewing</a> ; <a href="#">BPG Management and Protection of Data</a> ; <a href="#">BPG Social Science Outside the UK</a>                                |
| <b>7. Name of departmental / peer reviewer (if applicable)</b>                                 | See the section on 'Applications requiring departmental review' at <a href="https://researchsupport.admin.ox.ac.uk/governance/ethics/apply/msidrec">https://researchsupport.admin.ox.ac.uk/governance/ethics/apply/msidrec</a><br>N/A |

| SECTION D. PARTICIPANTS                                                                                                        |                                                                                                                                                                                                                                                                                                         |
|--------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Age range of participants</b>                                                                                            | 18 – 110 years old.                                                                                                                                                                                                                                                                                     |
| <b>2. Are research participants classed as people whose ability to give free and informed consent is in question?</b>          | Yes                                                                                                                                                                                                                                                                                                     |
| <b>3. Anticipated number of participants</b>                                                                                   | 2,000. Demographic surveys will aim to sample ~10% of the population, around 600 households, and this work will be supplemented by additional work targeting other specific groups e.g. farmers in a particular area, or women's groups. Each of these smaller surveys is likely to target 200+ people. |
| <b>4. Inclusion criteria</b>                                                                                                   | The inclusion criteria will vary between individual surveys, interviews, and focus group aims. Only participants who are able to give free and informed consent will be included.                                                                                                                       |
| <b>5. Exclusion criteria</b>                                                                                                   | Limited capacity to make decisions or represent themselves e.g. intellectual disabilities that make an individual vulnerable.                                                                                                                                                                           |
| <b>6. Please mark 'X' against all planned recruitment methods</b><br><br>Provide copies of all recruitment material for review | Poster advert <input type="checkbox"/>                                                                                                                                                                                                                                                                  |
|                                                                                                                                | Flyer <input type="checkbox"/>                                                                                                                                                                                                                                                                          |
|                                                                                                                                | Email circulation <input type="checkbox"/>                                                                                                                                                                                                                                                              |
|                                                                                                                                | In-person approach <input checked="" type="checkbox"/>                                                                                                                                                                                                                                                  |
|                                                                                                                                | Website <input type="checkbox"/>                                                                                                                                                                                                                                                                        |
|                                                                                                                                | Social media (e.g. twitter, Facebook) <input type="checkbox"/>                                                                                                                                                                                                                                          |
|                                                                                                                                | Snowball sampling (recruiting through contacts of existing participants) <input checked="" type="checkbox"/>                                                                                                                                                                                            |

|                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                          |
|------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
|                                                                                                      | Newspapers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <input type="checkbox"/> |
|                                                                                                      | Research recruitment sites (e.g. Prolific Academic, Amazon Turk)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <input type="checkbox"/> |
|                                                                                                      | Existing departmental contacts or volunteer database                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <input type="checkbox"/> |
|                                                                                                      | Other (please specify)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <input type="checkbox"/> |
|                                                                                                      | As the study is working with communities through a project they already know, and literacy rates are very low, formal 'recruitment materials' are not appropriate. Instead informal person-to-person approaches, tailored to the content of each individual survey, will be favoured.                                                                                                                                                                                                                                                                                                                                          |                          |
| <b>7. How will recruitment material be distributed?</b>                                              | This will depend entirely on the specific survey, interview topic, or focus group in question. An in-person approach and snowball sampling will be used in most instances, although in some cases specific adverts may be put out via local networks of contacts. Where this is the case, local chiefs will be contacted, and simple adverts in Swahili and Portuguese will be placed in community spaces e.g. schools or village halls.                                                                                                                                                                                       |                          |
| <b>8. Once identified, how will potential participants be approached and invited to take part?</b>   | Prior to any sampling, local chiefs will be consulted and their approval sought before proceeding with any given survey. Local members of staff will informally approach participants and discuss with them whether they are willing to participate in a study, before any formal recruitment takes place. These members of staff will be trusted individuals, and will be trained in the appropriate way to approach a participant and discuss participation. There will be no negative consequences for individuals if they choose not to participate, and this will be made clear at all stages of the recruitment process. |                          |
| <b>9. How will consent be obtained from participants in the research or their parents/guardians?</b> | Due to low levels of literacy, oral consent will be obtained and recorded, along with any conditions for consent, prior to the time of interview. No minors will be included in the study, so consent from guardians will not be necessary. Where materials are to be recorded (either photographs, video, or audio recordings), a written photo/video/audio release form will be read out to the participant and filled in.                                                                                                                                                                                                   |                          |

