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# Understanding rule-breaking in conservation



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# Abstract

Conservation interventions often rely on rules that restrict and regulate activities harmful to biodiversity. To be effective, such interventions require reliable information about the prevalence of rule-breaking behaviours, alongside sufficient understanding of the factors that affect compliance. However, this is challenging given the secretive nature of rule-breaking. Subsequent data may be heavily biased and thus unreliable, resulting in inappropriate conservation interventions which represent a waste of participant's time and research resource. My thesis aims to increase understanding of rule-breaking behaviour in conservation with a particular focus on developing and advancing quantitative and qualitative methods. I use a combination of fieldwork with people living around protected areas in two highly biodiverse but socially and economically dissimilar countries (Indonesia and Tanzania), and systematic reviews of existing research.

First, I explore different approaches for understanding if and when a topic is sensitive and develop a psychometric scale to measure topic sensitivity. Then I investigate how Specialised Questioning Techniques, a suite of methods developed by social scientists to encourage people to answer sensitive questions more accurately, might contribute to obtaining robust information about sensitive rule-breaking behaviours in conservation. I use an experimental approach to critically assess the performance of Specialised Questioning Techniques (specifically the Randomised Response Technique, the Unmatched Count Technique, the Crosswise model and the Bean method) when asking about a common rule-breaking behaviour: wildlife hunting. Results suggest these methods do produce more accurate data, but that respondents do not always feel more at ease using them. I then focus on one method, the Randomised Response Technique, and provide conservation scientists with detailed guidance on robust study design and application, based on a systematic review of studies using this approach to quantify rule-breaking. Building on these lessons, I apply the RRT to quantify compliance in the Ruaha-Rungwa ecosystem of Tanzania and assess how well it performed. Results highlight that Randomised Response Techniques cannot overcome participants' lack of trust in the research process. Lastly, I examine factors that motivate compliance with protected area rules. Drawing on previous conservation research and using factorial survey experiments, I explore how the administration of rules by law enforcers around protected areas can influence compliance. Importantly, results show that people want rules to be administered fairly, and that the abuse of power by law enforcers, for example through the acceptance of bribes, is not tolerated.

This thesis enhances conservation science by providing empirical evidence and detailed guidance on how to study rule-breaking.

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# Authors declaration

'I hereby declare that this thesis is the results of my own investigations, except where otherwise stated. All other sources are acknowledged by bibliographic references. This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree unless, as agreed by the University, for approved dual awards.

I confirm that I am submitting this work with the agreement of my Supervisor(s).'

---

'Yr wyf drwy hyn yn datgan mai canlyniad fy ymchwil fy hun yw'r thesis hwn, ac eithrio lle nodir yn wahanol. Caiff ffynonellau eraill eu cydnabod gan droednodiadau yn rhoi cyfeiriadau eglur. Nid yw sylwedd y gwaith hwn wedi cael ei dderbyn o'r blaen ar gyfer unrhyw radd, ac nid yw'n cael ei gyflwyno ar yr un pryd mewn ymgeisiaeth am unrhyw radd oni bai ei fod, fel y cytunwyd gan y Brifysgol, am gymwysterau deuol cymeradwy.

Rwy'n cadarnhau fy mod yn cyflwyno'r gwaith hwn gyda chytundeb fy Ngoruchwyliwr (Goruchwylwyr).'

# Author contributions

## **Chapter 1. Introduction**

This chapter is entirely my own work and was reviewed by Freya St John, Julia Jones & Leejiah Dorward.

## **Chapter 2. Using mixed methods to assess topic sensitivity in conservation**

I conceived the ideas and research questions along with Freya St John, Julia Jones and Leejiah Dorward. I supervised data collection, which was carried out by Stephen Sakeni, Joseph Kaduma, Jesca Mchomvu, Karlina Prayitno, Humairah Sabiladiyni and Andie Wijaya Saputra. I conducted analyses and wrote the chapter. The chapter was reviewed by all mentioned, alongside Asri Dwiyahreni, Edward Kohi & Jatna Supriatna.

## **Chapter 3. Experimentally validating Specialised Questioning Techniques in conservation**

I conceived the ideas and research questions along with Freya St John, Julia Jones and Leejiah Dorward. I supervised data collection, which was carried out by Stephen Sakeni, Joseph Kaduma, Jesca Mchomvu, Karlina Prayitno, Humairah Sabiladiyni and Andie Wijaya Saputra. I conducted analyses and wrote the chapter. The chapter was reviewed by all mentioned, alongside Asri Dwiyahreni, Edward Kohi & Jatna Supriatna.

## **Chapter 4. Asking sensitive questions in conservation using Randomised Response Techniques**

I conceived the ideas and research questions along with Freya St John and Julia Jones. I carried out data collection, analyses, and wrote the chapter. The chapter was reviewed by Freya St John & Julia Jones.

## **Chapter 5. Topic sensitivity still affects honest responding, even when Specialised Questioning Techniques are used**

I conceived the ideas and research questions along with Freya St John and Leejiah Dorward. I supervised data collection, which was carried out by Stephen Sakeni, Joseph Kaduma, Jesca Mchomvu, Rose Mawenya. I conducted analyses and wrote the chapter. The chapter was reviewed by all mentioned, along with Julia Jones & Edward Kohi.

## **Chapter 6. A greater focus on fair administration of protected area rules could improve compliance**

I conceived the ideas and research questions along with Freya St John, Julia Jones and Leejiah Dorward. I supervised data collection, which was carried out by Stephen Sakeni, Joseph Kaduma, Jesca Mchomvu, Rose Mawenya, Karlina Prayitno, Ika Yuni Agustin and Tyassanti Tryswidiarini, and Andie Wijaya Saputra. I conducted analyses and wrote the chapter. The chapter was reviewed by Freya St John, Julia Jones & Leejiah Dorward.

## **Chapter 7. Discussion**

This chapter is entirely my own work and was reviewed by Freya St John & Julia Jones.

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# List of Acronyms

CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CoESE	College of Environmental Science and Engineering at Bangor University
COSTECH	Tanzania Commission for Science and Technology
EFA	Exploratory Factor Analysis
ERC	European Research Council
FSE	Factorial Survey Experiment
GCA	Game Controlled Area
GLM	General Linear Model
GLMM	General Linear Mixed Model
GLNP / TNGL	Gunung Leuser National Park / Taman Nasional Gunung Leuser
GR	Game Reserve
IQR	Interquartile range
MBOMIPA	Matumizi Bora ya Malihai Idodi na Pawaga
MPI	Multidimensional Poverty Indicator
NGO	Non-Governmental Organisation
NTFP	Non-Timber Forest Product
PA	Protected Area
RISTEK	Ministry of Research and technology of the Republic of Indonesia
RNP	Ruaha National Park
RRT	Randomised Response Technique
SQT	Specialised Questioning Technique
STEP	Southern Tanzania Elephant Project
TANAPA	Tanzania National Parks
TANESCO	Tanzania Electric Supply Company Limited
TAWA	Tanzania Wildlife Management Authority
TAWIRI	Tanzania Wildlife Research Institute
UCT	Unmatched Count Technique
UoI	Universitas Indonesia
WMA	Wildlife Management Area

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All photographs included in this thesis were taken by me, unless specifically stated. Consent was sought from all participants.

# Chapter 1

## Introduction



Gunung Leuser National Park, North Sumatra (photo taken by Leejiah Dorward)



## 1.1 Introduction

### 1.1.1 Why study rule-breaking in conservation?

Biodiversity is in crisis. Human activities such as overexploitation, land conversion, and climate change are causing irrevocable damage to planetary health and human well-being (Maxwell et al. 2016). As such there is increasing recognition of the need to develop solutions that consider people (Mascia et al. 2003; Schultz 2011; Kareiva & Marvier 2012), with conservationists increasingly turning towards the social sciences in order to better understand and influence human behaviour (Cinner 2018; Nielsen et al. 2021). One of the primary ways in which conservationists seek to change human behaviour is through regulation, specifically by developing rules to discourage environmentally harmful behaviours (St John et al. 2013; Keane 2010).

Rules defining shared understandings amongst parties about what actions are required, prohibited, or permitted (Ostrom 2011) are widely considered essential for conservation (Keane et al. 2008). Rules are determined at multiple scales, by a range of institutions, and can be externally imposed, or evolve in situ (Keane et al. 2008). Within conservation, a plethora of formal rules exist to protect specific species (e.g., in the UK it is illegal to handle certain species without a license), outline terms of trade (e.g., the Convention on International Trade in Endangered Species of Wild Fauna and Flora, CITES), regulate extraction of natural resources (e.g., fishing quotas in the European Union) and restrict access both spatially (e.g., in protected areas) and temporally (e.g., via hunting or fishing seasons) (Keane et al. 2008). Formal rules exist in law, supported by legal frameworks and defined sanctions. However, informal rules, which can be defined as ritualised, soft, or normative procedures and practices, often exist alongside, or instead of, formal regulations (Gore et al. 2013). Informal rules govern human-nature relationships in many biodiverse nations and are enforced by informal institutions (Colding & Folke 2001). In Madagascar for example, taboos known as *fady* are passed down through generations and determine which wildlife species should and should not be eaten (Jones et al. 2008), whilst in Vanuatu traditional taboos are used to temporally and spatially restrict fishing (Johannes 1998).

It is famously recognised that a world without rules risks bringing "*ruin to all*" (Hardin 1968). Failure to restrict access to natural resources, or to define user rights and duties, can result in a 'Tragedy of the Commons' whereby unfettered exploitation leads to resource collapse (Hardin 1968; Ostrom et al. 1999). This can have profound biological impacts including loss of genetic diversity, species extirpations and extinctions, and ecosystem disfunction and failure (Pimm & Raven 2000; Cardinale et al. 2012). Failure to regulate extraction can also adversely affect the health of socio-ecological systems. From an anthropogenic perspective, unregulated use may provide people with short-term benefits, such as food and fuel (Gavin et al. 2010). But in the long-term, it can undermine societal and economic well-being; depriving communities of opportunities to legally benefit from resources (Kahler et al. 2013), decreasing government revenue (e.g., from taxation), increasing social inequality (Ostrom et al. 1999), and contributing to social unrest and conflict (Brashares et al. 2014). Studying compliance is therefore essential for securing better outcomes both for biodiversity and people (Keane et al. 2008; Arias 2015).

### 1.1.2 How has rule-breaking been studied previously in conservation?

Research has shown that compliance with conservation rules is influenced by a range of complex and interrelated drivers, including economic, geographic and social factors that manifest at different levels, depending on the individual, group or institution involved (Sutinen & Kuperan 1999; Solomon et al. 2015). For example, people may break rules to meet subsistence needs (e.g., to obtain food, medicine, firewood, building materials) or to generate income (Knapp et al. 2017; Coad et al. 2019), because they lack alternatives (e.g., due to displacement, crop failure, or job loss) (Yamagiwa 2003), or in response to wildlife damaging crops, property or life (Kahler et al. 2013). Additionally, people may break rules to fulfil cultural beliefs (Glaw et al. 2008; Mmahi & Usman 2020), or in response to commercial demand (e.g., logging rosewoods, mahoganies and ebonies to meet demand in East Asia for *hongmu* furniture (EIA 2016)). Rules may be broken opportunistically, with individuals taking advantage of chance encounters, or accidentally when people are unaware of rules (Keane et al. 2011a) or misinterpret them (Ostrom 2011). Additionally, people may not follow rules consistently. They may break some rules but not all, or respect rules most of the time, but not always (Arias 2015). Moreover, non-compliance can be a politically motivated act of social defiance (Kahler & Gore 2012; Mmahi & Usman 2020). For example, in contexts where external rules have been imposed on communities, where communities have been forcibly relocated, or where people have suffered abuses of power at the hands of conservation authorities, resentment may build culminating in acts of violent resistance (Robbins et al. 2005). Such resistance may be further exacerbated where conservation efforts are driven by authorities who are perceived as illegitimate or neo-colonial by local communities (Robbins et al. 2005).

The evolution of conservation from a discipline predominately grounded in the natural sciences towards one that encourages more meaningful engagement with the social sciences (Mascia et al. 2003; Moon & Blackman 2014; Bennett et al. 2017), means conservation science increasingly draws on a diverse range of tools and disciplinary perspectives to study rule-breaking (Solomon et al. 2015; Arias 2015). For example, conservation criminology has emerged as a growing area of scholarship (Gore 2017), whilst frameworks from the behavioural sciences (St John et al. 2015), and research methods from the social sciences (Nuno & St John 2015), are increasingly used to better understand and quantify non-compliant behaviour.

Subsequent data can be used to identify emerging threats to biodiversity, inform management decisions and policy, as well as contribute to the development of more effective conservation interventions (Gavin et al. 2010; St John et al. 2013). However, studying rule-breaking is inherently challenging. Those involved are rarely willing to reveal their involvement and activities are usually conducted in secrecy to minimise potential detection (Keane et al. 2008). Moreover, direct victims of conservation crime (including wildlife) are unable to self-report crimes, meaning the level of rule-breaking that occurs undetected (often called the 'dark figure') is likely higher than other crime sectors (Lemieux 2014). To date, rule-breaking has generally been studied using one of two approaches. The first relies on the use of data identifying *incidents of rule-breaking*, while the second entails collecting information *directly from people* about their possible involvement in rule-breaking (Table 1.1).

### 1.1.3 Incidents of rule-breaking behaviour

One of the main methods used to study conservation compliance is by using data collected by law enforcement officers (Table 1.1). Often incidents of rule-breaking (such as animal carcasses, tree stumps, traps, hunting or logging camps) are observed and recorded by law enforcers (such as rangers, park guards, the police or the army) during the course of their duties with arbitrary units, such as Catch per Unit of Effort (e.g., number of incidences detected per number of days or km patrolled) calculated to estimate temporal trends in rule-breaking (Dobson et al. 2018), while location data are used to analyse geographical trends. For example, aerial counts of elephant carcasses have been used to determine spatial patterns of elephant poaching in Ruaha National Park, Tanzania (Beale et al. 2018), while Critchlow et al. (2017) used ranger collected data to determine 'hotspots' of rule-breaking in Queen Elizabeth Protected Area, Uganda. Similarly, Moore et al. (2017) investigated wildlife poaching in Nyungwe National Park, Rwanda using ranger-collected observations. Judicial data, such as records detailing arrests and prosecutions, are also used to determine the types of crime committed, where, when and by whom, as well as the punishments distributed (Gavin et al. 2010; Paudel et al. 2020). Meanwhile, seizure data collected by law enforcers at transport hubs such as air and seaports are used to assess wildlife trafficking trends (e.g., Kurland & Pires 2017). Encouragingly, forensic advances mean that the geographic origin of some seized wildlife products, including elephant ivory, can be identified (Wasser et al. 2008).

The emergence of novel surveillance technologies has further enabled conservationists to observe incidents of non-compliant behaviour without being present themselves (Table 1.1). For example, camera traps, initially developed to monitor wildlife populations, often capture images of people breaking rules as 'by-catch' (Sandbrook et al. 2018). These images can be used to identify rules broken, alongside perpetrator characteristics, although this has considerable ethical implications (Simlai 2021). Increasingly, conservationists are exploring the use of passive acoustic monitoring to detect human presence and gunshots in protected areas (Wrege et al. 2017), while technologies such as drones and towers mounted with infrared cameras have been used to assess unauthorised entry into National Parks in Northern India (Simlai 2021). Additionally, conservationists are increasingly able to gather data on rule-breaking using high resolution satellite imagery. For example, compliance with deforestation embargoes has been monitored this way in the Brazilian Amazon (da Silva et al. 2022). Further, the growth of the internet and online sales platforms has enabled researchers to determine the demographics of sellers and consumers of illegal wildlife products. For example, Hinsley et al. (2016) studied the extent and structure of horticultural orchid trade via social media, while Siriwat & Nijman (2018) studied the illegal sale of otters in the Thai pet trade by monitoring Facebook groups.

Data on incidents of conservation rule-breaking are also collected by researchers observing in-person, certain activities (Table 1.1). For example, researchers may conduct market surveys to quantify items seen for sale, price changes and demand for specific wildlife products (Milner-Gulland & Clayton 2002; Gomez & Shepherd 2018). Meanwhile, researchers may also observe incidents of non-compliance covertly. Due to the

secretive nature, and often difficult terrain in which much conservation rule-breaking occurs, this approach is rare, but it has been applied in fisheries (Bergseth et al. 2013). For example, Bova et al. (2018) covertly observed fishers in South Africa to determine whether they illegally retained undersize fish, exceeded bag limits, broke bait and tackle specifications, caught prohibited species, or sold fish.

#### 1.14 Limitations of using data on incidents of rule-breaking

Despite their wide-spread use, incident data have several limitations (Gavin et al. 2010). Inherent biases in the way law enforcers collect data mean they can be extremely difficult to analyse and require specific expertise (Keane et al. 2011b; Dobson et al. 2020), whilst factors such as corruption, may mean these data are subject to deliberate underreporting (Gavin et al. 2010). Further, challenging terrain, limited resources, and the subsistence and thus small-scale nature of much rule-breaking means incidents are often hard to detect (Robbins et al. 2005). An experimental study conducted in Cambodia, for example, found rangers had a 0.3 probability of finding snares set in tropical forest (Ibbett et al. 2020). Incident data also provide incomplete information about compliance. Market surveys do not reveal where resources originate, meaning it can be difficult to distinguish whether they were extracted legally or illegally, and data do not capture information about resources consumed for subsistence (Gavin et al. 2010). More problematic, is that incident data rarely explain what motivates rule-breaking, leaving conservationists poorly equipped to develop solutions that encourage and generate greater behavioural compliance (St John et al. 2013).

Table 1.1. Approaches typically used in conservation to gather data to measure rule-breaking behaviour, with examples of their application (Adapted from Gavin et al. 2010; Bergseth et al. 2013; Arias 2015).

			Provides information about:				
Method	Description	Examples	What rules are broken	When rules are broken	Where rules are broken	Who breaks rules	Why rules are broken
<i>Data on incidents of rule-breaking</i>							
Observations made by law enforcers	Incidents of rule-breaking (e.g., traps, carcasses, tree stumps, camps, sawmills) detected & recorded by law enforcers while on foot, vehicle, boat or air patrol.	Critchlow et al. (2017) assess spatial patterns of poaching in Queen Elizabeth National Park, Uganda using ranger-collected data.  Beale et al. (2018) assessed distribution of elephant poaching in Ruaha National Park, Tanzania via analysis of arial survey data.	✓	✓	✓	x	x
	Judicial records or legal proceedings (e.g., arrest and prosecution records).	Paudel et al. (2020) used arrest records (alongside seizure data) to assess trends in illicit wildlife trade in Nepal.	✓	✓	✓	✓	x
	Seizure data, such as records of wildlife products seized by law enforcers at air, rail and seaports.	Kurland & Pires (2016) used the Law Enforcement Management Information System database to track trends in wildlife seizures across the United States.	✓	x	x	x	x
Observations made <i>in absentia</i>	Bio-surveillance technologies such as camera traps, bio-acoustic monitoring, or drones used to record incidences of rule-breaking.	Astaras et al. (2020) established a grid of listening posts to monitor gunshots (and illegal hunting) in Korup National Park, Cameroon.	✓	✓	✓	x	x

		Simlai (2021) reported how drones, camera traps and towers mounted with infra-red cameras are used to assess non-compliance around Jim Corbett National Park in northern India.						
	Use of satellite imagery (remote sensing) to detect non-compliance (e.g., illegal deforestation, agricultural expansion, or mining).	da Silva et al. (2022) used satellite imagery to measure compliance with deforestation embargoes in the Brazilian Amazon.	✓	✓	✓	✓		x
	Online surveillance of rule-breaking (e.g., through search of on-line marketplaces, or social media platforms).	Hinsley et al. (2016) studied orchid sellers and collectors' behaviour by monitoring social media.	✓	✓	x	✓		x
Observations made <i>in-person</i>	Surveys of products available for sale in markets.	Milner-Gulland & Clayton (2002) studied the sale of babirusas and wild pigs in markets in North Sulawesi.	✓	x	x	x <sup>1</sup>		x
		Gomez & Shepherd (2018) observed sales of protected bear parts in markets in Laos PDR.						
	Researchers observe rule-breaking covertly (i.e., without the consent of the person being observed).	Bova et al. (2018) covertly observed fishers in South Africa to monitor their compliance with fishing regulations.	✓	✓	✓	✓		x
<i>Data collected directly from people</i>								
Face-to-face	Data collected directly from people via interview, group exercises or questionnaires about their behaviour.	Paudal et al. (2019) interviewed those imprisoned for wildlife crimes in Nepal to assess their motivations.	✓	✓	✓	✓		✓

		Kahler et al. (2013) conducted group exercises to obtain local perceptions of poaching risks to wildlife in Caprivi, Namibia.						
	Observations of people conducted in-person with their consent (e.g., hunter follows, or ethnographic studies).	van Vliet et al. (2015) directly observed the illegal catch of wildlife by hunters in the Brazilian Amazon.  Borgerson (2015) shadowed hunters to assess offtake of protected lemur species in Madagascar.	✓	✓	✓	✓	✓	✗
Self-reports	Individuals provide information about their compliance (e.g., via hunter diaries, or fisheries logbooks).	Coad et al. (2013) asked hunters in Gabon to provide information about their hunting activities – often illegal (but rarely enforced) behaviours (i.e., using snares) were reported.	✓	✓	✓	✓	✓	✓

<sup>1</sup> Market surveys may not provide information about the resource extractor (e.g., the hunter, fisher or logger), although characteristics (e.g., gender, age) of the seller may be collected. More information may be obtained if the researcher speaks to the seller directly.

### 1.1.5 Data collected directly from people

Some of these limitations can be overcome by collecting data directly from people about their own behaviour. Not only do direct approaches generate information about rule-breaker's motivations, but compared to incident data, which can be temporally and financially costly, direct approaches are relatively inexpensive (particularly if administered online) and enable researchers to obtain large amounts of data rapidly. Face-to-face methods (Table 1.1), such as interviews, questionnaires and group exercises, are regularly used to estimate and explore rule-breaking behaviour such as illegal hunting (von Essen et al. 2014; Ibbett & Brittain 2020). For example, to quantify and explore drivers of rule-breaking in Nepal, Paudal et al. (2019) conducted in-depth interviews with prisoners convicted of trafficking or illegally killing wildlife. To assess drivers of illegal bushmeat hunting in Savé Valley Conservancy in Zimbabwe, Lindsey et al. (2011) conducted household questionnaires, while Kahler et al. (2013) conducted a series of group exercises, including participatory mapping, to obtain local people's perceptions about risks to wildlife from illegal killing in Caprivi, Namibia. Often studies adopt mixed methods to triangulate findings, for example, MacMillan & Nguyen (2013) used semi-structured and unstructured interviews, alongside focus groups, to understand drivers of illegal wildlife hunting in Vietnam. Information can also be obtained through direct ethnographic observation. For example, with participants' consent, Borgerson (2015) spent a year following hunters to better understand the impact of illegal hunting of lemur species in Madagascar. Self-reports are another approach commonly employed, here individuals agree to provide information about their own compliance. Such approaches are common in fisheries where mechanisms, such as catch logbooks, are used to monitor fishers' compliance with regulations (Bastardie et al. 2010). Meanwhile, methods such as hunter diaries have been used to assess illegal offtake of wildlife across the tropics (e.g., Coad et al. 2013; van Vliet et al. 2015; Borgerson 2015).

### 1.1.6 Limitations of using data collected directly from people

Despite direct approaches providing detailed understanding about the drivers of rule-breaking, data remain affected by bias. Critically, rule-breakers are rarely willing to reveal themselves or to discuss their motivations freely for fear of punishment (Solomon et al. 2007). This may make it difficult to identify participants, and result in samples biased towards only those who are willing to participate (known as sampling bias), and/or lead to high levels of refusals for some, or all questions (known as non-response bias) (Tourangeau & Yan 2007; Krumpal 2013). Data provided by those who consent to participate, but who harbour concerns about possible repercussions, may be affected by sensitivity bias or social desirability bias, where inaccurate responses are provided in order to reduce risk, or to conform to prevailing social norms (Krumpal 2013; Blair et al. 2020). Moreover, if the study population has previously been exposed to extensive research, respondents may be suffering from survey fatigue, resulting in a further risk of non-response bias, or acquiesce bias, where respondents agree with all non-sensitive statements simply to complete the survey sooner. Obtaining data directly from people about their rule-breaking behaviour also raises several ethical issues regarding the safety of research participants and researchers, as well as the use and storage of potentially incriminating information (St John et al. 2016; Ibbett & Brittain 2020).



Responding to these concerns, and recognising the importance of obtaining reliable, accurate data on sensitive topics, including the prevalence of socially undesirable views or illicit behaviour, social scientists developed a suite of methods specifically to overcome these challenges. Known as Specialised Questioning Techniques (SQTs) (also referred to as indirect questioning), these methods are hypothesised to provide respondents greater protection and encourage more honest responding when answering questions, thereby increasing the accuracy of prevalence estimates (Chaudhuri & Christofides 2013). Over the last two decades, SQTs have increasingly been applied in conservation to obtain more reliable and quantitative estimates of rule-breaking (Hinsley et al. 2019; Cerri et al. 2021). However, despite their growing use, significant challenges remain about their suitability and effectiveness. As such, there is a need to critically examine these tools to assess whether they are fit for purpose.

## 1.2 Aims and Objectives

This research aimed to contribute to current understanding of compliance and to explore how to ask questions about rule-breaking in conservation. My main objectives were to:

1. Provide researchers with best practice guidance on how to assess whether topics are likely to be sensitive amongst study participants;
2. Critically assess and advance the robust application of Specialised Questioning Techniques to ask sensitive questions in conservation science;
3. Improve understanding of drivers of conservation compliance.

To achieve these objectives, I conducted research across two study sites (the Leuser Ecosystem in Northern Sumatra, and the Ruaha-Rungwa ecosystem in Tanzania), which differ considerably in their biological, social, political and economic contexts, and thus offer contrasting insights.

### 1.2.1 Key definitions

Throughout this thesis, I use the terms rule-breaking and non-compliance interchangeably to describe violations of rules designed to protect biodiversity and sustainably manage natural resources. Whilst recognising that a multitude of conservation rules exist, here I restrict my attention to the study of non-compliance around protected areas. This is because protected areas represent a keystone of global efforts to conserve biodiversity (Bruner et al. 2001), covering some 16.6% of the earth's terrestrial surface and 7.75% of the oceans (UNEP-WCMC 2021). Yet, the integrity of many protected areas is regularly threatened by rule-breaking behaviours such as hunting, logging, grazing, mining and land clearance (Maxwell et al. 2016). Understanding compliance within such contexts is thus a particular conservation priority. However, the formal enshrinement in law of many protected area rules can affect respondents' willingness to provide accurate information.

## 1.3 Thesis outline

My thesis is divided into seven chapters (Fig. 1.1). This first chapter serves as an introduction. Five chapters follow and address my three research objectives. A final chapter provides discussion on the synthesis and application of my research.

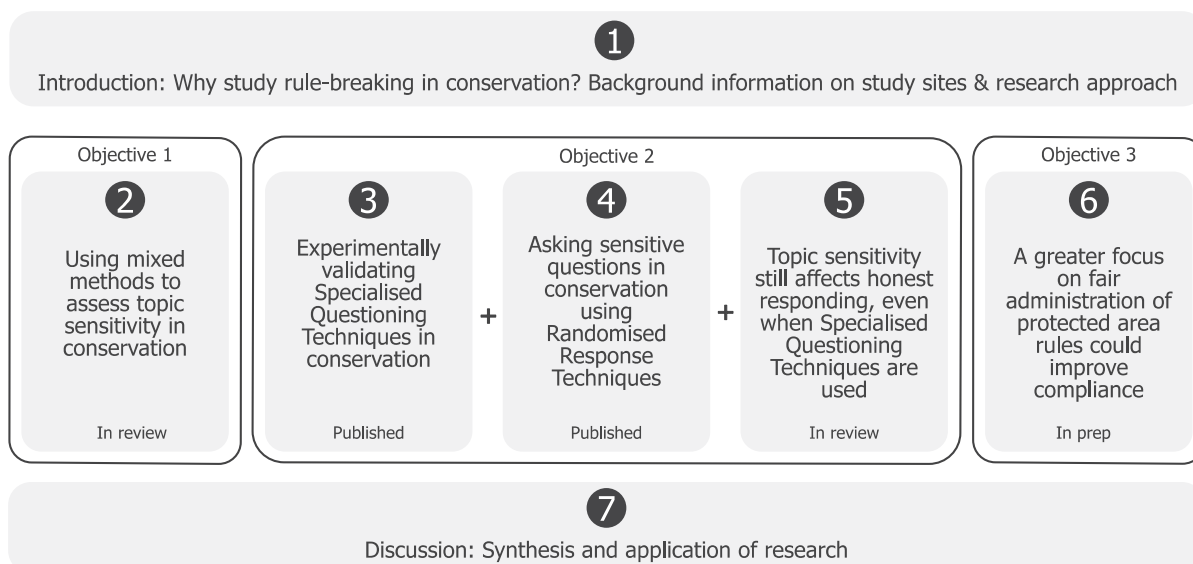


Figure 1.1. Conceptual diagram of my thesis, showing how the different chapters situate together to meet the three thesis objectives. Circled numbers indicate each chapter.

### Chapter 2 – Using mixed methods to assess topic sensitivity in conservation

When researching non-compliance, conservation researchers may harbour concerns about how participants will receive questions, and whether they will provide accurate, honest responses. As a result, researchers are increasingly opting to use Specialised Questioning Techniques to minimise the risk of biases emerging. However, often concerns are based on assumptions about topic sensitivity, rather than participants true perspectives. In my first data chapter, with my co-authors, we dive into sociology and review what makes a topic 'sensitive'. We adopt a mixed methods approach to explore how willing participants are to discuss breaking of protected area rules in two different conservation contexts. We conclude by providing recommendations to researchers on how to assess topic sensitivity. This chapter is under review for *People and Nature*, as:

*Ibbett, H., Jones, J.P.G., Dorward, L., Kohi, E.M., Dwiyahreni, A.A., Prayitno, K., Sanken, S., Kaduma, J., Mchomvu, J., Wijaya Saputra, A., Sabiladiyini, H., Supriatna, J., St John, F.A.V., in review. A mixed methods approach for measuring topic sensitivity in conservation.*

### Chapter 3 – Experimentally validating Specialised Questioning Techniques in conservation

After identifying whether topics are sensitive, this chapter sets out to explore whether Specialised Questioning Techniques are likely to provide more accurate prevalence estimates when asking sensitive

questions. Using an experimental design, we validate the performance of four Specialised Questioning Techniques (Unmatched Count Technique, Randomised Response Technique, Crosswise model, Bean method) against conventional direct questioning, when asking about a commonly researched sensitive behaviour in conservation, wildlife hunting. Published as:

*Ibbett, H., Dorward, L., Dwiyaeheni, A.A., Jones, J.P.G., Kaduma, J., Kohi, E.M., Mchomvu, J., Prayitno, K., Sabiladiyni, H., Sankeni, S., Saputra, A.W., St John. F.A.V., 2022. Experimental validation of Specialised Questioning Techniques in conservation. Conservation Biology.*  
<https://doi.org/10.1111/cobi.13908>

## **Chapter 4 – Asking sensitive questions in conservation using Randomised Response Techniques**

In this chapter we undertake a systematic review of the Specialised Questioning Technique most often applied in conservation, Randomised Response Technique. We review the various designs, explore their application in conservation, and assess how Randomised Response Techniques perform relative to other methods. We finish by providing best-practice guidance on how to design and apply Randomised Response Techniques in conservation research. Published as:

*Ibbett, H., Jones, J.P.G., St John, F.A.V., 2021. Asking sensitive questions in conservation using Randomised Response Techniques. Biological Conservation, 260:109191.*  
<https://doi.org/10.1016/j.biocon.2021.109191>

## **Chapter 5 – Topic sensitivity still affects honest responding, even when Specialised Questioning Techniques are used**

In my fifth chapter, we use findings from Chapters 2, 3, and 4 and apply a Randomised Response Technique to estimate rule-breaking behaviour around protected areas in Tanzania and explore how topic sensitivity affects respondents' willingness to answer questions using the method. This chapter is under review for Conservation Science and Practice, as:

*Ibbett, H., Dorward, L., Kohi, E.M., Jones, J.P.G., Sankeni, S., Kaduma, J., Mchomvu, J., Mmwenya, R., St John, F.A.V., in review. Topic sensitivity still affects honest responding, even when Specialised Questioning Techniques are used.*

## **Chapter 6 – A greater focus on fair administration of protected area rules could improve compliance**

In my last data chapter, I take a step back and reflect on the factors that motivate compliance with protected area rules. Throughout my research, participants expressed different views about how rules were enforced around protected areas. We undertook an experimental study to explore how fair people perceive the sanctions administered by law enforcers to be, and to assess how factors such as corruption and norms concerning rule compliance affect individuals' willingness to follow protected area rules. We plan to submit this chapter to Conservation Letters.

## Chapter 7 - Discussion

Finally, I bring my research together to reflect on my research findings. I reflect on research considerations, suggest future directions for conservation research and practice, and summarise my conclusions.

### 1.4 Setting the scene: Study sites

I undertook my research in two incredible landscapes: the Leuser Ecosystem in Northern Sumatra, Indonesia, and the Ruaha-Rungwa ecosystem in central-southern Tanzania, each chosen for several reasons. Both countries are highly biodiverse and are of global conservation importance (Myers et al. 2000; Olson & Dinerstein 1998). They both have extensive protected area networks (which conserve biodiversity and regulate human behaviour) that are surrounded by culturally diverse communities who depend on small-scale agriculture and natural resource use. These therefore presented interesting, and highly relevant backdrops against which to study compliance. Secondly, my research is situated within a wider project that aims to assess the linkages between multidimensional poverty and rule-breaking. Indonesia and Tanzania are positioned differently on the global development trajectory. While Indonesia is characterised by relatively low levels of multidimensional poverty, Tanzania is not. Working across both contexts therefore provided the project with contrasting perspectives. Thirdly, protected area regimes in both countries were established by colonial administrations and are associated with contested environmental histories and controversial practices (Boomgaard 1999; Brockington et al. 2008). Importantly, these continue to affect how conservation interventions (including rules and regulations) are perceived today. Finally, site selection was also pragmatic as my supervisor (and project lead), Dr Freya St John, had previously worked and conducted research in both countries so she could draw on her extensive knowledge, cultural understanding, and network of contacts to form research ideas, build collaborations, secure funding, and conduct the research. Below I briefly provide background information to set the scene in each study site.

#### 1.4.1 The Leuser Ecosystem, Northern Sumatra, Indonesia

Straddling the border between North Sumatra and Aceh Provinces, the Leuser Ecosystem spans some ~25,000km<sup>2</sup> and includes Gunung Leuser National Park (7,927km<sup>2</sup>), its buffer zone, as well as a series of forest concessions. The landscape is one of the world's Global 200 Ecoregions (Olson & Dinerstein 1998) and is home to 350 bird species, 194 species of reptiles and amphibians, 129 mammalian species and more than 4,000 plant species (Orangutan Information Centre 2009), with the National Park containing over half the species of Sumatra (Ghiglieri 1986). The Park has been recognised as one of the world's most irreplaceable protected areas due to the high proportion of rare and endangered species it supports (Le Saout et al. 2013). In addition, the Ecosystem is commonly referred to as "The Last Place" because it is the last known place on earth where the Sumatran rhinoceros (*Dicerorhinus sumatrensis*), elephant (*Elephas maximus sumatrensis*), tiger (*Panthera tigris sumatrae*) and orangutan (*Pongo abelii*) co-exist (Minarchek 2020). The landscape is hugely varied and includes peat swamplands, tropical lowland forest (below 600m), rising to upland (600-1500m) and montane forest (1500-2500m) and subalpine habitat (+2500m), culminating in the

peak of Mount Leuser, some 3466m above sea level (Ghiglieri 1986; Lubis et al. 2020). The landscape is divided by the Alas River, which descends from Mount Leuser along the Alas Valley towards the Indian Ocean (Ghiglieri 1986).

Approximately 281,700 people live across 242 villages (excluding towns) within 10km of Gunung Leuser National Park or 5km of a forest concession or edge (Bondarenko et al. 2020). The cultural landscape is highly diverse and consists of a range of different ethnic groups including the Gayo, Alas and Acehnese as well as Christian Karo and Batak immigrants (Ghiglieri 1986). Local livelihoods typically involve small-scale cultivation of cash crops (such as coffee and rice) alongside livestock keeping for cash and consumption (Lubis et al. 2020). In the north-eastern areas, working on industrial oil palm plantations and dryland agriculture is common. Income and household consumption is often supplemented by the collection of Non-Timber Forest Products (NTFPs) such as wild edible fruits from forested areas (Suwardi et al. 2020). Mount Leuser is considered a sacred mountain by many people living in the interior of Aceh, who believe the peak provides a link between heaven and earth and is home to both human and non-human spirits (Minarchek 2020).

#### *A brief environmental history of protected areas in the Leuser Ecosystem*

To help understand the Leuser Ecosystem today, it is useful to reflect on how protected areas were established in the landscape. Although variations of protected areas have existed in Indonesia for centuries (e.g., aristocratic hunting grounds in Java, and sacred forests) the existing network stems from the Dutch colonial administration (Boomgaard 1999). During this time (1796-1949), Northern Sumatra, particularly the port city of Medan, became an international hub for wildlife trade. Colonial expeditions were regularly undertaken to the island's forested interior to document and collect new wildlife specimens for European zoological collections, and to meet burgeoning demand in western Europe for exotic species (Minarchek 2018). As swathes of rich lowland plains and lower montane forests situated along Sumatra's east coast were gradually transformed into monoculture plantations, huge volumes of wildlife were reportedly trapped, hunted, and traded internationally (Minarchek 2018).

Towards the latter half of 19<sup>th</sup> and beginning of the 20<sup>th</sup> century, perspectives regarding humans' relationship with nature in western Europe started to change (Boomgaard 1999; Jepson & Whittaker 2002). The emergence of an international movement for nature protection meant that unlimited harvesting of wildlife in the colonies was no longer deemed ecologically or morally acceptable (Jepson & Whittaker 2002). In 1909, amid increasing pressure from powerful proponents of conservation, the Dutch East Indian administration introduced legislation to protect specific species, with further reforms including the creation of protected areas introduced across the Dutch East Indies in 1924 (Boomgaard 1999; Cribb 2007). It is against this backdrop that in the 1920's the 'Gayo and Alaslands Reserve', covering some 928,000ha, was first proposed in the Leuser landscape (Minarchek 2020). These plans gained support, particularly given the realisation that protected areas could enable the Dutch to meet strategic military objectives in Northern Sumatra, who were struggling with insurgency and fierce resistance in the forested mountainous heartlands

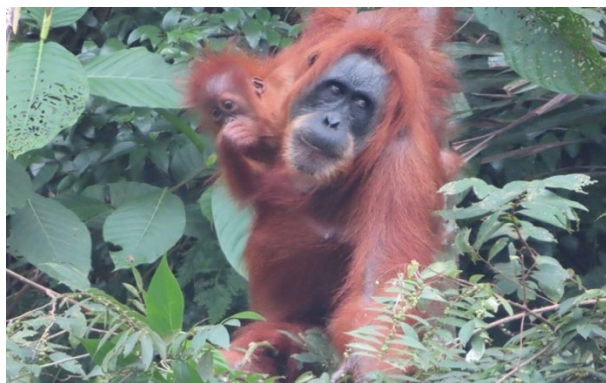
of the Gayo and Alas people. It is argued that ideologically and physically removing people from forests enabled the Government to counter insurgency and establish greater control over populations concentrated in plain and valley areas (Minarchek 2020).

Consequently, the Gunung Leuser Wildlife Reserve, covering some 415,000ha, was established in 1934 (Minarchek 2019). At the same time, the Tapaktuan Doctrine which outlined new regulations regarding local people's use of nature was ratified by Aceh's provincial government. The Doctrine converted all native territories in Aceh into state owned lands, required all inhabitants to agree to protect natural resources, illegalised the capture, killing or injuring of wild animals, the collection of eggs, and the transport of live or dead wild animals or their body parts and prohibited the ownership and use of firearms, air rifles and hunting dogs (Minarchek 2020). Although local people were allowed to remain within reserves, their ability to access natural resources was severely restricted (Minarchek 2019), and these restrictions largely remain in place today. Further Wildlife Reserves were established across the landscape in 1936 (Kleut Wildlife Reserve, covering some 20,000ha) and 1938 (Sikundur Wildlife Reserve, 79,100ha, and Langkat Barat and Selatan Wildlife Reserve, 127,000ha) (Pusparini et al. 2014).

After independence, the network of reserves inherited from colonial powers continued. However, throughout the 1970's cash for national economic development was largely generated by logging forests including wildlife reserves designated in the Leuser landscape (Purwanto 2016). In the early 1980's, following a policy change towards protectionism, the Indonesian government started to strengthen and extend the national protected area network, with the Leuser landscape formally recognised as part of the UNESCO Tropical Rainforest Heritage of Sumatra World Heritage Site in 1981 (UNESCO 2019). In the 1990's, the Leuser Development Programme, funded by the European Union, was established (Sloan et al. 2018) with Gunung Leuser National Park formally decreed in 1995 (Orangutan Information Centre 2009).

Since 2011, the landscape has been listed as a World Heritage Site in Danger, largely due to 'serious and specific infrastructure threats', driven by road and hydro-electric development proposals (Sloan et al. 2018), some of which have proceeded (Jong 2021). Conservation efforts in the northern half of the landscape were affected through much of the late 20<sup>th</sup> century by the Aceh War of independence, with the separatist movement often based out of forested areas. However, the 2004 Boxing Day Tsunami, which devastated much of Aceh's coastline, triggered reconciliation between the Aceh Liberation Movement and the Indonesian Government, and consequently stimulated government approval of development in Aceh's forested areas (Pusparini et al. 2014). In addition, post-tsunami settlement reconstruction relied heavily on local timber resources, resulting in forest degradation in Aceh (Pusparini et al. 2014). Meanwhile, in the North Sumatran district of Langkat on the Ecosystems eastern edge, widespread conversion of former logging concessions to plantation estates for oil palm and rubber cultivation has fuelled forest loss (van Beukering et al. 2003). Illegal logging is reported to occur across the landscape, with reports of military involvement in some areas of the National Park (van Beukering et al. 2003; Putra Adela & Saragih 2017). Wildlife populations are declining, threatened by habitat loss, conflict and hunting (Ghiglieri 1986; Van

Schaik et al. 2001; Lubis et al. 2020), with wildlife from Leuser documented for sale in wildlife markets in nearby Medan (Shepherd 2006; Pusparini et al. 2014). Recent studies have shown that, in addition to these threats, most mammalian species living in the landscape will be severely impacted by climate change, particularly in lowland forested areas (Condro et al. 2021).



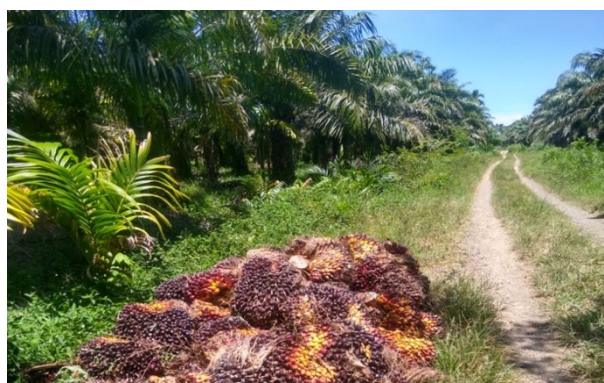
A Sumatran orangutan – one of the 'big four' focal species found in the landscape  
(Photo taken by Karlina Prayitno)



View of the forest landscape  
(Photo taken by Andie Wijaya Saputra)



Rice paddy against a forest backdrop  
(Photo taken by Karlina Prayitno)



Oil palm plantations, one of the primary drivers of forest loss around the landscape  
(Photo taken by Leejiah Doward)



### 1.4.2 The Ruaha-Rungwa ecosystem, central southern Tanzania

Situated in central southern Tanzania, the Ruaha-Rungwa ecosystem spans some ~45,000km<sup>2</sup>. This vast landscape is comprised of a range of protected areas, including state-managed Ruaha National Park (RNP) and Rungwa, Muhesi and Kizigo Game Reserves, as well as the community-based Pagwaga-Idodi Wildlife Management Area (WMA) (Masozera et al. 2013). Credited with outstanding biodiversity and high species endemism, the Ruaha-Rungwa ecosystem is home to over 1600 plant and 370 bird species (Barnes 1983), as well as populations of globally threatened species such as African elephant (*Loxodonta Africana*) (Beale et al. 2018). Moreover, it is considered a 'hotspot' for African carnivore conservation, supporting some of the largest remaining populations of lion (*Panthera leo*), cheetah (*Acinonyx jubatus*) and African wild dog (*Lycaon pictus*) in the world, alongside important populations of leopard (*Panthera pardus pardus*) and spotted hyena (*Crocruta crocruta*) (Dickman et al. 2014). With a semi-arid to arid climate, the landscape is characterised by a mix of semi-arid savannah and East Africa acacia-commiphora woodland which transitions into Zambizeian miombo woodland (Sosovele & Ngwale 2002). Originating in the Southern Highlands and meandering through the Usangu Plains and Ihefu wetlands, to the south of the landscape flows the Great Ruaha River, a critical resource which supports wildlife, the livelihoods of local communities and contributes to the national economy, providing 56% of water supply to the Mtera reservoir and hydroelectric plant (the source of 70% of Tanzania's electricity) (Kadigi et al. 2004; Masozera et al. 2013).

In addition to the rich flora and fauna, the landscape supports an ethnically diverse range of communities. These include pastoralist tribes (e.g., Sangu, Sukuma, Masai and Barabaig), as well as agro-pastoralists (e.g., Hehe, Bena, Gogo) (Walsh 2007; Dickman et al. 2014), with ethnic diversity boosted by the increasing number of people migrating to the area (Walsh 2007). It is estimated that approximately 72 villages, home to ~128,400 people, are located within a 10km radius of a protected area boundary (WorldPop 2018). Historically, hunting and collection of natural resources, such as honey, alongside grazing of livestock were important livelihood activities (Walsh 2007). Today, most communities practice livestock keeping and mixed agriculture, growing crops such as maize, sunflower, tobacco, groundnuts, rice, and millet (STEP 2016; STEP & Wildlife Connection 2016). Local people have long reported challenges from living alongside wildlife, including damage to crops, property, livestock and human life by wildlife including elephant and large carnivores, with studies showing the likelihood of an incident increases with proximity to protected area boundaries (Dickman et al. 2014; Hariohay et al. 2020).

#### *A brief environmental history of protected areas in the Ruaha-Rungwa ecosystem*

Parts of the landscape have been under some form of legal protection for well over 100 years. The first protected area, the Saba River Game Reserve, was established in 1910 by the German colonial administration. The protected area was one of several established across the country, following concerns about the impact of commercial hunting on game populations, and in 1911, was followed by national legislation regulating all hunting of wildlife in the colony (Baldus 2001). In 1946, following the end of WWII and the absorption of German colonial lands into the British Empire, the British re-gazetted the area, naming



it Rungwa Game Reserve. In the proceeding years, it is reported that local people were gradually relocated to outside the Reserve's boundaries (Barnes 1983). Three years after independence from Britain, in 1964 the Tanzania Government formally elevated the southern half of Rungwa Game Reserve to National Park status, granting it the highest level of protection and creating what is known today as Ruaha National Park. In 1984 lands to the northeast of Ruaha were gazetted to create the Lunda-Mkwammbi Game Controlled Area.

To understand the conservation in the landscape today, it is also important to reflect on historical events in the south of the landscape in the Usangu Plains area. Historically, the Plains and Ifuhe wetlands were inhabited by the Wasangu, a pastoral people with large herds of cattle (Charnley 1997). Paddy irrigation was introduced in the Basin in the 1940's and was rapidly adopted by local farmers (Kadigi et al. 2004). In the 1950's, widespread drought across Tanzania saw the immigration of Il-Parakuyo Masaai pastoralists to the plains (Charnley 1997), followed by immigration of Sukuma pastoralists from Northern Tanzania later in the 1960's (Walsh 2012). Throughout the British colonial period, interest in the Usangu Basin remained low, primarily due to challenging climate and low economic interest, and pastoralists were allowed to continue grazing with little consequence (Charnley 1997). However, post-independence in the 1980's, interest in the area for agricultural production grew, with the development of several large-scale and small-holder irrigation schemes across the basin (Kadigi et al. 2004; Walsh 2012). Recent studies report that crop production and livestock activities account for more than 90% of household incomes in the Usangu Plains (Kadigi et al. 2007) and 14.4.% of annual paddy production in Tanzania (Kadigi et al. 2004).

However, in 1991-1992 the flow of the Great Ruaha River declined dramatically and temporarily stopped altogether in 1993, resulting in extremely low water levels and reduced energy output at the Mtera Dam. Energy shortages and electricity rationing in Dar es Salaam subsequently followed (Walsh 2012). Despite several reports citing multiple drivers of water declines, including unsustainable extraction of water during dry season and mismanagement of the Mtera dam by TANESCO (the state-owned electricity company), blame for the water crisis was largely apportioned to grazing pressure within the Usangu Basin (Walsh 2012). Pressurised to resolve the crisis, the Government proceeded to gazette the Ifuhe wetlands and forcibly evicted local fishermen and livestock keepers from the area. In 1998, the Usangu Game Reserve was created on the southern border of Ruaha National Park (Walsh 2012). Concerns about the viability of the river continued over the next decade, with mounting pressures to protect agricultural interests, increase protection around the southern boundary of Ruaha and to develop a 'Southern Safari Circuit' (Walsh 2012). Consequently, in 2006 the Tanzanian government conducted a Special Operation to forcibly remove all herders, their livestock and the residents of seven villages and two hamlets from the Plains. In 2008 the former Usangu Game Reserve, along with additional lands, were formally incorporated into Ruaha National Park, to create the largest National Park in Tanzania, and one of the biggest in Africa (Sirima & Backman 2013). The eviction was one of the largest of its kind in Tanzania and was highly controversial with pro-pastoralist groups reporting human rights abuses (Brockington et al. 2008). The evictions remain a controversial and sensitive topic in the landscape today (Kiwango & Mabele 2022).



A typical view of maize crops, planted around homes in a village around Rungwa Game Reserve



A vista taken in Ruaha National Park



Cattle, grazed by pastoralists who live in a village on the boundary of Ruaha National Park



A male lion in Ruaha National Park, a species subject to much conservation research in the landscape

## 1.5 Situating myself within the research

Increasingly, conservation scientists are encouraged to acknowledge their positionality and include reflexive writings in their work (Pasgaard et al. 2017; Montana et al. 2020; Satizábal et al. 2021). I reflect on my personal research approach in the following section.

I have been interested in nature and wildlife from a young age. However, growing up I started to realise that to be successful, conservation must also consider the needs of people. It was for this reason that I chose to undertake a BSc in Environmental Geography and International Development, believing it important to gain a solid grounding in the natural sciences, as well as a robust understanding of development issues such as poverty; an affliction affecting many biodiverse countries. I took whatever ecology and conservation modules I could, along with those that focused on sustainable natural resource management. In my final year, I developed a research project which involved talking to stakeholders about their perspectives of proposals to reintroduce white tailed sea eagles into East Anglia. This was my first real exposure to social science research, and I learnt a lot about how (not!) to conduct interviews, and how personal and political values influence conservation conflicts.

After graduating I spent several years working for a range of conservation initiatives in the UK, Poland and Madagascar. These experiences improved my research skills and provided important insights into the conservation Non-Governmental Organisation (NGO) sector. Most importantly, they heightened my understanding of the complex realities in which much conservation occurs and emboldened my belief in the need to find solutions that work for both people and biodiversity. In 2014 I was accepted on to an MSc in Conservation Science. I knew I was interested in the relationships between people and nature, and so when the opportunity arose to work with the Wildlife Conservation Society Cambodia programme to understand how livelihood activities interacted with Bengal florican breeding habitat, I jumped. Here, I applied a Specialised Questioning Technique (the Unmatched Count Technique) to investigate illegal behaviour. This was both the first time I had used the method, and the first application of Unmatched Count Technique in Cambodia. While the method did not work as expected (Ibbett et al. 2019), it kick started my thinking about how to research conservation rule-breaking and provided me with a baptism of fire to international fieldwork. With little prior experience or training, I found myself working for a conservation NGO, asking questions about illegal behaviours, working in a language I could not speak in an unfamiliar cultural context, and relying on the goodwill of participants to facilitate my research; all of which I found profoundly uncomfortable at times.

Following my MSc, I spent three years as a Research Assistant in Conservation Science at Oxford University. Again, collaborating with the Wildlife Conservation Society in Cambodia, I aimed to better understand and quantify illegal hunting behaviour. I designed a series of experiments to assess snare detectability (Ibbett et al. 2020) and conducted face-to-face surveys with people in villages located within Seima Wildlife Sanctuary to quantify hunting behaviour. I opted to use a Specialised Questioning Technique, but again found it

ineffectual (Ibbett et al. 2021a). By this time, I was unclear if there were issues with my research design, whether participants simply did not understand the method, or whether there were more fundamental factors affecting people's willingness to engage in research. As well as raising methodological questions, my combined experiences in Cambodia started to unsettle my ethical and moral convictions. I found navigating the bridge between my role as an academic researcher, and my position collaborating with an NGO challenging, particularly regarding how best to protect participants and how much information about illegal behaviour to share with project partners. I started to reflect more critically on the type of knowledge I was generating, how this was generated, and how this could negatively affect participants, as well as conservation objectives. I became increasingly aware of the underlying political context and the delicate line that NGOs traverse with regards to the State. I developed a greater awareness of power dynamics, particularly when researching illegal behaviours, and how these can be ethically contentious. I started to explore these ideas in greater detail (Ibbett & Brittain, 2020; Brittain et al. 2020), and saw my PhD as an opportunity to resolve some of my unanswered questions about researching illegal behaviour.

Thus, by the time I came to start my PhD research, I was highly aware of the ethical issues that permeate conservation, and the many ethical conundrums that arise during research. As a discipline, conservation is heavily value laden (Kareiva & Marvier 2012); rarely, if ever, are conservationists neutral or objective in their scientific inquiry (Barry & Oelschlaeger 1996). Both the 'crisis' and applied nature of the discipline mean data is often collected with the intention to inform interventions that change human behaviour (Soulé 1985; Brittain et al. 2020). Moreover, conservation is inherently affected by power relations (Sandbrook 2018). As such, throughout fieldwork I was astutely aware there was a need to be attentive to histories of colonialism, development, globalisation and local realities and to avoid research that is exploitative, or which perpetuates relations of domination or control (Sultana 2007). I realise that I am not impartial, and I acknowledge that the framing and research questions for this thesis were developed by me; and that I believe it is important to conserve biodiversity for intrinsic reasons and for human well-being; and that mechanisms such as protected areas and the enforcement of rules, are important tools for achieving this aim. Thus, I recognise that these beliefs influenced the way I approached research questions and interpreted data.

Before the Covid-19 pandemic, I spent three months conducting PhD fieldwork in Tanzania. Throughout this period, I was mindful of my position as a western researcher, as one of educational privilege, and as an outsider. I was aware this introduced certain biases and affected the lens through which I approached research and how people perceived me. I was conscious that I held power over participants (through the questions I asked, the framings I used, and the narratives I adopted), and that people held power over me (for example, by enabling or blocking my research). I am unable to speak Kiswahili, which meant I could rarely communicate directly with participants, and instead relied on my Tanzanian colleagues to translate. Often this would cause amusement and raise curious questions about why I was there. Throughout fieldwork people were mostly willing to talk to us (the research team) and they patiently answered our questions, and in most group exercises people actively participated. In some, participants requested that we (the research team) convey their concerns to the Government, highlighting a perception of power greater

than we had. On occasions, some respondents called me “mzungu”, a term which refers to white people and dates to colonial times. This raised my awareness of the colonial context in which I was working, and reinforced concerns that the objectives of my research (to determine appropriate methods to ask sensitive questions) and the wider project (to explore illegal resource use), did not necessarily align with the priorities or interests of research participants. Throughout I made efforts to recognise and minimise this, for example, by thinking carefully about how to compensate participants (outlined in the next section), and by providing clear information about how data would be used.

Whilst I spent five weeks in Indonesia conducting training and developing survey instruments with my Indonesian colleagues pre Covid-19, unfortunately, due to the pandemic, I was unable to conduct any fieldwork there myself. I have not been back to either country since. This has affected my research in many ways, particularly I feel, my ability to relate to, and legitimately discuss the context in which research was conducted, particularly in Indonesia. This means that nearly all my knowledge and contextual understanding from the study system in northern Sumatra stems purely from the data and discussions with the research team who, also as educated, outsiders from elsewhere in Indonesia, brought their own biases to the research. In both countries, the role of the in-country research team was crucial, and their contributions to the survey design, data collection and interpretation of results are recognised with co-authorship on all data chapters.

Although I have outlined some social science experience, I remain hesitant to refer to myself as a social scientist, believing I still have so much more to learn. My training has been interdisciplinary, but primarily informed by the natural sciences, which typically applies a *positivist* research approach, positing that the natural world can be studied objectively using quantitative approaches (Moon & Blackman 2014). However, I subscribe to the criticisms of this approach, believing that it is important to consider sources of knowledge beyond those that can be objectively studied; that context is central to how knowledge is generated; and that there is no single truth concerning the nature of the world (Fox 2008). Recognising that we can never know reality perfectly, that no method is perfect and therefore that a diversity of methods is required to understand a given problem, I applied a *post-positivist* approach throughout my thesis (Moon & Blackman 2014). It is not unusual for researchers to exercise pluralism in their philosophical approach, and throughout I also employed elements of *structural realism*, incorporating qualitative elements in order to better examine human feelings, emotions and values (Evely et al. 2008; Moon & Blackman 2014).

## 1.6 Research Ethics

My research was approved by Bangor University College of Environmental Science and Engineering Ethics Committee (coese2019hi01; coese2021hi01). Research permissions were received from the Ministry of Research and Technology of the Republic of Indonesia (RISTEK permit no. 55/E5/E5.4/SIP/2020; 6/E5/E5.4/SIP.EXT/2021) and Tanzania Commission for Science and Technology (COSTECH permit no. 2019-495-NA-2019-227). In addition, permissions and consent to conduct research in each study village were sought and granted from the appropriate regional, district and village authorities. Free, Prior and Informed consent was sought from all respondents and participation was voluntary. Because of the potentially sensitive nature of the research and concerns about illiteracy, consent was sought verbally and, wherever possible, anonymously. Despite these measures, it is important to recognise that when using face-to-face methods, data are never truly anonymous; interviewers know who said what. This situates interviewers in a position of power over participants, but also can threaten the safety of interviewers themselves (Brittain et al. 2020). In recognition of this, we (as a project) spent time discussing the potential risks with our team members and ensured measures were in place to minimise them. Additionally, we spent extensive time together discussing ethical issues, and I provided training on ethical research approaches.

Researching illegal behaviours raises a range of ethical issues, the discussion of which forms an underlying theme throughout my thesis. Several ethical questions relate to relationships with research collaborators, such as how affiliations influence the creation of knowledge, and how research can affect collaborators when research ends (Brittain et al. 2020). Collaborating with Universitas Indonesia (an academic institution) helped legitimise the perception of the research as an independent, academic exercise in Indonesia, which may have helped the team be viewed more neutrally by participants. However, in Tanzania, where research was facilitated by an established Tanzanian NGO, this perception of neutrality was harder to maintain, particularly because all wildlife research in the country must be approved by the Government, meaning our research activities were rarely perceived to be impartial.

Research on illegal behaviours risks the potential for uncomfortable findings, including those potentially critical of powerful interests, which in turn may lead to repercussions (Brittain et al. 2020). Potential repercussions, and those of research legacy, are something that we (as a project) are particularly mindful of with regards to all our collaborators. Consequently, throughout the research process (which is ongoing with respect to developing manuscripts), we worked closely with collaborators to minimise risk. Finally, in Tanzania, my COSTECH permit required all research to be reviewed and approved by the Government of Tanzania prior to publication. This entails all manuscripts to be scrutinised by the Tanzania Wildlife Research Institute (TAWIRI) prior to submission to a journal. To date, all submitted manuscripts were approved without revisions.

An additional ethical question concerns the distribution of benefits from research. As lead researcher, I stand to benefit most from the data - I will attain a degree and publications, which will help build my

reputation and further my career. Similarly, my supervisors and collaborators (Universitas Indonesia and TAWIRI) stand to benefit through the co-production of research and co-authorship of publications, as do the funder (European Research Council) and Bangor University. Colleagues in Indonesia and Tanzania have benefitted through employment, receiving a salary for over two and a half years, as well as co-authorship and training in variety of research methods. Already, references have helped several colleagues secure employment.

However, for participants, the direct benefits are minimal. To counter this, we made sure that we conducted a full Free, Prior and Informed consent process with participants so that they were fully aware of the costs and risks of participation. To mitigate some of the opportunity costs incurred, we (full project team) spent considerable time thinking about how to appropriately compensate participants. In group exercises participants received refreshments, a small culturally appropriate gift, and were reimbursed travel expenses, while survey participants received a small culturally appropriate gift, and those who helped facilitate research, such as village leaders, were paid a daily allowance. Moreover, following the completion of data collection in both countries, colleagues travelled across the study landscapes disseminating project findings back to study communities. While the abstract nature of my research (i.e., testing methods), means that my research findings are of little direct relevance or benefit to my research participants, I hope that by helping researchers make better methodological choices when researching illegal behaviours, this research will provide wider benefits to research participants around the world.

Finally, the emergence of Covid-19 in March 2020 ethically questioned the viability of further in-person data collection. Concerns about transmitting the disease were heightened by the vulnerable socio-economic contexts in which data was being collected (villages were often remote, impoverished, with poor infrastructure and lacking access to good healthcare). If data collection continued, there were concerns about spreading Covid-19 between communities as well as for the health and safety of colleagues; it was unclear how receptive communities would be to outsiders. Consequently, all field activities were suspended for approximately six months. Throughout this time (and after) we relied on advice from in country collaborators and national Government guidance to inform when and how we might continue fieldwork. In Tanzania legal restrictions on human movement were never imposed so lawfully we could have continued with fieldwork. However, the potential, and at that time unknown level, of risk to the health of all involved was considered too high and our moral convictions considered it unethical to do so. Around September 2020 and in line with the lifting of national restrictions (Indonesia), we took steps to resume fieldwork. Before doing so, as a team, the project undertook a rigorous health and safety review, and developed strict protocols to minimise the risk of spreading Covid-19 through fieldwork. These involved measures such as wearing masks, sanitising hands between interviews and equipment between use, taking regular Covid-19 tests, quarantining between trips, conducting interviews outdoors or in well ventilated spaces, and explaining these measures to participants. In Indonesia, this also required some tweaks to the research design of Chapter 3.



# Chapter 2

## Using mixed methods to assess topic sensitivity in conservation



An all-female focus group conducted in Tanzania, led by Joseph Kaduma (right), to assess topic sensitivity



## 2.1 Abstract

Conservationists increasingly aim to understand human behaviour. However, obtaining information from people can be challenging, particularly if the research topic is considered sensitive. Topic sensitivity may raise methodological, technical, ethical, political and legal concerns which, if poorly addressed, can have significant impacts on research participants, the research process, data quality and the success of conservation outcomes that are informed by research findings. While considerable effort has been invested in developing techniques for reducing bias when collecting data on sensitive topics, less attention has been focused on identifying if, and why, a topic is sensitive. We use a mixed methods approach to explore how willing people are to discuss topics that could be considered sensitive (e.g., illegal wildlife hunting). Collecting data from people living near protected areas in Indonesia and Tanzania, we developed and tested a psychometric scale to measure topic sensitivity at the individual level and conducted group exercises (free-listing and pile-sorts) to gain a deeper understanding of peoples' willingness to discuss different topics. The perceived sensitivity of topics varied both within a landscape, and between contexts, with more topics being perceived as more sensitive in the study site in Tanzania than in Indonesia. Participants' knowledge of rules, and how participants experienced protected areas affected how sensitive they considered topics to be. Mixed methods approaches can provide holistic and nuanced understanding of topic sensitivity. However, recognising that in-depth studies are not always feasible to implement, we demonstrate that individual methods, such as our sensitivity index, can easily be adapted and deployed to rapidly obtain valuable insights on topic sensitive, to help inform conservation research and practice.

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## 2.2 Introduction

Most conservation challenges originate from the actions of people (Balmford et al. 2021). Consequently, conservation science increasingly aims to understand the prevalence and drivers of human behaviours (Cinner 2018), including those which involve non-compliance with conservation rules (St John et al. 2013). To do so, researchers often use questionnaires and interviews to collect data from people (Bennett et al. 2016), however, obtaining robust information can be challenging, particularly when research topics are sensitive (Tourangeau & Smith 1996). Participants may refuse to answer or provide inaccurate responses, resulting in data affected by bias (non-response bias and sensitivity bias) (Tourangeau & Yan 2007; Blair et al. 2020). Asking questions about sensitive topics also has implications beyond data quality, often raising methodological, technical, ethical, political and legal concerns (Lee & Renzetti 1990), which can impact research participants, the research process, as well as the success of conservation outcomes that are informed by study findings (Brittain et al. 2020). For example, failure to identify and acknowledge topic sensitivity may cause offence, be construed as disrespectful, or alienate or endanger those involved (Sieber & Stanley 1988). Alternatively, researchers may perceive some subjects to be more sensitive than they are, resulting in the use of inappropriate or unnecessarily complex methods (Ibbett et al. 2022, Chapter 3). Assessing whether a topic is likely to be sensitive should therefore be an important step when developing conservation research on human behaviour. Yet, while a considerable amount of social science research has addressed the impact of bias when asking sensitive questions (Krumpal 2013; Krumpal & Voss 2020; Blair et al. 2020), less attention has been focused on assessing topic sensitivity.

Various theories exist to describe what makes a topic sensitive (Krumpal 2013; Farquhar & Das 1999; Sieber & Stanley 1988). One of the most widely recognised conceptualisations is that of Lee & Renzetti (1990) who define sensitive research topics as those which present a substantial threat or result in significant costs to those involved, including psychological costs (e.g., feelings of guilt, shame, or embarrassment), physical costs (e.g., violence), as well as formal or informal sanctions (e.g., fines or social isolation). Costs may occur because of the content of a response (i.e., admission of a restricted behaviour), but in some situations even the act of participating can be sensitive, regardless of the answer provided.

While any topic has the potential to be sensitive, Lee & Renzetti (1990) argue topics are more likely to be perceived as sensitive if they fall into one of four categories. The first is when research intrudes into private spheres or deeply personal experiences and evokes strong emotional responses; simply asking the question is an invasion of privacy, regardless of the answer (Lee & Renzetti 1990; Tourangeau & Yan 2007). In the context of conservation, research about conflict (Redpath et al. 2013), including dispossession of land, violence, law enforcement, and the costs of protected areas or living alongside wildlife (Benjaminsen & Bryceson 2012; Soliku & Schraml 2018) may stir negative emotions, and force participants to relive traumatic experiences (Thondhlana et al. 2020). Secondly, a topic may be sensitive if it is concerned with breaking legal or social rules. These topics are sensitive because respondents fear consequences via formal and informal sanctions if they reveal their participation in specific acts (Tourangeau & Yan 2007). Within

conservation, many researchers have investigated illegal wildlife hunting (Nuno et al. 2013; Fairbrass et al. 2016; Chang et al. 2019), whilst others have explored taboos, which govern the harvesting and consumption of wildlife (Jones et al. 2008; Alexander et al. 2017). Thirdly, if the research impinges on the vested interests of powerful elites, it may be sensitive because it presents risks to participants and researchers' safety (Lee & Renzetti 1990; Robbins 2000), particularly in contexts of censorship, where media and freedom of speech are restricted. Measuring trends in natural resource use or assessing the effectiveness of conservation policies can produce findings that highlight corruption or abuse of power (e.g., Global Witness 2015), as well as project success or failure. Finally, sensitivity may arise if the research focuses on topics that are considered sacred (Lee & Renzetti 1990). For example, conservation has long been interested in documenting local ecological knowledge, however, in some cultures certain knowledge is revered, and participants may fear desecration of long-standing beliefs and traditions, alongside concerns about possible exploitation (Posey 2002).

Importantly, sensitivity is also defined by the social context in which research occurs (Lee & Renzetti 1990). What might be an innocuous topic in one context, might be highly sensitive in another. For example, asking questions about illegal behaviours may not be considered sensitive among participants in contexts where conservation laws are poorly enforced and rule-breaking is common practice, but may be highly sensitive in contexts where conservation laws have been imposed or experienced negatively (Razafimanahaka et al. 2012). Social norms, the unwritten rules that prescribe and regulate how people behave, also influence topic sensitivity (Hechter & Opp 2001). Norms differ across social classes and subgroups within a society, and their influence on behaviour may vary across cultural orientations (Johnson & van de Vijver 2002; Lalwani et al. 2006). Actions that deviate from social norms may be perceived by society as unacceptable or undesirable, and result in specific repercussions (e.g., social stigmatisation or ostracism) (Ostrom 1990). In Nigeria, Atuo et al. (2020) found social norms to be a stronger driver of compliance with conservation rules than national legislation. While in Madagascar, cultural prohibitions known as *fady* dictate different wildlife uses, with studies showing communities are more familiar with *fady* than national legislation (Keane et al. 2011a), meaning research about violating *fady* may be more sensitive than research on law breaking.

Here, we aimed to explore the sensitivity of various topics in two conservation contexts: one in Indonesia, another in Tanzania (Fig. 2.1). Our research was situated within a wider project which focused on understanding drivers of conservation rule-breaking behaviour, using a questionnaire-based study aimed at individuals. Prior to designing the main survey instrument for the wider project, we wished to better understand the context in which the data would be collected, including how willing people living in communities around protected areas would be to discuss natural resource use, including behaviours such as illegal hunting. Our primary assumption was that any discussions would be regarded as sensitive because of protected area rules limiting natural resource use, and because participants may have preconceptions about our research intentions. We adopted a mixed methods approach to measure sensitivity of several behaviours within each context, and to explore the usefulness of different methods for assessing topic sensitivity.

## 2.3 Methods

### 2.3.1 Study sites

Data were collected from five locations (comprised of villages and sub-villages) around the Leuser Ecosystem in northern Sumatra, Indonesia, and four locations around the Ruaha-Rungwa ecosystem in Tanzania (Fig. 2.1). Both landscapes are considered of global importance for biodiversity (Dickman et al. 2014; Myers et al. 2020) and have extensive protected area networks initially established by colonial administrations (Walsh 2007; Minarchek 2020). Each landscape encompasses a range of different protected area designations, including community-managed areas (e.g., Wildlife Management Areas in Tanzania), Game Reserves and Game Controlled Areas (Tanzania), Protection Forest (Indonesia) and National Parks (Gunung Leuser National Park, Indonesia and Ruaha National Park, Tanzania). Rules restricting wildlife and natural resource use vary, with the strictest sanctions in both countries associated with National Parks. In Indonesia, all wild plant and animal species are classified either as protected or unprotected, with the harvest, capture or destruction of any protected species (regardless of whether it resides in a protected area) prohibited (Article 21, Act No. 5, 1990). Rules regarding natural resource use further depend upon protected area designation and zonation. For example, in the core zone of National Parks any modification of the natural integrity is banned (Article 33), while other activities (e.g., tourism or traditional use) are permitted in other zones. In Protection Forests, land clearance is forbidden, and extraction of timber and non-timber forest products is permitted for authorised rights holders or those with license, and only under certain conditions (Article 50, Law No. 41 on Forestry, 1999). In Tanzania, all wild animals are property of the state (Article 4, Wildlife Conservation Act No.5, 2009), and it is illegal to hunt, kill or wound any wild animal without permission (Article 55.1). There are strict rules regarding natural resource use in certain protected areas, National Parks can only be entered for the purposes of photographic tourism and Game Reserves allow entrance for photographic tourism and trophy hunting with no other natural resource collection allowed (Wildlife Conservation Act No.5, 2009; National Parks Act, 1975).

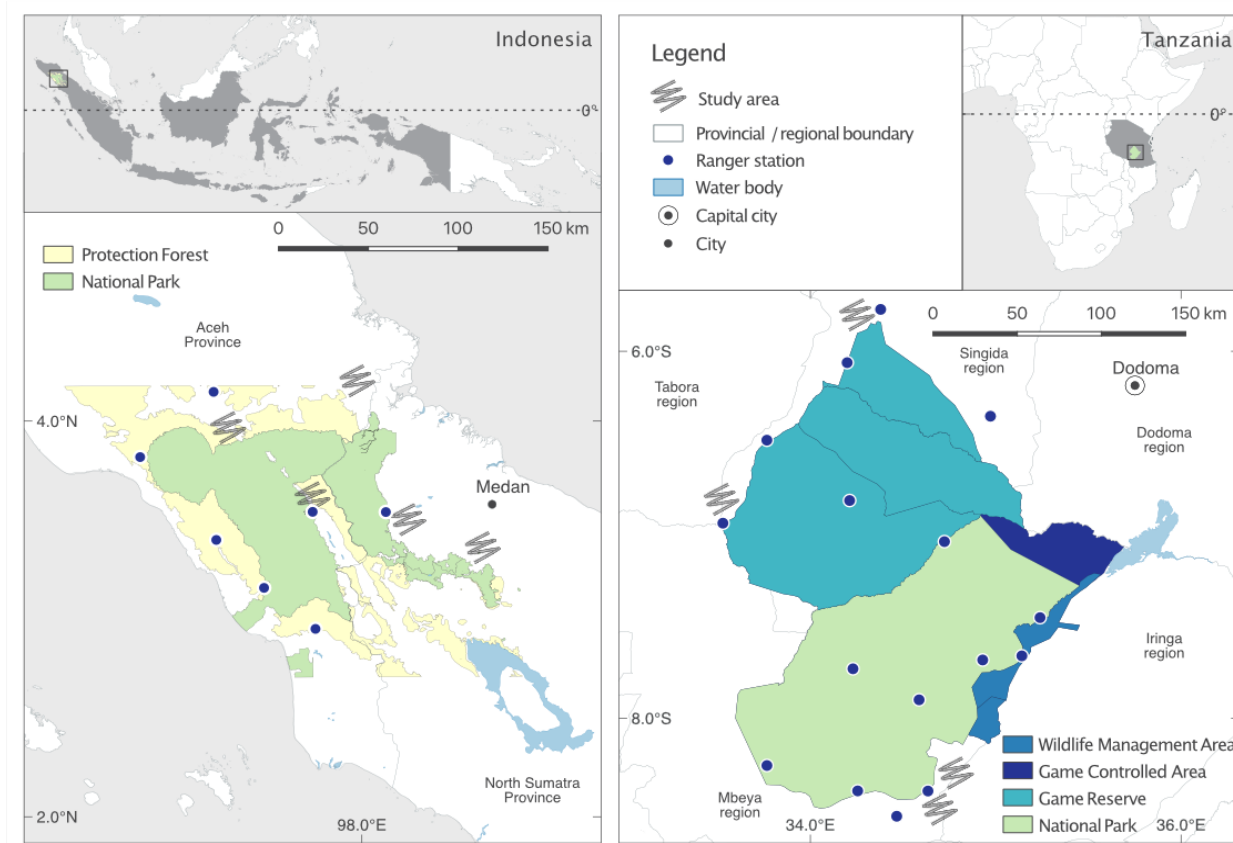


Figure 2.1. Data were collected around two protected landscapes: the Leuser Ecosystem in northern Sumatra, Indonesia (five locations); and the Ruaha-Rungwa ecosystem in central Tanzania (four locations). In accordance with ethics approval, we do not indicate the precise study locations.

### 2.3.2 Overview of methods

To investigate topic sensitivity, we used a mixed methods approach. Conservation researchers often use questionnaires to ask individuals about sensitive topics (Ibbett & Brittain 2020), thus it is important to be able to measure topic sensitivity at the individual level. Because sensitivity is a latent construct, meaning it cannot be measured or observed directly (Kyle et al. 2020), we developed and tested a psychometric scale delivered to individuals. Further, to improve our understanding of the social context in which the research was occurring, specifically *why* different topics were perceived as sensitive, we conducted group-level exercises. These gathered a diversity of perspectives, plus additional information with which to triangulate quantitative findings. We made observations throughout data collection on how participants responded to our presence and the questions we asked.

### 2.3.3 Individual psychometric scale measuring topic sensitivity

We conducted a questionnaire with individuals in each study location which gathered basic demographic data (respondent age, gender, years of education) alongside perspectives about the sensitivity of different

conservation behaviours. Five items formed the basis of our psychometric scale. These items measured injunctive norms (perceptions of how acceptable peers regard the behaviour); the individual's moral attitude towards the behaviour (whether the individual believes the behaviour is good); whether the behaviour is socially (un)desirable; the individual's own level of (dis)comfort discussing the behaviour; and perceptions of whether community members would be (un)willing to discuss the behaviour. Responses were gathered using 5-point Likert scales (Table 2.1). Irrespective of the behaviour investigated, we hypothesised that these five items would load onto two factors, one associated with behavioural approval, the other with willingness to discuss the topic. Respondents were asked about three behaviours in Indonesia (logging inside the National Park, clearing land in the National Park, and hunting for wildlife on village land) and four in Tanzania (grazing livestock inside the nearest protected area, eating bushmeat, hunting wildlife on village land, and entering the nearest protected area to collect resources), that were identified as present in the landscape from previous literature and discussions with protected area managers. In both countries, rules regarding wildlife hunting persist beyond protected areas, therefore we asked about hunting on village land, with a follow up question about how willingness to discuss wildlife hunting might change if conducted in a protected area. We also asked individuals if they knew whether there were any rules associated with each behaviour.

The questionnaire was developed in English and translated into the national languages of Bahasa Indonesia and Kiswahili by two team members fluent in the respective language. An independent back-translation was used to check and revise translation accuracy, with the questionnaire piloted in the field. Questionnaires were administered face-to-face by KP, HS and AWS in Indonesia and SS, JM, JK in Tanzania, and lasted between 10-30 minutes, with respondents given a small, culturally appropriate gift (e.g., phone voucher, or reusable shopping bag) afterwards. Data were collected using Open Data Kit (Brunette et al. 2013) on encrypted mobile phones. We adopted convenience sampling (Newing 2011), with respondents recruited with the assistance of local guides, based on availability. Wherever possible, the team targeted male respondents aged 18 to 55, as this was the demographic hypothesised to most likely be involved in hunting, thus information on how willing this group of respondents would be to discuss rule-breaking was of particular interest.

Table 2.1. Items used in the psychometric scale to measure individual's perceptions of topic sensitivity. Respondents were asked about three behaviours in Indonesia (logging timber inside the National Park, clearing land in the National Park, and hunting for wildlife on village land) and four in Tanzania (grazing livestock inside the nearest protected area, eating bushmeat, hunting wildlife on village land, and entering the nearest protected area to collect resources). The wording of two items (moral attitude and social desirability) was revised in Indonesia to avoid the use of double negatives.

Item	Wording	Likert response scales & scores
Factor measuring behavioural approval		
Injunctive norms surrounding the behaviour	If you did (behaviour), would your friends or family....	Strongly approve (1), approve (2), neutral (3), disapprove (4), strongly disapprove (5)
Moral attitude towards the behaviour	It is good to do (behaviour) (Indonesia only)	Strongly agree (1), agree (2), neutral (3), disagree (4), strongly disagree (5)
	It is wrong to do (behaviour) (Tanzania only)	Strongly agree (5), agree (4), neutral (3), disagree (2), strongly disagree (1)
Social desirability of the behaviour	If you did (behaviour), people in the community would think well of you (Indonesia only)	Strongly agree (1), agree (2), neutral (3), disagree (4), strongly disagree (5)
	If you did (behaviour), people in the community would think less of you (Tanzania only)	Strongly agree (5), agree (4), neutral (3), disagree (2), strongly disagree (1)
Factor measuring willingness to talk		
Personal comfort discussing the behaviour	If you did (behaviour), how comfortable would you feel answering questions honestly?	Very comfortable (1), comfortable (2), neutral (3), uncomfortable (4), very uncomfortable (5)
Community members' willingness to discuss	How willing do you think people in the community would be to talk honestly about (behaviour)?	Very willing (1), willing (2), neutral (3), unwilling (4), very unwilling (5)

### 2.3.4 Group exercises

Free-listing and pile-sort exercises were conducted in each country. With the help of a local leader, two separate groups of people (ranging from 6-11 participants) were convened in each location, with exercises led by one team member, and data recorded by another. Sessions lasted between one and three hours (depending on the level of engagement), and participants were reimbursed travel expenses and provided a meal. To encourage active participation, and in recognition of cultural norms, groups were divided by gender, and in Tanzania, separate groups were held for pastoralists and agriculturalists. We considered our framing carefully, emphasising that we were interested in peoples' relationships with protected areas and their rules, rather than whether people broke rules.

#### *Free-listing*

Free-listing belongs to a suite of methods used to analyse cultural domains, specifically to explore how groups of people think about, and define their world (Puri 2010). The method is ideal for gathering information about the range and parameters of a specific topic and works by asking respondents to list all the items that come to mind when thinking of a particular topic until the list is exhausted (Guest et al. 2013). Both the item, as described by respondents, and the order the item is listed are recorded. Metrics such as the number of times the item is mentioned across different groups, and the average position in the list (rank) can be used to calculate salience (Guest et al. 2013), a measure which captures the relative importance of an item, with the most salient items those most thought of when the domain is mentioned (Puri 2010). Free-listing has been successfully used by Harrison et al. (2015) to investigate unauthorised resource use in Ugandan protected areas, and to investigate the cultural salience of different primate species amongst Waorani people in the Ecuadorian Amazon (Papworth et al. 2013). Two free-listing exercises were conducted. In the first, participants were asked to list all the reasons why people from their community went to the protected area. Here we wanted to understand the diverse ways in which local people use protected areas and to explore whether behaviours that breached conservation rules, that we assumed would be sensitive, were openly raised by participants. During the second exercise, participants were asked to list all the challenges faced from living alongside the protected area. Here, our intention was to improve our understanding of the ways in which conservation is perceived.

#### *Pile-sorts*

Unconstrained pile-sorts are often used to identify how people classify items and relate them to each other (Puri 2010; Guest et al. 2013). Drawing on our knowledge of each landscape, and available literature, we generated a list of behaviours undertaken in each landscape (Appendix 1). These included everyday activities, such as growing rice or maize, as well as prohibited behaviours, such as eating wildlife or logging for timber. We wanted to explore whether specific factors, such as wildlife species killed, the reason for killing wild animals (e.g., for food, income, prestige, livelihood protection), and the technology used (e.g., snare, gun, dog, poison), affected how willing people would be to discuss the topic. For each behaviour, we created A4 cards featuring a photograph and a descriptive caption (Appendix 1). Participants were shown



each card in a fixed order and asked as a group to discuss and categorise the behaviour according to how willing they believed people in their community would be to talk about it if the behaviour was conducted on village land. Both the number of piles, and the pile categories were defined by participants. The reason for the allocation into each pile was recorded, with follow up questions asked where appropriate. Once all cards were allocated to piles according to how willing participants believed people in their community would be to talk about the behaviour depicted, we asked participants how their categorisations might change if the behaviour was conducted in the nearest protected area, noting if any cards moved to other piles. All methods were piloted prior to data collection.

### 2.3.5 Researcher reflections

In recognition that sensitivity can be influenced by participants' perceptions about who researchers are, throughout data collection, we kept notes reflecting on how participants reacted to our presence. Observations included questions participants asked, comments relating to the research aims, as well as participants' body language and reactions during data collection.

### 2.3.6 Ethical considerations

All data collection was anonymous with no personal identifiers collected. Free, prior and informed consent was sought from participants verbally, and all participants were aged 18 years or over. Research was approved by Bangor CoESE Ethics Committee (coese2019hi01), and all relevant permissions were granted at national, regional and local levels. Data was collected in Tanzania between September-December 2019, and in Indonesia between August-November 2020. Rigorous measures were implemented to minimise transmission of Covid-19, with local and national regulations adhered to (Appendix 1).

### 2.3.7 Analysis

#### *Explanatory factor analyses for psychometric scale development*

Explanatory factor analysis was conducted following the guidance of Watkins (2018). All rows with missing data were excluded from analysis. Using 'psych' (Revelle 2021) in R (v. 4.0.3) we created correlation matrixes of the five items constituting our proposed psychometric scale of topic sensitivity and confirmed factorability using Bartlett's test of sphericity (Bartlett 1951) and the Kaiser-Meyer-Olkin test (Kaiser 1974). Parallel analysis (Horn 1965), and the visual scree test (Cattell 1966) were used to determine the appropriate number of factors to retain. In both countries, results suggested the possibility of one or two-factor dimensionality, we thus ran analyses for both options and compared chi-square test of exact fit, Root Mean Square Error of Approximation (where a RMSEA  $\leq 0.06$  indicated strong model fit), Tucker Lewis Index (TLI  $\geq 0.95$  indicated strong model fit), Standardized Root Mean Square Residual (SRMR  $\leq 0.08$  indicated strong model fit) and the Bayesian Information Criteria (BIC) to determine the best model (Boateng et al. 2018). Criteria for determining factor adequacy were established a priori, with factor loadings above 0.40 considered reasonably strong, and loadings of 0.70 or 0.80 very strong (Furr 2011). Due to the

nature of the constructs, we assumed factors would be correlated, therefore, an oblimin rotation was employed (Furr 2011). To test internal consistency, we calculated raw coefficient alpha and Omega Total, with 0.7 considered a reasonable threshold for psychometric scale development (Streiner 2003).

### *Sensitivity index*

Using the outcome of the exploratory factor analysis, a sensitivity index (i.e., a value from 0 to 1, which indicated how sensitive a topic was) was calculated for each respondent, for each behaviour. Weighted factor-scores, that considered correlation between factors, were extracted (Revelle 2021), and to improve interpretability, were transformed from z-scores to a scale between 0 and 1. The ratio of variance represented by each factor was calculated by dividing the proportion of variance described by each factor, by the total variance. The transformed weighted factor-scores were then multiplied by the ratio of variance and summed together to create a composite index of sensitivity for each respondent, for each behaviour. The higher the sensitivity index, the more sensitive the topic was perceived to be.

### *Beta regression models*

We first summarised the demographics of the sample in each country using descriptive statistics. To examine which variables influenced a respondent's perception of topic sensitivity, we fitted beta regression models with mixed-effects (Douma & Weedon 2019) with a logit-link structure to each country dataset using 'glmmTMB' (Brooks et al. 2017). Beta regression models were deemed most suitable for analysing continuous data ranging between zero and one (Douma & Weedon 2019). The sensitivity index was the response variable, with respondent gender, age, years of education, the behaviour, whether the respondent had knowledge of any conservation rules pertaining to the behaviour, and the type of protected area they lived nearest too included as predictors (Appendix 1). To improve the interpretability of coefficients, continuous variables for respondent age and years of education were scaled and centred by subtracting the mean and dividing by two standard deviations (Gelman & Hill 2007). The grouping structure of the data, whereby each respondent answered questions about several behaviours, was reflected in the model by including individual respondents as a random effect.

### *Group-exercises*

For each of the items listed during the free-listing exercise we calculated a Smith's salience score using 'AnthroTools' in R (Purzycki & Jamieson-Lane 2017) (Appendix 1). For the pile-sort data, the number of piles identified by each group, and the frequency that each card was grouped into a pile across all groups was summarised, with the behaviours ordered and plotted by sensitivity. Qualitative notes made during group-exercises were used to triangulate findings and place the results in context.

## 2.4 Results

### 2.4.1 Psychometric scale development

Data for the psychometric scale were collected from 590 people, 302 in Indonesia and 288 in Tanzania. The gender of both samples was biased towards men (Indonesia, 75% male, Tanzania, 57%). The median respondent age was 38 years (IQR:30-48) in Indonesia, and 38 years (IQR:28-46) in Tanzania. Respondents reported a mean of 9.9 (SE:0.21) years education in Indonesia, and 6.6 (SE:0.17) years in Tanzania.

Analysis of the psychometric scale was highly promising. Bartlett's test of sphericity indicated that the correlation matrixes were non-random (Indonesia:  $\chi^2=1264.4$ ,  $p<.001$ , Tanzania:  $\chi^2=979.31$ ,  $p<.001$ ), and the KMO statistics were well above the 0.5 minimum standard for conducting a factor analysis (Indonesia:0.81, Tanzania:0.69). In both countries, the two-factor model performed best, with a stronger model fit in Indonesia than Tanzania (Table 2.2, Appendix 1). In both countries, and in line with our hypothesis, three items (injunctive norm, moral attitude and social desirability) loaded well onto Factor1, while two items (personal comfort and willingness of community to discuss behaviour) loaded well onto Factor2 (Table 2.2). Measures of internal consistency (Cronbach's Alpha & Omega Total) for Factor1 were reasonable for psychometric scale development in both countries, but just under the ideal threshold for Factor2 in Indonesia, and considerably so in Tanzania. Descriptive statistics and distribution of item responses are shown in Appendix 1.