| SECTION E. RESEARCH METHODOLOGY                                                                        |                                     |                                                                   |                                     |
|--------------------------------------------------------------------------------------------------------|-------------------------------------|-------------------------------------------------------------------|-------------------------------------|
| Please mark 'X' against the methods that will be used in your research                                 |                                     |                                                                   |                                     |
| Ensure you have addressed each method you will use in your informed consent documents and on this form |                                     |                                                                   |                                     |
| Use of casual or local workers (e.g. interpreters)                                                     | <input checked="" type="checkbox"/> | Audio recording of participant                                    | <input checked="" type="checkbox"/> |
| Interview                                                                                              | <input checked="" type="checkbox"/> | Video recording of participant                                    | <input checked="" type="checkbox"/> |
| Focus group                                                                                            | <input checked="" type="checkbox"/> | Photography of participant                                        | <input checked="" type="checkbox"/> |
| Participant completes questionnaire in hard copy                                                       | <input type="checkbox"/>            | Physiological recording from participant                          | <input type="checkbox"/>            |
| Participant completes online questionnaire or other online task                                        | <input type="checkbox"/>            | Taking a sample of blood or other bodily fluid from a participant | <input type="checkbox"/>            |
| Use of social media                                                                                    | <input type="checkbox"/>            | Participant observation                                           | <input checked="" type="checkbox"/> |
| Analysis of existing records                                                                           | <input checked="" type="checkbox"/> | Covert observation                                                | <input type="checkbox"/>            |
| Participant performs verbal or aural task                                                              | <input checked="" type="checkbox"/> | Systematic observation                                            | <input type="checkbox"/>            |
| Participant performs paper and pencil task                                                             | <input type="checkbox"/>            | Observation of specific organisational practices                  | <input checked="" type="checkbox"/> |
| Participant performs computer based task                                                               | <input type="checkbox"/>            | Other (please specify below)                                      | <input type="checkbox"/>            |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| Measurement/recording of motor behaviour                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <input type="checkbox"/> |
| <p><b>1. Describe what participants in the research will be asked to do</b></p> <p>Research visits will be carried out in a variety of locations, and surveys, interviews, and focus groups will be carried out in face-to-face settings. It is likely that many surveys – e.g. household surveys and interviews – will be done at a participant’s home. This is most practical for participants, who are unlikely to be willing to walk for miles to participate in a study. Similarly, they are more likely to be comfortable in this environment; this is not seen as intrusive, but more a leveller which reduces any asymmetries between interviewer and interviewee. Willingness to participate in a study, as well as the oral consent script, will be covered before the researcher/s enter a participant’s home. It will be made very clear at all times that the respondent can opt out of the study at any time, with no negative consequences.</p> <p>Research participants will be asked to participate in one of three key activities:</p> <ol style="list-style-type: none"> <li>1. A structured survey. These will be administered by either Laura Perry or a trained local research assistant. The surveys will be minimally invasive, and will concentrate on attitudes, perceptions, and behaviours. There are unlikely to be any traumatising topics, although some questions may touch on conflict with wildlife or marginalisation of communities, which may cause temporary upset, but no lasting psychological trauma. All interviewers will be trained in how to respond if this unlikely event occurs.</li> <li>2. An unstructured interview. These will all be carried out by Laura Perry, possibly in the presence of a translator. These may touch on more delicate topics, e.g. oral history of the area, significant events including conflict events, which may have caused damage to property or loss of life. Laura Perry has undergone training in how to handle these situations, and these interviews will proceed delicately. The interpreted, if present, will be chosen sensitively, e.g. a female interpreter if discussing local women’s issues and marginalisation.</li> <li>3. Focus group/meeting. These sessions will convene local people to discuss a particular issue. Sensitive topics will be avoided at these events. Focus groups will be run by Laura Perry, possibly in conjunction with other members of staff. Focus groups will be carried out in communal areas, e.g. town meeting halls or schools.</li> </ol> <p>This CUREC proposal outlines an ongoing programme of work, which will include a variety of survey, interview, and focus group research tools. Whilst the processes outlined in this document will be rigorously applied, it is not at present possible to define exactly what specific studies will be carried out, or the frequency/duration of these activities. Similarly, interview questions will be subject to information collated when working in the area, and it is not possible or suitable to have fixed design ideas at this stage of the project. However the topics the project is interested in are as follows: social and demographic characteristics; perceptions and attitudes towards wildlife, local governance structures, and the NGO; access to healthcare and schooling; conflict with wildlife; natural resource use; oral histories; hopes and aspirations. A sample interview template and survey template have been attached, to illustrate the kind of content this programme of work will capture. I will update this section with each study aim, activities etc as these are finalised.</p> <p>All tools will be piloted extensively in the region before teach survey commences properly. The same principles of informed oral consent will also apply to these pilots. If CUREC considers it valuable, Laura Perry can update a CUREC officer with the finalised materials, as they are developed, although development will be an ongoing process.</p> <p><b>4. Will the research include any audio, video or photographic recordings?</b></p> <p>Yes. Laura Perry and her research assistants may occasionally record interviews or surveys. This may be for quality control purposes (i.e. to check that the interviewers are performing as expected), or to create files for later reference. In particular, oral histories and other interviews may be recorded to allow later reflection and analysis</p> |                          |

of the interview content. Photographs will also be taken occasionally, as part of the process of documenting the work that is taking place. These photographs will be used as part of the literature Laura Perry submits to funders etc as evidence of project activities. Recordings, photographs etc will only be taken where the participant is informed of and happy to agree to their use. Where photographs or other recordings are taken for the use of funding organisations, the individuals in the photograph will all sign a media release form.

#### 5. Biological sample handling

No samples will be taken.

#### 6. Please detail all expenses or gifts that will be offered to participants

No payment will be made for participation. We are also unlikely to gift participants anything for their response, as this will be an ongoing community project, and we do not want to incentivise participation in an unsustainable way, or influence the local economy. However, for focus groups or long interviews, refreshments may be provided.

### SECTION F. ETHICAL CONSIDERATIONS

For guidance on ethical issues, please see <http://researchsupport.admin.ox.ac.uk/governance/ethics/resources>

(N.B. To complete, double click on the check boxes and select 'checked')

#### 1. Will the research involve any vulnerable participants (e.g. children, elderly, prisoners)?

Yes ☐ No ☒

If yes, please describe how they are defined as vulnerable and detail any CUREC Approved Procedures or guidance that will be applied to the research (for current documents and templates see <https://researchsupport.admin.ox.ac.uk/governance/ethics/resources>).

If yes, and you cannot apply any Approved Procedure, please cease completion of this form – a CUREC 2 application is required

#### 2. Will [unequal relationships](#) exist between participants and those obtaining informed consent?

Yes ☒ No ☐

If yes, describe the nature of the unequal relationship and how arising ethical issues will be addressed

The interviewers will be in a position of significant affluence compared to the participants: this is a very poor rural area, and this issue is unavoidable. However, participants will be in no way financially reliant on the interviewers. All interviewers will be trained in conducting this type of work, and making participants comfortable. Where possible, interviewers will also be recruited from the local area, and therefore there will be less asymmetry between the respondent and the interviewer. Laura Perry is accustomed to working in this kind of situation, and is used to making participants comfortable in her presence; she has a good conversational proficiency (although not fluency) in the local language, which also helps reduce perceived asymmetries.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                         |                                        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|----------------------------------------|
| <p><b>3. Will the research involve questions and/or discussions of contentious and/or sensitive issues (e.g. information relating to ethnicity, political opinions, religious beliefs, physical/mental health or sexual life)?</b></p> <p><b>If yes,</b> please justify why this is required and provide a copy of the questionnaire raising the issues that will be used in your research.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/>            |
| <p>Whilst most interviews, surveys, and focus groups will not cover sensitive topics, it is highly possible that sensitive topics will sometimes be relevant to a discussion. For example, it is very important to understand human-wildlife conflict issues, but these may involve discussions of threat or even death or loved ones. Again, these interviews have not been designed or structured at this point, and will only be created in response to local need. Indeed, it is not possible or desirable to actively prevent interviewees from bringing up these topics. The interview and survey programme to be implemented will be entirely responsive to local concerns and needs, and we believe that even if sensitive topics are raised, it is important to discuss these fully in order to work with communities to reduce these issues in the future.</p> |                                         |                                        |
| <p><b>4. Will the research involve deliberate <a href="#">deception</a> of participants outside the scope of <a href="#">CUREC Approved Procedure 07</a>?</b></p> <p><b>If yes,</b> please cease completion of this form – a CUREC 2 application is required</p> <p><b>If no,</b> please either give details of the deception or state that no deception will be involved</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Yes <input type="checkbox"/>            | No <input checked="" type="checkbox"/> |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                         |                                        |
| <p><b>5. Could the proposed research affect your own physical and/or psychological safety as a researcher?</b></p> <p><b>If yes,</b> describe how you will manage this.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Yes <input type="checkbox"/>            | No <input checked="" type="checkbox"/> |
| <p>This work will be conducted abroad, but under all of the correct university health and safety and travel insurance coverage. This has been updated to include COVID-associated risks and implications for the fieldwork. Laura Perry will also have all the correct research and residency permits for Mozambique. Concerns for Laura's safety when entering participants' homes are minimal, as friendly relations exist between the project and local communities, and violence would be extremely unlikely. If there are any changes to this, the CUREC and Risk Assessment will be updated accordingly.</p>                                                                                                                                                                                                                                                       |                                         |                                        |