Table 2.2. Factor loadings and measures of model fit for 2-factor exploratory factor analysis of our psychometric scale conducted for each country. Only factor loadings >0.4 are presented.

	Indonesia		Tanzania	
Confirmation of factorability:				
Bartlett's Test of Sphericity	1264.40,		979.31,	
	p-value=<0.001		p-value=<0.001	
KMO	0.81		0.69	
Exploratory factor analysis loadings:	Factor1	Factor2	Factor1	Factor2
Injunctive norm (approval of friends/family)	0.56	-	0.40	-
Moral attitude towards behaviour	0.87	-	0.73	-
Social desirability of behaviour	0.61	-	0.85	-
Personal comfort discussing behaviour	-	0.57	-	0.66
Community willingness to discuss behaviour	-	0.78	-	0.54
Sum of Squared loadings	1.59	1.07	1.44	0.84
Proportion variance	0.32	0.21	0.29	0.17
Cumulative variance	0.32	0.53	0.29	0.46
Proportion ratio	0.60	0.40	0.63	0.37
Number of observations	849		1025	
Likelihood Chi-Square	0.84 with prob <0.36		5.69 with prob <0.017	
RMSEA Index	0.00 (90%CI:0, 0.08)		0.07 (90%CI:0.02, 0.13)	
Tucker Lewis Index	1.001		0.952	
SRMR	0.00		0.01	
BIC	-5.91		-1.25	
Factor1-Factor2 Correlation	0.71		0.44	
Tests for internal consistency:				
Cronbach's Alpha	0.76	0.69	0.73	0.52
Omega Total	0.76	0.69	0.74	0.52

*Cut-offs for good model fit: Chi-Square Test of exact fit, Root Mean Square Error of Approximation (RMSEA  $\leq$  0.06), Tucker Lewis Index (TLI  $\geq$  0.95), Standardized Root Mean Square Residual (SRMR  $\leq$  0.08) (Boatang et al. 2018), Bayesian Information Criteria (BIC < as possible)*

The sensitivity index, created by summing weighted, transformed factor-scores derived from our exploratory factor analysis identified that, logging in the National Park was the most sensitive behaviour investigated in Indonesia (mean sensitivity index=0.67, [95%CI:0.01]; Fig. 2.2), implying it was a reasonably sensitive topic to discuss in communities. Nearly all respondents (97%) were aware of rules prohibiting this behaviour. Clearing land in the National Park obtained a slightly lower mean sensitivity index of 0.53 [0.02], suggesting it was less sensitive to discuss; slightly fewer respondents were aware of rules (91%). Hunting wildlife on village land 0.40 [0.01] obtained the lowest sensitivity index (Fig. 2.2), with only 65% of respondents

reporting knowledge of rules associated with this behaviour. When asked how sensitivity might change when discussing hunting in protected areas, most respondents reported sensitivity would increase a little (62% of respondents) or a lot (10%).

In Tanzania, there was little difference in mean sensitivity indices between behaviours; hunting wildlife on village land obtained the highest sensitivity index 0.74 [0.01], closely followed by entering the nearest protected area 0.70 [0.01], grazing livestock in the nearest protected area 0.70 [0.01] and eating bushmeat 0.69 [0.01] (Fig. 2.3). Some respondents reported the sensitivity of discussing hunting, when conducted in the protected area (compared to village land), would increase a little (10%), or a lot (20%), but most (49%) reported sensitivity would stay the same (Appendix 1). Overall, respondents in Tanzania reported high awareness of rules, regardless of behaviour (88% of respondents knew of rules about hunting on village land, 91% for eating bushmeat, 95% for grazing livestock, 93% for entering PA).

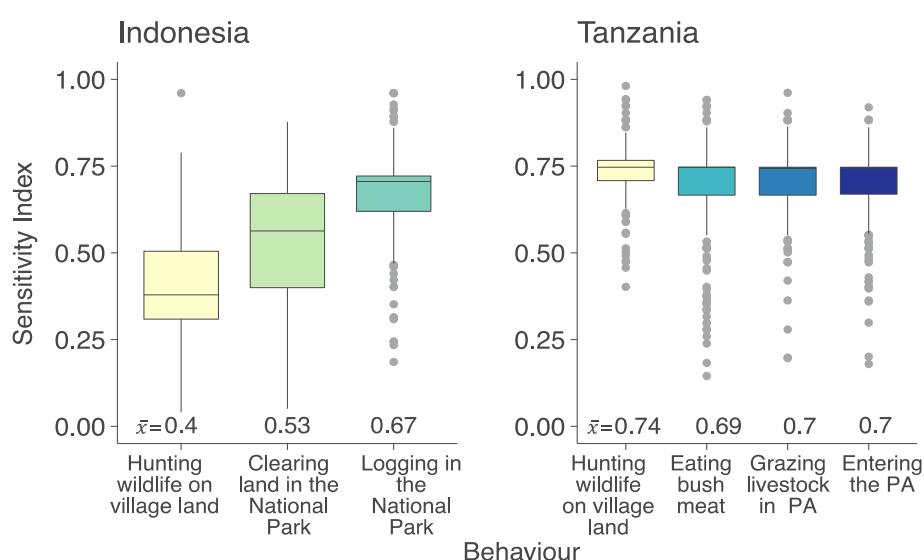


Figure 2.2. Sensitivity index for each behaviour assessed in Indonesia (left, N=302) and Tanzania (right, N=288). Different behaviours are represented by unique colours. Thick line indicates the mean score (numeric value at bottom), shaded areas and circles show the distribution of the data. PA= Protected Area. Scores range from 0 (implying no sensitivity) to 1 (implying high sensitivity).

Modelling showed that in Indonesia, discussing clearing land and logging for timber in the National Park were considered significantly more sensitive than discussing hunting on village land (Table 2.3). While in Tanzania, hunting on village land was considered slightly more sensitive than the other behaviours examined (Table 2.3). Those with greater awareness of rules reported behaviours as more sensitive in Indonesia, but not in Tanzania, probably because rules were more widely known for each behaviour in Tanzania. Gender was a significant predictor of sensitivity in Indonesia with women more likely to report topics as sensitive than men, but not in Tanzania. Other demographic characteristics including education, and age, along with

the type of protected area the respondent lived nearest to, were not significant predictors of sensitivity in either country.

Table 2.3. Log-odds regression coefficients with 95% confidence intervals from a beta mixed regression model, with random effects for respondent. The response represents a sensitivity index between 0 and 1. Text in **bold** represent p-values which had statistical significance of <0.05

Predictors		Indonesia			Tanzania		
		Estimate	95% CIs	p-value	Estimate	95% CIs	p-value
(Intercept)		-0.42	-0.54 – -0.30	<b>&lt;0.001</b>	0.95	0.73 – 1.18	<b>&lt;0.001</b>
Gender <sup>a</sup> :	Male	-0.14	-0.25 – -0.02	<b>0.019</b>	-0.08	-0.17 – 0.01	0.097
Age		0.03	-0.02 – 0.08	0.230	0.01	-0.03 – 0.06	0.570
	Years of education	0.02	-0.03 – 0.07	0.366	0.01	-0.03 – 0.06	0.612
Behaviour <sup>b</sup> :	Clearing land in National Park	0.34	0.22 – 0.46	<b>&lt;0.001</b>	0.12	-0.09 – 0.33	0.253
	Logging in National Park	0.89	0.76 – 1.01	<b>&lt;0.001</b>	-	-	-
	Grazing livestock in PA	-	-	-	-0.18	-0.26 – -0.10	<b>&lt;0.001</b>
	Eating bushmeat	-	-	-	-0.24	-0.32 – -0.16	<b>&lt;0.001</b>
	Entering PA	-	-	-	-0.19	-0.27 – -0.12	<b>&lt;0.001</b>
	Knowledge of rules regarding behaviour <sup>c</sup>	0.33	0.20 – 0.46	<b>&lt;0.001</b>	0.12	-0.09 – 0.33	0.253
PA Type: <sup>d</sup>	Protection Forest	0.34	-0.01 – 0.68	0.054	-	-	-
	Game Reserve	-	-	-	0.04	-0.05 – 0.13	0.413
Random Effects:							
$\sigma^2$		-0.01			-0.02		
$\tau_{00}$		0.07 <sub>id</sub>			0.08 <sub>id</sub>		
ICC		1.14			1.37		
N		300 <sub>id</sub>			281 <sub>id</sub>		
Observations		829			979		
Marginal R <sup>2</sup> / Conditional R <sup>2</sup>		0.781/1.032			0.146/1.320		

Reference levels: <sup>a</sup> Gender: female; <sup>b</sup> Behaviour: Hunting on village land; <sup>c</sup> No knowledge of rules regarding behaviour; <sup>d</sup> Protected Area type: National Park

### 2.4.2 Free-listing

#### *Reasons why people go to Protected Areas*

In both countries, participants reported entering protected areas for various livelihood supporting activities including to collect firewood, plant materials (e.g., agar, rattan, bamboo, wild cinnamon, wild fruits) or tap trees (rubber, palm) in Indonesia, and to fish, collect firewood, honey, water and building materials in Tanzania (Table 2.4). Overall, the mean number of items listed was lower in Indonesia (5.9 items) than Tanzania (8.1 items). A number of these freely listed activities are prohibited, demonstrating that participants were willing to raise these topics with researchers in group settings. In both countries, no item achieved a salience higher than 0.63 (Table 2.4). This likely reflects heterogeneity in types of activities conducted across these large landscapes (>7,000km<sup>2</sup>). In Indonesia, the most salient reason reported for going to a nearby PA was to farm, while in Tanzania grazing livestock, collecting timber and fishing were most salient. Groups in both countries reported wildlife hunting as a reason for going to protected areas, although this was not particularly salient in either. In Indonesia, hunting wildlife was referred to in several ways, both broader taxonomic groups (primates) and specific species (wild boar, *Sus scrofa*) were mentioned alongside 'hunting wildlife'.



Table 2.4. Reasons for going to protected areas listed by group participants in Indonesia (10 groups, 60 participants) and Tanzania (8 groups, 66 participants), ordered by Smith's Saliency, with number groups mentioning an item (n). Items marked by an \* are those that are allowed within protected areas, <sup>p</sup> indicate activities that are allowed in some protected areas with a permit.

Indonesia (26 items listed)	Saliency	n	Tanzania (20 items listed)	Saliency	n
Farming	0.63	7	Grazing livestock	0.49	6
Collecting firewood	0.50	8	Collecting timber to build houses	0.49	6
Collecting flowers	0.28	4	Fishing	0.48	5
Working as a tour guide *	0.24	4	Collecting honey	0.41	5
Hunting wild pig	0.24	3	Collecting water <sup>p</sup>	0.40	5
Collecting birds	0.22	3	Hunting wildlife	0.37	4
Collecting rattan	0.20	4	Farming	0.28	4
Clearing land	0.20	1	Collecting firewood	0.27	4
Collecting wood for building (logging) <sup>p</sup>	0.18	2	Collecting grass for roofs	0.25	5
Collect damar resin	0.13	1	Mining	0.24	3
Collecting herbs/plants for medicine	0.10	3	Charcoal making	0.20	3
Hunting monkey	0.10	2	Collecting medicine	0.18	4
Tapping palm trees	0.10	1	Employment *	0.13	1
Tapping rubber trees	0.09	1	Collecting wood for sculptures	0.12	2
Collecting grass	0.08	1	Visiting relatives <sup>p</sup>	0.07	1
Grazing cattle	0.08	1	Worship <sup>p</sup>	0.06	3
Grazing livestock & collecting grass	0.07	1	Collecting natural fibres to make rope	0.06	1
Hunting wildlife	0.06	2	To sell products <sup>p</sup>	0.05	1
Fishing	0.05	2	To see the airplane	0.02	1
Collecting wild plants	0.05	2	To run away from home	0.01	1
Fixing the pipelines from spring *	0.05	1			
Collecting bamboo	0.04	1			
Collecting cinnamon seeds	0.03	1			
Collecting gaharu (agarwood)	0.03	1			
Collecting rattan fruit	0.03	1			
Checking the border of the National Park *	0.02	1			

*Challenges faced living alongside protected areas*

Overall, participants in Indonesia reported far fewer challenges (10 items, mean 1.4 challenges listed per group) from living alongside protected areas than in Tanzania (25 items, mean 5.1 challenges listed per group), with three groups in Indonesia listing no challenges at all, suggesting that relationships between communities and protected areas were more challenging in Tanzania than Indonesia. In Indonesia, an inability to expand farmland due to the presence of the National Park was the most salient item, however, the overall salience was low (0.3) with the item only mentioned by three out of ten groups (Table 2.5). In Tanzania, challenges associated with living alongside wildlife were the most salient items, with wildlife damaging crops mentioned prominently by nearly all groups (salience 0.69, 7 out of 8 groups) (Table 2.5).

In Tanzania, free-listing revealed differences in the types of challenges experienced across the landscape. For example, around Game Reserves, most of the challenges reported related to the costs of living alongside wildlife (e.g., crop damage, livestock loss, injury and human fatalities) (Table 2.5). Discussions here often became sensitive because they involved respondents recalling traumatic events (e.g., deaths caused by wildlife) or describing emotions, such as fear or anxiety, experienced as a result of living alongside wildlife (Appendix 1). In contrast, groups adjacent to the National Park listed issues such as boundary disputes and discontent at the way rules were enforced with more prominence. Interestingly, two groups here highlighted that threatening to report others to law enforcers for rule-breaking (e.g., for hunting wildlife) was a particular challenge, suggesting that any discussions about conservation laws or the National Park in these communities were likely to be sensitive, because of communities' poor perceptions of, and relationships with, National Park authorities, as well as concerns about the repercussions of discussing rule-breaking.

Table 2.5. Challenges of living alongside protected areas listed by participants during group-exercises in Indonesia (10 groups, 60 participants,) and Tanzania (8 groups, 66 participants), ordered by Smith's Saliency, with number groups mentioning an item (n). NP indicates if the challenge was mentioned by groups living next to a National Park, Protection Forest (PF, Indonesia only) or Game Reserve (GR, Tanzania only).

Indonesia (10 items listed)	Saliency	n	NP	PF	Tanzania (25 items listed)	Saliency	n	NP	GR
Cannot expand farming areas	0.30	3	✓	✓	Crops destroyed by wildlife	0.69	7	✓	✓
Disturbance from wildlife	0.17	3	✓	✓	Livestock predated by wildlife	0.29	4		✓
Prohibited to grow crops	0.10	1		✓	People injured/killed by wildlife	0.26	4		✓
Bear came to the village	0.10	1		✓	Conflicts over National Park boundaries	0.21	2	✓	
Monkeys raiding farms and houses	0.10	1		✓	People use arrest by law enforcers to threaten people	0.19	2	✓	
Unemployment	0.10	1		✓	Cannot access water sources	0.16	2	✓	
Cannot collect hardwood for house	0.08	1		✓	High fines if caught grazing livestock in the National Park	0.15	2	✓	
Crops destroyed by wildlife	0.05	1		✓	Movement of National Park boundary closer to the village	0.13	1	✓	
Boundary of protected area is unclear	0.03	1	✓		Land shortages for agriculture	0.13	1	✓	
Landslides and floods from rivers	0.03	1		✓	Authorities don't allow electricity pylons through NP to village	0.11	1	✓	
					Children not safe when wildlife is around	0.10	1		✓
					Nowhere to graze livestock	0.09	1	✓	
					Cannot collect firewood	0.08	1	✓	
					Corruption, having to pay law enforcers bribes	0.06	1	✓	
					Tsetse flies	0.06	1		✓
					Land shortages increase conflicts between agriculturalists & pastoralists over grazing/cultivation land	0.05	1	✓	
					Law enforcers search houses, if they don't find anything they arrest or beat people	0.05	1	✓	
					Destruction of water sources by wildlife	0.05	1		✓
					People killed by law enforcers	0.05	1	✓	

Poor relationship between National Park and community	0.03	1	✓
People/livestock lost after being chased by law enforcers	0.03	1	✓
Law enforcers do not inform village chief before making arrests	0.03	1	✓
Chased by buffalo	0.03	1	✓
Unreliable infrastructure (due to remote location of village)	0.03	1	✓
Livestock killed by law enforcers if found in the National Park	0.02	1	✓

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### 2.4.3 Pile-sorting

#### *Indonesia*

Participants in the ten groups (60 participants) organised the 37 behaviours featured on the pile-sort cards into up to four self-defined categories of sensitivity. These were: very sensitive (participants felt that community members would not discuss the topic openly or honestly); sensitive (community members would be hesitant to discuss the topic); non-sensitive (the behaviour was widely engaged in, and community members were willing to talk about it); and not applicable (NA, participants were unaware of the behaviour and thus were unable to comment) (Fig. 2.3).

Few behaviours were categorised as very sensitive or sensitive. Only one topic, bribing a law enforcer, was considered very sensitive and only by one group (Fig. 2.3). Other behaviours categorised as sensitive by one or two groups included using poison to kill wildlife, setting snares in the forest, logging for income, capturing songbirds for income and killing protected species such as orangutan (*Pongo abelii*), elephant (*Elephas maximus ssp. sumatranus*), tiger (*Panthera tigris ssp. sumatrae*) or pangolin (*Manis javanica*) for money. When asked, groups explained that these behaviours were illegal, and thus did not think community members would be willing to discuss them.

Overall, most behaviours were categorised as non-sensitive, despite some being prohibited. For example, one group said that they believed community members would be happy to discuss collecting songbirds, because birds were only collected to keep as pets, rather than for profit, and so it was less sensitive. In other groups, participants classified killing legally protected sambar (*Rusa unicolor*) for food as non-sensitive, explaining that as a relatively common behaviour, community members would be willing to discuss it. However, participants emphasised that sambar was not hunted within the protected area, suggesting such discussions may be more sensitive.

In four groups, when asked how sensitivity would change if behaviours were conducted in the nearest protected area, participants reported there would be no change in categorisation for any behaviours. In the six other groups, participants reported that more behaviours would become sensitive to talk about, and that the sensitivity of topics that were already sensitive would increase. For example, three groups thought that discussing logging (regardless of whether it was for income or subsistence) in their nearest protected area, would become more sensitive for community members to discuss, compared to on village lands (Fig. 2.3).

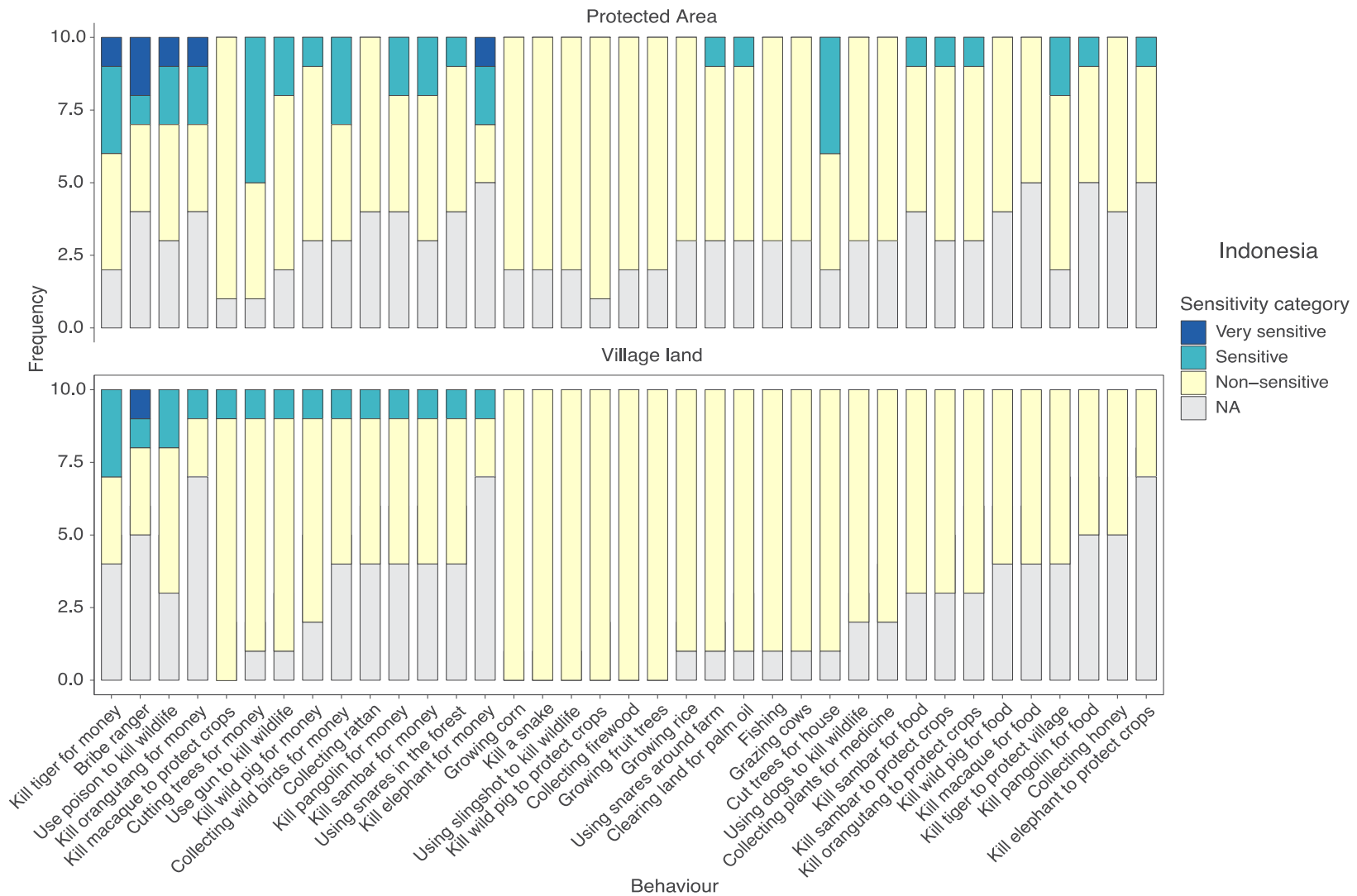


Figure 2.3. The reported sensitivity of behaviours when conducted in village/community land (bottom) and in protected areas (top) based on pile-sorts conducted by 10 groups with 60 participants living in the Leuser Ecosystem in Indonesia. NA represents behaviours that participants reported they were unaware of, and thus were not able to classify.

### *Tanzania*

In Tanzania, 57 participants in seven groups identified the 32 pile-sort cards into up to five categories of sensitivity (Fig. 2.4). These were the same as those in Indonesia, but with the addition of a slightly sensitive category (where participants felt community members would discuss the topic but may not feel completely comfortable doing so). Compared to Indonesia, a greater number of groups considered a greater number of behaviours to be very sensitive or sensitive topics of discussion. Consuming, trading and transporting bushmeat (defined by participants as meat from any wild animal) were identified as very sensitive or sensitive by six of the seven groups. One participant gave the analogy that asking someone to transport bushmeat was like asking them to drink poison; another said it was better to be caught in possession of marijuana than bushmeat. In several groups, participants explained that if caught transporting bushmeat you could go to jail; thus, community members were scared to discuss it.

Bribing law enforcers and killing elephant (*Loxodonta Africana*) for ivory or to eat were also considered to be very sensitive or sensitive topics for most groups. When asked why, one participant stated that discussing bribes was very sensitive because it causes problems for law enforcers, which might result in repercussions for the individual who provided the information. Another participant highlighted that the government has a strong anti-corruption agenda, meaning discussing bribery is politically sensitive, while another explained that giving a bribe can be dangerous because it involves committing two crimes at once; admitting to the offence that required the bribe, plus the offence of paying the bribe. When asked why killing elephants was sensitive, participants emphasised that it was because elephants were legally protected. One participant stated that if caught killing an elephant "*you will remain in jail until the bars break*". Another said that that killing elephants for their ivory was unacceptable, and thus sensitive, because only hunters' benefit, while other groups explained that having elephants live in the protected area brings benefits to the whole community (e.g., through photographic tourism), thus killing elephants harms the community.

Discussing killing a common species such as dik-dik (*Madoqua sp.*), either for food or for income was also categorised as sensitive by most groups. When asked why, participants reported that all wildlife belongs to the government in Tanzania, and so killing dik-dik equates to stealing from the government. Killing dik-dik to protect crops was considered sensitive by fewer groups, who explained it was less sensitive to discuss because the intention was to protect livelihoods, rather than to kill wildlife. Several groups reported that people might eat dik-dik if they caught them around farms, but that community members would still not be comfortable discussing it as eating wildlife is illegal. Interestingly, few groups categorised the killing of species such as baboon (*Papio cynocephalus*) or lion (*Panthera leo*) for crop or livestock protection as sensitive topics of discussion, despite these being protected species. Several groups explained baboons were considered pests, and that speaking about the challenges of living alongside wildlife like lion was not sensitive, although discussing any actions taken would be. All groups reported that killing lion for prestige, for income or for food were not activities they had knowledge of, and therefore had no opinion about how sensitive the topic might be to discuss.

Discussion of all hunting methods were reported as sensitive or very sensitive by four of the seven groups (and NA by all others), who explained that hunting any wildlife was illegal, thus it didn't matter what method was used. One group said it was only slightly sensitive to discuss setting snares around farms because the intention was to protect crops. However, other groups considered this as very sensitive because snares can also catch livestock and impact the livelihoods of others. Two groups classified using guns to hunt as very sensitive because guns were associated with ivory poaching. Another group explained gun ownership was illegal, hence discussing their use was sensitive. Using poison to hunt wildlife was described as sensitive because poison was dangerous for both human and livestock health, and again could have implications for community members. One participant in one group reported that it would not be sensitive to discuss hunting with dogs. They suggested that it would be normal to be seen walking with six dogs, but not walking with a gun or bow and arrow, and that it was less sensitive to discuss dogs hunting wildlife because dogs hunted on their own accord, rather than at the discretion of the owner. However, other group members disagreed.

Fishing and collecting honey were considered slightly sensitive topics to discuss by one group. Participants explained that conducting these behaviours within proximity to protected areas could result in sanctions from law enforcers. Entering a protected area was widely categorised as sensitive, with groups reiterating that entering a Game Reserve or National Park for any reason without permission was prohibited.

When asked how topic sensitivity would change if behaviours were conducted inside protected areas, in all groups that gave responses, the sensitivity of the topic increased (Fig. 2.4), largely because protected area rules prohibit these activities. Activities that breached rules (e.g., giving a bribe or hunting wildlife) that were already considered highly sensitive discussion topics, were not reported as being more sensitive by most groups.

#### 2.4.5 Researcher reflections

In Indonesia, most participants were willing to engage in the research and share their experiences of living alongside protected areas. However, we felt that participants in two groups were less willing to engage openly but were unsure if this was due to concerns about revealing information, or because the exercises were of less relevance as their villages were located further from protected areas. In Tanzania, throughout data collection, participants expressed interest, but also concern and sometimes suspicion. For example, one group stated that a *mzungu* (a Swahili phrase used to describe white people) had previously come to the community to conduct research on the National Park boundary, and that afterwards the boundaries were moved. Two groups questioned the benefit of the research, highlighting that they had attended many research events but had never seen any change, nor experienced benefits. Other participants were cautious about why we were not collecting personal information such as their names and found this unusual despite our explanation that this was a protective measure. In some groups, we observed clear concerns from participants. For example, during one group exercise, participants repeatedly questioned our intentions, and were very hesitant to provide responses during the first free-listing exercise. In another group, participants



reported that no rule-breaking behaviours occurred and refused to sort cards, despite the question being about people's willingness to discuss these behaviours. In some other groups, participants displayed apprehension when discussing illegal topics, for example, by providing short answers, or warning others in the group not to reveal information. The discomfort some participants felt during group exercises underlines the importance of thinking carefully about how questions might be received.

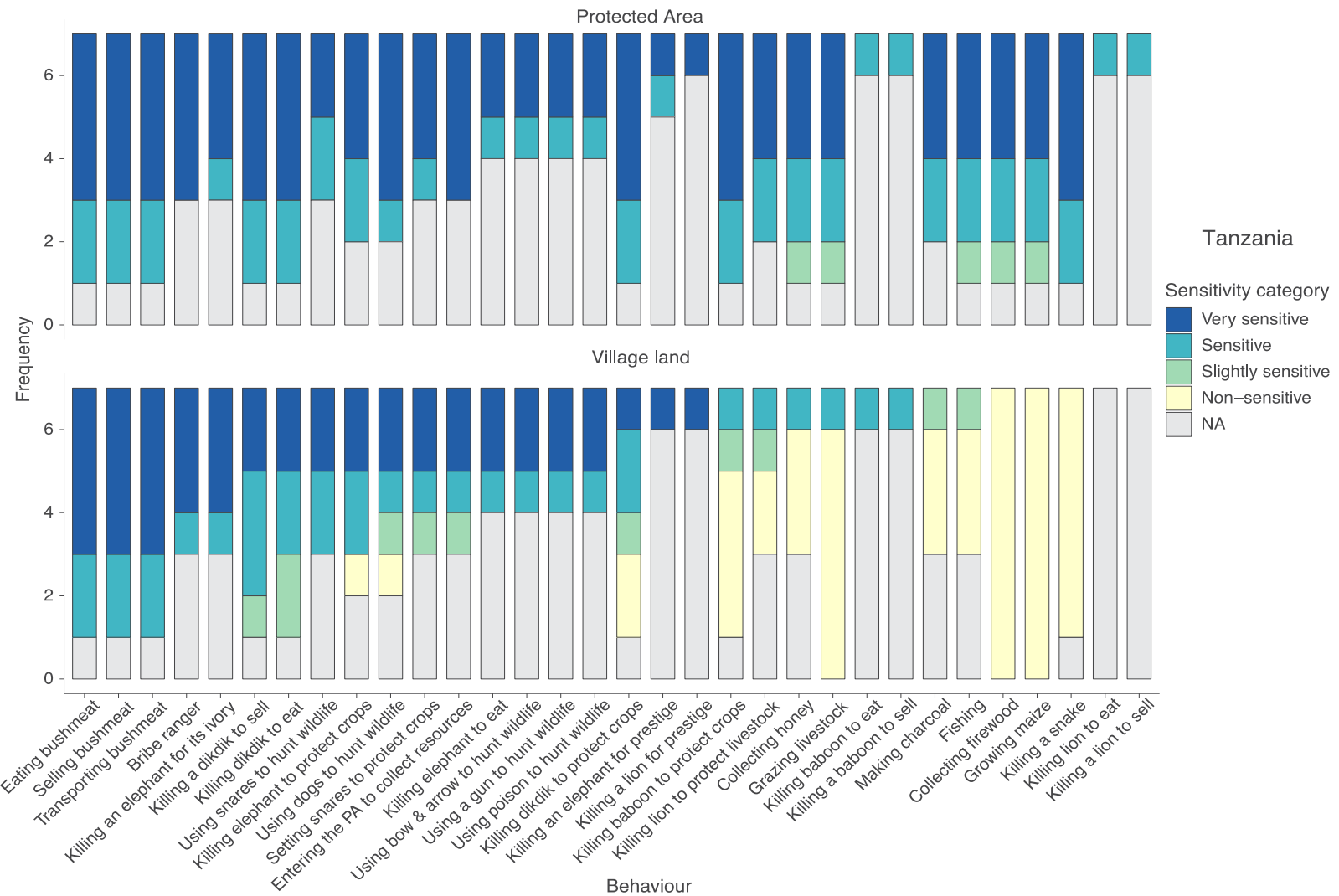


Figure 2.4. The reported sensitivity of behaviours when conducted in village/community land (bottom) and in protected areas (top) based on pile-sorts conducted by 7 groups with 57 participants living in the Ruaha-Rungwa ecosystem in Tanzania. NA represents behaviours that participants reported they were unaware of, and thus were not able to classify.

## 2.5 Discussion

Understanding if, and why, a topic is sensitive is critical to the success of social science research (Lee & Renzetti 1990; Sieber & Stanley 1988), yet this has received little attention in conservation. Our findings reveal substantial variation in the perceived sensitivity of different topics both within, and between different study contexts, highlighting the value of a mixed methods approach for understanding topic sensitivity.

### 2.5.1 Drivers of topic sensitivity

Overall, topics seemed considerably more sensitive in Tanzania, than Indonesia. All four behaviours investigated using our sensitivity index (the psychometric scale developed to assess topic sensitivity) in Tanzania were considered more sensitive than the most sensitive behaviour in Indonesia. Similarly, the pile-sort revealed that groups in Tanzania categorized a higher proportion of topics as very sensitive or sensitive, compared to groups in Indonesia. This difference in perceived sensitivity likely stems from a variety of factors, including differences in legislation, communities' awareness of the laws and differing levels of law enforcement.

Generally, knowledge of conservation rules was higher amongst participants in Tanzania than Indonesia. For example, during group-exercises in Tanzania participants often referenced Tanzanian law which deems that all wildlife belongs to the state; they described strict rules which prohibit the entering of National Parks or Game Reserves for any reason, and reported that if caught doing so, the likelihood of incurring sanctions was high. In Indonesia when known, awareness of rules was also a significant predictor of topic sensitivity: topics that were known to be prohibited were considered sensitive. In both contexts, results suggests that when rules are well known and at least occasionally enforced, discussing non-compliant behaviour is likely to be sensitive. Contrastingly, in Indonesia, some behaviours which were illegal (e.g., hunting sambar) were openly discussed. This may be because poor knowledge of rules or low levels of enforcement meant participants associated less risk with discussing the behaviour. Examples from other contexts, such as the Gola Forest in Liberia, demonstrate that when illegal behaviours are openly conducted and rules are not enforced, people are more willing to discuss rule-breaking (Jones et al. 2021).

Communities in Tanzania reported experiencing more challenges from living alongside protected areas than those in Indonesia, suggesting that any research was likely to be sensitive in these contexts because of the costs imposed on communities. Within Tanzania, the types of challenges reported differed across protected area types. For example, communities situated around Game Reserves often reported challenges relating to wildlife coexistence, including crop damage, livestock depredation and human fatalities. Discussions often detailed the non-material burdens, such as grief, trauma and anxiety (Thondhlana et al. 2020) that communities experienced; in such instances conversations were sensitive because of the strong emotional responses they evoked (Lee & Renzetti 1990). Communities living around Ruaha National Park often reported challenges associated with the way the National Park was managed, including how the law was enforced by law enforcers. In recent years, the eviction of villages and cattle herders from the former

Usangu Game Reserve, as part of its incorporation into Ruaha National Park, has exacerbated communities' resentment towards, and distrust of, government and protected areas (Walsh 2007; Zia et al. 2011). Researchers working around other Tanzanian protected areas with similar environmental histories have found communities can perceive any research related to wildlife as a plot to further appropriate resources (Brockington et al. 2008; Weldemichel 2020). Against a turbulent history, any research relating to protected areas is likely to be met with distrust and suspicion, and thus could be perceived as sensitive. In Indonesia, communities' also reported challenges associated with living alongside wildlife and protected areas, however, these were not reported as often by participants, and conversations did not evoke such strong emotional responses. While this may reflect cultural differences in how emotion is portrayed, it may also be an artefact of our sampling strategy and unequal coverage across the landscape. Recent research details the colonial militarization of the Leuser Ecosystem (Minarchek 2019). Discussions relating to conservation may well be sensitive in other areas of the landscape because of these past injustices. Thus, in any research it is critical to understand and engage with the environmental history, so that research can be designed and implemented appropriately.




### 2.5.2 Methods for measuring sensitivity

We successfully present three new approaches to measure topic sensitivity (Fig. 2.5). Applying our newly developed psychometric scale across two culturally different landscapes enabled us to test and verify performance. Symmetry of factor loadings across contexts suggests the resulting sensitivity index is reasonably robust. Overall, performance was stronger in Indonesia, than Tanzania. This may be reflective of the lower response variability reported for items in Tanzania, or construct-underrepresentation, which can arise if items relevant to the latent variable are omitted (Furr 2011). Testing of additional questions, for example, items that measure descriptive norms (Cialdini 2007) or respondent's acceptance of rules regarding different behaviours, could enhance the tool further. Creating a psychometric scale enabled measurement of topic sensitivity at the individual level, however, scales usually require a significant amount of data to obtain sufficient statistical power; if resources are limited, employing this approach may not be feasible to inform wider study design. Promisingly, we found that by extracting responses from smaller subsets of individuals (e.g., 40 respondents) and crudely calculating the mean item response score, produced results reflective of the sophisticated Sensitive Index (Appendix 1). This is reassuring, as it suggests our tool has potential to be adapted and easily deployed by conservationists to rapidly appraise topic sensitivity.

One limitation of psychometric scales and questionnaire-based research more broadly, is that their highly structured nature often leaves little flexibility to explore additional points of interest that arise. In contrast, both the pile-sort and free-listing exercises provided freedom to ask about a wide range of behaviours, alongside valuable insights into why topics were sensitive, and how conservation laws were experienced, and perceived in the landscapes. Moreover, these methods are easy to use, require less resource and fewer participants, making them particularly attractive tools for familiarising oneself with the research context at

the onset (Fig. 2.5). A key limitation of any group-exercise is that they run the risk of incurring biases, such as group think (members think similarly in order to maintain agreement) and halo effects (the status of one group member influences others) (Nyumba et al. 2018). There is also debate about whether group exercises are appropriate settings to discuss sensitive topics, with careful consideration of the ethical implications of doing so required (Farquhar & Das 1999). When conducting qualitative research that is less structured, it is also important to be aware that conversations can unintentionally transition into areas that can cause discomfort, requiring skilled facilitators that are properly prepared to handle sensitivity as and when it arises.

Figure 2.5. Summary of the benefits and design considerations of three methods (sensitivity index, free-listing and pile-sort) tested to measure topic sensitivity.

Method	Benefits	Considerations
 Sensitivity Index	<ul style="list-style-type: none"> <li>Provides an indicator of sensitivity at the individual level</li> <li>Subsequent data can be incorporated into multivariate models</li> <li>Possible to compare sensitivity between individuals, contexts, behaviours etc.</li> </ul>	<ul style="list-style-type: none"> <li>Requires larger sample sizes (e.g. n=200)</li> <li>Only feasible to collect information about a limited number of behaviours</li> <li>More complex analysis required to produce Index (e.g. Factor Analysis)</li> </ul>
 Free-listing	<ul style="list-style-type: none"> <li>Quick &amp; easy to administer, and easy for participants to understand</li> <li>Can collect data at group &amp;/or individual level</li> <li>Easy to compare data between individuals/groups</li> <li>Enables in-depth discussion about why topics are sensitive</li> </ul>	<ul style="list-style-type: none"> <li>Careful consideration of the list topic is required</li> <li>Data usually aggregated across sample, not possible to conduct multivariate analysis on data</li> </ul>
 Pile-sort	<ul style="list-style-type: none"> <li>Easy for participants to understand</li> <li>Can ask about a wide range of behaviours &amp;/or species</li> <li>Can collect data at group &amp;/or individual level</li> <li>Enables in-depth discussion about why topics are sensitive</li> </ul>	<ul style="list-style-type: none"> <li>Pile-sort cards require careful design (e.g. appropriate images &amp; captions)</li> <li>Need to decide whether categories should be pre-defined or participant-defined</li> <li>Can be time consuming to administer</li> </ul>

### 2.5.3 Who asks questions matters

In any research, who is conducting the research matters. Sensitivity may be affected by preconceptions held by participants about researchers and the power they hold, which in turn may influence their willingness to engage in research, and the information they choose to share (Blair et al. 2020). For example, in Tanzania, the presence of the lead researcher (a white European) was problematic for some communities, who associated research previously conducted by someone of a similar ethnicity, with evictions. Equally, a researcher's personal sense of identity influences the assumptions made about whether and why a topic is

sensitive. As individuals we simultaneously belong to and identify with a range of groups (Farquhar & Das 1999). Our conceptualisations of sensitivity are therefore informed by our experiences as a member of these groups, as well as the context in which the research is situated, with different norms more salient in different contexts (Farquhar & Das 1999). Recognising sensitivity thus requires researchers to take a step back and to critically assess their own assumptions, to inwardly reflect on their own identity, to externally assess how these factors affect the research process and outcomes (Montana et al. 2020). Known as reflexivity, this process is increasingly promoted in conservation research (Montana et al. 2020; Beck et al. 2021; Satizábal et al. 2021), alongside practices that require researchers to consider their positionality, and the power-relations between themselves and participants (Attia & Edge 2017; Satizábal et al. 2021). This is particularly important in a value-driven discipline such as conservation, where personal values risk influencing scientific objectivity (Brittain et al. 2020).

#### 2.5.4 Conclusions

Few methods exist to measure topic sensitivity, meaning researchers and practitioners often rely on assumptions to design research. Our study highlights significant variation in the perceived sensitivity of topics both within, and across study contexts. What is sensitive in one context, may not be in another (Albaum et al. 2012), meaning it can be difficult in advance to assess how research will be perceived, and to determine the most appropriate methods to use to collect data and protect participants. Conservation research is increasingly conducted over large landscapes, where significant variation in perceptions will likely be encountered. Investing time and effort to obtain a robust understanding of topic sensitivity can inform better research. To this end, we encourage others to use our sensitivity index, within a mixed methods framework where resources allow, to make decisions on the suitability of methods (Nuno & St John 2015) for researching topics that are potentially sensitive.

# Chapter 3

## Experimentally validating Specialised Questioning Techniques in conservation



Humairah Sabiladiyini (left), Karlina Prayitno (centre) and Andie Wijaya Saputra (right) practicing different questioning methods before starting data collection in Indonesia

### 3.1 Abstract

Conservation increasingly relies on social science tools to understand human behaviour. Specialized Questioning Techniques (SQTs) are a suite of methods designed to reduce bias in social surveys and are widely used to collect data on sensitive topics, including compliance with conservation rules. Most SQTs have been developed in Western, industrialized, educated, rich, and democratic countries, meaning their suitability in other contexts may be limited. Whether these techniques perform better than conventional direct questioning is important for those considering their use. We designed an experiment to validate the performance of 4 SQTs (Unmatched Count Technique, Randomised Response Technique, Crosswise model, Bean method) against direct questions when asking about a commonly researched sensitive behaviour in conservation, wildlife hunting. We developed fictional characters, and for each method asked respondents to report the answers that each fictional character should give when asked if they hunt wildlife. We collected data from 609 individuals living close to protected areas in two different cultural and socioeconomic contexts (Indonesia, Tanzania) to quantify the extent to which respondents understood and followed SQT instructions and to explore the socio-demographic factors that influenced a correct response. Data were modelled using binomial general linear mixed models. Participants were more likely to refuse to answer questions asked using SQTs compared to direct questions. Model results suggested SQTs were harder for participants to understand. Demographic factors (e.g., age and education level) significantly influenced response accuracy. When sensitive responses to sensitive questions were required, all SQTs (excluding Bean method) outperformed direct questions, demonstrating that SQTs can successfully reduce sensitivity bias. However, when asked about each method, most respondents (59-89%) reported they would feel uncomfortable using them to provide information on their own hunting behaviour, highlighting the considerable challenge of encouraging truthful reporting on sensitive topics. Our results demonstrate the importance of assessing the suitability of social science methods prior to their implementation in conservation contexts.

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## 3.2 Introduction

Theories, frameworks, and tools from the social sciences are increasingly integrated into conservation research and practice (Bennett et al. 2016). With this transition comes a responsibility to critically examine the tools adopted to ensure they are fit for purpose. Many of the social science methods used in conservation have been developed in Western, educated populations in industrialized, rich and democratic contexts (so-called WEIRD populations; Henrich et al. 2010). However, cultural, sociological, and psychological differences mean that methods and understandings developed in one context may be inappropriate when applied in another, with subsequent implications for data reliability and validity (Henrich et al. 2010). Assessing the relevance of methods when delivered in contexts different from those in which they were developed is thus of critical importance to those considering their use.

Questionnaires asking respondents directly about their beliefs, attitudes, and behaviours are commonly used to collect data in conservation contexts, but data can be subject to bias, particularly if the research topic is sensitive (Nuno & St John 2015). Respondents may fear repercussions if they reveal the truth and thus censor their responses (sensitivity bias) or refuse to answer whole or parts of surveys (non-response bias) (Blair et al. 2020). Developed by social scientists to overcome these biases, Specialised Questioning Techniques (SQTs) are being increasingly applied in conservation to investigate illegal behaviours (Hinsley et al. 2019; Ibbett et al. 2021b; Chapter 4). Through varied mechanisms, SQTs ensure incriminating answers cannot be linked to individuals. Prevalence is estimated at the population level, and multivariate analyses can be applied post hoc to identify characteristics of those possessing sensitive attributes (St John et al. 2012; Nuno & St John 2015). Compared with conventional questioning techniques (hereafter direct questions), SQTs are hypothesized to provide respondents greater protection, encourage more honest responding, and increase data accuracy (Chaudhuri & Christofides 2013). However, SQTs require careful design (Hinsley et al. 2019; Ibbett et al. 2021b; Chapter 4), are more complex to administer, and are less efficient as noise introduced by anonymizing processes mean more data (and thus more resources) are needed to achieve SQT estimates with similar confidence to direct questions (Lensvelt-Mulders et al. 2005a).

Numerous SQTs exist, each developed to overcome the limitations of others (Nuno & St John 2015; Cerri et al. 2021). Some rely on probability to determine how respondents should answer. For example, Randomised Response Techniques (RRTs) use randomisers (e.g., dice) to determine whether a respondent should answer truthfully or provide a prescribed response (Ibbett et al. 2021b; Chapter 4). Other methods mask responses by aggregating answers. For example, the Unmatched Count Technique (UCT) divides the sample in half. One-half are provided a list of innocuous items, and the other receives the same list with the sensitive attribute added (Droitcour et al. 1991). Respondents report how many of the listed items apply to them. The Crosswise model presents participants with one innocuous question with known prevalence and one question that is sensitive. Respondents report whether their answer is the same for both questions or yes to only one question (Yu et al. 2008; Sagoe et al. 2021). Developed for lower-education contexts and with reduced complexity compared to other SQTs (Lau et al. 2011), the Bean method asks respondents to

secretly move specific-coloured beans from one jar to another, depending on their answer (Jones et al. 2021) (examples of applications of all methods in conservation in Appendix 2).

Whether SQTs reduce biases relative to direct questions is of critical importance to those designing surveys investigating sensitive topics. Ideally, the performance of SQTs is assessed by validating estimates against data on the true prevalence of the sensitive characteristic. However, difficulties associated with obtaining data on true prevalence means validation studies are rare (Blair et al. 2015). A review of 35 years of RRT research identified only six studies across multiple disciplines (Lensvelt-Mulders et al. 2005b). In the only validation study in conservation, Bova et al. (2018) covertly observed recreational anglers in South Africa and invited those who had been recorded breaking regulations to participate in a survey on angling compliance. Although all were observed breaking rules, only 79.6% of respondents admitted violations when asked to self-complete a questionnaire and deposit it in a sealed box. Estimates from those surveyed face-to-face with direct questions or RRT were substantially lower (46.5% and 38.5% respectively). Other studies document similar findings (Wolter & Preisendörfer 2013; Rosenfeld et al. 2016), highlighting that although SQTs can reduce bias, their performance varies and may underestimate prevalence.

In lieu of being able to validate estimates against true prevalence, researchers commonly compare estimates derived from SQTs against estimates derived from direct questions; with the method that produces the highest estimate considered the most accurate and least biased (Blair et al. 2015). Numerous studies across disciplines demonstrate that SQTs perform better than direct questions when investigating sensitive topics (e.g., Anglewicz et al. 2013; Stubbe et al. 2014). However, a substantial proportion also report the opposite (Coutts & Jann 2011; Höglinger et al. 2016), including in conservation science (e.g., Nuno et al. 2018; Davis et al. 2019). Although such findings can occur if the behaviour is exceptionally rare (St John et al. 2018; Ibbett et al. 2019), SQTs also have higher cognitive load (Solomon et al. 2007), are harder to understand (Coutts & Jann 2011; Davis et al. 2019), take longer to complete (Bova et al. 2018), and can arouse suspicion among respondents (Razafimanahaka et al. 2012). To be successful, SQTs require respondents to understand what they must do and why and be willing to follow procedures fully (Hoffmann et al. 2017).

Several experimental studies have contributed evidence on what affects how well SQTs work. To explore how randomisers, phrasing of instructions, and response options affect respondents' willingness to follow RRT instructions, John et al. (2018) conducted a series of online experiments. Similarly, to experimentally measure respondents' comprehension of five SQTs, Hoffmann et al. (2017) presented participants with descriptions of fictional characters, some who possessed the sensitive attribute (exams cheating), some who did not. Via each method, respondents reported the answer fictional characters should give when asked if they cheated in exams. How well respondents understood the method was calculated per respondent as the percentage of correct answers provided across all fictional characters. All SQTs were less comprehensible than direct questions; less-educated respondents experienced greater comprehension difficulties. While these studies provide invaluable insights into the efficacy of SQTs when asking sensitive questions, they

were conducted in so called 'WEIRD' contexts (Henrich et al. 2010) and mostly online. Yet, due to various factors (e.g., lower literacy; poor technological access) conservation social science studies are often delivered face-to-face. Understanding how SQTs perform under such conditions is crucial.

We built on Hoffmann et al.'s (2017) experimental design, adapting it to explore the performance of SQTs when asking people living around protected areas about a commonly researched sensitive behaviour, wildlife hunting. We collected data in person in Indonesia and Tanzania, two non-WEIRD countries which are highly biodiverse, but significantly different in cultural and socio-economic terms. We aimed to quantify the extent to which respondents understood and followed SQT instructions and explored how socio-economic characteristics (age, gender, and education) affected whether individuals answered correctly. We compared direct questioning and 4 SQTs, two frequently applied in conservation research, UCT and RRT (Hinsley et al. 2019; Ibbett et al. 2021b; Chapter 4) and two considered easier to understand than UCT or RRT, but that are not yet widely applied in conservation, the Bean method (Jones et al. 2021) and Crosswise model (Yu et al. 2008).

### 3.3 Methods

#### 3.3.1 Study Sites

Data were collected from a selection of villages situated around the Leuser Ecosystem in northern Sumatra, Indonesia, and the Ruaha-Rungwa ecosystem in Tanzania (Fig. 3.1). Both landscapes are of global conservation importance (Dickman et al. 2014; Myers et al. 2020), where natural resource use is restricted and regulated. Hunting of protected species and hunting without a permit (unless for traditional use) is prohibited in Indonesia, whereas hunting any wild animal without permission is forbidden in Tanzania. Illegal hunting is a conservation concern at both sites (Pusparini et al. 2018; Beale et al. 2018) that has been little researched (although see Knapp et al. 2017; Hariohay et al. 2019). We know of no applications of SQTs in either landscape. Nuno et al. (2013) and Wilfred et al. (2019) used UCT to investigate hunting elsewhere in Tanzania, and St John et al. (2018) used RRT with limited success in Indonesia.

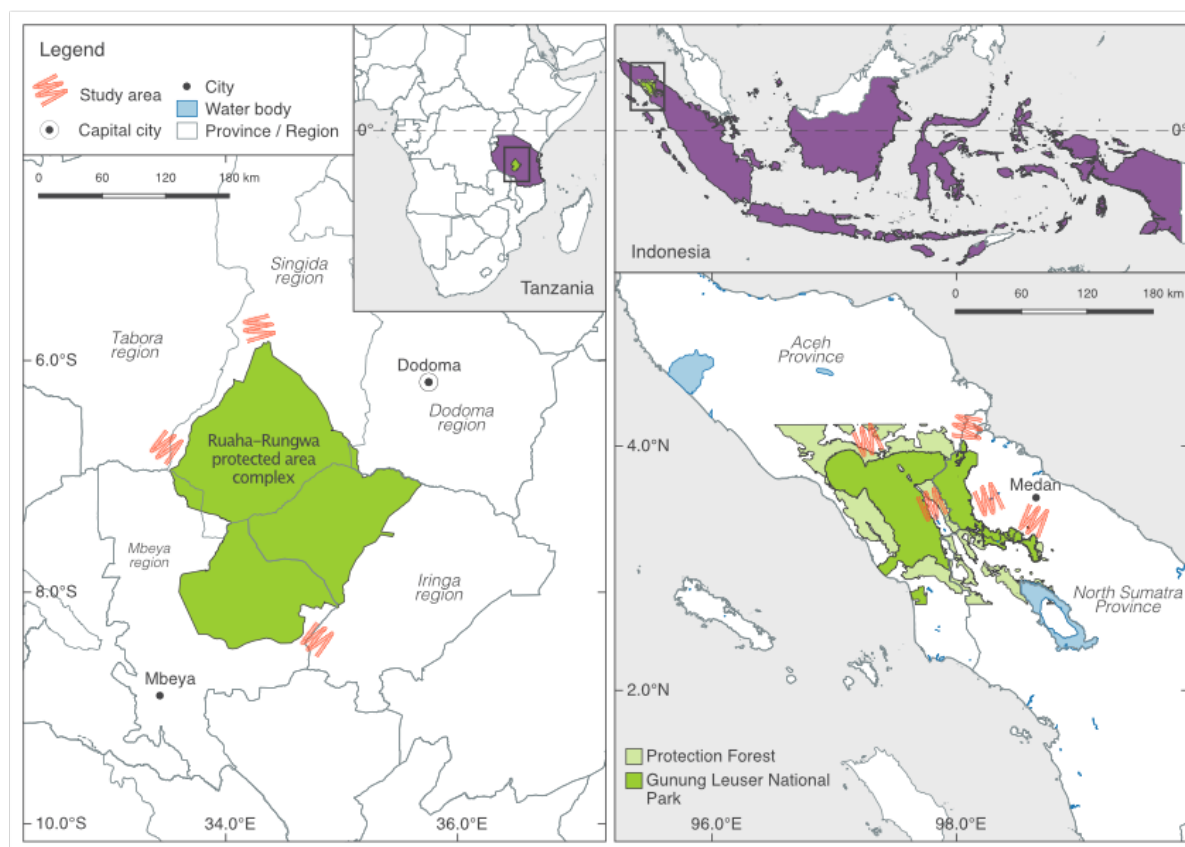


Figure 3.1. Villages where surveys to assess respondents understanding of SQTs were conducted in northern Sumatra, Indonesia (7 villages), and central southern Tanzania (6 villages). In accordance with ethics approval, precise locations of study villages are not indicated.

### 3.3.2 Experimental design


We presented respondents with cards depicting fictional characters. Respondents were asked to imagine they were each of the fictional characters and via each method to answer questions about whether each fictional character hunted wildlife. Because the behaviour of each character was known, we could validate whether a respondent provided the correct answer and use this as a proxy to measure whether respondents understood and followed the instructions associated with each method.


### 3.3.3 Fictional characters


Five fictional characters were introduced to respondents via character cards (Appendix 2). The cards detailed information on the characters' birth month alongside four livelihood activities the character conducted (Fig. 3.2). Three characters conducted a sensitive activity (hunting wildlife), two did not. Character 1 was used to introduce the method to respondents and character 2 was used to practice the method. We proceeded to characters 3, 4 and 5, only after we were certain respondents understood instructions associated with each method. Characters 3-5 were used to determine whether respondents provided accurate answers for each method. To minimize respondent fatigue and maximize data on how respondents answered sensitive questions, two characters hunted, one did not. The order of characters presented to respondents was randomised to eliminate order effects.


**1** Imagine you are Character 1


**Character 1**

Born in 

 Goes fishing

 Owns chickens


 Grows rice

 Hunts wildlife

**2** Now, imagining you are Character 1, answer the question using each of the following methods...


**Direct question**


Answer the question...


 Do you hunt wildlife?


**Unmatched Count Technique (UCT)**

How many of these activities do you do?

 Grows rice

 Hunts wildlife

 Owns chickens

 Collects firewood

Don't tell me which, just how many

**Randomized Response Technique (RRT)**


I will ask you a question

Roll the dice

If you score a 1, 2, 3, or 4 tell the truth

If you score 5 say 'Yes'

If you score 6 say 'No'

Do you hunt wildlife? 

**Crosswise model**

Here are two statements:

- I was born in November or December
- I hunt wildlife

If both statements are true, or both are false, tap the green square

If only one statement is true, tap the black square

✓/XX
✓X

**Bean method**

To answer, move a bean from the small jar to the large jar

- If the answer is yes, move a yellow bean
- If the answer is no, move a red bean

Do you hunt wildlife?

Figure 3.2. Example of a fictional character card (step 1, left) and the instructions associated with each of the questioning methods tested (step 2, right). For each method, respondents were given detailed instructions on how to answer and then asked to identify the answer the character should provide. The

diagram shows only the Randomised Response Technique (RTT) which used a die as a randomiser. A description of the RRT-button method is in Appendix 2.

### 3.3.4 Methods tested

Respondents received instructions for each method. With direct questioning, respondents were asked to answer *yes* or *no* to the question about whether the character hunted wildlife. For the RRT, each respondent shook a six-sided die in an opaque cup and did not reveal the result to the interviewer. In Tanzania if 1 was rolled respondents were forced to answer *yes*, regardless of whether this was true for the character. If 2 was rolled, respondents were forced to answer *no*. If 3, 4, 5, or 6 was rolled, respondents were instructed to answer truthfully about the character's behaviour (Appendix 2). In Indonesia the response options were reversed (i.e., 1, 2, 3, 4, truthful; 5, yes; 6, no) to assess whether the order of forced responses affected performance. Dice are common randomisers in conservation RRT studies (Ibbett et al. 2021b; Chapter 4) and appear effective in similar conservation contexts (St John et al. 2015; Ruppert et al. 2020). Because randomiser choice can affect respondent's willingness to engage with the method (Coutts & Jann 2011; Razafimanahaka et al. 2012), in Indonesia, we tested another randomiser: a cloth bag containing 8 orange buttons, 2 yellow buttons and 2 white buttons. Respondents were instructed to provide a truthful answer if an orange button was selected and to answer *yes* if a yellow button was selected and *no* if a white button was selected (Appendix 2).

To test UCT, respondents were shown a card depicting four activities, including hunting wildlife, and asked to report the number of activities that applied to the fictional character (Appendix 2). Researchers must be careful to avoid UCT design effects that can occur if respondents report that all (ceiling effect) or none (floor effect) of the items apply to them (Droitcour et al. 1991), meaning careful piloting of UCT items is required (Hinsley et al. 2019). Our UCT design ensured that respondents were never required to report that a character conducted zero or four activities, thus avoiding ceiling and floor effects.

With the Bean method, respondents were presented with two jars--one large, one small--and asked to secretly move a maize kernel from the small to large jar if the fictional character hunted wildlife or a kidney bean if the fictional character did not. Jars were shaken before and after use and were opaque, so as not to reveal the colour of the bean moved. Due to the Covid-19 pandemic and subsequent impracticalities associated with adapting the method for safe enumeration (e.g., sanitizing beans between respondents and using multiple sets of jars) we were unable to test the Bean method in Indonesia.

For the Crosswise model, respondents were asked, were you born in November or December, and do you hunt wildlife? They were then asked to report whether the characters answer would be the same for both questions, or yes to only one (Appendix 2). Most applications of Crosswise model have been online, meaning participants are able to read the question-and-answer options (Meisters et al. 2020). However, our survey

was face-to-face and question-and-answer options were read aloud to respondents. Preliminary piloting suggested this was problematic because respondents had to remember the instructions and both questions. To overcome this, we developed a prompt card that featured a green square with two ticks and two crosses underneath and a black square featuring one tick and one cross underneath (Appendix 2). Respondents were asked to tap the green square if their response was the same for both questions and the black square if their response was *yes* to only one question (Fig. 3.2).

### 3.3.5 Data collection

Survey instruments were developed in English and translated into the national languages of Bahasa Indonesia or Kiswahili by two team members fluent in the respective language (Appendix 2). An independent back translation was used to check the initial translation's accuracy. Questionnaire refinement coincided with training and piloting. Questionnaires were administered face-to-face by KP, HS, and AWS in Indonesia and SS, JM, JK in Tanzania. All data were collected using Open Data Kit (Brunette et al. 2013) on encrypted mobile phones. We adopted a convenience sampling strategy; respondents were recruited with the assistance of local guides based on availability. Wherever possible, the team targeted male respondents 18-55 years old because this is the demographic most likely to hunt (Hariohay et al. 2019); thus, information on how well this group of respondents understood SQTs was of interest for future research on rule breaking.

We gathered basic demographic data (respondent age, gender, years of education) alongside birth month. Birth month is often used as an alternative statement in Crosswise model designs (Sagoe et al. 2021) or as a randomiser for RRT (Ibbett et al. 2021b; Chapter 4). Yet, in many contexts people do not know their Gregorian birth date; therefore, it was important to determine how prevalent knowledge of birth month was so that we could assess its feasibility as an alternative statement.

Using character 2, we recorded the number of times participants practiced each method before asking three questions via the method (with characters 3, 4 and 5) (Appendix 2). For responses to direct questions, UCT, and Crosswise model it was possible to immediately assess whether the respondent provided the correct response because the answer was fixed. For RRTs and the Bean method, where responses depended on the outcome of a randomizing event or movement of a bean, we could not verify whether the respondent provided the correct answer. Thus, after each RRT and Bean question, respondents were asked to report the outcome of the randomizing device (number rolled, button colour) or the type of bean moved. After each question, respondents rated, on a 5-point Likert scale, how much privacy they felt the method afforded. Five-point Likert-scales were also used to measure how well respondents felt they understood the method; how easy the method was to comprehend; how much protection respondents felt the method offered; and how comfortable respondents would feel providing honest responses about their own hunting behaviour through the method. For full methods, see Appendix 2.

### 3.3.6 Ethical considerations

All data were anonymous. We did not collect sensitive data because respondents were only asked about the rule-breaking behaviour of fictional characters. All respondents were over 18 years old, and verbal consent was sought before every interview. As a token of thanks, participants were given a small, culturally appropriate gift. Research was formally approved by the College of Environmental Science and Engineering Ethics Committee at Bangor University (coses2019hi01). HI and LD accompanied SS, JM, and JF in Tanzania throughout data collection (September-December 2019) but were unable to do so in Indonesia due to the Covid-19 pandemic (data collected August-November 2020). Rigorous health and safety measures were implemented to mitigate Covid-19 transmission in survey communities. Research was conducted with the permission of national and local authorities.

### 3.3.7 Analyses

We performed analyses in R 3.6.2 (R Core Team 2019). For each method, we calculated the percentage of correct responses per respondent across all fictional characters. We used descriptive statistics to explore data, assess respondent's understanding of methods and compliance with instructions, and test for collinearity between predictors prior to modelling. To examine which factors influenced whether a respondent answered a question correctly, we fitted generalized linear mixed models to each country data set with lme4 (Bates et al. 2015). The response variable was a binary indicator of whether a respondent gave the correct answer to each question (Table 3.1). Respondent gender, age, years of education, method tested, number of practices required, interviewer, and whether a sensitive response was required (i.e., character hunted) were all included as fixed effects. We included interactions between method and whether a sensitive response was required and between method and years of education. To improve interpretability of coefficients, continuous variables for respondent age, years of education, and number of practices were scaled and centred by subtracting the mean and dividing by 2 SDs (Gelman & Hill 2007). Random effects were included to control for respondent and method. To achieve convergence, models were fitted using a BOBYQA optimizer and tested for singularity. Models showed no significant signs of dispersion when checked using DHARMA (Harting 2020). Tukey post hoc tests were conducted to assess pairwise correlations between each method.



Table 3.1. Explanation of the response and predictor variables tested in country-specific binomial general linear mixed models to explore what influenced whether a respondent provided a correct answer.

Variable	Description of data
Response variable	
Did the respondent provide the correct answer?	Categorical: yes or no
Predictor variable (effect type)	
Gender	Gender of the respondent, categorical: male or female
Age	Age of respondents in years, continuous
Education	Number of years of schooling completed, continuous
Practices	Number of practices respondent required before providing the correct response, continuous
Interviewer	ID of the interviewer administering questionnaire, categorical: 1, 2, 3
Response sensitive	Whether a sensitive response was required (i.e., whether the respondent was required to report that a character hunted), categorical: sensitive or not sensitive
ID (random effect) <sup>a</sup>	Unique ID code assigned to each respondent, continuous
Method (random effect) <sup>b</sup>	Method tested, categorical: direct question, UCT, RRT-dice, RRT-button, crosswise model, bean method
Interaction terms	
Method * response sensitive	
Method * education	

<sup>a</sup> Included as a random effect to control for respondents answering multiple questions per method.

<sup>b</sup> Included as a random effect to control for 1 question being asked for each of the 3 characters per method. Abbreviations: UCT – Unmatched Count Technique; RRT – Randomised Response Technique using either a dice or a button as a randomiser.

## 3.4 Results

### 3.4.1 Respondent demographics

Data were collected from 303 people in Indonesia and 306 in Tanzania. The gender of both samples was biased towards men (Indonesia, 75% male; Tanzania, 56%). Education levels were higher in Indonesia (mean [SE]= 9.9 years [0.207]) than in Tanzania (mean 6.6 years [0.180]). In Tanzania men had significantly more years of education than women (mean 7 and 6 years, respectively) ( $t=-2.864$ ,  $df=280$ ,  $p=0.005$ ). There was no relationship between gender and education in Indonesia (mean 9.9 years,  $t=0.278$ ,  $df=116$ ,  $p=0.781$ ). The mean age of respondents sampled in both countries was 38 years (Indonesia, minimum 18, maximum 60, SE 0.752; Tanzania, minimum 18, maximum 80, SE 0.569). Most respondents knew their birth month (Indonesia, 83.5%; Tanzania, 73.5%).

### 3.4.2 Non-response

Levels of non-response varied by method and country. Overall, respondents refused to answer questions more often in Tanzania than Indonesia. In both countries, RRT-dice was the method most frequently refused (Table 3.2), followed by Crosswise model. Direct questions received the least refusals in both countries, followed by UCT.

Table 3.2. Number of non-responses per questioning method by country in a survey assessing respondents understanding of Specialised Questioning Techniques.

Method <sup>a</sup>	Indonesia ( $n=303$ ) <sup>b</sup>		Tanzania ( $n=306$ ) <sup>b</sup>	
	Responses	Refusals (%)	Responses	Refusals (%)
Direct questions	909	0	842	76 (8)
UCT	908	1 (<1)	798	120 (13)
Crosswise model	904	5 (1)	767	151 (16)
RRT-dice	891	18 (2)	761	157 (17)
RRT-button	909	0	-	-
Bean method	-	-	784	134 (14)
Total	4521	27 (<1)	3,952	638 (14)

<sup>a</sup> Each method was repeated three times, per respondent.

<sup>b</sup> Responses, number of questions answered per method; refusals, number of questions respondents refused to answer per method.

Abbreviations: UCT – Unmatched Count Technique; RTT – Randomised Response Technique using either a dice or a button as a randomiser.

### 3.4.3 Correct responses per method

In Indonesia UCT and direct questions resulted in the highest percentage of correct responses (90.1% [95% CI 1.9] and 89.4% [2.0], respectively) (Fig. 3.3). Fewer correct responses were reported via RRT-dice and RRT-button (dice, 81.0% [2.6]; button, 82.8% [2.4]), whereas Crosswise model resulted in the lowest percentage of correct responses (64.3% [3.1]). In Tanzania RRT-dice, UCT, direct questions secured the highest percentage of correct responses (80.0% [2.8], 78.9% [2.8], and 77.2% [2.8], respectively) (Fig. 3.3) in comparison with the Bean method and Crosswise model; both performed significantly worse (67.6% [3.3] and 65.0% [3.4]).

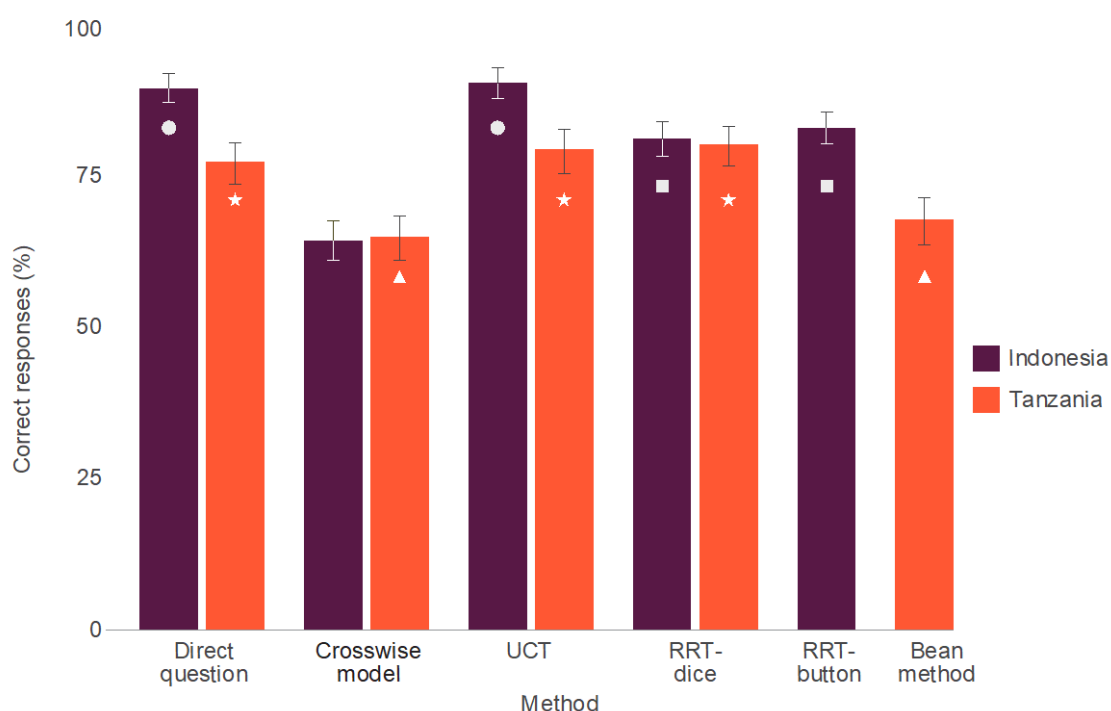


Figure 3.3. Mean percentage of correct responses for each questioning method tested in Indonesia and Tanzania (error bars, 95% CI; matching shapes (circle, square, triangle, asterisk), no significant difference in the mean percentage of correct responses between these methods when tested in the same country; UCT – Unmatched Count Technique, RRT – Randomised Response Technique using either a dice or buttons as a randomiser).

### 3.4.4 Sociodemographic predictors of correct responses

Modelling showed several factors predicted whether a respondent answered correctly (Figs. 3.4, 3.5; Appendix 2). In Indonesia women were more likely than men to answer correctly, although there was no effect of gender in Tanzania. In both countries, likelihood of a correct response decreased as age increased. Education was not a significant predictor of a correct response in Indonesia, but in Tanzania the more years of education a respondent had, the greater the probability they would answer correctly. Respondents who

required more practices were also more likely to answer incorrectly; more practices were required on average per respondent in Tanzania than in Indonesia. Who delivered the survey affected response accuracy in Indonesia; respondents questioned by interviewer two, were significantly less likely to answer correctly.

### 3.4.5 Impact of method and response sensitivity on correct answers

According to our model, respondents were more likely to provide a correct response when answering a direct question, compared with all other methods (Fig. 3.4, 3.5, Appendix 2), although in Tanzania, direct questioning did not perform significantly better than RRT-dice or UCT (Appendix 2). When compared with each other, all SQTs performed equally, except for the Crosswise model, which performed significantly worse than other SQTs (Appendix 2). Whether the character hunted, and thus whether the respondent was required to provide a sensitive response, was a significant predictor of whether a respondent answered correctly. In both countries, participants were less likely to provide correct answers when the character hunted. Findings suggested a significant interaction between method and whether a sensitive response was required. When respondents were required to provide a sensitive answer, the probability of a respondent providing a correct response was significantly higher with an SQT than with direct questions. This applied in both countries and for all SQTs, except the Bean method, suggesting that, except for the Bean method, SQTs outperformed direct questions when a socially undesirable response was required (Appendix 2). This effect was particularly pronounced for Crosswise model, which demonstrated the greatest difference in probability of a correct answer when a sensitive response was and was not required. There was little overall interaction between education and method, except in Tanzania, where those who had more years of education were less likely to provide a correct response via Crosswise model (Appendix 2).

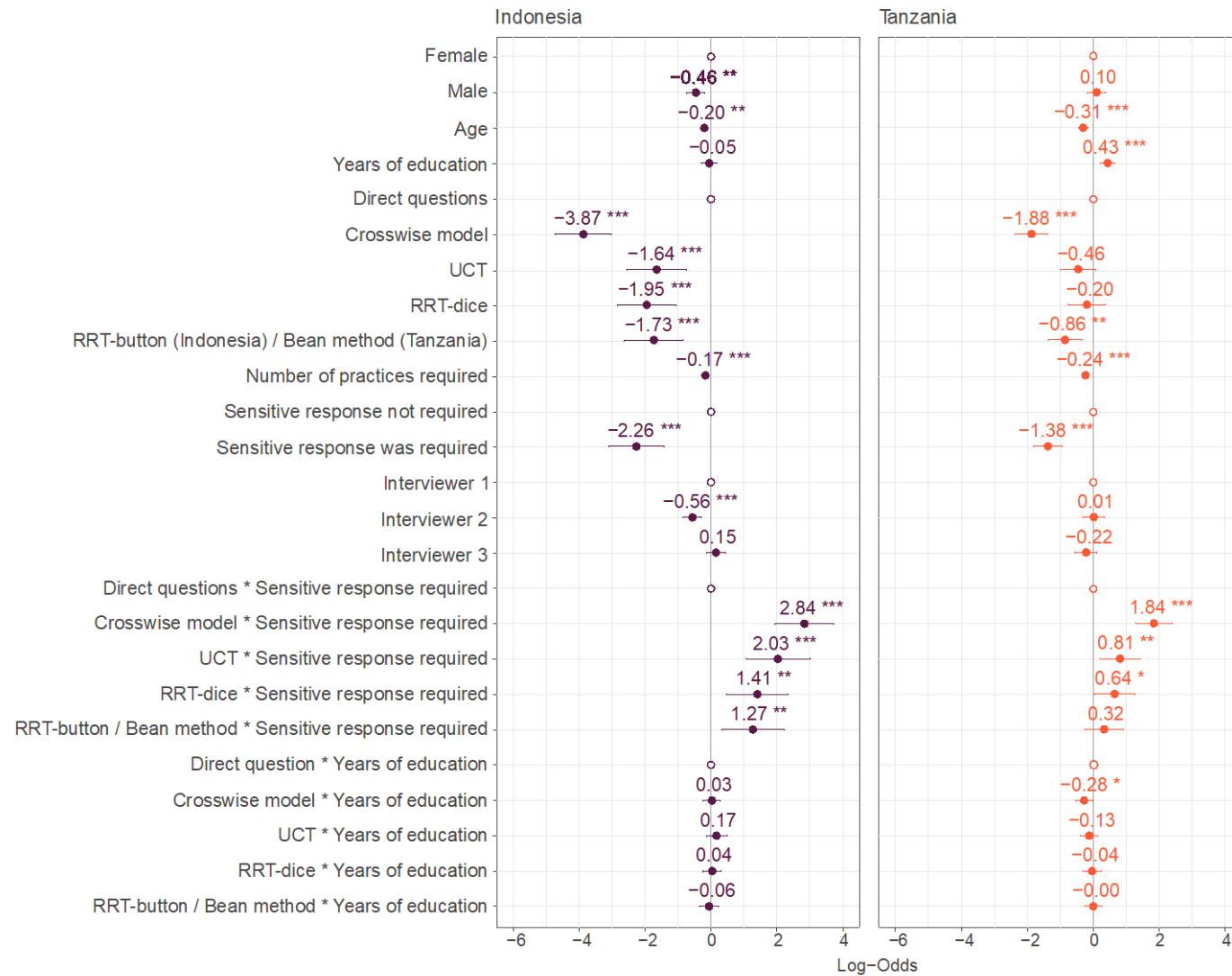


Figure 3.4. Regression coefficients with standard errors from a general linear mixed model of whether a respondent answered the question correctly or not, with random effects for respondent and method (UCT – Unmatched Count Technique, RRT -Randomised Response Technique; white circles, reference categories for categorical variables; significance, \*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$ ). The RRT-button was used only in Indonesia, & the Bean method was used only in Tanzania.

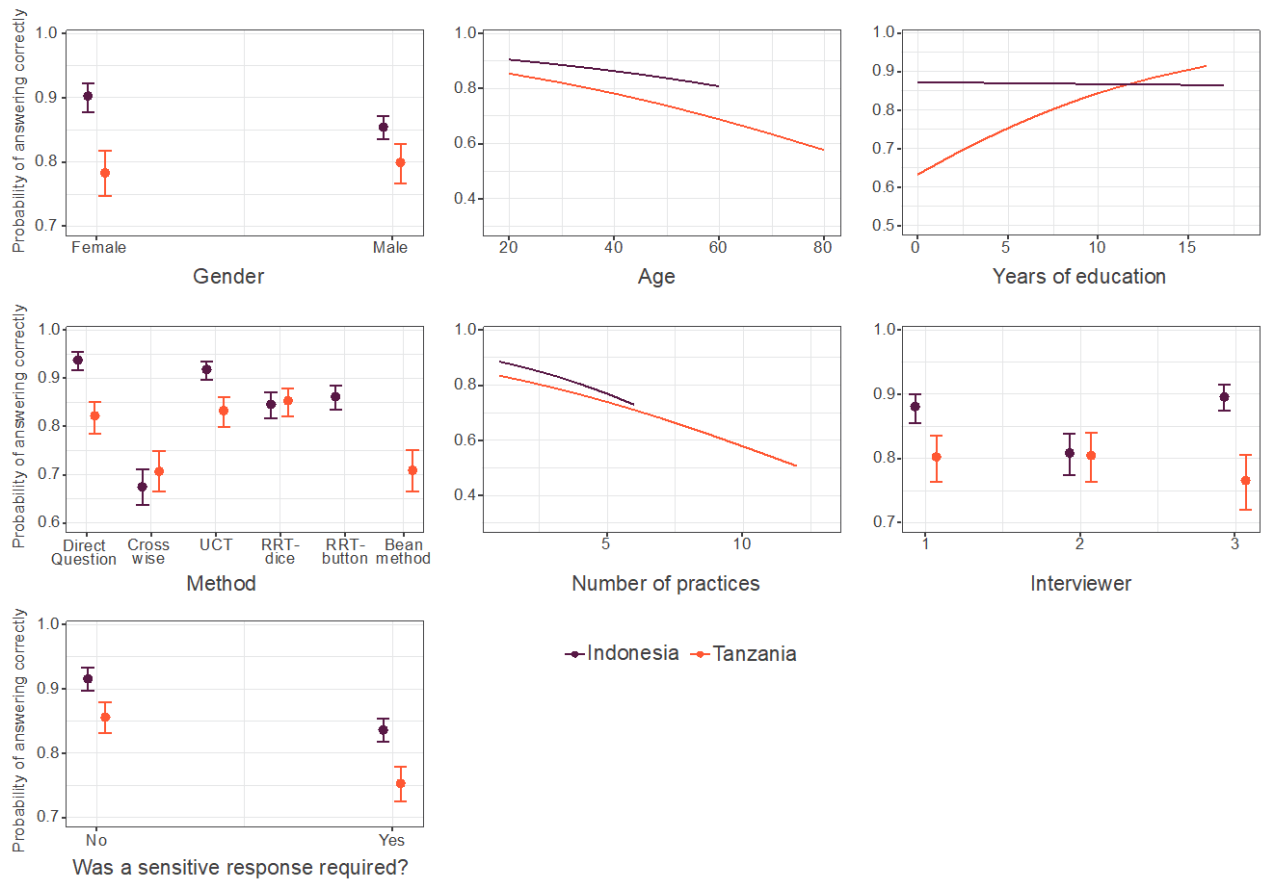


Figure 3.5. Marginal effects for each fixed effect included in the GLMM model, showing the probability of a respondent answering questions correctly (error bars, 95% CIs).

### 3.4.6 Compliance with instructions

For both RRT designs, whether the respondent gave the correct response was verified by the respondent's providing information on their action (e.g., die number rolled or button selected) (Appendix 2). For a standard six-sided die, the probability of rolling any number is 0.167, meaning all numbers (1-6) should have been reported in equal abundance. For the RRT-button, the probability of selecting an orange button was 0.66 and the probability of selecting a white or a yellow button was 0.17. In Tanzania, the number of times each dice number was reported was significantly different from expected ( $\chi^2=28.658$ ,  $df=5$ ,  $p<0.001$ ); respondents overreported options that instructed them to give forced responses and underreported responses that required truthful answers. A similar trend in Indonesia was not significant for either the RRT-dice ( $\chi^2=7.162$ ,  $df=5$ ,  $p=0.209$ ) or RRT-button ( $\chi^2=5.806$ ,  $df=2$ ,  $p=0.055$ ) (Appendix 2).

### 3.4.7 Respondent's self-reported understanding of methods

Direct questions were generally considered easier to understand than SQTs (Table 3.3). In Indonesia 90% of respondents found direct questions easy or very easy to answer, whereas in Tanzania, UCT was considered easiest to answer (82% of respondents, although this was only marginally more than direct questions [79%]) (Table 3.3). Overall, few respondents reported they would feel comfortable providing honest responses about their own hunting behaviour via any of the methods, especially in Tanzania. However, they reported they would be more comfortable with SQTs than direct questions. In both countries, a higher percentage of respondents felt SQTs kept their answers secret or very secret compared with direct questions. Respondents reported understanding direct questions better than any of the SQTs (except UCT in Tanzania) (Table 3.3). Crosswise model was the least well understood in both countries.

Table 3.3. Percentage of respondents in a survey assessing understanding of Specialised Questioning Techniques in Indonesia ( $n=303$ ) and Tanzania ( $n=306$ ) who reported agreement with each statement related to questioning methods used.

Method *	Respondents who felt questions were easy or very easy to answer through the method (%)		Respondents who would feel comfortable or very comfortable providing honest responses about their own hunting behavior through the method (%)		Respondents who felt the method kept their answer secret or very secret (%)		Respondents who understood or understood well the method (%)	
	Indonesia	Tanzania	Indonesia	Tanzania	Indonesia	Tanzania	Indonesia	Tanzania
Direct questions	90	79	25	11	33	44	88	92
Crosswise model	59	61	32	13	41	58	56	76
UCT	86	82	36	14	50	61	78	93
RRT-dice	65	73	41	15	51	64	63	85
RRT-button	66	-	31	-	51	-	62	-
Bean method	-	80	-	18	-	62	-	89

\* Abbreviations: UCT – Unmatched Count Technique; RTT – Randomised Response Technique using either a dice or a button as a randomiser.



### 3.5 Discussion

To develop effective interventions, conservationists require reliable information about human behaviour, including the proportion of a population engaged in illegal or otherwise sensitive behaviours (St John et al., 2013). Designed to reduce bias, Specialised Questioning Techniques are increasingly applied in conservation, but with mixed success (Cerri et al. 2021), leading researchers to question exactly how well research participants understand and follow SQTs instructions (Hinsley et al. 2019; Davis et al. 2019). Conservation research is often conducted in different contexts and conditions to those in which SQTs were developed, meaning it is important to determine how factors such as education level, gender and face-to-face enumeration affect how well respondents understand SQTs, and how comfortable respondents feel using these methods. Here, we provide valuable insights for conservationists considering SQT use in the field.

In both Indonesia and Tanzania, the probability of a respondent answering an SQT correctly was lower than for direct questions, suggesting they were harder for respondents to understand (Hoffmann et al. 2017; Davis et al. 2019), particularly in Tanzania when education level was low. This is likely because SQTs involve more instructions and often rely on the use of additional equipment (e.g., dice, beans and jars, or lists). Together, these factors increase cognitive load, making it harder for respondents to follow instructions (Hoffmann et al. 2020). Based on our similar findings from two culturally distinct countries, we recommend contexts in which SQTs might be better understood by respondents. Respondents were more likely to answer correctly about a fictional character's behaviour and thus to have understood instructions, when they had more years of education and were younger. Another good indicator of respondent understanding was the number of practices required; the more an interviewer had to explain a method, the lower the likelihood instructions were understood. Therefore if, when piloting a survey design, excessive explanation is required to introduce the method to participants, researchers should consider whether the method is appropriate, and if many explanations are required, interpret data cautiously. Our results reinforce that who asks questions matters. It is important to consider how factors, including interviewer characteristics (e.g., gender, age, manner and personality), influence research and to be mindful that interviewers vary in their experience, how comfortable they make respondents feel, and the quality of data they collect (Blair et al. 2020).

Overall, respondents' understanding of SQTs varied across the methods tested. Estimates from the percentage of respondents answering correctly and respondents self-reported evaluation of each method suggests UCT was the SQT understood best in both countries. One might thus infer that UCT is superior to other SQTs tested; however, pairwise comparisons showed that UCT was not significantly better understood than other SQTs (excluding Crosswise model). Additionally, complexities associated with the selection of list items mean UCTs may not always be an appropriate or feasible method, particularly if asking about multiple behaviours (Hinsley et al. 2019) or if low prevalence is expected (Ibbett et al. 2019; Davis et al. 2020). That Crosswise model was poorly understood was surprising because in other studies it was easier to

comprehend than alternatives (Hoffmann et al. 2017; Höglinger & Jann 2018). However, these studies relied on self-administration, either online or with printed questionnaires (Sagoe et al. 2021), whereas our respondents relied on verbal instructions, meaning respondents had to remember instructions and questions. Crosswise model may tend to produce false-positive responses, leading to overestimations of prevalence (Höglinger et al. 2016; Höglinger & Jann 2018), although this may be overcome by providing respondents with more comprehensive and detailed instructions (Meisters et al. 2020). While Crosswise model shows potential where self-administration is viable, the low overall comprehension we detected suggests significant adaptation is required to deploy this method face-to-face, particularly in low-literacy contexts, where written instructions may be inappropriate. More surprising was how poorly the Bean method performed. Promoted for its ease of use, particularly in low-literacy contexts, the method involves clear, simple instructions and relies on familiar equipment (Jones et al. 2021). Yet, when tested in Tanzania, the percentage of correct responses was relatively low, despite a high proportion of respondents reporting they found the method easy to use and that they understood instructions. Some of this error could be attributed to interviewers incorrectly counting beans (Jones et al. 2021) and the experimental nature of the exercise (having to report the behaviour of a character). Further error may also result from purposeful false responding. When asked how private they felt the method was, some respondents reported low levels of privacy, suggesting interviewers would look in the jar to determine what bean had been moved. One respondent suggested it was possible to satellite track the movement of individual beans, highlighting wider concerns about the trustworthiness of researchers, as well as the use of surveillance technologies in monitoring communities' activities (Sandbrook et al. 2021).

Ultimately, SQTs are designed to protect research participants when collecting sensitive data. When sensitive responses were required (i.e., the respondent was required to report the fictional character hunted), all SQTs (except the Bean method) significantly increased the likelihood of respondents giving a correct response relative to direct questions. This was the result we expected if respondents were answering about their own behaviour (and suggests SQTs reduce sensitivity bias). This result was observed even though respondents were answering on behalf of fictional characters. This effect was strongest for Crosswise model, perhaps because in this method there is no safe response; both answers can be chosen by those who do and do not possess the sensitive attribute (Hoffmann et al. 2020).

Although our findings suggest SQTs can reduce sensitivity bias, they may exacerbate other forms of bias, such as non-response and evasive-response bias. All SQTs in both countries received higher refusals than direct questions; RRT received the highest number of non-responses. Studies from Madagascar reported that survey respondents did not like being forced to admit to eating certain bushmeat species by the RRT design and therefore refused to answer (Razafimanahaka et al. 2012). Moreover, responding can be affected by randomiser type. Although we found no effect of randomiser type in Indonesia, participants in both countries associated dice with gambling. In Tanzania some participants refused to touch equipment, concerned that we were trying to con or curse them. Alternatively in some cultures, certain numbers are considered lucky or unlucky (e.g., Yang 2011), which might affect how people interact with number-

dependent randomisers. The order RRT response options are provided to respondents may influence answers; for example, respondents may fixate on the safest or most desirable answer they hear (e.g., forced no) and fail to listen to all options. While extensive piloting and adopting different RRT designs, such as the unrelated-question methods, can overcome the likelihood of non-response bias (Ibbett et al. 2021b; Chapter 4), high refusals emphasize wider problems regarding efficiency. Due to the additional noise introduced to the data by anonymization processes, compared with direct questions, all SQTs require larger sample sizes and thus more research resource (Hinsley et al. 2019; Ibbett et al. 2021b; Chapter 4).

To be successful, SQTs rely on the assumption that those who do not possess the sensitive trait will comply with instructions and respond appropriately (Krumpal & Voss 2020). However, methods like RRT can enhance socially desirable responding rather than reduce it, particularly when those who do not possess the sensitive trait are forced to provide affirmative responses (Krumpal & Voss 2020). As in Chuang et al. (2021), our data suggest that some respondents understood the instructions but deliberately chose not to comply with them, mostly when sensitive responses were required and particularly for the Bean and RRT methods. While many false-negative responses may lead to underestimations of prevalence, false-positives (which can also occur if respondents deliberately choose not to follow instructions or if they misunderstand them) can be just as harmful. For example, false positives may lead conservationists to believe prevalence is higher than it is, resulting in inappropriately targeted interventions. Techniques have emerged to counter this. For example, internal consistency checks can be used to identify potential bias (Cerri et al. 2021; Chuang et al. 2021), and designs, such as the double-list UCT (Glynn 2013) and cheating-detection RRT (Clark & Desharnais 1998), can help quantify potential bias. However, few empirical examples of the effectiveness of these approaches exist (Cerri et al. 2021).