**6. How will you ensure the research is conducted according to the details given in this form?**

Laura Perry will be leading all surveys. All members of staff will report directly to her. They will be monitored on an ongoing basis, with daily reviews during data collection periods, and Laura will be able to identify any inconsistencies or emerging problems in their work.

Laura Perry reports on a weekly basis to her supervisors, although if issues arise these can be discussed as they progress.

It is highly unlikely that there will be any data breaches, as the information collated in this programme will simply not be of interest to research assistants. However, all survey records, recordings (audio and visual), and indeed all survey materials will be stored in a password-protected computer. Surveys will be carried out via the Qualtrics platform, which will be used in the field as a mobile phone application. Through this platform, interviewers will not have access to surveys which they have previously filled in. The Qualtrics central database is also password protected.

Should there be breaches of data security, a formal review and management process would be undertaken with the local NGO who is supporting this work. In case of injury etc., local staff will be covered under the health and safety insurance of the local NGO.

**7. Please give details of any other research-specific ethical and/or safety considerations**

None.

**8. How do you propose to deal with / handle any incidental findings?**

'Not applicable' if there is no likelihood of incidental findings in your research

**9. Will any data or information from this study be provided to individual participants?**

No

**SECTION G. OTHER CONSIDERATIONS****1. Is any part of this research being conducted overseas?**

Yes ☒

No ☐

If yes, please give details below. Ensure you complete and submit a travel risk assessment form to your departmental safety officer. (This is necessary to ensure the travel/fieldwork is covered by the University's travel insurance – see <http://www.admin.ox.ac.uk/finance/insurance/travel/>)

All research will take place in the Niassa area, in northern Mozambique. All travel/fieldwork documentation will be completed, and the fieldwork timetable updated in accordance with government travel policy in light of the COVID pandemic. Laura Perry will travel out to Mozambique when permitted, and carry out a two week self-quarantine before going to her field site, to reduce any possibility of her bringing infection into the area. Her risk assessment has been updated to consider risks of her contracting the disease whilst in the field, although this is highly unlikely.

|                                                                                                                                                                                                                                                                                                                                                               |                                     |                                               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-----------------------------------------------|
| <p><b>2. Does your research raise issues relevant to the Counter-Terrorism and Security Act (<a href="#">the Prevent Duty</a>), which seeks to prevent people from being drawn into terrorism?</b></p> <p>If yes, please say how you plan to address any related risks. Please see advice on this on our <a href="#">Best Practice Guidance Web Page</a>.</p> | <p>Yes <input type="checkbox"/></p> | <p>No <input checked="" type="checkbox"/></p> |
|                                                                                                                                                                                                                                                                                                                                                               |                                     |                                               |

## SECTION H. DATA MANAGEMENT AND HANDLING

For the purposes of completing this section, all information provided by research participants is considered to be research data. Any research data from which participants can be identified, is known as **personal data\***, and if data within this category is sensitive, it is referred to as **special category data\*\***.

Management of **personal data\*** and **special category data\*\*** of human participants, either directly or via a third party, will need to comply with the requirements of the General Data Protection Regulation (GDPR) and the Data Protection Act 2018, as set out in the [University's Guidance on Data Protection and Research](#). In answering the questions below, please also consider the points raised in the [Data Protection Checklist](#). For advice on research data management and security, please consult with the University's Research Data Team ([researchdata@ox.ac.uk](mailto:researchdata@ox.ac.uk)) and/or your local IT department and the University's [web pages on research data management](#).