Reliance on fictional characters to explore respondents understanding of methods had limitations. The use of characters added complexity to the response process, which may have decreased overall understanding of the methods. Consequently, our estimates may only represent minimal levels of understanding per method. Conversely, because respondents were not required to provide information about their own behaviour, they may have been more willing to engage than they would be in a conventional survey. Our results showed that some respondents deliberately failed to comply with SQT instructions because they felt uncomfortable admitting to a fictional character conducting sensitive behaviours, suggesting that if applied to their own behaviour, there may have been more evasive responses or refusals. Skewed prevalence of hunting among characters may also have aroused suspicion and affected responding because respondents were asked to report hunting often. Moreover, our design involved considerable repetition; surveys ranged from 45 minutes to two hours depending on the skill of the interviewer, the respondent, and the interview environment. This became tedious for some respondents and may have resulted in bias, with individuals providing answers simply to finish sooner. Shortening the survey by adopting a block-experimental design could overcome this challenge, but potentially at the cost of participant intra-comparability. As with any experiment, our results should be considered cautiously and within the confines of its limitations.

Despite the significant ways SQTs aim to minimize risk to respondents, our results highlight the substantial effect of sensitivity when conducting conservation research on illegal behaviours. Our respondents were never asked about their own behaviour, the experimental nature of the research was emphasized throughout, and respondents were only required to provide information on fictional characters, yet sensitivity still affected responses. Concern that answers would be used to incriminate individuals in hunting was particularly high in Tanzania; some respondents associated the survey with trickery, especially when it was combined with the RRT, which forced participants to provide undesirable responses. While research previously conducted in Ruaha-Rungwa successfully gathered qualitative information on hunting, data were only obtained after key informants encouraged other community members to approach researchers (Knapp et al. 2017). The concerns we encountered emphasize the complexity of relationships that exist between communities and conservation research, especially around protected areas, where regulations restricting people's access to, and use of natural resources are often strongly enforced. Conservation research often occurs in contested spaces, and both the Ruaha-Rungwa protected area complex and the Leuser Ecosystem have turbulent colonial histories associated with dispossession (Walsh 2007; Minarchek 2020). Researchers asking about wildlife or natural resource use in such places are rarely perceived as neutral parties and are often assumed to be affiliated with conservation organizations, government, or protected area management (Brittain et al. 2020). Thus, distrust of researchers' intentions and their use of data is high. Not only does this raise ethical questions about whether methods, such as RRT, that "force" respondents to admit to illegal behaviours causing potential distress, are appropriate, but it emphasizes the need for ethical procedures, such as free, prior, and informed consent, that promote transparency and awareness of the research objectives (Brittain et al. 2020). It also highlights the importance of embedding research in long-term conservation efforts (e.g., Ruppert et al. 2021) and practices, such as disseminating research findings to communities (Brittain et al. 2020).

While social science has made significant strides in developing methods that reduce bias during sensitive research, our results highlight that these methods are not understood by all respondents and even if they are, respondents may not feel comfortable enough to provide honest responses. To be successful, conservation researchers must be sensitive to the context in which the research will occur, have awareness about how conservation is perceived by potential study participants, and should pilot their design extensively. Fundamentally, our results demonstrate the importance of assessing the suitability of social science methods prior to their implementation in contexts that differ substantially from where they were developed because cultural, sociological, and psychological differences may have substantial effects on data reliability and validity.

# Chapter 4

## Asking sensitive questions in conservation using Randomised Response Techniques



Humairah Sabiladiyni interviewing a respondent in Indonesia (photo taken by Karlina Prayitno, with participants verbal consent)

## 4.1 Abstract

Conservation increasingly seeks knowledge of human behaviour. However, securing reliable data can be challenging, particularly if the behaviour is illegal or otherwise sensitive. Specialised questioning methods such as Randomised Response Techniques (RRTs) are increasingly used in conservation to provide greater anonymity, increase response rates, and reduce bias. A rich RRT literature exists, but successfully navigating it can be challenging. To help conservationists access this literature, we summarise the various RRT designs available and conduct a systematic review of empirical applications of RRTs within (n=32), and beyond conservation (n=66). Our results show increased application of RRTs in conservation since 2000. We compare the performance of RRTs against known prevalence of the sensitive behaviour and relative to other questioning techniques to assess how successful RRTs are at reducing bias (indicated by securing higher estimates). Findings suggest that RRT applications in conservation were less likely than those in other disciplines to provide prevalence estimates equal to, or higher than those derived from direct questions. Across all disciplines, we found reports of non-compliance with RRT instructions were common, but rarely accounted for in study design or analysis. For the first time, we provide conservationists considering RRTs with evidence on what works and provide guidance on how to develop robust designs suitable for conservation research contexts. We highlight when alternate methods should be used, how to increase design efficiency and improve compliance with RRT instructions. We conclude RRTs are a useful tool, but their performance depends on careful design and implementation.

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## 4.2 Introduction

Conservationists increasingly seek reliable information about people's behaviour, including illegal or otherwise sensitive topics where people may not be comfortable answering truthfully (Solomon et al. 2007; Cinner 2018). Securing reliable estimates about the proportion of the population engaged in rule-breaking, as well as what drives non-compliance, is critical for the development of effective conservation interventions (St John et al. 2013). It is well understood across a range of social research disciplines, particularly when the topic of investigation is sensitive, that respondents may adjust their answers to appear more socially acceptable (social desirability bias), or refuse to answer altogether (non-response bias, Krumpal 2013; Tourangeau & Yan 2007). Specialised Questioning Techniques such as the Unmatched Count Technique (UCT) (Droitcour et al. 1991) and Randomised Response Techniques (RRTs) (Warner 1965) have been developed to overcome these biases. These methods provide respondents with greater anonymity when answering sensitive questions (Chaudhuri & Christofides 2013) and are grounded in the premise that respondents are more likely to answer truthfully when question design protects them from revealing incriminating information (Warner 1965). Within conservation, there is growing interest in using Specialised Questioning Techniques to derive more reliable estimates when researching potentially sensitive behaviours (Arias et al. 2020; Cerri et al. 2021; Hinsley et al. 2019), but to be effective, these techniques require robust design underpinned by good understanding of their advantages and limitations (Hinsley et al. 2019; Nuno & St John 2015). Here, we describe the various RRT designs, conduct a systematic review of their application, and provide evidence on what works. In doing so, we aim to improve conservationists' understanding of the design considerations, alongside potential pitfalls.

Developed by Warner in 1965 to overcome bias, RRTs work by enabling interviewees to respond with answers that provide information on a probability basis (Warner 1965). In Warner's original RRT design (sometimes referred to as Warner's model, or the mirrored-question design, Blair et al. 2015), respondents are presented with a randomising device (e.g., a spinner), which they use to randomly select a statement relating to a sensitive topic. Respondents are asked to report if the statement selected by the randomiser is true or false for them (Fig. 4.1a). The sample-level prevalence of the sensitive behaviour is calculated using the known probability of answering the sensitive statement ( $\rho$ ), the total number of 'yes' responses ( $\gamma$ ), and the total sample size ( $n$ ) (Box 4.1). By protecting respondents (who never reveal which statement they answered), and enumerators (who cannot tell which statement was answered), RRTs can reduce bias and yield higher estimates than asking people sensitive questions directly (hereafter, direct questions) (Dietz et al. 2013; Lensvelt-Mulders et al. 2005a). Consequently, RRTs have been applied extensively to investigate sensitive topics including drug-use, sexual behaviour and abortion (de Jong et al. 2012; Lara et al. 2006; Stubbe et al. 2014).

Box 4.1. How to calculate estimates of prevalence using RRT (Warner 1965):

$$\pi = \frac{\rho - 1 + \frac{\gamma}{n}}{2\rho - 1}$$

Variance, which considers the additional uncertainty added by the randomisation process, is calculated as:

$$Variance = \frac{\pi(1 - \pi)}{n} + \frac{\rho(1 - \rho)}{n(2\rho - 1)^2}$$

After Warners' inception of the first RRT, it was rapidly recognised that the additional anonymity afforded by the randomisation process came at a cost of efficiency, with estimates associated with high levels of error (Greenberg et al. 1969). As a result, Warners' original design was extensively refined (Blair et al. 2015) and a suite of different RRT designs (also referred to as models) are now available; each optimised to improve administration, reduce error and increase efficiency (Chaudhuri & Mukherjee 1987; Fox 2017). Today, a rich literature documenting advances in RRTs and reviewing their efficacy exists (Lensvelt-Mulders et al. 2005b; Umesh and Peterson 1991). However, successfully navigating it can present challenge to conservationists; there are inconsistencies in nomenclature (e.g., Warner's design and the mirrored-question design are the same) and accessing research requires extensive review of literature across multiple fields. Moreover, many RRT designs were developed and applied in western-educated contexts, yet substantial conservation research occurs in places where literacy and access to education are more limited (Brittain et al. 2020).

Determining which RRT to use is challenging without empirical information about what works. To improve understanding and to guide conservationists, we summarise the various RRT designs and then undertake a systematic review of peer-reviewed literature describing the use of RRTs in conservation. We review the conservation topics studied, countries where it has been used, and the designs applied. Using the wider literature, we assess the performance of RRTs by exploring studies that validated RRT estimates using data on known prevalence, alongside studies that compared RRT estimates to those derived from alternate questioning methods; we then explore which design considerations affect performance. Using findings from our review, along with our own experience, we provide best practice guidelines to conservationists deciding whether, and how, to use RRTs.

#### 4.2.1 The unrelated-question, and paired alternative RRT designs

One of the most used post-Warner designs is the unrelated-question RRT. First proposed by Simmons (1967) and improved by Greenberg et al. (1969), instead of randomly selecting from two statements about the *same* topic, respondents randomly select a question from *two different* topics (Horvitz et al. 1976). One question is innocuous and completely unrelated to the sensitive topic, the other is the sensitive question of interest. A randomising device is used to determine *which* question is answered, while the possible responses to both questions remain the same (e.g., yes, or no). In Idaho, USA, Schill and Kline (1995)



successfully used an unrelated-question design to estimate non-compliance of anglers with fishing regulations.

The unrelated-question design is improved further by asking an unrelated-question for which probability of an affirmative (yes) response is *known* (Fig. 4.1b), for example, asking about a respondent's birth month, population-level data on which can be obtained from census records (Boruch 1971). Even if the level of the unrelated question is *unknown*, prevalence of the sensitive characteristic can still be obtained (albeit with lower statistical efficiency) by splitting the sample into two and assigning each a different probability of answering the sensitive question (e.g., sample 1 has 0.7 chance of answering the sensitive question, while the probability for sample 2 is 0.3) (Fox 2017) (Fig. 4.1c). Chu et al. (2018) adopted this approach in an online survey to research misuse of IT software and the internet by employees in the workplace.

Where obtaining data on an unrelated-question is challenging, or it is impractical to split the sample in two, a *paired-alternative* design (also known as the *two unrelated-questions* design (Fox 2017)) can be used. This design introduces an additional randomisation process, the outcome of which forms the subject of the unrelated-question (Fig. 4.1d). For example, in their study investigating illegal resource use in Kibale National Park, Uganda, Solomon et al. (2007) first asked respondents to flip a coin, and then presented two identical envelopes and asked respondents to select one. Inside, one envelope contained a card featuring an image of the 'head' side of a coin, the other included a photograph depicting an illegal activity (e.g., setting snares inside the park). When respondents looked at the card in the envelope, they were asked to say "yes", if the card showed the head of a coin and they had flipped a head, or "no" if the card showed the head of a coin, and they had not flipped a head. If the card in the envelope featured the photograph depicting setting snares, they were asked to honestly report whether they had done the activity. This method can increase efficiency in contexts where questions with known probabilities (e.g., birth months) are poorly known.

#### 4.2.2 The forced-response RRT design

To further improve statistical efficiency and to enhance RRT simplicity, Boruch (1971) developed the forced-response RRT design (also referred to as the forced-alternative (Fox et al. 2017)). Boruch (1971) aimed to eliminate the need for a second topic of enquiry whilst maintaining the randomisation process. The forced-response design uses randomisation to establish *how* a respondent should answer the sensitive question; truthfully (with probability  $p$ ), or with a 'forced' response (e.g., yes, or no). Within conservation, this design has been applied extensively (e.g., St John et al. 2012; Oyanedel et al. 2017). Two variations of the forced-response exist: the symmetric design, whereby respondents are instructed to provide a truthful answer (e.g., yes, or no), a forced yes or a forced no (Fig. 4.1e); and the asymmetric design (Fig. 4.1f), where respondents are instructed to provide either a truthful response (e.g., yes, or no) or one prescribed response, usually "yes". Although enumerators cannot determine if positive responses are truthful or forced, typically, asymmetric designs assure less protection because enumerators can determine when participants

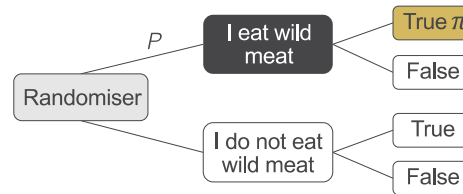
were required to answer the sensitive question (e.g., because people only say no when responding truthfully, Fig 4.1f). Even though such a response may not be socially undesirable, it can add discomfort as it decreases anonymity (Fox 2017).

### 4.2.3 Kuk's disguised-response RRT design

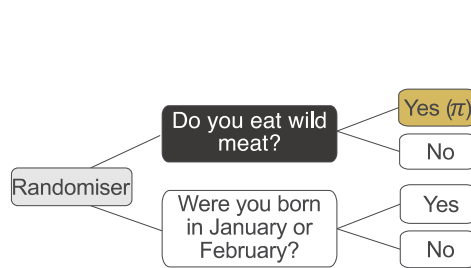
Despite its efficiency, a key criticism of the forced-response design is that respondents can feel uncomfortable being 'forced' to answer yes when their truthful answer would be no (Coutts & Jann 2011). To overcome this, Kuk (1990) proposed the disguised-response design. Here, respondents are provided two decks of cards, one representing "yes" responses, the other representing "no". Each deck contains cards of two colours (e.g., orange, and white). In the "yes" deck the ratio of white to orange cards is 4:1, whereas in the "no" deck the ratio is 1:4 (Fig. 4.1g). To answer a question, respondents secretly select one card from each deck, and report the colour of the card that reflects their answer (i.e., if their answer is yes, they report the colour of the card that they selected from the yes pile) (Blair et al. 2015; Kuk 1990). Despite its potential, few applications of Kuk's design exist (but see van der Heijden et al. 2000), and only one in conservation. Investigating bird hunting in China, Chang et al. (2019) reported no significant difference in estimates between the disguised-response and forced-response designs and found the disguised-response more time consuming as respondents were required to shuffle two decks of cards between questions.

**Warner's original RRT design (Warner 1965)**

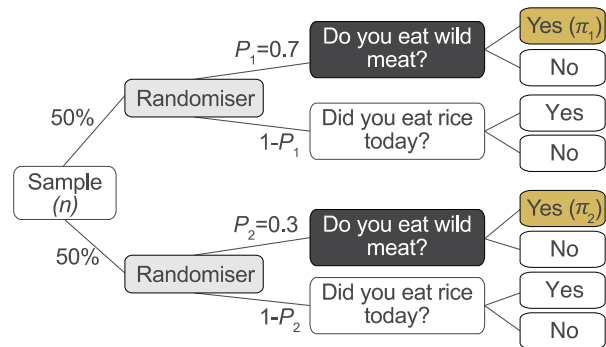
a) Sometimes referred to as Warner's model or the mirrored-question design

**Unrelated-question RRT designs (Greenberg et al. 1969)**

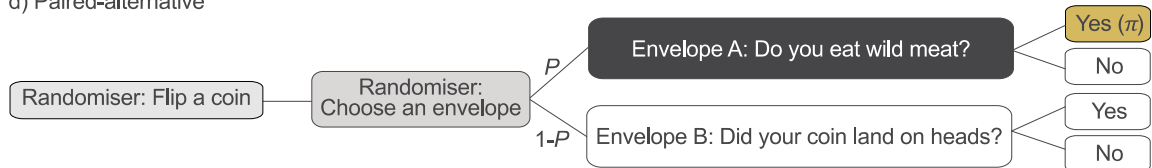
b) Known prevalence of unrelated-question



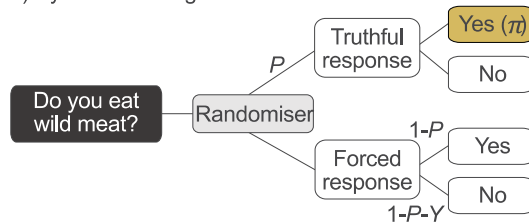
c) Unknown prevalence of unrelated-question



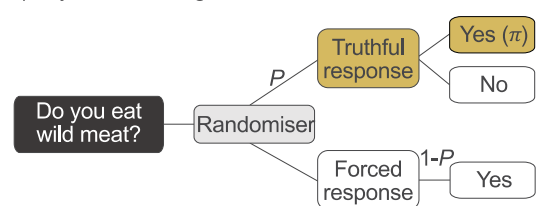
d) Paired-alternative

**Forced-response RRT designs (Boruch 1971)**

e) Symmetric design



f) Asymmetric design

**Disguised-response design (Kuk 1990)**

g) Also known as Kuk's design/model

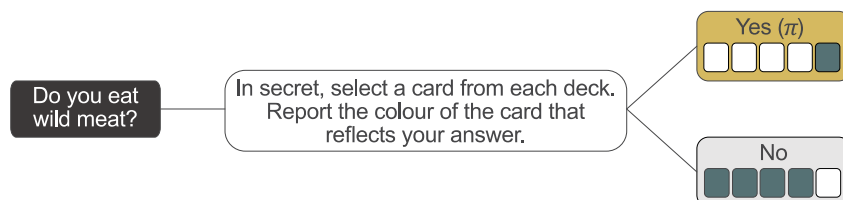


Figure 4.1. Probability trees showing various RRT designs used to estimate the proportion of a population engaged in a sensitive behaviour, such as consuming wildmeat. Light grey boxes indicate the point at which a randomising device is used; dark grey boxes indicate the sensitive question; yellow boxes and  $\pi$  indicate

the prevalence estimate.  $P$  = probability of answering a question truthfully (forced-response designs) or being asked to answer the sensitive question (unrelated-question designs),  $Y$  = probability of providing a forced-yes response.

#### 4.2.4 Estimating incidence

RRT designs described so far, all capture responses that determine *whether* respondents do something (e.g., eat wild meat), not *how often* they do it. However, RRT designs for estimating incidence do exist (Fox 2017). Simple adaptations can be made to designs already discussed. For example, the forced-response RRT can be altered so that polychotomous responses are provided (e.g., daily, weekly, monthly, annually, never) instead of dichotomous responses (i.e., 'yes' or 'no'), (de Jong et al. 2012). Asking respondents to provide truthful, or 'forced' answers from a wider range of options, each with a known probability can help reduce non-response bias by enabling respondents to provide answers which are more reflective of their true behaviour (Cerri et al. 2018; Cruyff et al. 2007).

The RRT can also be used to capture more quantitative estimates of incidence. The *quantitative RRT* design (also known as the *quantitative unrelated-question model*) was first proposed by Greenberg et al. (1971) and works in the same way as the unrelated-question with an unknown prevalence. The sample is split in two, each assigned a different probability of answering the sensitive question, but instead of a binary 'yes' or 'no' answer, respondents provide a numeric response (Fig. 4.2a). The mean incidence estimate is calculated using knowledge of the probability of receiving the sensitive question. To further develop the efficiency of this RRT design, Liu & Chow (1976) presented the *discrete-quantitative RRT* (sometimes known as the *quantitative forced-alternative*). This variation builds on the forced-response design and uses a randomiser to determine *how* the respondent should answer. For example, in their study, Liu & Chow (1976) developed a device which contained two different coloured balls (red and white). All the white balls were marked with a number (e.g., 0, 1, 2....) whilst red balls were unmarked. Respondents shook the device, if the ball that appeared in the window was red (or yellow in Fig. 4.2b), they were asked to provide an honest numeric response, if the ball was white, they reported the number on the ball. To avoid it being obvious which coloured ball was selected, the numbers listed on white balls all came from a similar distribution to the values expected through honest reporting (i.e., when red balls were selected). Because the probability of reporting white ball numbers is known, efficiency is increased (Fox 2017). Conteh et al. (2015) adopted this approach to quantify the number of illegal hunting trips undertaken into a forest reserve in Sierra Leone (although note ethical issues with this study see St John et al. 2016).

A further method of note is the *additive* or *contamination* RRT design (Fig. 4.2c). First proposed by Warner (1971), this design is like the *discrete-quantitative RRT* (Lui & Chow 1976) except all balls are marked with a number from a known distribution and respondents are asked to 'contaminate' their response by adding the randomly selected number to their numeric answer (Warner 1971; Fox 2017). A variation of this design,

known as the *partial-additive RRT* (Gupta & Thornton 2013) was applied by Robinson et al. (2015) to research reptile pet trade and demand for wildlife. Here, a proportion of respondents were required to answer truthfully (e.g., if they selected a card marked “zero”) and a proportion were asked to add the number on the selected card to their truthful response (Fig. 4.2d). Kim & Flueck (1978) note that additive models are efficient designs but warned they can increase cognitive load by requiring respondents to sum numeric values.

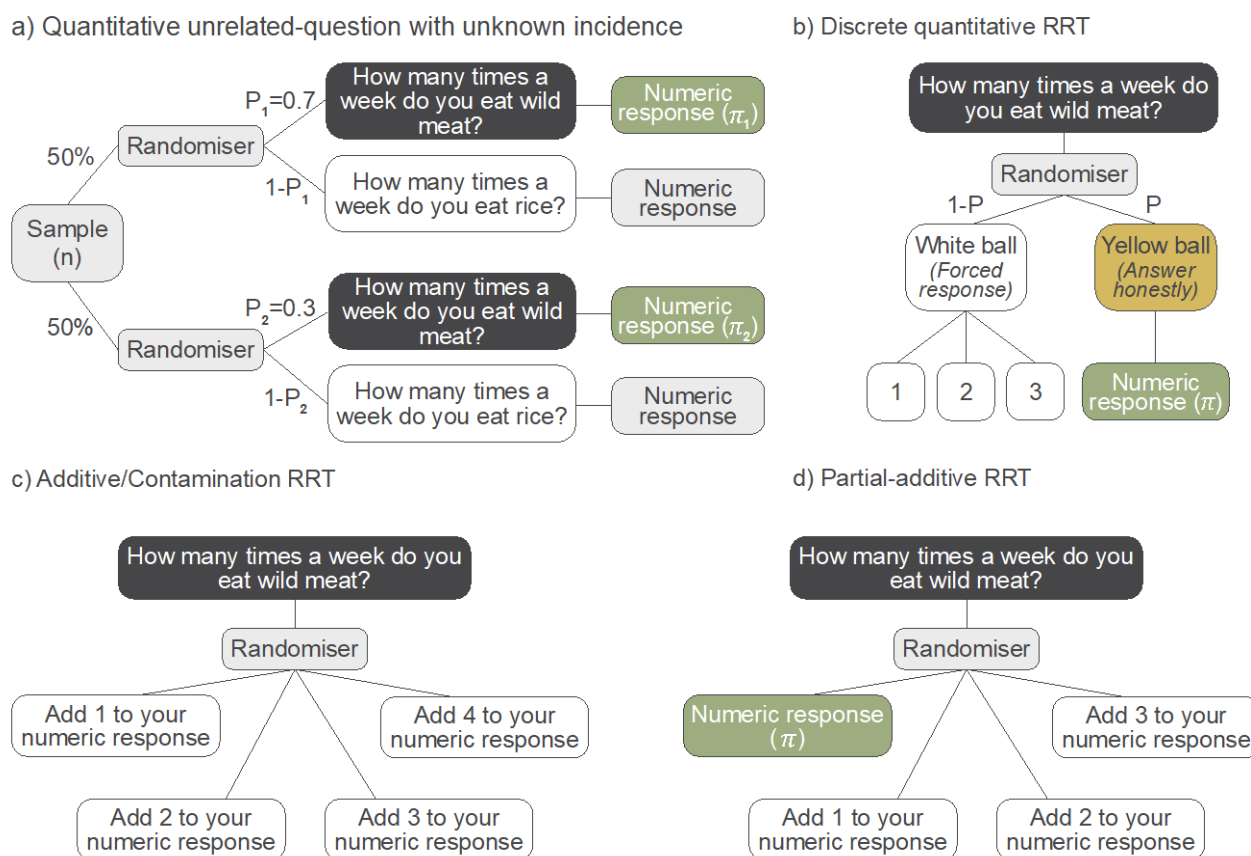


Figure 4.2. Probability trees for RRT designs that estimate how often (i.e., incidence) sensitive behaviours (such as consuming wild meat) occur. Light grey boxes represent the point at which the randomising device is used; dark grey boxes indicate the sensitive question; green boxes indicate the incidence estimate ( $\pi$ ),  $P$  = the probability of answering a question truthfully (forced-response design) or answering the sensitive question (unrelated-question design).

#### 4.2.5 Are RRTs effective at reducing bias?

Whether RRTs reduce bias is of key interest to conservationists considering their use. One of the key barriers to measuring their performance is the inability to validate results, which requires knowledge about the true prevalence of the sensitive characteristic, ideally at the level of the individual respondent (although

often aggregate data are used). A review of 35 years of RRT applications found only six studies where RRT estimates were validated using data on known prevalence (Lensvelt-Mulders et al. 2005b). Of these, a mean discrepancy of 42% was identified between the known prevalence and RRT estimates, with the effect size (i.e., the discrepancy between the values) increasing with question sensitivity. In the absence of reliable data against which to ground-truth estimates, RRT results are often compared to estimates derived from asking people sensitive questions directly; if RRT estimates are significantly higher, then RRT is deemed to have successfully reduced bias (Blair et al. 2015). However, evidence suggests RRTs are not universally successful, with reviews documenting examples where RRT estimates were lower than those of alternate methods (Lensvelt-Mulders et al. 2005b; Umesh & Peterson 1991).

A range of reasons exist for why RRTs are not always effective. Compared to other Specialised Questioning Techniques, RRTs are reported to be harder for participants to understand (Coutts & Jann 2011; Davis et al. 2019). Studies have shown that perceptions of privacy can be low (Hoffmann et al. 2017; Höglinger et al. 2016), that randomising devices place excessive cognitive load on respondents (Razafimanahaka et al. 2012; Solomon et al. 2007) and may create distrust towards researchers (Tan et al. 2009) meaning respondents are unwilling or unable to respond to researchers' questions as instructed. Further, although RRTs protect individuals, the wider purpose of the method is to reveal group behaviour. Therefore, where respondents are concerned about incriminating their group (e.g., their community, ethnic group or profession), RRTs may not work (Razafimanahaka et al. 2012).

Moreover, designs such as the forced-response RRT have been shown to evoke psychological resistance where respondents are required to give affirmative answers to actions they did not perform or characteristic they do not possess (Lee & Lee 2012). Evasive responding (also called self-protective responding, non-adherence or cheating) occurs when respondents answer "no" regardless of the outcome of the randomising device (John et al. 2018). It may be accidental (i.e., people fail to understand instructions and subsequently answer incorrectly (Clark & Desharnais 1998)), or deliberate (i.e., individuals anxious to protect themselves and/or avoid being identified as performing a sensitive behaviour purposefully manipulate their responses to avoid sensitive admissions (Moshagen & Musch 2012)). Measuring the extent to which RRT data suffer from evasive responses is possible but ethically questionable, as it requires deception. For example, suspecting respondents were failing to follow instructions, Edgell et al. (1982) published one of the first observations of non-adherence. They surreptitiously recorded the outcome of the randomising device and found 25% of respondents reported "no" when instructed to say "yes".

## 4.3 Methods

### 4.3.1 Search Criteria & Selection

In March 2019 and April 2020, we conducted systematic searches in Scopus and Web of Science using the search terms “Randomised Response Technique” and “Randomized Response Technique” (English and American spelling). We searched for any peer-reviewed articles published in English language journals, with no constraints on academic discipline since 1965 (Appendix 3, Fig. A3.1). The searches provided 1508 articles, including 398 duplicates. The title of each article was scanned to identify whether it mentioned or suggested use of RRTs resulting in 502 articles retained for abstract screening. Abstracts were read to identify a) whether the study collected empirical data using RRTs, and b) whether the study researched a conservation issue including hunting, fishing, wildlife trade or consumption or other forms of natural resource extraction. Conservation articles were included regardless of publication date, while we only included articles from other disciplines published after 2000, as the last substantial review of RRT was published in 2005 (Lensvelt-Mulders et al. 2005b). In total, 127 articles thought to use RRTs were forwarded for full review. Of these, five were inaccessible. A further 32 were excluded as they either focused on refining RRT design (n=9), did not use RRT (n=15) or discussed RRTs but did not provide prevalence estimates (n=6), one article was not peer reviewed, while one article provided insufficient information. In addition, we identified five conservation articles recently published or published in journals that were not identified in the database searches and added them to the sample.

### 4.3.2 Data extraction

In total, data were extracted from 98 studies in 95 articles (three articles included two studies) (See Table A3.1 in Appendix 3 for a full list of articles reviewed, organised by discipline). For each study, we recorded study location, research topic, and its sensitivity using categories defined by Hinsley et al. (2018) (non-compliant or illegal behaviour (e.g., smuggling or illegal hunting); socially undesirable behaviour (e.g., promiscuity); socially undesirable views (e.g., racism); personal or health (e.g., being HIV positive), and socially desirable behaviours (e.g., recycling). We documented survey administration (sample size, administration mode), RRT method (design used, instructions provided to respondents, randomising device, probability of receiving the sensitive question or providing an honest response, probability of a forced-yes or forced-no response, if pilot study was conducted), and whether RRT estimates were validated using data on known prevalence (e.g., government records), or compared to estimates derived using other methods. We recorded the analyses conducted (statistical tests, power analysis, software used), how results were presented, the error reported, and if applicable, whether RRT estimates were statistically higher, lower or the same as those derived using other methods. We documented if authors measured respondents’ level of understanding and perceptions of privacy, if free prior informed consent was sought, and whether confidentiality and anonymity was assured. The full review protocol is available in Appendix 3.

### 4.3.3 Analyses

We present a timeline of key events in the development of RRTs and describe variation in study design, administration, and results. We review performance by summarising results from validation studies, and then assess whether RRT estimates were significantly higher or lower than estimates derived using other questioning methods. In instances where 95% confidence intervals between estimates overlapped, we concluded there was no significant difference in performance. When RRT estimates were higher than those of other methods, we assumed RRTs were successful at reducing bias, and vice versa when RRT estimates were lower. To investigate which aspects of RRT design affected performance, we ran an ordered logistic regression with a random effect for study using the 'clmm' function in the 'ordinal' package in R (Christensen 2019). Due to limited sample sizes, we only used data from studies that used a forced-response or unrelated-question design and compared RRT estimates to direct questioning. We included RRT design, administration mode, the probability of receiving the sensitive question, whether the RRT and direct question data were collected from the same or different samples, and the type of randomising device used as predictors. All predictors were all checked prior to modelling for collinearity. We then assess how well respondents understood the RRT process in each RRT study, and where possible, examine the level of evasive responding.



## 4.4 Results

### 4.4.1 Types of study

In the 98 studies reviewed, RRT was used to investigate a range of topics including doping in sport (15% of studies reviewed), sexual behaviour (10%), and drug use (5%) (Appendix 3, Fig. A3.2). We identified 32 studies (33% of all studies reviewed) that used RRT to research conservation topics including illegal hunting of wildlife (44% of conservation studies), breaches of fishing regulations (38%), consumption of wildlife (12%), and illegal extraction of natural resources from protected areas (6%). The first recorded use of RRT in conservation estimated illegal deer hunting in the USA in 1980 (Fig. 4.3). Across all studies, authors justified the use of an RRT where the topic was illegal or non-compliant (67% of all studies) or involved a socially undesirable behaviour (26%) or view (7%) (Appendix 3, Fig. A3.2). The greatest number of RRT studies were conducted in Germany (24% of all studies), followed by the USA (12%) and UK (8%). Conservation studies were conducted across a wide geographic range; most in the USA (n=4) (Appendix 3, Fig. A3.3).

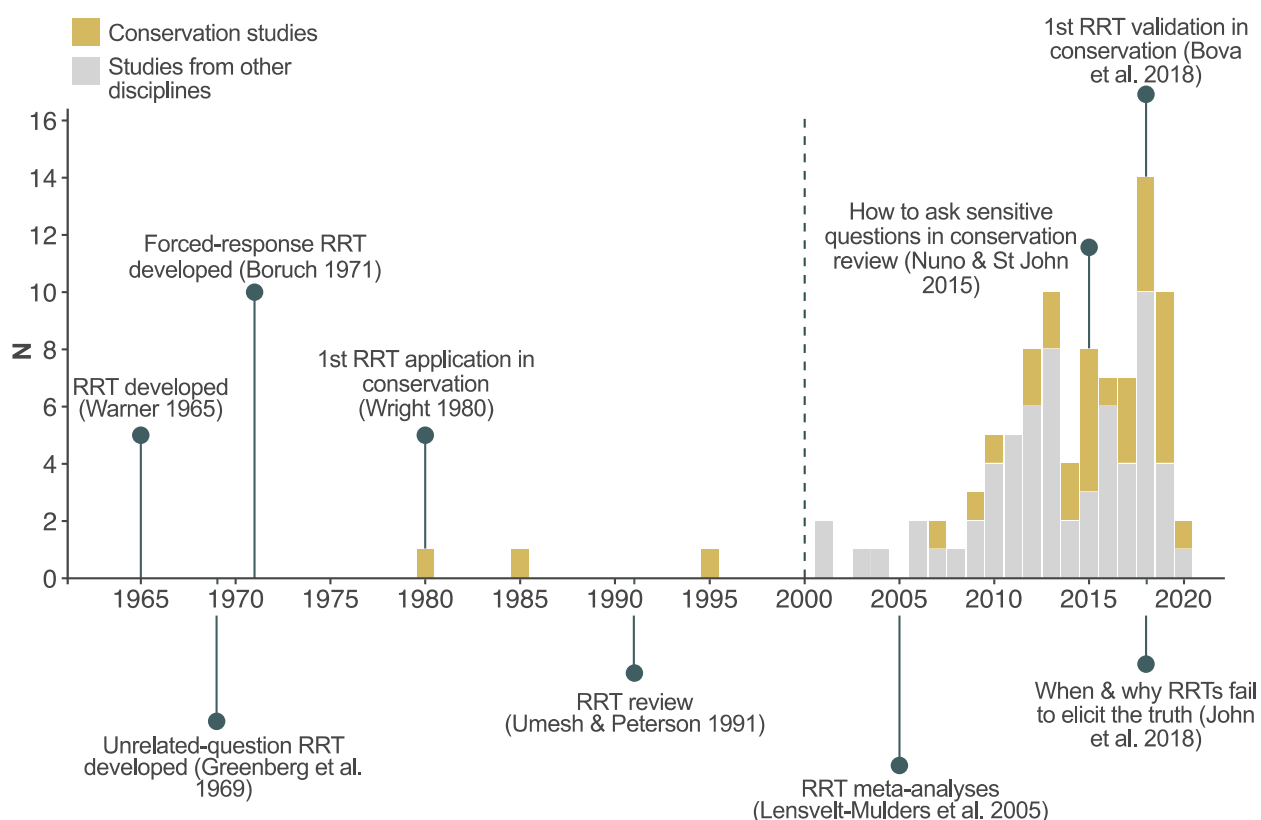


Figure 4.3. Timeline showing key dates in the development of RRTs, and the number of empirical studies reviewed in this analysis (from conservation and other disciplines) published per year to April 2020. Dashed line indicates the year (2000) after which studies from other disciplines were included (see methods).

#### 4.4.2 Data collection approaches

Surveys were predominately administered face-to-face (50% of all studies) or were self-completed (28%) (of which 75% used ballot-boxes to assure additional anonymity), delivered online (21%) or via telephone (3%). Administration mode was not listed in one study, while more than one method was used in four studies. Compared to other disciplines, a greater proportion of conservation surveys were administered face-to-face (87% of conservation studies), with fewer self-completed (15%) or administered online (3%) (Appendix 3, Table A3.2).

The number of respondents included in each study varied considerably (median=714, IQR=298–1862,  $n=98$ ), with the mean number of respondents significantly higher for studies conducted in other disciplines (median=1144, IQR=552–2075,  $n=66$ ) than conservation (median=279, IQR=169–501,  $n=32$ ) ( $t=-4.628$ ,  $df=92.252$ ,  $p=0.000$ ). Only 28% of studies reported conducting a pilot study or pre-testing the survey instrument prior to data collection.

#### 4.4.3 Variations in RRT Design

##### *Design type*

The most employed RRT design was the forced-response (51% of all studies, 69% of conservation studies), followed by the unrelated-question design (including the paired-alternative) (39% of all studies, 25% of conservation studies); 'incidence' designs (e.g., an additive, discrete-quantitative or quantitative unrelated-question design) were used in 10% of studies, while 11% adopted other rarely used RRT designs (e.g., multi-group item randomised response (de Jong et al. 2012)) (Fig. 4.4). Most studies used one RRT design (92%) whilst 5% employed two RRTs, usually to derive different types of estimates (e.g., prevalence and frequency estimates), or to compare different RRT designs. Three studies (3%) used three RRTs. Quantitative or additive RRTs were used in 16% of conservation studies to estimate incidences such as the number of fish caught, or number of hunting trips conducted.

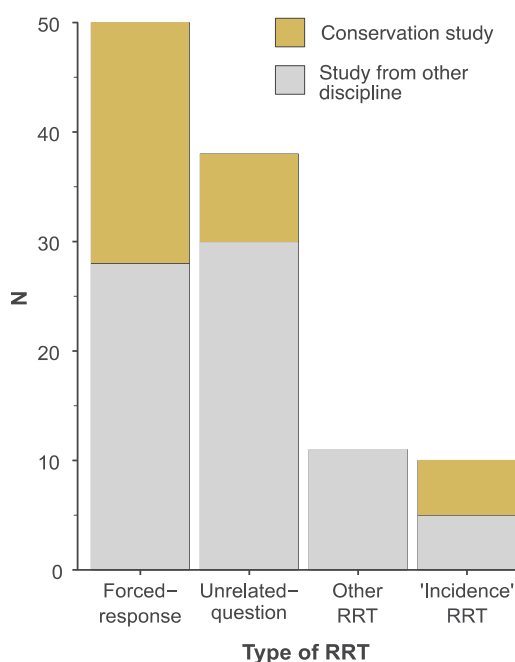


Figure 4.4. Types of RRT design used. 'Incidence' RRT design represents studies which used RRT to estimate frequencies associated with the sensitive characteristic (e.g., additive, or quantitative RRT designs)

#### *Probability of answering the sensitive question*

The majority (68%,  $n=34$ ) of forced-response RRT questions used symmetrical designs, the mean probability of being required to provide a truthful response was 0.72 (min=0.33, max=0.9), forced-yes was 0.16 and forced-no was 0.13. In the 32% of studies that used an asymmetric forced-response design, the mean probability of being asked to answer truthfully was lower (0.57, min=0.5, max=0.67), and the mean probability of providing a prescribed response, higher (0.44). Within conservation, most studies used a symmetrical forced-response (63% of conservation studies).

For the unrelated-question RRT, the mean probability of receiving the sensitive question was 0.62 (min=0.5, max=0.83). Unrelated-question designs used innocuous questions for which the probability was known (74% of unrelated-question studies) and unknown (21%), insufficient detail was provided for two studies. The two most common types of innocuous question with known probabilities asked about a birth date or month or used a paired-alternative design. This approach was commonly used in (18% of conservation studies).

#### *Randomiser choice*

A variety of randomising devices were used including dice (28% of all studies), coins (16%), birth dates (15%), a 'lucky dip' (e.g., counters picked from a container, 13%), tables or lists of numbers which respondents selected from and then matched with electronically generated numbers (11%), deck of cards (9%); 16% used other methods (e.g., Benford's law, free choice, a spinner, numbers listed on bank notes). One study incorrectly conducted randomisation at the group level, rather than individual. No information on

the randomising device was provided in one study. Within conservation, the most used devices were dice (47% of conservation studies), 'lucky dips' (22%), coins (22%), playing cards (6%) or lists of numbers of respondents had to select from (3%).

#### *Number of RRT questions asked*

Respondents were required to answer a mean of five RRT questions per study, 89% of studies asked fewer than 10 RRT questions per respondent, although one study asked 29 RRT questions per respondent. Conservation studies usually asked about multiple forms of rule-breaking within one study, for example, breaches of several different fishing regulations (quotas, fishing gear, fish size), or the killing of several different wildlife species.

#### 4.4.4 How were RRT data analysed?

Most (56%,  $n=55$ ) studies presented results with confidence intervals (usually at the 95% level), 15% of studies provided standard errors, 4% presented standard deviation, variance was provided but unidentified in 2% of studies, while 27% of studies failed to provide any estimates of variance. To account for the additional uncertainty introduced by the randomising process, 22% of studies reported bootstrapping to derive confidence intervals. Power analyses were conducted prior to data collection in 12% of studies to predict whether the sample would achieve sufficient statistical power. Most studies reported prevalence estimates only (68%), while 31% conducted multivariate analyses, usually using specialised forms of logistic regression or multinomial processing trees to account for noise added by randomisation processes. Prevalence estimates were most often presented in tables (53% of all studies), graphically (32%) or listed in the text (19%). A variety of software was used to analyse data, including R (20% of studies), SPSS (13%), multiTree (4%), or STATA (3%).

#### 4.4.5 Performance of RRTs

RRT estimates were rarely validated using data on known prevalence of sensitive behaviours. Only six studies, published in five articles did so. In these studies, validation data were collected before survey administration (e.g., from government records or covert observation). In one study, RRT overestimated the known prevalence of the sensitive characteristic by 0.2%; but in all other studies RRTs underestimated prevalence (min: 5.9%, max: 55.7%, Appendix 3 Table A3.3). Findings highlight significant variation in RRT performance and suggest RRTs may be prone to underestimating true prevalence.

Nearly half the studies (46% of all studies,  $n=45$ ) compared RRT estimates to those derived using alternate methods. Most (96%,  $n=43$ ) compared RRTs to direct questions, while 29% ( $n=13$ ) compared RRTs against other methods. In conservation, 47% of studies compared RRT estimates against direct questions (93% of conservation studies that compared estimates), or other Specialised Questioning Techniques (16%, e.g., UCT, bean method, false consensus, nominative technique). In other disciplines, RRTs performed better than direct questions across 61% of the questions asked, while in conservation, only 30% of RRT estimates

were significantly higher than those of direct questions (Fig. 4.5). When compared to Specialised Questioning Techniques, a greater proportion of conservation RRT estimates performed better than other disciplines (50% vs. 10%) (Fig. 4.5). Overall, RRTs provided estimates better than, or equal to (i.e., no significant difference between estimates) those derived using alternate methods most of the time (Fig. 4.5).

Ordered logistic regression suggested RRTs were more likely to secure higher estimates less affected by bias when they allocated a lower probability of answering the sensitive question, used an unrelated-question rather than forced-response design, and responses for each method were collected from separate respondents (rather than respondents answering the same question using two methods). We found no significant effect for randomising device or administration mode (Table 4.1, Appendix 3 Fig. A3.4).

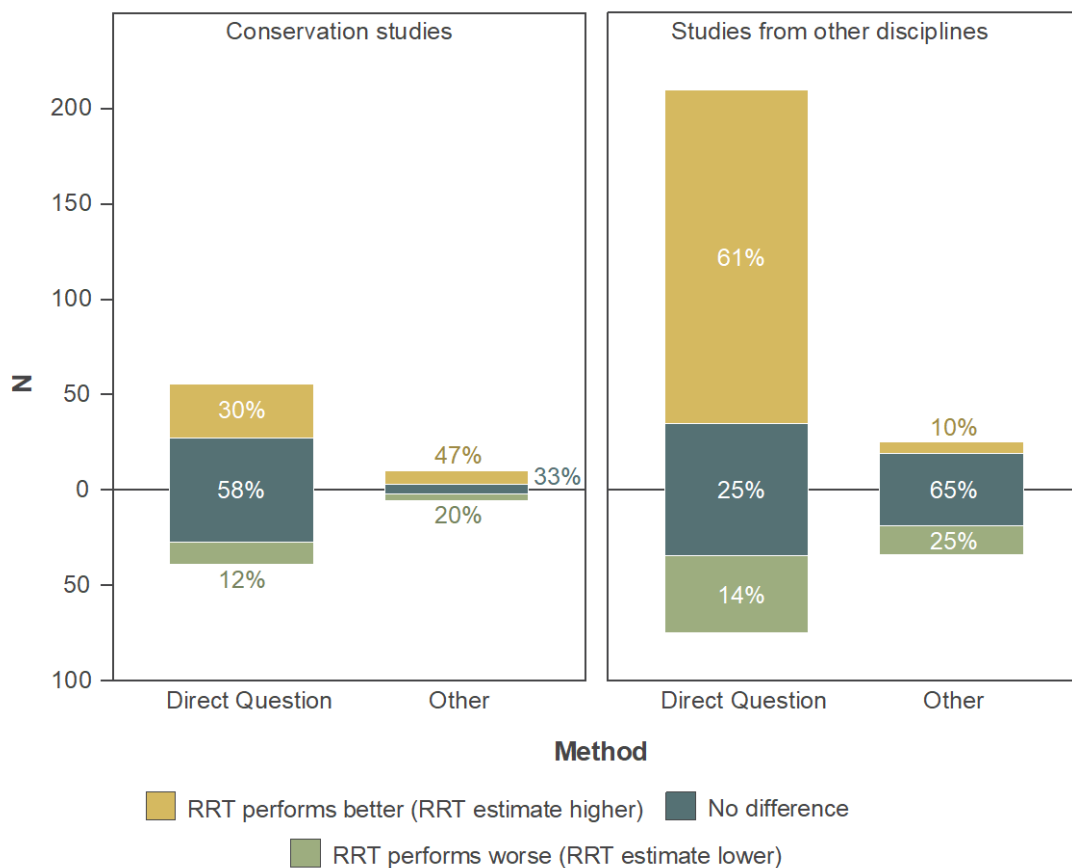


Figure 4.5. Performance of RRT compared to direct questioning and other Specialised Questioning Techniques (SQT, e.g., the Unmatched Count Technique). Data were available from 43 studies (14 conservation studies, and 29 studies in other disciplines), which asked 319 sensitive questions. Some questions were duplicated (i.e., when more than one method was tested in a study), providing a total of 452 prevalence estimate comparisons.

Table 4.1. Co-efficient, standard errors, z-values, and p-values from an ordered-logistic regression (with study included as a random-effect), fitted to assess which factors influence whether RRTs estimates are higher, lower, or indifferent to those derived from direct questions. Comparisons were made between 231 questions across 32 studies. Text in **bold** represent p-values which had statistical significance of <0.05.

Predictors		Value	SE	z-value	p-value
Probability of responding truthfully		-5.34	2.30	-2.32	<b>0.02</b>
RRT design	Forced-response <sup>Ref</sup>	-	-	-	-
	Unrelated-question	1.72	0.55	3.15	<b>0.00</b>
DQ & RRT response from separate samples <sup>Ref</sup>		-	-	-	-
DQ & RRT response from same sample		-1.27	0.59	-2.15	<b>0.03</b>
Randomising device	Personal number (e.g., birth date) <sup>Ref</sup>	-	-	-	-
	Physical (e.g., dice, cards)	1.41	0.89	1.59	0.11
	Virtual (e.g., online spinner)	2.55	1.31	1.95	0.05
Administration mode	Face-to-face <sup>Ref</sup>	-	-	-	-
	Online	-0.19	1.07	-0.18	0.86
	Self-complete & ballot	0.70	1.08	0.65	0.52
	Telephone	-0.34	1.16	-0.30	0.77
<i>Intercepts between categories:</i>					
RRT performed worse than DQs   No Significant difference		-4.88	1.79	-2.74	<b>0.00</b>
No significant difference   RRT performed better than DQs		-2.04	1.76	-1.16	0.25
Log Likelihood		-176.46			
AIC		374.92			
BIC		412.64			
Num. obs.		228			
Groups: (Study)		31			
Variance: Study (Intercept)		0.66 (SD: 0.811)			

<sup>Ref</sup> – Reference categories

#### 4.4.6 Measuring respondents understanding and adherence to RRT instructions

Overall, respondents' understanding of RRTs was poorly measured and rarely tested. Only 19% of studies (n=19) discussed respondent's understanding of RRTs, of which 58% (n=10) explicitly measured it, usually by asking respondents to identify, on a Likert-type scale, how well they had understood the RRT process. In seven of these studies, high levels of understanding were reported. Numerous studies qualitatively reported that respondents failed to adhere to RRT instructions and instead gave evasive or self-protective responses

(e.g., by answering 'no' when they were required to provide a forced 'yes'). Nine studies used post-hoc statistical analyses to detect the proportion of respondents who failed to follow RRT instructions (known as 'cheating'). Across these studies a mean of 24.4% (min: 0%, max: 64.9%) of responses were thought to be evasive (Fig. 4.6). In addition, one conservation study (Chang et al. 2019) used item-response theory to estimate cheating in a study of bird hunting. They found 17.5% of all responses did not follow RRT instructions. A further five conservation studies reported that they suspected or knew respondents were failing to adhere to RRT instructions.

Respondents' perceptions of the anonymity offered by RRTs was measured in eight studies (8% of all studies), in six of these, most respondents reported they felt RRT increased protection. Only 49% of studies provided respondents assurances of anonymity before starting data collection, while 11% offered confidentiality, although this is likely an underestimate as information on ethical measures was often excluded from manuscripts.

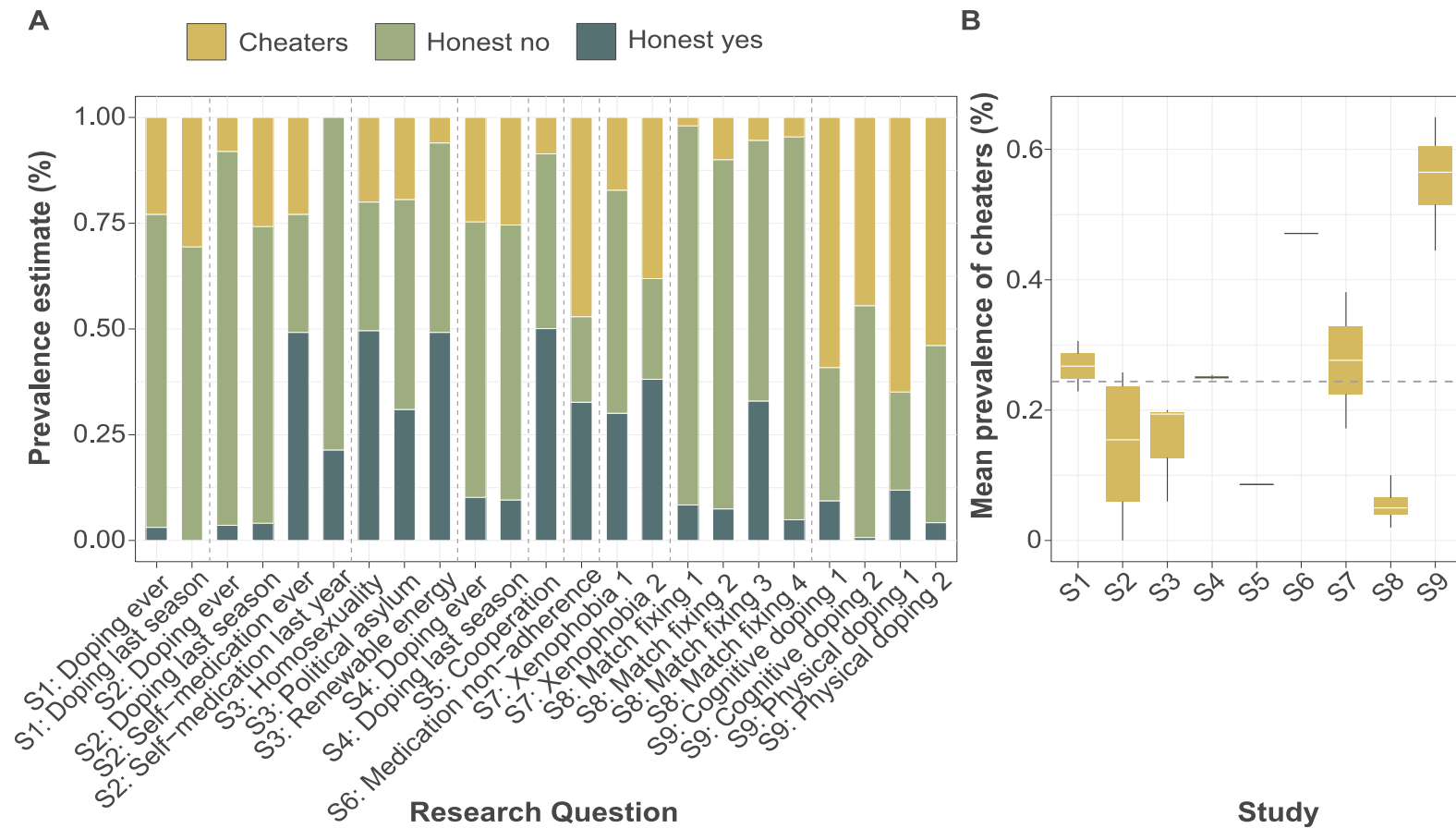


Figure 4.6. A) Prevalence estimates of the 23 sensitive questions asked in nine studies which used post-hoc analyses (Table A3.4 in Appendix 3) to estimate non-adherence to RRT instructions. Dashed lines indicate questions asked in studies S1-S9. B) Box and whisker plot of cheating prevalence per study; grey dashed line indicates mean estimate of cheating across studies S1-S9 (24.4%). Only one conservation study used post-hoc analyses (Chang et al. 2019), but findings are not included as estimates of cheating were derived across all RRT items, rather than for individual questions.



## 4.5 Discussion

Specialised Questioning Techniques such as RRTs are increasingly applied in conservation to overcome bias when investigating rule-breaking behaviours such as illegal fishing or hunting. The flexibility of the method, along with positive reviews of its performance suggests RRTs can overcome biases associated with research on sensitive topics. However, our findings, along with reviews by others (Cerri et al. 2021; Lensvelt-Mulders et al. 2005b; Umesh & Peterson 1991), highlight a need for caution; RRTs do not consistently provide 'better' results (Höglinger & Jann 2018). Validation studies reveal that RRTs typically underestimate true prevalence, and whilst RRTs typically out-perform direct questioning in other fields, our evidence suggests they do not yet do so in conservation. Using information collected throughout our review, we provide advice for conservationists on when RRTs should be used, alongside best practice guidelines when considering RRT design, delivery, and analysis.

### 4.5.1 When should and shouldn't RRTs be used?

Conservationists often investigate behaviours that involve endangered species or rare resources. An inherent reason why these are of conservation interest is due to their declining abundance, thus the prevalence of these behaviours is also likely to be scarce. Randomised response procedures add noise to data, meaning estimates suffer large standard errors, and reduced power (Lensvelt-Mulders et al. 2005b), as a result behaviours which are exceptionally rare can yield inconclusive results (for example, see St John et al. 2018). While increasing sample sizes can overcome this, often this comes at additional cost (e.g., time, money), or may be impossible if the target population is small. Thus, if researching behaviours that are predicted to be rare, and/or it is only possible to achieve a small sample size, qualitative methods, such as key informant interviews, may be more suitable (Davis et al. 2020). Before deciding whether to use RRT, or indeed any Specialised Questioning Technique, we recommend consideration of a range of factors, including how sensitive the topic is, the likely sample size and the type of estimate required (e.g., prevalence in the population, or an estimate of incidence) (Fig. 4.7).

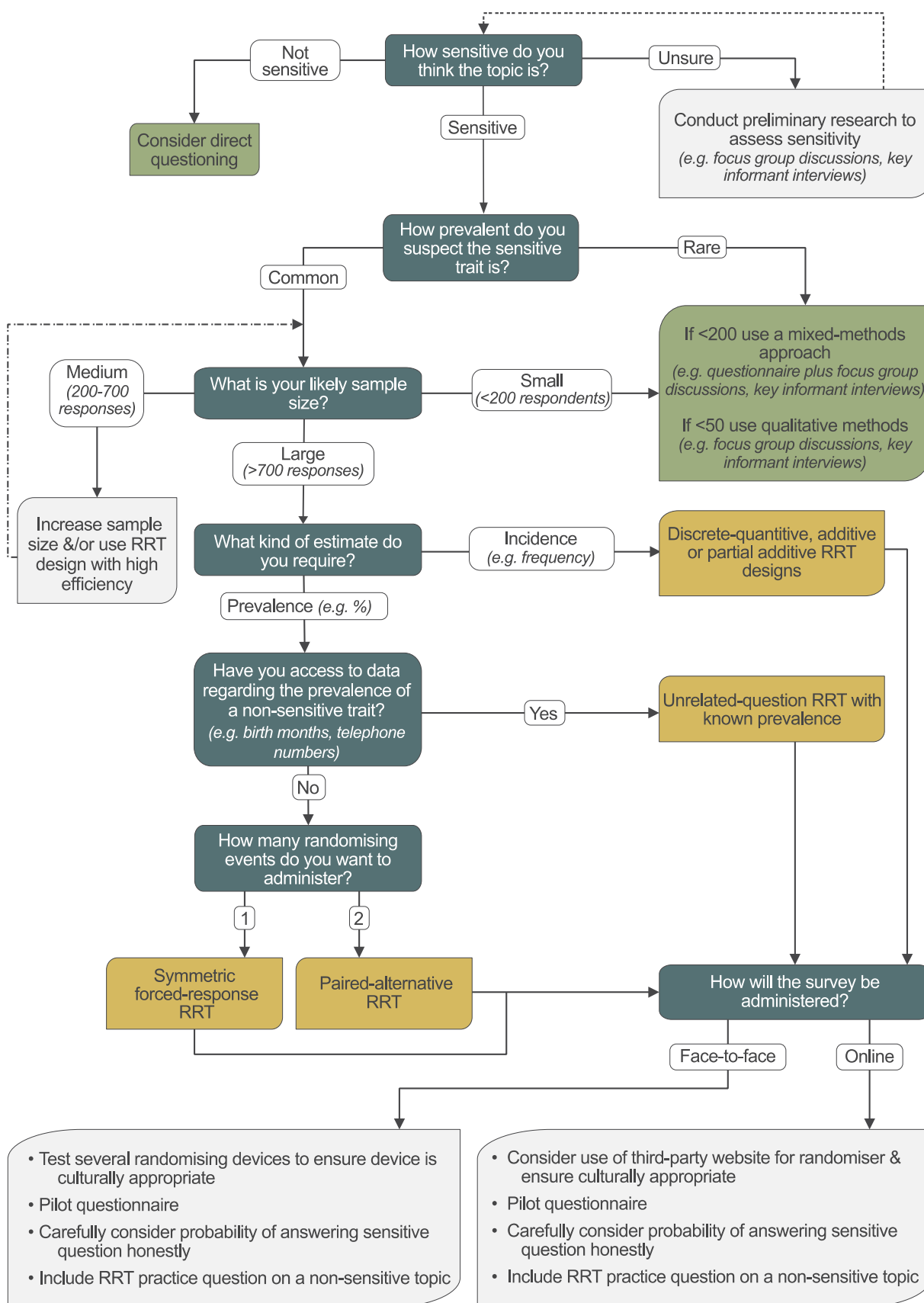


Figure 4.7. Decision tree to identify a) whether an RRT is appropriate (blue boxes), b) the most suitable RRT design (green boxes), and c) considerations to improve robustness (light grey boxes).

Having committed to incorporating RRT into a study, researchers must make decisions about RRT design and administration. The forced-response RRT and unrelated-question RRT have been identified as the most efficient designs (Lensvelt-Mulders et al. 2005a), while our model suggested the unrelated-question (including the paired-alternative design) was better at reducing bias. However, there are elements of both designs that can be adjusted on a case-by-case basis to improve performance. These include the probability of respondents answering truthfully ( $p$ ), and the type of randomising device used. The closer  $p$  is to 1, the more efficient the design, and the smaller the sample size required (Fox 2017). However, as demonstrated in our model, allocating a  $p$  value too high undermines the protection offered by the method, and can discourage truthful responding; set too low, and the number of affirmative responses may be insufficient to produce robust estimates. Research suggests the optimal value for  $p$  lies between 0.75 and 0.8 (Soeken & Macready 1982). Identifying a suitable randomising device is key. Ideally, randomisers should be simple, familiar, easy to use and importantly, trusted by respondents. Be aware, in some contexts, devices may have undesirable connotations, for example, when investigating bushmeat consumption in Madagascar Razafimanahaka et al. (2012) reported dice were associated with gambling. Consequently, they utilised a 'lucky dip' format and asked respondents to select different coloured balls from a bag. Moreover, when conducting experimental research to assess virtual/online randomisers, Coutts & Jann (2011) found automated randomisers were trusted less due to concerns of anonymity and randomiser manipulation. Directing participants to third-party websites can overcome this. For example, in their study of marijuana use, Cobo et al. (2017) encouraged respondents to download an independent card app which respondents used to randomly select a card from a deck and determine the answer they should give. This approach requires care to ensure randomising outcomes are not surreptitiously recorded by the website, as this would count as deceptive research with ethical implications. Testing several randomisers before data collection, paying close attention to how each device is received and asking respondents for feedback will ensure an appropriate device is chosen.

The type of randomiser used is also influenced by how surveys are delivered. Research has shown online response times can be quicker when using automated devices (e.g., electronic coin toss), and that devices that require shifts away from the survey mode (i.e., locating and manually tossing a coin) can induce higher levels of non-response (Coutts & Jann 2011). Making small tweaks to how randomisers are used can improve design efficiency. For example, using two dice (instead of one) and asking respondents to sum scores together, enables researchers to capitalise on people's poor calculations of probability, and provides respondents with an augmented sense of protection (Cross et al. 2013). If asked to provide a truthful response when 5-10 is scored, a respondent may believe they have a 0.5 chance of providing an honest response, yet they will roll a truthful score 75% of the time (Cross et al. 2013; Lensvelt-Mulders et al. 2005b). However, summing the scores of two dice together adds another step to the response process and may increase cognitive load. For devices other than dice, efficiency is improved more easily, for example, adding extra cards to a deck, or counters to a bag, increases the  $p$  but without increasing cognitive burden.

As with all methods, successful implementation depends upon rigorous piloting; for RRT, this includes trialling the script introducing RRT and the equipment (St John et al. 2014). Multiple rounds of piloting may be required if issues are detected (Newing 2011). Presenting the method as 'being like a game' with 'rules to follow', can help (St John et al. 2012; Razafimanahaka et al. 2012), as can practice questions about non-sensitive topics. This can help familiarise respondents with RRT processes and could involve role reversal, enabling participants to experience the process from enumerators' perspectives (St John et al. 2015). To study bird hunting in China, Chang et al. (2019) asked two training questions about common behaviours ("Do you play cards?", "Do you drink [alcohol]?") before sensitive questions to ensure respondents understood. Repeating this process until the enumerator is confident the respondent understands the process is important. If pre-tests indicate respondent concerns regarding privacy, consider mitigating these using additional measures (e.g., using a ballot-box if surveys are self-administered, revising the randomising device, reducing  $p$ ) (Arias et al. 2020; Krumpal & Voss 2020). If understanding is not reached, it is useful to provide enumerators with a mechanism to record this, so that potentially confused responses can be excluded from analysis. As with all research, who the enumerator is, is important. In Madagascar, Razafimanahaka et al. (2012) found recruiting someone from the same community to help explain RRTs to participants invaluable. They found that even though trained enumerators spoke local dialects, seeing a familiar person who was clearly comfortable with the method gave respondents the confidence to engage with it.

Small changes in how responses options are phrased can also impact results. During a series of online experiments, John et al. (2018) found that adapting the forced-response answer respondents were required to give, resulted in more accurate prevalence estimates compared to standard forced-responses. For example, changing binary "yes" or "no" responses to "yes, or flipped heads" or "no" increased the ambiguity of the response, and emphasized to respondents that saying meant "yes, I do the sensitive behaviour" and "yes, I flipped a head". The effect was strongest amongst respondents who did not possess the sensitive characteristic but were forced to respond affirmatively, this group were more likely to follow instructions when using the revised forced-response RRT. Interestingly, the effect became more pronounced when anonymity was assured, with the revised-RRT providing higher estimates than a normal forced-response RRT (John et al. 2018). Considering how instructions are delivered can also be effective. Instead of stating "*you must say yes*", greater responding may be encouraged by acknowledging that answers may be contrary to the truth, for example by saying, "*if your dice lands on 6, you simply have to answer yes, even if this is not your true answer*".

Our findings highlight that unlike other disciplines, most conservation RRTs are delivered face-to-face. Often this is because research is conducted in contexts where illiteracy is high and access to technology low. However, the uptake of non-face-to-face enumeration modes (i.e., online) will likely increase in conservation, particularly during the Covid-19 pandemic, and as technological access improves and the need to better understand behaviours and attitudes of those engaged in controversial topics (e.g., consumption of illegal wildlife products, trophy hunting) increases. Unlike face-to-face administration, it is more challenging

to provide respondents with tailored assistance when delivering surveys online. If respondents do not comprehend how RRT protects them, levels of self-protective answering may rise, especially if a forced-response RRT design is used (Höglinger et al. 2016). Careful thought and extensive pre-testing will help detect this. Providing respondents with clear, and culturally appropriate information about the research and how the data will be used is essential and should reassure concerned participants (Ibbett & Brittain 2020). Consent to participate should be given freely, and in return respondents should be provided with assurances of anonymity and confidentiality. Not only does this ensure ethical integrity (Brittain et al. 2020), but research suggests it can reduce bias (Ong & Weiss 2000).

Researchers often wish to understand which variables best characterise those who possess sensitive traits by conducting multi-variate analyses. However, due to the random noise added to RRT, specialised forms of analysis are required (Keane et al. 2015). Several software packages have been developed for this purpose. The R package 'rr' (Blair et al. 2015) enables logistic regression for four RRT designs as well as univariate power analyses, while the package 'RRreg' goes further and provides logistic and linear regression models for a large class of randomised response designs (Heck & Moshagen 2018). Analysis at the individual level can also be conducted by combining randomised-response approaches with item-response theory (Fox & Meijer 2008). Chang et al. (2018) developed an R package specifically for conservationists adopting this approach. 'zapstRR' includes code for univariate analysis of multiple behaviours (e.g., hunting more than one species), methods for estimating the total prevalence of the sensitive behaviour across all RRT questions (known as Sum Scores), plus code to estimate evasive-response bias (Chang et al. 2018). In addition, Cerri et al. (2018) provide R code for multi-variate analyses of RRTs with polychotomous response options. Multinomial processing-tree models, which involve approaches applied in psychology to model observed categorical frequencies as a function of a sequence of latent states can also be employed using 'multiTree' software (Moshagen 2010).

Overall, our understanding of the ability of RRTs to reduce biases is hampered by too few validation studies. The only conservation study to validate findings was Bova et al. (2018), who covertly observed fishers and later questioned those who breached regulations about their behaviour using RRT and direct questioning with ballot-box. Replicating this approach is challenging; behaviours often occur in secret (e.g., illegal hunting), in places difficult to observe (e.g., in dense forest), may place researchers and respondents at risk, and can raise ethical questions about the role of research. Wherever possible, multiple sources of data (e.g., key informant interviews, arrest records, previous studies) should be used to triangulate and corroborate findings from RRT studies. In conservation, there is a tendency to compare RRT data by asking respondents the same questions using different methods, however, this undermines the protection provided by RRTs (particularly if direct questions are used), can erode trust, and contribute to survey fatigue (Ibbett & Britain 2020). In other disciplines, best practice is to collect data from separate samples using different methods, ideally adjusted at a ratio of 2:1, where two RRT responses are collected for everyone direct question response (Razafimanahaka et al. 2012), our model also suggests this approach provides higher RRT estimates.

In other disciplines, experiments are increasingly applied to assess respondents' comprehension and willingness to follow RRT instructions (Hoffmann et al. 2017; John et al. 2018), such approaches would be informative (see Chapter 3). Amendments to RRT design and post-hoc analyses can also help to determine the proportion of respondents following RRT instructions. For example, the Cheating Detection Model developed by Clark & Desharnais (1998) is designed to quantify the extent of non-adherence to RRT instructions (Appendix 3, Fig. A3.4). Ostapczuk et al. (2011) used this approach to estimate the proportion of patients failing to take medication prescribed by their physician. Recently, the model has been extended to incorporate multiple RRT questions (Multiple issues cheating model, Moshagen & Musch 2012) and for use with unrelated-question RRT designs (Reiber et al. 2020). Advances also aim to account for situations where social desirability does not occur in the assumed direction. The no-cheater detection and total-cheater detection models aim to improve estimates of evasive responding under these scenarios (Feth et al. 2017). Applications of these variations remain rare in conservation (but see Chang et al. 2019), yet use would enhance researcher's ability to assess the reliability of RRT data.

#### 4.5.2 Conclusions

Our review demonstrates that RRTs have become an important tool for conservation researchers investigating sensitive topics. To date, they have been predominately applied in face-to-face research to quantify the incidence or prevalence of non-compliant behaviour, such as illegal consumption of wildlife, or breaching of fishing regulations. Within conservation, there is increasing recognition of the need to better understand human behaviour (Cinner 2018) and considering Covid-19, there is likely to be a shift towards more online data collection (Wardropper et al. 2021). Methods that can reduce bias when asking sensitive questions, which can be administered in multiple ways, are a valuable addition to the research toolbox. With more accurate data, conservationists can better target, and better evaluate the impact of interventions aimed at reducing rule-breaking (St John et al. 2013). By following our detailed guidance, conservation researchers can firstly assess whether an RRT is appropriate, and secondly, develop more robust research designs. We strongly emphasize that to be successful, RRT studies require careful piloting and a strong understanding of their strengths and limitations, as well as the context in which the study will occur.

# Chapter 5

Topic sensitivity still  
affects honest responding, even when  
Specialised Questioning Techniques  
are used



A focus group in Tanzania, conducted under the shade of a tree.

## 5.1 Abstract

To develop more effective interventions, conservationists require robust information about the proportion of people who break conservation rules (such as those relating to hunting quotas, protected species, or protected area legislation). Developed to obtain more accurate estimates of the prevalence of sensitive behaviours like rule-breaking, Specialised Questioning Techniques such as Randomised Response Techniques (RRTs) are increasingly applied in conservation, but with mixed evidence of their effectiveness. We use a forced-response RRT to estimate the prevalence of five rule-breaking behaviours in communities living around the Ruaha-Rungwa ecosystem in central southern Tanzania. Prevalence estimates obtained for all behaviours were negative or did not differ significantly from zero, suggesting the RRT did not work as expected and that respondents did not feel adequately protected. To investigate, we carried out an experimental study to explore how topic sensitivity influenced respondents' propensity to follow RRT instructions. Results revealed respondents understood instructions well (~88% of responses were correct) but that a respondent's propensity to follow RRT instructions was significantly influenced by the behaviour asked about, and the type of answer they were required to provide. Overall, our studies highlight that even if RRTs are well understood by respondents, where topics are very sensitive and respondents are wary of researchers, their use does not necessarily encourage more honest responding.

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## 5.2 Introduction

Rules are essential for the sustainable management of natural resources, threatened species and protected areas (Ostrom et al. 1999; Keane et al. 2008). To develop more effective interventions, conservation practitioners and policymakers require an understanding of what motivates people both to comply with, and to break, rules (St John et al. 2013; Arias 2015). However, obtaining information from people about their own compliance can be challenging. People may perceive discussions concerning prohibited resource extraction or use to be sensitive (Lee & Renzetti 1990) and as a result, a non-random proportion of respondents may refuse to participate or answer specific questions, introducing non-response bias (Fisher 1993; Tourangeau et al. 2010; Blair et al. 2020). Further, respondents may not provide accurate or honest answers because they fear being punished for declaring their involvement in rule-breaking (sensitivity bias, (Blair et al. 2020)); or because of a desire to project a more favourable image of themselves to others, or to conform to prevailing social norms (social desirability bias, (Krumpal 2013)).


To overcome this, conservation researchers are increasingly using Specialised Questioning Techniques; a suite of tools developed by social scientists to reduce bias and obtain more accurate estimates of the prevalence of sensitive behaviours such as rule-breaking (Hinsley et al. 2019; Cerri et al. 2021; Ibbett et al. 2021b; Chapter 4). With their flexible designs, which make it possible to capture different types of information, Randomised Response Techniques (RRTs) are the most common Specialised Questioning Technique applied to date in conservation (Ibbett et al. 2021b; Chapter 4). RRTs typically rely on a randomisation process (e.g., the flipping of a coin, or rolling of a die, see Box 5.1), to determine the type of answer a respondent should give (e.g., a prescribed, or truthful response) (Fox 2017). Crucially, the result of the randomising process is never revealed to the researcher, but by using the known probability of each option being selected, researchers can estimate the prevalence of the sensitive trait (Warner 1965). By introducing an element of uncertainty into the response process, RRTs are proposed to provide respondents a greater sense of protection above and beyond simple guarantees of anonymity (St John et al., 2012), and thereby encourage more honest answers (Fox 2017). Consequently, RRTs have been used to explore a variety of conservation topics including illegal consumption of giraffe meat in Kenya (Ruppert et al. 2020) and bear bile in Cambodia (Davis et al. 2019), non-compliance with fishing regulations in New Zealand and Chile (Thomas et al. 2015; Oyanedel et al. 2017), and hunting of protected species in Indonesia (St John et al. 2018) and China (Chang et al. 2019).

Box 5.1. Example of RRT instructions provided to respondent when asking about sensitive topics. This design, which uses a randomising process to determine how the respondent should answer, is known as a 'forced-response' RRT.

Roll the die & answer the question using the following instructions:

- If you roll a **1, 2, 3, or 4**, you must **answer** the question **honestly**
- If you roll a **5**, you must **answer yes**, regardless of whether this answer is true for you
- If you roll a **6**, you must **answer no**, regardless of whether this answer is true for you

Do not say which number you rolled



**In the last 12 months, have you entered a protected area to hunt wildlife?**

Despite their widespread use, the ability of RRTs to reduce bias and increase response accuracy when discussing sensitive topics is unclear (Umesh & Peterson 1991; Lensvelt-Mulders et al. 2005b; Ibbett et al. 2021b; Chapter 4). While some comparative studies suggest RRTs produce higher, and presumably more accurate estimates than conventional methods such as direct questions (e.g., Cerri et al. 2017; Carvalho 2019), evidence from the few validation studies that exist, suggest RRTs often underestimate prevalence (Lensvelt-Mulders et al. 2005b; Rosenfeld et al. 2016; Bova et al. 2018). Some researchers suggest that the method confuses respondents (Razafimanahaka et al. 2012), and uncertainty remains as to how instruction comprehension and topic sensitivity influence respondents' propensity to answer accurately, potentially introducing other forms of error. For example, respondents may provide inaccurate answers because they do not understand RRT instructions, or because they choose not to follow instructions (known as evasive response bias) (Clark & Desharnais 1998; John et al. 2018). Deliberate inaccurate, or evasive answering has repeatedly been raised as a concern of RRTs, particularly forced-response designs (as described in Box 5.1) which by their very design instruct a known proportion of respondents to report possession of the sensitive characteristic, irrespective of whether this answer accurately reflects their own behaviour; understandably, respondents can be reticent to follow such instructions (Clark & Desharnais 1998; Feth et al. 2017; John et al. 2018). In recent years, advanced statistical measures have been developed to calculate the proportion of a sample who do not follow RRT instructions (i.e., the Cheater Detection Model, (Clark & Desharnais 1998)). However, these measures require specific design choices, large sample sizes, and are typically conducted post-hoc. Yet researchers need to know before conducting their research whether the questioning approach they choose is likely to be successful.

Given the increasing application of RRTs in conservation, understanding their effectiveness is of high importance for researchers, as well as practitioners and policymakers who require reliable data to make informed decisions. Recently, a study empirically tested understanding of forced-response RRT instructions (Ibbett et al. 2022; Chapter 3). Respondents living around protected areas in Indonesia and Tanzania were asked to imagine they were a fictional character, and to provide the response characters should give when

asked whether they conducted an illegal behaviour, hunting wildlife. Because the hunting status of each character was known, researchers could assess whether respondents provided accurate responses. Correct answers to the RRT questions were reasonably high (81% in Indonesia, and 80% in Tanzania). However, authors were unable to distinguish whether incorrect answers occurred because of poor understanding of RRT instructions, or because respondents understood instructions, but purposefully chose to ignore them due to concerns associated with the sensitivity of the research topic. This was particularly pertinent in Tanzania where additional research highlighted that discussing hunting wildlife was particularly sensitive in surveyed communities (Ibbett et al. *in review*; Chapter 2).

Here, we aimed to assess the performance of a forced-response RRT when asking communities living around protected areas questions about conservation non-compliance. To do so, we developed two studies. The first used a forced-response RRT to measure the prevalence of five prohibited behaviours. In the second study, we explored how topic sensitivity influenced respondents' propensity to follow RRT instructions. We compare findings from both studies and highlight some of the complexities that researchers must consider when deploying forced-response RRTs to investigate rule-breaking.

## 5.3 Methods

### 5.3.1 Study Area

Our research was conducted in communities surrounding the Ruaha-Rungwa ecosystem in central southern Tanzania (Fig. 5.1). Covering ~45,000km<sup>2</sup>, the landscape supports some of the largest remaining carnivore populations in Africa (Dickman et al. 2014), and is comprised of several protected area types, including community-managed Wildlife Management Areas, game-controlled areas, privately leased hunting concessions (e.g., Rungwa, Kizigo and Muhesi Game Reserves), and Ruaha National Park. In 2008, Usangu Game Reserve was incorporated into Ruaha National Park, making it one of the largest protected areas in Tanzania (Zia et al. 2011). Communities living within the landscape are ethnically diverse, and include traditional pastoralists (e.g., Sangu, Masai and Barabaig), and agro pastoralists (e.g., Hehe, Bena, Gogo) (Walsh 2007; Dickman et al. 2014). Historically, hunting and collection of natural resources, such as honey, were important livelihood activities (Walsh 2007). Today however, strict rules regulate the use of natural resources within protected areas, with the entrance to any National Park or Game Reserve for any reason (including collection of natural resources or grazing of livestock) prohibited without permission (Wildlife Conservation Act, 2009; National Parks Act, 2003). In addition, in Tanzania, all wildlife belongs to the state (Article 4, Wildlife Conservation Act, No. 5 2009), meaning it is illegal to hunt, kill or wound any wild animal anywhere, without permission (Article 55.1).

Non-compliance with protected area and wildlife rules has been identified as a conservation concern in the ecosystem (e.g. Beale et al. 2018; Hariohay et al. 2019). Previous studies have surveyed community members arrested whilst rule-breaking in Game Reserves (Hariohay et al. 2019) and interviewed key informants to explore whether poverty drives poaching (Knapp et al. 2017). Findings revealed arrests were made for a variety of transgressions including logging timber, hunting wildlife, grazing livestock, mining, and elephant poaching (Hariohay et al. 2019); and indicated high economic heterogeneity among households that illegally hunt (Knapp et al. 2017). To our knowledge, this is the first application of RRT to estimate prevalence of rule-breaking in the Ruaha-Rungwa ecosystem.

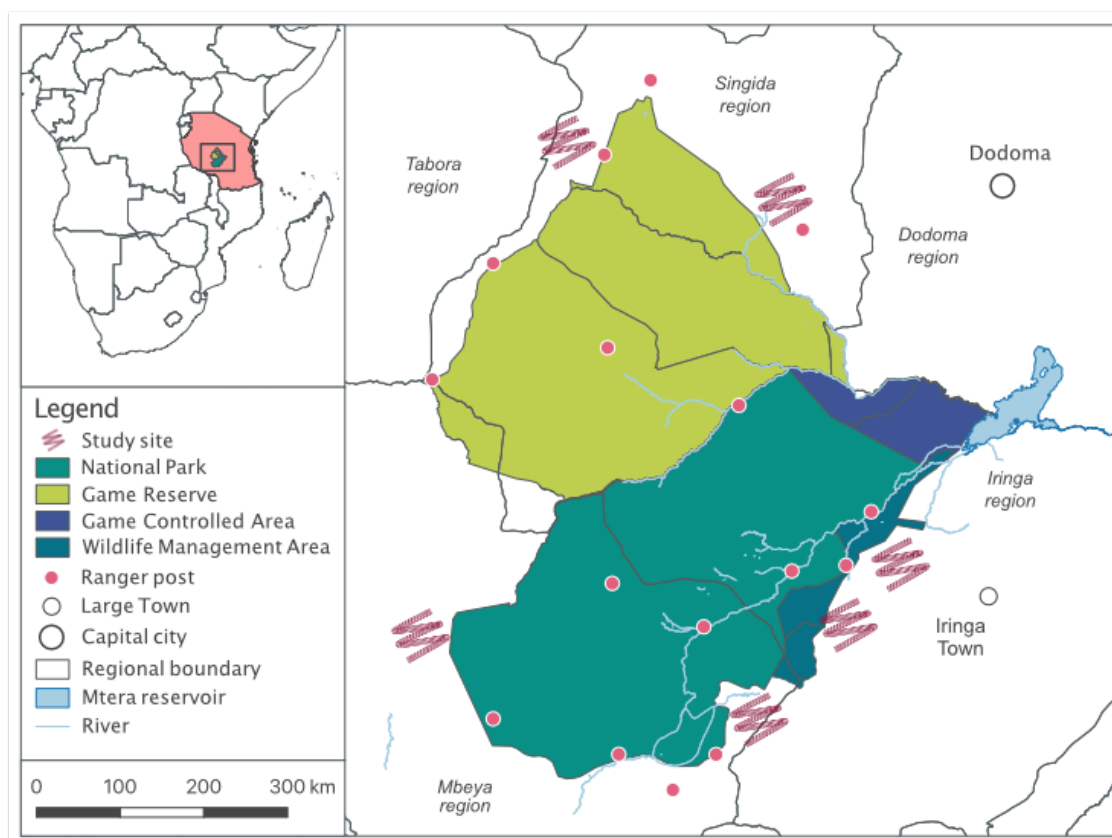


Figure 5.1. Data was collected in six villages situated around the Ruaha-Rungwa ecosystem in central southern Tanzania. In accordance with ethics approval, we do not indicate the precise locations of study villages.

### 5.3.2 Assessing the prevalence of respondents' rule-breaking behaviours (hereafter main study)

Previous research identified that people living in the Ruaha-Rungwa ecosystem enter protected areas for many reasons but are often unwilling to discuss doing so generally due to concerns about possible repercussions from law enforcement (Ibbett et al. *in review*; Chapter 2). To encourage more accurate responding, we used a forced-response RRT to ask individuals whether they conducted each of five prohibited behaviours in nearby protected areas. The behaviours identified as prevalent in protected areas during focus group discussions (Ibbett et al. *in review*. Chapter 2), were entering the nearest protected area for any reason without permission, as well as entering the nearest protected area for specific reasons including to: graze livestock; collect building materials; go fishing; and hunt wildlife. Because these activities were reported to be gendered, with men more likely to do them and women more likely to play a supporting role (unpublished data), we tailored questions according to respondent gender. Men were asked if they personally conducted the behaviour whilst for all behaviours except entering protected areas, women were asked if they encouraged the behaviour in other members of their household.

We first collected basic demographic data, including respondents' age, gender and years of schooling. To answer RRT questions on rule-breaking, respondents were provided a six-sided die in an opaque cup and asked to shake it prior to each question, without revealing the dice score to the interviewer. If a 1, 2, 3, or 4 was rolled (a probability of 0.66), respondents were instructed to answer truthfully whether they conducted (men only) or encouraged the behaviour (women only, except for entering protected areas). If a 5 was rolled, respondents were instructed to answer 'yes', regardless of whether this was their 'true' answer and if a 6 was scored, respondents were instructed to answer 'no' (probability 0.17 each). Piloting revealed that while some respondents associated dice (commonly used as randomisers in conservation RRT studies (Ibbett et al. 2021b; Chapter 4)) with gambling, overall, respondents were familiar and happy to use one.

### 5.3.3 Experimental study assessing effect of topic sensitivity on response accuracy (hereafter experimental study)

To assess whether respondents understood the RRT instructions and to explore how response accuracy varied with topic sensitivity, we adapted the experimental design of Ibbett et al. (2022; Chapter 3). We first explained how the RRT protects participants and then introduced cards depicting the behaviours of fictional characters. Respondents were asked to imagine they were each fictional character, and following the RRT instructions, answer questions about whether the fictional character conducted a specific behaviour (Fig 5.2). In the experiment, we used the same forced-response RRT design as the main study described above and asked about the same five rule-breaking behaviours. However, to assess whether topic sensitivity influenced responding, we included an additional non-sensitive behaviour, growing groundnuts. Farmed widely across the landscape, both for subsistence and commercial purposes (pers. comms), we assumed that individuals would have few concerns reporting whether fictional characters grew groundnuts. Thus, we hypothesised that any incorrect responses that occurred for this non-sensitive behaviour were likely to be because respondents did not understand the instructions, rather than because they understood instructions but chose to disregard them due to sensitivity concerns.

In total, we presented respondents with fourteen character cards (Fig. 5.2, Appendix 4). Of the fourteen fictional characters, the same two were always delivered first to introduce and practice the RRT. We only proceeded beyond these practice character cards once we were certain respondents understood RRT instructions. Of the remaining 12 characters, two were allocated to each of the six behaviours of interest; one character always conducted the behaviour of interest; one did not. To minimise order effects, we randomised the order characters were presented to respondents.

To assess whether individuals provided the correct answer, we asked them to report their dice score, after providing their answer. While this usually undermines the anonymity assured by the method and should never be done when using RRT to collect data on respondents' possession of sensitive traits, it was acceptable in this experimental study because we were collecting data on the behaviour of fictional characters. At the end of the experiment, respondents were asked how well they understood the RRT method, how easy RRT questions were to answer, how much privacy they perceived RRT provided, and how

comfortable they would feel providing honest responses about their own behaviours using RRT. Any specific feedback given to interviewers on the method or study was recorded. Interviewers also evaluated how well they thought the respondent understood the method, and whether they suspected the respondent of deliberately disregarding instructions. Basic demographic data (respondent age, gender, years of education) were also gathered, alongside respondent's familiarity with dice.

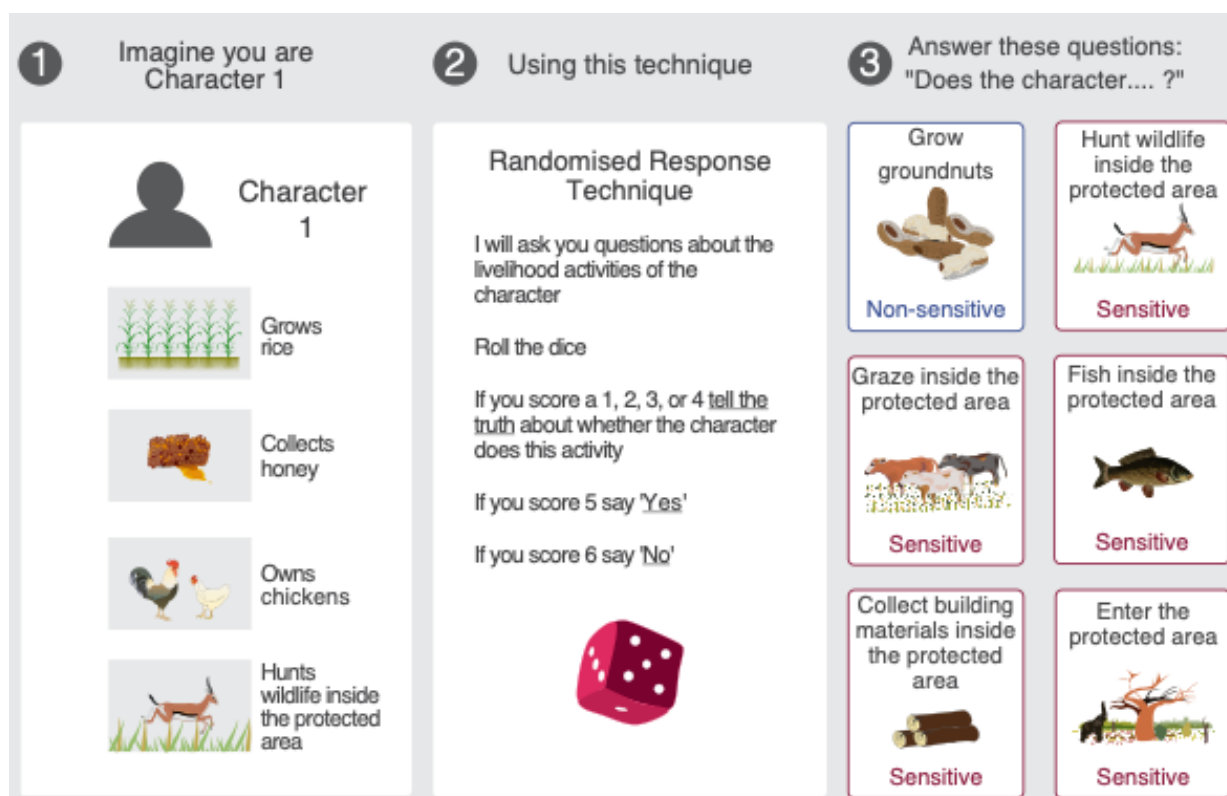


Figure 5.2. Example of a fictional character card (step 1, left), the instructions on how to answer the Randomised Response Technique (step 2, middle), and the six behaviours of interest respondents were asked about (step 3, right). One behaviour was a non-sensitive legal behaviour (outlined in blue), and five were potentially sensitive rule-breaking behaviours (outlined in red). Respondents were asked about the behaviour of two characters, for each of the six behaviours. Presumed sensitivity was not indicated to respondents.

### 5.3.4 Data collection

Data were collected between January 2020 and November 2021. To estimate the prevalence of rule-breaking (i.e., the main study) we selected villages proportionate to population size and recruited respondents using a random sampling strategy. To maximise admissions of rule-breaking, we biased survey effort towards men aged 18 to 55, who were more likely to be involved in rule-breaking (Hariohay et al. 2019; unpublished data). To reduce priming effects, our experimental study was conducted in neighbouring villages, with respondents recruited via convenience sampling. Because we wished to explore how

comprehension changed with gender, we sampled an equal proportion of men and women. Survey instruments were developed in English and translated into Kiswahili by two team members, and then independently backtranslated and piloted. Questionnaires were administered face-to-face by SS, JM, JK, RM. All data were collected using Open Data Kit (Brunette et al. 2013) on encrypted mobile phones (see Appendix 4).

### 5.3.5 Ethical considerations

All respondents were over 18 years old; with free, prior and informed consent obtained verbally. All data collected during the experimental study were anonymous, however, respondents in the main survey were given the option of providing contact details for follow up surveys if they wished. All identifiable data were encrypted at point of collected and pseudo-anonymised for analysis. As a token of thanks, respondents were given a voucher for a cell phone provider of their choice. Research was approved by Bangor CoESE Ethics Committee and fieldwork complied with all Tanzanian Covid-19 regulations, with health and safety measures implemented to mitigate against transmission in survey communities.

### 5.3.6 Analysis

We performed all analyses in R v3.6.2 (R Core Team 2019). In the main study, RRT prevalence estimates for each behaviour were calculated following Hox & Lensvelt-Mulders (2004):

$$\pi = \frac{\lambda - \theta}{s}$$

where  $\pi$  is the estimated prevalence of the behaviour in the sample,  $\lambda$  is the proportion of all 'yes' responses in the sample,  $\theta$  is the probability of providing a 'forced-yes' response (0.167), and  $s$  is the probability of answering the sensitive question truthfully (0.66). Bootstrapping, with 10,000 samples was used to calculate 95% confidence intervals.

For the experimental study, we calculated the overall proportion of correct responses for each behaviour. Using descriptive statistics we explored data, assessed respondent's understanding of RRT including compliance with instructions, and tested for collinearity between predictors prior to modelling. To examine what affected whether a respondent answered a question correctly, we fitted generalised linear mixed models using lme4 (Bates et al. 2015). The response variable was a binary indicator of whether a respondent gave a correct or incorrect answer to each question. Respondent gender, age, years of education and the type of response required (i.e., a yes to the sensitive behaviour, a yes to the non-sensitive behaviour, a no to the sensitive behaviour, or a no to the non-sensitive behaviour) were all included as fixed effects. We included a random effect to control for individual. Models were fitted using a BOBYQA optimizer to achieve convergence, were tested for singularity and showed no significant signs of dispersion when checked using DHARMA (Harting 2020).



## 5.4 Results

### 5.4.1 Main Study

#### *Prevalence of respondents' rule-breaking behaviour*

We asked 319 men and 105 women about their rule-breaking behaviour. Non-response rates were high (~10%) with 32 men and 10 women refusing to answer questions about any behaviour. Additionally, two women refused questions about entering protected areas, while one further woman did not answer about encouraging household members to collect building materials from inside protected areas.

Overall, prevalence estimates for all rule-breaking behaviours were very low (Fig. 5.3a). There was a notable difference in estimates between gender, with negative estimates obtained for men for three behaviours (hunting wildlife (-0.07 [lower 95% confidence interval:-0.12, upper confidence interval:-0.01]); grazing livestock (-0.08 [-0.13,-0.02]) and fishing (-0.06 [-0.11,-0.00]) and estimates that did not differ significantly from zero for two behaviours (entering protected areas (-0.03 [-0.09,0.03]), and collecting building materials inside protected areas (-0.03 [-0.08,0.04])). In contrast, prevalence estimates for all behaviours except entering protected areas for any reason without permission were positive for women (Fig. 5.3a). However, because of the small sample size, large confidence intervals overlapped with zero, indicating that prevalence did not differ significantly from zero for any behaviour.

### 5.4.2 Experimental study

#### *Proportion of correct responses for each behaviour*

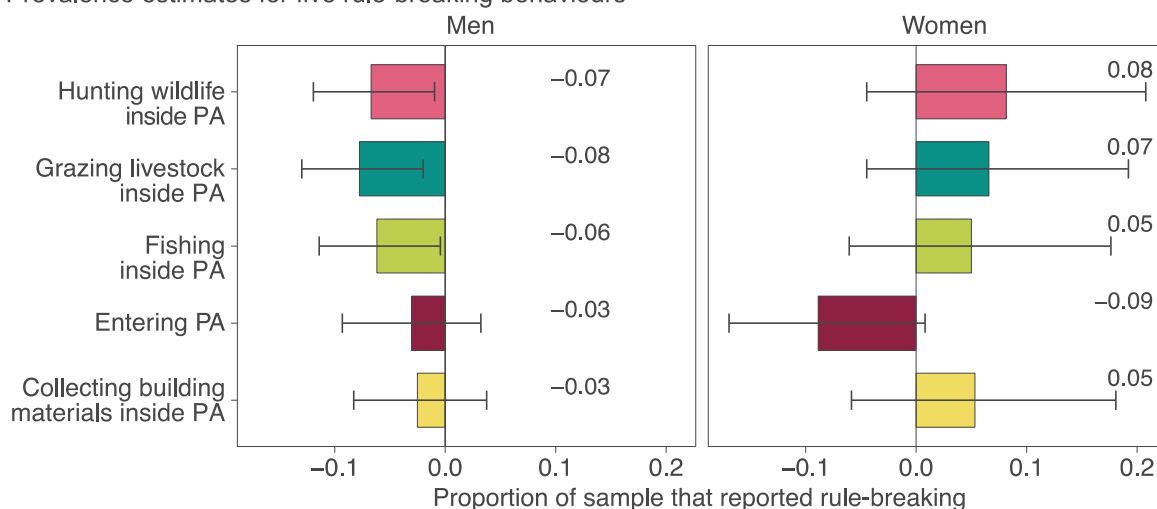
We surveyed 123 men and 120 women during the experimental study to assess how well our forced-response RRT design was understood, only one respondent refused to answer one question. Overall, respondents were more likely (but not significantly so) to answer correctly when asked about the non-sensitive behaviour (growing groundnuts) (Fig. 5.3b). The proportion of correct responses was slightly higher for men (0.89 [0.85,0.93]) than women (0.87 [0.83,0.91]).

#### *The type of response required significantly affected whether a respondent answered correctly*

When respondents had to answer 'yes' about the characters' behaviour (regardless of whether this was a truthful 'yes', or a 'forced' yes) for any of the rule-breaking behaviours, the likelihood of a respondent answering correctly was lower than when respondents were required to answer 'no' about the sensitive behaviour (either truthfully or 'forced') (Table 5.1, Fig. 5.3c). When required to answer 'yes', about whether the character grew groundnuts, the opposite was true, with respondents more likely to answer correctly than when they were required to answer 'no'. The type of 'no' (i.e., whether it was no to a sensitive behaviour, or non-sensitive behaviour). Demographic characteristics such as age, gender and education had no effect on response accuracy.

## Main Study

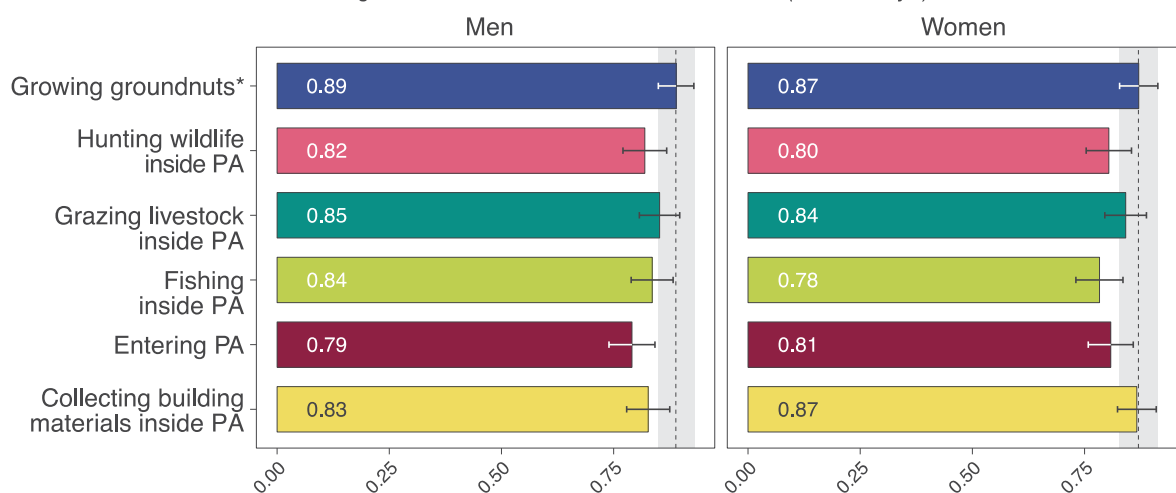
### A) Prevalence estimates for five rule-breaking behaviours



## Experimental Study

### B) Respondent understanding of RRT

*Dashed line shows mean & shading shows 95% CIs for non-sensitive behaviour (indicated by \*)*



### C) Affect of required response on answer accuracy

*Dashed line shows mean & shading shows 95% CIs for non-sensitive behaviour (indicated by \*)*

*Filled bars show when a 'yes' response was required, outlined bars show when a 'no' response was required*

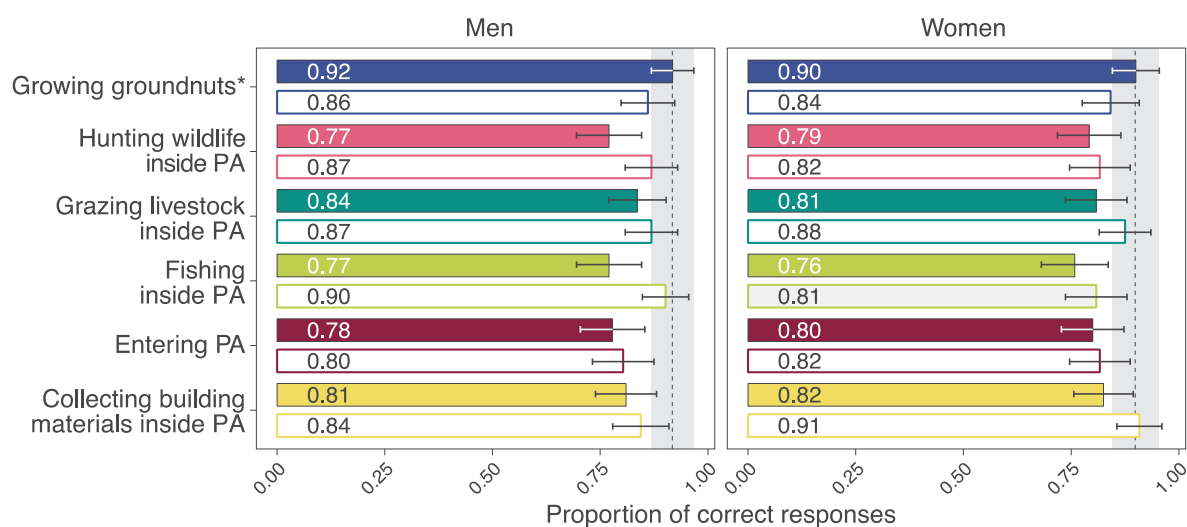


Figure 5.3. A) Prevalence of rule-breaking behaviours obtained in the main study using RRT (men, n=287; women, n=95 (n=94 for collecting materials, n=93 for entering PA)) with 95% CIs. B) Mean proportion of

correct responses when using RRT to answer questions about behaviour of fictional characters in the experimental study (men,  $n=123$ ; women,  $n=120$ ). C) Proportion of correct responses for each behaviour, separated by the type of answer required.

Table 5.1. Log-odds regression coefficients with 95% confidence intervals from a binomial general linear mixed model, with random effects for respondent. The binomial represents whether the respondent answered the question correctly, or not. Text in **bold** represent p-values which had statistical significance of  $<0.05$ .

Predictors	Log-Odds	95% CIs	p-value
(Intercept)	2.10	1.79 – 2.40	<b>&lt;0.001</b>
Age	0.10	-0.09 – 0.29	0.303
Years of education	-0.06	-0.24 – 0.13	0.554
Female <sup>Ref</sup>	-	-	-
Male	0.06	-0.30 – 0.43	0.746
Required to answer 'no' to sensitive behaviour <sup>Ref</sup>	-	-	-
Required to answer 'no' to non-sensitive behaviour	0	-0.41 – 0.41	1
Required to answer 'yes' to non-sensitive behaviour	0.62	0.13 – 1.11	<b>0.013</b>
Required to answer 'yes' to sensitive behaviour	-0.45	-0.68 – -0.22	<b>&lt;0.001</b>
Random Effects			
$\sigma^2$	3.29		
T00 id	1.18		
ICC	0.26		
N id	242		
Observations	2903		
Marginal R <sup>2</sup> / Conditional R <sup>2</sup>	0.25 / 0.282		

<sup>Ref</sup> = Reference category

When answering questions about the non-sensitive behaviour (growing groundnuts), dice scores reported by respondents did not differ from expected ( $\chi^2=2.4651$ ,  $df = 5$ ,  $p\text{-value} = 0.782$ ), suggesting that respondents followed instructions (Fig. 5.4). However, when asked to answer questions about a sensitive rule-breaking behaviour, the dice scores reported differed significantly from expected ( $\chi^2=16.167$ ,  $df = 5$ ,  $p\text{-value}=0.006$ ), with more individuals reporting that they obtained a forced-no score (i.e., that their die landed on 6), and fewer individuals reporting scores that required truthful answers (i.e., die landing on 1, 2, 3 or 4). The number of forced-yes responses reported (i.e., die landing on 5) was as expected.

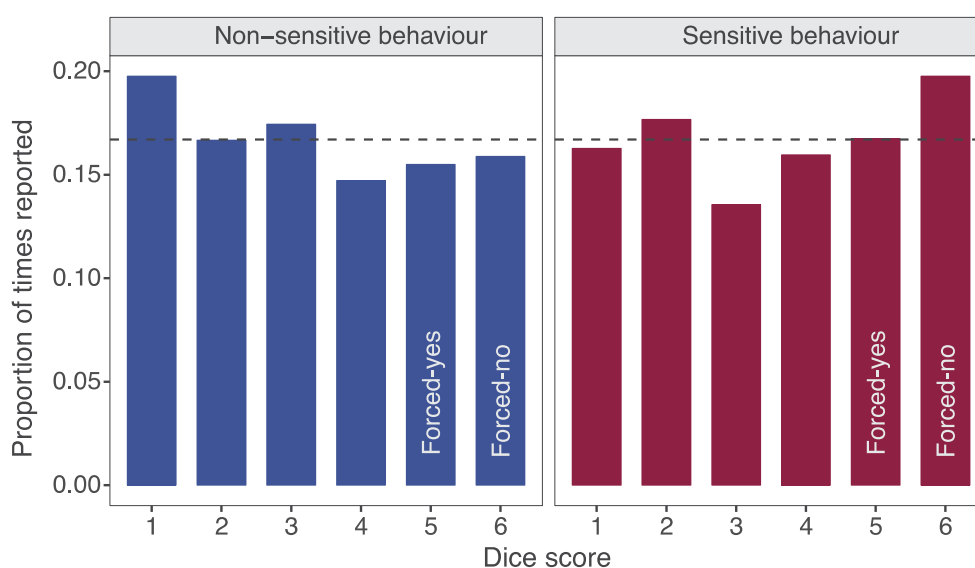


Figure 5.4. Proportion of times each number on the die was reported as rolled when respondents were answering questions about a non-sensitive behaviour (growing groundnuts) versus a sensitive behaviour (all other behaviours). Dashed line indicates the expected proportion of times each dice number should have been reported (0.167).

*Do interviewers accurately assess respondents understanding of, and compliance with, RRT instructions?*

In the experimental study, interviewers reported that they thought respondents clearly understood or understood RRT in 70% of surveys. When interviewers' assessments were compared against a respondents' performance (measured as the proportion of correct responses across all behaviours) we found no significant association ( $F\text{-value}=1.284$ ,  $p=0.281$ ), suggesting interviewers did not accurately assess respondents' understanding (Appendix 4, Fig. A4.2). Interestingly, interviewers suspected 12% of respondents of deliberately not following instructions. When compared against respondents' actual performance, we found a significant association between interviewers' suspicions and the likelihood of answering correctly, with those suspected of not following instructions significantly less likely to answer correctly, compared to those that interviewers believed followed instructions (Appendix 4, Fig. A4.2,  $F\text{-value}=5.192$ ,  $p=0.006$ ).

*Respondents' perspectives of RRT*

Most respondents in the experimental study reported they found RRT easy or very easy to understand (72%), and that they understood how to answer questions (90%), with most (72%) reporting that they would be comfortable answering sensitive questions about their own behaviour honestly using RRT. Fewer (59%) respondents felt RRT kept their response secret (Table 5.2).

Nearly a fifth (18%) of respondents provided additional feedback. A third (31%) of comments were positive. Respondents reported that "*it [RRT] is simple and easy to understand*" and "*it [RRT] is a good technique*" (see Appendix 4). A third (30%) of comments highlighted concerns about the method. For example, three

respondents were concerned the RRT was related to magic or witchcraft, while eight individuals reported concerns about being forced to provide answers that incorrectly suggested they might do the behaviour. One respondent was concerned that their farm would be incorporated into the protected area as a result of the study, and stated that they deliberately answered incorrectly, whilst another said, *"it is hard to answer 'yes' to rule-breaking because the study may bring eviction"*. Other comments related to level of education. For example, one respondent said, *"it is difficult for us who did not go to school"*. Another said, *"it is difficult because it contains many things that are confusing"*. Interestingly, one respondent stated, *"people are now better educated so you should [just] ask them directly"*.

Table 5.2. Percentage of respondents in the experimental study (n=243) that reported different perspectives regarding the Randomised Response Technique.

How easy did you find it to answer the question using this method?					
Don't know	Very difficult	Difficult	OK	Easy	Very easy
-	3%	11%	14%	35%	37%
How comfortable would you feel answering questions honestly about sensitive topics using this method?					
Don't know	Very uncomfortable	Uncomfortable	Neutral	Comfortable	Very Comfortable
-	4%	5%	14%	50%	22%
Do you feel you clearly understood how to answer the questions?					
Don't know	Did not understand	Difficult to understand	Understood	Understood well	
-	2%	8%	60%	30%	
How secret do you think your answers were using this method?					
Don't know	Not at all secret	Neutral	Secret	Very secret	
12%	20%	9%	44%	15%	

## 5.5 Discussion

We estimated that the prevalence of all rule-breaking behaviours assessed in the main study were negative or did not differ significantly from zero; suggesting that the Randomised Response Technique did not work as expected. Other studies have reported similar findings, for example, when asking about hunting of tiger, sambar and pangolin in Indonesia, St John et al. (2018) obtained negative prevalence estimates, and Davies et al. (2019) obtained estimates that did not differ from zero when using RRT to estimate bear bile consumption in Cambodia. While the likelihood of obtaining such estimates can be decreased through larger sample sizes (thereby reducing noise introduced during randomisation and resulting in tighter confidence intervals) (Lensvelt-Mulders et al. 2005a; Fox 2017), obtaining negative estimates highlights more fundamental issues with how the method has been received by respondents. According to the forced-response RRT design, negative estimates can only occur when fewer than expected forced-yes responses are obtained, perhaps because respondents misunderstand instructions, or distrust that anonymity is ensured (Feth et al. 2017).

While poor comprehension of RRT instructions is often cited as a driver of non-significant or negative RRT estimates, particularly in low literacy contexts (e.g., Razafimanahaka et al. 2012; Davis et al. 2019), our experimental study suggests that low understanding was unlikely to be the only driver of the negative prevalence estimates derived in the main study. More than two thirds of respondents reported that the method was easy and understandable, and respondents generally answered correctly for the non-sensitive behaviour. The forced-response RRT design assumes that when respondents feel adequately protected, they are equally as happy to provide a 'yes' or 'no' answer, regardless of whether answers are 'forced' or truthful (Fox 2017). We found compelling evidence that this was not the case in our experimental study as the type of response required significantly impacted the likelihood of a respondent answering correctly. Respondents were significantly less likely to answer correctly when they had to provide an affirmative answer about a character's rule-breaking behaviour. Both the negative prevalence estimates obtained in the main study and the failure to provide the correct responses about the sensitive behaviours of the character in the experimental study highlight respondents' concerns about the potential consequences of providing affirmative responses to researchers. The higher-than-expected dice scores reported for the forced-no response (a dice score of 6) suggests some respondents answered "no" to avoid even the possibility of anyone associating them with rule-breaking, a trend suspected to occur if participants perceive a topic as especially sensitive (Clark & Desharnais 1998; John et al. 2018).

Where respondent's face potentially moderate to severe costs (whether psychological, social, monetary or physical), they are more likely to be concerned about providing truthful answers (Tourangeau & Yan 2007). Previous research (e.g., Chapter 2) has shown that discussing violations of protected area rules is sensitive in the study landscape, both because individuals are concerned about incurring sanctions (Ibbett et al. in review; Chapter 2), but also because of poor relations between some communities and protected area authorities (Zia et al. 2011). Elsewhere in Tanzania it has been reported that communities with poor relationships with protected areas can view conservation research efforts as an attempt to appropriate

resources (Brockington et al. 2008; Weldemichel 2020); despite the protection RRT offers to respondents, it failed to overcome these multiple and related challenges associated with estimating rule-breaking prevalence.

Indeed, some respondents in the experimental study highlighted concerns that their responses about character's behaviour may be used to trick them into revealing their own actions, while others raised concerns about being evicted from their lands as a result of research. Willingness to answer questions about sensitive topics is influenced by an individual's beliefs about whether their responses, and/or participation, will be revealed to third parties (Tourangeau & Yan 2007). Thus, questions about sensitive topics such as rule-breaking often raise issues of trust (Krumpal & Voss 2020), influenced by respondents' beliefs about who the researcher is, who they work for, who can access data, as well as what the researcher represents to the participant (Tourangeau & Yan 2007; Blair et al. 2020). Communities living around conservation areas can perceive researchers to represent the interests of government, and conservation NGOs, regardless of whether they do (Kiik 2018; Brittain et al. 2020), which can significantly affect respondents' trust in the research process. Our findings also reinforce ethical concerns about the appropriateness of using RRT designs that force respondents to provide responses that could be construed as admissions of incriminating behaviour (Ibbett et al. 2022; Chapter 3), particularly in contexts where distrust of researchers may already be high. Alternative RRT designs, such as the Unrelated-Question which use randomisers to determine the question answered, rather than force specific types of response, may assure respondents a greater sense of protection. Beyond RRT, other Specialised Questioning Techniques, such as the Unmatched Count Technique, which requires respondents to report the number of items from a list that apply to them (Hinsley et al. 2019), have been shown to be well understood (Ibbett et al. 2022; Chapter 3) and may be more appropriate. Researchers should also consider ways in which they can triangulate findings from quantitative surveys. Conducting in-depth interviews, or group exercises with key informants, for example, may provide additional data to help researchers better understand the context in which research is being conducted, and any sensitivities associated with discussing rule-breaking (Ibbett et al. *in review*; Chapter 2).

Both studies had limitations. Previous studies have found that using randomisers such as dice can be problematic for some respondents due to associations with divination (Razafimanahaka et al. 2012). Although piloting suggested dice were appropriate, a small minority of respondents raised concerns in both studies, suggesting a different choice of randomiser may be more appropriate in future. A key limitation of the experiment was its complexity. Asking respondents about the behaviour of fictional characters undoubtedly added cognitive load to an already complex task. This may have deflated the proportion of people who answered correctly (because answering about a character was more difficult).

### 5.5.1 Conclusions

Specialised Questioning Techniques, such as RRT, are often promoted in conservation science as a way of improving the reliability of data collected from people about potentially sensitive topics. However, they do not always work as expected. Overall, while participants living around protected areas in central southern

Tanzania understood the forced-response RRT method, their level of trust in the researchers and research process was insufficient for them to report true behaviour. Ultimately, the challenges of using RRT go beyond respondents' understanding of the method and can be heavily influenced by their wider trust in the research process. Careful consideration of these factors is needed before methods are selected.



# Chapter 6

A greater focus on fair  
administration of protected area rules  
could improve compliance



A staged photograph of a monetary transaction used to ask about bribery in pile-sort exercises.

## **6.1 Abstract**

Protected area management often depends heavily on law enforcement to encourage compliance with rules; however, this can contribute to conflict between protected area authorities and local people. Compliance is affected by many factors, including whether those who enforce rules are perceived to do so fairly; as well as the perceived rule-related behaviour of others. We use factorial survey experiments to explore how fair people living around protected areas in Indonesia and Tanzania perceive sanctions distributed by law enforcers to be, and how norms and corruption influence individuals' willingness to obey rules. Results highlight that corruption reduces the perceived fairness of sanctions, and that attitudes towards protected area rules, corruption, and norms all influence peoples' willingness to follow rules. A greater focus on fair administration of rules could improve compliance around protected areas, resulting in better outcomes for biodiversity and people.

## 6.2 Introduction

Rules restricting and regulating access to resources are an integral component of protected area management, yet to be effective, rules must be complied with (Arias 2015). Law enforcement – the monitoring of adherence to rules and the punishment of detected infractions – has long been the dominant strategy for generating compliance in conservation (Keane et al. 2008). Grounded in economics, law enforcement emphasises the role of rational choice and deterrence theory in influencing individuals' decisions to obey rules, with the underlying hypothesis being that people break rules when anticipated benefits outweigh costs (Becker 1974). Consequently, significant conservation resource is spent deploying law enforcers, such as rangers, park guards, the army or police, to patrol protected areas, detect infractions and administer sanctions (Moreto & Gau 2017). However, coercing compliance in this way can contribute to conflict between protected area authorities and local people, undermining conservation outcomes. Understanding the social factors that influence compliance, including whether those who make and enforce protected area rules are perceived as legitimate, is thus essential to improving outcomes for biodiversity and local people (Stern 2008).

Legitimate authorities are those that are recognised as proper, just and worthy of power (Tyler 2021). It has been shown that legitimacy encourages greater voluntary compliance, and is strongly affected by personal experiences with authorities, including whether authorities treat people fairly, with respect, and administer sanctions consistently and impartially (Sunshine & Tyler 2003). This matters as interactions between law enforcers and local people around protected areas often involve discretion (Eliason 2003); if the decisions and sanctions imparted by law enforcers are perceived as inconsistent or unfair it can undermine legitimacy. For example, people in Madagascar felt it unfair that rich offenders received more favourable treatment when they broke conservation rules compared to the poor (Gore et al. 2013). Legitimacy is also affected by how authorities use their power (Trinkner et al. 2018). In conservation, law enforcers are frequently poorly paid, inadequately equipped, and tasked with protecting landscapes rich in high-value resources, often in remote areas with little oversight, and in contexts with weak governance and high social-economic inequality, meaning there are plentiful incentives and opportunities to misuse power for personal gain (Belecky et al. 2021). Corruption, defined as the use of public office for private gain (Wilson & Damania 2005), is reported to occur in conservation in a variety of ways, including when law enforcers collude with rule-breakers (e.g. by accepting bribes), wilfully neglect their duties (Moreto et al. 2015), share enforcement information (Mmahi & Usman 2020) and rule-break themselves (Moreto et al. 2015), all of which corrodes trust in authorities, and reduces compliance (Kahler et al. 2013; Moreto & Gau 2017).

Additionally, other social factors such as what others think (injunctive norms) and what others do (descriptive norms) prescribe desirable behaviour (Cialdini & Trost 1998) and foster compliance (Ramcilovic-Suominen & Epstein 2012). Norms have been shown to affect compliance with rules governing natural resource use across multiple contexts. For example, in Nigeria, whether friends and family followed rules regarding hunting in protected areas had a significant impact on individuals' intention to comply (Atuo et al.

2020); while norms influenced individuals' decisions to obey fishing regulations in Chile (Oyanedel et al. 2020).

We use factorial survey experiments to explore how fair respondents living around protected areas in Indonesia and Tanzania perceive sanctioning by law enforcers to be. We present respondents with vignettes that differ in a discrete number of factors and levels and ask them to evaluate each one according to pre-defined criteria (Auspurg & Hinz 2014). We specifically assess how crime type, offender characteristics (including where an offender is from, and whether they are 'powerful'), and corruption influence respondents' judgements of sanction fairness. We then assess how respondents' willingness to comply with protected area rules is affected by corruption, descriptive norms, and demographic factors including their age, gender, and multidimensional poverty status.

## 6.3 Methods

### 6.3.1 Study sites

Research was conducted in six villages situated around Gunung Leuser National Park in Northern Sumatra, Indonesia, and six villages located in the Ruaha-Rungwa ecosystem in central Tanzania (Fig. 6.1). Both study sites are of global importance for biodiversity (Olson & Dinerstein 1998), in countries that rate poorly on the global Corruption Perception Index (Indonesia: 38/100, Tanzania: 39/100, where 0=highly corrupt, Transparency International 2021). Activities such as hunting wildlife, logging for timber and grazing livestock without permits are forbidden, with rules enforced by protected area authorities.

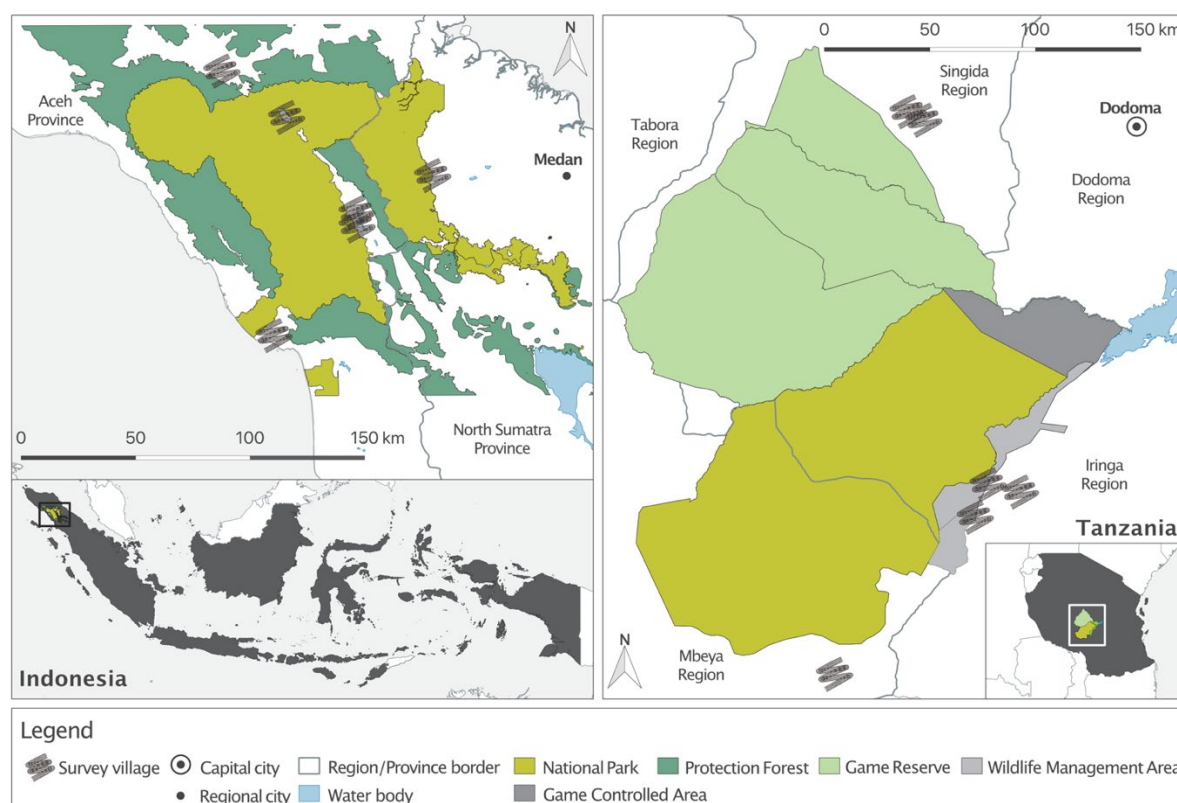


Figure 6.1. Surveys were undertaken around Gunung Leuser National Park in northern Sumatra, Indonesia (six villages), and across the Ruaha-Rungwa ecosystem in central Tanzania (six villages). In line with ethics approval, precise locations of study villages are not indicated.

### 6.3.2 Survey Instrument

We developed our questionnaire in English, translated it into Indonesian and Kiswahili, then independently back translated it before piloting. It was administered face-to-face, with statements and response options relayed verbally. Anonymised responses were recorded on encrypted mobile phones. We adopted a convenience sampling strategy (Newing 2011) with participants recruited with the help of village leaders. Only individuals aged 18 years or over were surveyed, with verbal consent sought from all participants.

Research was approved by Bangor University Ethics Committee (coses2021hi01). Data were collected in Indonesia from September 2021 to February 2022, and in Tanzania from January to February 2022.

We first collected demographic characteristics including respondent age, gender, and years of education. We incorporated questions about household education, health, and living standards to calculate a household measure of multidimensional poverty (MPI) (Alkire et al. 2020) (Appendix 5).

### *Experiment 1: Fairness of sanctions*

To explore the fairness of sanctions administered by law enforcers, we presented respondents with a series of vignettes in which an offender was caught breaking protected area rules. Vignettes varied across four factors (Table 6.1): crime committed; whether the offender was from the same community as the respondent or not; whether the offender held power or not (e.g., social or financial standing which enables exertion of control or influence over others); and sanction administered. To assess how abuse of power influenced perceived fairness, two lawful sanctions were included (arrest and prosecution; formal warning with resources confiscated), alongside no sanction, representing law enforcers use of discretion, and bribery, representing abuse of power. Respondents were asked to evaluate each vignette reporting how fair they perceived the sanction to be using a 5-point Likert scale (Box 6.1). Following Lawson et al. (2009), we generated a mixed-level full factorial design, comprised of 32 vignettes, divided into four blocks of eight. The design was orthogonal and balanced, with a D-efficiency of 100, meaning all main effects and interactions could be estimated independently (Dülmer 2016). Respondents were randomly allocated to vignette blocks, and the order of the vignettes within blocks was randomised to minimise order effects (Appendix 5).

Table 6.1. Factors and their levels applied in factorial survey experiment 1. The crime studied differed by country.

Factor	Levels
Crime committed	<i>Indonesia</i> : Hunting protected sambar in the National Park; Logging high-value timber in the National Park <sup>1</sup> <i>Tanzania</i> : Hunting wildlife in the nearest protected area <sup>1</sup> ; Grazing livestock in the nearest protected area
Where the offender was from	Someone from the community; Someone from outside the community
The power held by the offender	Someone with little power; Someone with lots of power
Sanction administered	Arrest and prosecution; Warning with resources confiscated; No sanction <sup>2</sup> ; Bribe accepted by law enforcer and offender allowed to continue <sup>3</sup>

<sup>1</sup> Typically these crimes were considered more sensitive and thus more serious (Ibbett et al. in review; Chapter 2)

<sup>2</sup> representing the use of discretion by the law enforcer; <sup>3</sup> representing an abuse of power by the law enforcer

Box 6.1. Example of a vignette read to respondents; the four factors that comprised the factorial survey experiment are highlighted in bold.

**A powerful person** from **outside your community** is caught **logging in the National Park** by a law enforcer. **They were allowed to continue without any repercussions.**

How fair is this?

Very fair, Fair, Neither fair or unfair, Unfair, Very unfair, Don't know

*Experiment 2 - Impact of corruption and descriptive norms on willingness to comply*

To explore how corruption and descriptive norms affected an individual's willingness to follow protected area rules, we first measured respondents' attitude towards protected area rules by assessing agreement with this statement "*The rules of the protected area are fair and consistent with the law*". We then randomly allocated respondents to one of four vignettes and asked [given the vignette described] "*How willing you be to follow protected area rules?*". Answers were reported using a 5-point Likert scale (Very willing to Very unwilling). The scenarios contained two factors, each with two levels: corruption: whether law enforcers were likely to accept a bribe, or not; and descriptive norms: whether compliance of others in the community with protected area rules was high, or low (Table 6.2). This design is an adaptation of Sundström (2016).

Table 6.2. In the second factorial survey experiment, respondents were randomly allocated one of four vignettes and asked how willing they would be to follow protected area rules, if the given scenario were true. Vignettes were comprised of two factors, each with two levels. Vignette differences are shown in bold.

		Corruption ( <i>Likelihood of a bribe being accepted</i> )	
		<i>High</i>	<i>Low</i>
Descriptive norms ( <i>Compliance of others</i> )	<i>High</i>	Your fellow community members <b>rarely</b> break rules and enter the Protected Area to collect resources. If caught breaking rules, it is <b>highly likely</b> that law enforcers will accept a small amount of money, and any criminal charges or fines will disappear.	Your fellow community members <b>rarely</b> break rules and enter the Protected Area to collect resources. If caught breaking rules, it is <b>highly unlikely</b> that law enforcers will accept a small amount of money, resulting in criminal charges or fines.
	<i>Low</i>	Your fellow community members <b>often</b> break rules and enter the Protected Area to collect resources. If caught breaking rules, it is <b>highly likely</b> that law enforcers will accept a small amount of money, and any criminal charges or fines will disappear.	Your fellow community members <b>often</b> break rules and enter the Protected Area to collect resources. If caught breaking rules, it is <b>highly unlikely</b> that law enforcers will accept a small amount of money, resulting in criminal charges or fines.

### 6.3.3 Data analysis

In Experiment 1, perceived fairness is modelled as an ordinal response variable (R package 'ordinal', (Christensen 2019; R Core Team 2019). To improve model interpretability, we condensed our 5-point response variable to a 3-point scale (Agree, Neutral, Disagree). We included the four vignette factors (crime committed, where the offender was from, the power of the offender, and sanction administered) as predictors, alongside interactions between the sanction administered and each other factor. Because data were grouped, with each respondent answering multiple vignettes, we included individual respondent IDs as a random effect. We only included respondents who answered all eight vignettes, and to minimise bias we excluded all cases where respondents provided the same response across all vignettes (Auspurg & Hinz 2014). Separate models were run for each country.

We checked whether the proportional odd assumptions of models held by testing each model for nominal and scale effects (Christensen 2019). We found no effects for our Tanzania dataset, but found non-proportional odds structures present in our Indonesian dataset for two variables and their interaction term. We thus included scale effects to relax the proportional odds assumptions for these variables and compared the two models using a likelihood ratio test, with the latter model revealing a stronger fit if the difference between the two was significant. We selected scale effects over nominal effects, as these offer greater



flexibility for all values of predictor variables, and use fewer parameters, leading to more sensitive tests than those that include nominal effects (Christensen 2019).

We conducted similar analyses for Experiment 2. The response variable (respondents' willingness to follow protected area rules) was condensed to a 3-point scale, and the two vignette factors (corruption and descriptive norms) were included as predictors, alongside respondent age, gender, education level, household MPI and attitude towards protected area rules. Models were checked to assess non-proportional odds assumptions, with scale effects included where appropriate.

## 6.4 Results

### 6.4.1 Respondent demographics

Data were collected from 229 people in Indonesia and 217 in Tanzania. Samples in both countries were almost evenly divided by gender (Indonesia, 52% male; Tanzania, 51%). The median years of education were higher in Indonesia (9, Inter-quartile range (IQR):6-12) than Tanzania (7, IQR:7-7), the mean age of respondents was 36 years (min:18, max: 60) in Indonesia and 37 in Tanzania (min:18, max: 70). Overall, households were poorer in Tanzania (MPI, whereby 0 indicates no poverty and 1 absolute poverty, median:0.22, IQR:0.11-0.27) than Indonesia (median:0.05, IQR:0- 0.05).

Eight respondents in Indonesia and three in Tanzania did not evaluate all eight vignettes and were excluded from analysis. Vignette responses from a further five individuals in Indonesia and six in Tanzania were also discarded as they showed no variation in the response pattern, suggesting low engagement.

### 6.4.2 Factors affecting perceived fairness of sanctions

At both sites, the only factor significantly influencing respondents' perceptions of sanction fairness was the sanction administered (Table 6.3). In Indonesia, failing to administer a sanction ( $\beta$ -1.64,  $p$ =<0.001), or a bribe being accepted, and the transgression being allowed to continue ( $\beta$ -2.06,  $p$ =<0.001) were both perceived as significantly less fair than if an offender was arrested and prosecuted, irrespective of the other factors in the vignette. The same pattern applied in Tanzania, although additionally, the distribution of a warning with goods being confiscated ( $\beta$ -2.81,  $p$ =<0.001) was also seen as significantly less fair than an offender being arrested and prosecuted. In Indonesia, a significant negative interaction was identified if someone from outside the community went unsanctioned ( $\beta$ -0.92,  $p$ =0.007), or a bribe was accepted ( $\beta$ -0.65,  $p$ =0.055), suggesting respondents thought it unfair if people from outside/inside the community were treated differently. A significant negative interaction was also identified if no sanction was administered when an offender was caught logging ( $\beta$ -0.77,  $p$ =0.025), suggesting respondents felt that inaction was not appropriate for logging, compared to hunting. No significant interactions were identified in Tanzania.

Table 6.3. Multi-level ordinal regression modelling showing the perceived fairness of different sanctions, where response is a 3-point Likert scale where (1= Unfair, 3=Fair). Text in **bold** represent p-values which had statistical significance of <0.05.

Predictors		Indonesia			Tanzania		
		Log-Odds	95% CIs	p-value	Log-Odds	95% CIs	p-value
Crime committed	Hunting protected sambar in NP <sup>I</sup> /	-	-	-	-	-	-
	Hunting wildlife in nearest PA <sup>T</sup> Ref	-	-	-	-	-	-
	Logging high-value timber in NP <sup>I</sup> /	0.28	-0.19 – 0.74	0.245	-0.37	-1.23 – 0.48	0.391
	Grazing livestock in nearest PA <sup>T</sup>						
Where offender is from	Someone from community <sup>Ref</sup>	-	-	-	-	-	-
	Someone from outside community	0.40	-0.06 – 0.86	0.092	-0.18	-1.02 – 0.66	0.677
The power of offender	Someone with little power <sup>Ref</sup>	-	-	-	-	-	-
	Someone with lots of power	0.75	-0.44 – 1.93	0.217	0.06	-0.79 – 0.90	0.898
Sanction administered	Arrested & prosecuted <sup>Ref</sup>	-	-	-	-	-	-
	Warning & goods confiscated	0.17	-0.62 – 0.97	0.671	-2.81	-3.79 – -1.83	<b>&lt;0.001</b>
	No sanction	-1.64	-2.37 – -0.90	<b>&lt;0.001</b>	-7.15	-8.45 – -5.85	<b>&lt;0.001</b>
	Bribe & allowed to continue	-2.06	-3.07 – -1.06	<b>&lt;0.001</b>	-8.28	-9.92 – -6.64	<b>&lt;0.001</b>
<i>Interactions</i>							
	Warning x Outsider	-0.33	-0.98 – 0.32	0.315	0.29	-0.65 – 1.24	0.544
	No sanction x Outsider	-0.92	-1.60 – -0.25	<b>0.007</b>	0.26	-0.89 – 1.40	0.66
	Bribe x Outsider	-0.65	-1.31 – 0.02	<b>0.055</b>	0.17	-1.29 – 1.64	0.816
	Warning x Logging <sup>I</sup> / Grazing <sup>T</sup>	-0.10	-0.76 – 0.55	0.753	0.09	-0.87 – 1.05	0.859
	No sanction x Logging <sup>I</sup> / Grazing <sup>T</sup>	-0.77	-1.44 – -0.10	<b>0.025</b>	0.92	-0.25 – 2.09	0.123
	Bribe x Logging <sup>I</sup> / Grazing <sup>T</sup>	-0.61	-1.31 – 0.10	0.092	0.75	-0.73 – 2.23	0.318
	Warning x Lots of Power	0.01	-1.72 – 1.73	0.994	-0.20	-1.15 – 0.75	0.68
	No sanction x Lots of Power	-1.15	-2.64 – 0.34	0.129	-0.08	-1.24 – 1.07	0.886
	Bribe x Lots of Power	-2.30	-5.34 – 0.74	0.138	0.30	-1.17 – 1.78	0.687

<i>Scale coefficients</i>		Warning	-0.29	-1.10 – 0.50	0.356	-	-	-
		No sanction	-0.39	-1.10 – 0.34	0.259	-	-	-
		Bribe	-1.23	-2.20 – -0.22	<b>0.022</b>	-	-	-
		Lots of power	0.04	-1.10 – 1.20	0.906	-	-	-
		Warning x Lots of Power	1.05	-0.67 – 2.80	<b>0.039</b>	-	-	-
		No sanction x Lots of Power	-0.25	-1.70 – 1.20	0.583	-	-	-
		Bribe x Lots of Power	1.01	-2.00 – 4.10	0.137	-	-	-
<i>Threshold coefficients</i>		Unfair (1)   Neutral (2)	-1.11	-1.56 – -0.66	<b>&lt;0.001</b>	-3.69	-4.60 – -2.78	<b>&lt;0.001</b>
		Neutral (2)   Fair (3)	-0.65	-1.08 – -0.23	<b>0.003</b>	-3.59	-4.50 – -2.68	<b>&lt;0.001</b>
<i>N (Individuals)</i>				229			217	
Observations				1832			1734	
Log-likelihood				-943.57			-578.5	
AIC				1937.15			1192.99	

<sup>I</sup> = crime asked about in Indonesia, <sup>T</sup> = crime asked about in Tanzania. <sup>Ref</sup> = reference level, NP=National Park, PA=Protected Area

### 6.4.3 How corruption and descriptive norms affect willingness to comply with protected area rules

Overall, respondents in Tanzania reported higher willingness to follow rules than in Indonesia (Fig. 6.2). In both countries, modelling suggested that those with more positive attitudes towards protected area rules were more willing to follow them (Indonesia:  $\beta 0.76$ ,  $p=0.014$ ; Tanzania:  $\beta 0.38$ ,  $p=0.029$ ) (Table 6.4). The impact of descriptive norms and corruption on willingness to follow rules differed across countries. In Indonesia, descriptive norms did not significantly affect individuals' willingness to follow protected area rules ( $\beta -0.07$ ,  $p=0.875$ ), while corruption did ( $\beta -2.49$ ,  $p<0.001$ ); respondents were less willing to follow rules if a bribe was likely to be accepted. Respondents here qualitatively reported that law enforcers regularly asked for 'cigarette money'. In Tanzania, corruption did not affect individuals' willingness to follow protected area rules ( $\beta 0.27$ ,  $p=0.199$ ), but descriptive norms did ( $\beta -0.97$ ,  $p=0.007$ ); where community compliance was high, so too was willingness to follow rules. In Tanzania, gender ( $\beta -1.03$ ,  $p=0.012$ ) and age ( $\beta 0.03$ ,  $p=0.03$ ) were significant predictors, with female, and older respondents more willing to comply. At both sites, neither years of education completed, nor multidimensional poverty level were significantly related to willingness to follow rules.

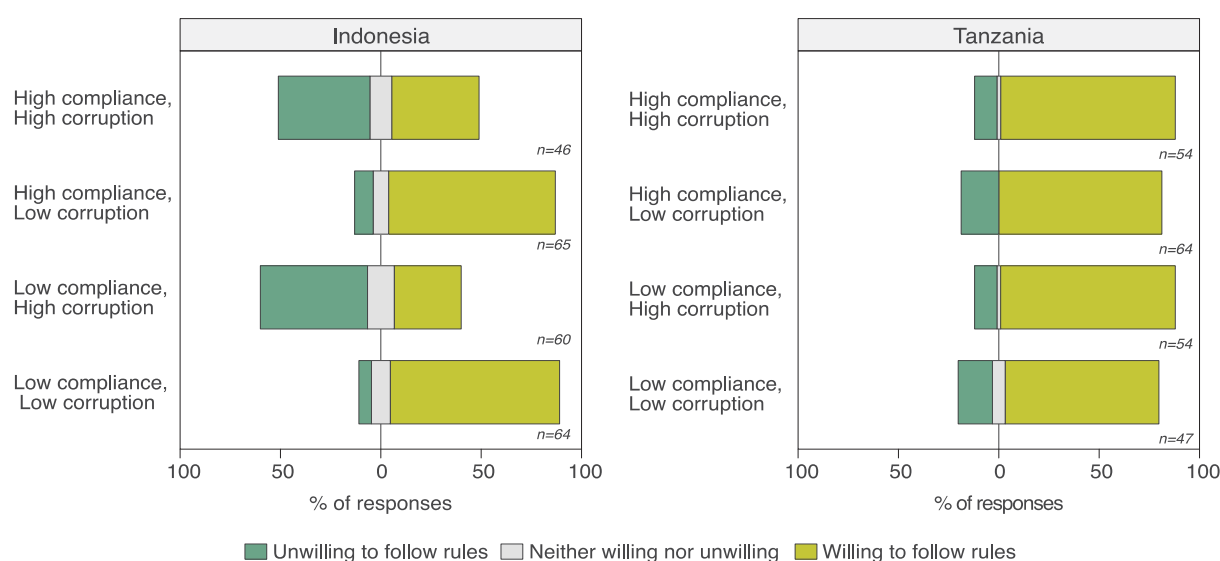


Figure 6.2. Distribution of responses when respondents were asked how willing they would be to follow protected area rules under different scenarios.

Table 6.4. Ordinal regression modelling of individuals' willingness to follow protected area rules under different scenarios, where 3=Willing to follow rules, 2=Neither willing nor unwilling, 1=Unwilling to follow rules. PA=protected area. Text in **bold** represent p-values which had statistical significance of <0.05.

Predictors		Indonesia			Tanzania		
		Log-Odds	95% CIs	p-value	Log-Odds	95% CIs	p-value
Descriptive norms (Compliance of others)	High <sup>Ref</sup>	-	-	-	-	-	-
	Low	-0.07	-0.93 – 0.79	0.875	-0.97	-1.67 – -0.27	<b>0.007</b>
Corruption (Acceptance of bribe)	Low <sup>Ref</sup>	-	-	-	-	-	-
	High	-2.49	-3.55 – -1.43	<b>&lt;0.001</b>	0.27	-0.14 – 0.69	0.199
Gender	Female <sup>Ref</sup>	-	-	-	-	-	-
	Male	0.23	-0.67 – 1.13	0.612	-1.03	-1.84 – -0.23	<b>0.012</b>
Age		0.05	-0.01 – 0.10	0.083	0.03	0.00 – 0.05	<b>0.030</b>
Years of education completed		0.04	-0.11 – 0.18	0.620	0.03	-0.05 – 0.10	0.473
Household multidimensional poverty <sup>1</sup>		-0.37	-6.75 – 6.00	0.909	-1.74	-3.86 – 0.38	0.108
Attitude towards protected area rules <sup>2</sup>		0.76	0.16 – 1.36	<b>0.014</b>	0.38	0.04 – 0.72	<b>0.029</b>
<i>Scale coefficients</i>							
Level of compliance	Low	-	-	-	-1.12	-1.67 – -0.27	<b>0.010</b>
Level of corruption	High	0.75	-3.55 – -1.43	<b>0.040</b>	-	-	-
<i>Threshold coefficients</i>							
Unwilling (1)   Neutral (2)		2.13	-1.52 – 5.79	0.252	0.12	-1.70 – 1.94	0.897
Neutral (2)   Willing (3)		3.15	-0.68 – 6.99	0.107	0.24	-1.61 – 2.09	0.800
Observations:			221			211	
Log-likelihood:			-163.17			-89.97	
AIC:			346.35			199.94	

<sup>Ref</sup> Represents the reference category.

<sup>1</sup> Multidimensional poverty index between 0 and 1, where 0 represents no poverty, and 1 represents absolute poverty.

<sup>2</sup> Measured as agreement with the following statement "The rules of the protected area are fair and consistent with the law" where 1=disagree, 2=neither agree nor disagree, 3=agree.

## 6.5 Discussion

Our results demonstrate that how authorities administer sanctions around protected areas matters. In Tanzania, regardless of where an offender was from, or the power they held, respondents desired authorities to administer sanctions consistently. Similarly, in Indonesia, respondents expected powerful actors to be treated the same as those without power; a sentiment supported across the landscape and elsewhere (Gore et al. 2013). This is important as powerful actors, such as those with significant social or financial standing, often use their advantage to influence criminal justice processes, resulting in outcomes where disadvantaged groups incur severe punishment, while well-funded or well-connected offenders do not (Wilson & Boratto 2020). Such administration can alienate local people, generate hostility and lead to general distrust of protected area authorities, which may encourage further rule-breaking and contribute to conflict (von Essen et al. 2014; Moreto & Gau 2017). To this end, there have been calls for conservationists to pay greater attention to procedural justice in law enforcement. Procedural justice research theorises that high-quality treatment of individuals by authorities, for example, through consistent, fair, even-handed enforcement of laws, can enhance people's belief in the legitimacy of authorities, which in turn can foster greater voluntary compliance, reduce law enforcement costs and improve relations between protected area authorities and local people (Stern 2008; Moreto & Gau 2017; Tyler 2021).

The way in which discretion is exercised is also important. In Indonesia, it was seen as significantly less fair if an outsider received more lenient sanctions than a community member. Failure to differentiate between outsiders' rule-breaking for criminal purposes and local people doing so for subsistence needs can generate resentment of authorities amongst local people (Bell et al. 2007). Our findings from Indonesia suggest a social expectation for law enforcers to exercise discretion compassionately (Paley 2015; Belecky et al. 2021). Interestingly, this pattern was not detected in Tanzania, potentially reflecting variation in the rules governing natural resource use in the two study landscapes. In Tanzania, entrance to any National Park or Game Reserve for any reason is prohibited without a permit. Whereas in the Leuser Ecosystem there is a complex array of protected area designations, including those that allow some resource use with access rights that differ by community. While the use of discretion has been widely studied in policing, it is underexplored in conservation, particularly in the Global South (although see Warchol & Kapla 2012). However, much could be learnt by studying how discretion influences the legitimacy with which protected area authorities are viewed.

Importantly, bribery was never considered fair, and in Indonesia corruption significantly undermined peoples' willingness to follow rules. Studies show that corruption undermines trust in authorities (Jackson et al. 2014), making governance both harder and less effective (Kahler & Gore 2012). Resolving corruption in conservation law enforcement is challenging; it is a multi-faceted and complex problem which manifests in many ways (Robbins & Czeglédi 2000). Fair administration of the law, particularly when dealing with powerful offenders can be difficult to enact; in some circumstances, physical, psychological or financial threats may make it safer for law enforcers to collude, and in contexts where corruption is systemic and institutionalised, or where positions are maintained through patronage, pressure from superiors may make it

impossible to avoid (Paley 2015). Development of well-targeted anti-corruption policies thus requires an understanding of the determinants of, and relationships that exist between different actors, alongside simultaneous reform of political systems and enforcement infrastructure (Wilson & Damania 2005). Despite the need to better understand how corruption hampers law enforcement and conservation more broadly, it remains poorly studied within conservation science (Sundström 2016). In Tanzania, we found descriptive norms rather than corruption predicted willingness to comply with protected area rules. This supports previous research reporting significant social disapproval of rule-breaking and bribery at the study site (Ibbett et al. *in review*; Chapter 2) and that fear of informal sanctions (e.g., social ostracization) can be more costly than formal punishment (Atuo et al. 2020).

While our experimental approach offers valuable insights into peoples' perceptions of law enforcement administration, it was not without limitations. Because of their hypothetical nature, we are uncertain how well vignette data reflect reality. Moreover, our questionnaire did not attempt to formally measure people's perceptions of procedural justice or legitimacy of authorities using frameworks outlined in criminal psychology (Tyler 2021); doing so would strengthen the ability of conservation scientists to suggest practical measures, including tailored training programmes (e.g., Gilbert et al. 2015).

Significant conservation resource is invested in coercing compliance around protected areas. Yet our study provides clear evidence that to be effective, conservation practice must address challenges associated with the fair administration of the law.



# Chapter 7

## Discussion



A plains zebra (*Equus quagga*) in Ruaha National Park, Tanzania

## 7.1 Contribution to knowledge

Conservation interventions often rely on rules that restrict and regulate activities harmful to biodiversity (Keane et al. 2008). Yet to be effective, these require reliable information about the prevalence of rule-breaking behaviours, alongside sufficient understanding of the factors that affect compliance (St John et al. 2013). However, this can be challenging, given the secretive nature of rule-breaking, and the general reluctance of those involved to discuss their motives freely (Solomon et al. 2007; Tourangeau & Yan 2007; Nuno & St John 2015). In this thesis, I aimed to improve current understanding of conservation compliance, and to explore how best to ask questions about rule-breaking behaviours.

Overall, my thesis has made several important contributions to scholarship in conservation science. Firstly, by synthesising the literature on Randomised Response Techniques and critically assessing the performance of a suite of methods (four Specialised Questioning Techniques, free-listing, pile-sorting and Factorial Survey Experiments), I contribute to improving the application of social science methods in conservation science. Secondly, by quantifying the prevalence of rule-breaking behaviour, and by exploring how compliance can be improved around protected areas, I make valuable contributions to conservation policy and practice in two contexts (i.e., the Leuser Ecosystem, Indonesia and Ruaha-Rungwa ecosystem, Tanzania). Below, I discuss the key contributions made towards each objective.

*Objective 1. Provide researchers with best practice guidance on how to assess whether topics are likely to be sensitive amongst study participants.*

Understanding whether a research topic will be construed as sensitive by participants, and thus whether they are likely to censor their responses is often recognised as important (Sieber & Stanley 1988), yet rarely explicitly investigated in conservation. However, if ignored, topic sensitivity can significantly affect research participants, the research process, as well as conservation outcomes (Lee & Renzetti 1990; Brittain et al. 2020). Chapter 2 represents one of the first attempts to explicitly assess and empirically evidence topic sensitivity in conservation. In this chapter I set out to provide conservation scientists who study compliance with useful insights and greater guidance on how to assess topic sensitivity. Firstly, my co-authors and I reviewed the literature from across the social sciences and outlined the different ways in which sensitivity arises. We then assessed the suitability of three different methods for rapidly appraising sensitivity and developed a promising new psychometric scale to measure the perceived sensitivity of research topics. We suggest this new tool can be used to calculate sensitivity indices to enable researchers to gauge respondents' willingness to discuss different topics in the piloting stage of research. Such information is useful to assess variation in perceived topic sensitivity across contexts, as well as between individual respondents and demographic groups, and can inform the design of subsequent research. Indeed, our empirical application of the psychometric scale revealed differences in the willingness of participants to discuss different behaviours in the Leuser Ecosystem in Indonesia; and that discussing any form of rule-breaking was sensitive in the Ruaha-Rungwa ecosystem, Tanzania. Importantly, Chapter 2 shows that while quantitative tools such as our proposed psychometric scale are useful, they provide limited contextual understanding. Instead, participatory approaches (such as pile-sorts and free-listing) can give much richer

insights into people's perceptions of protected areas, their relationships with authorities, as well as their views of researchers. These findings highlight the importance of contextual understanding, including of environmental histories, and the need for greater engagement with processes such as reflexivity, which encourage researchers to reflect on their own positionality and power relations within research (Montana et al. 2020; Satizábal et al. 2021).

*Objective 2. Critically assess and advance the robust application of Specialised Questioning Techniques to ask sensitive questions in conservation science.*

An important contribution of this thesis has been to critically assess the effectiveness of Specialised Questioning Techniques, a suite of methods increasingly used in conservation to overcome biases associated with asking people about their involvement in rule-breaking. Conservationists usually apply Specialised Questioning Techniques in contexts different to those in which they were developed; but recent research has shown they are not always effective (Nuno et al. 2018; St. John et al. 2018; Davis et al. 2019). Using methods that perform poorly could result in inadequate information, wasting time and money. However, there is little evidence about how well these methods work, particularly in the Global South. In Chapter 3 we empirically tested four methods (Randomised Response Technique (RRT), the Unmatched Count Technique (UCT), Crosswise model and Bean method) using a novel experimental design and compared their performance to conventional direct questioning. Results revealed that when sensitive answers are required (i.e., admissions of illegal behaviour), Specialised Questioning Techniques do produce higher, and thus presumably more accurate estimates than direct questions, suggesting these approaches are valuable additions to the methodological toolbox. Importantly, our study highlights the conditions which affect success. Methods such as RRT and UCT generally performed better than the other Specialised Questioning Techniques trialled, and demographic factors including respondent age, education level, and gender all influenced response accuracy. More importantly, results echoed those of Chapter 2; that context, including power relations, environmental histories and whose interests' researchers serve, matters.

In Chapter 4, we undertook a systematic review of literature on Randomised Response Techniques. We outlined the numerous RRT designs, reviewed modes of RRT application, and assessed their performance in conservation relative to other disciplines. Results reveal that RRTs are the method applied most often in conservation research on rule-breaking. Analyses show that despite the perceived benefits of their application, RRTs still underestimate prevalence when compared against data on known prevalence. Crucially, Chapter 4 highlights that 'gold standard' validation studies, where RRT estimates are validated against reports of known behaviour, are generally extremely rare, with only one empirical example in conservation achieved through covert observation (Bova et al. 2018). Most conservationists validate RRT data by comparing estimates to those derived from direct questions. However, findings reveal that conservationists often use both methods on the same respondent; an approach which is ethically problematic as it undermines anonymity. In the wider literature, best practice recommends researchers ask questions using only one method, and that the RRT sample size should be double that of the direct question sample (to overcome error introduced by noise) (Lensvelt-Mulders et al. 2005a). My fourth chapter furthers

conservationists' understanding of the design considerations and potential pitfalls of RRTs and provides detailed practical guidance to help inform more robust RRT study design, delivery, and analysis. Our findings are relevant beyond conservation and apply to range of disciplines.

Chapter 5 puts the lessons learnt in Chapters 2, 3 and 4 into practice. Chapter 3 revealed that RRT was generally well understood in the Ruaha-Rungwa ecosystem, suggesting it could be used to ask questions about rule-breaking, while Chapter 4 helped inform our RRT research design (e.g., design choice, appropriate equipment). As far as we know, our study represents the first application of RRT in Tanzania. Despite the considerable focus on research design, the RRT did not work as expected. Our estimates did not differ significantly from zero, suggesting low levels of rule-breaking in the landscape, while negative estimates suggested more fundamental issues with the method. Similar findings were found by St. John et al. (2018), and highlight the importance of publishing null results, in order to enable others to learn from failure (Catalano et al. 2019). Our experimental study goes further than most as we explicitly explored why the method did not work as expected. Results highlight that while participants understood the RRT, their level of trust in researchers and the research process was insufficient for them to report true behaviour. Findings reinforce wider concerns raised in Chapter 3 about the ethics of using approaches such as the forced-response RRT design, which force respondents to give answers that could be construed as admissions of guilt; something reported elsewhere (Razafimanahaka et al. 2012). Our study builds on the work of others (e.g., Cerri et al. 2021) and provides an important warning for those considering using RRTs in their research.

*Objective 3. Improve understanding of drivers of conservation compliance.*

Given global proposals to protect 30% of earth by 2030 (CBD 2022), improving understanding of what drives compliance, particularly around protected areas, is more important than ever. My thesis makes several contributions in this area. My research reveals that normative factors strongly influenced people's perceptions of rule-breaking. For example, rule-breaking behaviours were rarely approved of (demonstrated by measuring injunctive norms) by people living around the Ruaha-Rungwa ecosystem (Chapter 2), and perceptions of how others behave (descriptive norms) significantly affected peoples' willingness to follow protected area rules here also (Chapter 6). Moreover, the failure of RRT to obtain reliable estimates of rule-breaking from the Tanzanian study site (Chapter 5) emphasised people's concerns about reporting non-compliant behaviour. In both study systems in Indonesia and Tanzania, knowledge of rules significantly predicted topic sensitivity (Chapter 2). Combined, these findings emphasise the significant role social norms play in determining and guiding acceptable behaviour including compliance with conservation rules; something also found elsewhere (e.g., Atuo et al. 2020; Oyanedel et al. 2020).

Throughout my research, how designated authorities enforced protected areas rule emerged as a factor influencing people's perceptions of the authorities. Drawing on the literature from criminology, Chapter 6 offers new insights into how administration of rules around protected areas can influence and improve compliance. Importantly, results show that people want rules to be administered fairly, and that the abuse

of power by law enforcers, for example through the acceptance of bribes, was rarely tolerable. Around Gunung Leuser National Park in Indonesia, the presence of corruption significantly decreased the willingness of respondents to follow conservation rules whilst around the Ruaha-Rungwa ecosystem in Tanzania willingness to follow rules was predicted by the behaviour of others. Our findings add support to the growing body of literature that highlights how legitimacy building and the application of procedural justice can improve compliance around protected areas and reduce the need for expensive coercive approaches which can also be socially detrimental (Stern 2008; Moreto & Gau 2017).

## **7.2 Considerations when studying rule-breaking in conservation**

An important theme that runs throughout my thesis is research ethics. Addressing ethics, both in the application of Specialised Questioning Techniques, and in wider research on rule-breaking behaviour is vital for ensuring research is perceived and experienced positively by all participants, and for ensuring research quality.

### **7.2.1 Methodological considerations**

Data collected directly from people are never truly anonymous. Even when personal identifiers are not recorded and interviews are conducted away from participants' homes, interviewers may still recognise respondents by sight and/or name. Additionally, other people, who may or may not be directly involved in the research, may observe who data are collected from. When the research topic is sensitive, these limits to anonymity must be recognised by researchers with steps made to minimise risk to participants and researchers. By adding uncertainty to responses, Specialised Questioning Techniques make a valuable contribution to preserving anonymity and protecting participants (Nuno & St John 2015; Hinsley et al. 2019). However, as highlighted throughout our research, Specialised Questioning Techniques can raise other ethical challenges. For example, where respondents experience uneasiness when asked to use any SQT, their application is questionable. Failure to adequately pilot survey tools and adapt them to address concerns reported by participants can heighten people's mistrust of researchers, potentially affecting future willingness to engage. Moreover, there is a need to consider who is collecting data, and how this affects the research process. In some instances, being viewed as an 'outsider' can be beneficial, as respondents may be more willing to reveal sensitive information to someone they are unlikely to have further contact with. Conversely, outsiders may be less trusted and viewed with greater suspicion (Darwin Holmes 2020). Working with people local to study areas, for example a trusted leader, can help encourage greater participation (Razafimanahaka et al. 2012), and was something that we found useful throughout our research. However, it can also provide those who facilitate research with new knowledge, which may situate them in positions of power over participants (Brittain et al. 2020), or present risk to their safety (Lee & Renzetti 1990). Careful consideration of these factors is particularly pertinent when investigating rule-breaking.

Looking forward, the emergence of the Covid-19 pandemic combined with increased internet accessibility and improved global literacy, suggests more conservation scientists will shift survey effort away from face-to-face research and towards online data collection (Wardropper et al. 2021). While this can reduce research costs, empower researchers to access new participants, give voice to new groups, and allow for significantly larger sample sizes, there are potential ethical and methodological implications for those studying rule-breaking. Special consideration needs to be given to the anonymisation of data, for example by ensuring URLs are not captured during online survey completion, while the design of Specialised Questioning Techniques will require some adjustment, such as to randomiser choice (Coutts & Jann 2011; Cobo et al. 2017). Moreover, online survey administration generally does not enable participants to check their understanding of survey questions or methods; this may be problematic when using Specialised Questioning Techniques in contexts such as those in our studies, where they were considered harder for respondents to understand (Chapter 3). While detailed guidance about the need for ethical consideration when collecting data online are emerging (Monkman et al. 2018; Thompson et al. 2021; Wardropper et al. 2021), more specific guidance relating to researching illegal behaviours online is needed.

### 7.2.2 Emerging technologies

During a test of the Bean method in Tanzania (Chapter 3), one respondent refused to participate stating they believed the beans to be individually satellite tracked. For me, this anecdote is particularly poignant; not only did it highlight the participant's distrust of researchers, but it also revealed beliefs about the power of surveillance technology wielded by researchers. There is an impetus within conservation to use novel approaches to study non-compliance; this is fuelled by funders' desire to support projects seeking to push new technological boundaries (e.g., using drones (Earthranger 2022)); as well as by conservationists' desire to obtain data to better inform the design of interventions that stem biodiversity loss (Wich & Koh 2018). However, as outlined in the anecdote above, and by the work of others (e.g., Simlai 2021), if used carelessly, novel technologies can have detrimental impacts on how research is perceived, as well as on human well-being, and can even undermine conservation success (Hulme et al. 2014). Some advancements in the ethical application of novel technologies have already been made. For example, publishers increasingly mandate the inclusion of ethics statements in academic journal articles (e.g., Teel et al. 2018), while guidelines exist to support conservation researchers in the ethical use of surveillance technologies (e.g., Sandbrook et al. 2021). It is important to ensure such measures are rigorously applied in conservation research and are promoted widely to governmental and non-governmental conservation organisations.

### 7.2.3 Narratives adopted in rule-breaking

Another important factor to consider is the narratives that are adopted when discussing rule-breaking. Data on rule-breaking in protected area contexts are often collected at the individual or community level. By its very nature, research on rule-breaking faces an ethical conundrum. The primary objective is to uncover what remains hidden, yet doing so can have significant impacts on already marginalised groups (Satizábal et al. 2021) and risks placing the blame on smaller actors, while those that are perhaps better resourced to

hide their practices, continue unabated (Sundström 2016). To this end, greater engagement with disciplines such as political ecology, which aims to cast critical light on the wider structural mechanisms enabling rule-breaking, could be beneficial (Duffy et al. 2015). Conservation researchers have a moral and shared responsibility to minimise the risks of further marginalisation, victimisation and criminalisation (Satizábal et al. 2021); this includes by engaging in ethics processes such as Free, Prior and Informed consent (Guillemin & Gillam 2004), by returning to communities at the end of research to share findings and check understanding (Brittain et al. 2020), but also by giving thought to the narratives used in research outputs (Duffy et al. 2015). Discourses used to frame rule-breaking can have powerful implications on how people are perceived and may perpetuate negative connotations (von Essen et al. 2014). For example, the term 'unlawful hunting' can be perceived relatively neutrally, whereas describing hunters as poachers criminalises individuals and raises connotations of thievery and dishonesty (von Essen et al. 2014). In their introduction to a journal issue dedicated to the study of non-compliance, Solomon et al. (2015) highlight that many who do not comply with conservation regulations do so for subsistence reasons, and that labelling those who do so as criminals is ethically and morally problematic, particularly given that conservation has often been imposed within these contexts (Duffy 2010). Throughout my thesis and wider publications, this is something I paid particular attention to, for example, by avoiding the term poaching and by referring to hunting as illegal, when conducted in breach of national laws.

### **7.3 Future directions for conservation research and practice**

Ultimately, monitoring the success of any conservation intervention relies on reliable data, including that on people's compliance with rules. My thesis revealed several emerging themes to guide future conservation research and practice on rule-breaking:

#### **7.3.1 More mixed methods approaches are needed to study compliance**

Mixed methods research and triangulation of data sources can strengthen our understanding of compliance in conservation. Throughout, my thesis focuses on the application of Specialised Questioning Techniques to collect quantitative data from individuals. However, these methods represent just one approach of many, and are limited in the extent of the knowledge they provide. For example, quantitative results from Chapter 5, along with preliminary findings from the wider project in which my thesis was situated, suggest there are few rule-breakers in the Ruaha-Rungwa ecosystem. Yet law enforcement data and previous research (Beale et al. 2018; Knapp et al. 2017; Hariohay et al. 2019) suggest rules are regularly broken. Without further information it is impossible to determine the extent of mismatch between the data we collected directly from people, incident data collected by conservation authorities, and the findings of others. Triangulating knowledge and supplementing research in the landscape with qualitative approaches like the participatory exercises employed in Chapter 2, could provide greater contextual understanding to help validate findings. This approach has been used by others. For example, Collins et al. (2021) successfully combined enforcement reports with fisher interviews and focus group data to quantify and improve understanding of

non-compliance in the British Indian Ocean Territory. While in Uganda, Harrison et al. (2015) complemented the Unmatched Count Technique with focus groups to study unauthorised resource use in Bwindi Impenetrable National Park. Moreover, often research on conservation compliance focusses on those suspected of rule-breaking, rarely are the perspectives of those involved in implementing conservation, such as protected area managers or NGO staff, considered. Yet, understanding these perspectives could offer valuable insights about rule-breaking, particularly if compared to the perspectives of local people. This approach was employed in Uganda by Travers et al. (2019) successfully and has recently been employed in Ugalla Game Reserve in southern Tanzania to study the views of authorised resource users and managers (Kisingo et al. 2022). Meanwhile, Ribeiro et al. (2019) surveyed experts to better understand and predict future global trends in legal and illegal bird trade.

### 7.3.2 Conservationists must apply Specialised Questioning Techniques and other social science methods robustly

My thesis revealed that there is much room for improvement in the way conservation scientists apply Specialised Questioning Techniques. Specifically, researchers must critically assess how these methods perform when asking about rule-breaking. Experimental approaches which validate the performance of methods, such as those demonstrated in my thesis, remain scant. Yet, as we and others (Hoffman et al. 2017; John et al. 2018) have shown, experimental studies can reveal whether methods work as expected. Given the significant resource that research requires, and the opportunity costs borne by participants, it is critical that methods are appropriate for the contexts in which they will be used. While my body of research, along with that of others (Nuno & St John 2015; Hinsley et al. 2018; Arias et al. 2020; Cerri et al. 2021) will enable conservation scientists to make better methodological decisions when researching rule-breaking, journal paywalls combined with a bias towards the publication of English language research, means that much guidance remains inaccessible to those in nations where English is not a spoken language. Further, the provision of guidance will not necessarily overcome the gap in social science training that permeates conservation (St John et al. 2014; Saltz et al. 2018). Despite widespread recognition of its importance, social science features negligibly on many conservation degree pathways (Slater et al. n.d.). These barriers must be overcome to progress the application of conservation social science. To this end, throughout my PhD I made small contributions wherever possible, for example, I delivered a range of training workshops on research ethics and non-compliance research in Indonesia, as well as to practitioners online. I have also supported the work of the Conservation Social Science partnership; a network of practitioners and academics aiming to improve and expand the use of social science in conservation. Looking forward, I hope to continue and expand on this work in future.

### 7.3.3 More scholarship is needed on those who enforce rules

Conservation is reliant on huge investments in law enforcement to coerce compliance around protected areas. To date, the effectiveness of this approach has been studied in numerous ways. For example, by assessing the impact of sanction severity on behaviour (Wilson & Boratto 2020), by quantifying how much



resource is required to motivate law enforcers (Jachmann 2008), and to assess how different incentives may change behaviour (Milner-Gulland & Leader-Williams 1992). Yet, as revealed by Chapter 6, *how* rules are enforced matters. This point has been starkly reinforced in recent years with the emergence of work by investigative journalists revealing the involvement of law enforcers, funded by international conservation NGOs, in human rights abuses around protected areas (Buzzfeed 2019). There is a clear need for conservationists to extend their focus on understanding the motivations of those who break rules, to also understand the behaviour of those who enforce them, and the subsequent implications for compliance. In the last decade, research on conservation law enforcement personnel has become an emerging area of conservation scholarship (e.g., Moreto et al. 2015, 2021; Spira et al. 2019), however, there is still much work to do. To this end, there are many lessons to be learnt from disciplines such as criminal psychology, and criminology more broadly, which have invested significant time developing frameworks to measure the effect of procedural justice and legitimacy on compliance in policing (Tyler 2021). Lesson learnt through the adoption of such frameworks could inform strategies targeted at improving relations in areas, such as around Ruaha National Park, where tensions between protected area authorities and local people run high.

## 7.4 Conclusion

Solutions to the biodiversity crisis depend upon people. As such, greater engagement with the social sciences is critical for improving our understanding of human behaviour. Tools, frameworks and methodologies from the social sciences can help enhance our understanding of compliance and enable conservation scientists to develop more effective interventions. However, to be successful, social science research must be applied by conservation scientists with appropriate rigor and be underpinned by a good understanding of the advantages and limitations of different approaches. Additionally, there is an inherent need to consider the ethical implications of research, particularly when investigating sensitive topics such as rule-breaking. Doing so will help promote more ethically just conservation research and practice, which in turn will increase the likelihood of securing positive outcomes for both biodiversity and people.

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# Appendices

# Appendix 1

Chapter 2 - Using mixed methods to assess topic sensitivity in conservation

## Group exercise protocols – English

Instructions to enumerators are highlighted in grey.

### Information script [15 minutes]

Hello my name is [name of enumerator] and this is my colleague [team member name]. We are researchers from [name of partner institution] working with Harriet Ibbett, who is from Bangor University in the UK. Her research aims to better understand the use of natural resources by people who live in the [landscape name]. We have asked you to join us today to ask for your help in better understanding your culture, and to identify how you think we should ask people about natural resource use. We expect this discussion to last around two and a half hours, however, it may be longer or shorter depending on your answers.

We are independent researchers, and are not related to the government or any NGOs, but we do have permission of the Indonesian government and the village authorities to carry out this research. Your participation is voluntary. You do not have to participate and you may stop participating at any time, without having to explain why. If you feel uncomfortable answering some of the questions, you do not have to answer. If you would like to skip a question or a topic, please say.

I [name of enumerator] will lead the discussion. I will ask questions and ask you to participate in exercises that we have prepared. [Team member name] here will record your responses. With your consent, we would like to record this discussion. This is because sometimes many people speak at once, and it can be hard to record every person's opinion.

Your responses and discussion will be kept confidential and will not be linked to you individually or your village. The information you share with us will be stored safely, and we will not share the recordings with anyone else.

Harriet will use the results to help design future surveys on local communities' natural resource use asks questions in ways that are polite and respectful in your culture. Harriet may also publish the findings internationally, to help researchers in other countries understand how best to research these topics.

We are here to learn about your community, we may have lots of questions, or there may be things we don't understand, so we would be very grateful if you are happy to answer our questions. To make sure that everyone has an equal chance to speak and to share their thoughts and views, we would like to ask you to respect and listen to what each other has to say. There are no wrong or right answers, everyone will have a chance to speak.

This study has been approved by the ethics committee at Bangor University. If you have any concerns about this project, please speak to me and I will do my best to answer your query.

If you remain unhappy or wish to make a formal complaint, I can give you the contact details of someone to discuss this with.

There will be two activities. The first will take around an hour, then we will have a short break. The second will take around another hour.

**Covid-19 Precautions [Used in Indonesia only – Tanzania fieldwork conducted pre-Covid)**

- Before we start, we are aware that Covid-19 is present in North Sumatra. We want to share with you the measures we are taking to reduce the risk of spreading Covid-19 and to explain why we have asked you to sit like this.
- Firstly, be assured that the research team is healthy and free from any obvious Covid-19 symptoms. If we start to display any team member starts to display symptoms we will isolate ourselves immediately.
- To reduce risks, we would like for everyone to stay at least 2 metres apart at all times, this is why we have positioned the chairs like this.
- Before we start, we ask you to wash your hands. We have also done so, this helps to reduce the spread of the disease.
- We will also be wearing masks throughout the focus group, and ask you to wear one also. We will provide clean masks for you to keep. If you cannot hear, or need something repeating, please say.
- All equipment has been cleaned, but to stop the spread, we ask that you do not touch it. Only I will touch the equipment we use. If you need to see the equipment more clearly, please say and I will help.
- Thank you for your understanding in helping us to protect each other.
- Do you have any questions or concerns so far?
- Would you like to continue the meeting?
- Would you be happy for us to record this meeting? (Get verbal consent from every participant, if someone disagrees, do not record).
- Go around the group and ask people for information about their age and ethnicity – explain this is for our research purposes – to help us understand the opinions of different groups that live in the village.



**Free-listing [Estimated 1 hour]**

I would like you to think of all the reasons you know about why people who live in your community go to *[Protected area]*. *[Pause to let people think]*. For example, people may go to collect resources, or for their livelihoods. Many people may go for the same reason, or perhaps only a few people go for different reasons. As a group, I would like you to tell me all the different reasons you know about why people go to the *[Protected area]*. I would like you to tell me these one by one and we will list all the reasons down on a piece of paper. [Keep prompting ] Are there any other reasons you know why people go?

*List all items on large piece of paper in the order they are mentioned. Be careful not to lead responses.*

- Do they go for any natural resources?
- Are there culture or heritage reasons?
- Any other reasons?

Is that all?

*Once the list is completed, for each activity ask:*

- How many people do this activity? (e.g. everyone, very few)
- What types of people do this? (e.g. male, female, young / old )
- Why do people do this? (e.g. subsistence or income)
- When do people do this? How often do they go?

**Second free-list**

Now I want you to think of the ways in which you know that *[ Protected area]* negatively affects people who live in the community. You may know of problems people face or challenges encountered. Again, I would like you to tell me these, and one – by – one we will make a list and record it on paper.

*List all items on large piece of paper in the order they are mentioned*

- Are there things they would like to do but cant?
- Are there any costs from living near the protected area?
- Any more reasons?

*When each activity is mentioned, ask the respondents to provide more information about this. E.g.*

- How often does this happen?
- What do you do?
- Why is this a problem?

Are there any other reasons you know of?

**Third-free list**

Now I want you to think about the benefits of living alongside the Protected Area. Please can you list them?

*List all items on large piece of paper in the order they are mentioned.*

*Ask the respondents to provide more information about each benefit.*

**Pile sorting [Estimate 1.5 hour ]**

- For this next exercise, I have a pile of different cards. On each of these cards is a picture and a description of an activity someone might do in on land around the village.
- As individuals, and community members, you may feel happier talking about some activities than others.
- I would like you to look at each card, and as a group decide how happy you think people in this community would be to talk about this activity, if it was conducted on village land.
- Different people might be more willing to talk about some activities than others, for different reasons.
- For example, for some it may not be culturally appropriate to ask about a certain activity. For example, in the UK to ask a lady her age is very offensive.
- Some things may be sensitive for other reasons.
- If you say you do an activity you might worry others will disapprove or think worse of you.
- Some activities may only be conducted in secret, or at night.
- You might be worried discussing the activity will get you into trouble.
- I would like you to look at each card, and sort them into different piles depending on how similar you think they will be for people around here to talk about.
- For example, you may have one pile of cards showing activities that you think people will not like to talk about.
- In another pile you may have cards showing activities that you think people will be very happy and have no problem to talk about.

*Go through each card on a one-by-one basis.*

- *Get members to discuss the activity*
- *Ask them why is this activity sensitive / not sensitive?*
- *How the sensitivity of the activity contrasts with those in other piles (e.g. why is it more or less sensitive?)*

*For species cards*

- *Review all cards for the same species at the same time.*
- *Explore whether sensitivity changes if the reason for killing the animal changes.*
- *Record any other interesting information that arises about these activities (e.g. who does them, why, how often)*

**\*\* At the end of the pile sort - RECORD WHICH GROUP EACH CARD IS ALLOCATED TO\*\***

*Ask participants to name each pile – and provide a description about what this pile represents.*

Next, looking carefully at these piles, would certain activities move pile if the activity was conducted in [Nearest PA]?

Do you think people would be more or less willing to talk about these activities? Why?

## FAQs & Suggested Responses

What is the end goal of the research? What benefit will it bring to the community?

- It is good for us as researchers to understand why people go to protected areas, and the problems they face regarding natural resource use.
- We can feed our findings back to the government about how communities need resources and their feelings towards protected areas.

Why have we been separated by gender?

- Men and women often use natural resources in different ways.
- By having groups of only men or only women, it helps us to get a deeper understanding of how this natural resource use differs.

Last year, other researchers came and asked us similar questions. They promised this, yet nothing has happened or changed. Why should we talk to you now?

- We are working here with the permission of the government & are required to feedback some of our findings.
- We can tell them your problems and the reasons why you feel you need to go to the PA.
- We can't guarantee anything will change, but we can at least share your voices and concerns.

In the village we also have problems with XXX.

- Take notes about the problems, ask questions, show interest & concern.
- Say you are unable to make changes, but if you are able to share their concerns with the appropriate people you will.

Access to research findings & dissemination results.

- Results will be published in scientific reports.
- Results will also be used to inform a further study which will take place next year. We will return and complete that study.
- We are currently thinking about the best way to disseminate this information and would value your thoughts on how this can be achieved.

Table A1.1. Descriptions and translations of the behaviours depicted on cards used during pile sort activities.