**1. Please mark 'X' against the data you will collect for your research**

|                                                                                                                                          |                                     |                                                                           |                                     |
|------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|---------------------------------------------------------------------------|-------------------------------------|
| Screening documents                                                                                                                      | <input type="checkbox"/>            | Audio recordings                                                          | <input checked="" type="checkbox"/> |
| Consent records including participant name (written consent forms, audio-recorded consent, assent forms (for research involving minors)) | <input checked="" type="checkbox"/> | Video recordings                                                          | <input checked="" type="checkbox"/> |
| Online consent (may be anonymous)                                                                                                        | <input type="checkbox"/>            | Transcript of audio/video recordings                                      | <input checked="" type="checkbox"/> |
| Opt-out forms                                                                                                                            | <input type="checkbox"/>            | Photographs                                                               | <input checked="" type="checkbox"/> |
| Contact details for research purposes only (destroyed when no longer needed for this research)                                           | <input checked="" type="checkbox"/> | Information about the health of the participant (including mental health) | <input type="checkbox"/>            |
| Contact details kept for future studies                                                                                                  | <input type="checkbox"/>            | Physiological test results / measurements                                 | <input type="checkbox"/>            |
| Field notes                                                                                                                              | <input checked="" type="checkbox"/> | MRI scans                                                                 | <input type="checkbox"/>            |
| Questionnaire answers                                                                                                                    | <input checked="" type="checkbox"/> | Other (please specify below)                                              | <input type="checkbox"/>            |
| Task results (e.g. paper/online tasks, diary completion)                                                                                 | <input type="checkbox"/>            |                                                                           |                                     |

**2. For each of the types of data selected above, state how this will be physically transferred from where it is collected to a secure local storage site (and backed up as necessary). This includes both paper records and data captured electronically.**

Consent will either be given orally, with the relevant interviewers filling out an oral consent form, or will be recorded either with an audio file or video file. Digital files will be either be directly recorded on a password-

protected device, or immediately transferred to a password encrypted device. Paper records will be filed in a central, secure location on the main project site. On some occasions, certain portions of an interview may be transcribed by Laura Perry or a research assistant. However this will be done on the same computer as the records are kept, and subject to the same digital protection with passwords.

Questionnaire answers will also be recorded digitally, and stored in a password-protected system. No paper copies will be made.

Contact details will be filed and stored in a central, hard-copy system. As this is a small area, and households are known by the project staff, this is not sensitive or confidential information, but will help with follow-up where needed for the surveys, or requested by the participants. These files will be stored in a secure location, either with a lock or in an office which locks when not in use.

**3. How and where will each type of data be stored whilst the research is ongoing (until the end of all participant involvement)?** Describe the arrangements for ensuring confidentiality, i.e. location of storage (e.g. [Nexus 365 OneDrive for Business, SharePoint](#)), security arrangements and de-identification of such data. Do not store unencrypted data in freely available cloud services or unprotected USB drives.

All data will be stored on a password-protected computer, and backed up to the Nexus 365 OneDrive for business, a password-protected cloud. These passwords will only be held by Laura Perry. No digital information, either during or after the study, will be without password protection.

In the event of physical record keeping, e.g. Laura's personal interview notes etc., these will be kept in a secure location, and access to those files will only be available for Laura Perry. They will either be in a locked cupboard, or a locked room when not in use. An added layer of security is provided in that they will be written in a non-local language, so few residents would be able to understand them, even in the unlikely event that a notebook was lost or stolen.

**4. Will you use a unique participant number on research data instead of participant name?**

**If yes**, state whether or not you will retain a list of participant names against numbers (pseudonymisation via a linkage list). Where will the list be stored, and when will it be destroyed?

This depends on the exact survey, and the exact nature of the topic. Some responses may require pseudonymisation, e.g. where participants request that their records are made pseudonymous, or topics are particularly contentious. All interview participants will be asked if this how they would prefer their records are treated. This is unlikely, however, as interviews are unlikely to cover particularly contentious topics, and participants are typically proud to have participated, and eager that their own personal input be recorded by the project. For those participants who do prefer pseudonymisation, a linkage list will be created and stored on a password-protected computer, which can only be accessed by Laura Perry. Other individuals involved in the project will have no access to this information.

**5. Who will have access to the research data?**

The researchers listed on this form will have primary custody of the data, and Laura Perry will be the only person who has access to any data before the pseudonymisation this is carried out, and to the linkage list.

Other data may be shared with collaborators, notable the local NGO who is sponsoring this research.

**6. If research data is to be shared with another organisation, how will it be transferred / disclosed securely?**

The data will be fully anonymised before it is shared with collaborators or other organisations. It will be transferred via a shared cloud account, with password protection, which can only be accessed by the named organisation/individual, who will have been granted access to particular files.