Behaviours in Indonesia			Behaviours in Tanzania		
English	Bahasa Indonesia		English		Kiswahili
1 Growing rice	Menanam padi		1 Grow maize		Kulima mahindi
2 Fishing	Mencari ikan		2 Fishing		Uvuvi
3 Clearing land for palm oil	Membuka lahan untuk kebun sawit		3 Collecting wood		Kuokota kuni
4 Collecting firewood	Mengumpulkan kayu bakar		4 Killing dikdik for stew		Huua digi digi kwa ajili ya kitoweo
5 Growing corn	Menanam jagung		5 Killing dikdik for sale		Huua digi digi kwa ajili ya kuuza
6 Collecting plants for medicine	Mengumpulkan tanaman untuk obat		6 Killing dikdik to protect crops		Huua digi digi kwa ajili ya kuzuia wasiharibu mazao
7 Cutting trees for money	Menebang pohon yang bernilai jual tinggi		7 Feeding/herding livestock		Kulisha/kuchunga mifugo
8 Growing fruit trees	Menanam pohon buah-buahan		8 Honey		Kurina asali
9 Collecting rattan	Mencari rotan		9 Eating bushmeat		Kula nayampori
10 Grazing cows	Menggemala ternak		10 Selling bushmeat		Kuua nyamapori
11 Collecting honey	Mengambil madu		11 Transporting bushmeat		Kusafirisha nyamapori
12 Collecting wild birds	Mengambil burung liar		12 Making charcoal		Kuchoma mkaa
13 Cut trees for house	Menebang pohon untuk rumah		13 Killing elephant for stew		Kuua tembo kwa ajili ya kitoweo
14 Kill wild pig to sell	Membunuh babi liar untuk dijual		14 Killing elephant to sell their ivory		Kuua tembo kwa ajili ya kuuza meno yao
15 Kill wild pig for food	Membunuh babi liar untuk dimakan		15 Killing elephant to prevent crop damage		Kuua tembo ili kuzuia wasibaribu mazao
16 Kill wild pig to protect farms	Membunuh babi liar untuk melindungi kebun		16 Killing elephants for prestige		Kuua tembo kwa ajili ya ufahari
17 Kill a snake	Membunuh ular		17 Killing snake		Kuua nyoka
18 Kill elephant to sell	Membunuh gajah untuk dijual		18 Killing monkeys for stew		Kuua nyani kwa ajili ya kitoweo
19 Kill elephant to protect farms	Membunuh gajah untuk melindungi kebun		19 Killing monkeys for sale		Kuua nyani kwa ajili ya kuuza
20 Kill monkeys to eat	Membunuh monyet untuk dimakan		20 Killing monkeys to prevent crop damage		Kuua nyani kwa ajili ya wasiharibu mazao
21 Kill monkeys to protect farms	Membunuh monyet untuk melindungi kebun		21 Setting snares to protect crops		Kutega nyaya kwa ajili ya kulinda mazao
22 Kill pangolin to eat	Membunuh trenggiling untuk dimakan		22 Setting snares to catch & kill wildlife		Kutega nyaya kwa ajili ya kukumata na kuua wanyamapori
23 Kill pangolin to sell	Membunuh trenggiling untuk dijual		23 Hunting with a gun		Kuwinda kwa kutumia bunduki
24 Kill orangutan to protect crops	Membunuh orangutan untuk melindungi kebun		24 Using poison to kill wildlife		Kutumia sumu kuua wanyamapori
25 Kill orangutan for money	Membunuh orangutan untuk dijual		25 Using bow & arrow to hunt wildlife		Kutumia mshale na upinde kuwinda wanyamapori

26	Kill sambar for food	Membunuh rusa untuk dimakan	26	Hunting using dogs	Kuwinda kwa kutumia mbwa
27	Kill sambar to sell	Membunuh rusa untuk dijual	27	Killing lion to sell	Kuua simba kwa ajili ya kuuza
28	Kill sambar to protect farms	Membunuh rusa untuk melindungi kebun	28	Kill lions to protect livestock	Kuua simba kwa ajili ya luinda mifugo
29	Kill tiger to sell	Membunuh harimau untuk dijual	29	Killing lion for stew	Kuua simba kwa ajili ya kitoweo
30	Kill tiger to protect the village	Membunuh harimau untuk melindungi desa	30	Killing lion for prestige	Kuua simba kwa ajili ya ufahari
31	Using snares around the farm	Menggunakan jerat di sekitar kebun	31	Bribe wildlife officer	Kumpa rushwa askari wa wanyamapori
32	Using snares in the forest	Menggunakan jerat di hutan	32	Enter the protected area to collect resources	Kuingia ndani ya hifadhi kuokota rasilmali
33	Using rifles to kill wildlife	Menggunakan senapan untuk membunuh satwa liar			
34	Using slingshot to kill wildlife	Menggunakan katapel untuk membunuh satwa liar			
35	Using dogs to catch wildlife	Menggunakan anjing untuk menangkap satwa liar			
36	Use poison to kill wildlife	Menggunakan racun untuk membunuh satwa liar			
37	Bribing forest law enforcers	Menyuap polisi hutan			

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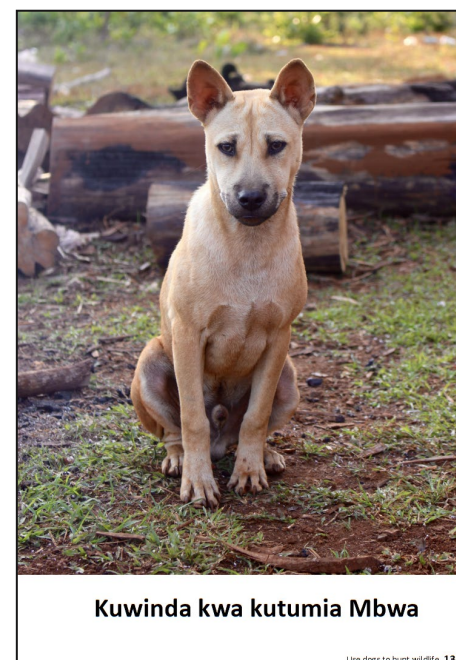


Figure A1.1 Examples of A4 pile-sort cards used in Indonesia (left), and Tanzania (right)

## Survey Instrument

Table A1.2. English version of the survey instrument used to collect data in Indonesia. Different behaviours were asked about in Tanzania (see Chapter 2)

	Question::English	Hint::English
Section 1. Survey location		
start_time		
end_time		
Date		
enumerator	Who is conducting the interview?	
region	Province	
district	District	
district_other	If other district, please write	
subdistrict	Sub-district	
subdistrict_other	if other subdistrict, please write	
village	Name of the village	
subvill	Name of the sub-village	
pa_type	Nearest Protected Area	**Do not ask the respondent this**
pa_type_other	If other, name of the Protected Area	
Section 2. Participant consent		
ethics_statement	Read the Consent Script to the participant	<p>Hello. My name is \${enumerator}, I am a researcher from the University of Indonesia, and I am helping Harriet Ibbett, who is from Bangor University in the UK to conduct research. Harriet's research is all about understanding the best way to ask questions about natural resource use.</p> <p>The survey has two parts. First of all, we will ask your opinion about different types of natural resource use. The second part of the survey is to find out how you most prefer to answer questions about an activity that might be considered sensitive.</p> <p>We are asking lots of people to complete this survey so that we can understand how people prefer to answer questions. Using your opinions and suggestions we will design a new survey, which will involve collecting information from local people about resource use around Protected Areas. The information you provide us is very important in making sure that we ask questions in the right way.</p> <p>The questionnaire will take about 1hour 15 minutes to complete. Any information you provide will be anonymous, this means I will not record your name, or any information that can personally identify you or your household. We may tell people your answers, but we will not reveal that you gave the information. I will record all your answers on this phone. All your answers will then be saved on a secure computer which can only be accessed by Harriet using a password.</p> <p>At the end of the research, Harriet will write a report on her findings. This report will be used to</p>

		<p>help other researchers conduct research that better meets the needs of local people. Some results may also be published internationally so that other people in different countries can learn from our experience working with communities here.</p> <p>Please note that we are independent, we are not related to the government or any NGOs and we have neutral views. We have permission of the Indonesian government and the village chief to carry out this research. However, participation is voluntary. You do not have to participate and you stop participating at any time, without explanation. If you do I will discard your responses. If you feel uncomfortable answering some of the questions, you do not have to answer. If you would like to skip a question or a topic, please say.</p> <p>This study has been reviewed by, and received ethics clearance through Bangor University. If you have any questions, please ask me and I will do my best to answer them.</p> <p>If you remain unhappy or wish to make a formal complaint, I can give you the contact details of someone to discuss this with.</p>
consent	Did participant give their consent to participate?	
no_consent	Thank the participant and end the survey.	
consent_gender	What was the gender of the participant?	
Section 3. Covid-19 precautions		
covid_note	Reminder: COVID Precautions	<p>If the guide has not already explained our COVID precautions then explain to the respondent:</p> <ol style="list-style-type: none"> <li>1. That the team are clear of symptoms</li> <li>2. That we will be working outside and maintaining social distancing</li> <li>3. We will be washing hands frequently</li> <li>4. That we wear masks to protect ourselves and the respondent</li> </ol>
covid_symptoms	Does anyone in your household have symptoms of COVID19 that have developed over the previous week?	<p>These are:</p> <ul style="list-style-type: none"> <li>• a new and persistent cough</li> <li>• difficulty in breathing</li> <li>• a high fever,</li> <li>• a recent loss of taste or smell</li> </ul>
covid_yes	Thank the respondent for their time, explain that even though the sick individual may not have COVID we do not want to put other respondents at risk if they do have COVID. Wish them or their household member a quick recovery	
covid_mask	Wearing disposable masks	Would you like me to provide a mask for you to wear also?
Section 4. Participant demographics		
gender	What gender is the participant?	
age	How old are you?	If unknown, ask them to estimate their age
ethn	Ethnicity	
ethn_other	Please specify which ethnic group	
language	What is the main language you speak?	



language_other	Please specify which language	
religious	Are you religious?	
religion1	Participants Religion	
religion	What is your religion?	
religion_other	Please specify which religion	
religion_importance	How important is religion to you?	
yrs_ed	How many years of schooling do you have?	Enter approximate number of years (max 12 years)  If none, enter 0 For university, write 12 plus number of years of university completed e.g. 12 + 4 years = 16years
literacy	Can you read?	
literacy_ease	How do you find reading?	Read out options to respondent
birth_month	Do you know the month in which you were born?	
month	Birth month	
own_mobile	Do you personally own a mobile phone?	This means the individual. Not the household.
know_pa	Do you know the name of the nearest Protected Area?	
pa_name	Name of the nearest Protected Area	
pa_other	If other, name of the Protected Area	
Section 5. Sensitive behaviour 1 – Clearing land		
sens_note	Measuring sensitive behaviours	I will now ask you about a range of activities that you, members of your household, other family members, your friends or neighbours in the village might do.  For each activity, I will ask several questions. I don't want to know whether you do these activities, but just about your opinions.  The first activity is clearing forest.
comm_land	If we ask people in the community if they **clear forest** inside TNGL, how willing do you think people will be to talk to us honestly about this?	
approval_land	If you personally cleared forest in the TNGL, do you think your friends & family would...	
morals_land	To what extent do you agree with the following statement?	*"It is acceptable to clear forest in the TNGL"
sdb_land	To what extent do you agree with the following statement?	*"If I cleared forest in the TNGL, people in the community would think well of me"
comfort_land	If you clearing forest inside the TNGL and a researcher asked you questions about that, how comfortable would you feel to answer questions truthfully?	
comwhy_land	Why would you be uncomfortable discussing clearing forest in the TNGL?	
rules_land	Are there any rules about clearing forest in the TNGL?	
senscale_land	Explain the Sensitivity Scale	Here we have a sensitivity scale. We can use this to see how sensitive people in the community think something is or isn't.  At one end, we have things that are not at all sensitive. Which means people will be very happy

		<p>to discuss this.</p> <p>At the other, we have topics that are VERY sensitive and that no-one likes or would be happy to talk about.</p> <p>The darker the color, the more sensitive the topic.</p>
agreescore_land	<p>Your previous answers suggest that clearing forest in TNGL is....</p> <p>`\${senscore_land}`</p> <p>Do you feel this is accurate?</p>	Show participant where they score on the sensitivity scale.
why_land	Why?	
Section 6. Sensitive behaviour 2 – Hunting wildlife		
hunt_note	Hunting wildlife	These next questions will be about hunting wildlife.
comm_hunt	If we ask people in the community if they hunt wildlife in village land, how willing do you think people will be to talk to us honestly?	
approval_hunt	If you personally hunted wildlife in village land, do you think your friends & family would...	
morals_hunt	To what extent do you agree with the following statement?	*"It is good to hunt wildlife in village land"*
sdb_hunt	To what extent do you agree with the following statement?	*"If I hunted wildlife in village land, people in the community would think well of me"*
comfort_hunt	If you hunted wildlife on village land and a researcher asked you questions about that, how comfortable would you feel answering questions truthfully?	
comwhy_hunt	Why would you be uncomfortable discussing hunting wildlife on village land?	
rules_hunt	Are there any rules about hunting wildlife in village land?	
senscale_hunt	Explain the Sensitivity Scale card	<p>Here we have a sensitivity scale. We can use this to see how sensitive people in the community think something is or isn't.</p> <p>At one end, we have things that are not at all sensitive. Which means people will be very happy to discuss this.</p> <p>At the other, we have topics that are VERY sensitive and that no-one likes or would be happy to talk about.</p> <p>The darker the color, the more sensitive the topic.</p>
agreescore_hunt	<p>Your score for hunting wildlife on village land is</p> <p>`\${senscore_hunt}`</p> <p>Do you feel this is accurate?</p>	Show participant where they score on the sensitivity scale.
why_hunt	Why?	
pa_hunt	If a researcher were to ask about hunting inside TNGL, would the level of sensitivity.....	Select one

pahunt_why	Why?	
Section 7. Sensitive behaviour 3 – Logging		
pa_note	Logging	These next questions will be about entering TNGL to collect resources
comm_log	If we ask people in the community if they enter TNGL to cut wood, how willing do you think people will be to talk to us honestly?	
approval_log	If you personally entered TNGL to cut wood do you think your friends & family would...	
morals_log	To what extent do you agree with the following statement?	*"It is good to cut wood in TNGL"*
sdb_log	To what extent do you agree with the following statement?	*"If I cut wood in the TNGL, people in the community would think well of me"*
comfort_log	If you cut wood in the TNGL and a researcher asked you about that, how happy would you be to answer questions honestly?	
comwhy_log	Why would you be uncomfortable cutting wood in the TNGL?	
rules_log	Are there any rules about cutting wood in the TNGL?	
senscale_log	Explain the Sensitivity Scale card	<p>Here we have a sensitivity scale. We can use this to see how sensitive people in the community think something is or isn't.</p> <p>At one end, we have things that are not at all sensitive. Which means people will be very happy to discuss this.</p> <p>At the other, we have topics that are VERY sensitive and that no-one likes or would be happy to talk about.</p> <p>The darker the color, the more sensitive the topic.</p>
agreescore_log	<p>Your score for cutting wood in the TNGL</p> <p>\${senscore_log}.</p> <p>Do you feel this is accurate?</p>	Show participant where they score on the sensitivity scale.
why_log	Why?	
Section 8. Thank you & wrap-up		
thank_you	<p>The survey is now finished.</p> <p>Thank you for participating.</p>	
feedback	\${enumerator} have you any comments or feedback?	

## Descriptive results of items included in the psychometric scale

Table A1.3. Descriptive statistics for psychometric scale items included in the exploratory factor analysis. n indicates number of rows where responses were obtained for all five scale items, across all behaviours.

Response item	n	Median	Mean	SD	SE	Skew	Kurtosis
Indonesia							
Injunctive norm	849	4	3.38	1.02	0.04	-0.46	-0.91
Moral attitude towards behaviour	849	4	3.30	1.02	0.04	-0.42	-1.07
Social desirability of behaviour	849	4	3.53	0.90	0.03	-0.98	-0.04
Personal comfort discussing behaviour	849	3	3.07	1.02	0.03	-0.07	-1.47
Community willingness to discuss behaviour	849	3	2.93	1.00	0.03	0.25	-1.40
Tanzania							
Injunctive norm	1025	4	3.88	0.61	0.02	-1.53	4.45
Moral attitude towards behaviour	1025	4	4.05	0.67	0.02	-1.80	6.95
Social desirability of behaviour	1025	4	3.89	0.61	0.02	-1.85	5.94
Personal comfort discussing behaviour	1025	4	3.62	0.79	0.02	-1.22	0.79
Community willingness to discuss behaviour	1025	4	3.51	1.01	0.03	-1.10	0.21

Table A1.4. Knowledge of rules regarding the behaviours asked about in the questionnaire.

Indonesia				Tanzania				
Do you know if there are any rules about...	Yes	No	Don't know	Do you know if there are any rules about...	Yes	No	Don't know	No response
Hunting on village land (n=281)	33%	65%	2%	Hunting on village land (n=263)	88%	4%	9%	-
Clearing land in the NP (n=279)	91%	5%	4%	Eating bushmeat (n=250)	91%	2%	7%	1%
Logging in the NP (n=289)	97%	2%	1%	Grazing livestock in the PA (n=248)	95%	1%	3%	-
				Entering the PA to collect resources (n=264)	93%	1%	5%	1%

Table A1.5. Changes in perceived sensitivity of hunting, when hunting conducted in protected areas

If a researcher were to ask about hunting inside the protected area, would the level of sensitivity...	Indonesia (n=301)	Tanzania (n=278)
Increase a lot	10%	20%
Increase a little	62%	10%
Stay the same	19%	49%
Decrease a little	1%	1%
Decrease a lot	0	0
Don't know	8%	20%

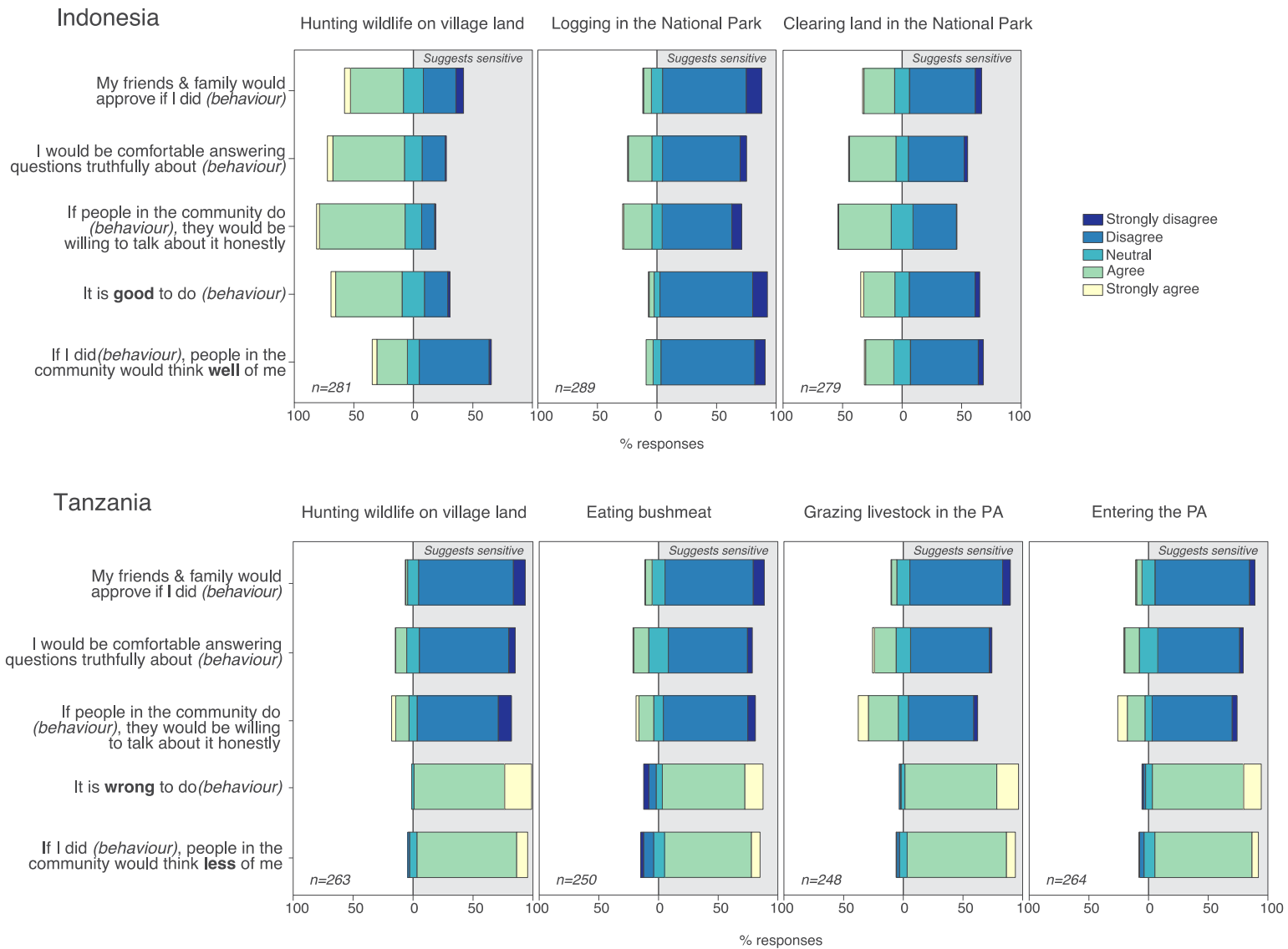


Figure A1.2. Percentage of responses in each category for each item in the psychometric scale used to measure topic sensitivity. Responses to the right of the centre line (grey shaded area) indicate the proportion of responses that suggest the behaviour is sensitive, while responses on the left suggest low sensitivity. Note that the response are presented in reverse for the last two statements in Tanzania (i.e. strongly agree appears to the right of 0, rather than the left).

Results from Exploratory Factor Analysis of psychometric scale data

Indonesia

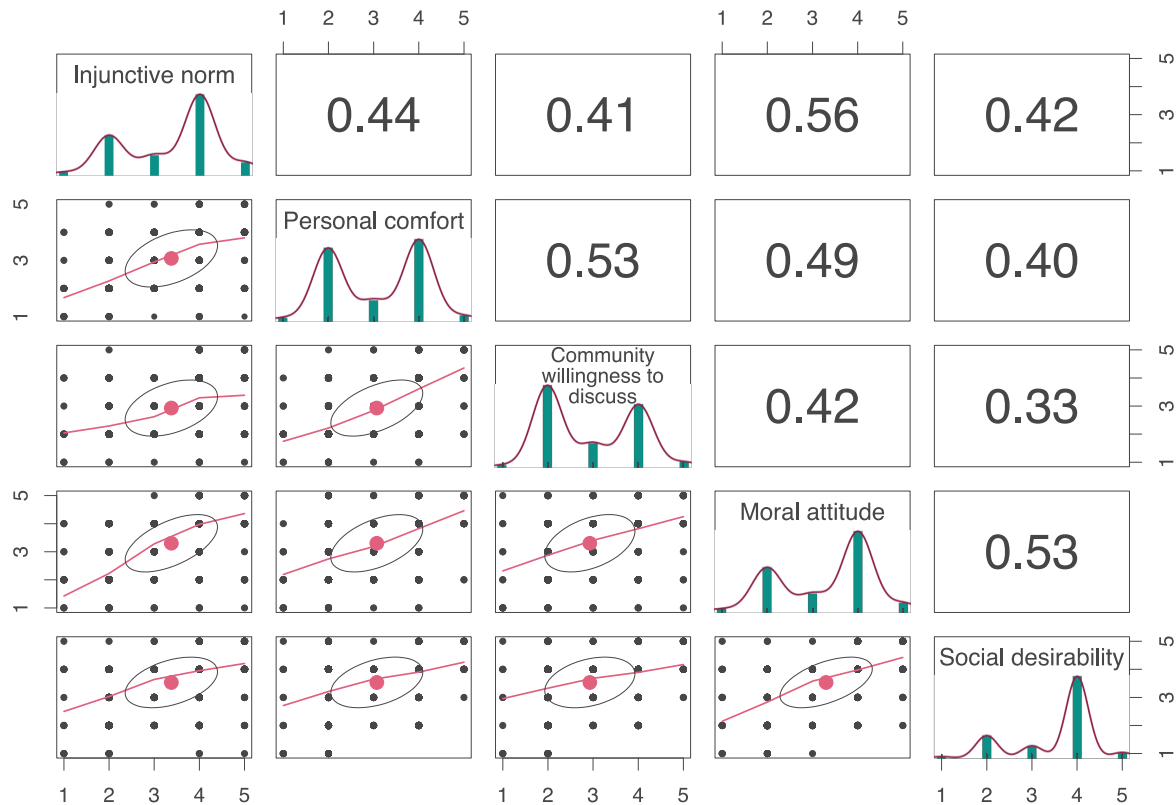


Figure A1.3. Scatter plots, histograms and Pearson correlation coefficients for each item in the Indonesia dataset (n=849).

Parallel Analysis Scree Plots

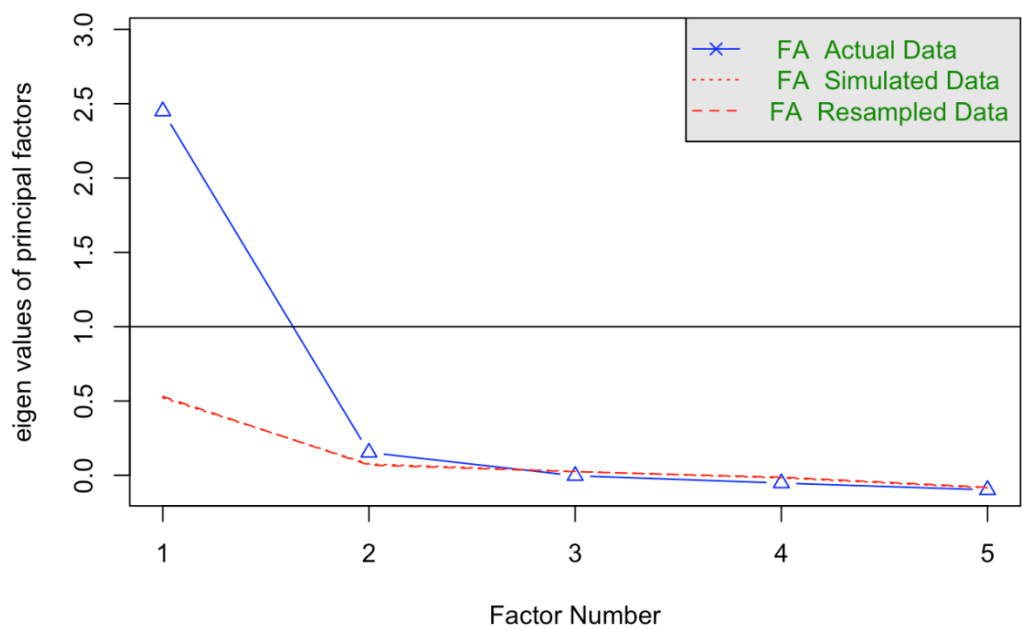


Figure A1.4. Scree plot of eigen values for Indonesian dataset (n= 849).



Table A1.6. Results from 1-factor and 2-factor Exploratory Factor Analyses run on Indonesia dataset.

Indonesia			
Item	1-factor EFA loadings	2-factor EFA loadings	
	Factor1	Factor1	Factor2
Injunctive norm	0.68	0.56	-
Moral attitude	0.77	0.87	-
Social desirability	0.62	0.61	-
Personal comfort	0.69	-	0.56
Community willingness to discuss	0.61	-	0.78
Sum of Squared loadings	-	1.59	1.07
Proportional Variance	-	0.32	0.21
Cumulative Variance	-	0.32	0.53
Degrees of freedom & fit	5, 0.07	1	
n	849	849	
Likelihood Chi-Sq	61.84 with prob < 0.001	0.84 with prob < 0.36	
RMSEA Index	0.116 90%CI (0.091, 0.142)	0.000 (90%CI 0, 0.08)	
Tucker Lewis Index	0.91	1.001	
SRMR	0.05	0	
BIC	28.12	-5.91	

*Cut-offs for good model fit: chi-square test of exact fit, Root Mean Square Error of Approximation (RMSEA  $\leq$  0.06), Tucker Lewis Index (TLI  $\geq$  0.95), Standardized Root Mean Square Residual (SRMR  $\leq$  0.08) (Boatang et al. 2018), Bayesian Information Criteria (BIC < as possible)*

Tanzania

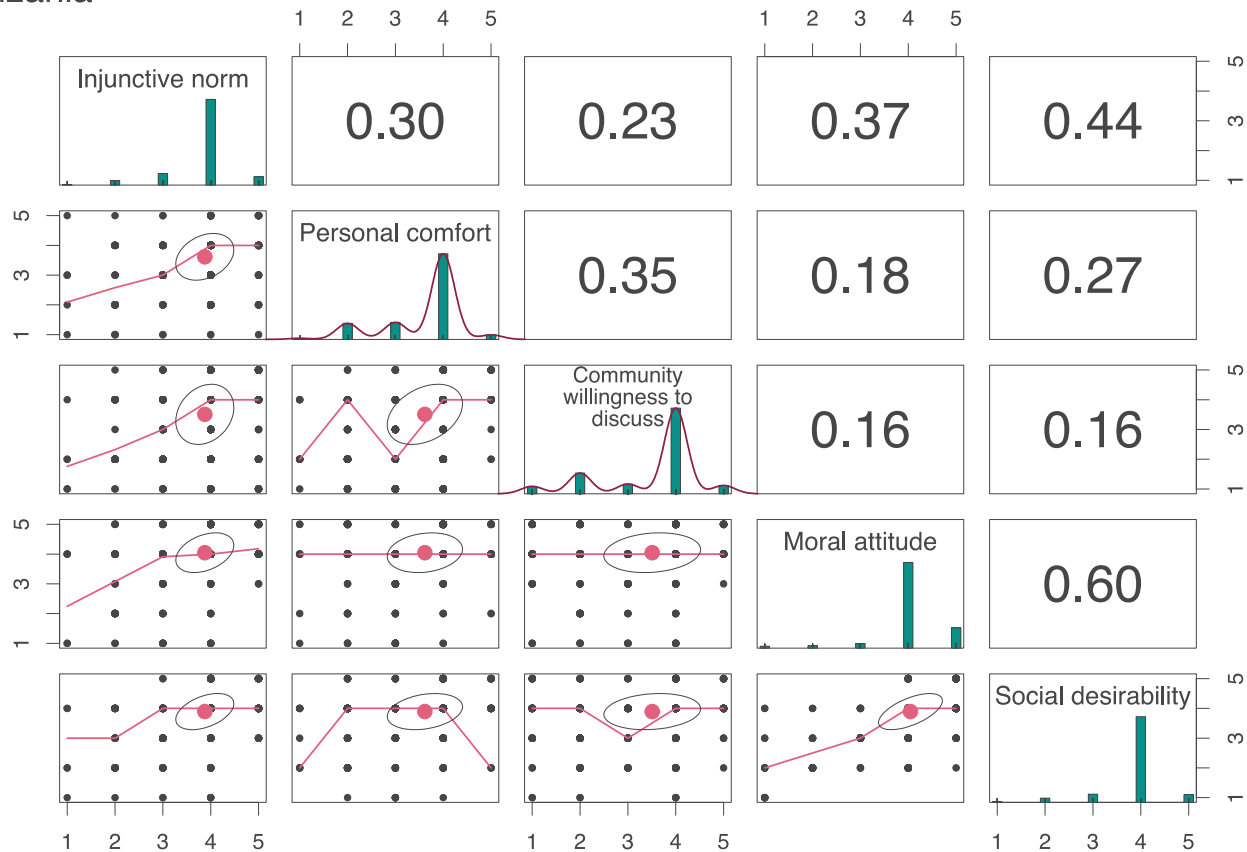


Figure A1.5. Scatter plots, histograms and Pearson correlation coefficient for each item in the Tanzania dataset (n=1025).

Parallel Analysis Scree Plots

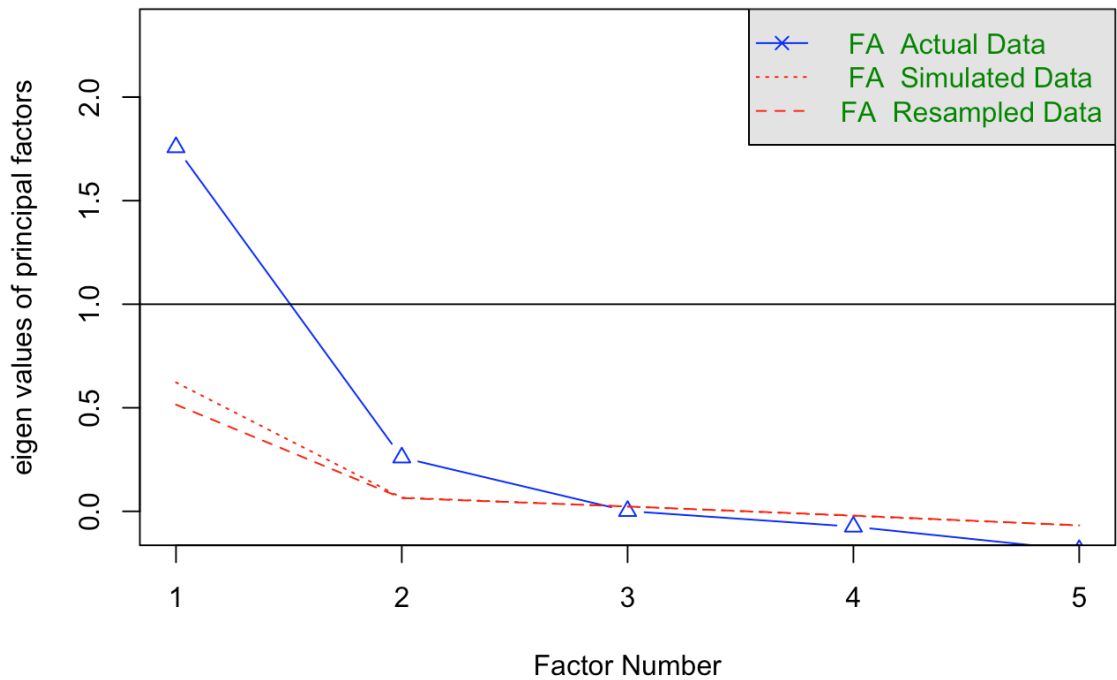


Figure A1.6. Scree plot of eigen values for Tanzania (n=1025)

Table A1.7. Results from 1-factor and 2-factor Exploratory Factor Analyses run on Tanzania dataset.

Tanzania			
	1-factor EFA loadings	2-factor EFA loadings	
Item	Factor1	Factor1	Factor2
Injunctive norm	0.60	0.401	-
Moral attitude	0.66	0.727	-
Social desirability	0.77	0.846	-
Personal comfort	0.41	-	0.663
Community willingness to discuss	0.32	-	0.538
Sum of Squared loadings	-	1.406	0.804
Proportional Variance	-	0.281	0.161
Cumulative Variance	-	0.281	0.442
Degrees of freedom	5	1	
n	1025	1025	
Likelihood Chi-Sq	151.8 with prob <0.001	5.69 with prob <0.017	
RMSEA Index	0.169 90%CI (0.147, 0.193)	0.068 (90%CI 0.023, 0.126)	
Tucker Lewis Index	0.697	0.952	
SRMR	0.09	0.01	
BIC	117.14	-1.25	

*Cut-offs for good model fit: chi-square test of exact fit, Root Mean Square Error of Approximation (RMSEA  $\leq$  0.06), Tucker Lewis Index (TLI  $\geq$  0.95), Standardized Root Mean Square Residual (SRMR  $\leq$  0.08) (Boatang et al. 2018), Bayesian Information Criteria (BIC < as possible)*

## Sensitivity Index

### *Creation of a composite Sensitivity Index*

The composite index for sensitivity was created by obtaining factor-scores from the 2-factor EFA model. We extracted factor-scores using the 'tenBerge' method in 'psych' package (Revelle 2021), which produces factor scores that preserve correlation between factors (i.e., when using an oblique factor rotation). These were transformed from z-scores to a scale ranging from 0 to 1. For each row of data, we multiplied the transformed factor-score for each factor, by the proportion ratio each factor represented, to create a weighted factor-score. The proportion ratio for each factor was calculated as:

$$\text{Proportion ratio} = \frac{\text{Proportion of variance represented by the factor}}{\text{Total variance explained by all factors}}$$

The composite Sensitivity Index was calculated by summing these transformed weighted factor-scores:

$$\text{Sensitivity Index} = (F_1 * R_1) + (F_2 * R_2)$$

Where:

$F$  = Transformed factor-score identified for each factor, for each row of data

$R$  = Proportion ratio for the factor (i.e., the proportion of variance explained by the factor, transformed into a ratio)

$1, 2, \dots$  = The id of the factor identified in the model (e.g., 1 = Factor1, 2 = Factor2)

*Beta regression models*

Table A1.8. Explanation of the response and predictor variables tested in country-specific Beta regression models with mixed-effects

Variables	Description (Data type: Levels)
Response variable	
Sensitivity Index	Composite index created from summing weighted factor-scores (Continuous: ranging from 0 to 1)
Predictor variables ( <i>Effect type</i> )	
ID (Random effect) <sup>a</sup>	Unique ID code assigned to each respondent ( <i>Continuous</i> )
Age	Age of respondents in years ( <i>Continuous</i> )
Gender	Gender of the respondent (Categorical: Male / Female)
Education	Number of years schooling the respondent completed ( <i>Continuous</i> )
Behaviour	Behaviour the respondent was asked about (Categorical: Indonesia – hunting in village land, logging in the National Park, Clearing land in the National Park; Tanzania – hunting in village land, eating bushmeat, grazing livestock in the nearest protected area, entering the protected area)
Knowledge of rules	Whether the respondent knew if there were any rules associated with the behaviour (categorical: Yes / No)
Type of Protected Area	The type of protected area the respondent lived nearest to (Categorical: Indonesia – National Park, Protected Forest, Other; Tanzania – National Park, Game Reserve, Other)

<sup>a</sup> Included as a random effect to control for respondents answering multiple questions per behaviour

### Can simplistic analyses on smaller samples provide similar results to the Sensitivity Index?

Psychometric scales require large samples, which are not always possible to obtain during the preliminary design stages of research. Recognising this as a limitation of our Sensitivity Index, we wanted to test whether a simple analysis, conducted using a more feasible sample size (e.g., 40 individuals) would produce similar results to those obtained with weighted-factor-scores. To do so, we randomly extracted responses from 40 individuals from each country dataset, and summarised the mean raw response for each behaviour. We repeated this process 10 times, each time extracting a different subset of 40 individuals. Results are plotted below (Fig. A1.7) alongside the Sensitivity Index calculated using weighted-factor scores for the whole sample. Although they are portrayed using different y-axis, broadly speaking, the patterns of sensitivity are the same, suggesting crude analysis using raw data, can provide an indicator of sensitivity equal to that obtained using more complex analyses.



Figure A1.7. Raw response scores show the mean score obtained for each behaviour, in each country (Indonesia, left; Tanzania, right) from a subset of 10 randomly generated samples of 40 respondents. Each coloured dot represents the mean score of the five items used to measure the sensitivity of each behaviour. Weighted-factor-scores, shows the mean Sensitivity Index calculated for the whole dataset using weighted-factor-scores. Dark grey dots represent the mean Sensitivity Index, other coloured dots show the distribution of the data.

## Free-listing analysis and results

### Calculating item salience

The following formula can be used to calculate salience of each item:

$$\text{Item salience} = \frac{1 + \text{length}_i - \text{rank}_i}{\text{length}_i}$$

Where length indicates the number of items listed in focus group  $i$ , and rank reflects the position of the item in the list of focus group  $i$ . Smiths salience, which reflects the overall importance of an item in the sample, is calculated by summing the salience scores for each item listed, and dividing it by the total number of lists ( $n$ ):

$$\text{Smiths Salience} = \frac{\sum \text{item salience}_i}{n}$$

## Qualitative notes from second free-listing exercise (Challenges of living alongside PAs)

### Indonesia

In Indonesia, several groups reported that village populations were growing, and that protected area boundaries limited their ability to expand farms. One group explained that farms were often handed down through generations, and as a result many preceded the protected area. However, when the protected area was established, the boundary markers were incorrectly laid, absorbing their farmlands. As a result, some participants reported being unable to clear or cultivate their lands. In another group, participants explained that although most people in their community were farmers, not everyone owned land. The presence of the protected area prevented those without land from obtaining any. Although some households had permission to grow crops on state land near protected areas, lack of land tenure meant there was no long-term security in doing so.

The other main challenge listed by participants in Indonesia was damage to property and crops from wildlife. One group reported predation of livestock by tiger, and that species such as sun bear (*Helarctos malayanus*), elephant and orangutan visited the village. They said they received no compensation for livestock losses to tiger but did for crops (such as durian) damaged by orangutan. Another group reported issues with wild pig, and primates such as macaque (*Macaca sp.*), langur (*Presbytis sp.*) and orangutan destroying crops. They reported using snares and electric fences to protect farms but said these were also dangerous as they posed a risk to people. Three groups reported no challenges to living alongside protected areas.

Focus group participants specifically requested to highlight that there were many benefits obtained from living alongside protected forest areas. These included clean water and air, protection from extreme weather events such as flooding, as well the provision of jobs through tourism.

## Tanzania

In Tanzania, challenges of living alongside wildlife, particularly large, dangerous species were highly salient, particularly around Game Reserves. Elephant, bush pig (*Potamochoerus larvatus*), ground hornbill (*Bucorvus leadbeateri*) and primates were reported to damage crops, while livestock was lost to carnivores such as lion, leopard (*Panthera pardus pardus*), spotted hyena (*Crocuta crocuta*) and jackal (*Canis sp.*). Participants also highlighted the risk to people from wildlife. One group relayed how a villager walking on the road at night had been attacked by hyena, and that a man had been killed and eaten by lion after falling asleep in the bush. In other groups, participants reported villagers being killed by elephant while protecting crops and defending food stores.

Issues associated with the location of Ruaha National Park boundary were listed by participants living near the park. Several groups reported that the National Park boundary had been moved several times without, they felt, adequate consultation or compensation, resulting in people reporting that they had lost access to water sources, ancestral lands (including burial grounds and worship sites) and agricultural and grazing lands. Participants explained that movement of the boundary had led to feelings of anxiety, distrust towards the National Park and a sense of powerlessness, with participants describing that they were unclear where 'true' boundaries now lay. One group was hesitant to complete the construction of a school, because they were afraid boundaries would move again. Changes to the National Park boundary was also reported as problematic because it reduced the land available for pastoralists to graze livestock, which in turn, exacerbated conflict within communities, particularly between pastoralists and agriculturalists who were left competing for land on which to graze livestock and grow crops.

Legislation relating to the establishment of protected areas in Tanzania varies with protected area type. According to Article 6 of the National Park Act (1959), the President can declare any area of land to be a National Park and can alter the boundaries of a National Park to include any area of land not already included. In such cases all rights, titles, interests, franchises, claims, privileges, exemptions or immunities of any person in respect of any land within the area ceases and are forever extinguished. Any person who has any rights to land is entitled to compensation, providing claims are submitted within ten weeks of the date of the proclamation. The southern extent of Ruaha National Park was formerly Usangu Game Reserve, gazetted as such in 1998. According to the Wildlife Conservation Act (2009) the President may also declare any area of Tanzania to be a Game Reserve, and, under Article 14.1, should consult with relevant local authorities first. The designation of wildlife corridors, dispersal areas, buffer zones and migratory routes is decentralised to the Minister, who may, in consultation with relevant local authorities order such gazettlements. In 2008, Usangu Game Reserve was incorporated into Ruaha National Park (Wildlife Conservation Act 1974 – Wildlife Conservation (Usangu Game Reserve Declaration) Order – Government Notice 436A of 1998). The change in protected area status followed the eviction of hundreds of cattle herders and their animals from the reserve (Walsh 2012). According to government, under the Wildlife Conservation Act (2009), the Usangu Game Reserve land was already reserved land, and not village land as suggested by participants in our focus groups. Contemporary complaints concerning the National Park



boundary reported by our participants, and others (see Zia et al. 2011) likely reflect the turbulent historic context of protected area establishment in the Usangu area.

The relationship between people and protected area law enforcement was raised in one capacity or another in all groups. Some groups living near Game Reserves reported that law enforcers, tasked with enforcing protected area rules, assisted people when they had problems with wildlife. However, other groups living around the National Park reported poor relations with law enforcers, reporting stories of misconduct, corruption, and violence. One group felt law enforcers often went beyond their authority. They described a recent incident whereby law enforcers had searched homes in the middle of the night, shot bullets into the air, and beaten those suspected of wrongdoing. Another group reported that rules were enforced unequally. For example, they explained that it was legal to fish, however, if you were unable to prove where your catch came from, law enforcers may arrest you for fishing in the protected area. Another group said that if law enforcers searched your home and found beef meat, they would claim it was bushmeat and impart sanctions. In several groups, participants reported that villagers had been arrested on their farms (particularly during rainy season), simply because their farms were located close to the protected area. Issues related to power and law enforcement also came up within these groups. For example, one group located far from the main village (and closer to the National Park), reported that they felt powerless against law enforcers because they were so far from the protection of their community leader, and that they were disadvantaged as law enforcers only spoke Kiswahili (whereas some villagers only spoke their ethnic language); if a villager was unable to speak Kiswahili, they were unable to explain or defend themselves. In several groups, participants said that threatening to report community members to law enforcers for rule-breaking (e.g., for hunting wildlife) was used to leverage power over others.

Other challenges listed included that protected areas restricted local peoples' access to essential resources (e.g., water and firewood), restricted opportunities for development (e.g., authorities would not allow the construction of power lines to the village through the protected area), with tsetse flies being reported as a specific issue around Game Reserves. Participants reported that they received few benefits from protected areas; unlike the 'safari circuit' in the north of the country, there was little tourist infrastructure in the landscape.

# Appendix 2

Chapter 3 - Experimentally validating Specialised Questioning Techniques in conservation

## Experimental Design

We adapted an experimental design developed by Hoffmann et al. (2017), with our study differing in several ways. Firstly, Hoffmann et al. (2017) used a block design, meaning not all methods were tested on all respondents. In our study, we wanted to compare respondents' understanding across all methods, thus asked respondents about all five methods. This increased the time it took for respondents to complete the questionnaire and the cognitive demand of the experiment. To minimise these costs, we made trade-offs elsewhere. Hoffman et al. (2017) collected four tests of a method per respondent (two requiring a sensitive response, two which did not). We conducted three tests per respondent (requiring two sensitive responses, one not) (Table A2.1). Hoffmann et al. (2017) calculated comprehension as the proportion of correct responses per respondent across all characters. We were specifically interested in how the type of response (i.e., whether it was sensitive or not) affected response accuracy and respondent's willingness to follow instructions. Thus, data were modelled at the question level (rather than the respondent) as a binomial of whether the individual answered the question correctly, with random-effects for individual and method included to control for group-level variation.

Table A2.1. Example of the questions each respondent received. The method order, and the character order were randomly allocated to reduce order effects.

Question		Method (order randomised)				
		Method 1	Method 2	Method 3	Method 4	Method 5
		One of: Direct question, Crosswise model, UCT, RRT-dice, or RRT-button/Bean method				
Introduce method		Character 1	Character 1	Character 1	Character 1	Character 1
Practice method		Character 2	Character 2	Character 2	Character 2	Character 2
Characters (Order randomised)	Q 1	Character 3, 4, or 5	Character 3, 4, or 5	Character 3, 4, or 5	Character 3, 4, or 5	Character 3, 4, or 5
	Q 2					
	Q 3					

Initially, we used photographs of real people accompanied by fictional, but culturally appropriate names. However, piloting in Tanzania revealed high levels of non-response, with participants expressing concern about incriminating those depicted in the photographs. To overcome this, we adopted innocuous names (e.g., Character One), and replaced photographs with silhouettes (Fig. A2.1 & A2.2).



Figure A2.1. Character cards used in Indonesia. Characters One (Satu), Three (Tiga) and Five (Lima) possessed the sensitive trait: hunting wildlife.

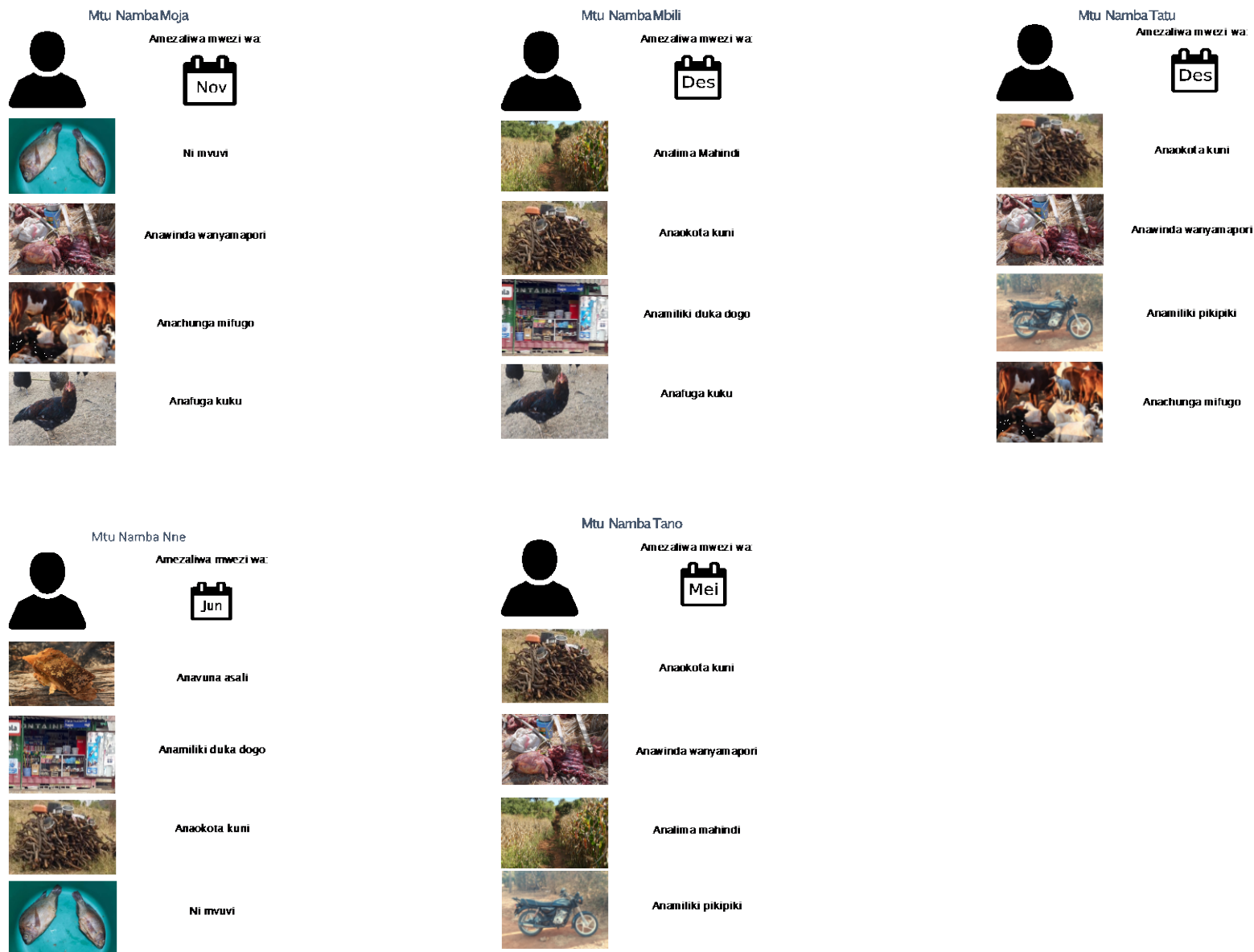
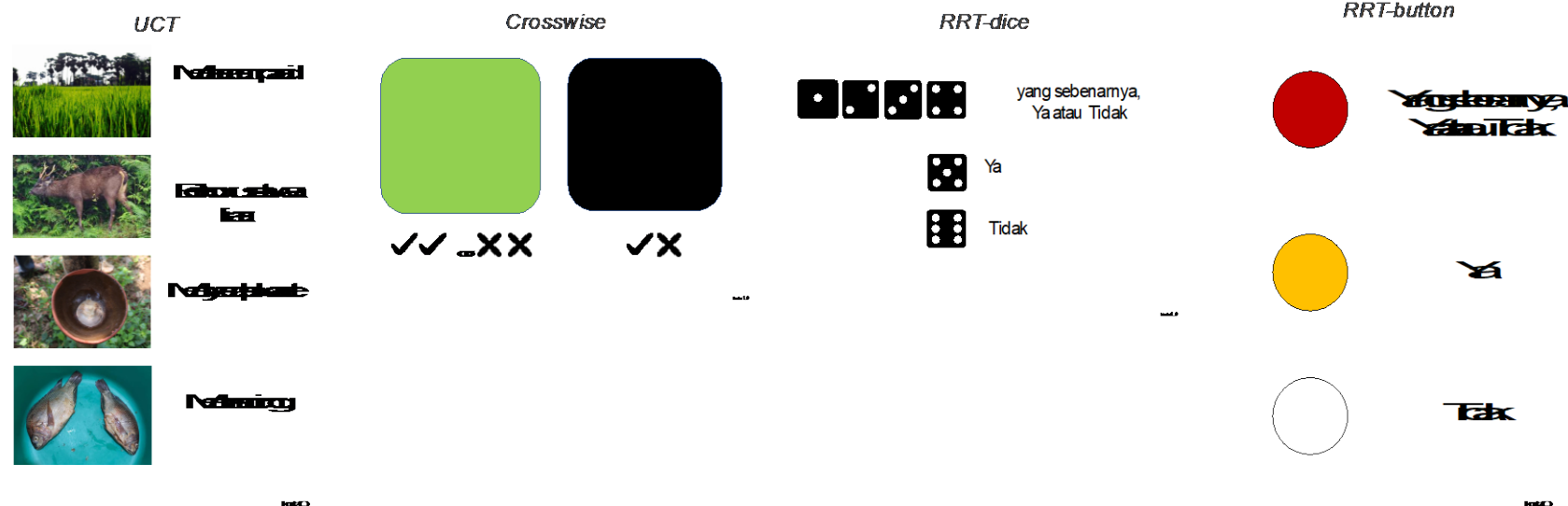


Figure A2.2. Character cards used in Tanzania. Characters One (Moja), Three (Tatu) and Five (Tano) possessed the sensitive trait: hunting wildlife

## Indonesia



## Tanzania

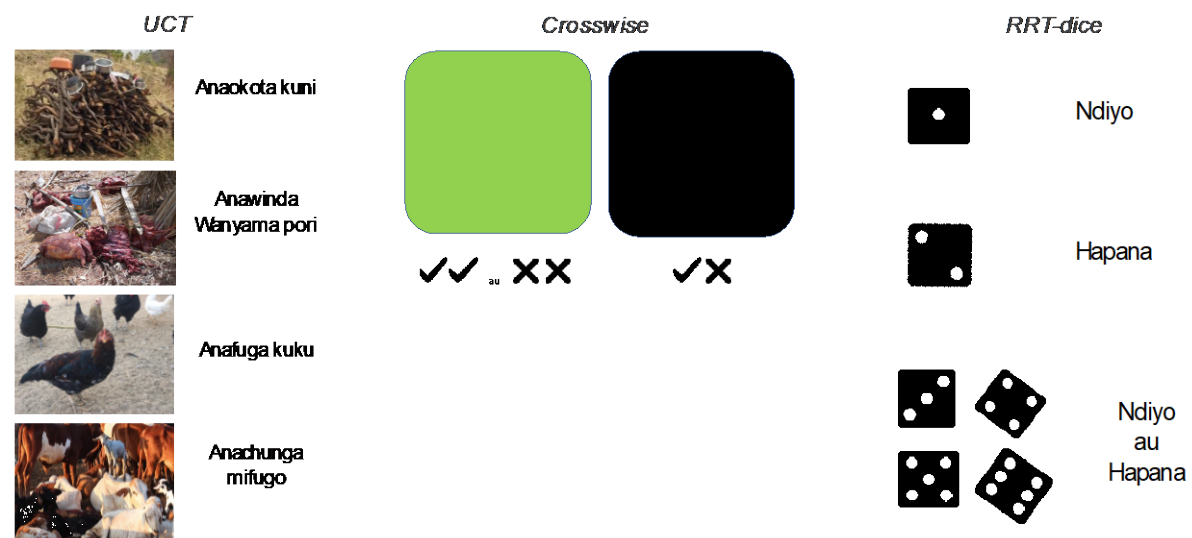


Figure A2.3. Prompt cards used in both countries to explain the methods to respondents.

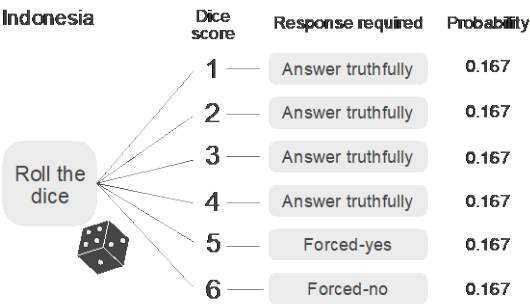
Randomised Response Techniques (both countries)

Randomised Response Techniques are one of the most commonly applied SQTs in conservation, see Table A2.2 for some case studies, and Ibbett et al. (2021) for a full review of their application in conservation.

RRT-button (Indonesia only)

In Indonesia, we tested an alternative randomising device; a cloth bag containing 8 orange buttons, 2 yellow buttons and 2 white buttons. Respondents were instructed to provide a truthful answer if an orange button was selected, to answer 'yes' if a yellow button was selected, and 'no' if a white button was selected (Fig. A2.4). The probability of each of these response options being selected was 0.66, 0.17 and 0.17 respectively.

RRT-dice (both countries)



RRT-button (Indonesia only)

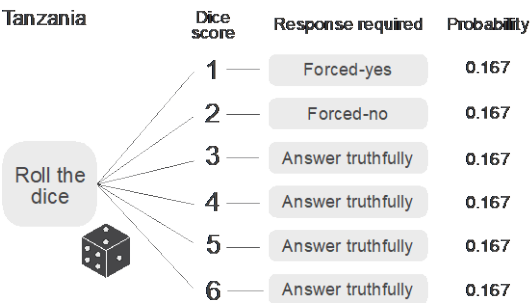
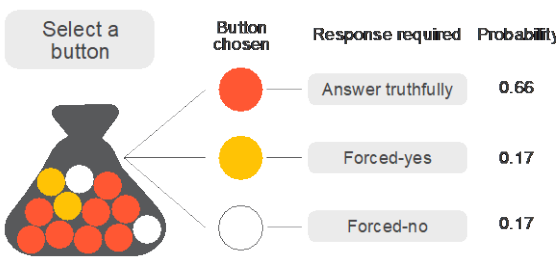


Figure A2.4. Probability trees for the three symmetric forced-response RRT designs included in the study.

RRT-dice (both countries)

When piloting RRT we provided respondents with prompt cards with instructions on how to answer (Fig. A2.4). Respondents were advised that depending on the outcome of the dice, they had to answer yes, no, or provide a truthful yes or no response. Initially, the truthful response option was introduced as “you should answer honestly” and we wrote “answer honestly” on the prompt card. However, instead of providing a simple ‘yes’ or ‘no’ response, respondents replied “honest response”, undermining the anonymity of the method. Subsequently, we tested several alternatives in each country. In Tanzania, we settled on writing “Yes or No” on the prompt card and in Indonesia, “Answer truthfully, yes or no”. In both countries, we verbally reinforced instructions to reiterate that we wanted only “Yes” or “No” responses, and that a truthful “yes” should be indistinguishable from a forced “yes”. For both RRT designs, prevalence can be calculated using the following formula:

$$\pi = \frac{\lambda - \theta}{\delta}$$

Where:

$\pi$  = estimated proportion of sample who possess the sensitive characteristics or have undertaken the behaviour,

$\lambda$  = proportion of all responses in the sample that are 'yes',

$\theta$  = probability of the answer being a 'forced-yes',

$\delta$  = probability of having to answer the sensitive question truthfully

### UCT (both countries)

Recent research suggests UCT is the second most applied SQT in conservation and is also known as the list experiment. Several different variations of the list experiment exist, including the double-list experiment. See Hinsley et al. (2018) for a full review of their use in conservation, and Table A2.2 in Appendix 2 for examples of conservation applications.

UCT works by providing respondents a list of items and asking them to report how many apply to them. To assume anonymity, respondents are told to never identify which items on the list are applicable. To derive prevalence estimates the sample is divided in two. One half receives a 'control' list, this includes a set of non-sensitive items. The other half receives the 'treatment' list, this includes the same set of innocuous items, but with the addition of the sensitive item of research interest (Nuno & St John 2015). When designing a UCT, researchers must be careful to avoid design effects which can occur if a respondent reports that all (ceiling effect), or none (floor effect), of the items apply to them (Droitcour et al. 1991). Prevalence is calculated by using the following formula:

$$\pi = Y - X$$

Where:

$\pi$  = prevalence of sensitive trait in sampled population,

$Y$  = mean response for the treatment list,

$X$  = mean response for the control list

### Bean method (Tanzania only)

Developed to reduce the complexity associated with UCT and RRT, the bean method has been applied successfully in conservation (Cerri et al. 2017; Jones et al. 2021) and shows promise as suitable alternative for deriving prevalence estimates at the sample level. Initially, we started using two larger beans of similar shape, but different colour. However, during the pilot, some of the beans started to change colour as they aged, and it became difficult to differentiate between the bean types. We also had issues with weevils eating beans. For the main data collection, we transitioned to maize kernels and kidney beans, as these were sufficiently different in shape, size and colour to always be distinguishable.



Deciding how many of each bean to include in a jar was a trade-off between minimising the amount of effort interviewers would have to invest in counting at the end of each day (the more beans, the longer it took to count and the more scope for error) and including enough beans in the jar so that the removal of a proportion wouldn't be obvious. After assessing how many respondents would be surveyed per day and estimating the likely number of beans that would be moved, we settled on 75 maize kernels and 75 red kidney beans (150 beans total) per jar. Jars were shaken before and after use, and were opaque, to hide colour of the bean moved. Prevalence is calculated by counting the additional number of each type of bean that are present in the large jar at the end of the day. Although we were not attempting to estimate prevalence, interviewers counted the total number of beans in each jar to assess whether the number of each coloured bean equalled the expected number of beans in each jar. This was often a tiring task to complete at the end of each survey day, and risked introducing new error to estimates (e.g., if beans were dropped or lost, counting error).

### **Crosswise model (both countries)**

Developed by Yu et al. (2008) the crosswise model has been promoted as more efficient and having simpler instructions than RRTs (Hoffmann et al. 2020; Meisters et al. 2020). The method has been applied to research topics such as xenophobia (Hoffmann et al. 2017) and plagiarism (Jann et al. 2012), but no published examples yet exist in conservation. An example of the prompt card used to explain crosswise model is shown in Figure A2.3. Prevalence is calculated from Crosswise model using the following formula:

$$\hat{\pi}_{\text{CWM}} = \frac{\hat{\lambda}_{\text{CWM}} + r - 1}{2 * r - 1}$$

Where:

$\hat{\lambda}_{\text{CWM}}$  = the observed proportion of respondents choosing that "both statements are true, or both statements are false.

$r$  = known prevalence of the non-sensitive control item (e.g., proportion of population born in November or December).

## Examples of SQT applications in conservation

Table A2.2. Examples of studies which have used SQTs to investigate a sensitive conservation topic.

SQT	Behaviour	Country	Reference
UCT	Fisher compliance	Australia	Bergseth et al. (2017) A social–ecological approach to assessing and managing poaching by recreational fishers. <i>Frontiers in Ecology and the Environment</i> , 15(2), 67-73.
UCT	Wildlife persecution	South Africa	Brink et al. (2021) Prevalence and drivers of poison use by South African commercial farmers and perceptions of alternative livestock protection measures. <i>Ambio</i> , 50(6), 1211-1221.
UCT	Bear part consumption	Myanmar	Davis et al. (2020) Insights into medicinal wildlife consumption and bear part use in Rakhine, Myanmar. <i>Journal for Nature Conservation</i> , 58, 125923.
UCT	Wildlife poisoning	Cambodia	de Lange et al. (2021) Using mixed methods to understand sensitive wildlife poisoning behaviours in northern Cambodia. <i>Oryx</i> , 1-14.
UCT	Bird persecution	Portugal	Fairbrass et al. (2016). Investigating determinants of compliance with wildlife protection laws: bird persecution in Portugal. <i>European Journal of Wildlife Research</i> , 62(1), 93-101.
UCT	Natural resource use	Uganda	Harrison et al. (2015). Profiling unauthorized natural resource users for better targeting of conservation interventions. <i>Conservation Biology</i> , 29(6), 1636-1646.
UCT	CITES non-compliance	Global	Hinsley et al. (2017) Estimating the extent of CITES noncompliance among traders and end-consumers; lessons from the global orchid trade. <i>Conservation Letters</i> , 10(5), 602-609.
UCT	Bear bile consumption	China	Hinsley et al. (2021) Combining data from consumers and traditional medicine practitioners to provide a more complete picture of Chinese bear bile markets. <i>People and Nature</i> , 3(5), 1064-1077.
UCT	Hunting wildlife	Cambodia	Ibbett et al. (2019). Conserving a globally threatened species in a semi-natural, agrarian landscape. <i>Oryx</i> , 53(1), 181-191.
UCT	Hunting wildlife	Cambodia	Ibbett et al. (2021) Estimating hunting prevalence and reliance on wild meat in Cambodia's Eastern Plains. <i>Oryx</i> , 1-11.
UCT	Bushmeat consumption	Tanzania	Nuno et al. (2013) A novel approach to assessing the prevalence and drivers of illegal bushmeat hunting in the Serengeti. <i>Conservation Biology</i> , 27(6), 1355-1365.
UCT	Turtle consumption	Cayman Islands	Nuno et al. (2018). Understanding implications of consumer behaviour for wildlife farming and sustainable wildlife trade. <i>Conservation Biology</i> , 32(2), 390-400.
UCT	Consumption of pangolin	Vietnam	Olmedo et al. (2021) Uncovering prevalence of pangolin consumption using a technique for investigating sensitive behaviour. <i>Oryx</i> , 1-9.
UCT	Hunting wildlife	Madagascar	Spira et al. (2021). Assessing the prevalence of protected species consumption by rural communities in Makira Natural Park, Madagascar, through the unmatched count technique. <i>Conservation Science and Practice</i> , e441.
UCT	Hunting wildlife	Malawi	Van Velden et al. (2020). Bushmeat hunting and consumption is a pervasive issue in African savannahs: insights from four protected areas in Malawi. <i>Biodiversity and Conservation</i> , 29(4), 1443-1464.
UCT	Hunting wildlife	Cameroon	Whytock et al. (2018) Quantifying the scale and socioeconomic drivers of bird hunting in Central African forest communities. <i>Biological Conservation</i> , 218, 18-25.
UCT	Hunting wildlife	Tanzania	Wilfred et al. (2019) Attitudes to illegal behaviour and conservation in western Tanzania. <i>Oryx</i> , 53(3), 513-522
UCT & RRT	Bear bile consumption	Cambodia	Davis et al. (2020) Insights for reducing the consumption of wildlife: The use of bear bile and gallbladder in Cambodia. <i>People and Nature</i> , 2(4), 950-963.

UCT & RRT	Giraffe consumption	Kenya	Ruppert et al. (2020) Use of specialized questioning techniques to detect decline in giraffe meat consumption. <i>Journal for Nature Conservation</i> , 126029
UCT & RRT	Fisher compliance	New Zealand	Thomas et al. (2015) Estimating non-compliance among recreational fishers: insights into factors affecting the usefulness of the randomized response and item count techniques. <i>Biological Conservation</i> , 189, 24-32.
RRT	Natural resource use	Nigeria	Akinsorotan et al. (2019) Evaluating rule breaking behavior in a Nigerian protected forest reserve area. <i>Journal of Applied Sciences and Environmental Management</i> , 23(6), 1075-1079.
RRT	Fisher compliance	Australia	Arias & Sutton (2013) Understanding recreational fishers' compliance with no-take zones in the Great Barrier Reef Marine Park. <i>Ecology and Society</i> , 18(4).
RRT	Fisher compliance	USA	Blank & Gavin (2009) The randomized response technique as a tool for estimating non-compliance rates in fisheries: A case study of illegal red abalone ( <i>Haliotis rufescens</i> ) fishing in Northern California. <i>Environmental Conservation</i> , 36(2), 112-119.
RRT	Fisher compliance	South Africa	Bova et al. (2018) Limitations of the random response technique and a call to implement the ballot box method for estimating recreational angler compliance using surveys. <i>Fisheries Research</i> , 208, 34-41.
RRT	Hunting wildlife	Brazil	Carvalho (2019) Jaguar hunting in Amazonian extractive reserves: acceptance and prevalence. <i>Environmental Conservation</i> , 46(4), 334-339.
RRT	Hunting wildlife	Brazil	Castilho et al. (2019) Hunting of mammal species in protected areas of the southern Bahian Atlantic Forest, Brazil. <i>Oryx</i> , 53(4), 687-697.
RRT	Wildlife persecution	Italy	Cerri et al. (2017) Are wildlife value orientations useful tools to explain tolerance and illegal killing of wildlife by farmers in response to crop damage? <i>European Journal of Wildlife Research</i> , 63(4), 1-8.
RRT	Fisher compliance	Australia	Chaloupka (1985) Application of the randomized response technique to marine park management: an assessment of permit compliance. <i>Environmental Management</i> , 9(5), 393-398.
RRT	Hunting wildlife	China	Chang et al. (2019) Perceived entertainment and recreational value motivate illegal hunting in Southwest China. <i>Biological Conservation</i> , 234, 100-106.
RRT	Wildlife consumption	Brazil	Chaves et al. (2021). Investigating illegal activities that affect biodiversity: the case of wildlife consumption in the Brazilian Amazon. <i>Ecological Applications</i> , 31(7), e02402.
RRT	Hunting wildlife	Sierra Leone	Conteh & Gavin (2017) Influence of war on hunting patterns and pressure in Sierra Leone. <i>Environmental Conservation</i> , 44(2), 131-138.
RRT	Hunting wildlife	Sierra Leone	Conteh et al. (2015) Quantifying illegal hunting: a novel application of the quantitative randomised response technique. <i>Biological Conservation</i> , 189, 16-23.
RRT	Vulture persecution	Namibia	Craig et al. (2019) The drivers and extent of poison use by Namibia's communal farmers: Implications for averting the African vulture crisis. <i>Ambio</i> , 48(8), 913-922.
RRT	Wildlife persecution	UK	Cross et al. (2013) Innovative techniques for estimating illegal activities in a human-wildlife-management conflict. <i>PLoS One</i> , 8(1), e53681
RRT	Bear part consumption	Cambodia	Davis et al. (2019) Understanding the prevalence of bear part consumption in Cambodia: A comparison of specialised questioning techniques. <i>PLoS One</i> , 14(2), e0211544.
RRT	Hunting wildlife	Chile	Gálvez et al. (2018) A spatially integrated framework for assessing socioecological drivers of carnivore decline. <i>Journal of Applied Ecology</i> , 55(3), 1393-1405.
RRT	Fisher compliance	Canada	Lancaster et al. (2015) Drivers of recreational fisher compliance in temperate marine conservation areas: A study of Rockfish Conservation Areas in British Columbia, Canada. <i>Global Ecology and Conservation</i> , 4, 645-657.

RRT	Fisher compliance	USA	Lewis (2015) Bags and tags: randomized response technique indicates reductions in illegal recreational fishing of red abalone ( <i>Haliotis rufescens</i> ) in Northern California. <i>Biological Conservation</i> , 189, 72-77.
RRT	Fisher compliance	Chile	Oyanedel et al. (2017) Illegal fishing and territorial user rights in Chile. <i>Conservation Biology</i> , 32(3), 619-627.
RRT	Fisher compliance	Chile	Oyanedel et al. (2020) Motivations for (non-) compliance with conservation rules by small-scale resource users. <i>Conservation Letters</i> , 13(5), e12725.
RRT	Hunting wildlife	Madagascar	Randriamamonjy et al. (2015) Consumption of bushmeat around a major mine, and matched communities, in Madagascar. <i>Biological Conservation</i> , 186, 35-43.
RRT	Hunting wildlife	Madagascar	Razafimanahaka et al. (2012) Novel approach for quantifying illegal bushmeat consumption reveals high consumption of protected species in Madagascar. <i>Oryx</i> , 46(4), 584-592.
RRT	Wildlife trade	UK	Robinson et al. (2015) Captive reptile mortality rates in the home and implications for the wildlife trade. <i>PloS one</i> , 10(11), e0141460.
RRT	Vulture persecution	Namibia	Santangeli et al. (2016) Understanding, quantifying and mapping the use of poison by commercial farmers in Namibia—implications for scavengers' conservation and ecosystem health. <i>Biological Conservation</i> , 204, 205-211.
RRT	Fisher compliance	USA	Schill & Kline (1995) Use of Random Response to Estimate Angler Noncompliance with Fishing Regulations. <i>North American Journal of Fisheries Management</i> , 15: 721-731
RRT	Natural resource use	Uganda	Solomon et al. (2007) Estimating illegal resource use at a Ugandan park with the randomized response technique. <i>Human Dimensions of Wildlife</i> , 12(2), 75-88.
RRT	Wildlife persecution	South Africa	St John et al. (2012) Identifying indicators of illegal behaviour: carnivore killing in human-managed landscapes. <i>Proceedings of the Royal Society B: Biological Sciences</i> , 279(1729), 804-812.
RRT	Hunting wildlife	Indonesia	St John et al. (2018) Intention to kill: Tolerance and illegal persecution of Sumatran tigers and sympatric species. <i>Conservation Letters</i> , 11(4), e12451.
RRT	Fisher compliance	UK	St John et al. (2010) Testing novel methods for assessing rule breaking in conservation. <i>Biological Conservation</i> , 143(4), 1025-1030.
RRT	Hunting wildlife	Taiwan	St John et al. (2015) Evaluating deterrents of illegal behaviour in conservation: carnivore killing in rural Taiwan. <i>Biological Conservation</i> , 189, 86-94.
RRT	Hunting wildlife	USA	Wright (1980) Use of randomized response technique to estimate deer poaching. <i>Wildlife Society Bulletin (1973-2006)</i> , 8(4), 342-344.
RRT & Bean	Recreational angler compliance	Italy	Cerri et al. (2017) The randomised response technique: A valuable approach to monitor pathways of aquatic biological invasions. <i>Fisheries Management and Ecology</i> 24:504–511
Bean	Hunting wildlife	Liberia	Jones et al. (2020) The bean method as a tool to measure sensitive behaviour. <i>Conservation Biology</i> 0:1–10.

## Design adaptations made in Indonesia in response to Covid-19

Data was collected in Indonesia during the Covid-19 pandemic. Before going to the field, the team isolated before travel, undertook regular testing, and took precautionary measures wherever possible. Details on the Covid procedures taken during interviews are outlined below.

### Meeting and research participants and carrying out questionnaires

Questionnaires must be conducted outdoors (e.g., in participants garden, or on their porch). Social distancing must be maintained with participants, with a MINIMUM of 2-meter distance maintained throughout the questionnaire. Prior to starting the questionnaire, it is important to enquire about the health of the respondent and their household. If a respondent or any member of their household is displaying symptoms of COVID-19 (primarily a persistent cough or a fever) then we should avoid conducting a questionnaire with them and they should be excluded from the study.

At the start of a questionnaire, it is important to explain to the respondent the precautions we are taking to avoid risks associated with COVID-19 (see Survey Instrument for script). We will provide **each** respondent with a face mask; we should ask the respondent to wear the mask during the interview if they are willing. However, we must be careful about how this may be perceived by respondents as telling respondents they must wear the mask could promote fear and distrust. The respondent can keep the mask after the questionnaire has finished, make sure they understand how to wear and wash the mask properly.

### Testing different SQT methods

Originally the questionnaire required respondents to be interactive and touch several different pieces of equipment. Each of these methods will be amended in the following ways to minimise risk of transmission:

#### **Character cards**

These cards can still be used as before, however, the team must ensure that participants do not touch the cards. The person conducting the questionnaire should be the only one who touches the cards. Cards may be placed on a surface closer to the respondent (e.g., floor, chair), to help them see the cards. Ensure you talk through the content of each card carefully with respondent. After each interview and before starting the next, wipe the cards clean carefully using an alcohol solution.

#### UCT

Originally, this method involved showing respondents a card featuring a list of activities. Risk of transmission can occur if more than one person touches the card. The UCT can still be administered in the same way, however, as per the character cards, respondents should not touch the cards. Place the card on a surface near the respondent so they can see but ask them not to touch the card. Clean the card after use.

### Crosswise model

Again, this method risks transmissions by requiring respondents to physically touch the card to indicate their response. Instead, respondents should be asked the colour that represents their response, either black or green, and encouraged not to touch the cards. Cards should be cleaned after use.

### Bean method

This method required individuals to take a bean from one jar and move it to another. Interviewers were then required to count the number of beans present in each jar at the end of the day. Lots of people putting their hands in the same jar risks high levels of transmission. To make this method completely safe, two options are available: 1) to wash all beans in each jar after every use by a participant, however, this is impractical and would result in lots of wet mushy beans. It may also undermine the anonymity of the method, as individuals may see the interviewer counting the beans, 2) to have several different sets of jars, one for each participant, which are washed at the end of the day. Again, however, this would require each interviewer to clean all the beans and then count the number of beans in all jars (5 questionnaires would mean counting 750 beans per day). This would-be time consuming and may result in error and undermines anonymity (you can see exactly how many beans were moved by which individual). These limited options for adaption, combined with the fact it isn't possible to conduct multi-variate statistics on the bean data, suggest the best approach is to remove the bean method from the questionnaire.

### RRT

The RRT method risks transmitting COVID-19 between respondents, as an infected respondent could contaminate the equipment with COVID-19. This puts future respondents who touch the equipment (dice & cup or counters in a bag), as well as the interviewer who handles the equipment at risk. To avoid this, each member of the field team should carry a clean set of equipment for each questionnaire they conduct each day. They should also carry two bags, one for 'clean' unused equipment and one for 'dirty' used equipment. At the start of each interview each respondent can be given a clean set for use (this should be done by placing the equipment on the ground between you to maintain social distancing). At the end of each interview, the respondent should place the used equipment directly into the 'dirty' bag. At the end of the day the used equipment should be cleaned in boiling water and then washing them thoroughly with soapy water. We may need to have two sets of equipment for each member of the field team so that one set can be in use while the other set is being cleaned and dried.

To ensure that we do not carry COVID between respondents it is important to wash our hands between each questionnaire. This can be with either running water and soap or by using alcohol gel. When washing hands, it is important to be mindful of how this is perceived by respondents, for example, in some communities' people may be offended if the team is seen washing their hands directly after each questionnaire is conducted. In other cases, respondents may have a positive view of the team washing their hands directly before starting a questionnaire as this may be perceived as the team taking good care to protect the respondent. It will be down to the field team's judgement how best to manage these perceptions.

## Survey instrument

Table A2.3. Survey instrument in English applied in Chapter 3. In Indonesia RRT-button was applied in Indonesia, while Bean method was applied in Tanzania

	Question::English	Instruction/prompt::English
Section 1. Survey location		
start_time		
end_time		
Date		
device_id		
interviewer	Who is conducting the interview?	
region	Province	
district	District	
district_other	If other district, please write	
subdistrict	Sub-district	
subdistrict_other	if other subdistrict, please write	
village	Name of the village	
subvill	Name of the sub-village	
pa_type	Nearest Protected Area	**Do not ask the respondent this**
pa_type_other	If other, name of the Protected Area	
Section 2. Participant consent		
ethics_statement	Read the Consent Script to the participant	<p>Hello. My name is \${interviewer}, I am a researcher from the University of Indonesia, and I am helping Harriet Ibbett, who is from Bangor University in the UK to conduct research. Harriet's research is all about understanding the best way to ask questions about natural resource use.</p> <p>The survey has two parts. First of all, we will ask your opinion about different types of natural resource use. The second part of the survey is to find out how you most prefer to answer questions about an activity that might be considered sensitive.</p> <p>We are asking lots of people to complete this survey so that we can understand how people prefer to answer questions. Using your opinions and suggestions we will design a new survey, which will involve collecting information from local people about resource use around Protected Areas. The information you provide us is very important in making sure that we ask questions in the right way.</p> <p>The questionnaire will take about 1hour 15 minutes to complete. Any information you provide will be anonymous, this means I will not record your name, or any information that can personally identify you or your household. We may tell people your answers, but we will not reveal that you gave the information. I will record all your answers on this phone. All your answers will then be saved on a secure computer which can only</p>

		<p>be accessed by Harriet using a password.</p> <p>At the end of the research, Harriet will write a report on her findings. This report will be used to help other researchers conduct research that better meets the needs of local people. Some results may also be published internationally so that other people in different countries can learn from our experience working with communities here.</p> <p>Please note that we are independent, we are not related to the government or any NGOs and we have neutral views. We have permission of the Indonesian government and the village chief to carry out this research. However, participation is voluntary. You do not have to participate and you stop participating at any time, without explanation. If you do I will discard your responses. If you feel uncomfortable answering some of the questions, you do not have to answer. If you would like to skip a question or a topic, please say.</p> <p>This study has been reviewed by, and received ethics clearance through Bangor University. If you have any questions, please ask me and I will do my best to answer them.</p> <p>If you remain unhappy or wish to make a formal complaint, I can give you the contact details of someone to discuss this with.</p>
consent	Did participant give their consent to participate?	
no_consent	Thank the participant and end the survey.	
consent_gender	What was the gender of the participant?	
Section 3. Covid-19 precautions		
covid_note	Reminder: COVID Precautions	<p>If the guide has not already explained our COVID precautions then explain to the respondent:</p> <ol style="list-style-type: none"> <li>1. That the team are clear of symptoms</li> <li>2. That we will be working outside and maintaining social distancing</li> <li>3. We will be washing hands frequently</li> <li>4. That we wear masks to protect ourselves and the respondent</li> </ol>
covid_symptoms	Does anyone in your household have symptoms of COVID19 that have developed over the previous week?	<p>These are:</p> <ul style="list-style-type: none"> <li>• a new and persistent cough</li> <li>• difficulty in breathing</li> <li>• a high fever,</li> <li>• a recent loss of taste or smell</li> </ul>
covid_yes	Thank the respondent for their time, explain that even though the sick individual may not have COVID we do not want to put other respondents at risk if they do have COVID. Wish them or	



	their household member a quick recovery	
covid_mask	Wearing disposable masks	Would you like me to provide a mask for you to wear also?
Section 4. Respondent demographics		
gender	What gender is the participant?	
age	How old are you?	If unknown, ask them to estimate their age
ethn	Ethnicity	
ethn_other	Please specify which ethnic group	
language	What is the main language you speak?	
language_other	Please specify which language	
religious	Are you religious?	
religion	What is your religion?	
religion_other	Please specify which religion	
religion_importance	How important is religion to you?	
yrs_ed	How many years of schooling do you have?	Enter approximate number of years (max 12 years)  If none, enter 0 For university, write 12 plus number of years of university completed e.g. 12 + 4 years = 16years
literacy	Can you read?	
literacy_ease	How do you find reading?	Read out options to respondent
birth_month	Do you know the month in which you were born?	
month	Birth month	
own_mobile	Do you personally own a mobile phone?	This means the individual. Not the household.
know_pa	Do you know the name of the nearest Protected Area?	
pa_name	Name of the nearest Protected Area	
pa_other	If other, name of the Protected Area	
Section 5. Introducing the experiment		
sqt_intro_1	Intro: Testing Methods	<p>The aim of this next section is to find out how you most prefer to answer questions about an activity that might be considered sensitive.</p> <p>When we are asked questions about using natural resources, sometimes we don't always want to tell the truth.</p> <p>We might be embarrassed about our answer, we might not trust the person asking the questions, or we might be scared that if we do tell the truth we will get into trouble.</p> <p>However, for researchers, when we ask questions about natural resource it is very important that we do get honest answers.</p> <p>Otherwise the information we have will not be correct,</p>

		and we may not make the best recommendations for the community.
sqt_intro_2	Introduce method	<p>To solve this problem, researchers have developed special ways of asking questions, which allow people to answer questions honestly, but mean the researcher cannot tell if the person answering the question does the activity.</p> <p>I would like to try these different ways with you, to see which one you understand best, to find out which one you most prefer.</p> <p>All these questions will be about hunting wildlife.</p> <p>I do not want to know whether this is something you or your household does.</p> <p>I am only interested in understanding the best way for a researcher to ask questions about this.</p>
char_intro_1	Introduce the characters	<p>To make sure that you do not answer questions about yourself I would like to introduce you to these fictional characters.</p> <p>Here I have 5 characters. Each of whom does different things to earn a living.</p> <p>When we try the different ways of answering questions, I want you to imagine you are one of these characters, and so you should give me the answer that they should give.</p> <p>Do you understand?</p>
char_intro_2	Collect character card for Character One	<p>For example, here we have Character One.</p> <p>Character One was born in November and they:</p> <ul style="list-style-type: none"> <li>• Fish</li> <li>• Hunt wildlife</li> <li>• Raise chickens</li> <li>• Graze livestock.</li> </ul>
Section 6. Testing the 1 <sup>st</sup> method (this block of questions is repeated five times, once for each method. The method order is randomly allocated. Below shows the instructions for each method)		
m1_dice_intro	<b>**Dice method**</b>	<p>The way to answer this question is a bit like a game. And like games, there are rules you must follow.</p> <p>First of all I will give you a dice, and ask you to roll it.</p> <p>If you roll a <b>**1, 2, 3, or 4**</b> you must <b>**tell the truth**</b></p> <p>If you roll a <b>**5**</b> you must always say <b>**Yes**</b> *Even if this is not true answer *</p> <p>If you roll a <b>**6**</b> you must always say <b>**No**</b> *Even if this is not the true answer*</p> <p>Do you understand?</p>

		<p>Let's have a practice. *[Roll the dice]* which number did you get? What answer should you give?</p> <p>*[Do not practice more than twice]*</p> <p>let's practice with an example.</p> <p>Here is Character One. My question to Character One is "Character One, do you hunt wildlife?"</p> <p>I roll the dice. I get XX. Because I got a XX, my answer should be XX.</p> <p>Do you understand?</p>
m1_uct_intro	<b>**Number method**</b>	<p>For this method we will use this card. On this card are four different activities.</p> <p>To answer my question, all you have to do is tell me how many of these apply to you.</p> <p>The different activities are:</p> <ul style="list-style-type: none"> <li>• Collect firewood</li> <li>• Hunt wildlife</li> <li>• Raise chickens</li> <li>• Grazing livestock</li> </ul> <p>It is very important that you do not tell me which activities. But just the number that apply to you.</p> <p>First, let's practice.</p> <p>Here is Character One. We can see that Character One:</p> <p>Hunts wildlife Raises chickens Grazes livestock But they do not collect firewood</p> <p>So Character One does 3 of the 4 activities.</p> <p>The answer I give should be 3.</p> <p>Do you understand?</p> <p>Explain and repeat until correct.</p>
m1_crosswise_intro	<b>**Colored box method**</b>	<p>I will read out to you two questions.</p> <p>If your answer is Yes or No to BOTH questions, please tap the green square.</p> <p>If your answer is Yes to only one question (irrespective of which one) please tap the black square.</p> <p>Let's try with a practice. The two questions are:</p> <p>Do you hunt wildlife? Were you born in November or December?</p>

		<p>Let's pretend you are Character One. We see that Character One is born in November and they hunt wildlife.</p> <p>Character One = green as their answer is YES to BOTH questions</p>
m1_button_intro	<b>**Button method**</b>	<p>The way to answer this question is a bit like a game. And like games, there are rules you must follow.</p> <p>First of all I will give you a pouch. In this pouch are different color counters (button in Indonesian).</p> <p>I will ask you to pick one button from this pouch.</p> <p>If you pick a red button – you must answer <b>** truthfully yes or no **</b></p> <p>If you pick a yellow button you must always answer <b>**Yes**</b> *Even if this is not the true answer*</p> <p>If you pick a white button, you must always answer <b>**No**</b> *Even if this is not the true answer*</p> <p>Let's have a practice. * which color did you pick? What answer should you give?</p> <p>let's practice with an example.</p> <p>Here is Character One. My question to Character One is "Character One, do you hunt wildlife?"</p> <p>I roll the dice. I get XX. Because I got a XX, my answer should be XX.</p> <p>Do you understand?</p>
m1_dq_intro	<b>**Direct Questioning**</b>	<p>For this question, there is no special way of answering the question. I would just like you to tell me the true answer.</p> <p>Remember to imagine you are the character when you answer.</p> <p>Let's practice with Character One.</p> <p>The question is:</p> <p><b>**Character One, do you hunt wildlife?**</b></p> <p>We can see that Character One does hunt wildlife, so we should answer yes.</p>
m1_dice_dice	Was the respondent familiar with a dice?	
m1_intro_ch1	*Select character card for Character Two	<p>Ok, now we shall practice with Character Two.</p> <p>Character Two was born in December. They:</p>

		Grow rice Collect firewood Owns small shop Grazes cows
Practice method using Character Two		
m1_dice_ch1	Dice method  Character Two, do you hunt wildlife?	Remember, if you roll a: **1, 2, 3, 4** answer **truthfully yes or no** **5** answer **YES** **6** answer **NO**  Record the number of practices required, before the respondent answered correctly.  If respondent prefers not to answer enter '999'
m1_uct_ch1	Number method  *Character Two, how many of these activities do you do?*  Remember, do not tell me which activities you do, just tell me how many.	Record the number of practices required, before the respondent answered correctly  If respondent prefers not to answer enter '999'
m1_crosswise_ch1	Colored box method  Character Two,  A) Do you hunt wildlife?  B) Were you born in November or December?	Remember, if your answer is:  Yes or No to **BOTH** question tap the **green** square  Yes to ONLY **ONE** questions tap the **black** square  Record the number of practices required, before the respondent answered correctly.  If respondent Prefers not to answer enter '999'
m1_dq_ch1	DQ  Remember, for this method, please answer the question directly.  Character Two, do you hunt wildlife?	Record the number of practices required, before the respondent answered correctly  If respondent Prefers not to answer enter '999'
m1_button_ch1	Button method  Character Two, do you hunt wildlife?	Remember, if you roll a:  If you pick a red button – you must answer ** truthfully yes or no **  If you pick a yellow button you must always answer **Yes** *Even if this is not the true answer*  If you pick a white button, you must always answer **No** *Even if this is not the true answer*  If respondent prefers not to answer enter '999'
Collect test data – 1 <sup>st</sup> character		

m1_C_A	Select the card for **\${m1_ch2}**	Briefly describe the activities on the card.  \${m1_ch2_attributes}
m1_dice_ch2	Dice method  \${m1_ch2}, do you hunt wildlife?	Remember, if you roll a: **1, 2, 3, 4** answer **truthfully yes or no** **5** answer **YES** **6** answer **NO**  Record the number of practices required, before the respondent answered correctly.  If respondent prefers not to answer enter '999'
m1_uct_ch2	Number method  \${m1_ch2}, how many of these activities do you do?	Remember, do not tell me which activities you do, just tell me how many
m1_crosswise_ch2	Colored box method  \${m1_ch2},  A) Do you hunt wildlife? B) Were you born in November or December?	Remember, if your answer is:  Yes or No to **BOTH** question tap the **green** square  Yes to ONLY **ONE** questions tap the **black** square  Record the number of practices required, before the respondent answered correctly.  If respondent Prefers not to answer enter '999'
m1_dq_ch2	DQ  \${m1_ch2}, do you hunt wildlife?	Please answer the question directly
m1_button_ch2	Button method  \${m1_ch2}, do you hunt wildlife?	Remember, if you roll a:  If you pick a red button – you must answer ** truthfully yes or no **  If you pick a yellow button you must always answer **Yes** *Even if this is not the true answer*  If you pick a white button, you must always answer **No** *Even if this is not the true answer*  If respondent prefers not to answer enter '999'
m1_privacy_ch2	From your answer, do you think I would be able to tell whether \${m1_ch2} hunted?	
m1_diceroll_ch2	What number did you roll on the dice?	So I can check if you answered correctly.  If NA, enter '0'
m1_counter_ch2	What color button did you pick?	So I can check if you answered correctly.
Collect test data – 2 <sup>nd</sup> character		
m1_C_B	Select the card for **\${m1_ch3}**	Briefly describe the activities on the card.  \${m1_ch3_attributes}

m1_dice_ch3	Dice method  \${m1_ch3}, do you hunt wildlife?	Remember, if you roll a: **1, 2, 3, 4** answer **truthfully yes or no** **5** answer **YES** **6** answer **NO**  Record the number of practices required, before the respondent answered correctly.  If respondent prefers not to answer enter '999'
m1_uct_ch3	Number method  \${m1_ch3}, how many of these activities do you do?	Remember, do not tell me which activities you do, just tell me how many
m1_crosswise_ch3	Colored box method  \${m1_ch3},  A) Do you hunt wildlife? B) Were you born in November or December?	Remember, if your answer is:  Yes or No to **BOTH** question tap the **green** square  Yes to ONLY **ONE** questions tap the **black** square  Record the number of practices required, before the respondent answered correctly.  If respondent Prefers not to answer enter '999'
m1_dq_ch3	DQ  \${m1_ch3}, do you hunt wildlife?	Please answer the question directly
m1_button_ch3	Button method  \${m1_ch3}, do you hunt wildlife?	Remember, if you roll a:  If you pick a red button – you must answer ** truthfully yes or no **  If you pick a yellow button you must always answer **Yes** *Even if this is not the true answer*  If you pick a white button, you must always answer **No** *Even if this is not the true answer*  If respondent prefers not to answer enter '999'
m1_privacy_ch3	From your answer, do you think I would be able to tell whether \${m1_ch3} hunted?	
m1_diceroll_ch3	What number did you roll on the dice?	So I can check if you answered correctly.  If NA, enter '0'
m1_counter_ch3	What color button did you pick?	So I can check if you answered correctly.
Collect test data – 3 <sup>rd</sup> character		
m1_C_C	Select the card for **\${m1_ch4}**	Briefly describe the activities on the card.  \${m1_ch4_attributes}
m1_dice_ch4	Dice method  \${m1_ch4}, do you hunt wildlife?	Remember, if you roll a: **1, 2, 3, 4** answer **truthfully yes or no** **5** answer **YES** **6** answer **NO**

		Record the number of practices required, before the respondent answered correctly.  If respondent prefers not to answer enter '999'
m1_uct_ch4	Number method  \${m1_ch4}, how many of these activities do you do?	Remember, do not tell me which activities you do, just tell me how many
m1_crosswise_ch4	Colored box method  \${m1_ch4},  A) Do you hunt wildlife? B) Were you born in November or December?	Remember, if your answer is:  Yes or No to <b>BOTH</b> question tap the <b>green</b> square  Yes to <b>ONLY ONE</b> questions tap the <b>black</b> square  Record the number of practices required, before the respondent answered correctly.  If respondent Prefers not to answer enter '999'
m1_dq_ch4	DQ  \${m1_ch4}, do you hunt wildlife?	Please answer the question directly
m1_button_ch4	Button method  \${m1_ch4}, do you hunt wildlife?	Remember, if you roll a:  If you pick a red button – you must answer <b>truthfully</b> yes or no  If you pick a yellow button you must always answer <b>Yes</b> *Even if this is not the true answer*  If you pick a white button, you must always answer <b>No</b> *Even if this is not the true answer*  If respondent prefers not to answer enter '999'
m1_privacy_ch4	From your answer, do you think I would be able to tell whether \${m1_ch4} hunted?	
m1_dice_roll_ch4	What number did you roll on the dice?	So I can check if you answered correctly.  If NA, enter '0'
m1_counter_ch4	What color button did you pick?	So I can check if you answered correctly.
Review of 1 <sup>st</sup> method		
m1_understand	Did you understand how to answer the questions?	
m1_answer_ease	How easy did you find it to answer the question using this method?	
m1_privacy	How secret do you think your answers were using this method?	
m1_comfort	If you undertook an activity, such as hunting, how comfortable would you feel answering questions honestly this way?	



m1_comments	Any other comments to add?	Record any comments from the respondent about the method
m1_enumunder	\${interviewer}, how well do you think the respondent understood the method?	
m1_enumhonesty	\${interviewer}, did you feel the respondent was deliberately answering incorrectly?	E.g. they were scared to answer honestly
Section 6 was repeated four further times, once more for each of the remaining methods.		
Section 11. Review of all methods		
quest_pref	Method Preferences	These next few questions are about how you most prefer to answer questions.
method_best	Which method did you find easiest to understand?	
method_comfort	Which method made you feel most comfortable when answering questions?	
method_privacy	Which method do you think best preserves the confidentiality of your answer?	
method_prefer	If a researcher was to ask you a question about whether you did an illegal behaviour, which method would you choose to answer their questions?	1 = Most preferred method 5 = Least preferred method
most_prefer_why	Why do you most prefer this method?	
least_prefer_why	Why do you least prefer this method?	
thank_you	The survey is now finished.  Thank you for participating.	Do you have any questions for me?
adults_present	\${interviewer}, were there any other adults (+18years) present during the survey?	
survey_engage	\${interviewer}, how engaged was the participant throughout the survey?	
survey_ease	\${interviewer}, how did you find surveying this individual?	
Section 12. Comments from the interviewer		
other_comments	Additional Comments	
comments	Have you any comments or feedback?	Record any comments or feedback If none, NA

## Additional results &amp; analyses

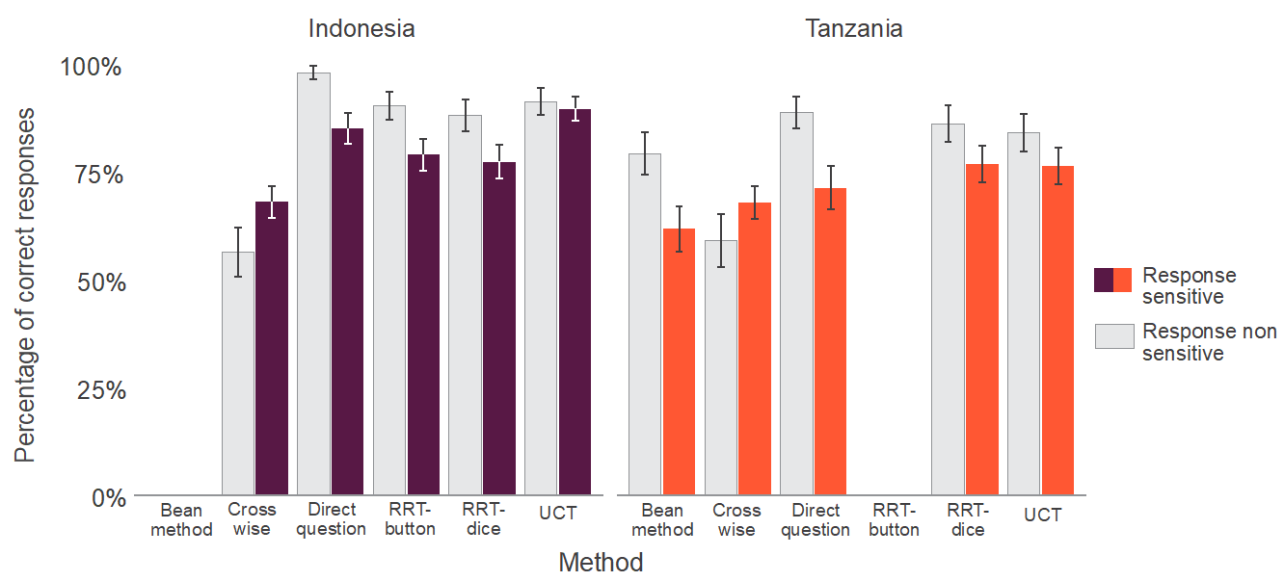


Figure A2.3. Plot showing proportion of correct responses for each method, when a sensitive response was, and was not required (i.e., coloured bars indicate where respondent had to state that the character hunted), with 95% CIs.

Table A2.4. Proportion of correct responses plus descriptive statistics, when a sensitive response was (i.e., the respondent had to report that the character hunted) and was not required.

Country	Method	N	Proportion	SD	SE	95%CI	Response sensitive?
Indonesia	crosswise	301	0.68	0.33	0.02	0.04	yes
		301	0.56	0.50	0.03	0.06	no
	dq	303	0.85	0.32	0.02	0.04	yes
		303	0.98	0.14	0.01	0.02	no
	rrt-button	303	0.79	0.32	0.02	0.04	yes
		303	0.90	0.29	0.02	0.03	no
	rrt-dice	297	0.77	0.34	0.02	0.04	yes
		297	0.88	0.32	0.02	0.04	no
	uct	302	0.90	0.25	0.01	0.03	yes
		303	0.91	0.28	0.02	0.03	no
Tanzania	bean	261	0.62	0.43	0.03	0.05	yes
		261	0.79	0.41	0.03	0.05	no
	crosswise	256	0.68	0.31	0.02	0.04	yes
		255	0.59	0.49	0.03	0.06	no
	dq	280	0.71	0.43	0.03	0.05	yes
		280	0.89	0.31	0.02	0.04	no
	rrt-dice	252	0.77	0.34	0.02	0.04	yes
		254	0.86	0.35	0.02	0.04	no
	uct	266	0.77	0.36	0.02	0.04	yes
		265	0.84	0.37	0.02	0.04	no

Table A2.5. Log-odds regression coefficients with 95% confidence intervals from a binomial general linear mixed model, with random effects for respondent and method. The binomial represents whether the respondent answered the question correctly, or not. Text in **bold** represent p-values which had statistical significance of <0.05

Predictors	Indonesia			Tanzania		
	Log-Odds	95% CIs	p-value	Log-Odds	95% CIs	p-value
(Intercept)	4.68	3.82 – 5.54	<b>&lt;0.001</b>	2.46	1.99 – 2.93	<b>&lt;0.001</b>
Gender [male] <sup>a</sup>	-0.46	-0.73 – -0.18	<b>0.001</b>	0.1	-0.18 – 0.38	0.499
Age	-0.2	-0.32 – -0.08	<b>0.001</b>	-0.31	-0.45 – -0.17	<b>&lt;0.001</b>
Education	-0.05	-0.29 – 0.19	0.683	0.43	0.22 – 0.65	<b>&lt;0.001</b>
Crosswise model <sup>b</sup>	-3.87	-4.72 – -3.03	<b>&lt;0.001</b>	-1.88	-2.37 – -1.38	<b>&lt;0.001</b>
UCT	-1.64	-2.55 – -0.74	<b>&lt;0.001</b>	-0.46	-1.00 – 0.07	0.09
RRT-dice	-1.95	-2.83 – -1.06	<b>&lt;0.001</b>	-0.2	-0.76 – 0.36	0.486
RRT-button / Bean method	-1.73	-2.63 – -0.84	<b>&lt;0.001</b>	-0.86	-1.37 – -0.34	<b>0.001</b>
Practices	-0.17	-0.27 – -0.08	<b>&lt;0.001</b>	-0.24	-0.34 – -0.14	<b>&lt;0.001</b>
Interviewer 2 <sup>c</sup>	-0.56	-0.84 – -0.28	<b>&lt;0.001</b>	0.01	-0.31 – 0.34	0.938
Interviewer 3	0.15	-0.14 – 0.45	0.308	-0.22	-0.55 – 0.11	0.194
Response was sensitive <sup>d</sup>	-2.26	-3.10 – -1.42	<b>&lt;0.001</b>	-1.38	-1.82 – -0.93	<b>&lt;0.001</b>
Crosswise model * Response was sensitive <sup>e</sup>	2.84	1.94 – 3.73	<b>&lt;0.001</b>	1.84	1.28 – 2.40	<b>&lt;0.001</b>
UCT * Response was sensitive	2.03	1.06 – 3.00	<b>&lt;0.001</b>	0.81	0.20 – 1.41	<b>0.009</b>
RRT-dice * Response was sensitive	1.41	0.47 – 2.34	<b>0.003</b>	0.64	0.02 – 1.26	<b>0.043</b>
RRT-button / Bean method * Response was sensitive	1.27	0.33 – 2.22	<b>0.008</b>	0.32	-0.26 – 0.91	0.273
Education * Crosswise model <sup>f</sup>	0.03	-0.24 – 0.29	0.839	-0.28	-0.53 – -0.04	<b>0.024</b>
Education * UCT	0.17	-0.14 – 0.48	0.291	-0.13	-0.38 – 0.13	0.339
Education * RRT-dice	0.04	-0.25 – 0.32	0.792	-0.04	-0.31 – 0.23	0.765
Education * RRT-button / Bean method	-0.06	-0.34 – 0.23	0.692	0	-0.26 – 0.25	0.984
Random Effects						
$\sigma^2$	3.29			3.29		
T00	0.44 <sub>id</sub>			0.78 <sub>id</sub>		
	0.00 <sub>method</sub>			0.00 <sub>method</sub>		
N	303 <sub>id</sub> , 5 <sub>method</sub>			289 <sub>id</sub> , 5 <sub>method</sub>		
Observations	4521			3952		
Marginal R <sup>2</sup> / Conditional R <sup>2</sup>	0.239 / NA			0.187 / NA		

Reference categories: <sup>a</sup> Gender: female; <sup>b</sup> Method: Direct question; <sup>c</sup> Interviewer 1; <sup>d</sup> Response was not sensitive; <sup>e</sup> Direct question \* response was sensitive; <sup>f</sup> Education \* Direct question

Table A2.6. Multiple comparisons of means, calculated using Tukey post-hoc tests, between each method in Indonesia and Tanzania (RRT-button used in Indonesia only, Bean method applied in Tanzania only).

	Indonesia				Tanzania			
	Estimate	SE	z-value	P	Estimate	SE	z-value	P
Crosswise - DQ	-3.872	0.432	-8.970	0.000	-1.846	0.252	-7.332	0.000
UCT - DQ	-1.645	0.462	-3.560	0.003	-0.448	0.271	-1.656	0.459
RRT-dice - DQ	-1.947	0.451	-4.314	0.000	-0.193	0.282	-0.685	0.959
RRT-button/Bean - DQ	-1.731	0.457	-3.786	0.001	-0.857	0.261	-3.279	0.009
UCT - Crosswise	2.227	0.247	9.022	0.000	1.397	0.230	6.064	0.000
RRT-dice - Crosswise	1.925	0.225	8.567	0.000	1.652	0.239	6.901	0.000
RRT-button/Bean - Crosswise	2.141	0.236	9.055	0.000	0.989	0.220	4.488	0.000
RRT-dice - UCT	-0.302	0.280	-1.077	0.808	0.255	0.264	0.964	0.870
RRT-button/bean - UCT	-0.086	0.289	-0.296	0.998	-0.408	0.244	-1.676	0.446
RRT-button/bean - RRT-dice	0.216	0.272	0.796	0.927	-0.663	0.256	-2.594	0.071

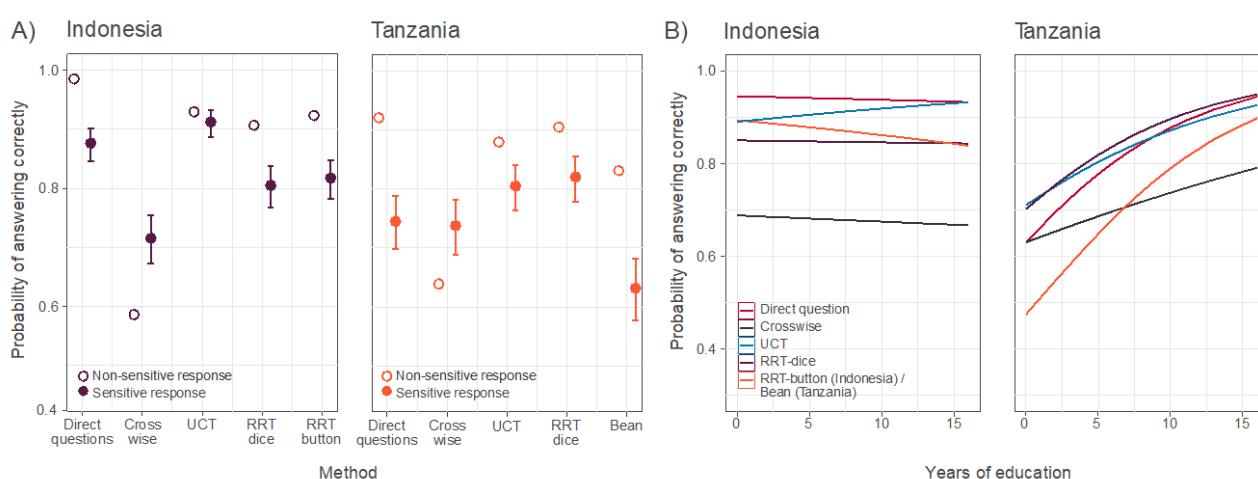


Figure A2.4. Marginal effect plots for both interactions included in the model, showing the probability of a respondent answering correctly between A) method and whether a sensitive response was required, and B) method and years of education. Error bars represent 95% CIs.

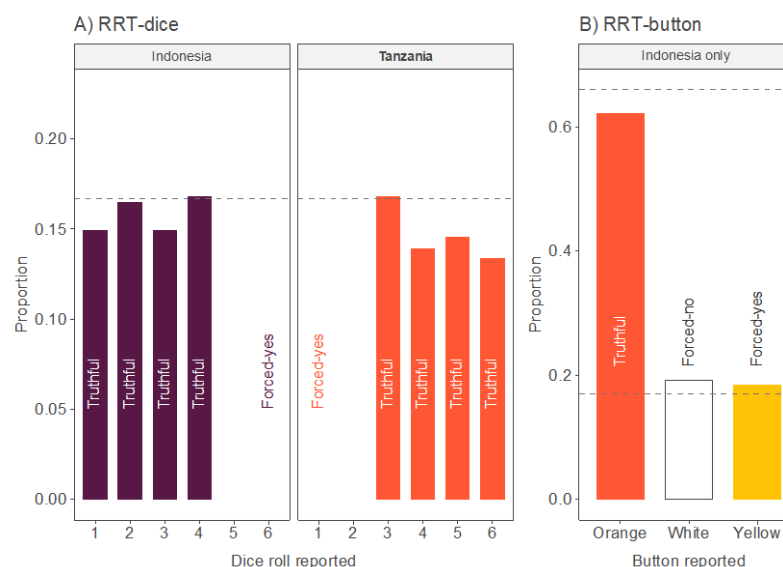


Figure A2.5. Proportion of times each number of a die was reported as rolled, or each colour button was reported as selected. A) Data for RRT-dice from both countries, dashed line indicates expected proportion of rolls for each die number (0.167) based on probability. B) Data for RRT-button from Indonesia only, top dashed line indicates expected proportion of orange buttons (0.66), bottom dashed line indicates expected proportion of white or yellow buttons (0.17).

Table A2.7. Frequency that each die number was reported as rolled, or each colour button was reported as selected

Indonesia						Tanzania	
RRT-button		RRT-dice				RRT-dice	
Response	Color	n	Response	Score	n	Score	n
Truthful	Orange	566	Truthful	1	133	6	102
Forced-no	White	175		2	147	5	111
Forced-yes	Yellow	168		3	133	4	106
				4	150	3	128
		Forced-no	5	171	2	173	
		Forced-yes	6	157	1	141	

# Appendix 3

Chapter 4 - Asking sensitive questions in conservation using Randomised Response Techniques

## Review Structure & data extraction protocol

### Stage 1 – Systematically search databases

**Databases:** Web of Science, Scopus

**Search term:** "Randomised Response Technique" OR "Randomized Response Technique"

Note // The acronym RRT was removed from the search term on the assumption that any article that used an acronym would also use the full term. In addition, RRT has alternate definitions in other disciplines (e.g., Rapid Response Team in medicine), thus removing the acronym avoided a proliferation of irrelevant search results.

**Document type:** Peer-reviewed Articles only

**Language:** English only

Research areas/categories: All

**Dates:** 1970 to 2020

**Recorded:** date of search, database, search terms & selected criteria, number of results, researcher conducting the search.

**Extract:** .csv of all search results and import into excel. For each .csv of search results:

- i. Add column and allocate each paper an ID code, identifying which database the article was retrieved from, and the number in the list (e.g. the first record from Scopus coded as = Sco\_01);
- ii. Combine all the search results into one spreadsheet;
- iii. Re-sort the rows alphabetically by author, then article title; and
- iv. Use the conditional formatting function to identify duplicates, mark duplicates, ensure only one version of article left in list.

### Stage 2 – Title Scan

Does the title mention or suggest use of RRT?

- If Yes, forward for abstract review.
- If unsure, forward for abstract review.
- If No, exclude.

### Stage 3 – Abstract Scan

Does the abstract mention use of RRT to collect empirical data on a sensitive topic?

- If Yes, forward for full review.
- If unsure, forward for full review.
- If No, exclude.

### Stages 4 & 5 – Data Extraction

- Read the full article, and extract the following information:
- Article details (Authors, Title, Journal, DOI, Year published, Academic discipline);



- Study details (Behaviour(s) studied, sensitivity of behaviour ((a) non-compliant or illegal behaviour (e.g. smuggling); b) socially undesirable behaviour (e.g. promiscuity); c) socially undesirable views (e.g. racism); d) socially desirable behaviour (e.g. recycling); e) personal or health topic (e.g. being HIV positive)), study country, year data collected, sample size, number of RRT questions);
- Methods details (RRT design, description of RRT method, administration mode, probability of truthful, forced-yes (or unrelated question) and forced-no responses, randomising device used, prompts used, whether a practice question and/or control question asked, whether a pilot was conducted);
- Validation details (Were RRT estimates compared against data on known prevalence, or estimates derived using other questioning methods (e.g. direct questions, other SQTs). Record details;
- Analysis details (Were power analyses conducted? What type of analyses were conducted (unknown, univariate, multivariate), software and packages used);
- Results details (prevalence estimate, type of error presented (i.e. SE, 95% CI, none), were RRT estimates higher, lower or non-statistically different than those collected using other methods, Was understanding measured and findings, was whether respondents followed instructions assessed? Findings. Was privacy measured and findings. Was RRT reported as successful. How were results presented (e.g. graph, table));
- Ethics details (Did the article state whether: research was approved by an ethics board; free, prior and informed consent was sought from participants; participants were provided assurances of anonymity and/or confidentiality?).

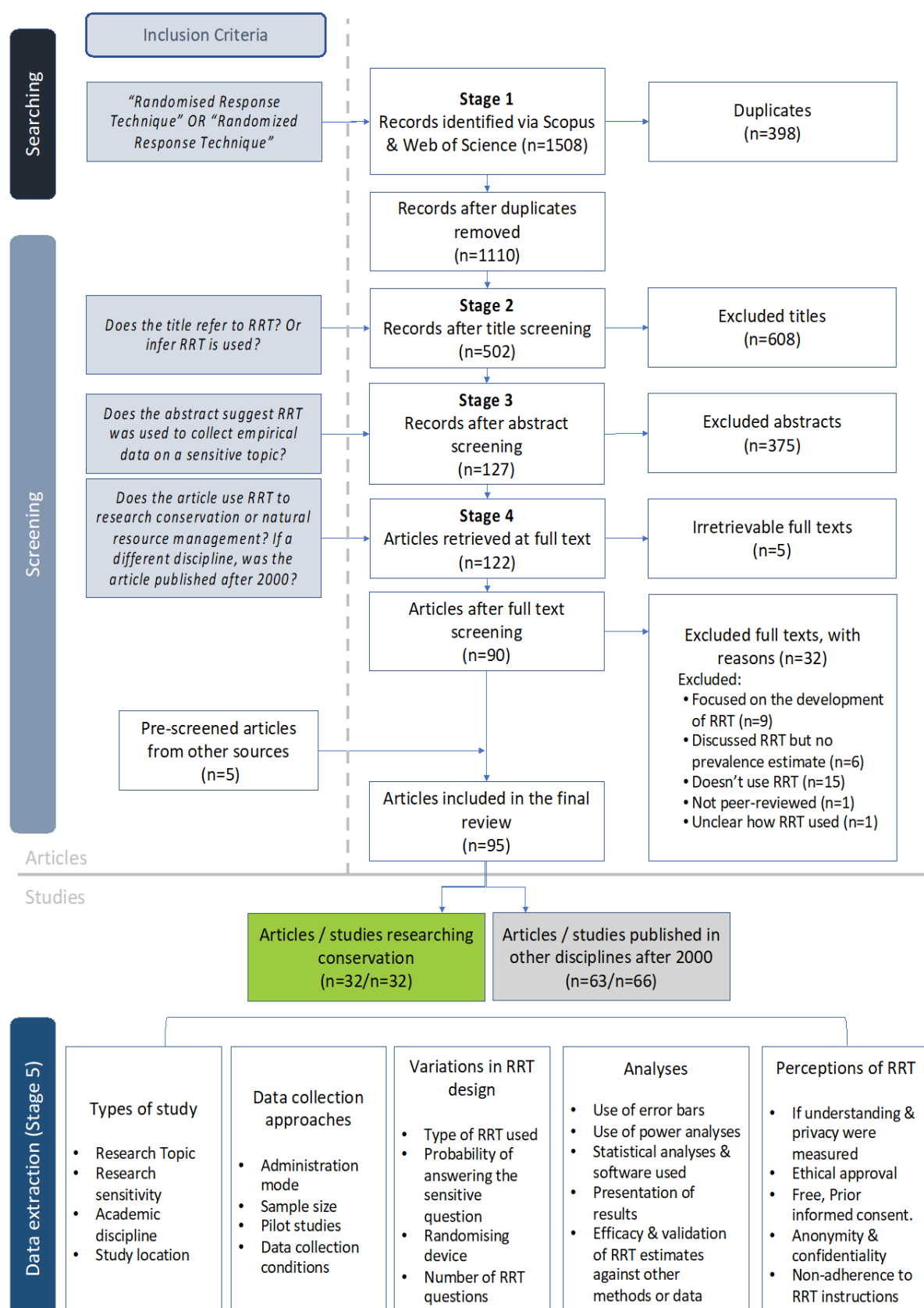


Figure A3.1. Flow diagram showing the inclusion criteria and structure of the systematic review according to the Reporting standards for Systematic Evidence Synthesis (ROSES) from Haddaway NR, Macura B, Whaley P, and Pullin AS. 2017. ROSES flow diagram for systematic reviews. Version 1.0. DOI: 10.6084/m9.figshare.5897389

Table A3.1. List of 95 articles included in review (n=98 studies)

#	Authors	Title & DOI	Journal
Conservation Studies			
1	Akinsorotan et al. 2019	Evaluating Rule Breaking Behavior in a Nigerian Protected Forest Reserve Area	Journal of Applied Science and Environmental Management
2	Arias & Sutton 2013	Understanding recreational fishers' compliance with no-take zones in the Great Barrier Reef Marine Park	Ecology and Society
3	Blank & Gavin 2009	The randomized response technique as a tool for estimating non-compliance rates in fisheries: A case study of illegal red abalone ( <i>Haliotis rufescens</i> ) fishing in Northern California	Environmental Conservation
4	Bova et al. 2018.	Limitations of the random response technique and a call to implement the ballot box method for estimating recreational angler compliance using surveys	Fisheries Research
5	Carvalho et al. 2019	Jaguar hunting in Amazonian extractive reserves: acceptance and prevalence	Environmental Conservation
6	Castilho et al. 2019	Hunting of mammal species in protected areas of the southern Bahian Atlantic Forest, Brazil	Oryx
7	Cerri et al. 2017	The randomised response technique: A valuable approach to monitor pathways of aquatic biological invasions	Fisheries Management and Ecology
8	Cerri et al. 2017	Are wildlife value orientations useful tools to explain tolerance and illegal killing of wildlife by farmers in response to crop damage?	European Journal of Wildlife Research
9	Chaloupka 1985	Application of the randomized response technique to marine park management: an assessment of permit compliance	Environmental Management
10	Chang et al. 2019	Perceived entertainment and recreational value motivate illegal hunting in Southwest China	Biological Conservation
11	Conteh & Gavin 2017	Influence of war on hunting patterns and pressure in Sierra Leone	Environmental Conservation
12	Conteh et al. 2015	Quantifying illegal hunting: A novel application of the quantitative randomised response technique	Biological Conservation
13	Craig et al. 2019	The drivers and extent of poison use by Namibia's communal farmers: Implications for averting the African vulture crisis	Ambio
14	Cross et al. 2013	Innovative Techniques for Estimating Illegal Activities in a Human-Wildlife-Management Conflict	PLoS ONE
15	Davis et al. 2019	Understanding the prevalence of bear part consumption in Cambodia: A comparison of specialised questioning techniques	PLoS ONE
16	Gálvez et al. 2018	A spatially integrated framework for assessing socioecological drivers of carnivore decline	Journal of Applied Ecology
17	Lancaster et al. 2015	Drivers of recreational fisher compliance in temperate MCAs	Global Ecology and Conservation
18	Lewis 2015	Bags and tags: Randomized response technique indicates reductions in illegal recreational fishing of red abalone ( <i>Haliotis rufescens</i> ) in Northern California	Biological Conservation
19	Oyanedel et al. 2018	Illegal fishing and territorial user rights in Chile	Conservation Biology
20	Oyanedel et al. 2020	Motivations for (non-)compliance with conservation rules by small-scale resource users	Conservation Letters
21	Randriamamonjy et al. 2015	Consumption of bushmeat around a major mine, and matched communities, in Madagascar	Biological Conservation
22	Razafimanahaka et al. 2012	Novel approach for quantifying illegal bushmeat consumption reveals high consumption of protected species in Madagascar	Oryx

23	Robinson et al. 2015	Captive reptile mortality rates in the home and implications for the wildlife trade	PLoS ONE
24	Santangeli et al. 2016	Understanding, quantifying and mapping the use of poison by commercial farmers in Namibia – Implications for scavengers' conservation and ecosystem health	Biological Conservation
25	Schill & Kline 1995	Use of Randomised Response to Estimate Angler Noncompliance with fishing regulations	North American Journal of Fisheries Management
26	Solomon et al. 2007	Estimating illegal resource use at a Ugandan park with the randomized response technique	Human Dimensions of Wildlife
27	St John et al. 2012	Identifying indicators of illegal behaviour: Carnivore killing in human-managed landscapes	Proceedings of the Royal Society B: Biological Sciences
28	St John et al. 2018	Intention to kill: Tolerance and illegal persecution of Sumatran tigers and sympatric species	Conservation Letters
29	St. John et al. 2010	Testing novel methods for assessing rule breaking in conservation	Biological Conservation
30	St. John et al. 2014	Evaluating deterrents of illegal behaviour in conservation: Carnivore killing in rural Taiwan	Biological Conservation
31	Thomas et al. 2014	Estimating non-compliance among recreational fishers: Insights into factors affecting the usefulness of the randomized response and item count techniques	Biological Conservation
32	Wright 1980	Use of Randomized Response Technique to Estimate Deer Poaching	Wildlife Society Bulletin
Studies from other disciplines			
33	Akwataghbe et al. 2013	Assessing health workers' revenues and coping strategies in Nigeria - A mixed-methods study	BMC Health Services Research
34	Anglewicz et al. 2013	The effect of interview method on self-reported sexual behavior and perceptions of community norms in Botswana	AIDS and Behavior
35	Bailey et al. 2001	Research misconduct in accounting literature: A survey of the most prolific researchers' actions and beliefs	Abacus
36	Boardley et al. 2019	Perceptions of coach doping confrontation efficacy and athlete susceptibility to intentional and inadvertent doping	Scandinavian Journal of Science and Medicine in Sports
37	Chen et al. 2014	The randomized response technique application in the survey of homosexual commercial sex among men in Beijing	Iranian Journal of Public Health
38	Chong et al. 2019	Asking Sensitive Questions Using the Randomized Response Approach in Public Health Research: An Empirical Study on the Factors of Illegal Waste Disposal	International Journal of Environmental Research and Public Health
39	Chu et al. 2018	Applying the Randomized Response Technique in Business Ethics Research: The Misuse of Information Systems Resources in the Workplace	Journal of Business Ethics
40	Cobo et al. 2017	Application of randomized response techniques for investigating cannabis use by Spanish university students	International Journal of Methods in Psychiatric Research
41	Coutts & Jann 2011	Sensitive questions in online surveys: Experimental results for the randomized response technique (RRT) and the unmatched count technique (UCT)	Sociological Methods and Research
42	Cross et al. 2010	Use of a Randomized Response Technique to obtain sensitive information on animal disease prevalence	Preventive Veterinary Medicine
43	De Jong et al. 2010	Reducing social desirability bias through item randomized response: An application to measure underreported desires	Journal of Marketing Research
44	De Jong et al. 2012	Analysis of sensitive questions across cultures: An application of multigroup item randomized response theory to sexual attitudes and behavior	Journal of Personality and Social Psychology

45	Dietz et al. 2013	Randomized response estimates for the 12-month prevalence of cognitive-enhancing drug use in university students	Pharmacotherapy
46	Dietz et al. 2013	Associations between physical and cognitive doping - A cross-sectional study in 2.997 triathletes	PLoS ONE
47	Dietz et al. 2016	Analgesics use in competitive triathletes: its relationship to doping and on predicting its usage	Journal of Sports Sciences
48	Dietz et al. 2018	Physical and cognitive doping in university students using the unrelated question model (UQM): Assessing the influence of the probability of receiving the sensitive question on prevalence estimation	PLoS ONE
49	Donovan et al. 2003	An assessment of the prevalence, severity, and verifiability of entry-level applicant faking using the randomized response technique	Human Performance
50	Elbe & Pitsch 2018	Doping prevalence among Danish elite athletes	Performance Enhancement and Health
51	Fox et al. 2013	Mixture randomized item-response modeling: A smoking behavior validation study	Statistics in Medicine
52	Franke et al. 2013	Use of illicit and prescription drugs for cognitive or mood enhancement among surgeons	BMC Medicine
53	Franzen & Pointner 2012	Anonymity in the dictator game revisited	Journal of Economic Behavior and Organization
54	Frenger et al. 2016	Sport-induced substance use-an empirical study to the extent within a German Sports Association	PLoS ONE
55	Frenger et al. 2019	Corruption in Olympic Sports: Prevalence Estimations of Match Fixing Among German Squad Athletes	Sage Open
56	Geng et al. 2016.	Behavioral risk profile of men who have sex with men in beijing, China: Results from a cross-sectional survey with randomized response techniques	Chinese Medical Journal
57	Ghofrani et al. 2018	Prevalence of Induced Abortion in Iran: A Comparison of Two Indirect Estimation Techniques	International perspectives on sexual and reproductive health
58	Hejri et al. 2013	Academic disintegrity among medical students: A randomised response technique study	Medical Education
59	Hilbig et al. 2015	Truth Will Out: Linking Personality, Morality, and Honesty Through Indirect Questioning	Social Psychological and Personality Science
60	Hoglinger & Jann 2018	More is not always better: An experimental individual-level validation of the randomized response technique and the crosswise model	PLoS ONE
61	Höglinger et al. 2016	Sensitive questions in online surveys: An experimental evaluation of different implementations of the randomized response technique and the crosswise model	Survey Research Methods
62	Husain et al. 2018	How much self-presentation behavior do applicants from the United Arab Emirates exhibit?	International Journal of Selection and Assessment
63	Jing et al. 2018	Combining the randomized response technique and the network scale-up method to estimate the female sex worker population size: an exploratory study	Public Health
64	Jones et al. 2017	Estimating the prevalence of food risk increasing behaviours in UK kitchens	PLoS ONE
65	Khadem-Rezaiyan & Dadgarmoghaddam 2017	Research misconduct: A report from a developing country	Iranian Journal of Public Health
66	Kirchner 2015	Validating sensitive questions: A comparison of survey and register data	Journal of Official Statistics
67	Kirtadze et al. 2018	Republic of Georgia estimates for prevalence of drug use: Randomized response techniques suggest under-estimation	Drug and Alcohol Dependence

68	Koenig et al. 2012	How Much do Chinese Applicants Fake?	International Journal of Selection and Assessment
69	König et al. 2011	Applicants' Self-presentational Behavior across Cultures: Less self-presentation in Switzerland and Iceland than in the United States	International Journal of Selection and Assessment
70	Krumpal 2012	Estimating the prevalence of xenophobia and anti-Semitism in Germany: A comparison of randomized response and direct questioning	Social Science Research
71	Kwan et al. 2010	Applying the randomized response technique to elicit truthful responses to sensitive questions in is research: The case of software piracy behavior	Information Systems Research
72	Lara et al. 2004	Measuring Induced Abortion in Mexico: A Comparison of Four Methodologies	Sociological Methods and Research
73	Lara et al. 2006.	The measure of induced abortion levels in Mexico using random response technique	Sociological Methods and Research
74	Lavender & Anderson 2009	Effect of perceived anonymity in assessments of eating disordered behaviors and attitudes	International Journal of Eating Disorders
75	Miner & Center 2008	Improving the measurement of criminal sexual behavior: The application of randomized responding technique	Sexual Abuse: Journal of Research and Treatment
76	Moshagen & Musch 2012	Surveying multiple sensitive attributes using an extension of the randomized-response technique	International Journal of Public Opinion Research
77	Moshagen et al. 2011	Defection in the dark? A randomized-response investigation of cooperativeness in social dilemma games	European Journal of Social Psychology
78	Ostapczuk et al. 2009.	A randomized-response investigation of the education effect in attitudes towards foreigners	European Journal of Social Psychology
79	Ostapczuk et al. 2011	Improving self-report measures of medication non-adherence using a cheating detection extension of the randomised-response-technique	Statistical Methods in Medical Research
80	Perri et al. 2018	A mixed-mode sensitive research on cannabis use and sexual addiction: improving self-reporting by means of indirect questioning techniques	Quality and Quantity
81	Petróczi et al. 2011	New non-randomised model to assess the prevalence of discriminating behaviour: A pilot study on mephedrone	Substance Abuse: Treatment, Prevention, and Policy
82	Pitsch & Emrich 2012	The frequency of doping in elite sport: Results of a replication study	International Review for the Sociology of Sport
83	Pitsch et al. 2007	Doping in elite sports in Germany: results of a www survey	European Journal for Sport and Society
84	Robertson & Rymon 2001	Purchasing agents' deceptive behavior: A randomized response technique study	Business Ethics Quarterly
85	Rosenfeld et al. 2016	An Empirical Validation Study of Popular Survey Methodologies for Sensitive Questions	American Journal of Political Science
86	Rueda et al. 2020	Measuring Inappropriate Sexual Behavior Among University Students: Using the Randomized Response Technique to Enhance Self-Reporting	Sexual Abuse: Journal of Research and Treatment
87	Schröter et al. 2016	A comparison of the cheater detection and the unrelated question models: A randomized response survey on physical and cognitive doping in recreational triathletes	PLoS ONE
88	Seifarth et al. 2019	The Prevalence of Legal Performance-Enhancing Substance Use and Potential Cognitive and or Physical Doping in German Recreational Triathletes, Assessed via the Randomised Response Technique	Sports
89	Simon et al. 2006	Doping in fitness sports: Estimated number of unreported cases and individual probability of doping	Addiction
90	Srivastava et al. 2015	Application of Randomized Response Techniques in Estimation of prevalence of Child Sexual Abuse	Statistics and Applications

91	Striegel et al. 2010	Randomized response estimates for doping and illicit drug use in elite athletes	Drug and Alcohol Dependence
92	Stubbe et al. 2014	Prevalence of use of performance enhancing drugs by fitness centre members	Drug Testing and Analysis
93	Tu & Hsieh 2017	Estimates of Lifetime Extradyadic Sex Using a Hybrid of Randomized Response Technique and Crosswise Design	Archives of Sexual Behavior
94	Ulrich et al. 2018	Doping in Two Elite Athletics Competitions Assessed by Randomized-Response Surveys	Sports Medicine
95	Wolter & Preisendörfer 2013	Asking Sensitive Questions: An Evaluation of the Randomized Response Technique Versus Direct Questioning Using Individual Validation Data	Sociological Methods and Research

Additional Figures & Tables

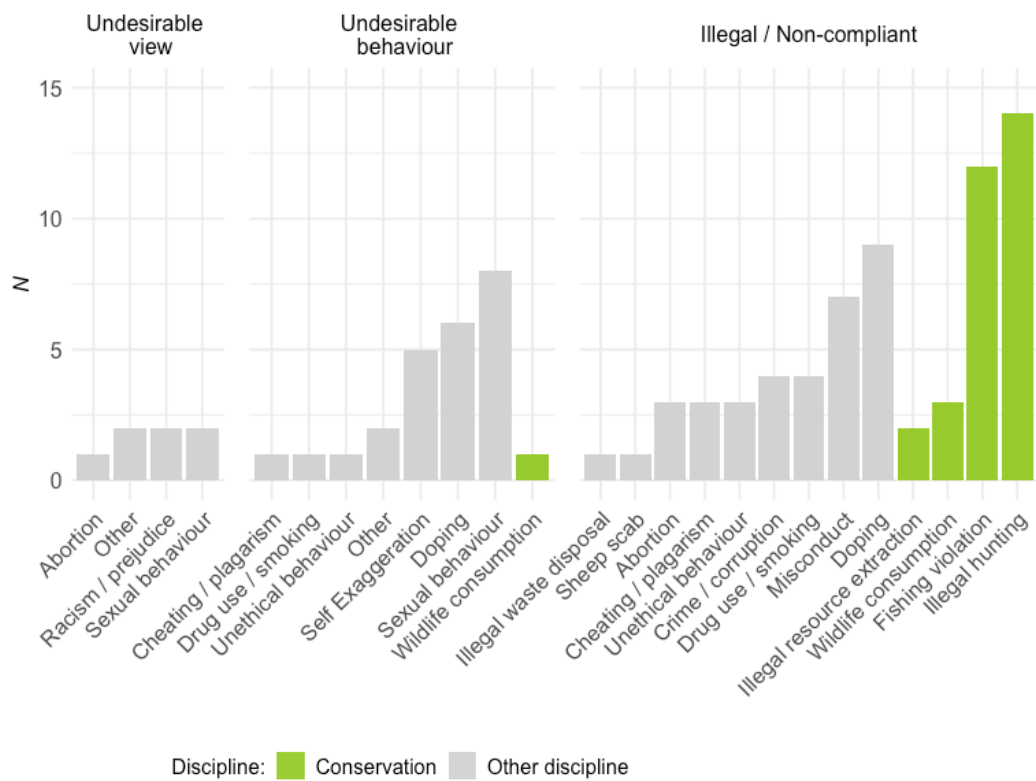


Figure A3.2. Behaviours RRT was used to investigate, categorised in ascending order by the sensitivity of the research topic

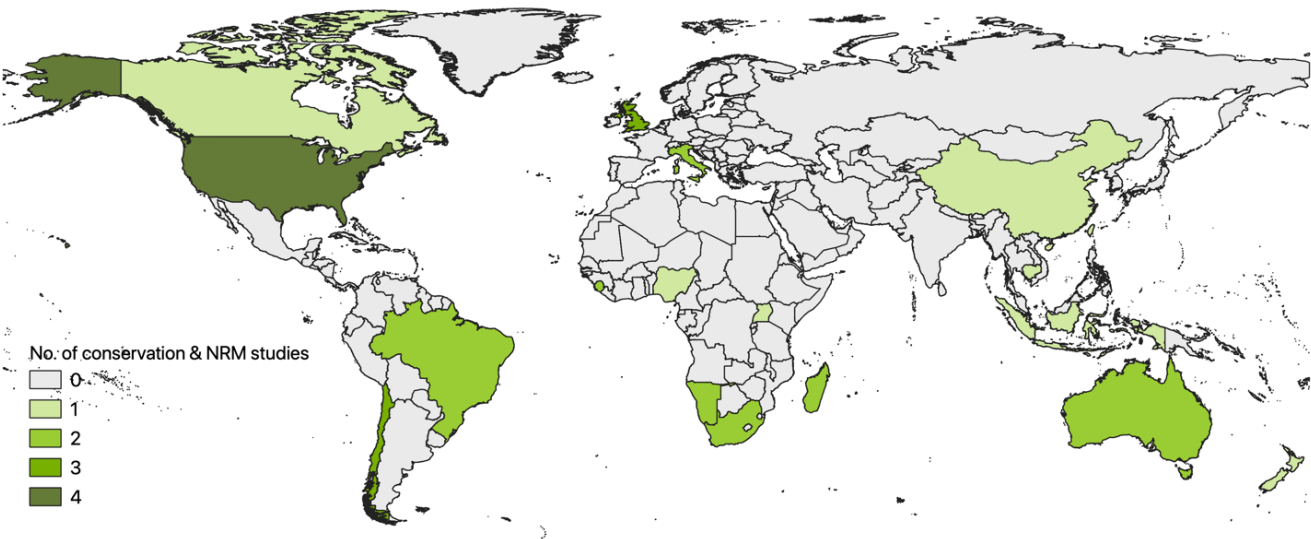


Figure A3.3. Geographical distribution of all known peer-reviewed studies conducted in conservation that used an RRT (n=32).



Table A3.2. Modes of administering RRT surveys, displayed by discipline. Four studies used >1 administration mode.

Administration Method	Conservation (n=32) %		Other disciplines (n=66) %		All studies (n=98) %	
Face-to-face	28	87%	22	33%	50	50%
Self-complete	5	15%	22	33%	27	28%
.... with ballot box	3	9%	17	26%	20	21%
Online	1	3%	20	30%	21	21%
Telephone	0	0%	3	5%	3	3%
Unknown	0	0%	1	1%	1	1%

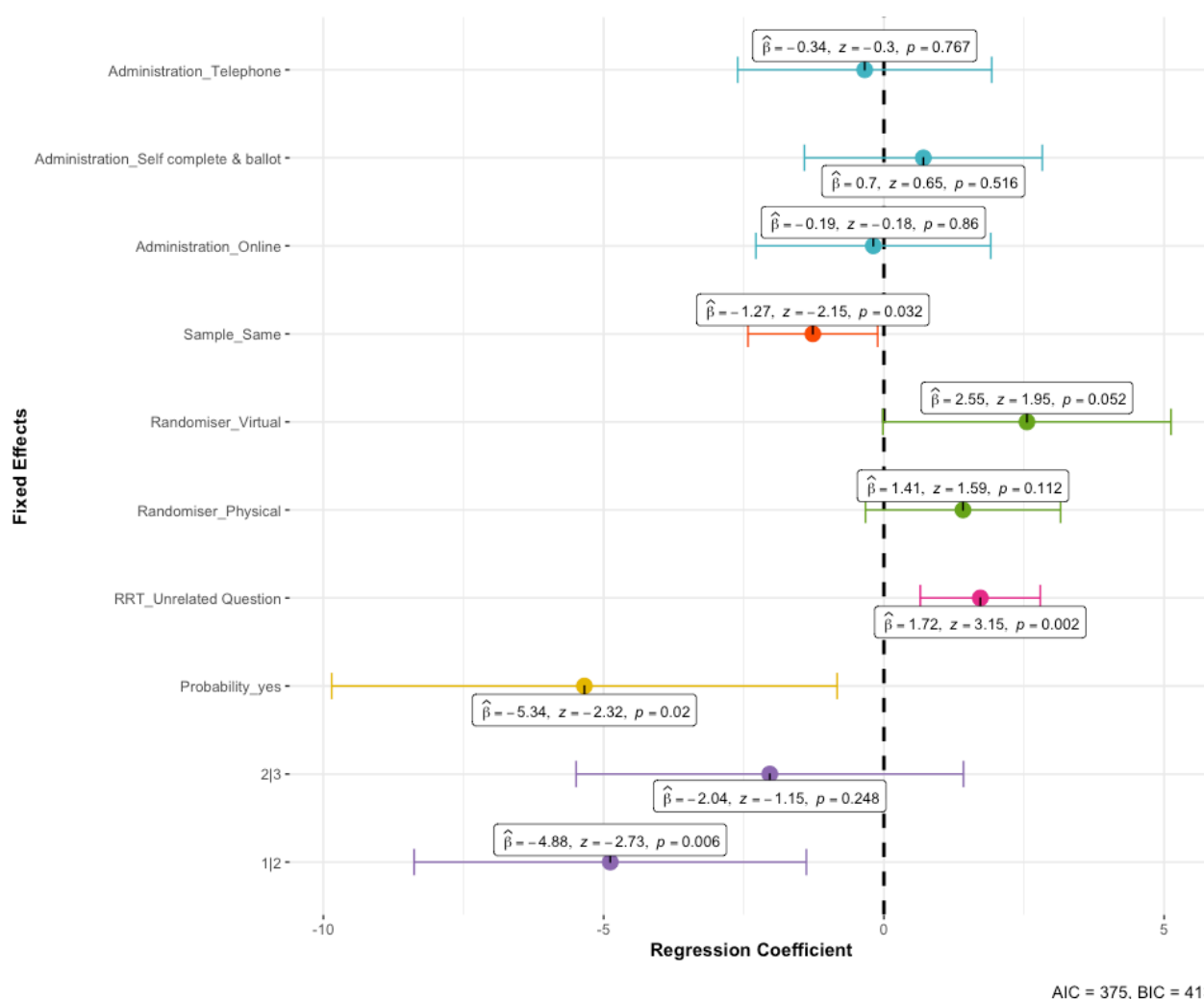


Figure A3.4. Box & whisker plot showing regression coefficients with 95% CIs from an ordered-logistic regression with random-effect for study, fitted to assess which factors influence whether RRTs provide higher, lower or non-significant prevalence estimates, compared to direct questions. Comparisons were made between 231 questions across 32 studies. Incept/reference levels were: Forced-response RRT design, Personal number randomising device (e.g., birth date or month), DQ & RRT responses collected from separate samples, face-to-face administration mode; 1= RRT performed worse than DQ, 2 = No significant difference, 3= RRT performed better than DQ

Table A3.3. Results from six validation studies included in the review. Level of validation data refers to whether validation data was collected at the individual respondent level, or the group level. In the Estimated Prevalence columns, values in ( ) show the % difference between the known prevalence and the estimated RRT prevalence.

Study	Topic	RRT Method	Validation data	Level of validation data	Known prevalence	Estimated prevalence ( <i>difference</i> )		
						RRT	DQ	UCT
Rosenfeld et al. 2016	Voting against anti-abortion bill in 2011 Mississippi elections	Forced-response	Voting records	Individual	65.3%	59.4% (-5.9%)	30% (-35.3%)	56.2% (-9.1%)
Höglinger & Jann 2018	Cheating in an experimental prediction game	Unrelated-Question	Known probability of number selection	Individual	26.13%	3.74% (-22.4%)	-	-
		Forced-response		Individual	26.53%	0.85% (-25.7%)	-	-
	Cheating in an experimental dice game	Unrelated-Question	Observation (Dice roll recorded)	Individual	5.01%	5.23% (+0.2%)	-	-
		Forced-response		Individual	5.20%	-1.94% (-7.1%)	-	-
Kirchner 2015	Receipt of basic income support	Forced-response	Government records	Group	100%	85.4% (-14.6%)	90.6% (-9.4%)	-
Wolter & Preisendorfer 2013	Committing minor offences	Forced-response	Court records	Individual	100%	59.6% (-40.4%)	57.5 (-42.5%)	-
Bova et al. 2018	Breaching of recreational angling regulations	Forced-response	Covert observation	Individual	100%	44.3% (-55.7%)	46.5% (-53.5%)	-

Table A3.4. Studies identified in the review that used a statistical model to quantify the prevalence of self-protective responses.

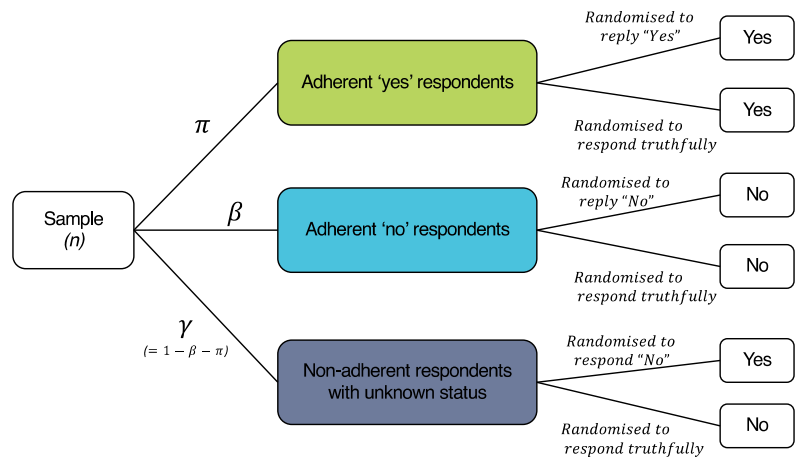
UQ-RRT = unrelated-question RRT design, FR-RRT = forced-response RRT design, CDM = Cheating Detection Model

ID	Study	Research Question	RRT design	Post-hoc analyses	Sample size (n)	Estimates (%)		
						Honest yes	Honest no	Cheaters
S1	Elbe et al. 2018	Have you intentionally used forbidden substances and/or forbidden methods in order to enhance your sporting performance in competitions during the last season?	UQ-RRT	Total cheating detection model <sup>2</sup>	624	0	69.4	30.6
		Have you ever intentionally used forbidden substances and/or forbidden methods in order to enhance your sporting performance in competitions?"			581	3.1	74	22.9
S2	Frenger et al. 2016	Doping last year	UQ-RRT	CDM <sup>2</sup>	616	4.1	70.2	25.8
		Doping ever			786	3.6	88.4	8
		Self-medication last year			616	21.4	78.6	0
		Self-medication ever			786	49.2	27.9	22.9
S3	Moshagen & Musch 2012	Political asylum	FR-RRT	Multiple-Issues cheating detection model <sup>3</sup>	1053	31	49.6	19.4
		Homosexuality			1053	49.6	30.4	20
		Renewable energy			1053	49.2	44.8	6
S4	Pitsch et al. 2011	Have you ever used illicit drugs or methods in order to enhance your sporting performance?	FR-RRT	CDM <sup>1</sup>	1556	10.2	65.2	24.7
		Have you used illicit drugs or methods in order to enhance your sporting performance in the current season?			1556	9.6	65	25.4
S5	Moshagen et al. 2011	Cooperation in an experimental game	FR-RRT	CDM <sup>1</sup>	1361	50.1	41.3	8.6
S6	Ostapczuk et al. 2011	Have you ever intentionally and for a considerable time not taken medication prescribed by a physician as directed?	FR-RRT	CDM <sup>1</sup>	473	32.7	20.2	47.1
S7	Ostapczuk et al. 2008	Assuming that you have a 20-year-old daughter. Would you mind her having a relationship with a dark-skinned Nigerian (high education)	FR-RRT	CDM <sup>1</sup>	217	30.1	52.7	17.2
		Assuming that you have a 20-year-old daughter. Would you mind her having a relationship with a dark-skinned Nigerian (low education)			259	38.1	23.8	38.1
S8	Frenger et al. 2019	Have you ever been approached to participate in a competition manipulation or match fixing?	UQ-RRT	No cheater detection model <sup>2</sup>	Unclear	8.4	89.6	2
		Have you ever been personally involved in a competition manipulation or match fixing?			Unclear	7.5	82.6	10

S9	Schroter et al. 2016	FR-RRT	CDM <sup>1</sup>	Have you ever observed an active effort to influence a referee or official with the objective of competition rigging?	351	33	61.6	5.4
				Have you ever personally exerted an influence on a referee with the objective to manipulate a competition?	351	4.9	90.5	4.6
				Have you taken substances to increase your physical performance in the past 12 months that are only available at a pharmacy, at the doctor's office or on the black market? (Frankfurt)	1001	11.9	23.2	64.9
				Have you taken substances to increase your mental performance in the past 12 months that are only available at a pharmacy, at the doctor's office or on the black market? (Frankfurt)	1001	9.4	31.5	59.1
				Have you taken substances to increase your physical performance in the past 12 months that are only available at a pharmacy, at the doctor's office or on the black market? (Wiesbaden)	482	4.2	41.9	53.9
				Have you taken substances to increase your mental performance in the past 12 months that are only available at a pharmacy, at the doctor's office or on the black market? (Wiesbaden)	482	0.7	54.8	44.5

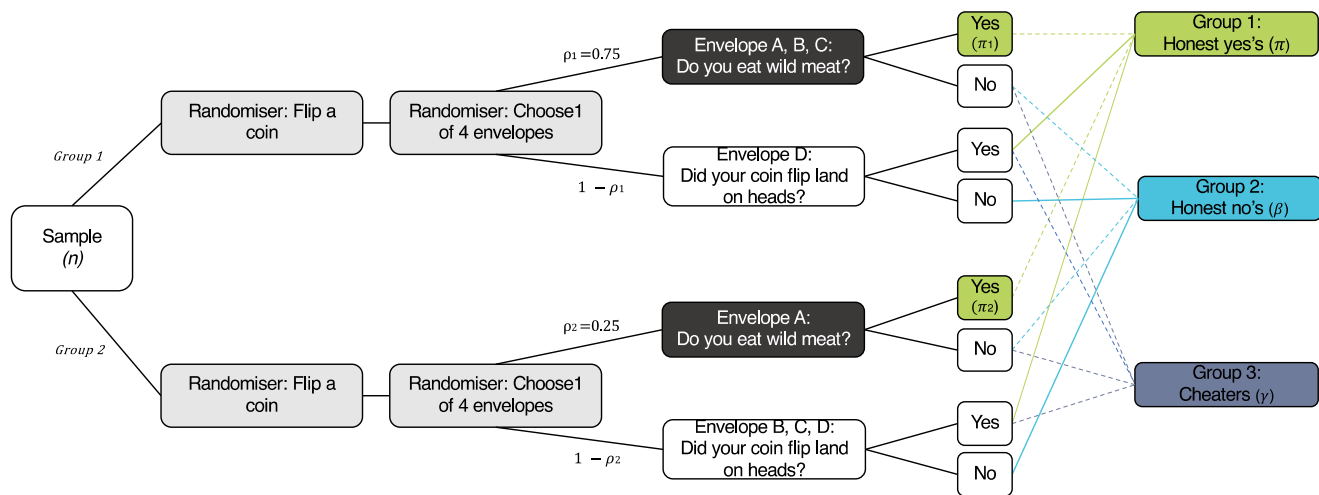
<sup>1</sup> following design of Clark & Desharnais, 1998 referenced, <sup>2</sup> following design of Feth et al. 2017, <sup>3</sup> As proposed by author

Probability tree outlining the Cheating Detection Model



Assumes research question is socially undesirable, and that respondents are likely to underreport possession of the sensitive trait.  
Adapted from Moshagen & Musch, 2013

Example of a how a Cheating Detection Model might adapted for a paired-alternative design



Solid lines = assume 100% of participants who obtained these randomizing outcomes will give this response (no sensitivity bias attached to doing so)  
Dashed lines = unknown proportion of respondents likely to give this answer

Figure A3.5. Probability tree and example of the Cheating Detection Model developed by Clark & Desharnais (1998) where  $p$  represents the probability of the respondent being asked to answer the sensitive question.

# Appendix 4

Chapter 5 - Topic sensitivity still affects honest responding even when Specialised Questioning Techniques  
are used

Table A4.1. Survey instrument used in the main questionnaire in English

Question	Hint
Section 1: Location	
Region	For interviewer to answer
District	For interviewer to answer
What is the district?	For interviewer to answer
Village	For interviewer to answer
Sub-village	For interviewer to answer
Which is the nearest protected area?	For interviewer to answer
Who is conducting the interview?	For interviewer to answer
What type of respondent is being interviewed?	
Can you provide more information on why the respondent is part of the snowball sample?	"For interviewer to answer: Were we given their information? Who gave us their information? What behaviours do we think they do? Did they approach us?"
What gender is the respondent?	
Section 2: Consent	
<p>"Read the information sheet to the respondent, either from the sheet of paper or the phone:</p> <p>My name is \${interviewer} and I am a Research Assistant working for a project being conducted by Bangor University in the United Kingdom. Today, I would like to invite you to take part in a short study. The aim of the study is to understand what life is like for people like you that live close to a protected area. I am asking you to take part because you live close to a one. In total we are hoping to speak to between 2,000 and 3,000 people like you who live close to a protected area. If you agree to take part, I will ask you some questions and record your answer on this device [show questionnaire on tablet]. I will never record your name or your address on this, or any other form; your answers are private and confidential. The first set of questions is about you and your household, then I will ask about different activities you may or may not have done inside the protected area. Next, I will ask questions about your opinions and experiences of living in this area. This should take between 30 minutes and one hour. Because I am not recording your name, your answers cannot be attributed to you, and it will not be possible to identify you from our records. Information you provide will not be shared with anybody outside of the research team and will only be used by members of the research team based in the UK. Your answers, together with those of 2,000-3,000 other people, will be used to write reports. The study has been approved by the Bangor University Ethics Committee. If you would prefer not to take part, that is ok. Also, if you agree at first but then change your mind and would like to stop at any point, please tell me and I will stop immediately. If you have any concerns please contact us on this phone number [provide contact card]. Before going any further, do you have any questions that you would like to ask me? Would you like to take part in this study?"</p>	
"I confirm that I have had the ConHuB Information Sheet read out to me and I understand the information provided for this study. I have had the opportunity to ask questions if necessary and have had these answered satisfactorily. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason. If I withdraw my data will be removed from the study and will be destroyed. I understand that the answers	

I provide will be used for the purposes detailed in the ConHuB Information Sheet. Based upon the above, I agree to take part in this study "	
Thank the respondent for their time	If you want to return to the previous question, just swipe backwards.
Section 3: COVID-19 Precautions	
"While we understand that the government has announced that Tanzania has no COVID-19, because it is a dangerous disease, we are taking precautions to keep ourselves and everyone we meet safe in case there are cases that the government has not detected. "	" If the guide has not already explained our COVID-19 precautions then explain to the respondent: 1. That the team are clear of symptoms 2. That we wear masks to protect ourselves and the respondent 3. That we will be working outside and maintaining social distancing 4. We will be washing hands frequently "
Does anyone in your household have symptoms of COVID-19 that have developed over the previous week? These are: a new and persistent cough, difficulty in breathing, a high fever, a recent loss of taste or smell?	
Thank the respondent for their time, explain that even though the sick individual may not have COVID-19 we do not want to put other respondents at risk if they do have COVID-19. Wish them or their household member a quick recovery	
Section 4: Respondent demographics	
1. I am going to ask you a few questions about yourself and the others in your household, by household I mean those who eat together and sleep in the same house, including children who may be at boarding school	
2. How old are you?	If the respondent does not know their age ask for a best estimate. To skip question enter -99
3a. What tribe do you belong to?	
3b. Please specify which tribe	
4. How many years have you lived in this village?	Round to the nearest whole number (e.g. 5 months = 0 yrs, 6 months = 1 yr). To skip question enter -99
5. Are you currently attending school?	
6. How many years of schooling have you completed?	Includes primary and secondary school. To skip question enter -99
7. How many other people live in this household? Both adults and children	
Section 5a: RRT questions for men	
<p>"I'm now going to ask you some questions in a different way. The way that I will ask you these questions is a bit like a game, and like games, there are rules that you must follow.</p> <p>First of all I will give you a dice and this cup, and ask you to roll the dice inside this cup, like this [shake dice], giving it a really good shake.</p> <p>I will then ask you to look inside the cup to see what number the dice is showing [look inside cup].</p> <p>If you roll a **1, 2, 3 or 4** you should answer my question **with the truth about your actual behaviour,** your answer can be **Yes** or **No.**"</p>	**Repeat example until respondent understands how to answer**



<p>If you roll a <b>**5**</b> you must answer my question <b>**Yes**</b> *Even if this is not the true answer*</p> <p>If you roll a <b>**6**</b> you must answer my question <b>**No**</b> *Even if this is not the true answer*</p> <p>It is important that you do not tell me what number your dice shows, that is your secret.</p> <p>Let's have a practice, first, I will answer a question.</p> <p>See, I'm shaking the dice in the cup, now I'm going to look inside &amp; see what number I got. OK. So I know what number I have and now I will look at this sheet to remind myself how to answer: 1, 2, 3, or 4 and I must answer according to my own behaviour, my answer can be Yes or No. If I got a 5, I just say Yes and if I got a 6, I just say No.</p> <p>So, now let's think of a question... Did I break the speed limit in that car when I was in town last week? I'm looking at my dice number again [look in cup], OK, my answer is Yes. Now, you see, you do not know if I said Yes because I really did drive too fast last week, or if I said Yes because the dice landed on 5. This means that you do not know anything sensitive about me, we are both safe.</p> <p>Let's have a practice. This time, you roll the dice in the cup. Make sure you give it a really big shake and then look inside the cup to see what number you got.</p> <p>My question is: Have you eaten beans today?</p> <p>Following the rules of the dice, what is your answer, remember if your dice landed on 1, 2, 3, or 4 you must answer according to your own behaviour, your answer can be Yes or No. However, if you get a 5, you just say Yes and if you got a 6, you just say No [point to dice card]. OK, so your answer was X [say answer given], but see, I can't tell if you answered X [say answer given], because it was your true behaviour, or if it is because your dice landed on X [say 5 if answer was Yes, say No if answer was 6].</p> <p>Do you understand?</p> <p>OK, I can see that you now understand this method. I will now ask you the actual questions. "</p>	
1. How many times did you practice the method before the respondent understood?	For interviewer to answer. To skip question enter -99
2. In the past 12 months have you hunted wildlife inside \${protected_area_name} for example birds francolin, guinea fowl, quail, small animals like dik dik or impala, or larger animals like buffalo, giraffe or others?	
3. In the past 12 months have you been fishing inside \${protected_area_name}?	
4. In the past 12 months have you taken livestock inside \${protected_area_name} to graze or for water?	
5. In the past 12 months have you collected timber or construction materials inside \${protected_area_name}?	
6. In the past 12 months have you entered \${protected_area_name} without a permit?	

Section 5b: RRT questions for women	
<p>"I'm now going to ask you some questions in a different way. The way that I will ask you these questions is a bit like a game, and like games, there are rules that you must follow.</p> <p>First of all I will give you a dice and this cup, and ask you to roll the dice inside this cup, like this [shake dice], giving it a really good shake.</p> <p>I will then ask you to look inside the cup to see what number the dice is showing [look inside cup].</p> <p>If you roll a <b>**1, 2, 3 or 4**</b> you should answer my question <b>**with the truth about your actual behaviour,**</b> your answer can be <b>**Yes**</b> or <b>**No**</b>.</p> <p>If you roll a <b>**5**</b> you must answer my question <b>**Yes**</b> *Even if this is not the true answer*</p> <p>If you roll a <b>**6**</b> you must answer my question <b>**No**</b> *Even if this is not the true answer*</p> <p>It is important that you do not tell me what number your dice shows, that is your secret.</p> <p>Let's have a practice, first, I will answer a question.</p> <p>See, I'm shaking the dice in the cup, now I'm going to look inside &amp; see what number I got. OK. So I know what number I have and now I will look at this sheet to remind myself how to answer: 1, 2, 3, or 4 and I must answer according to my own behaviour, my answer can be Yes or No. If I got a 5, I just say Yes and if I got a 6, I just say No.</p> <p>So, now let's think of a question... Did I break the speed limit in that car when I was in town last week? I'm looking at my dice number again [look in cup], OK, my answer is Yes. Now, you see, you do not know if I said Yes because I really did drive too fast last week, or if I said Yes because the dice landed on 5. This means that you do not know anything sensitive about me, we are both safe.</p> <p>Let's have a practice. This time, you roll the dice in the cup. Make sure you give it a really big shake and then look inside the cup to see what number you got.</p> <p>My question is: Have you eaten beans today?</p> <p>Following the rules of the dice, what is your answer, remember if your dice landed on 1, 2, 3, or 4 you must answer according to your own behaviour, your answer can be Yes or No. However, if you get a 5, you just say Yes and if you got a 6, you just say No [point to dice card]. OK, so your answer was X [say answer given], but see, I can't tell if you answered X [say answer given], because it was your true behaviour, or if it is because your dice landed on X [say 5 if answer was Yes, say No if answer was 6].</p> <p>Do you understand?</p>	<p><b>**Repeat example until respondent understands how to answer**</b></p>

1. How many times did you practice the method before the respondent understood?	For interviewer to answer. To skip question enter -99
2. In the past 12 months have you encouraged someone in your household to hunt wildlife inside \${protected_area_name} for example birds francolin, guinea fowl, quail, small animals like dik dik or impala, or larger animals like buffalo, giraffe or others?	
3. In the past 12 months have you encouraged someone in your household to fish inside \${protected_area_name}?	
4. In the past 12 months have you encouraged someone in your household to take livestock inside \${protected_area_name} to graze or for water?	
5. In the past 12 months have you encouraged someone in your household to collect timber or construction materials inside \${protected_area_name}?	
6. In the past 12 months have you entered \${protected_area_name} without a permit?	
Section 6: Review of RRT	
7. \${interviewer}, how well do you think the respondent understood the method?	
8. \${interviewer}, any comments on RRT section?	For interviewer, if no comments leave blank
Section 7: Thank you	
We are interested in learning about how people's lives change over time. Would you be willing to be visited again by our team in approximately 12 months time?  If so I will record your name and some contact details, therefore your responses will no longer be anonymous. However, your name and phone number will be stored securely, and will not be shared with anybody outside the research team.	
2. What is your name so we can find you again in 12 months time?	
3. What is your common name?	
4. What is your phone number so we can find you again in 12 months time?	
5. GPS location	If you are not at the respondent's house then SKIP this question. Automatically records the GPS location when accuracy is less than 20m. You may have to be outside to get a good location
Thank the respondent for their time	
\${interviewer}. where is the interview being conducted?	For interviewer to answer
\${interviewer}, what is the "other" location?	For interviewer to answer
\${interviewer}, any notes to record? Or unusual circumstances? E.g. other people present, disruptions etc	For interviewer to answer

Table A4.1. Survey instrument used in the Experimental Questionnaire in English

Question	Hint
Section 1: Location	
Who is conducting the interview?	
Region	
District	
Name of the village	Write the village name.
Name of sub-village	Write the name of the sub-village
Nearest Protected Area	<b>**Do not ask the respondent this**</b>
Section 2: Consent	
<p>Hello. My name is \${interviewer} and I am helping X, who is from X University in the UK to conduct research. X's research is all about understanding the best way to ask questions about natural resource use.</p> <p>We are asking lots of people to complete this survey so that we can understand how people prefer to answer questions about natural resource use. The information you provide us is very important in making sure that we ask questions in the right way.</p> <p>The questionnaire will take about 25 minutes to complete. Any information you provide will be anonymous, this means I will not record your name, or any information that can personally identify you or your household. Your answers will not be communicated to anyone in a form where your reply can be linked to you. I will record all your answers on this phone. All your answers will then be saved on a secure computer which can only be accessed by XXX.</p> <p>At the end of the research, XXX will write a report on her findings. This report will be used to help other researchers conduct research that better meets the needs of local people. Some results may also be published internationally so that other people in different countries can learn from our experience working with communities here.</p> <p>Please note that we are independent, we are not related to the government or any NGOs and we have neutral views. We have permission of the Tanzanian government and the village chief to carry out this research. However, participation is voluntary. You do not have to participate and you stop participating at any time, without explanation. If you do I will discard your responses. If you feel uncomfortable answering some of the questions, you do not have to answer. If you would like to skip a question or a topic, please say.</p> <p>This study has been reviewed by, and received ethics clearance through X University. If you have any questions, please ask me and I will do my best to answer them.</p> <p>If you remain unhappy or wish to make a formal complaint, I can give you the contact details of someone to discuss this with.</p>	Read consent script to participant
Did participant give their consent to participate?	
Thank the participant and end the survey.	
What was the gender of the participant?	
Section 3: Covid-19 Precautions	

While we understand that the government has announced that Tanzania has no COVID-19, because it is a dangerous disease, we are taking precautions to keep ourselves and everyone we meet safe in case there are cases that the government has not detected.	<p>If the guide has not already explained our COVID precautions then explain to the respondent:</p> <ol style="list-style-type: none"> <li>1. That the team are clear of symptoms</li> <li>2. That we wear masks to protect ourselves and the respondent</li> <li>3. That we will be working outside and maintaining social distancing</li> <li>4. We will be washing hands frequently</li> </ol>
<p>Does anyone in your household have symptoms of COVID19 that have developed over the previous week?</p> <p>These are:</p> <ul style="list-style-type: none"> <li>• a new and persistent cough</li> <li>• difficulty in breathing</li> <li>• a high fever,</li> <li>• a recent loss of taste or smell</li> </ul>	
Thank the respondent for their time, explain that even though the sick individual may not have COVID we do not want to put other respondents at risk if they do have COVID. Wish them or their household member a quick recovery	If yes
<b>Section 4: Participant demographics</b>	
What gender is the participant?	
How old are you?	If unknown, ask them to estimate their age
What tribe are you?	
Please specify which tribe	
What is the main language you speak?	
Please specify which language	
How many years of schooling do you have?	<p>Enter approximate number of years</p> <p>If none, enter 0</p> <p>If unsure, write DK</p> <p>For diploma/degree - add on the number of extra years e.g. 13 + 2 = 15</p>
Can you read?	
How do you find reading?	Read out options to respondent
<b>Section 5: Introducing RRT</b>	
<p>The aim of this next section is to find out how you most prefer to answer questions.</p> <p>When we are asked questions about using natural resources, sometimes we don't always want to tell the truth.</p> <p>We might be embarrassed about our answer, we might not trust the person asking the questions, or we might be scared that if we do tell the truth we will get into trouble.</p> <p>However, for researchers, when we ask questions about natural resource it is very important that we do get honest answers.</p> <p>Otherwise the information we have will not be correct, and we may not make the best recommendations for the community.</p>	

<p>To solve this problem, researchers have developed special ways of asking questions, which allow people to answer questions honestly, but mean the researcher cannot tell if the person answering the question does the activity.</p> <p>I would like to try one of these ways with you, to see if you understand it and your opinions.</p> <p>I do not want to know whether this is something you or your household does.</p> <p>I am only interested in understanding the best way for a researcher to ask questions about this.</p>	
<p>To make sure that you do not answer questions about yourself I would like to introduce you to these fictional characters.</p> <p>Here I have 14 characters. Each of whom owns or does different things.</p> <p>When we try the different ways of answering questions, I want you to pretend you are one of these characters, and so you should give me the answer that they should give.</p> <p>Do you understand?</p>	
<p>For example, here we have Moja. Moja eats several different types of fruit. These are:</p> <ul style="list-style-type: none"> <li>• Mango</li> <li>• Avocado</li> <li>• Papaya</li> <li>• Pineapple</li> </ul>	Collect character card for Moja
Section 6: Practicing RRT	
<p>The way to answer this question is a bit like a game. And like games, there are rules you must follow.</p> <p>First of all I will give you a dice, and ask you to roll it.</p> <p>If you roll a **1, 2, 3 or 4** you should answer my question truthfully</p> <p>If you roll a **5** you must always say **Yes** *Even if this is not the true answer*</p> <p>If you roll a **6** you must always say **No** *Even if this is not the true answer*</p> <p>Do you understand?</p> <p>Let's have a practice. *[Roll the dice]* which number did you get? What answer should you give?</p> <p>Let's practice with an example.</p> <p>Here is Moja. My question to Moja is "Moja, do you eat avocado?"</p> <p>I roll the dice. I get XX. Because I got a XX, my answer should be XX.</p> <p>Do you understand?</p>	
Was the respondent familiar with a dice?	

Ok, now we shall practice with Mbili. Mbili eats: Mango Watermelon Orange Banana	*Select character card for Mbili*
Mbili, do you eat avocado?  Remember, if you roll a: 1, 2, 3, 4 **answer truthfully** 5 say **YES** 6 say **NO**  Record the number of practices required, before the respondent answered correctly.  If respondent Prefers not to answer enter '999'	
Section 7: Collecting data – This section was repeated 6 times, once for each of the study behaviours	
Select the card for **\${character 1}** \${character 1_attributes}	Briefly describe the activities on the card.
\${character 1}, do you \${behaviour 1}?  Remember, if you roll a: 1, 2, 3, or 4 answer honestly 5 say Yes 6 say No	Refer to the 'protected area' as the \${pa_type}.
From the answer you gave, do you think I would be able to tell if \${character 1}, \${behaviour 1}?	
What number did you roll on the dice?	So I can check if you answered correctly.  If NA, enter '0'
Select the card for **\${character 2}**	Briefly describe the activities on the card.  \${character 2_attributes}
\${character 2}, do you \${behaviour 1}?  Remember, if you roll a: 1, 2, 3, or 4 answer honestly 5 say Yes 6 say No	Refer to the 'protected area' as the \${pa_type}.
From the answer you gave, do you think I would be able to tell if \${character 2} \${behaviour 1}?	
What number did you roll on the dice?	So I can check if you answered correctly.  If NA, enter '0'
Section: 8 Review of RRT	
Do you feel you clearly understood how to answer the questions?	
How easy did you find it to answer the question using this method?	
How secret do you think your answers were using this method?	
How comfortable would you feel answering questions honestly about sensitive topics using this method?	
Any other comments to add?	Record any comments from the respondent about the method

Section 9: Interviewer feedback	
The survey is now finished. Thank you for participating.	Do you have any questions for me?
`\${interviewer}`, how well do you think the respondent understood the method?	
`\${interviewer}`, did you feel the respondent was deliberately answering incorrectly?	E.g., they were scared to answer honestly
`\${interviewer}`, how engaged was the participant throughout the survey?	
`\${interviewer}`, how did you find surveying this individual?	
Have you any comments or feedback?	Record any comments or feedback If none, NA



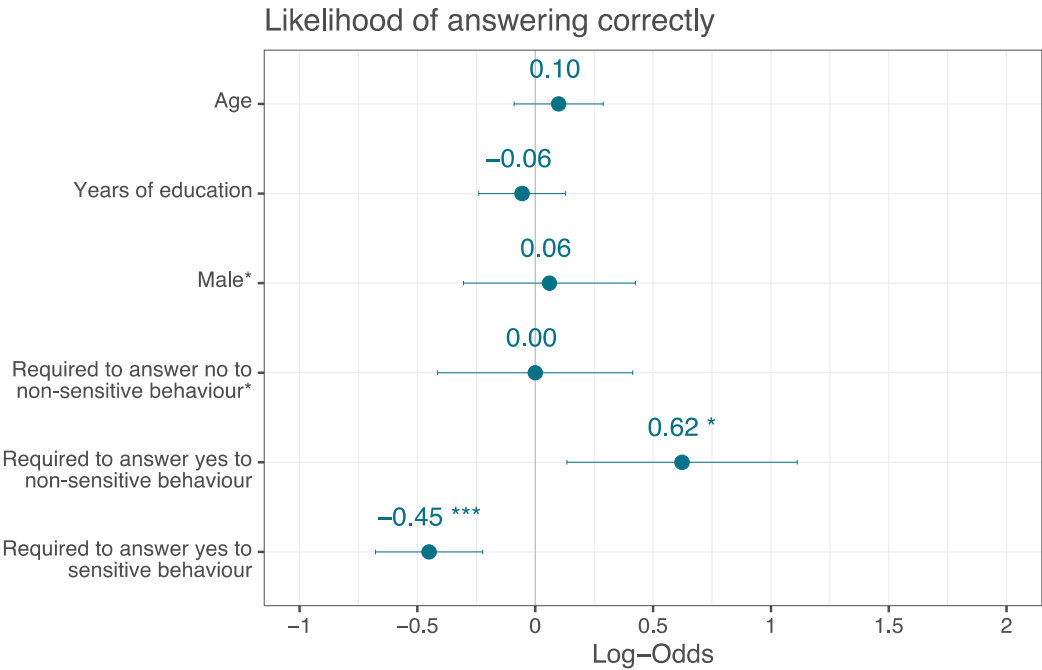


Figure A4.1. Plotted regression coefficients with standard errors from a general linear mixed model from the experimental study of whether a respondent answered the Randomised Response Technique question correctly or not, with random effects for respondent. \*Reference levels: Female, Required to answer no to sensitive behaviour.

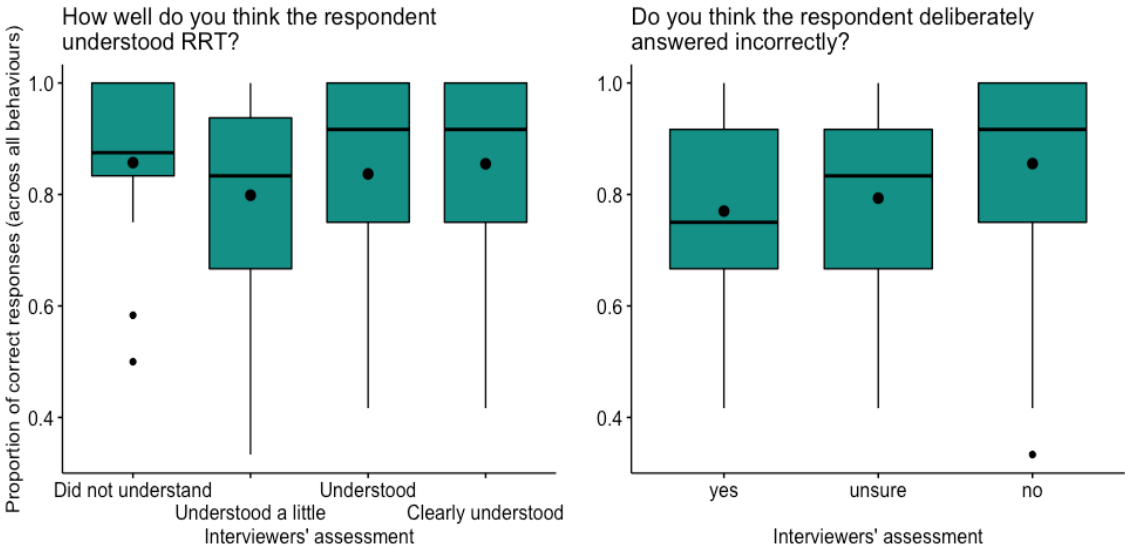


Figure A4.2. Interviewers' assessments of respondents understanding and evasive responses, compared against respondents' performance (measured by the proportion of correct responses given, across all behaviours). Dots show the mean, thick lines in shaded boxes show the median.

Table A4.3. Feedback from respondents about the RRT method, coded into three different categories.

Comment (translated to English)	Positive	Concerns	Understanding
He was afraid, as he thought it [RRT] contained magic	-	1	-
He was afraid of [rolling the] number five. He asked why he should have to answer he did, when he did not?	-	1	-
He says this method has a bit of secrecy	-	-	-
Fearful people will not answer questions using this [RRT] method.	-	1	-
He said some of the respondents will not answer 'yes' for rule breaking because of sensitivity.	-	1	-
He was worried his farm is going to be included in the Protected area as a result of this study. Consequently, he deliberately answered incorrectly.	-	1	-
I am afraid that I may be asked to give evidence of rule breaking after participating in this survey	-	1	-
I think it will be difficult especially for people who did not go to school	-	-	1
I was fearful of giving wrong answers on the method	-	1	-
Improve the method by avoiding repetition of questions and pictures on the cards	-	-	-
Is a good method	1	-	-
Is a good method for it gives freedom	1	-	-
It is difficult for us who did not go to school	-	-	1
It is difficult to know what these things mean	-	-	1
It is simple and easy to understand	1	-	-
It needs much energy to understand, and it will be more difficult to understand to those who did not go to school	-	-	1
It was difficult at the beginning but as I progressed it became easy	1	-	-
It was difficult because I didn't get prior information [that surveys were taking place], so I didn't get prepared to participate in the survey.	-	-	1
It will not work for people who did not go to school	-	-	1
It's a good method	1	-	-
It's difficult at the beginning but as I progressed it became clear.	1	-	-
It's easy	1	-	-
It's had to answer 'yes' to rule breaking, but I am concerned the study may bring eviction.	-	1	-
It will confuse people especially those who have not studied [been to school]	-	-	1

This technique is good	1	-	-
The method is good, but it forces one to give answers even if it is not true	-	1	-
Hard if you do not read, it is disturbing	-	-	1
It is difficult because it contains many things that are confusing	-	-	1
It's a good technique	1	-	-
It's easy	1	-	-
Nice method and would yield success	1	-	-
The dice method is easy to answer questions	1	-	-
People are now educated, so you are better [off] asking them directly	-	-	1
People with difficulties to understand will face problems, because it is confusing	-	-	1
She associated dice with witchcraft and refused to respond to the questions	-	1	-
She associated RRT with witchcraft	-	1	-
The method seems to be good and [it] is my hope you will get good answers	1	-	-
This method is difficult	-	-	1
This method is easy but for people like the Sukuma it will be more difficult because they are so worried	1	1	-
Understanding of this method depends on understanding the capacity of a respondent.	-	-	1
[The respondent] understood the method at the beginning but later forgot due to many numbers of character cards.	-	-	1
Total number of comments	14 (31%)	12 (30%)	14 (31%)

# Appendix 5

Chapter 6 – A greater focus on fair administration of protected areas could improve compliance

## Survey design

**Calculation of Multidimensional Poverty Indices (MPI)**

Table A5.1. Table outlining how a Multidimensional Poverty Index was calculated for each respondent's household. The classifications follow Table 1 of Global MPI Methodological Note 51 (Alkire et al. 2021), and where appropriate were adapted for the local context. Responses to each question were coded 1 (signalling deprivation) or 0 (signalling no deprivation), and then multiplied by the weightings shown. Multidimensional Poverty Indices were calculated by summing weighted measures across the three indicators for each respondent.

Poverty Indicator	Measure	Weight allocated to measure	A household was considered deprived (and allocated a score of 1) where... (Based on Alkire et al. 2016; 2021)	Notes
Education (1/3)	Years of Schooling	1/6 (0.1667)	No eligible household member has completed six years of schooling	
	Child school attendance	1/6 (0.1667)	Any school-aged child is not attending school up to the age at which he/she would complete class 8.	
Health (1/3)	Nutrition HHS	1/6 (0.1667)	Any person under 70 years of age for whom there is nutritional information is undernourished.  Measured using Household Hunger Score from FANTA USAID toolkit, which asks three questions:  <ul style="list-style-type: none"> <li>• In the past 12 months, how often was there no food to eat of any kind in your house because of lack of resources to get food?</li> <li>• In the past 12 months, how often did any household member go to sleep at night hungry because there was not enough food?</li> <li>• In the past 12 months, how often did any household member go a whole day and night without eating anything because there was not enough food?</li> </ul>	<i>In Indonesia:</i> A household measured as deprived if their answer to any of the three questions was one day.  <i>In Tanzania:</i> A household measured as deprived if their answer to any of the three questions was +30days.
	Child Mortality	1/6 (0.1667)	A child under 18 has died in the household in the five-year period preceding the survey	
	Cooking Fuel	1/18 (0.055)	A household cooks with dung, agricultural crop, shrubs, wood, charcoal or coal.	

Living standards (1/3)	Sanitation	1/18 (0.055)	The household has unimproved or no sanitation facility or it is improved but shared with other households.	Improved sanitation defined as a flush toilet or latrine, or ventilated improved pit or composting toilet, if they are not shared.
	Drinking water	1/18 (0.055)	The household does not have access to improved drinking water (according to SDG guidelines) or safe drinking water is at least a 30-minute walk from home, roundtrip.	A household has access to clean drinking water if the water source is any of the following types: piped water, public tap, borehole or pump, protected well, protected spring, or rainwater, and it is within a 30-minute round trip by usual means of transport.  Bottled water included as an improved water source here following notes in Alkire 2021
	Electricity	1/18 (0.055)	The household has no electricity.	
	Housing	1/18 (0.055)	The household has a dirt, sand, dung or 'other' (unspecified) type of floor	
	Assets	1/18 (0.055)	The household does not own more than one radio, TV, telephone, bicycle, motorbike or refrigerator and does not own a car or truck.	Deprived: Sum of the number of small assets is less than two AND no car/truck Not deprived: Sum of small assets greater than 1 OR owns a car/truck

Alkire, S., Jindra, C., Robles, G. and Vaz, A. (2016). "Multidimensional Poverty Index - 2016: Brief methodological note and results." OPHI Briefing 42, University of Oxford. [https://www.ophi.org.uk/wp-content/uploads/OPHIBrief\\_42\\_MPI\\_meth\\_note\\_2016.pdf](https://www.ophi.org.uk/wp-content/uploads/OPHIBrief_42_MPI_meth_note_2016.pdf)

Alkire, S., Kanagaratnam, U., and Suppa, N. (2021). 'The global Multidimensional Poverty Index (MPI) 2021', OPHI MPI Methodological Note 51, Oxford Poverty and Human Development Initiative, University of Oxford. [https://www.ophi.org.uk/wp-content/uploads/OPHI\\_MPI\\_MN\\_51\\_2021\\_4\\_2022.pdf](https://www.ophi.org.uk/wp-content/uploads/OPHI_MPI_MN_51_2021_4_2022.pdf)

### Information on the Factorial Survey Experiment (FSE)

To calculate the total number of vignette combinations (i.e., the full factorial design) we multiplied the number of levels in each factor (e.g.,  $2 \times 2 \times 2 \times 4 = 32$ ). Ideally, respondents would be asked to assess all 32 vignettes. However, presenting a respondent with too many vignettes' risks fatigue, boredom and unwanted methodological effects. Instead, a common approach is to divide the vignettes into smaller 'blocks' or sets of vignettes, a selection of which are administered to respondents (Ausperg & Hinz 2015). Vignette allocation to blocks can be random or systematic. Most studies use random allocation, however, increasingly it is seen as good practice (and more statistically efficient) to use systematic designs (Dülmer 2016). Specialist software can be used to develop the most efficient combination of blocks. Here, using the software SAS and following the code of Lawson et al. (2009) (below) we used a mixed-level full factorial design, separated into four blocks of eight vignettes (Table A5.2). This design has a D-efficiency of 100, and is orthogonal (meaning all main effects and interaction effects can be estimated uncorrelated, which implies that all effects can be estimated independently of all other effects) and balanced (each level occurs equally often within each vignette) (Dülmer 2016). Respondents were randomly allocated to a block, and the vignette order within each block was also randomised.