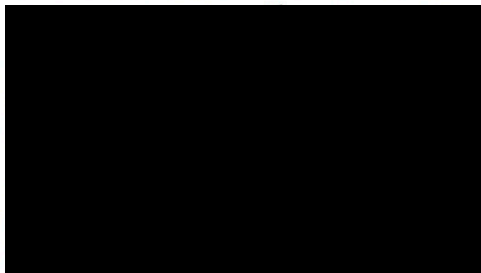
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                         |                             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|-----------------------------|
| <b>7. When and how will identifiable data be destroyed or deleted?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                         |                             |
| Records of consent will be retained for a minimum of three years after publication or public release. When individual participant involvement is complete, once all data has been analysed/anonymised, individual identifiers will be destroyed.                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                         |                             |
| <b>8. Please confirm that you will store other research data safely for at least 3 years after final publication or public release and adhere to any <a href="#">additional research funder policies</a>.</b><br><br>For more information about the University policies, please see the University's web pages on <a href="#">research data management</a> .<br><br><b>If 'Yes', please give details of who will store the data and on storage format, location and security.</b><br><br><b>Laura Perry will store the data on her personal laptop, which is password protected, and on the Nexus 365 OneDrive for business.</b><br><br><b>If 'No', please provide further details.</b> | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> |

| SECTION I. PUBLICATION AND DISSEMINATION OF RESULTS                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. How will you disseminate and feedback project outcomes at the end of the research?</b> | This work will be written up as various academic publications, and part of a thesis. The results will also be used to compile management reports, e.g. measuring the impact of local community programmes. Results from some studies, e.g. exploration of the key priorities of the communities, will be fed back to local people through community meetings and discussions.<br><br>Where possible, open access to research data will be provided through data archives e.g. Data Dryad. All data will be anonymous. |

## DECLARATIONS AND SIGNATURES OF RESEARCHERS

I/We, the researcher(s):

- Understand our responsibilities as outlined on this form and in the CUREC glossary and guidance
- Agree to start this research only after obtaining approval from the MS IDREC;
- Understand that the Principal Investigator must ensure that all researchers are suitably qualified and trained to conduct the research described, or are appropriately supervised until deemed qualified/trained;
- Agree to provide additional information as requested by the MS IDREC before approval is secured and as research progresses;
- Agree to maintain the confidentiality of all data collected from or about participants;
- Agree to notify the MS IDREC in writing immediately of any proposed change to the research, and await approval before proceeding with the proposed change;
- Agree to notify the MS IDREC if the Principal Investigator changes and supply the name of the successor;
- Will use the data collected only for the research for which approval has been given;
- Will grant access to data only to authorised persons; and
- Have made arrangements to ensure that personal data collected from participants will be held in compliance with the requirements of the GDPR and the Data Protection Act 2018.

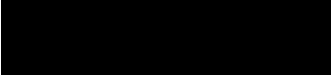
|                                    |                                                                                      |
|------------------------------------|--------------------------------------------------------------------------------------|
| Principal Investigator (Name)      | David Macdonald                                                                      |
| Principal Investigator (Signature) |  |
| Date                               |                                                                                      |
| Student (Name)                     | Laura Perry                                                                          |
| Student (Signature)                |  |
| Date                               |                                                                                      |

## ACCEPTANCE BY HEAD OF DEPARTMENT/FACULTY OR DESIGNATED NOMINEE\*

\*Another senior member of the department may sign where the head of department is the Principal Investigator, or where the head of department has appointed a nominee. Example nominees include Deputy Head of Department, Director of Research, or Director of Graduate/Undergraduate Studies.

I have read the research proposal above. On the basis of the information available to me, I:

- consider the Principal Investigator/Supervisor and student researcher (if applicable) to be aware of their ethical responsibilities in regard to this research;
- am satisfied that the proposed design and scientific methodology are sound; the research has been subject to appropriate peer review and is likely to contribute to existing knowledge and/or to the education and training of the researcher(s) and that it is in the public interest.

|                                                             |                                                                                                                                                                                                                                                   |
|-------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Head of Department or designated nominee (Name)</b>      | <br>Professor Tim Coulson                                                                                                                                       |
| <b>Head of Department or designated nominee (Signature)</b> | This must either be a wet-ink signature (not electronic)<br>Or<br>The Head of Department/nominee can send an email (including PI name and study title) to <a href="mailto:ethics@medsci.ox.ac.uk">ethics@medsci.ox.ac.uk</a> confirming the above |
| <b>Date</b>                                                 | 11/2/20                                                                                                                                                                                                                                           |