Table A5.2. Blocked full-factorial design for  $2 \times 2 \times 2 \times 4$  with a D-efficiency of 100. The top row shows the four factors (crime committed, power of offender, where offender was from, and sanction administered) and the columns show the levels of this factor allocated in each vignette. In Tanzania, the crime 'logging' was replaced with 'grazing livestock'.

Block ID	Vignette ID	Crime committed	Power of offender	Where offender was from	Sanction administered
1	1	logging	big	outsider	nothing
1	2	hunting	small	outsider	bribe
1	3	hunting	big	outsider	warning
1	4	logging	small	insider	warning
1	5	hunting	big	insider	arrest
1	6	logging	small	outsider	arrest
1	7	hunting	small	insider	nothing
1	8	logging	big	insider	bribe
2	9	hunting	small	outsider	nothing
2	10	logging	big	outsider	arrest
2	11	logging	big	insider	nothing
2	12	logging	small	outsider	warning
2	13	hunting	big	outsider	bribe
2	14	hunting	big	insider	warning
2	15	hunting	small	insider	arrest
2	16	logging	small	insider	bribe
3	17	hunting	small	outsider	warning
3	18	hunting	big	outsider	arrest

3	19	logging	big	insider	warning
3	20	logging	small	insider	arrest
3	21	hunting	big	insider	nothing
3	22	hunting	small	insider	bribe
3	23	logging	small	outsider	nothing
3	24	logging	big	outsider	bribe
4	25	logging	big	insider	arrest
4	26	logging	small	outsider	bribe
4	27	hunting	big	insider	bribe
4	28	logging	big	outsider	warning
4	29	hunting	big	outsider	nothing
4	30	logging	small	insider	nothing
4	31	hunting	small	outsider	arrest
4	32	hunting	small	insider	warning

SAS Code (<https://welcome.oda.sas.com>)

```
proc plan;
  factors actor=2 power=2 behaviour=2 sanction=4;
  output out=cdesign actor cvals=('insider' 'outsider')
power cvals=('small' 'big')
      behaviour cvals=('hunting' 'logging')
      sanction cvals=('nothing' 'warning' 'bribe' 'arrest');
proc optex data=cdesign coding=orthcan seed=73565;
  class actor power behaviour sanction;
  model actor power behaviour sanction actor*behaviour actor*sanction
actor*power behaviour*power sanction*power behaviour*sanction;
  blocks structure=(4)8 init=chain noexchange;
  generate initdesign=cdesign method=sequential;
  output out=bdesign blockname=blk; run;
proc print data=bdesign; run;
```



Table A5.3. Full vignette descriptions used in Experiment 1 (*perceived fairness of sanctions*). Wording here is for Indonesia. In Tanzania 'hunting a protected sambar' was replaced with 'hunting wildlife' while 'logging' was replaced with 'grazing livestock'. 'TNGL' was replaced with 'protected area'

Block	Vignette	English
1	1	1. A powerful person from outside your community is caught logging in TNGL by a law enforcer. The law enforcer allowed them to continue without any repercussions.
1	2	2. A person with no power from outside your community is caught hunting a protected sambar in TNGL by a law enforcer. The law enforcer accepted a bribe and they were allowed to continue.
1	3	3. A powerful person from outside your community is caught hunting a protected sambar in TNGL by a law enforcer. The law enforcer confiscated the sambar, and warned them not to hunt again.
1	4	4. A person with no power from your community is caught logging in TNGL by a law enforcer. The law enforcer confiscated the timber and warned them not to log again.
1	5	5. A powerful person from your community is caught hunting a protected sambar in TNGL by a law enforcer. The law enforcer arrested them and they were prosecuted.
1	6	6. A person with no power from outside your community is caught logging in TNGL by a law enforcer. The law enforcer arrested them and they were prosecuted.
1	7	7. A person with no power from your community is caught hunting a protected sambar in TNGL by a law enforcer. The law enforcer allowed them to continue without any repercussions.
1	8	8. A powerful person from your community is caught logging in TNGL by a law enforcer. The law enforcer accepted a bribe and they were allowed to continue.
2	9	9. A person with no power from outside your community is caught hunting a protected sambar in TNGL by a law enforcer. The law enforcer allowed them to continue without any repercussions.
2	10	10. A powerful person from outside your community is caught logging in TNGL by a law enforcer. The law enforcer arrested them and they were prosecuted.
2	11	11. A powerful person from your community is caught logging in TNGL by a law enforcer. The law enforcer allowed them to continue without any repercussions.
2	12	12. A person with no power from outside your community is caught logging in TNGL by a law enforcer. The law enforcer confiscated the timber and warned them not to log again.
2	13	13. A powerful person from outside your community is caught hunting a protected sambar in TNGL by a law enforcer. The law enforcer accepted a bribe and they were allowed to continue.
2	14	14. A powerful person from your community is caught hunting a protected sambar in TNGL by a law enforcer. The law enforcer confiscated the sambar, and warned them not to hunt again.
2	15	15. A person with no power from your community is caught hunting a protected sambar in TNGL by a law enforcer. The law enforcer arrested them and they were prosecuted.
2	16	16. A person with no power from your community is caught logging in TNGL by a law enforcer. The law enforcer accepted a bribe and they were allowed to continue.
3	17	17. A person with no power from outside your community is caught hunting a protected sambar in TNGL by a law enforcer. The law enforcer confiscated the sambar, and warned them not to hunt again.
3	18	18. A powerful person from outside your community is caught hunting a protected sambar in TNGL by a law enforcer. The law enforcer arrested them and they were prosecuted.

3	19	19. A powerful person from your community is caught logging in TNGL by a law enforcer. The law enforcer confiscated the timber and warned them not to log again.
3	20	20. A person with no power from your community is caught logging in TNGL by a law enforcer. The law enforcer arrested them and they were prosecuted.
3	21	21. A powerful person from your community is caught hunting a protected sambar in TNGL by a law enforcer. The law enforcer allowed them to continue without any repercussions.
3	22	22. A person with no power from your community is caught hunting a protected sambar in TNGL by a law enforcer. The law enforcer accepted a bribe and they were allowed to continue.
3	23	23. A person with no power from outside your community is caught logging in TNGL by a law enforcer. The law enforcer allowed them to continue without any repercussions.
3	24	24. A powerful person from outside your community is caught logging in TNGL by a law enforcer. The law enforcer accepted a bribe and they were allowed to continue.
4	25	25. A powerful person from your community is caught logging in TNGL by a law enforcer. The law enforcer arrested them and they were prosecuted.
4	26	26. A person with no power from outside your community is caught logging in TNGL by a law enforcer. The law enforcer accepted a bribe and they were allowed to continue.
4	27	27. A powerful person from your community is caught hunting a protected sambar in TNGL by a law enforcer. The law enforcer accepted a bribe and they were allowed to continue.
4	28	28. A powerful person from outside your community is caught logging in TNGL by a law enforcer. The law enforcer confiscated the timber and warned them not to log again.
4	29	29. A powerful person from outside your community is caught hunting a protected sambar in TNGL by a law enforcer. The law enforcer allowed them to continue without any repercussions.
4	30	30. A person with no power from your community is caught logging in TNGL by a law enforcer. The law enforcer allowed them to continue without any repercussions.
4	31	31. A person with no power from outside your community is caught hunting a protected sambar in TNGL by a law enforcer. The law enforcer arrested them and they were prosecuted.
4	32	32. A person with no power from your community is caught hunting a protected sambar in TNGL by a law enforcer. The law enforcer confiscated the sambar, and warned them not to hunt again.

Table A5.4. Respondents were randomly allocated to one of the following vignettes in Experiment 2, which assessed the impact of corruption and norms on willingness to comply.

Vignette	Level of Compliance	Level of Corruption	English
1	high	low	Members of your community rarely break rules by entering a protected area to collect resources. If caught breaking rules by a ranger, it is very likely that offenders will face criminal charges or fines.
2	low	high	Members of your community often break rules by entering a protected area to collect resources. If caught breaking rules by a ranger, it is very likely that offenders can pay a bribe and avoid any criminal charges.

3	high	high	Members of your community rarely break rules by entering a protected area to collect resources. If caught breaking rules by a ranger, it is very likely that offenders can pay a bribe and avoid any criminal charges.
4	low	low	Members of your community often break rules by entering a protected area to collect resources. If caught breaking rules by a ranger, it is very likely that offenders will face criminal charges or fines.

Table A5.5. Survey instrument used to gather data in both countries (English version only)

Question (English)	Answer options (English)
Section 1: Survey location (interviewer completes)	
Province	
District	
What is the district?	
Sub-district	
Village	
Sub-village	
Who is conducting the interview?	
What gender is the respondent?	
Section 2: Experimental design details (not shown to respondent)	
Vignette order: \${v_order}	
Vignettes selected from block: \${block}	
Scenario number: \${rand_scenario}	
Section 3: Consent	
<p>My name is \${interviewer} and I work for a project being conducted by Bangor University in the United Kingdom. Today, I would like to invite you to take part in a short study.</p> <p>The aim of the study is to understand what life is like for people like you that live close to a protected area. I am asking you to take part because you live close to a one. In total we are hoping to speak to between 200 and 300 people like you who live close to a protected area.</p> <p>If you agree to take part, I will ask you some questions and record your answer on this device [show questionnaire on tablet]. I will never record your name or your address on this, or any other form; your answers are private and confidential. The first set of questions is about you and your household, then I will ask about your opinions about the rules of the protected area. This should take between 30 minutes and one hour.</p> <p>Because I am not recording your name, your answers cannot be attributed to you, and it will not be possible to identify you from our records. Information you provide will not be shared with anybody outside of the research team and will only be used by members of the research team based in the UK. Your answers, together with those of other respondents, will be used to write reports.</p>	Yes / No

<p>The study has been approved by the Bangor University Ethics Committee. If you would prefer not to take part, that is ok. Also, if you agree at first but then change your mind and would like to stop at any point, please tell me and I will stop immediately. Before going any further, do you have any questions that you would like to ask me?</p> <p>If you have any concerns please contact us on this phone number [provide contact card].</p> <p>Would you like to take part in this study?</p>	
<p>The respondent must agree to the following statements:</p> <ul style="list-style-type: none"> <li>• I confirm that I have had the Information Sheet read out to me and I understand the information provided for this study. I have had the opportunity to ask questions if necessary and have had these answered satisfactorily.</li> <li>• I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason. If I withdraw my data will be removed from the study and will be destroyed.</li> <li>• I understand that the answers I provide will be used for the purposes explained to me.</li> <li>• Based upon the above, I agree to take part in this study.</li> </ul>	Yes / No
Section 4: COVID-19 precautions	
<p>If the guide has not already explained our COVID precautions then explain to the respondent:</p> <ol style="list-style-type: none"> <li>1. That the team are clear of symptoms</li> <li>2. That the team are taking regular covid tests before starting fieldwork.</li> <li>3. That we wear masks to protect ourselves and the respondent</li> <li>4. That we will be working outside and maintaining social distancing</li> <li>5. We will be washing hands frequently</li> </ol>	
<p>Does anyone in your household have symptoms of COVID19 that have developed over the previous week?</p> <p>These are:</p> <ul style="list-style-type: none"> <li>* a new and persistent cough,</li> <li>* difficulty in breathing,</li> <li>* a high fever,</li> <li>* a recent loss of taste or smell?</li> </ul>	
<p>Thank the respondent for their time, explain that even though the sick individual may not have COVID we do not want to put other respondents at risk if they do have COVID. Wish them or their household member a quick recovery</p>	
Section 5: Respondent demographics	
<p>I am going to ask you a few questions about yourself and the others in your household, by household I mean those who eat together and sleep in the same house, including children who may be at boarding school</p>	
<p>1. How old are you?</p>	
<p>2. How many people are there in your household?</p>	
<p>3a. What is the ethnic majority of your household?</p>	
<p>3b. Please specify which ethnic group</p>	
<p>4. How many years have you lived in this village?</p>	
<p>5. Are you currently attending school?</p>	

6. How many years of schooling have you completed?	
7. How many members of the household who are aged 12 years or older, have completed at least 5 years of schooling?	
8. Are there any children in the household aged between 7 and 18 who do not go to school?	
Section 6: Multi-dimensional Poverty Assessment	
1. What is your households main livelihood activity?	
2. Does the household's main residence have electricity?	
3. Does the household have access to a toilet?	
3a. What type of toilet is this?	
3b. What is the 'other' type of toilet?	
4. Does the household share this toilet with other households?	
5a. What is the household's main source of drinking water?	
5b. What is the 'other' water source?	
6. How many minutes does it take to travel to the household's main source of drinking water? There and back using the mode of transport you use most often to collect water	
7a. What is the floor of the household's main residence made from?	
7b. What is the 'other' floor material?	
8a. What is the household's main cooking fuel?	
8b. What is the 'other' cooking fuel?	
9. Has a child under the age of 18 died in the household in the last 5 years?	
10. How many children under the age of 18 have died in the household in the last 5 years?	
I am now going to ask about your households' access to food over the last 12 months"	
11. In the past 12 months, how often was there no food to eat of any kind in your house because of lack of resources to get food?	
12. In the past 12 months, how often did any household member go to sleep at night hungry because there was not enough food?	
13. In the past 12 months, how often did any household member go a whole day and night without eating anything because there was not enough food?	
The following questions are about the items that you and your household own.	
14. How many radios does the household own?	
15. How many TVs does the household own?	
16. How many mobile phones does the household own?	
17. How many bicycles does the household own?	
18. How many motorbikes does the household own?	
19. How many refrigerators does the household own?	
20. How many cars or trucks does the household own?	
The next questions are about how you perceive yourself and your household. Please answer on a scale of strongly agree to strongly disagree	
21. Your household is poor	Strongly agree, Agree, Neither agree or disagree, Disagree, Strongly disagree, Prefer
22. Your household is happy	
23. Yours is a prosperous household	
24. Community members are willing to help each other (e.g., with work, food or financially)	

25. Trust among community members in this village is strong	not to answer, Don't know
26. Conflicts frequently arise between people or families in this community	
27. The amount of land your household has at the moment means you are prosperous	
28. \${interviewer}, any comments on the poverty section?	
Section 7: Factorial Survey Experiment → \${v_X_q} – represents the vignette number shown to the respondent	
I will now read you several short descriptions of hypothetical interactions between rangers of TNGL and people who enter the National Park. For each one, I would like you to consider the situation, and tell me how fair you think the outcome is.	
Vignette 1 : \${v_1_q} How fair do you think this?	Very fair, Fair, Neither fair nor unfair, Unfair, Very unfair, Prefer not to answer, Don't know
v1b. How likely do you think it is that this situation would happen in real life?	Very likely, Likely, Neither likely nor unlikely, Unlikely, Very unlikely, Prefer not to answer, Don't know
Vignette 2 : \${v_2_q} How fair do you think this?	Very fair, Fair, Neither fair nor unfair, Unfair, Very unfair, Prefer not to answer, Don't know
v2b. How likely do you think it is that this situation would happen in real life?	Very likely, Likely, Neither likely nor unlikely, Unlikely, Very unlikely, Prefer not to answer, Don't know
Vignette 3 : \${v_3_q} How fair do you think this?	Very fair, Fair, Neither fair nor unfair, Unfair, Very unfair, Prefer not to answer, Don't know
v3b. How likely do you think it is that this situation would happen in real life?	Very likely, Likely, Neither likely nor unlikely, Unlikely, Very unlikely, Prefer not to answer, Don't know
Vignette 4 : \${v_4_q} How fair do you think this?	Very fair, Fair, Neither fair nor unfair, Unfair, Very unfair, Prefer not to answer, Don't know
v4b. How likely do you think it is that this situation would happen in real life?	Very likely, Likely, Neither likely nor unlikely, Unlikely, Very unlikely, Prefer not to answer, Don't know
Vignette 5 : \${v_5_q} How fair do you think this?	Very fair, Fair, Neither fair nor unfair, Unfair, Very unfair, Prefer not to answer, Don't know

v5b. How likely do you think it is that this situation would happen in real life?	Very likely, Likely, Neither likely nor unlikely, Unlikely, Very unlikely, Prefer not to answer, Don't know
Vignette 6 : \${v_6_q} How fair do you think this?	Very fair, Fair, Neither fair nor unfair, Unfair, Very unfair, Prefer not to answer, Don't know
v6b. How likely do you think it is that this situation would happen in real life?	Very likely, Likely, Neither likely nor unlikely, Unlikely, Very unlikely, Prefer not to answer, Don't know
Vignette 7 : \${v_7_q} How fair do you think this?	Very fair, Fair, Neither fair nor unfair, Unfair, Very unfair, Prefer not to answer, Don't know
v7b. How likely do you think it is that this situation would happen in real life?	Very likely, Likely, Neither likely nor unlikely, Unlikely, Very unlikely, Prefer not to answer, Don't know
Vignette 8 : \${v_8_q} How fair do you think this?	Very fair, Fair, Neither fair nor unfair, Unfair, Very unfair, Prefer not to answer, Don't know
v8b. How likely do you think it is that this situation would happen in real life?	Very likely, Likely, Neither likely nor unlikely, Unlikely, Very unlikely, Prefer not to answer, Don't know
Section 8: Scenarios	
Please tell me to what extent you agree or disagree with the following statements	
1. Violating TNGl rules risks the good name of people in the community	Strongly agree, Agree, Neither agree or disagree, Disagree, Strongly disagree, Prefer not to answer, Don't know
2. The rules of TNGl support conservation of biodiversity	
3. The rules of TNGl are fair and consistent with the law	
4. Breaking rules is considered a disloyal towards fellow members of the community	
I will now read you out an imaginary scenario. Based on this scenario I will ask you some questions, please answer them as honestly as you can.	
Imagine the following situation. \${scenario}	
5. If this scenario were true, how willing would you be, in general to follow the rules of TNGl?	Very willing, Willing, neither willing nor unwilling, Unwilling, Very unwilling, Prefer not to answer, Don't know

6. If this scenario were true, how often in the coming months would you follow the rules of TNGL?	Every Time, Almost every time, Occasionally, Rarely, Never, Prefer not to answer, Don't know
7. If this scenario were true, to what extent would you consider violating the rules of TNGL?	Definitely consider, May or may not consider, Would definitely not consider, Prefer not to answer, Don't know
Section 9: End of survey	
The survey is now finished. Thank you for participating. Do you have any questions for me?	
#{interviewer}, how engaged was the participant throughout the survey?	Very engaged, Engaged, Neutral, Unengaged, Very unengaged
#{interviewer}, how did you find surveying this individual?	Very easy, easy, Neutral, Hard, Very hard
#{interviewer}, do you have anything to add?	

## Ordinal Regression Analyses

To assess the model fit of our ordinal regressions, we checked whether the proportional odd assumptions of models held by testing each model for nominal and scale effects (Christensen 2019). Where identified as present, we included scale effects to relax the proportional odds assumptions for these variables and compared models that did and did not feature scale effects using a likelihood ratio test. We selected which model to use by determining whether there was a significant difference between the two models. We selected scale effects over nominal effects, as these offer greater flexibility for all values of predictor variables, and use fewer parameters, leading to more sensitive tests than including nominal effects (Christensen 2019). Model results and the various processes undertaken are outlined below.

### Analysis of data from Indonesia for Experiment 1 (*Fairness of sanctions*)

Stage 1. We first ran a basic ordinal regression model which included interactions between sanction, and each of the other factorial variables. The response variable was the perceived fairness of the sanction. This model was initially run *without* a random effect for respondent following Christensen (2019). Results from the Indonesian dataset are shown below.

```
summary(int_mod_v1)
## formula: fairness2 ~ sanction*actor + sanction*behaviour + sanction*power
## data:    data
##
## link threshold nobs logLik AIC      niter max.grad cond.H
## logit flexible 1832 -955.77 1945.53 7(1)   6.90e-09 6.0e+02
##
```



```
## Coefficients:
##               Estimate Std. Error z value Pr(>|z|)
## sanctionwarning    0.464560   0.303369   1.531 0.125686
## sanctionnothing   -1.839549   0.297712  -6.179 6.45e-10 ***
## sanctionbribe     -3.862336   0.489493  -7.890 3.01e-15 ***
## actoroutsider      0.383103   0.228463   1.677 0.093568 .
## behaviourlogging   0.268442   0.227993   1.177 0.239030
## powerbig           0.670818   0.230188   2.914 0.003566 **
## sanctionwarning:actoroutsider -0.414415   0.310273  -1.336 0.181665
## sanctionnothing:actoroutsider -1.156074   0.359677  -3.214 0.001308 **
## sanctionbribe:actoroutsider -0.893458   0.545758  -1.637 0.101611
## sanctionwarning:behaviourlogging -0.004534   0.310928  -0.015 0.988366
## sanctionnothing:behaviourlogging -0.972791   0.359769  -2.704 0.006852 **
## sanctionbribe:behaviourlogging -0.781811   0.546740  -1.430 0.152731
## sanctionwarning:powerbig -1.177027   0.312496  -3.767 0.000166 ***
## sanctionnothing:powerbig -1.574911   0.364908  -4.316 1.59e-05 ***
## sanctionbribe:powerbig -0.644885   0.535759  -1.204 0.228711
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Threshold coefficients:
##      Estimate Std. Error z value
## 1|2  -1.1037    0.2110  -5.231
## 2|3  -0.6206    0.2085  -2.976
```

Stage 2. We then ran tests to see if nominal and scale effects were present. Results (below) suggested both nominal and scale effects were present for the 'sanction' and 'power' variables.

```
## Tests of nominal effects in Indonesia (int_mod_v1)
##
## formula: fairness2 ~ sanction * actor + sanction * behaviour + sanction * power
##              Df logLik   AIC    LRT Pr(>Chi)
## <none>          -955.77 1945.5
## sanction        3 -950.51 1941.0 10.5074 0.014711 *
## actor           1 -954.23 1944.5  3.0711 0.079696 .
## behaviour       1 -955.75 1947.5  0.0272 0.868921
## power           1 -952.65 1941.3  6.2285 0.012571 *
## sanction:actor   7 -948.91 1945.8 13.7207 0.056379 .
## sanction:behaviour 7 -949.83 1947.7 11.8766 0.104689
## sanction:power   7 -946.38 1940.8 18.7817 0.008899 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
## Tests of scale effects in Indonesia (int_mod_v1)
##
## formula: fairness2 ~ sanction*actor + sanction*behaviour + sanction*power
##              Df logLik   AIC    LRT Pr(>Chi)
## <none>          -955.77 1945.5
## sanction        3 -950.51 1941.0 10.5074 0.014711 *
## actor           1 -955.25 1946.5  1.0397 0.307895
## behaviour       1 -955.74 1947.5  0.0589 0.808234
## power           1 -953.80 1943.6  3.9272 0.047512 *
## sanction:actor   7 -949.37 1946.8 12.7841 0.077547 .
## sanction:behaviour 7 -949.30 1946.6 12.9265 0.073919 .
## sanction:power   7 -946.41 1940.8 18.7179 0.009119 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Stage 3. To compare model fit, we first ran the original model with the inclusion of a random effect for respondent id:

```
int_mod_v2 <- clmm2(fairness2 ~ sanction*actor + sanction*behaviour + sanction*power
                    random = id, # random effect for individual
                    data = data, # data set
                    Hess = TRUE, # allows summary call for p-values
                    nAGQ=9)

## Cumulative Link Mixed Model fitted with the adaptive Gauss-Hermite
## quadrature approximation with 9 quadrature points
```

```
##
## Call:
## clmm2(location = fairness2 ~ sanction * actor + sanction * behaviour +
##       sanction * power, random = id, data = data, Hess = TRUE,
##       nAGQ = 9)
##
## Random effects:
##       Var      Std.Dev
## id 0.2717311 0.5212784
##
## Location coefficients:
##
##       Estimate Std. Error z value Pr(>|z|)
## sanctionwarning      0.4879   0.3100    1.5738 0.11554178
## sanctionnothing     -1.9211   0.3089   -6.2183 5.0260e-10
## sanctionbribe       -4.0538   0.4994   -8.1168 4.7855e-16
## actoroutsider        0.4078   0.2339    1.7434 0.08126798
## behaviourlogging     0.2758   0.2331    1.1833 0.23667595
## powerbig             0.7018   0.2354    2.9818 0.00286606
## sanctionwarning:actoroutsider -0.4359   0.3171   -1.3743 0.16933365
## sanctionnothing:actoroutsider -1.2116   0.3691   -3.2830 0.00102713
## sanctionbribe:actoroutsider  -0.9101   0.5498   -1.6553 0.09786626
## sanctionwarning:behaviourlogging  0.0039   0.3177    0.0121 0.99031423
## sanctionnothing:behaviourlogging -1.0296   0.3684   -2.7944 0.00519950
## sanctionbribe:behaviourlogging  -0.7814   0.5511   -1.4178 0.15623790
## sanctionwarning:powerbig     -1.2372   0.3203   -3.8626 0.00011216
## sanctionnothing:powerbig     -1.6651   0.3748   -4.4426 8.8877e-06
## sanctionbribe:powerbig      -0.6623   0.5407   -1.2249 0.22061395
##
## No scale coefficients
##
## Threshold coefficients:
##       Estimate Std. Error z value
## 1|2 -1.1565    0.2202   -5.2523
## 2|3 -0.6527    0.2170   -3.0075
##
## log-likelihood: -952.8473
## AIC: 1941.695
## Condition number of Hessian: 563.5959
```

Step 4. We then ran the same model, but included scale effects fitted for the interaction term `sanction*power`:

```
int_mod_v4 <- clmm2(fairness2 ~ sanction*actor + sanction*behaviour + sanction*power
,
                    random = id, # random effect for individual
                    data = data, # data set
                    Hess = TRUE, # allows summary call for p-values
                    nAGQ=9, # improves accuracy over default 1 (laplace approximatio
n)
                    scale = ~ sanction * power)

## Cumulative Link Mixed Model fitted with the adaptive Gauss-Hermite
## quadrature approximation with 9 quadrature points
##
## Call:
## clmm2(location = fairness2 ~ sanction * actor + sanction * behaviour +
##       sanction * power, scale = ~sanction * power, random = id,
##       data = data, Hess = TRUE, nAGQ = 9)
##
## Random effects:
##       Var      Std.Dev
## id 0.1792407 0.4233683
##
## Location coefficients:
##
##       Estimate Std. Error z value Pr(>|z|)
## sanctionwarning      0.1722   0.4061    0.4241 0.6714738
## sanctionnothing     -1.6391   0.3748   -4.3730 1.2257e-05
## sanctionbribe       -2.0629   0.5113   -4.0345 5.4730e-05
## actoroutsider        0.3982   0.2363    1.6854 0.0919081
## behaviourlogging     0.2754   0.2371    1.1614 0.2454887
## powerbig             0.7476   0.6050    1.2357 0.2165740
## sanctionwarning:actoroutsider -0.3312   0.3297   -1.0043 0.3152105
## sanctionnothing:actoroutsider -0.9248   0.3453   -2.6778 0.0074106
## sanctionbribe:actoroutsider  -0.6484   0.3385   -1.9156 0.0554180
## sanctionwarning:behaviourlogging -0.1049   0.3328   -0.3152 0.7525989
## sanctionnothing:behaviourlogging -0.7672   0.3424   -2.2403 0.0250737
```

```
## sanctionbribe:behaviourlogging -0.6067 0.3603 -1.6838 0.0922204
## sanctionwarning:powerbig 0.0065 0.8789 0.0074 0.9940601
## sanctionnothing:powerbig -1.1531 0.7604 -1.5163 0.1294352
## sanctionbribe:powerbig -2.3012 1.5512 -1.4835 0.1379316
##
## Scale coefficients:
## Estimate Std. Error z value Pr(>|z|)
## sanctionwarning -0.2916 0.3160 -0.9230 0.3560205
## sanctionnothing -0.3917 0.3473 -1.1278 0.2593978
## sanctionbribe -1.2254 0.5373 -2.2806 0.0225704
## powerbig 0.0390 0.3312 0.1179 0.9061415
## sanctionwarning:powerbig 1.0511 0.5108 2.0577 0.0396152
## sanctionnothing:powerbig -0.2507 0.4572 -0.5484 0.5834454
## sanctionbribe:powerbig 1.0126 0.6825 1.4837 0.1378965
##
## Threshold coefficients:
## Estimate Std. Error z value
## 1|2 -1.1063 0.2292 -4.8266
## 2|3 -0.6530 0.2175 -3.0020
##
## log-likelihood: -943.5751
## AIC: 1937.15
## Condition number of Hessian: 3720.982
```

Stage 5. We then compared these two models using a Likelihood Ratio test. Results showed the model that included scale effects performed better than the model without scale effects ( $p < 0.01$ ). This model is presented in the manuscript.

```
anova(int_mod_v2, int_mod_v4)
## Likelihood ratio tests of cumulative link models
##
## Response: fairness2
## Model
## sanction * actor + sanction * behaviour + sanction * power |
## sanction * actor + sanction * behaviour + sanction * power | sanction * power |
##
## Resid. df -2logLik Test Df LR stat. Pr(Chi)
## 1814 1905.695
## 1807 1887.150 1 vs 2 7 18.54447 0.009740662
```

### Analysis of data from Tanzania for Experiment 1 (*Fairness of sanctions*)

The same process was repeated for data collected in Tanzania.

Stage 1. A basic model (without random effects) which included interactions between all factors was run first.

```
summary(int_mod_v1)
## formula: fairness2 ~ sanction * actor + sanction * behaviour + sanction * power
## data: data
##
## link threshold nobs logLik AIC niter max.grad cond.H
## logit flexible 1734 -598.29 1230.59 8(2) 4.08e-08 7.5e+03
##
## Coefficients:
## Estimate Std. Error z value Pr(>|z|)
## sanctionwarning -2.39332 0.46990 -5.093 3.52e-07 ***
## sanctionnothing -5.96419 0.59023 -10.105 < 2e-16 ***
## sanctionbribe -7.06238 0.78632 -8.982 < 2e-16 ***
## actoroutsider -0.17166 0.40643 -0.422 0.673
## behaviourgrazing -0.33665 0.41052 -0.820 0.412
## powerbig 0.01875 0.40648 0.046 0.963
## sanctionwarning:actoroutsider 0.24791 0.45236 0.548 0.584
## sanctionnothing:actoroutsider 0.27799 0.55324 0.502 0.615
## sanctionbribe:actoroutsider 0.18266 0.71368 0.256 0.798
## sanctionwarning:behaviourgrazing 0.10883 0.45603 0.239 0.811
## sanctionnothing:behaviourgrazing 0.84063 0.56165 1.497 0.134
```

```
## sanctionbribe:behaviourgrazing    0.71812    0.72362    0.992    0.321
## sanctionwarning:powerbig          -0.12683    0.45215   -0.281    0.779
## sanctionnothing:powerbig          -0.08183    0.55240   -0.148    0.882
## sanctionbribe:powerbig             0.35465    0.72162    0.491    0.623
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Threshold coefficients:
##      Estimate Std. Error z value
## 1|2   -3.0885     0.4287   -7.204
## 2|3   -3.0085     0.4282   -7.026
## (2 observations deleted due to missingness)
```

Stage 2. Nominal and Scale tests were then conducted to assess model fit. Nominal tests revealed no effects, while Scale tests showed negligible effects for actor and power ( $p > 0.05$ ). The final model (presented in the results) was run without the inclusion of any scale effects.

```
## Tests of nominal effects in Tanzania (int_mod_v1)
##
## formula: fairness2 ~ sanction * actor + sanction * behaviour + sanction * power
##      Df logLik   AIC    LRT   Pr(>Chi)
## <none>      -598.29 1230.6
## sanction
## actor           1 -597.30 1230.6 1.98758   0.1586
## behaviour       1 -598.15 1232.3 0.28095   0.5961
## power           1 -598.24 1232.5 0.10882   0.7415
## sanction:actor
## sanction:behaviour
## sanction:power
```

```
## Tests of scale effects in Tanzania (int_mod_v1)
##
## formula: fairness2 ~ sanction * actor + sanction * behaviour + sanction * power
##      Df logLik   AIC    LRT Pr(>Chi)
## <none>      -598.29 1230.6
## sanction
## actor           1 -596.56 1229.1 3.4687   0.06254 .
## behaviour       1 -596.83 1229.7 2.9313   0.08688 .
## power           1 -596.83 1229.7 2.9313   0.08688 .
## sanction:actor
## sanction:behaviour
## sanction:power
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

## Analysis of data from Indonesia for Experiment 2 (Effect of corruption and descriptive norms on willingness to follow rules)

Stage 1. A basic ordinal regression with all predictors (response = willingness to follow rules) was run on the Indonesian dataset.

```
summary(imod3)
## formula:
## intention3 ~ compliance + corruption + gender + age + education + MPI + attitude
## data:    ind
##
## link threshold nobs logLik   AIC    niter max.grad cond.H
## logit flexible  221 -165.13 348.26 9(0)  3.21e-11 3.2e+05
##
## Coefficients:
##      Estimate Std. Error z value Pr(>|z|)
## complianceLow -0.151673   0.319499  -0.475   0.6350
## corruptionHigh -2.106622   0.318377  -6.617 3.67e-11 ***
## gendermale     0.119660   0.330440   0.362   0.7173
```

```
## age          0.024106   0.018336   1.315   0.1886
## education    0.001232   0.051517   0.024   0.9809
## MPI          -1.366007   2.189925  -0.624   0.5328
## attitude     0.476565   0.212829   2.239   0.0251 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Threshold coefficients:
##              Estimate Std. Error z value
## Unwilling|Neither  0.2221     1.2500   0.178
## Neither|Willing    0.8744     1.2497   0.700
## (19 observations deleted due to missingness)
```

Stage 2. This model was then tested for nominal and scale effects. Results showed a significant scale effect for the variable 'corruption' ( $p < 0.05$ )

```
## Tests of nominal effects (imod3)
## formula: intention3 ~ compliance + corruption + gender + age + education + MPI +
## attitude
##              Df  logLik    AIC    LRT   Pr(>Chi)
## <none>          -165.13 348.26
## compliance      1 -165.07 350.13 0.12409  0.7246
## corruption      1 -164.41 348.82 1.44165  0.2299
## gender          1 -165.07 350.14 0.12063  0.7283
## age            1 -164.02 348.03 2.22374  0.1359
## education       1 -165.01 350.02 0.23704  0.6263
## MPI            1 -165.07 350.14 0.11858  0.7306
## attitude        1 -164.93 349.85 0.40467  0.5247
```

```
## Tests of scale effects (imod3)
## formula: intention3 ~ compliance + corruption + gender + age + education + MPI +
## attitude
##              Df  logLik    AIC    LRT   Pr(>Chi)
## <none>          -165.13 348.26
## compliance      1 -164.40 348.80 1.4567  0.22745
## corruption      1 -163.17 346.35 3.9103  0.04799 *
## gender          1 -165.08 350.16 0.0971  0.75529
## age            1 -165.10 350.20 0.0556  0.81357
## education       1 -164.72 349.44 0.8208  0.36495
## MPI            1 -164.62 349.24 1.0136  0.31404
## attitude        1 -164.96 349.92 0.3425  0.55836
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Stage 3. The original model was then re-run, with the addition of a scale effect for 'corruption'.

```
## formula:
## intention3 ~ compliance + corruption + gender + age + education + MPI + attitude
## scale: ~corruption
## data: ind
##
## link threshold nobs logLik AIC niter max.grad cond.H
## logit flexible 221 -163.17 346.35 13(0) 1.09e-11 3.6e+05
##
## Coefficients:
##              Estimate Std. Error z value Pr(>|z|)
## complianceLow -0.06913   0.43910  -0.157  0.8749
## corruptionHigh -2.49301   0.54096  -4.608  4.06e-06 ***
## gendermale     0.23221   0.45840   0.507  0.6125
## age            0.04725   0.02730   1.731  0.0835 .
## education      0.03606   0.07264   0.496  0.6196
## MPI           -0.37161   3.25330  -0.114  0.9091
## attitude       0.75885   0.30771   2.466  0.0137 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## log-scale coefficients:
##              Estimate Std. Error z value Pr(>|z|)
## corruptionHigh  0.7459     0.3641   2.048  0.0405 *
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Threshold coefficients:
##               Estimate Std. Error z value
## Unwilling|Neither    2.134      1.864   1.145
## Neither|Willing      3.155      1.956   1.613
## (19 observations deleted due to missingness)
```

Stage 4. Both models were compared using a Likelihood Ratio test. Results showed that the model that included a Scale effect for 'corruption' performed better ( $p < 0.05$ ). This model is presented in the results.

```
anova(imod3, imod4)
## Likelihood ratio tests of cumulative link models:
## formula:
## imod3 intention3 ~ compliance + corruption + gender + age + education + MPI + attitude
## imod4 intention3 ~ compliance + corruption + gender + age + education + MPI + attitude
##      scale:      link: threshold:
## imod3 ~1        logit flexible
## imod4 ~corruption logit flexible
##
##      no.par    AIC  logLik LR.stat df      Pr(>Chisq)
## imod3      9 348.26 -165.13
## imod4     10 346.35 -163.17  3.9103  1      0.04799 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

### Analysis of data Tanzania for Experiment 2 (Effect of corruption and descriptive norms on willingness to follow rules)

Stage 1. A basic ordinal regression with all predictors (response = willingness to follow rules) was run on the Tanzanian dataset.

```
summary(tmod3)
## formula:
## intention3 ~ compliance + corruption + gender + age + education + MPI + attitude
## data:      tz
##
## link threshold nobs logLik AIC      niter max.grad cond.H
## logit flexible  211  -93.68 205.36 8(2)  1.79e-13 2.3e+05
##
## Coefficients:
##               Estimate Std. Error z value Pr(>|z|)
## complianceLow  -0.136399  0.407424  -0.335  0.73779
## corruptionHigh  0.415785  0.411822   1.010  0.31268
## gendermale     -1.732575  0.471799  -3.672  0.00024 ***
## age            0.028058  0.018132   1.547  0.12176
## education      -0.004424  0.083192  -0.053  0.95759
## MPI            -3.659562  1.920188  -1.906  0.05667 .
## attitude       0.641299  0.248995   2.576  0.01001 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Threshold coefficients:
##               Estimate Std. Error z value
## Unwilling|Neither    0.1743      1.6486   0.106
## Neither|Willing      0.3886      1.6487   0.236
## (13 observations deleted due to missingness)
```

Stage 2. This model was then tested for nominal and scale effects. Results showed a significant scale effect for the variable 'compliance' ( $p < 0.01$ ) and negligible effects for corruption and attitude

```
## Tests of nominal effects(tmod3)
## formula: intention3 ~ compliance + corruption + gender + age + education + MPI +
attitude
##           Df  logLik    AIC      LRT Pr(>Chi)
## <none>          -93.681 205.36
## compliance      1 -92.380 204.76  2.6019 0.106733
## corruption      1 -93.675 207.35  0.0117 0.913713
## gender          1 -93.352 206.70  0.6570 0.417630
## age
## education      1 -89.990 199.98  7.3806 0.006593 **
## MPI
## attitude       1 -83.357 186.71 20.6479 5.52e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
## Tests of scale effects (tmod3)
## formula: intention3 ~ compliance + corruption + gender + age + education + MPI +
attitude
##           Df  logLik    AIC      LRT Pr(>Chi)
## <none>          -93.681 205.36
## compliance      1 -89.969 199.94  7.4236 0.006437 **
## corruption      1 -92.002 204.00  3.3578 0.066887 .
## gender          1 -93.613 207.23  0.1347 0.713572
## age            1 -93.666 207.33  0.0289 0.864951
## education      1 -93.678 207.35  0.0058 0.939053
## MPI            1 -93.185 206.37  0.9914 0.319403
## attitude       1 -92.157 204.31  3.0468 0.080895 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Stage 3. The original model was then re-run, with the addition of a scale effect for 'compliance'.

```
summary(tmod4)
## formula:
## intention3 ~ compliance + corruption + gender + age + education + MPI + attitude
## scale:    ~compliance
## data:     tz
##
## link threshold nobs logLik AIC      niter max.grad cond.H
## logit flexible 211  -89.97 199.94 13(4) 9.04e-07 2.8e+05
##
## Coefficients:
##           Estimate Std. Error z value Pr(>|z|)
## complianceLow  -0.97357    0.35786  -2.721  0.00652 **
## corruptionHigh   0.27445    0.21362   1.285  0.19888
## gendermale      -1.03421    0.41000  -2.522  0.01165 *
## age              0.02509    0.01158   2.166  0.03032 *
## education        0.02646    0.03684   0.718  0.47265
## MPI             -1.73978    1.08230  -1.607  0.10795
## attitude         0.38009    0.17381   2.187  0.02876 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## log-scale coefficients:
##           Estimate Std. Error z value Pr(>|z|)
## complianceLow  -1.1204    0.4337  -2.583  0.00979 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Threshold coefficients:
##           Estimate Std. Error z value
## Unwilling|Neither  0.1200    0.9301  0.129
## Neither|Willing    0.2390    0.9451  0.253
## (13 observations deleted due to missingness)
```

Stage 4. Both models were compared using a Likelihood Ratio test. Results showed that the model that included a Scale effect for 'compliance' performed better ( $p < 0.01$ ). This model is presented in the results.

```
anova(tmod3, tmod4)
## Likelihood ratio tests of cumulative link models:
##
##      formula:
## tmod3 intention3 ~ compliance + corruption + gender + age + education + MPI + attitude
## tmod4 intention3 ~ compliance + corruption + gender + age + education + MPI + attitude
##      scale:      link: threshold:
## tmod3 ~1          logit flexible
## tmod4 ~compliance logit flexible
##
##      no.par      AIC  logLik LR.stat df   Pr(>Chisq)
## tmod3         9 205.36 -93.681
## tmod4        10 199.94 -89.969  7.4236  1   0.006437 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



# Appendix 6

Survey instruments in Bahasa Indonesia

## Chapter 2

### Group exercise protocols – Bahasa Indonesia

#### Information script [15 minutes]

Salam (Assalamualaikum wr.wb atau Shalom atau horas). Nama saya xxx dan ini adalah teman saya xxx. Kami adalah peneliti dari Universitas Indonesia bekerjasama dengan Harriet Ibbett dari Universitas Bangor di Inggris. Penelitiannya bertujuan untuk mengetahui penggunaan sumber daya alam oleh masyarakat yang tinggal di sekitar kawasan Gunung Leuser. Kami mengundang BapakBapak atau Ibu-Ibu hari ini untuk membantu kami dalam memahami adat istiadat di sini, dan juga meminta pendapat dari BapakBapak atau Ibu-Ibu bagaimana kami bertanya mengenai cara masyarakat di sini memanfaatkan sumber daya alam. Harapannya, diskusi ini berlangsung tidak lama sekitar 2 – 2.5 jam, tapi kemungkinannya bisa lebih lama dan lebih cepat tergantung bagaimana Bapak atau Ibu menjawab.

Kami adalah peneliti independen, dan tidak bekerjasama dengan pemerintah ataupun NGO atau LSM, tetapi kami sudah memiliki izin dari pemerintah Indonesia dan dari aparat desa untuk melakukan penelitian ini. Keikutsertaan Anda adalah sukarela. Bapak atau Ibu boleh tidak mengikuti dan berhenti kapan saja tanpa menjelaskan alasannya. Jika Bapak atau ibu tidak nyaman untuk menjawab beberapa pertanyaan, maka tidak perlu dijawab. Jika Bapak atau Ibu ingin melewati pertanyaan atau topik, mohon beritahu kami.

Saya [nama] akan memimpin diskusi ini. Saya akan bertanya dan meminta Bapak/Ibu untuk berpartisipasi dalam kegiatan yang sudah kami persiapkan. XXX akan mencatat diskusi ini. Dengan persetujuan dari Bapak/Ibu, kami akan merekam diskusi ini, karena terkadang Bapak/Ibu berbicara bersamaan, sehingga akan sulit bagi kami untuk merekam setiap opini yang Bapak/Ibu sampaikan.

Jawaban dan hasil diskusi Bapak/Ibu akan dijaga kerahasiaannya dan tidak akan dilihat secara personal atau per desa. Informasi yang Bapak/Ibu berikan kepada kami akan tersimpan secara aman dan Kami tidak akan memberikan hasil diskusi kepada siapapun.

Harriet akan menggunakan hasil ini untuk merancang survei selanjutnya di masyarakat terkait penggunaan sumber daya alam yang ditanya dengan cara yang sopan dan sesuai dengan adat istiadat. Harriet juga akan memublikasikan hasil penelitian ini secara internasional agar dapat membantu peneliti-peneliti dari berbagai negara bagaimana cara terbaik melakukan penelitian dengan topik ini.

Kami di sini untuk belajar tentang komunitas/masyarakat di sini, kami mungkin akan menanyakan banyak pertanyaan atau mungkin ada hal yang tidak kami mengerti, karenanya kami sangat berharap Bapak/Ibu dengan senang hati menjawab pertanyaan-pertanyaan kami. Untuk memastikan setiap orang memiliki kesempatan yang sama dalam berbicara dan berpendapat, kami memohon setiap orang untuk mendengarkan dan menghargai apa yang orang lain sampaikan. Tidak ada jawaban salah atau benar, setiap orang memiliki kesempatan untuk berbicara.

Penelitian ini sudah disetujui oleh komite etik di Universitas Bangor, Inggris. Jika Bapak/Ibu ada hal-hal yang ingin ditanyakan terkait penelitian ini, silahkan untuk bertanya dan saya akan menjawab sebisa mungkin.

Jika ada yang masih kurang berkenan atau ada yang ingin ditanyakan, kami akan memberi kontak seseorang untuk diajak berdiskusi.

Akan ada dua kegiatan.

Kegiatan pertama akan memakan waktu sekitar 1 jam, kemudian kita akan istirahat sebentar.

Kegiatan kedua akan memakan waktu sekitar 2 jam.

Sejauh ini, apa ada yang ingin ditanyakan atau disampaikan?

(Pause here to give people time to think & comment)

Apakah Bapak/Ibu masih ingin melanjutkan diskusi ini?

(Get verbal consent from every participant)

Apakah Bapak/Ibu bersedia untuk kami merekam kegiatan ini?

(Get verbal consent from every participant, if someone disagrees, do not record).

Berkeliling grup untuk menanyakan peserta tentang umur dan suku – jelaskan bahwa ini adalah untuk kepentingan penelitian – membantu kami dalam memahami opini dari kelompok yang berbeda.

#### Free-listing [Estimated 1 hour]

Saya ingin Bapak/Ibu memberikan beberapa alasan mengapa masyarakat pergi ke [kawasan lindung].

Contohnya, masyarakat pergi untuk mencari sesuatu atau memasuki hutan untuk keperluan lain.

Banyak orang mungkin memiliki alasan yang sama, atau mungkin beberapa memiliki alasan yg berbeda.

Sebagai kelompok, Saya ingin Bapak/Ibu untuk memberitahu saya alasan-alasan yang berbeda mengapa masyarakat pergi ke [kawasan lindung].

Saya ingin Bapak/Ibu memberitahu saya satu persatu dan kami akan mencatat semua alasan secara berurutan di selembar kertas.

Apakah masih ada alasan lain?

List all items on large piece of paper in the order they are mentioned

- Apakah mereka pergi untuk mendapatkan sumberdaya alam?
- Apakah ada alasan budaya atau adat?
- Apakah ada alasan lain?

**\*\*JANGAN MENGARAHKAN JAWABAN MEREKA\*\***

Apakah sudah semua?

Once the list is completed, for each activity, ask:

- Berapa banyak yang melakukan aktivitas ini? (contoh: semua orang, beberapa).
- Orang yang seperti apa yang melakukan aktivitas ini? (contoh: laki-laki, perempuan, muda/tua).
- Mengapa orang tersebut melakukan itu? (contoh: konsumsi sendiri atau pemasukan (dijual)).
- Kapan biasanya hal tersebut dilakukan? (Seberapa sering mereka pergi?)

Second free-list

Sekarang, saya ingin Bapak/Ibu menyampaikan dampak negatif dari taman nasional terhadap masyarakat yang tinggal di sekitar [kawasan lindung].

Bapak/Ibu mungkin juga mengetahui masalah atau tantangan yang dihadapi.

Sekali lagi, saya ingin Bapak/Ibu menyampaikan hal ini secara satu persatu, dan kami akan mencatat di kertas.

List all items on large piece of paper in the order they are mentioned

- Apakah ada kegiatan yang mereka ingin lakukan tetapi tidak bisa?
- Apakah ada dampak yang didapatkan karena tinggal di dekat kawasan lindung.
- Apakah ada alasan lain?

Ketika masing-masing kegiatan disebutkan, tanyakan kepada responden untuk mendapatkan informasi berikut

- Seberapa sering hal ini terjadi?
- Apa yang Anda lakukan?
- Mengapa hal ini menjadi masalah?

Apakah ada alasan lain?

### **Third-free list**

Sekarang saya ingin Bapak/Ibu menyebutkan keuntungan yang didapat ketika tinggal di sekitar kawasan lindung.

Dapatkah Bapak/Ibu menyebutkannya?

Catat semua pada kertas besar sesuai urutan yang mereka sebutkan.

Tanyakan kepada responden untuk mendapatkan informasi lebih mengenai masing-masing keuntungan tersebut.

Jika mereka mengatakan mendapatkan uang dari Kawasan lindung – bagaimana? Siapa yang memberikan uang tersebut?

Bagaimana hal tersebut diatur? Biasanya digunakan untuk apa uang tersebut?

### **Pile sorting [Estimate 1.5 hour ]**

Pada kegiatan ini, saya memiliki beberapa kartu yang berbeda. Masing-masing kartu memiliki gambar dan penjelasan dari aktivitas yang mungkin dilakukan seseorang di sekitar desa.

Sebagai perseorangan dan anggota kelompok, Bapak/Ibu mungkin lebih senang menyampaikan tentang aktifitas dibandingkan yang lain.

Saya ingin Bapak/Ibu melihat setiap kartu, dan sebagai kelompok memutuskan apakah masyarakat akan senang menyampaikan tentang aktivitas tersebut jika kegiatan ini dilakukan di desa.

Beberapa orang mungkin lebih bersedia untuk menyampaikan tentang kegiatan tersebut dibandingkan yang lainnya untuk alasan lain.

Contohnya, mungkin secara kultur pertanyaan terkait beberapa kegiatan tidak pantas untuk ditanyakan. Seperti, di Inggris, menanyakan umur pada seorang perempuan sangat tidak pantas.

Beberapa hal mungkin sensitif untuk alasan lain.

Jika Bapak/Ibu melakukan kegiatan yang mungkin dikhawatirkan akan membuat orang lain tidak setuju atau berpikir buruk tentang Bapak/Ibu.

Beberapa kegiatan mungkin hanya dilakukan secara rahasia atau di malam hari.

Bapak/Ibu mungkin akan khawatir jika membicarakan kegiatan tersebut akan membuat Bapak/ibu terkena masalah.

Saya ingin Bapak/Ibu melihat ke setiap kartu, dan mengelompokkan kartu tersebut berdasarkan bagaimana masyarakat akan membicarakannya.

Contohnya, Bapak/Ibu akan memiliki satu tumpuk kartu yang menunjukkan kegiatan yang mungkin masyarakat tidak akan suka untuk membicarakannya.

Di tumpukan lain, Bapak/Ibu mungkin akan memiliki kartu yang menunjukkan kegiatan yang mungkin masyarakat akan senang dan tidak memiliki masalah untuk membicarakannya.

Go through each card on a one-by-one basis.

- Diskusikan tentang kegiatan tersebut.
- Mengapa kegiatan tersebut sensitif/tidak sensitif.
- Bagaimana sensitivitas dari kegiatan tersebut berbeda dengan tumpukan yang lain (apakah lebih sensitif atau tidak)?

For species cards

- Tunjukkan kartu dengan spesies yang sama secara bersamaan.
- Cari tahu apakah sensitivitasnya berubah ketika alasan untuk membunuh binatang tersebut berubah
- Catat informasi menarik yang muncul tentang kegiatan tersebut (contoh: siapa yang melakukannya, kenapa, seberapa sering).

**\*\* Setelah responden mengelompokkan kartu – CATAT NOMOR GRUP DARI MASING-MASING KEGIATAN (KARTU) \*\***  
Minta peserta untuk memberi nama pada setiap kelompok kartu – dan berikan deskripsi tentang kelompok tersebut.

Jika memungkinkan, ambil gambar untuk setiap kelompok kartu, dan beri label pada setiap foto dengan kode grup.

Selanjutnya, Saya ingin Bapak/Ibu untuk melihat kelompok kartu ini, apakah ada kegiatan yang ingin dipindahkan jika kegiatan tersebut dilakukan di [kawasan lindung]?

Menurut Bapak/Ibu apakah masyarakat bersedia untuk membicarakan tentang kegiatan-kegiatan ini?

Mengapa?

### **Wrap-up [10 minutes]**

Terimakasih Bapak/Ibu atas partisipasinya.  
Tanyakan apabila ada pertanyaan.

Di akhir sesi Diskusi Kelompok – Ambil foto pada urutan di kertas, catat nama desa dan nomor grup.

### **FAQs & Suggested Responses**

Apa tujuan akhir dari penelitian ini? Apa keuntungan yang masyarakat dapatkan?

- Untuk mengetahui mengapa masyarakat pergi ke kawasan lindung dan masalah yang dihadapi terkait dengan pemanfaatan sumberdaya alam.
- Memberikan rekomendasi kepada pemerintah tentang bagaimana masyarakat membutuhkan sumberdaya dan pendapat mereka terhadap kawasan lindung.

Mengapa dipisahkan berdasarkan jenis kelamin?

- Laki-laki dan perempuan biasanya menggunakan sumberdaya alam secara berbeda.
- Dengan membuat kelompok yang hanya berisi laki-laki dan perempuan, akan membantu kami dalam memahami lebih lanjut bagaimana sumberdaya alam tersebut digunakan.

Tahun lalu juga ada peneliti yang datang dan menanyakan hal yang sama. Mereka berjanji sesuatu, namun tidak ada perubahan. Untuk apa kami membicarakannya lagi kepada Anda?

- Kami bekerja di sini dengan ijin dari pemerintah dan diwajibkan memberikan masukan dari hasil penelitian ini.
- Kami dapat memberitahukan mereka tentang masalah yang dihadapi dan alasan mengapa Bapak/Ibu merasa jika harus pergi ke kawasan lindung.

- Kami tidak bisa menjanjikan sesuatu akan berubah, tetapi setidaknya kami dapat menyampaikan suara/pendapat Bapak/Ibu.

Di desa kami juga menemukan masalah dengan XXX

- Mencatat tentang masalahnya, menanyakan pertanyaan, menunjukkan ketertarikan dan kekhawatiran.
- Katakan bahwa kamu tidak bisa melakukan perubahan, tetapi kamu dapat menyampaikan kekhawatirannya dengan orang yang pantas.

Akses untuk mendapatkan hasil penelitian

- Penelitian ini akan dipublikasi dalam laporan ilmiah.
- Hasil penelitian ini akan digunakan untuk dijadikan bahan pertimbangan pada penelitian selanjutnya yang akan dilakukan tahun depan.
- Saat ini kami sedang memikirkan cara terbaik untuk menyampaikan hasil penelitian ini.

Table A6.1. Survey Instrument used in Chapter 2, in Bahasa Indonesia

	Question::Bahasa Indonesia	Hint:: Bahasa Indonesia
Section 1. Survey location		
start_time		
end_time		
Date		
enumerator	Siapa yang melakukan wawancara?	
region	Area	
district	Kabupaten	
district_other	Jika Kabupaten lain, silahkan ditulis	
subdistrict	Kecamatan	
subdistrict_other	Jika Kecamatan lain, silahkan ditulis	
village	Nama Desa	
subvill	Nama Dusun	
pa_type	Kawasan lindung terdekat	**Jangan tanyakan ini kepada responden**
pa_type_other	Jika ada yang lain, berikan nama kawasan lindungnya	
Section 2. Participant consent		
ethics_statement	Membaca naskah persetujuan kepada peserta	<p>Halo nama saya \${enumerator}, saya peneliti dari Universitas Indonesia dan saya akan membantu Harriet Ibbett dari Universitas Bangor di Inggris untuk melakukan penelitian. Penelitiannya tentang memahami cara terbaik dalam menanyakan pertanyaan tentang penggunaan sumberdaya alam.</p> <p>Survei ini terdiri dari 2 bagian. Bagian pertama, kami akan menanyakan opini Bapak/Ibu tentang berbagai jenis penggunaan sumberdaya alam. Bagian kedua, untuk menemukan cara bagaimana Bapak/Ibu paling nyaman menjawab pertanyaan tentang kegiatan yang dianggap sensitif.</p> <p>Kami menanyakan banyak orang untuk melengkapi survei ini, sehingga kami bisa memahami bagaimana orang menjawab pertanyaan. Berdasarkan opini dan saran dari Bapak/Ibu, kami akan merancang survei baru, yang akan melibatkan pengumpulan informasi dari masyarakat lokal terkait pemanfaatan sumberdaya alam di kawasan lindung. Informasi yang Bapak/Ibu berikan sangat penting bagi kami sehingga kami bisa menanyakan pertanyaan secara tepat.</p> <p>Kuesioner ini akan memakan waktu sekitar 1 jam 15 menit. Informasi yang Bapak/Ibu berikan bersifat anonim, yang artinya kami tidak akan mencatat nama, atau informasi personal terkait rumah tangga Bapak/Ibu. Kami kemungkinan akan memberikan jawaban Bapak/Ibu ke pihak lain, tetapi tidak akan memberitahukan dari siapa kami mendapat informasi tersebut. Saya akan merekam jawaban Bapak/Ibu di hp ini. Semua jawaban akan disimpan pada komputer yang aman yang hanya bisa di akses oleh Harriet dengan password.</p>

		<p>Di akhir penelitian, Harriet akan menulis laporan berdasarkan penemuan di lapangan. Laporan ini akan dipakai untuk membantu peneliti-peneliti lain dalam melakukan penelitian sehingga bisa lebih sesuai dengan kebutuhan masyarakat lokal. Beberapa hasil akan dipublikasikan secara internasional sehingga masyarakat dari berbagai negara bisa belajar dari pengalaman kita bekerja dengan komunitas di sini.</p> <p>Perlu diketahui bahwa kami independen, kami tidak ada kaitannya dengan pemerintah atau lembaga lainnya dan kami memiliki pandangan yang netral. Kami sudah mendapatkan izin dari pemerintah Indonesia dan juga kepala desa untuk melakukan penelitian ini. Namun demikian, keikutsertaan Bapak/Ibu bersifat sukarela.</p> <p>Bapak/ibu tidak perlu berpartisipasi atau berhenti kapan saja tanpa alasan. Jika Bapak/Ibu melakukan itu, saya akan menghapus jawaban Bapak/Ibu. Jika Bapak/Ibu merasa tidak nyaman untuk menjawab beberapa pertanyaan, maka Bapak/Ibu tidak perlu menjawabnya. Jika Bapak/Ibu ingin melewati pertanyaan atau topik, mohon sampaikan kepada saya.</p> <p>Penelitian ini sudah ditinjau dan juga telah mendapatkan persetujuan etik dari Universitas Bangor. Jika Bapak/Ibu memiliki pertanyaan, mohon sampaikan kepada saya, dan saya akan berusaha untuk menjawab sebaik mungkin.</p> <p>Jika Bapak/Ibu masih merasa kurang senang atau ingin menyampaikan keluhan, saya bisa memberikan kontak kepada seseorang untuk menyampaikan hal tersebut.</p>
consent	Apakah peserta memberikan izin untuk berpartisipasi?	
no_consent	Ucapkan terimakasih dan mengakhiri survei.	
consent_gender	Apa jenis kelamin peserta?	
Section 3. Covid precautions		
covid_note	Peringat: Tindakan pencegahan COVID-19	<p>Jika pemandu belum menjelaskan tentang cara kita mewaspadai COVID maka jelaskan kepada responden:</p> <ol style="list-style-type: none"> <li>1. Bahwa tim sudah bebas dari semua gejala.</li> <li>2. Bahwa tidak akan bekerja di luar dan menjaga jarak.</li> <li>3. Akan membasuh tangan sesering mungkin.</li> <li>4. Bahwa kita mengenakan masker untuk melindungi diri sendiri dan responden.</li> </ol>
covid_symptoms	Apakah ada anggota rumah tangga Bapak/Ibu yang terkena COVID19?	<p>Adalah:</p> <ul style="list-style-type: none"> <li>• batuk yang baru dan terus menerus</li> <li>• kesulitan bernapas</li> <li>• demam tinggi</li> <li>• kehilangan indera perasa dan penciuman</li> </ul>
covid_yes	Berterimakasih pada responden untuk waktunya, jelaskan bahwa walaupun orang yang sakit mungkin bukan karena COVID, tapi kami tidak ingin responden yang lain berisiko jika mereka	

	terkena COVID. Katakan semoga anggota rumah tangga yang sakit lekas sembuh.	
covid_mask	Kenakan masker yang bisa didaur ulang.	Untuk melindungi saya dan Bapak/Ibu, Jika Bapak/Ibu bersedia, saya bisa memberikan masker untuk dipakai oleh Bapak/Ibu.
Section 4. Participant demographics		
gender	Apa jenis kelamin peserta?	
age	Berapa umur Anda?	Jika tidak tahu, tanyakan perkiraan umurnya.
ethn	Suku apa Anda?	
ethn_other	Tolong dispesifikasi suku Anda	
language	Apa bahasa yang sering digunakan?	
language_other	Tolong dispesifikasi bahasa Anda	
religious	Apakah Anda meyakini suatu agama?	
religion1	Agama peserta	
religion	Apa agama Anda?	
religion_other	Tolong dispesifikasi agama Anda	
religion_importance	Seberapa penting agama bagi Anda?	
yrs_ed	Berapa tahun Anda sekolah?	Masukan perkiraan jumlah tahun. Jika tidak sekolah, masukan 0 Untuk setiap tahun pendidikan tinggi, tambahkan 1, contoh 4 tahun kuliah = $12 + 4 = 16$ .
literacy	Apakah Anda bisa membaca?	
literacy_ease	Seberapa mudah membaca untuk Anda?	Bacakan opsi kepada responden.
birth_month	Apakah Anda tahu di bulan apa Anda lahir?	
month	Bulan lahir	
own_mobile	Apakah Anda memiliki telepon genggam sendiri?	Untuk individu, bukan rumah tangga atau keluarga.
know_pa	Apakah Anda tau nama dari kawasan lindung terdekat di sekitar sini?	
pa_name	Nama dari kawasan lindung terdekat	
pa_other	Jika ada yang lain, berikan nama kawasan lindungnya	
Section 5. Sensitive behaviour 1 – Clearing land		
sens_note	Mengukur kegiatan sensitif	"Sekarang saya akan bertanya tentang beberapa kegiatan yang Anda, anggota keluarga Anda, anggota keluarga lainnya, teman Anda atau tetangga di desa mungkin lakukan.  Untuk setiap kegiatan, saya akan menanyakan beberapa pertanyaan. Saya tidak ingin mengetahui apakah Anda melakukan kegiatan tersebut, tetapi hanya pendapat Anda tentang kegiatan tersebut.



		Kegiatan pertama adalah membuka hutan"
comm_land	Jika kami bertanya masyarakat di kelompok jika mereka **membuka hutan** di dalam TNGL, menurut Anda seberapa bersedia mereka untuk berkata jujur tentang itu ?	
approval_land	Jika Anda membuka hutan di TNGL, menurut Anda keluarga dan teman Anda akan....	
morals_land	Sejauh mana Anda setuju dengan pernyataan ini?	**Memembuka hutan di TNGL dapat diterima**
sdb_land	Sejauh mana Anda setuju dengan pernyataan ini?	**"Jika saya membuka hutan di TNGL, anggota masyarakat akan berpikir baik tentang saya"
comfort_land	Jika Anda membuka hutan di TNGL, dan peneliti menanyakan pertanyaan tentang hal tersebut, seberapa nyaman anda akan menjawab pertanyaan tersebut secara jujur?	
comwhy_land	Mengapa anda merasa tidak nyaman untuk membicarakan tentang membuka hutan di TNGL?	
rules_land	Apakah ada aturan tentang membuka hutan di TNGL?	
sensscale_land	Jelaskan skala sensitifitas	<p>Di sini kami memiliki skala sensitivitas. Kami bisa menggunakan ini untuk melihat seberapa bersedia masyarakat, membicarakan topik yang berbeda.</p> <p>Di satu sisi, kami memiliki topik di mana masyarakat akan sangat senang berdiskusi dengan peneliti.</p> <p>Di sisi lainnya, kami memiliki topik yang SANGAT sensitif dan masyarakat tidak senang membicarakan tentang itu dengan peneliti.</p> <p>Semakin gelap warnanya, dan tinggi angkanya, semakin tidak bersedia membicarakan tentang topik itu.</p>
agreescore_land	<p>Jawaban anda sebelumnya menyatakan bahwa membuka hutan di TNGL adalah...</p> <p>`\${sensscore_land}`</p> <p>Apakah Anda merasa ini akurat?</p>	Tunjukkan kepada peserta di mana nilai mereka pada skala sensitivitas.
why_land	Mengapa?	
Section 6. Sensitive behaviour 2 – Hunting wildlife		
hunt_note	Berburu satwa liar	Pertanyaan berikut adalah tentang berburu satwa liar.

comm_hunt	Jika kami bertanya kepada orang-orang di kelompok masyarakat apakah mereka berburu satwa liar di lahan desa, menurut Anda seberapa bersedia mereka untuk berkata jujur tentang itu ?	
approval_hunt	Jika Anda sendiri berburu satwa liar di lahan desa, menurut Anda keluarga dan teman-teman Anda akan...	
morals_hunt	Sejauh mana Anda setuju dengan pernyataan ini?	*"Adalah hal baik berburu satwa liar di lahan desa"*
sdb_hunt	Sejauh mana Anda setuju dengan pernyataan ini?	*"Jika saya berburu satwa liar di lahan desa, orang-orang di masyarakat akan memandang tinggi kepada saya"*
comfort_hunt	Jika Anda berburu satwa liar di lahan desa, dan peneliti menanyakan pertanyaan tentang hal tersebut, seberapa nyaman Anda akan menjawab pertanyaan tersebut secara jujur?	
comwhy_hunt	Kenapa Anda merasa tidak nyaman membicarakan tentang berburu satwa liar di lahan desa?	
rules_hunt	Apakah ada aturan tentang berburu satwa liar di lahan desa?	
sensscale_hunt	Jelaskan skala sensitivitas	<p>Disini kami memiliki skala sensitivitas. Kami bisa menggunakan ini untuk melihat seberapa bersedia masyarakat, membicarakan topik yang berbeda.</p> <p>Di satu sisi, kami memiliki topik di mana masyarakat akan sangat senang berdiskusi dengan peneliti.</p> <p>Di sisi lainnya, kami memiliki topik yang SANGAT sensitif dan masyarakat tidak senang membicarakan tentang itu dengan peneliti.</p> <p>Semakin gelap warnanya, dan tinggi angkanya, semakin tidak bersedia membicarakan tentang topik itu.</p>
agreescore_hunt	<p>Nilai Anda tentang berburu satwa liar di lahan desa adalah</p> <p>#{senscore_hunt}</p> <p>apakah Anda merasa ini akurat?</p>	Tunjukan kepada peserta di mana nilai mereka pada skala sensitivitas.
why_hunt	Mengapa?	
pa_hunt	Jika seorang peneliti menanyakan tentang berburu di dalam TNGL, seberapa tingkat sensitivitasnya	
pahunt_why	Mengapa?	

Section 7. Sensitive behaviour 3 – Logging		
pa_note	Menebang kayu	Pertanyaan berikutnya adalah tentang masuk ke dalam TNGL untuk menebang kayu.
comm_log	Jika kami bertanya kepada masyarakat jika mereka masuk ke dalam TNGL untuk menebang kayu, menurut Anda seberapa bersedia mereka untuk berkata jujur tentang itu ?	
approval_log	Jika Anda sendiri masuk ke dalam TNGL untuk menebang kayu, menurut Anda, keluarga dan teman Anda akan....	
morals_log	Sejauh mana Anda setuju dengan pernyataan ini?	**Adalah hal yang baik menebang kayu di dalam TNGL**
sdb_log	Sejauh mana Anda setuju dengan pernyataan ini?	**Jika saya menebang kayu di dalam TNGL, orang di masyarakat ini akan berpikir baik tentang saya**
comfort_log	Jika Anda menebang pohon di TNGL, dan peneliti menanyakan pertanyaan tentang hal tersebut, seberapa nyaman Anda akan menjawab pertanyaan tersebut secara jujur?	
comwhy_log	Mengapa Anda merasa tidak nyaman untuk membicarakan tentang menebang kayu di TNGL?	
rules_log	Apakah ada aturan tentang menebang kayu di TNGL?	
sensscale_log	Jelaskan skala sensitivitas	<p>Di sini kami memiliki skala sensitivitas. Kami bisa menggunakan ini untuk melihat seberapa bersedia masyarakat, membicarakan topik yang berbeda.</p> <p>Di satu sisi, kami memiliki topik di mana masyarakat akan sangat senang berdiskusi dengan peneliti.</p> <p>Di sisi lainnya, kami memiliki topik yang SANGAT sensitif dan masyarakat tidak senang membicarakan tentang itu dengan peneliti.</p> <p>Semakin gelap warnanya, dan tinggi angkanya, semakin tidak bersedia membicarakan tentang topik itu.</p>
agreescore_log	<p>Jawaban Anda sebelumnya menyatakan bahwa menebang kayu di TNGL adalah...</p> <p>\${sensscore_log}</p> <p>Apakah Anda merasa ini akurat?</p>	Tunjukkan kepada peserta di mana nilai mereka pada skala sensitivitas.
why_log	Mengapa?	
Section 8. Thank you & wrap-up		
thank_you	Do you have any questions for me?	Apakah Anda memiliki pertanyaan untuk saya?

feedback	Record any comments or feedback If none, NA	Catat semua komentar dan pertanyaan, jika tidak "NA".
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## Chapter 3

Table A6.2. Survey instrument in Bahasa Indonesia which was applied in Chapter 3.

	Question:: Bahasa Indonesia	Instruction/prompt:: Bahasa Indonesia
Section 1. Survey location		
start_time		
end_time		
Date		
device_id		
interviewer	Siapa yang melakukan wawancara?	
region	Area	
district	Kabupaten	
district_other	Jika Kabupaten lain, silahkan ditulis	
subdistrict	Kecamatan	
subdistrict_other	Jika Kecamatan lain, silahkan ditulis	
village	Nama Desa	
subvill	Nama Dusun	
pa_type	Kawasan lindung terdekat	**Jangan tanyakan ini kepada responden**
pa_type_other	Jika ada yang lain, berikan nama kawasan lindungnya	
Section 2. Participant consent		
ethics_statement	Membaca naskah persetujuan kepada peserta	<p>Halo nama saya \${interviewer}, saya peneliti dari Universitas Indonesia dan saya akan membantu Harriet Ibbett dari Universitas Bangor di Inggris untuk melakukan penelitian. Penelitiannya tentang memahami cara terbaik dalam menanyakan pertanyaan tentang penggunaan sumberdaya alam.</p> <p>Survey ini terdiri dari 2 bagian. Bagian pertama, kami akan menanyakan opini bapak/ibu tentang berbagai jenis penggunaan sumberdaya alam. Bagian kedua, untuk menemukan cara bagaimana bapak/ibu paling nyaman menjawab pertanyaan tentang kegiatan yang dianggap sensitif.</p> <p>Kami menanyakan banyak orang untuk melengkapi survey ini, sehingga kami bisa memahami bagaimana orang menjawab pertanyaan. Berdasarkan opini dan saran dari bapak/ibu, kami akan merancang survey baru, yang akan melibatkan pengumpulan informasi dari masyarakat local terkait pemanfaatan sumberdaya alam di area lindung. Informasi yang bapak/ibu berikan sangat penting bagi kami sehingga kami bisa menanyakan pertanyaan secara tepat.</p> <p>Kuesioner ini akan memakan waktu sekitar 1 jam 15 menit. Informasi yang bapak/ibu berikan bersifat anonim, yang</p>

		<p>artinya kami tidak akan mencatat nama, atau informasi personal terkait rumah tangga bapak/ibu. Kami kemungkinan akan memberikan jawaban bapak/ibu ke pihak lain, tetapi tidak akan memberitahukan dari siapa kami mendapat informasi tersebut. Saya akan merekam jawaban bapak/ibu di hp ini. Semua jawaban akan disimpan pada computer yang aman yang hanya bisa di akses oleh Harriet dengan password.</p> <p>Di akhir penelitian, Harriet akan menulis laporan berdasarkan penemuan di lapangan. Laporan ini akan dipakai untuk membantu peneliti-peneliti lain dalam melakukan penelitian sehingga bisa lebih sesuai dengan kebutuhan masyarakat lokal. Beberapa hasil akan dipublikasikan secara internasional sehingga masyarakat dari berbagai negara bisa belajar dari pengalaman kita bekerja dengan komunitas di sini.</p> <p>Perlu diketahui bahwa kami independen, kami tidak ada kaitannya dengan pemerintah atau lembaga lainnya dan kami memiliki pandangan yang netral. Kami sudah mendapatkan izin dari pemerintah Indonesia dan juga kepala desa untuk melakukan penelitian ini. Namun demikian, keikutsertaan bapak/ibu bersifat sukarela.</p> <p>Bapak/ibu tidak perlu berpartisipasi atau berhenti kapan saja tanpa alasan. Jika bapak/ibu melakukan itu, saya akan menghapus jawaban bapak/ibu. Jika bapak/ibu merasa tidak nyaman untuk menjawab beberapa pertanyaan, maka bapak/ibu tidak perlu menjawabnya. Jika bapak/ibu ingin melewati pertanyaan atau topik, mohon sampaikan kepada saya.</p> <p>Penelitian ini sudah ditinjau dan juga telah mendapatkan persetujuan etik dari Universitas Bangor. Jika bapak/ibu memiliki pertanyaan, mohon sampaikan kepada saya, dan saya akan berusaha untuk menjawab sebaik mungkin.</p> <p>Jika bapak/ibu masih merasa kurang senang atau ingin menyampaikan keluhan, saya bisa memberikan kontak kepada seseorang untuk menyampaikan hal tersebut.</p>
consent	Apakah peserta memberikan ijin untuk berpartisipasi?	
no_consent	Ucapkan terimakasih dan mengakhiri survey.	
consent_gender	Apa jenis kelamin peserta?	
Section 3. Covid-19 precautions		
covid_note	Pengingat: Tindakan pencegahan COVID-19	<p>Jika pemandu belum menjelaskan tentang cara kita mewaspadai COVID maka jelaskan kepada responden:</p> <ol style="list-style-type: none"> <li>1. Bahwa tim sudah bebas dari semua gejala</li> <li>2. Bahwa tidak akan bekerja di luar dan menjaga jarak</li> <li>3. Akan membasuh tangan sesering mungkin</li> <li>4. Bahwa kita mengenakan masker untuk melindungi diri sendiri dan responden</li> </ol>
covid_symptoms	Apakah ada anggota rumah tangga Bapak/Ibu yang terkena COVID19?	<p>Adalah:</p> <ul style="list-style-type: none"> <li>• batuk yang baru dan terus menerus</li> <li>• kesulitan bernapas</li> <li>• demam tinggi</li> <li>• kehilangan indera perasa dan penciuman</li> </ul>

covid_yes	Berterimakasih pada responden untuk waktunya, jelaskan bahwa walaupun orang yang sakit mungkin bukan karena COVID, tapi kami tidak ingin responden yang lain berisiko jika mereka terkena COVID. Katakan semoga anggota rumah tangga yang sakit lekas sembuh.	
covid_mask	Kenakan masker yang bisa didaur ulang	Untuk melindungi saya dan Bapak/Ibu, Jika Bapak/Ibu bersedia, saya bisa memberikan masker untuk dipakai oleh Bapak/Ibu?
Section 4. Respondent demographics		
gender	Apa jenis kelamin peserta?	
age	Berapa umur Anda?	Jika tidak tau, tanyakan perkiraan umurnya
ethn	Suku apa Anda?	
ethn_other	Tolong dispesifikasi suku Anda	
language	Apa bahasa yang sering digunakan?	
language_other	Tolong dispesifikasi bahasa Anda	
religious	Apakah anda meyakini suatu agama?	
religion	Apa agama anda?	
religion_other	Tolong dispesifikasi agama Anda	
religion_importance	Seberapa penting agama bagi anda?	
yrs_ed	Berapa tahun anda sekolah?	Masukan perkiraan jumlah tahun  Jika tidak sekolah, masukan 0 Untuk setiap tahun pendidikan tinggi, tambahkan 1. contoh 4 tahun kuliah = 12 + 4 = 16
literacy	Apakah anda bisa membaca?	
literacy_ease	Seberapa mudah membaca untuk Anda?	Bacakan opsi kepada responden
birth_month	Apakah anda tahu di bulan apa anda lahir?	
month	Bulan lahir	
own_mobile	Apakah anda memiliki telepon genggam sendiri?	Untuk individu, bukan rumah tangga atau keluarga
know_pa	Apakah anda tau nama dari kawasan lindung terdekat di sekitar sini?	
pa_name	Nama dari kawasan lindung terdekat	
pa_other	Jika ada yang lain, berikan nama kawasan lindung nya	
Section 5. Introducing the experiment		

sqt_intro_1	Pendahuluan: Mencoba metode	<p>Tujuan dari bagian ini adalah untuk mengetahui bagaimana bapak/ibu lebih memilih untuk menjawab pertanyaan tentang kegiatan yang mungkin dianggap sensitif.</p> <p>Saat kita menanyakan pertanyaan mengenai penggunaan sumber daya alam, terkadang kita tidak selalu mau menjawab jujur.</p> <p>Kita mungkin akan merasa malu dengan jawaban kita, kita mungkin tidak percaya dengan orang yang bertanya, atau mungkin merasa takut jika kita menjawab jujur kita akan mendapat masalah.</p> <p>Namun, bagi para peneliti, ketika kami menanyakan pertanyaan mengenai sumber daya alam, sangat penting bagi kami untuk memperoleh jawaban yang jujur.</p> <p>Jika tidak, maka informasi yang kami dapatkan pun tidak benar, dan kami tidak dapat memberikan rekomendasi terbaik untuk masyarakat.</p>
sqt_intro_2	Mengenalkan metode	<p>Untuk memecahkan masalah itu, para peneliti telah mengembangkan berbagai cara khusus dalam bertanya, yang memungkinkan seseorang memberikan jawaban secara jujur, namun peneliti tidak bisa tahu bahwa orang yang memberikan jawaban melakukan aktivitas tersebut.</p> <p>Saya ingin mencobakan berbagai cara tersebut kepada bapak/ibu, untuk melihat mana yang paling mudah dimengerti, dan mengetahui mana yang paling bapak/ibu sukai.</p> <p>Pertanyaan-pertanyaan berikut adalah tentang berburu satwa liar.</p> <p>Saya tidak ingin tahu apakah hal ini adalah yang bapak/ibu atau anggota rumah tangga bapak/ibu lakukan.</p> <p>Saya hanya tertarik untuk mengetahui mana cara terbaik bagi bapak/ibu untuk menjawab pertanyaan tentang hal tersebut.</p>
char_intro_1	Mengenalkan beberapa karakter	<p>Untuk memastikan bahwa bapak/ibu tidak menjawab pertanyaan tentang diri bapak/ibu sendiri, saya akan memperkenalkan kepada bapak/ibu beberapa tokoh fiktional/rekaan.</p> <p>Di sini, saya memiliki 5 tokoh. Dimana masing-masing tokoh memiliki mata pencaharian yang berbeda.</p> <p>Ketika kita mencoba berbagai cara untuk menjawab pertanyaan, saya ingin bapak/ibu berpura-pura menjadi salah satu tokoh yang ada, dan kemudian memberi jawaban sesuai dengan peran tokoh tersebut.</p> <p>Apakah bapak/ibu mengerti?</p>
char_intro_2	Mengumpulkan kartu karakter untuk Satu	<p>Kumpulkan kartu karakter untuk orang nomor Satu.</p> <p>Sebagai contoh, di sini kita memiliki Satu.</p> <p>Satu lahir pada bulan November. Mata pencahariannya adalah:</p> <ul style="list-style-type: none"> <li>• Memelihara ayam</li> <li>• Berburu satwa liar</li> </ul>



		<ul style="list-style-type: none"> <li>• Menyadap karet</li> <li>• Memancing</li> </ul>
Section 6. Testing the 1 <sup>st</sup> method (this block of questions is repeated five times, once for each method. The method order is randomly allocated. Below shows the instructions for each method)		
m1_dice_intro	**RRT/ Metode Dadu**	<p>Cara menjawab pertanyaan ini agak seperti sebuah permainan. Dan seperti permainan, ada aturan-aturan yang harus diikuti.</p> <p>Pertama-tama, saya akan memberi dadu kepada bapak/ibu, dan saya akan meminta bapak/ibu melemparnya.</p> <p>Jika bapak/ibu mendapatkan **1, 2, 3, atau 4** bapak/ibu harus selalu memberikan jawaban **yang sebenarnya, Ya atau Tidak**</p> <p>Jika bapak/ibu mendapatkan **5** bapak/ibu harus selalu menjawab **Ya**</p> <p>*Meskipun itu bukan jawaban bapak/ibu sebenarnya*</p> <p>Jika bapak/ibu mendapatkan **6** bapak/ibu harus selalu menjawab **Tidak**</p> <p>*Meskipun itu bukan jawaban bapak/ibu sebenarnya*</p> <p>Apakah bapak/ibu mengerti?</p> <p>Mari kita praktikkan.</p> <p>*(lempar dadu)* angka berapa yang bapak/ibu peroleh?</p> <p>Jawaban apa yang harus bapak/ibu berikan?</p> <p>Mari kita praktik dengan contoh</p> <p>Ini adalah Satu. Pertanyaan saya pada Satu adalah "Satu, apakah kamu berburu satwa liar?"</p> <p>Saya akan melempar dadu. Saya mendapatkan angka XX. Karena saya mendapatkan angka XX, jawaban saya harus XX.</p> <p>Apakah anda mengerti?</p>
m1_uct_intro	**UCT/ Metode Angka**	<p>Untuk metode ini, kami akan menggunakan kartu ini. Pada kartu ini terdapat 4 macam kegiatan.</p> <p>Untuk menjawab pertanyaan saya, yang harus bapak/ibu lakukan adalah mengatakan berapa banyak hal-hal berikut yang bapak/ibu lakukan.</p> <p>Beberapa kegiatan yang berbeda itu adalah:</p> <ul style="list-style-type: none"> <li>• Menanam padi</li> <li>• Berburu satwa liar</li> <li>• Menyadap karet</li> <li>• Memancing</li> </ul>

		<p>Sangat penting bagi bapak/ibu untuk tidak memberitahu kami kegiatan yang mana. Tapi hanya jumlah kegiatannya saja.</p> <p>Pertama, mari kita praktikkan.</p> <p>Ini adalah Satu. Kita bisa melihat bahwa Satu :</p> <ul style="list-style-type: none"> <li>• Memelihara ayam</li> <li>• Berburu satwa liar</li> <li>• Menyadap karet</li> <li>• Memancing</li> </ul> <p>Jadi Satu melakukan 3 dari 4 kegiatan</p> <p>Jawaban yang harus Satu berikan adalah 3</p> <p>Apakah Anda mengerti?</p> <p>Jelaskan dan ulangi sampai benar.</p>
m1_crosswise_intro	<b>**Metode Crosswise**</b>	<p>Saya akan membacakan kepada anda dua pertanyaan.</p> <p>Jika anda menjawab YA atau TIDAK pada KEDUA pertanyaan, tolong sentuh kotak hijau.</p> <p>Jika anda menjawab YA pada salah satu pertanyaan (terlepas dari yang mana), tolong sentuh kotak hitam.</p> <p>Ayo kita mencoba. Dua pertanyaannya adalah:</p> <p>a) Apakah anda memburu satwa liar?</p> <p>b) Apakah anda lahir di bulan November atau Desember?</p> <p>Mari kita berpura-pura sebagai Satu. Kita melihat bahwa Satu lahir di bulan November dan Satu memburu satwa liar.</p> <p>Satu = hijau karena jawabannya adalah IYA untuk kedua pernyataan</p>
m1_button_intro	<b>**RRT/ Metode Button**</b>	<p>Pertama-tama saya akan memberikan Bapak/Ibu sebuah kantung, di dalam kantung ini terdapat kancing warna-warni</p> <p>Saya akan meminta Bapak/Ibu untuk mengambil satu kancing dari kantung ini.</p> <p>Jika Bapak/Ibu mendapatkan kancing berwarna Merah, Bapak/Ibu harus selalu menjawab jawaban <b>**yang sebenarnya, Ya atau Tidak**</b>.</p> <p>Jika bapak/ibu mendapatkan kancing berwarna Kuning, Bapak/Ibu harus selalu menjawab <b>**Ya**</b></p> <p><b>*Meskipun itu bukan jawaban bapak/ibu sebenarnya*</b></p>

		<p>Jika bapak/ibu mendapatkan kancing berwarna Putih, Bapak/Ibu harus menjawab <b>**Tidak**</b>  <b>*Meskipun itu bukan jawaban bapak/ibu sebenarnya*</b></p> <p>Mari kita praktikkan.</p> <p>Jawaban apa yang harus bapak/ibu berikan?</p> <p>Mari kita praktik dengan contoh</p> <p>Ini adalah Satu. Pertanyaan saya pada Satu adalah "Satu, apakah kamu berburu satwa liar?"</p> <p>Saya akan melempar dadu. Saya mendapatkan angka XX. Karena saya mendapatkan angka XX, jawaban saya harus XX.</p> <p>Apakah anda mengerti?</p>
m1_dq_intro	<b>**Pertanyaan langsung**</b>	<p>Untuk pertanyaan ini, tidak ada acara khusus untuk menjawabnya. Saya hanya ingin anda memberitahukan kepada saya jawaban yang sejujurnya.</p> <p>Ingatlah bahwa anda sedang menjadi seseorang ketika menjawab pertanyaan.</p> <p>Mari berlatih dengan Satu.</p> <p>Pertanyaannya adalah:</p> <p><b>**Satu, apakah anda memburu satwa liar?**</b></p> <p>Kita melihat bahwa Satu melakukan pemburuan satwa liar, sehingga Satu harus menjawab YA</p>
m1_dice_dice	Apakah peserta familiar dengan dadu?	
m1_intro_ch1	<b>*Pilih kartu karakter untuk Dua*</b>	<p>Sekarang kita akan mempraktekkan dengan Dua.</p> <p>Dua lahir di bulan Desember. mereka:</p> <p>Menanam padi  Mengumpulkan kayu bakar  Memiliki warung kecil  Memelihara sapi</p>
Practice method using Character Two		
m1_dice_ch1	<p>Metode dadu</p> <p><b>*Dua, apakah anda memburu satwa liar?*</b></p>	<p>Ingat, jika anda melempar:</p> <p><b>**1, 2, 3, 4**</b> Anda harus menjawab yang sebenarnya, iya atau <b>**tidak**</b>  <b>**5**</b> Anda harus menjawab <b>**IYA**</b>  <b>**6**</b> Anda harus menjawab <b>**TIDAK**</b></p>

		<p>Catat jumlah praktik yang dibutuhkan sebelum responden menjawab dengan benar.</p> <p>Jika responden memilih untuk tidak menjawab, masukkan '999'</p>
m1_uct_ch1	<p>Metode angka</p> <p>*Dua, berapa banyak dari aktivitas ini yang anda lakukan?</p> <p>*Ingat jangan beritahu saya aktivitas apa yang anda lakukan, hanya beritahu berapa banyak*</p>	<p>Catat jumlah praktik yang dibutuhkan sebelum responden menjawab dengan benar.</p> <p>Jika responden memilih untuk tidak menjawab, masukkan '999'</p>
m1_crosswise_ch1	<p>Metode kotak berwarna</p> <p>Dua,</p> <p>A) Apakah anda berburu satwa liar?</p> <p>B) Apakah anda lahir di bulan november atau desember?</p>	<p>Ingat, jika jawabannya:</p> <p>Iya atau Tidak untuk **KEDUA** pertanyaan sentuh kotak berwarna **hijau**</p> <p>Iya untuk HANYA **SATU** pertanyaan setuh kotak berwarna **hitam**</p> <p>Catat jumlah praktik yang dibutuhkan sebelum responden menjawab dengan benar.</p> <p>Jika responden memilih untuk tidak menjawab, masukkan '999'</p>
m1_dq_ch1	<p>DQ</p> <p>Ingat, untuk metode ini, tolong langsung jawab pertanyaannya.</p> <p>Dua, apakah anda berburu satwa liar?</p>	<p>Catat jumlah praktik yang dibutuhkan sebelum responden menjawab dengan benar.</p> <p>Jika responden memilih untuk tidak menjawab, masukkan '999'</p>
m1_button_ch1	<p>Metode Button</p> <p>*Dua, apakah anda memburu satwa liar?*</p>	<p>Ingat, jika Bapak/Ibu mendapatkan kancing berwarna</p> <p>Merah, Bapak/Ibu harus selalu menjawab jawaban **yang sebenarnya, Ya atau Tidak**.</p> <p>Jika bapak/ibu mendapatkan kancing berwarna Kuning, Bapak/Ibu harus selalu menjawab **Ya**</p> <p>*Meskipun itu bukan jawaban bapak/ibu sebenarnya*</p> <p>Jika bapak/ibu mendapatkan kancing berwarna Putih, Bapak/Ibu harus menjawab **Tidak**</p> <p>*Meskipun itu bukan jawaban bapak/ibu sebenarnya*</p> <p>Jika responden memilih untuk tidak menjawab, masukkan '999'</p>
Collect test data – 1 <sup>st</sup> character		
m1_C_A	Pilih kartu untuk **\${m1_ch2}**	<p>Jelaskan secara singkat kegiatan yang ada di kartu.</p> <p>\${m1_ch2_attributes}</p>

m1_dice_ch2	Metode dadu  \${m1_ch2}, apakah anda berburu satwa liar?	Ingat, jika anda melempar:  **1, 2, 3, 4** Anda harus menjawab yang sebenarnya, iya atau **tidak** **5** Anda harus menjawab **IYA** **6** Anda harus menjawab **TIDAK**  Catat jumlah praktik yang dibutuhkan sebelum responden menjawab dengan benar.  Jika responden memilih untuk tidak menjawab, masukkan '999'
m1_uct_ch2	Metode angka  \${m1_ch2}, berapa banyak dari aktivitas ini yang anda lakukan?	Ingat, jangan memberitahu saya kegiatan apa yang anda lakukan, hanya beritahukan berapa banyak kegiatan yang anda lakukan
m1_crosswise_ch2	Metode kotak berwarna  \${m1_ch2},  A) Apakah anda berburu satwa liar? B) Apakah anda lahir di bulan November atau Desember?	Ingat, jika jawabannya:  Iya atau Tidak untuk **KEDUA** pertanyaan sentuh kotak berwarna **hijau**  Iya untuk HANYA **SATU** pertanyaan setuh kotak berwarna **hitam**  Catat jumlah praktik yang dibutuhkan sebelum responden menjawab dengan benar.  Jika responden memilih untuk tidak menjawab, masukkan '999'
m1_dq_ch2	DQ  \${m1_ch2}, apakah anda berburu satwa liar?	Tolong jawab pertanyaan secara langsung
m1_button_ch2	Metode Button  *\${m1_ch2}, apakah anda memburu satwa liar?*	Ingat, jika Bapak/Ibu mendapatkan kancing berwarna  Merah, Bapak/Ibu harus selalu menjawab jawaban **yang sebenarnya, Ya atau Tidak**.  Jika bapak/ibu mendapatkan kancing berwarna Kuning, Bapak/Ibu harus selalu menjawab **Ya** *Meskipun itu bukan jawaban bapak/ibu sebenarnya*  Jika bapak/ibu mendapatkan kancing berwarna Putih, Bapak/Ibu harus menjawab **Tidak** *Meskipun itu bukan jawaban bapak/ibu sebenarnya*  Jika responden memilih untuk tidak menjawab, masukkan '999'
m1_privacy_ch2	Dari jawaban anda, menurut anda apakah saya akan tau bahwa \${m1_ch2} berburu?	
m1_diceroll_ch2	Angka berapa yang anda dapatkan di dadu?	Jadi saya dapat memeriksa apakah anda menjawab dengan benar.  Jika NA, masukkan '0'

m1_counter_ch2	Kancing warna apa yang Anda pilih?	Jadi saya dapat memeriksa apakah anda menjawab dengan benar.
Collect test data – 2 <sup>nd</sup> character		
m1_C_B	Pilih kartu untuk **\${m1_ch3}**	Jelaskan secara singkat kegiatan yang ada di kartu.  \${m1_ch3_attributes}
m1_dice_ch3	Metode dadu  \${m1_ch3}, apakah anda berburu satwa liar?	Ingat, jika anda melempar:  **1, 2, 3, 4** Anda harus menjawab yang sebenarnya, iya atau **tidak** **5** Anda harus menjawab **IYA** **6** Anda harus menjawab **TIDAK**  Catat jumlah praktik yang dibutuhkan sebelum responden menjawab dengan benar.  Jika responden memilih untuk tidak menjawab, masukkan '999'
m1_uct_ch3	Metode angka  \${m1_ch3}, berapa banyak dari aktivitas ini yang anda lakukan?	Ingat, jangan memberitahu saya kegiatan apa yang anda lakukan, hanya beritahukan berapa banyak kegiatan yang anda lakukan
m1_crosswise_ch3	Metode kotak berwarna  \${m1_ch3},  A) Apakah anda berburu satwa liar? B) Apakah anda lahir di bulan November atau Desember?	Ingat, jika jawabannya:  Iya atau Tidak untuk **KEDUA** pertanyaan sentuh kotak berwarna **hijau**  Iya untuk HANYA **SATU** pertanyaan sentuh kotak berwarna **hitam**  Catat jumlah praktik yang dibutuhkan sebelum responden menjawab dengan benar.  Jika responden memilih untuk tidak menjawab, masukkan '999'
m1_dq_ch3	DQ  \${m1_ch3}, apakah anda berburu satwa liar?	Tolong jawab pertanyaan secara langsung
m1_button_ch3	Metode Button  *\${m1_ch3}, apakah anda memburu satwa liar?*	Ingat, jika Bapak/Ibu mendapatkan kancing berwarna  Merah, Bapak/Ibu harus selalu menjawab jawaban **yang sebenarnya, Ya atau Tidak**.  Jika bapak/ibu mendapatkan kancing berwarna Kuning, Bapak/Ibu harus selalu menjawab **Ya** *Meskipun itu bukan jawaban bapak/ibu sebenarnya*  Jika bapak/ibu mendapatkan kancing berwarna Putih, Bapak/Ibu harus menjawab **Tidak** *Meskipun itu bukan jawaban bapak/ibu sebenarnya*  Jika responden memilih untuk tidak menjawab, masukkan '999'

m1_privacy_ch3	Dari jawaban anda, menurut anda apakah saya akan tau bahwa \${m1_ch3} berburu?	
m1_diceroll_ch3	Angka berapa yang anda dapatkan di dadu?	Jadi saya dapat memeriksa apakah anda menjawab dengan benar.  Jika NA, masukkan '0'
m1_counter_ch3	Kancing warna apa yang Anda pilih?	Jadi saya dapat memeriksa apakah anda menjawab dengan benar.
Collect test data – 3 <sup>rd</sup> character		
m1_C_C	Pilih kartu untuk **\${m1_ch4}**	Jelaskan secara singkat kegiatan yang ada di kartu.  \${m1_ch4_attributes}
m1_dice_ch4	Metode dadu  \${m1_ch4}, apakah anda berburu satwa liar?	Ingat, jika anda melempar:  **1, 2, 3, 4** Anda harus menjawab yang sebenarnya, iya atau **tidak** **5** Anda harus menjawab **IYA** **6** Anda harus menjawab **TIDAK**  Catat jumlah praktik yang dibutuhkan sebelum responden menjawab dengan benar.  Jika responden memilih untuk tidak menjawab, masukkan '999'
m1_uct_ch4	Metode angka  \${m1_ch4}, berapa banyak dari aktivitas ini yang anda lakukan?	Ingat, jangan memberitahu saya kegiatan apa yang anda lakukan, hanya beritahukan berapa banyak kegiatan yang anda lakukan
m1_crosswise_ch4	Metode kotak berwarna  \${m1_ch4},  A) Apakah anda berburu satwa liar? B) Apakah anda lahir di bulan November atau Desember?	Ingat, jika jawabannya:  Iya atau Tidak untuk **KEDUA** pertanyaan sentuh kotak berwarna **hijau**  Iya untuk HANYA **SATU** pertanyaan sentuh kotak berwarna **hitam**  Catat jumlah praktik yang dibutuhkan sebelum responden menjawab dengan benar.  Jika responden memilih untuk tidak menjawab, masukkan '999'
m1_dq_ch4	DQ  \${m1_ch4}, apakah anda berburu satwa liar?	Tolong jawab pertanyaan secara langsung
m1_button_ch4	Metode Button  *\${m1_ch4}, apakah anda memburu satwa liar?*	Ingat, jika Bapak/Ibu mendapatkan kancing berwarna  Merah, Bapak/Ibu harus selalu menjawab jawaban **yang sebenarnya, Ya atau Tidak**.  Jika bapak/ibu mendapatkan kancing berwarna Kuning, Bapak/Ibu harus selalu menjawab **Ya** *Meskipun itu bukan jawaban bapak/ibu sebenarnya*

		<p>Jika bapak/ibu mendapatkan kancing berwarna Putih, Bapak/Ibu harus menjawab <b>**Tidak**</b></p> <p>*Meskipun itu bukan jawaban bapak/ibu sebenarnya*</p> <p>Jika responden memilih untuk tidak menjawab, masukkan '999'</p>
m1_privacy_ch4	Dari jawaban anda, menurut anda apakah saya akan tau bahwa \${m1_ch4} berburu?	
m1_diceroll_ch4	Angka berapa yang anda dapatkan di dadu?	<p>Jadi saya dapat memeriksa apakah anda menjawab dengan benar.</p> <p>Jika NA, masukkan '0'</p>
m1_counter_ch4	Kancing warna apa yang Anda pilih?	Jadi saya dapat memeriksa apakah anda menjawab dengan benar.
Review of 1 <sup>st</sup> method		
m1_understand	Apakah anda cukup mengerti bagaimana menjawab pertanyaan-pertanyaan tersebut?	
m1_answerease	Seberapa mudah menurut anda untuk menjawab pertanyaan-pertanyaan tersebut?	
m1_privacy	Seberapa rahasia menurut anda jawaban yang anda berikan pada metode ini ?	
m1_comfort	Jika anda melakukan kegiatan, seperti berburu, seberapa nyaman anda untuk menjawab pertanyaan secara jujur dengan metode ini?	
m1_comments	Apakah ada komentar tambahan?	Catat komentar dari responden tentang metode ini
m1_enumunder	\${interviewer}, seberapa baik menurut anda responden mengerti tentang metode ini?	
m1_enumhonesty	\${interviewer}, apakah anda merasa bahwa responden sengaja menjawab salah?	Misalnya mereka takut untuk menjawab jujur
Section 6 was repeated four further times, once more for each of the remaining methods.		
Section 11. Review of all methods		
quest_pref	Preferensi metode	Beberapa pertanyaan selanjutnya, tentang seberapa ingin anda menjawab pertanyaan
method_best	Metode mana yang lebih mudah dimengerti?	
method_comfort	Metode mana yang membuat anda lebih nyaman dalam menjawab pertanyaan?	
method_privacy	Menurut anda metode mana yang paling menjaga kerahasiaan jawaban Anda?	
method_prefer	Jika peneliti menanyakan pertanyaan seputar apakah anda melakukan kegiatan ilegal atau tidak, menurut Anda metode mana yang akan	<p>1 = Metode yang paling dipilih</p> <p>5 = Metoda yang paling tidak dipilih</p>



	Anda pilih untuk menjawab pertanyaan tersebut?	
most_prefer_why	Mengapa anda lebih memilih metode ini?	
least_prefer_why	Mengapa anda tidak memilih metode ini?	
thank_you	Survey ini sudah selesai. Terimakasih sudah berpartisipasi.	Apakah anda memiliki pertanyaan untuk saya?
adults_present	\$(interviewer}, apakah ada orang dewasa lain (+18 tahun) yang hadir selama wawancara?	
survey_engage	\$(interviewer}, seberapa besar partisipasi peserta selama wawancara berlangsung?	
survey_ease	\$(interviewer}, bagaimana pendapatmu melakukan survey pada orang ini?	
Section 12. Comments from the interviewer		
other_comments	Komentar tambahan	
comments	Preferensi metode	Catat semua komentar dan pertanyaan, jika tidak "NA"

## Chapter 6

Table A6.3. Full vignette descriptions and their Bahasa Indonesia translations used in Experiment 1 – which assessed the perceived fairness of sanctions

Block	Vignette	Bahasa Indonesia
1	1	1. Seseorang yang memiliki kekuasaan dari luar komunitas Anda ketahuan menebang pohon di TNGL oleh ranger. Ranger memperbolehkan mereka untuk melanjutkan tanpa konsekuensi.
1	2	2. Seseorang yang tidak memiliki kekuasaan dari luar komunitas Anda ketahuan berburu rusa yang dilindungi di TNGL oleh ranger. Ranger menerima sogokan dan mereka diperbolehkan untuk melanjutkan.
1	3	3. Seseorang yang memiliki kekuasaan dari luar komunitas Anda ketahuan berburu rusa yang dilindungi di TNGL oleh ranger. Ranger menyita barang bukti (contohnya: rusa dan alat berburu) dan memperingatkan mereka untuk tidak berburu lagi.
1	4	4. Seseorang yang tidak memiliki kekuasaan dari komunitas Anda ketahuan menebang pohon di TNGL oleh ranger. Ranger menyita barang bukti (contohnya: kayu dan gergaji mesin) dan memperingatkan mereka untuk tidak menebang lagi.
1	5	5. Seseorang yang memiliki kekuasaan dari komunitas Anda ketahuan berburu rusa yang dilindungi di TNGL oleh ranger. Ranger menangkap mereka dan mereka diproses hukum.
1	6	6. Seseorang yang tidak memiliki kekuasaan dari luar komunitas Anda ketahuan menebang pohon di TNGL oleh ranger. Ranger menangkap mereka dan mereka diproses hukum.
1	7	7. Seseorang yang tidak memiliki kekuasaan dari komunitas Anda ketahuan berburu rusa yang dilindungi di TNGL oleh ranger. Ranger memperbolehkan mereka untuk melanjutkan tanpa ada tindak lanjut.
1	8	8. Seseorang yang memiliki kekuasaan dari komunitas Anda ketahuan menebang pohon di TNGL oleh ranger. Ranger menerima sogokan mereka dan mereka diperbolehkan untuk melanjutkan.
2	9	9. Seseorang yang tidak memiliki kekuasaan dari luar komunitas Anda ketahuan berburu rusa yang dilindungi di TNGL oleh ranger. Ranger memperbolehkan mereka untuk melanjutkan tanpa konsekuensi.
2	10	10. Seseorang yang memiliki kekuasaan dari luar komunitas Anda ketahuan menebang pohon di TNGL oleh ranger. Ranger menangkap mereka dan mereka diproses hukum.
2	11	11. Seseorang yang memiliki kekuasaan dari komunitas Anda ketahuan menebang pohon di TNGL oleh ranger. Ranger memperbolehkan mereka untuk melanjutkan tanpa konsekuensi.
2	12	12. Seseorang yang tidak memiliki kekuasaan dari luar komunitas Anda ketahuan menebang pohon di TNGL oleh ranger. Ranger menyita barang bukti (contohnya: kayu dan gergaji mesin) dan memperingatkan mereka untuk tidak menebang lagi.
2	13	13. Seseorang yang memiliki kekuasaan dari luar komunitas Anda ketahuan berburu rusa yang dilindungi di TNGL oleh ranger. Ranger menerima sogokan dan mereka diperbolehkan untuk melanjutkan.
2	14	14. Seseorang yang memiliki kekuasaan dari komunitas Anda ketahuan berburu rusa yang dilindungi di TNGL oleh ranger. Ranger menyita barang bukti (contohnya: rusa dan alat berburu) dan memperingatkan mereka untuk tidak berburu lagi.
2	15	15. Seseorang yang tidak memiliki kekuasaan dari komunitas Anda ketahuan berburu rusa yang dilindungi di TNGL oleh ranger. Ranger menangkap mereka dan mereka diproses hukum.
2	16	16. Seseorang yang tidak memiliki kekuasaan dari komunitas Anda ketahuan menebang pohon di TNGL oleh ranger. Ranger menerima sogokan dan mereka diperbolehkan untuk melanjutkan.
3	17	17. Seseorang yang tidak memiliki kekuasaan dari luar komunitas Anda ketahuan berburu rusa yang dilindungi di TNGL oleh ranger. Ranger menyita barang bukti (contohnya: rusa dan alat berburu) dan memperingatkan mereka untuk tidak berburu lagi.
3	18	18. Seseorang yang memiliki kekuasaan dari luar komunitas Anda ketahuan berburu rusa yang dilindungi di TNGL oleh ranger. Ranger menangkap mereka dan mereka diproses hukum.
3	19	19. Seseorang yang memiliki kekuasaan dari komunitas Anda ketahuan menebang pohon di TNGL oleh ranger. Ranger menyita barang bukti (contohnya: kayu dan gergaji mesin) dan memperingatkan mereka untuk tidak menebang lagi.

3	20	20. Seseorang yang tidak memiliki kekuasaan dari komunitas Anda ketahuan menebang pohon di TNGL oleh ranger. Ranger menangkap mereka dan mereka diproses hukum.
3	21	21. Seseorang yang memiliki kekuasaan dari komunitas Anda ketahuan berburu rusa yang dilindungi di TNGL oleh ranger. Ranger memperbolehkan mereka untuk melanjutkan tanpa konsekuensi.
3	22	22. Seseorang yang tidak memiliki kekuasaan dari komunitas Anda ketahuan berburu rusa yang dilindungi di TNGL oleh ranger. Ranger menerima sogokan dan mereka diperbolehkan untuk melanjutkan.
3	23	23. Seseorang yang tidak memiliki kekuasaan dari luar komunitas Anda ketahuan menebang pohon di TNGL oleh ranger. Ranger memperbolehkan mereka untuk melanjutkan tanpa konsekuensi.
3	24	24. Seseorang yang memiliki kekuasaan dari luar komunitas Anda ketahuan menebang pohon di TNGL oleh ranger. Ranger menerima sogokan mereka dan mereka diperbolehkan untuk melanjutkan.
4	25	25. Seseorang yang memiliki kekuasaan dari komunitas Anda ketahuan menebang pohon di TNGL oleh ranger. Ranger menangkap mereka dan mereka diproses hukum.
4	26	26. Seseorang yang tidak memiliki kekuasaan dari luar komunitas Anda ketahuan menebang pohon di TNGL oleh ranger. Ranger menerima sogokan mereka dan mereka diperbolehkan untuk melanjutkan.
4	27	27. Seseorang yang memiliki kekuasaan dari komunitas Anda ketahuan berburu rusa yang dilindungi di TNGL oleh ranger. Ranger menerima sogokan dan mereka diperbolehkan untuk melanjutkan.
4	28	28. Seseorang yang memiliki kekuasaan dari luar komunitas Anda ketahuan menebang pohon di TNGL oleh ranger. Ranger menyita barang bukti (contohnya: kayu dan gergaji mesin) dan memperingatkan mereka untuk tidak menebang lagi.
4	29	29. Seseorang yang memiliki kekuasaan dari luar komunitas Anda ketahuan berburu rusa yang dilindungi di TNGL oleh ranger. Ranger memperbolehkan mereka untuk melanjutkan tanpa konsekuensi.
4	30	30. Seseorang yang tidak memiliki kekuasaan dari komunitas Anda ketahuan menebang pohon di TNGL oleh ranger. Ranger memperbolehkan mereka untuk melanjutkan tanpa konsekuensi.
4	31	31. Seseorang yang tidak memiliki kekuasaan dari luar komunitas Anda ketahuan berburu rusa yang dilindungi di TNGL oleh ranger. Ranger menangkap mereka dan mereka diproses hukum.
4	32	32. Seseorang yang tidak memiliki kekuasaan dari komunitas Anda ketahuan berburu rusa yang dilindungi di TNGL oleh ranger. Ranger menyita barang bukti (contohnya: rusa dan alat berburu) dan memperingatkan mereka untuk tidak berburu lagi.

Table A6.4. Respondents in Indonesia were randomly allocated to one of the following vignettes in Experiment 2, which assessed the impact of corruption and norms on willingness to comply.

Vignette	Level of Compliance	Level of Corruption	English	Bahasa Indonesia
1	high	low	Members of your community rarely break rules by entering TNGL to collect resources. If caught breaking rules by a ranger, it is very likely that offenders will face criminal charges or fines.	Masyarakat di komunitas Anda jarang melanggar peraturan dengan memasuki TNGL untuk mengambil sumberdaya. Jika ketahuan melanggar peraturan oleh ranger, kemungkinan besar pelaku akan diproses hukum atau denda
2	low	high	Members of your community often break rules by entering TNGL to collect resources. If caught breaking rules by a ranger, it is very likely that offenders can pay a bribe and avoid any criminal charges.	Masyarakat di komunitas Anda sering melanggar peraturan dengan memasuki TNGL untuk mengambil sumberdaya. Jika ketahuan melanggar peraturan oleh ranger, kemungkinan besar pelaku dapat menyogok ranger dan terbebas dari semua proses hukum

3	high	high	Members of your community rarely break rules by entering TNGL to collect resources. If caught breaking rules by a ranger, it is very likely that offenders can pay a bribe and avoid any criminal charges.	Masyarakat di komunitas Anda jarang melanggar peraturan dengan memasuki TNGL untuk mengambil sumberdaya. Jika ketahuan melanggar peraturan oleh ranger, kemungkinan besar pelaku dapat menyogok ranger dan terbebas dari semua proses hukum
4	low	low	Members of your community often break rules by entering TNGL to collect resources. If caught breaking rules by a ranger, it is very likely that offenders will face criminal charges or fines.	Masyarakat di komunitas Anda sering melanggar peraturan dengan memasuki TNGL untuk mengambil sumberdaya. Jika ketahuan melanggar peraturan oleh ranger, kemungkinan besar pelaku akan diproses hukum atau denda

Table A6.5. Survey instrument in English and in Bahasa Indonesia.

Question (Bahasa Indonesia)	Answer options (Bahasa Indonesia)
Section 1: Survey location (interviewer completes)	
Provinsi	
Kabupaten	
Kabupaten apa?	
Kecamatan	
Desa	
Dusun	
Siapa yang melakukan wawancara?	
Apa jenis kelamin responden?	
Section 2: Experimental design details (not shown to respondent)	
Vignette order: \${v_order}	
Vignette dipilih dari blok: \${block}	
Scenario number: \${rand_scenario}	
Section 3: Consent	

<p>Nama saya \${interviewer} dan saya bekerja untuk proyek penelitian yang dilakukan oleh Universitas Bangor di Inggris. Hari ini, saya akan mengajak Anda untuk ikut serta dalam studi yang pendek.</p> <p>Maksud dari penelitian ini adalah untuk memahami seperti apa kehidupan masyarakat seperti Bapak/Ibu yang tinggal di dekat kawasan lindung. Saya mengajak Bapak/Ibu untuk ikut serta karena Bapak/Ibu tinggal berdekatan dengan salah satu kawasan. Secara keseluruhan, kami berharap bisa bertanya pada sekitar 200 sampai 300 orang seperti Bapak/Ibu yang tinggal di dekat kawasan lindung.</p> <p>Jika Bapak/Ibu bersedia untuk ikut serta, saya akan menanyakan beberapa pertanyaan dan mencatat jawaban Bapak/Ibu di alat ini [tunjukkan kuesioner di tablet]. Saya tidak akan pernah mencatat nama atau alamat Bapak/Ibu di sini, atau juga di lembar yang lain; jawaban Bapak/Ibu bersifat pribadi dan rahasia. Bagian pertama pertanyaan adalah tentang Bapak/Ibu dan rumah tangga Bapak/Ibu, kemudian saya akan bertanya tentang opini Bapak/Ibu mengenai peraturan-peraturan dari kawasan lindung. Ini mungkin akan memakan waktu sekitar 30 menit sampai 1 jam.</p> <p>Karena saya tidak mencatat nama Bapak/Ibu, jawaban Bapak/Ibu tidak dapat dikaitkan dengan Bapak/Ibu, dan juga tidak mungkin untuk mengidentifikasi Bapak/Ibu dari catatan kami. Informasi yang Bapak/Ibu berikan tidak akan dibagikan kepada siapapun di luar tim penelitian dan hanya akan digunakan oleh anggota tim penelitian yang berbasis di Inggris. Jawaban Bapak/Ibu, bersama-sama dengan responden lainnya, akan digunakan untuk menulis laporan penelitian.</p> <p>Penelitian ini telah disetujui oleh Komite Etik Universitas Bangor. Jika Bapak/Ibu memilih untuk tidak ikut serta, silakan saja. Juga, jika Bapak/Ibu awalnya setuju tapi kemudian berubah pikiran dan ingin berhenti di bagian tertentu, mohon katakan pada saya dan saya akan langsung berhenti. Sebelum lebih lanjut, apakah Bapak/Ibu memiliki pertanyaan yang ingin ditanyakan kepada saya?</p> <p>Jika Bapak/Ibu memiliki kekhawatiran atau sesuatu yang mengganjal, silakan hubungi kami melalui nomor ini [berikan kartu kontak].</p> <p>Apakah Bapak/Ibu bersedia untuk ikut serta dalam penelitian ini?</p>	<p>Iya / Tidak</p>
<p>Responden harus menyetujui pernyataan berikut:</p> <p><b>**Saya menyatakan bahwa saya telah mendapatkan lembar Informasi ConHub yang dibacakan kepada saya dan saya mengerti informasi terkait penelitian ini. Saya memiliki kesempatan untuk bertanya jika perlu dan sudah mendapatkan jawaban yang memuaskan**</b></p> <p><b>**Saya mengerti bahwa keikutsertaan saya bersifat sukarela dan bahwa saya bebas untuk tidak melanjutkan kapan saja tanpa memberikan alasan tertentu. Jika saya tidak melanjutkan, data saya akan dibuang dari penelitian ini dan dihilangkan. **</b></p> <p><b>**Saya mengerti bahwa jawaban yang saya berikan akan digunakan sesuai yang sudah dijelaskan kepada saya.**</b></p> <p><b>**Berdasarkan hal tersebut, saya bersedia untuk ikut serta dalam penelitian ini. ** "</b></p>	<p>Iya / Tidak</p>
<p>Section 4: COVID-19 precautions</p>	
<p>Jika pemandu/pendamping belum menjelaskan tentang tindakan pencegahan COVID yang sudah dilakukan oleh Tim, jelaskan kepada responden:</p> <ol style="list-style-type: none"> <li>1. Bahwa tim bebas dari gejala apapun</li> <li>2. Bahwa tim sudah melakukan cek rutin COVID sebelum ke lapangan</li> <li>3. Bahwa tim menggunakan masker untuk melindungi diri sendiri dan responden</li> </ol>	

4. Bahwa tim akan melakukan kegiatan di luar atau area terbuka dan menjaga jarak	
5. Tim akan rutin mencuci tangan	
Apakah ada orang di rumah tangga Anda yang memiliki gejala COVID19 dalam seminggu terakhir?	
Gejalanya adalah: * batuk yang baru terjadi dan terus-menerus, * kesulitan bernafas, * demam tinggi, * dan kehilangan kemampuan pengecapan atau penciuman?	
Berterima kasih kepada responden atas waktu mereka, jelaskan meskipun orang yang sakit tidak menderita COVID, kami tidak mau menyebabkan responden lain beresiko menderita COVID. Doakan semoga responden atau anggota keluarga mereka cepat pulih.	
Section 5: Respondent demographics	
Saya akan mengajukan pertanyaan tentang diri Anda dan anggota rumah tangga Anda, rumah tangga yang saya maksud adalah mereka yang makan dan tidur di rumah yang sama, termasuk anak-anak yang mungkin tinggal di asrama/bersekolah di luar	
1. Berapa usia Anda?	
2. Berapa banyak orang yang tinggal di rumah tangga Anda?	
3a. Apa etnis terbesar di rumah tangga Anda?	
3b. Tolong jelaskan etnik yang mana	
4. Sudah berapa lama Anda tinggal di desa ini?	
5. Apakah saat ini Anda masih bersekolah?	
6. Berapa tahun pendidikan yang pernah Anda tempuh?	
7. Ada berapa anggota rumah tangga yang berusia 12 tahun atau diatas yang menyelesaikan sekolah minimal 5 tahun?	
8. Apakah ada anak berusia 7 sampai 18 tahun di rumah tangga anda yang tidak bersekolah?	
Section 6: Multi-dimensional Poverty Assessment	
1. Bisakah Anda memberitahu daftar mata pencaharian anggota rumah tangga Anda	
2. Apakah rumah tinggal utama rumah tangga memiliki listrik?	
3. Apakah rumah tangga punya akses ke toilet?	
3a. Apa jenis toiletnya?	
3b. Apa jenis toilet yang 'lain'?	
4. Apakah rumah tangga ini berbagi toilet dengan rumah tangga lain?	
5a. Apa sumber utama air minum dalam rumah tangga ini?	
5b. Apa jenis sumber air 'lain'?	
6. Berapa menit jarak yang ditempuh rumah tangga ke sumber air minum? Pulang pergi dengan menggunakan transportasi yang paling sering digunakan untuk mengambil air	
7a. Terbuat dari apa lantai dari tempat tinggal utama rumah tangga ini?	

7b. Terbuat dari bahan apa lantai yang 'lain'?	
8a. Apa bahan bakar utama memasak yang digunakan rumah tangga?	
8b. Apa bahan bakar 'lain'?	
9. Apakah ada anak usia di bawah 18 tahun dalam rumah tangga ini yang meninggal dalam 5 tahun terakhir?	
10. Berapa banyak anak usia di bawah 18 tahun yang meninggal di rumah tangga ini dalam 5 tahun terakhir?	
Saya akan mengajukan pertanyaan tentang bagaimana cara rumah tangga Anda memenuhi kebutuhan pangan dalam 12 bulan terakhir	
11. Dalam 12 bulan terakhir, seberapa sering ketiadaan makanan dalam rumah tangga Anda karena kurangnya sumber daya untuk mendapatkan makanan?	
12. Dalam 12 bulan terakhir, seberapa sering anggota rumah tangga tidur malam hari dalam keadaan lapar karena tidak ada cukup makanan?	
13. Dalam 12 bulan terakhir, seberapa sering anggota rumah tangga tidak makan apapun sehari semalam karena tidak ada cukup makanan?	
Pertanyaan berikut adalah tentang barang-barang yang Anda dan rumah tangga Anda miliki	
14. Berapa banyak radio yang dimiliki rumah tangga Anda?	
15. Berapa banyak TV yang dimiliki rumah tangga Anda?	
16. Berapa banyak telepon genggam yang dimiliki rumah tangga Anda?	
17. Berapa banyak sepeda yang dimiliki rumah tangga Anda?	
18. Berapa banyak sepeda motor yang dimiliki rumah tangga Anda?	
19. Berapa banyak kulkas yang dimiliki rumah tangga Anda?	
20. Berapa banyak mobil atau truk yang dimiliki rumah tangga Anda?	
Pertanyaan berikut adalah tentang bagaimana Anda memandang diri Anda dan rumah tangga Anda. Tolong jawab dalam skala sangat setuju ke sangat tidak setuju.	
21. Rumah tangga Anda miskin	Sangat setuju, Setuju, Netral, Tidak setuju, Sangat tidak setuju, Memilih untuk tidak menjawab, Tidak tahu
22. Rumah tangga Anda bahagia	
23. Rumah tangga Anda sejahtera	
24. Anggota masyarakat bersedia untuk membantu satu sama lain (misalnya, terkait pekerjaan, makanan atau keuangan)	
25. Tingkat kepercayaan di masyarakat ini tinggi	
26. Konflik sering muncul antara orang dan keluarga di masyarakat ini	
27. Luas tanah yang anda miliki saat ini menandakan bahwa anda makmur	
28. \${interviewer}, ada komentar di Bagian Kemiskinan (poverty)?	
Section 7: Factorial Survey Experiment → \${v_X_q} – represents the vignette number shown to the respondent	
Sekarang Saya akan membacakan beberapa deskripsi singkat dari interaksi yang mungkin terjadi antara ranger TNGL dan masyarakat yang memasuki Taman Nasional. Untuk masing-masing deskripsi, Saya ingin Bapak/Ibu memikirkan situasinya, dan beritahu Saya seberapa adil menurut Bapak/Ibu hasilnya	

Vignette 1 : \${v_1_q} Seberapa adil menurut Anda	Dengan sangat adil, Dengan adil, Netral, Dengan tidak adil, Dengan sangat tidak adil, Memilih untuk tidak menjawab, Tidak tahu
v1b. Seberapa mungkin menurut Anda situasi tersebut akan terjadi di kehidupan nyata?	Sangat mungkin, Mungkin, Netral, Tidak mungkin, Sangat tidak mungkin, Memilih untuk tidak menjawab, Tidak tahu
Vignette 2 : \${v_2_q} Seberapa adil menurut Anda	Dengan sangat adil, Dengan adil, Netral, Dengan tidak adil, Dengan sangat tidak adil, Memilih untuk tidak menjawab, Tidak tahu
v2b. Seberapa mungkin menurut Anda situasi tersebut akan terjadi di kehidupan nyata?	Sangat mungkin, Mungkin, Netral, Tidak mungkin, Sangat tidak mungkin, Memilih untuk tidak menjawab, Tidak tahu
Vignette 3 : \${v_3_q} Seberapa adil menurut Anda	Dengan sangat adil, Dengan adil, Netral, Dengan tidak adil, Dengan sangat tidak adil, Memilih untuk tidak menjawab, Tidak tahu
v3b. Seberapa mungkin menurut Anda situasi tersebut akan terjadi di kehidupan nyata?	Sangat mungkin, Mungkin, Netral, Tidak mungkin, Sangat tidak mungkin, Memilih untuk tidak menjawab, Tidak tahu
Vignette 4 : \${v_4_q} Seberapa adil menurut Anda	Dengan sangat adil, Dengan adil, Netral, Dengan tidak adil, Dengan sangat tidak adil, Memilih untuk tidak menjawab, Tidak tahu
v4b. Seberapa mungkin menurut Anda situasi tersebut akan terjadi di kehidupan nyata?	Sangat mungkin, Mungkin, Netral, Tidak mungkin, Sangat tidak mungkin, Memilih untuk tidak menjawab, Tidak tahu
Vignette 5 : \${v_5_q} Seberapa adil menurut Anda	Dengan sangat adil, Dengan adil, Netral, Dengan tidak adil, Dengan sangat tidak adil, Memilih untuk tidak menjawab, Tidak tahu
v5b. Seberapa mungkin menurut Anda situasi tersebut akan terjadi di kehidupan nyata?	Sangat mungkin, Mungkin, Netral, Tidak mungkin, Sangat tidak mungkin, Memilih untuk tidak menjawab, Tidak tahu
Vignette 6 : \${v_6_q} Seberapa adil menurut Anda	Dengan sangat adil, Dengan adil, Netral, Dengan tidak adil, Dengan sangat tidak adil, Memilih untuk tidak menjawab, Tidak tahu
v6b. Seberapa mungkin menurut Anda situasi tersebut akan terjadi di kehidupan nyata?	Sangat mungkin, Mungkin, Netral, Tidak mungkin, Sangat tidak mungkin, Memilih untuk tidak menjawab, Tidak tahu
Vignette 7 : \${v_7_q} Seberapa adil menurut Anda	Dengan sangat adil, Dengan adil, Netral, Dengan tidak adil, Dengan sangat tidak adil, Memilih untuk tidak menjawab, Tidak tahu
v7b. Seberapa mungkin menurut Anda situasi tersebut akan terjadi di kehidupan nyata?	Sangat mungkin, Mungkin, Netral, Tidak mungkin, Sangat tidak mungkin, Memilih untuk tidak menjawab, Tidak tahu



Vignette 8 : \${v_8_q} Seberapa adil menurut Anda	Dengan sangat adil, Dengan adil, Netral, Dengan tidak adil, Dengan sangat tidak adil, Memilih untuk tidak menjawab, Tidak tahu
v8b. Seberapa mungkin menurut Anda situasi tersebut akan terjadi di kehidupan nyata?	Sangat mungkin, Mungkin, Netral, Tidak mungkin, Sangat tidak mungkin, Memilih untuk tidak menjawab, Tidak tahu
Section 8: Scenarios	
Tolong beritahu Saya sejauh mana Anda setuju atau tidak setuju dengan pernyataan berikut	
1. Melanggar peraturan TNGL membahayakan nama baik masyarakat di desa/komunitas ini	Sangat setuju, Setuju, Netral, Tidak setuju, Sangat tidak setuju, Memilih untuk tidak menjawab, Tidak tahu
2. Peraturan TNGL mendukung konservasi keanekaragaman hayati	
3. Peraturan TNGL adil dan sejalan dengan peraturan/hukum	
4. Melanggar peraturan dianggap tidak setia terhadap sesama masyarakat di desa/komunitas	
Sekarang Saya akan membacakan skenario khayalan. Berdasarkan skenario ini, Saya akan menanyakan beberapa pertanyaan, tolong dijawab secara jujur	
Bayangkan situasi berikut. \${scenario}	
5. Jika skenario semacam ini benar terjadi, seberapa bersedia Anda, secara umum mengikuti peraturan TNGL?	Sangat bersedia, Bersedia, Netral, Tidak bersedia, Sangat tidak bersedia, Memilih untuk tidak menjawab, Tidak tahu
6. Jika skenario semacam ini benar terjadi, seberapa sering dalam beberapa bulan mendatang Anda akan mengikuti peraturan TNGL?	Setiap saat, Hampir setiap saat, Kadang-kadang, Jarang, Tidak pernah, Memilih untuk tidak menjawab, Tidak tahu
7. Jika skenario semacam ini benar terjadi, sejauh mana Anda mempertimbangkan untuk melanggar peraturan TNGL?	Sangat mempertimbangkan, Mungkin mempertimbangkan, Tidak akan mempertimbangkan, Memilih untuk tidak menjawab, Tidak tahu
Section 9: End of survey	
Survey ini sudah selesai. Terima kasih sudah berpartisipasi. Apakah anda memiliki pertanyaan untuk saya?	
\${interviewer}, seberapa besar partisipasi peserta selama wawancara berlangsung?	Sangat tertarik, Tertarik, Netral, Tidak tertarik, Sangat tidak tertarik
\${interviewer}, bagaimana pendapatmu melakukan survey pada orang ini?	Sangat mudah, Cukup mudah, Tidak mudah tapi juga tidak sulit, Cukup sulit, Sangat sulit
\${interviewer}, apakah ada tambahan?	

# Appendix 7

Survey instruments in Kiswahili

## Chapter 2

### Group exercise protocols - Kiswahili

#### Information script [15 minutes]

Habari, Jina langu ni ..... na huyu ni mwenzangu ..... Ni watafiti tunaofanya kazi na Harriet Ibbett, ambaye ametokea Chuo Kikuu cha Bangor Uingereza. Utafiti wake una lengo la kuelewa namna rasilimali zinavyotumika na watu wanoishi katika uwanda wa Ruaha-Rungwa. Tumekuomba kuungana nasi leo ili utusaidie kuelewa utamaduni wenu na kutueleza namna sahihi ya kuuliza watu juu ya matumizi ya rasilimali asili. Tunatarajia mazungumzo kuchukua muda wa saa mbili, japokuwa yanaweza kuchukua muda mrefu au mfupi kutegemea na majibu yenu.

Sisi ni watafiti huru na hatuhusiani na Serikali au Mashirika yasiyokuwa ya serikali ila tuna kibali kutoka Serikali ya Tanzania na Serikali ya kijiji ya kufanya utafiti huu. Ushiriki wako ni wa kujitolea. Unaweza kujiondoa wakati wowote bila kutoa sababu. Kama hautajisikia vizuri kujibu baadhi ya maswali unarususiwa kutokujibu. Kama utataka kuruka swali au mada tafadhali sema.

Mimi {.....} nitaongoza majadiliano. Nitauliza maswali na kukuomba kushiriki katika mazoezi tuliyoyaandaa. XXX atamsaidia Harriet kuelewa kila mnachokisema, na Harriet ataandika majibu yenu na majadiliano anayoendelea kwenye daftari. Kwa ridhaa yako tutapenda pia kurekodi majadiliano haya. Hii ni kwa sababu wakati mwingine watu huongea kwa mara moja. Hivyo, kuwa vigumu kuandika maoni ya kila mtu.

Majibu yenu na majadiliano yatakuwa siri na hayatahusishwa na mtu mmoja mmoja au kijiji chenu. Taarifa mtakayotupatia itatunzwa kwenye kompyuta ambayo Harriet tuu ndio anauwezo wa kuitumia kwakutumia neno siri. Harriet atatumia majibu ya utafiti huu kusaidia kutengeneza tafiti za siku zijazo kwa jamii juu ya matumizi ya rasilimali kwa njia zinazozingatia upole na heshima kwa utamaduni wenu. Harriet pia atachapisha majibu ya utafiti kimataifa ili kusaidia watafiti wa nchi nyingine kuelewa jinsi ya kutafiti mada kama hizi.

Kwasababu tupo hapa kujifunza kuhusu jamii yenu tunaweza kuwa na maswali mengi au kunaweza kuwa na vitu hatuvielewi, hivyo tutashukuru sana kama utatujibu maswali yetu. Ili kuhakikisha kila mtu ananafasi sawa ya kuzungumza na kuchangia mawazo yao, tunakuomba uheshimu na usikilize kile ambacho kila mtu atasema. Hakuna majibu sahihi au yasiyosahihi na kila mmoja ananafasi sawa ya kuzungumza.

Utafiti huu umeruhusiwa na kamati ya maadili ya Chuo kikuu cha Bangor. Kama una swali lolote, tafadhali niulize na nitajitahidi niwezavyo kukujibu.

Kama utakuwa na wasiwasi au unataka kutoa malalamiko nitakupa mawasiliano ya mtu unayeweza kuzungumza naye.

Wasomee washiriki ratiba: zoezi 1 (kuorodhesha shughuli mbalimbali - kadirio la lisaa), mapumziko (dakika 10), halafu zoezi lingine (Kuweka shughuli kwenye makundi - kadirio la lisaa na nusu).

Je una swali lolote au wasiwasi mpaka sasa?

(Tafadhali wape watu nafasi ya kufikiri na kuchangia)

Uko tayari kuendelea na mazungumzo?

(Pata ridhaa ya maneno kutoka kwa kila mshiriki).

Utajisikia vizuri kama tutarekodi majadiliano haya

(Kama mtu yeyote hajakubali, tafadhali usirekodi).

Pita kwa kila mtu kwenye kundi na umwulize umri na kabila – elezea kuwa hii ni kwa ajili ya kutusaidia kuelewa maoni ya makundi mbali mbali ya watu yaliyomo kwenye kijiji.

***Kuorodhesha shughuli mbalimbali*** [kadirio la lisaa]

Ningependa ufikiri juu ya sababu zote unazojua zinazowafanya watu wanaoishi katika jamii yenu kwenda kwenye *[Hifadhi ya Taifa ya Ruaha / Pori la akiba (GR) / Pori tengefu (WMA)]*

[ Subiri watu wafikiri ]

Kwa mfano, watu huweza kwenda kuchukua rasilimali, au kwa ajili ya mahitaji yao ya kila siku.

Watu wengi wanaweza kwenda kwa sababu zile zile, au pengine ni watu wachache tu huwenda kwa sababu mbalimbali.

Kama kundi ningependa mniambie sababu tofauti tofauti inazowafanya watu waende kwenye *[ Hifadhi ya Taifa ya Ruaha / Pori la akiba (GR) / Pori Tengefu (WMA) ]*, na kila mtakapotaja tutaandika kila moja kwenye karatasi.

(Endelea kuuliza) Unaweza kufikiri sababu zingine?

Andika vitu vyote kwa kuzingatia mtiririko wa vinavyotajwa

- Unaweza kupata rasilimali asili yoyote?
- Unaweza kupata rasilimali asili kwa ajili ya kipato?
- Je kuna sababu za kiutamaduni na urithi?
- Ni muhimu kwa imani yako?

**\*\*KUWA MAKINI USIWAPE WATU MAJIBU\*\***

Ni hayo to?

Orodha hii ikikamilika, kama kuwinda, kuchunga mifugo, kuvua samaki, kurina asali au kuokota kuni yamejitokeza, uliza maswali:

- Watu wangapi wanafanya shughuli hizi?
- Watu gani hufanya shughuli hizi?
- Kwanini watu hufanya hivi/hufanya shughuli hizi?
- Ni wakati gani watu hufanya hivi/shughuli hizi?

Second free list

Sasa naomba ufikiri kwa namna unavyojua wewe kuhusu athari hasi za [ *Hifadhi ya Taifa ya Ruaha / Pori la akiba (GR) / Pori Tengefu (WMA)* ] kwa watu wanaoishi katika jamii

—kwa mfano unaweza kuwa unafahamu matatizo au changamoto ambazo watu hukutana nazo.

Tena, ningependa uniambie kuhusu changamoto hizo moja baada ya nyingine na tutatengeneza orodha na kuandika kwenye karatasi.

Andika kwenye karatasi kubwa vitu vyote kwa kufuata mtiririko wa vinavyotajwa

Vitu ambavyo unapenda kufanya, lakini hauruhusiwi, gharama za kuendesha maisha, afya na kipato

Orodhesha vitu vyote kwenye karatasi kubwa kwa mtiririko wa vilivyo tajwa

- Je kuna vitu ambavyo wangependa kufanya lakini hawawezi?
- Je kuna gharama zozote za kuishi pembezoni mwa hifadhi?
- Je kuna sababu nyingine zozote?

Je kuna sababu nyingine zozote unazozifahamu?

### **Kuweka kwenye makundi [kadirio la lisa na nusu]**

Katika zoezi linalofuata, nina kadi tofauti tofauti. Katika kila kadi kuna picha za watu na ufafanuzi wa shughuli ambazo mtu anaweza kufanya katika ardhi ya kijiji na sababu za kufanya shughuli hizo.

Kama mtu binafsi na mwanajamii unaweza kujisikia huru kuzungumza kuhusu baadhi ya shughuli kuliko nyingine.

Ningependa muangalie kila kadi, na kama kundi, mfanye maamuzi kama watu watafurahi kiasi gani kuzungumzia shughuli tajwa kwenye kadi kama ikifanywa kwenye ardhi ya kijiji.

Vitu tofauti tofauti vinaweza kuwa nyeti kwasababu mbalimbali.

Baadhi ya vitu vinaweza kuwa nyeti kwasababu haikubaliki kiutamaduni au sio sahihi kuuliza kuhusu vitu hivyo. Kwa mfano, kwa Uingereza si sahihi kumwuliza mwanamke umri wake, Tanzania si sahihi, kumuuliza mtu kama ameenda chooni leo.

Vitu vingine vinaweza kuwa nyeti kwa sababu nyingine.

Kama ukifanya shughuli hizi unaweza kuwa na wasiwasi kuwa wengine hawata kuunga mkono au watakufikiria vibaya.

Au shughuli nyingine zinaweza kuwa zinafanyika kwa siri sana au usiku tuu.

Au unaweza kuwa na wasiwasi kujadili shughuli hiyo/hizo kunaweza kukuweka matatizoni.

Ningependa muangalie kila kadi, na mzichambue na kuziweka katika makundi kutegemea na vile zinavyoendana na jinsi watu wa jamii hii wanaweza kuzungumzia.

Kwa mfano, unaweza kuwa na fungu moja la kadi linaloonyesha shughuli ambazo mnafikiri watu hawatapenda kuzungumzia.

Katika fungu lingine unaweza kuwa na kadi zinazoonyesha shughuli ambazo unafikiri watu watafurahia sana na hawatakuwa na tatizo kuzungumzia.

Pitia kila kadi kwa mfumo wa kuangalia mojamoya.

- Waambie watu wafanye majadiliano juu ya shughuli
- Waulize kwanini shughuli hii ni nyeti/sio nyeti?

- Jinsi unyeti wa shughuli unavyotofautiana na zile zilizoko kwenye kundi jingine (m.f kwanini hii ni + au – nyeti?)

Kwa kadi za wanyama

- Rejea kila kadi kwa wanyama mara moja.
- Chunguza ikiwa unyeti unabadilika kama sababu ya kumuua mnyama inabadilika.

**\*\* Mwishoni –ANDIKA JINA LA KILA KUNDI ZILIPOWEKWA KADI\*\***

Waulize jina la kila kundi –na wakukumbushe sababu kwanini kadi ipo katika kundi hilo

[Kusanya kadi na zirudishe katika mpangilio sahihi. Rudia kuchambua kadi]

Halafu, ningependa kurudia kuchambua kadi kwenye makundi. Ila wakati huu ningependa mniambie jinsi mtakavyofurahia kuzungumzia shughuli zilizonyeshwa kwenye kadi kama zingefanywa ndani ya [RNP / GR / WMA].

Rejea kila kadi. Uliza kama watu bado wanafurahia kuzungumzia shughuli kwenye kadi ukilinganisha na kama ikifanyika kwenye eneo la kijiji.

Wrap-up [10 minutes]

Washukuru watu kwa kushiriki

Uliza kama kuna swali lingine

Mwishoni mwa mjadala--piga picha kila orodha kwenye karatasi ya A2, andika jina la kijiji na namba ya kundi.

### **Maswali yanayojitokeza mara kwa mara na majibu yaliyopendekezwa**

Je, lengo la mwisho la utafiti ni nini? Je, utaleta faida gani kwa jamii?

- Ni vizuri sisi kama watafiti kuelewa ni kwa nini watu huenda kwenye maeneo yaliyohifadhiwa, na shida/ matatizo wanayokumbana nayo juu ya matumizi ya maliasili
- Tunaweza kutoa baadhi ya majibu ya utafiti huu kwa serikali kuhusu mahitaji ya jamii yanayowapelekea kuingia kwenye maeneo yaliyohifadhiwa ili kujipatia rasilimali

Kwa nini tumetenganishwa kwa jinsia?

- Kwa kawaida wanaume na wanawake hutumia rasilimali asili kwa njia tofauti
- Kwa kuwa na vikundi vya wanaume tu na wanawake tu, inatusaidia kupata ufahamu Zaidi wa jinsi utumiaji wa rasilimali asili hii hutofautiana .

Mwaka jana, watafiti wengine walikuja na kutuuliza maswali kama hayo. Walitoa ahadi mbalimbali lakini hakuna kilichotokea/kubadilika. Kwanini tuzungumze na nyinyi sasa?

- Tunafanya kazi hapa kwa idhini ya serikali na tunapaswa kutoa mrejesho wa baadhi ya majibu ya utafiti huu.
- Tunaweza kuwaambia matatizo yenu na sababu zinazowapelekea watu kufuata/kutafuta rasilimali ndani ya maeneo yaliyohifadhiwa.
- Hatuwezi kuahidi chochote kwa sasa lakini tunaweza kufikisha sauti zenu na mapendekezo yenu mahali husika.

Katika kijiji hiki pia tuna shida na XXX

- Andika maelezo juu ya shida zao, uliza maswali, onyesha shauku na wasiwasi.
- Hatuwezi kuahidi mabadiliko lakini tutawashirikisha wahusika matatizo yenu.

Upatikanaji wa matokeo ya utafiti na namna yatakavyosambazwa.

- Matokeo yatachapishwa katika ripoti ya kisayansi
- Matokeo yatatumika pia kuarifu uchunguzi Zaidi ambao utafanyika mwakani. Tutarudi kwa lengo la kumalizia utafiti huu.
- Hivi sasa tunafikiria juu ya njia bora ya kusambaza taarifa hii na tunathamini mawazo yenu juu ya jinsi tunavyoweza kufanikiwa katika hili.

Table A7.1. Survey Instrument used in Chapter 2 in Kiswahili

	Question::Kiswahili	Hint::Kiswahili
Section 1. Survey location		
start_time		
end_time		
Date		
enumerator	Nani anafanya mahojiano?	
region	Mkoa	
district	Wilaya	
village	Jina la kijiji	
pa_type	Hifadhi iliyokaribu hapa ni ipi	**Usimwulize mhojiwa hili**
hi_present	Harriet yupo?	
Section 2. Consent		
ethics_statement	Soma formu ya kuomba ridhaa ya mhojiwa	<p>Habari, Jina langu ni \${enumerator} na ninamsaidia Harriet Ibbett anayetoka chuo kikuu cha Bangor Uingereza, kufanya utafiti. Utafiti wa Harriet unahusu kuelewa njia nzuri ya kuuliza maswali kuhusu utumiaji wa rasilimali asili.</p> <p>Utafiti una sehemu mbili. Kwanza kabisa, tutakuuliza maoni yako kuhusu aina mbalimbali za matumizi ya rasilimali asili. Sehemu ya pili ya utafiti ni kuhusu jinsi unavyopenda kujibu maswali yanayoweza kuwa nyeti.</p> <p>Tutawaomba watu wengi kujibu maswali ya utafiti huu ili tuweze kuelewa jinsi watu wanavyopenda kujibu maswali. Kwa kutumia maoni na mapendekezo yako tutaandaa utafiti mpya, ambao utahusisha ukusanyaji wa taarifa kutoka kwa watu, kuhusu utumiaji wa rasilimali karibu na maeneo yaliyohifadhiwa. Taarifa utakayotupatia ni ya muhimu sana katika kuhakikisha kwamba tutauliza maswali kwakutumia njia sahihi.</p> <p>Mahojiano yanakadiriwa kuchukua takribani lisaa na robo. Taarifa yoyote utakayotupatia itakuwa ya siri, hii inamaana sitaandika jina lako au taarifa yoyote ambayo itaweza kukutambulisha binafsi au kaya yako. Majibu yako hayatatolewa kwa mtu yoyote kwa njia yoyote ambayo mtu anaweza kuhusianisha majibu yako na wewe.</p> <p>Nitaandika majibu yako yote kwenye simu hii. Majibu yako yote yatahifadhiwa kwenye kompyuta salama ambayo inaweza kutumiwa na Harriet kwakutumia neno la siri. Mwisho wa utafiti Harriet ataandika ripoti ya majibu ya utafiti.</p> <p>Taarifa hii itatumika kusaidia watafiti wengine kufanya tafiti zinazokidhi mahitaji ya jamii. Matokeo mengine yanaweza kuchapishwa kimataifa ili watu wengine katika mataifa mbalimbali waweze kujifunza kupitia uzoefu wetu wa kufanya kazi katika jamii za Tanzania.</p> <p>Tafadhali kumbuka tunajitegemea na hatuhusiani na upande wowote, uwe wa Serikali au Mashirika yasiyokuwa ya</p>

		<p>serikali na tunamtazamo usiofungamana na upande wowote. Tuna kibali kutoka Serikali ya Tanzania na Serikali ya kijiji ya kufanya utafiti huu.</p> <p>Japokuwa ushiriki ni wa hiari, na unaweza kujiondoa wakati wowote bila kutoa maelezo. Kama utajiondoa nitafuta majibu yako. Kama hautakuwa huru kujibu baadhi ya maswali unarususiwa kutokujibu. Kama utataka kuruka swali au mada tafadhali sema.</p> <p>Utafiti huu umerejewa na kuruhusiwa na kamati ya maadili ya Chuo kikuu cha Bangor. Kama una swali lolote, tafadhali niulize na nitajitahidi niwezavyo kukujibu.</p> <p>Kama utakuwa na wasiwasi au unataka kutoa malalamiko nitakupa mawasiliano ya mtu unayeweza kuzungumza naye.</p>
consent	Je, mhojiwa ametoa ridhaa yake ya ushiriki?	
no_consent	Mshukuru mshiriki na maliza mahojiano.	
consent_gender	Taja jinsia ya mshiriki	
Section 3. Respondent demographics		
gender	Jinsia ya mshiriki	
age	Una umri gani?	Kama hawafahamu waombe wakadirie umri wao
ethn	Wewe ni kabila gani?	
ethn_other	Tafadhali ainisha kabila lako	
language	Ipi ni lugha yako ya msingi unayozungumza?	
language_other	Tafadhali taja lugha hiyo	
religious	Una dini?	
religion	Dini yako ni ipi?	
religion_other	Tafadhali taja	
religion_den	Dhehebu lako ni lipi?	
den_other	Tafadhali taja dhehebu	
religion_importance	Dini ina umuhimu gani kwako?	
yrs_ed	Umesoma kwa miaka mingapi?	<p>Weka kadirio la miaka (isiyozidi miaka 13)</p> <p>Kama hakuna weka 0</p> <p>Kama hana uhakika, andika DK</p> <p>Kama ana diploma/shahada n.k. - andika</p>
literacy	Unaweza kusoma?	
literacy_ease	Ni rahisi kiasi gani kwako kusoma?	Soma machaguo kwa mhojiwa

birth_month	Je, unajua mwezi uliozaliwa?	
month	Mwezi uliozaliwa?	
own_mobile	Unamiliki simu ya mkononi ambayo ni yako binafsi?	Hii inamaana mtu binafsi na sio kaya
know_pa	Unafahamu jina la hifadhi iliyoko karibu?	
pa_name	Jina la hifadhi	
pa_other	Kama ni 'nyingine', taja jina la hifadhi	
Section 4. Sensitive behaviour 1 – Livestock grazing		
sens_note	Kupima unyeti wa tabia	<p>Tungependa kukuuliza kuhusu shughuli mbalimbali ambazo wewe,, wana kaya wako na wanafamilia wengine, rafiki zako au jirani zako hapa kijijini wanaweza kufanya.</p> <p>Kwa kila shughuli, tutakuuliza maswali machache.</p> <p>Hatuhitaji kufahamu kama unafanya shughuli hizi lakini kupata maoni yako juu ya shughuli hizi.</p> <p>Shughuli ya kwanza ni kuchunga mifugo</p>
comm_lg	Kama tukiuliza watu katika jamii kama wanachunga mifugo ndani ya \${pa_type}, unafikiri watakuwa na utayari kiasi gani kuongea na sisi kwa uwazi kuhusu hili?	
approval_lg	Kama wewe mwenyewe ulichunga mifugo ndani ya \${pa_type}, unafikiri ndugu na marafiki zako watafanyaje...	
morals_lg	Ni kwa kiasi gani unakubaliana na sentensi ifuatayo?	*"Ni kosa kuchunga mifugo ndani ya \${pa_type}"*
sdb_lg	Ni kwa kiasi gani unakubaliana na sentensi ifuatayo?	*"Kama nilichunga mifugo ndani ya \${pa_type}, nitakuwa na wasiwasi wanajamii hawatanifikiria vizuri"*
rules_lg	Je, kuna sheria zozote zinazozuia kuchunga mifugo ndani ya \${pa_type}?	
comfort_lg	Kama wewe binafsi ulichunga mifugo ndani ya \${pa_type} na mtafiti akakuuliza maswali kuhusu hilo, utajisikia vizuri kiasi gani kujibu maswali kwa ukweli?	
comwhy_lg	Kwa nini usiwe huru kuzungumza juu ya kuchunga mifugo ndani ya \${pa_type}?	
sensscale_lg	Elezea kadi ya kipimo cha unyeti	<p>Hapa tuna kipimo cha kiwango cha unyeti. Tunaweza kutumia hii kuona jinsi watu wanavyochukulia jambo fulani kuwa au kutokuwa nyeti.</p> <p>Upande mmoja tunavyo vitu ambavyo sio nyeti kabisa, ina maanisha watu watafurahi sana kujadili juu ya jambo hilo.</p>



		Kwa upande mwingine tunayo mada ambayo ni nyeti sana na hakuna mtu angependa au angefurahi kuizungumzia.  Rangi inavyozidi au kuongezeka kukolea inaonyesha kuongezeka kwa unyeti wa mada.
agreescore_lg	Alama zako kwa kuchunga mifugo ndani ya {pa_type} ni {senscore_lg}  Unafikiri hii ni sahihi	Waonyeshe washiriki wanapata alama gani katika kipimo/uwiano wa unyeti.
why_lg	Kwa nini?	
Section 5. Sensitive behaviour 2 – Bushmeat consumption		
meat_note	Kula nyamapori	Maswali yafuatayo yanahusu ulaji wa nyamapori.
qname_meat	Je, kuna jina linalotumika hapa kijijini kumaanisha nyamapori?	
meat_name	Inaitwaje?	
comm_meat	Kama tukiuliza watu katika jamii kama wanakula nyamapori, unafikiri watakuwa na utayari kiasi gani kuongea na sisi kwa uwazi?	
approval_meat	Kama wewe mwenyewe umekula nyamapori, unafikiri rafiki na ndugu zako watafanyaje...	
morals_meat	Ni kwa kiwango gani unakubaliana na sentensi ifuatayo?	*"Ni kosa kula nyamapori"*
sdb_meat	Ni kwa kiwango gani unakubaliana na sentensi ifuatayo?	*"Kama nimekula nyamapori nitakuwa na wasiwasi wanajamii watanifikiria vibaya"*
rules_meat	Je, kuna sheria zozote zinazozuia kula wa nyamapori?	
comfort_meat	Kama wewe binafsi ulikula nyamapori na mtafiti akakuuliza maswali kuhusu hilo, utajisikia vizuri kiasi gani kujibu maswali kwa ukweli?	
comfort_why_meat	Kwanini usiwe huru kuzungumza/kujadili juu ya ulaji wa nyamapori?	
senscale_meat	Elezea kadi ya kipimo cha unyeti	Hapa tuna kipimo cha kiwango cha unyeti. Tunaweza kutumia hii kuona jinsi watu wanavyochukulia jambo fulani kuwa au kutokuwa nyeti.  Upande mmoja tunavyo vitu ambavyo sio nyeti kabisa, ina maanisha watu watafurahi sana kujadili juu ya jambo hilo.  Kwa upande mwingine tunayo mada ambayo ni nyeti sana na hakuna mtu angependa au angefurahi kuizungumzia.  Rangi inavyozidi au kuongezeka kukolea inaonyesha kuongezeka kwa unyeti wa mada.

agreescore_meat	Alama zako kwa kula nyamapori ni \${senscore_meat}  Unafikiri hii ni sahihi?	Waonyeshe washiriki wanapata alama gani katika kipimo/uwiano wa unyeti.
why_meat	Kwa nini?	
pa_meat	Kama mtafiti angekuuliza kuhusu kula nyama pori iliyokamatwa ndani \${pa_type}, kiwango cha unyeti kinge...	Chagua moja hapa
pameat_why	Kwa nini ?	
Section 6. Sensitive behaviour 3 – Hunting wildlife		
hunt_note	Kuwinda wanyamapori	Maswali yafuatayo yanahusu uwindaji wa wanyamapori.
comm_hunt	Kama tukiuliza watu katika jamii kama wanafanya uwindaji wa wanyama pori katika ardhi ya kijiji, unafikiri watakuwa na utayari kiasi gani kuongea na sisi kwa uwazi?	
approval_hunt	Kama wewe mwenyewe umewinda wanyamapori katika ardhi ya kijiji, unafikiri rafiki na ndugu zako watafanyaje...	
morals_hunt	Ni kwa kiwango gani unakubaliana na sentensi ifuatayo?	*"Ni kosa kuwinda wanyamapori katika ardhi ya kijiji"*
sdb_hunt	Ni kwa kiwango gani unakubaliana na sentensi ifuatayo?	*"Kama nikiwinda wanyamapori katika ardhi ya kijiji nitakuwa na wasiwasi wanajamii watanifikiria vibaya"*
rules_hunt	Je, kuna sheria zozote zinazozuia uwindaji wa wanyamapori katika ardhi ya kijiji?	
comfort_hunt	Kama wewe binafsi uliwinda wanyamapori katika ardhi ya kijiji na mtafiti akakuuliza maswali kuhusu hilo, utajisikia vizuri kiasi gani kujibu maswali kwa ukweli?	
comfort_why_hunt	Kwanini usiwe huru kuzungumza juu ya uwindaji wanyamapori katika ardhi ya kijiji?	
sensscale_hunt	Elezea kadi ya kipimo cha unyeti	Hapa tuna kipimo cha kiwango cha unyeti. Tunaweza kutumia hii kuona jinsi watu wanavyochukulia jambo fulani kuwa au kutokuwa nyeti.  Upande mmoja tunavyo vitu ambavyo sio nyeti kabisa, ina maanisha watu watafurahi sana kujadili juu ya jambo hilo.  Kwa upande mwingine tunayo mada ambayo ni nyeti sana na hakuna mtu angependa au angefurahi kuizungumzia.  Rangi inavyozidi au kuongezeka kukolea inaonyesha kuongezeka kwa unyeti wa mada.

agreescore_hunt	Alama zako kwa kuwinda ni wanyamapori katika ardhi ya Kijiji \${sencore_hunt}  Unafikiri hii ni sahihi?	Waonyeshe washiriki wanapata alama gani katika kipimo/uwiano wa unyeti.
why_hunt	Kwa nini?	
pa_hunt	Kama mtafiti angekuuliza kuhusu kuwinda wanyamapori ndani ya \${pa_type}, kiwango cha unyeti kinge...	Chagua moja hapa
pahunt_why	Kwa nini?	
Section 7. Sensitive behaviour 3 – Entering PA to collect resources		
pa_note	Kuingia ndani ya \${pa_type} kuokota rasilimali	Maswali yafuatayo yatahusu kuingia ndani ya \${pa_type} kuokota rasilimali
comm_pa	Kama tukiuliza watu katika jamii kama wanaingia ndani ya \${pa_type} kuokota rasilimali, unafikiri watakuwa na utayari kiasi gani kuongea na sisi kwa uwazi?	
approval_pa	Kama wewe mwenyewe umeingia ndani ya \${pa_type} kuokota rasilimali, unafikiri rafiki na ndugu zako watafanyaje...	
morals_pa	Ni kwa kiwango gani unakubaliana na sentensi ifuatayo?	*"Ni kosa kuingia ndani ya \${pa_type} kuokota rasilimali"*
sdb_pa	Ni kwa kiwango gani unakubaliana na sentensi ifuatayo?	*"Kama nikiingia ndani ya \${pa_type} kuokota rasilimali, nitakuwa na wasiwasi wanajamii watanifikiria vibaya"*
rules_pa	Je, kuna sheria zozote zinazozuia kuingia ndani ya \${pa_type} kuokota rasilimali?	
comfort_pa	Kama wewe binafsi uliingia ndani ya \${pa_type} kuokota rasilimali na mtafiti akakuuliza maswali kuhusu hilo, utajisikia vizuri kiasi gani kujibu maswali kwa ukweli?	
comwhy_pa	Kwanini usiwe huru kuzungumza juu ya kuingia ndani ya \${pa_type} kuokota rasilimali?	
sensscale_pa	Elezea kadi ya kipimo cha unyeti	Hapa tuna kipimo cha kiwango cha unyeti. Tunaweza kutumia hii kuona jinsi watu wanavyochukulia jambo fulani kuwa au kutokuwa nyeti.  Upande mmoja tunavyo vitu ambavyo sio nyeti kabisa, ina maanisha watu watafurahi sana kujadili juu ya jambo hilo.  Kwa upande mwingine tunayo mada ambayo ni nyeti sana na hakuna mtu angependa au angefurahi kuizungumzia.  Rangi inavyozidi au kuongezeka kukolea inaonyesha kuongezeka kwa unyeti wa mada.

agreescore_pa	Alama zako kwa kuingia ndani ya \${pa_type} kuokota rasilimali ni \${senscore_pa}.  Unafikiri hii ni sahihi?	Waonyeshe washiriki wanapata alama gani katika kipimo/uwiano wa unyeti.
why_pa	Kwa nini?	
Section 8. Thank you & wrap-up		
thank_you	Mwisho wa mahojiano  Asante  kwa kushiriki	Una maswali yoyote ya kuniuliza?
feedback	\${enumerator}, una maoni yoyote au mrejesho?	Andika maoni yoyote au mrejesho

## Chapter 3

Table A7.2. Survey instrument in Kiswahili used in Chapter 3.

	Question::Kiswahili	Instructions/prompt::Kiswahili
Section 1. Survey location		
start_time		
end_time		
Date		
device_id		
interviewer	Nani anafanya mahojiano?	
region	Mkoa	
district	Wilaya	
village	Jina la kijiji	
pa_type	Hifadhi iliyokaribu hapa ni ipi	**Usimwulize mhojiwa hili**
hi_present	Harriet yupo?	
Section 2. Participant consent		
ethics_statement	Soma fomu ya kuomba ridhaa ya mhojiwa	<p>Habari, Jina langu ni \${interviewer} na ninamsaidia Harriet Ibbett anayetoka chuo kikuu cha Bangor Uingereza, kufanya utafiti. Utafiti wa Harriet unahusu kuelewa njia nzuri ya kuuliza maswali kuhusu utumiaji wa rasilimali asili.</p> <p>Utafiti una sehemu mbili. Kwanza kabisa, tutakuuliza maoni yako kuhusu aina mbalimbali za matumizi ya rasilimali asili. Sehemu ya pili ya utafiti ni kuhusu jinsi unavyopenda kujibu maswali yanayoweza kuwa nyeti.</p> <p>Tutawaomba watu wengi kujibu maswali ya utafiti huu ili tuweze kuelewa jinsi watu wanavyopenda kujibu maswali. Kwa kutumia maoni na mapendekezo yako tutaandaa utafiti mpya, ambao utahusisha ukusanyaji wa taarifa kutoka kwa watu, kuhusu utumiaji wa rasilimali karibu na maeneo yaliyohifadhiwa. Taarifa utakayotupatia ni ya muhimu sana katika kuhakikisha kwamba tutauliza maswali kwakutumia njia sahihi.</p> <p>Mahojiano yanakadiriwa kuchukua takribani lisaa na robo. Taarifa yoyote utakayotupatia itakuwa ya siri, hii inamaana sitaandika jina lako au taarifa yoyote ambayo itaweza kukutambulisha binafsi au kaya yako. Majibu yako hayatatolewa kwa mtu yoyote kwa njia yoyote ambayo mtu anaweza kuhusianisha majibu yako na wewe.</p> <p>Nitaandika majibu yako yote kwenye simu hii. Majibu yako yote yatahifadhiwa kwenye kompyuta salama ambayo inaweza kutumiwa na Harriet kwakutumia neno la siri. Mwisho wa utafiti Harriet ataandika ripoti ya majibu ya utafiti.</p> <p>Taarifa hii itatumika kusaidia watafiti wengine kufanya tafiti zinazokidhi mahitaji ya jamii. Matokeo mengine yanaweza kuchapishwa kimataifa ili watu wengine katika mataifa mbalimbali waweze kujifunza kupitia uzoefu wetu wa kufanya kazi</p>

		<p>katika jamii za Tanzania.</p> <p>Tafadhali kumbuka tunajitegemea na hatuhusiani na upande wowote, uwe wa Serikali au Mashirika yasiyokuwa ya serikali na tunamtazamo usiofungamana na upande wowote. Tuna kibali kutoka Serikali ya Tanzania na Serikali ya kijiji ya kufanya utafiti huu.</p> <p>Japokuwa ushiriki ni wa hiari, na unaweza kujiondoa wakati wowote bila kutoa maelezo. Kama utajiondoa nitafuta majibu yako. Kama hautakuwa huru kujibu baadhi ya maswali unarususiwa kutokujibu. Kama utataka kuruka swali au mada tafadhali sema.</p> <p>Utafiti huu umerejewa na kuruhusiwa na kamati ya maadili ya Chuo kikuu cha Bangor. Kama una swali lolote, tafadhali niulize na nitajitahidi niwezavyo kukujibu.</p> <p>Kama utakuwa na wasiwasi au unataka kutoa malalamiko nitakupa mawasiliano ya mtu unayeweza kuzungumza naye.</p>
consent	Je, mhojiwa ametoa ridhaa yake ya ushiriki?	
no_consent	Mshukuru mshiriki na maliza mahojiano.	
consent_gender	Taja jinsia ya mshiriki	
Section 3. Respondent demographics		
gender	Jinsia ya mshiriki	
age	Una umri gani?	Kama hawafahamu waombe wakadirie umri wao
ethn	Wewe ni kabila gani?	
ethn_other	Tafadhali ainisha kabila lako	
language	Ipi ni lugha yako ya msingi unayozungumza?	
language_other	Tafadhali taja lugha hiyo	
religious	Una dini?	
religion1		
religion	Dini yako ni ipi?	
religion_other	Tafadhali taja	
religion_den	Dhehebu lako ni lipi?	
den_other	Tafadhali taja dhehebu	
religion_importance	Dini ina umuhimu gani kwako?	
yrs_ed	Umesoma kwa miaka mingapi?	<p>Weka kadirio la miaka (isiyozidi miaka 13)</p> <p>Kama hakuna weka 0</p> <p>Kama hana uhakika, andika DK</p> <p>Kama ana diploma/shahada n.k. - andika</p>

literacy	Unaweza kusoma?	
literacy_ease	Ni rahisi kiasi gani kwako kusoma?	Soma machaguo kwa mhojiwa
birth_month	Je, unajua mwezi uliozaliwa?	
month	Mwezi uliozaliwa?	
own_mobile	Unamiliki simu ya mkononi ambayo ni yako binafsi?	Hii inamaana mtu binafsi na sio kaya
know_pa	Unafahamu jina la hifadhi iliyoko karibu?	
pa_name	Jina la hifadhi	
pa_other	Kama ni 'nyingine', taja jina la hifadhi	
Section 4. Introducing the experiment		
sqt_intro_1	Utangulizi: Kujaribu mbinu	<p>Lengo la kipengele kifuatacho ni kufahamu ni jinsi gani ungependa kujibu maswali kuhusu shughuli ambazo zinaweza kuwa ni nyeti.</p> <p>Tunapoulizwa maswali juu ya matumizi ya rasilimali asili, wakati mwingine hatupendi kusema ukweli.</p> <p>Tunaweza tukaona aibu juu ya majibu yetu, tunaweza tusimwamini anayetuuliza maswali, au tunaweza tukaogopa kwamba tutaingia matatizoni tukisema ukweli.</p> <p>Japokuwa, kwetu sisi watafiti, tunapouliza maswali kuhusu rasilimali asili ni muhimu sana kupata majibu sahihi na ya kweli.</p> <p>La sivyo taarifa tutakayoipata haitakuwa sahihi na hatutaweza kutoa mapendekezo mazuri kwa jamii.</p>
sqt_intro_2	Kutambulisha mbinu	<p>Ili kutatua tatizo hili, watafiti wamegundua njia malumu ya kuuliza maswali, ambayo inawaruhusu watu kutoa majibu ya kweli, lakini mtafiti hawezi kusema kama mhojiwa anajihusisha na shughuli hizo.</p> <p>Ningependa kujaribu mbinu hizi tofauti tofauti na wewe, ili kuona ipi unaielewa zaidi, na ipi unaipenda zaidi.</p> <p>Maswali yote yatakuwa juu ya uwindaji wa wanyamapori.</p> <p>Sihitaji kufahamu kama hiki ni kitu ambacho wewe au kaya yako mnakifanya. Ninapenda tu kuelewa njia sahihi kwa mtafiti kuuliza maswali kuhusu hili.</p>
char_intro_1	Tambulisha Mhusika	<p>Ili kuhakikisha haujibu maswali haya kuhusu wewe mwenyewe ningependa kukufahamisha kuhusu watu wa kubuni</p> <p>Hapa nina watu watano (wakubuni). Kila mmoja anafanya shughuli mbalimbali za kuendesha maisha yake.</p> <p>Tunapojaribu njia mbali mbali za kujibu maswali, naomba ujifanye wewe ni mmojawapo wa watu hawa wa kubuni na unipe majibu ambayo wangenipa.</p> <p>Umenielewa?</p>

char_intro_2	Chukua kadi ya Mtu Namba Moja	<p>Kwa mfano, hapa tunaye Mtu Namba Moja. Mtu Namba Moja amezaliwa mwezi wa Novemba. Shughuli zake za kila siku ni:</p> <ul style="list-style-type: none"> <li>• Kuvua samaki</li> <li>• Kuwinda wanyamapori</li> <li>• Kufuga kuku</li> <li>• Kuchunga mifugo</li> </ul>
Section 5. Testing the 1 <sup>st</sup> method (this block of questions is repeated five times, once for each method. The method order is randomly allocated. Below shows the instructions for each method)		
m1_rrt_intro	<b>**Mbinu ya Kete**</b>	<p>Jinsi ya kujibu maswali haya ni kama mchezo na katika kila mchezo kuna sheria ambazo unapaswa kuzifuata.</p> <p>Kwanza kabisa nitakupa kete uizungushe.</p> <p>Kama ukizungusha kete na ukapata <b>**1**</b> lazima useme <b>**Ndio**</b>, kila mara.  <b>*Hata kama ndio sio jibu sahihi, bado unapaswa kusema Ndio*</b></p> <p>Kama ukizungusha kete na ukapata <b>**2**</b> unapaswa kusema <b>**Hapana**</b> kila mara.  <b>*Hata kama Hapana sio jibu la kweli unapaswa kusema hapana*</b></p> <p>Kama ukizungusha kete na ukapata <b>**3,4,5 or 6**</b>, jifanye wewe ni mhusika wa kubuni <b>** jibu swali kwa ukweli**</b></p> <p>Unaelewa?</p> <p>Sasa tujaribu <b>*[Zungusha kete]*</b> Umepata namba gani? Ni Jibu gani unapaswa kutoa?</p> <p><b>*[Usijaribu zaidi ya mara mbili]*</b></p> <p>Tujaribu kwa mfano.</p> <p>Huyu ni Mtu Namba Moja. Swali langu kwa Mtu Namba Moja ni “Mtu namba moja, unawinda wanyamapori?”</p> <p>Nazungusha kete. Nimepata XX, jibu langu linapaswa kuwa XX</p> <p>Umeelewa?</p>
m1_uct_intro	<b>**Mbinu ya Namba/Tarakimu**</b>	<p>Kwa mbinu hii, tutatumia kadi hii. Kwenye kadi hii kuna shughuli nne tofauti. Shughuli hizi ni:</p> <ul style="list-style-type: none"> <li>• Kuokota kuni</li> <li>• Kuwinda wanyamapori</li> <li>• Kufuga kuku</li> <li>• Kuchunga mifugo</li> </ul> <p>Unachotakiwa kufanya ili kujibu maswali ni kuniambia ni shughuli ngapi zinakuhusu. Ni muhimu usiniambie ni zipi lakini unipe idadi inayokuhusu.</p>



		<p>Kwanza tutafanya majaribio</p> <p>Huyu ni Mtu Namba Moja: Tunaona kwamba Mtu Namba Moja anafanya shughuli mbalimbali.</p> <p>Swali langu ni kwamba: Mtu Namba Moja, ni shughuli ngapi za kimaisha unazozifanya?</p> <ul style="list-style-type: none"> <li>• Ya kwanza ni kuokota kuni. Nikangalia kadi ya Mtu Namba Moja naona Mtu Namba Moja haokoti kuni.</li> <li>• Ya pili ni kuwinda wanyamapori. Nikiangalia kadi ya Mtu Namba Moja naona Mtu Namba Moja anawinda.</li> <li>• Ya tatu ni kufuga kuku. Mtu Namba Moja anafuga kuku.</li> <li>• Ya mwisho ni kuchunga mifugo. Mtu Namba Moja anachunga mifugo</li> </ul> <p>Kwahiyo Mtu Namba Moja anafanya shughuli tatu kati ya nne zilizoko kwenye orodha. Jibu atakalotoa linapaswa kuwa tatu.</p> <p>Umeelewaa?</p> <p>Elezea na rudia mpaka atakapoelewa</p>
m1_bean_intro	**Mbinu ya haragwe**	<p>Njia hii inahitaji jibu la Ndiyo au Hapana</p> <p>Japokuwa, badala ya kusema jibu lako kwa sauti ningependa utumie hizi kopo za maharage.</p> <p>Hapa nina kopo mbili. Kwenye kila kopo kuna aina mbili tofauti za maharage zilizochanganywa.</p> <p>Kama jibu lako ni NDIYO ningependa uhamishe haragwe jeusi kutoka kwenye kopo ndogo uweke kwenye kopo kubwa</p> <p>Kama jibu lako ni HAPANA ningependa uhamishe haragwe la njano kutoka kwenye kopo ndogo uweke kwenye kopo kubwa.</p> <p>*(Jaribu kutafuta maharage na rangi zinazowakilisha)*</p> <p>Ni muhimu kutokunionyesha ni rangi gani umehamisha.</p> <p>Sasa nitakuuliza swali na katika haya ningependa ufikiri wewe ni Mtu Namba Moja.</p> <p>Swali ni kwamba;</p> <p>Mtu Namba Moja, unawinda wanyamapori?</p> <p>Tunaona kwenye kadi ya mtu namba moja kuwa anawinda. Hivyo harage ya zambarau (inayomaanisha, ndiyo) inapaswa kuhamishwa.</p>
m1_crosswise_intro	**Mbinu ya Kasha(Box) lililopakwa rangi**	<p>Nitakusomea Maswali mawili.</p> <p>Kama jibu lako ni Ndio au Hapana kwa mswali yote, tafadhali gusa mraba wa kijani.</p>

		<p>Kama jibu lako ni Ndio kwa swali moja (bila kujali ni ipi) tafadhali gusa mraba mweusi.</p> <p>Tujaribu mfano huu. Swali ni kwamba kati ya maswali haya, ngapi ni za kweli?</p> <p>Swali A- Unawinda wanyamapori?</p> <p>Swali B- Ulizaliwa mwezi wa kumi na moja (Novemba) au mwezi wa kumi na mbili (Disemba)?</p> <p>Tujifanye wewe ni Mtu Namba Moja. Tunaona Mtu Namba Moja amezaliwa mwezi wa kumi na moja na anawinda wanyamapori.</p> <p>Kwa hiyo Mtu Namba Moja anapaswa kugusa mraba wa kijani, kwa sababu majibu yake ni ndio kwa maswali yote mawili.</p>
m1_dq_intro	**Kuuliza maswali moja kwa moja**	<p>Kwa swali hili, hakuna njia maalumu ya kujibu. Ningependa uniambie jibu la kweli.</p> <p>Unapojibu kumbuka kwamba wewe ndio mhusika wa kubuni</p> <p>Tufanye jaribio kupitia Mtu Namba Moja.</p> <p>Swali ni: Mtu Namba Moja, unawinda wanyamapori?</p> <p>Tunaona kwamba Mtu Namba Moja anawinda, hivyo tunapaswa kujibu, ndiyo.</p>
m1_rrt_dice	Mhojiwa alikuwa anafahamu kuhusu kete?	
Practice method using Character Two		
m1_intro_ch1	*Chagua kadi kwa Mtu Namba Mbili*	<p>Sasa tutajaribu na Mtu Namba Mbili.</p> <p>Mtu Namba Mbili amezaliwa mwezi Disemba.</p> <p>Anaokota kuni</p> <p>Anafuga kuku</p> <p>Analima mahindi</p> <p>Anamiliki duka dogo</p>
m1_rrt_ch1	<p>Kanuni ya Kete</p> <p>Mtu Namba Mbili, unawinda wanyamapori?</p>	<p>Kumbuka, kama ukirusha kete</p> <p>1 sema *ndiyo*</p> <p>2 sema *hapana*</p> <p>3, 4,5, 6 *jibu swali kwa ukweli**</p> <p>Andika idadi ya majaribio yaliyofanyika kabla ya muhojiwa kutoa jibu sahihi</p> <p>Kama mhojiwa hapendi kujibu andika '999'</p>

m1_uct_ch1	<p>Mbinu ya tarakimu/namba</p> <p>*Mtu Namba Mbili, ni shughuli ngapi kati ya hizi unafanya?*</p> <p>Kumbuka, usiniambie mimi ni shughuli gani unafanya, niambie tu ni ngapi.</p>	<p>Andika idadi ya majaribio yaliyofanyika kabla ya muhojiwa kutoa jibu sahihi</p> <p>Kama mhojiwa hapendi kujibu andika '999'</p>
m1_bean_ch1	<p>Mbinu ya haragwe</p> <p>Mtu Namba Mbili, je, wewe unawinda wanyamapori?</p>	<p>Kumbuka, kujibu haya maswali ni lazima uhamishe haragwe.</p> <p>Kama jibu ni:</p> <p>NDIO hamisha haragwe ya **zambarau**</p> <p>HAPANA hamisha haragwe ya **njano**</p> <p><b>**Angalia wamehamisha rangi gani ya haragwe, ili kuona kama ni sahihi**</b></p> <p>Andika idadi ya majaribio yaliyofanyika kabla muhojiwa hajatoa jibu sahihi</p> <p>Kama mhojiwa hapendi kujibu andika '999'</p>
m1_crosswise_ch1	<p>Mbinu ya Kasha (Box)</p> <p>Mtu Namba Mbili,</p> <p>A) Unawinda wanyamapori?</p> <p>B) Ulizaliwa Novemba (mwezi wa kumi na moja) au Disemba (mwezi wa kumi na mbili)?</p>	<p>Kumbuka, kama jibu lako ni:</p> <p>Ndiyo/hapana kwa maswali <b>**MAWIILI**</b> bonyeza mraba wa <b>**KIJANI**</b></p> <p>Kama Ndiyo kwa swali <b>**MOJA**</b> tu bonyeza mraba wa <b>**KIJIVU**</b></p> <p>Andika idadi ya majaribio yaliyofanyika kabla ya muhojiwa kutoa jibu sahihi.</p> <p>Kama mhojiwa hapendi kujibu andika '999'</p>
m1_dq_ch1	<p>DQ</p> <p>Kumbuka, kwa mbinu hii jibu maswali moja kwa moja.</p> <p>Mtu Namba Mbili, je, unawinda wanyamapori?</p>	<p>Andika idadi ya majaribio yaliyofanyika kabla ya muhojiwa kutoa jibu sahihi</p> <p>Kama mhojiwa hapendi kujibu andika '999'</p>
Collect test data – 1 <sup>st</sup> character		
m1_C_A	<p>Chagua kadi kwa Mtu Namba</p> <p><b>**\${m1_ch2}**</b></p>	<p>Elezea kwa kifupi shughuli zilizoandikwa kwenye kadi</p> <p><b>\${m1_ch2_attributes}</b></p>
m1_rrt_ch2	Mbinu ya Kete	Kumbuka, kama ukirusha kete ukapata:

	Mtu Namba \${m1_ch2}, je unawinda wanyamapori?	1 sema *Ndiyo* 2 sema *Hapana* 3, 4, 5 au 6 *jibu swali kwa ukweli*
m1_uct_ch2	Mbinu ya tarakimu/namba  Mtu Namba \${m1_ch2}, unajihusisha na shughuli ngapi kati ya hizi?	Kumbuka, usiniambie ni shughuli gani niambie idadi
m1_bean_note1	Mbinu ya Maharagwe  Mtu Namba \${m1_ch2}, Je, unawinda wanyamapori?	*Kumbuka, kama jibu lako ni*  *Ndiyo hamisha harage zambarau *  *Hapana hamisha harage njano•
m1_crosswise_ch2	Mbinu ya kasha/box lililopakwa rangi  \${m1_ch2},  A) Unawinda wanyamapori?  B) Ulizaliwa Novemba (mwezi wa kumi na moja) au Disemba (mwezi wa kumi na mbili)?	Kumbuka, kama jibu lako ni:  Ndiyo/hapana kwa maswali **MAWIILI** bonyeza mraba wa **KIJANI**  Kama Ndiyo kwa swali **MOJA** tu bonyeza mraba wa **KIJIVU**
m1_dq_ch2	DQ  Mtu Namba \${m1_ch2}, Je, unawinda wanyamapori?	Tafadhali jibu maswali moja kwa moja
m1_privacy_ch2	Kutokana na jibu lako, unafikiri ninaweza kusema Mtu Namba \${m1_ch2} aliwinda?	
m1_dice_ch2	Umepata upande wa kete wenye namba ngapi?	Ili niangalie kama majibu yako ni sahihi  Kama mhojiwa hapendi kujibu andika 0
m1_bean_ch2	Umehamisha ya rangi gani?	Ili niangalie kama majibu yako ni sahihi
Collect test data – 2 <sup>nd</sup> character		
m1_C_B	Chagua kadi kwa Mtu Namba **\${m1_ch3}**	Elezea kwa kifupi shughuli zilizoandikwa kwenye kadi  \${m1_ch3_attributes}
m1_rrt_ch3	Mbinu ya Kete  Mtu Namba \${m1_ch3}, je unawinda wanyamapori?	Kumbuka, kama ukirusha kete ukapata:  1 sema *Ndiyo* 2 sema *Hapana* 3, 4, 5 au 6 *jibu swali kwa ukweli*

m1_uct_ch3	Mbinu ya tarakimu/namba  Mtu Namba \${m1_ch3}, unajihusisha na shughuli ngapi kati ya hizi?	Kumbuka, usiniambie ni shughuli gani niambie idadi
m1_bean_note2	Mbinu ya Maharagwe  Mtu Namba \${m1_ch3}, Je, unawinda wanyamapori?	*Kumbuka, kama jibu lako ni*  *Ndiyo hamisha harage zambarau *  *Hapana hamisha harage njano•
m1_crosswise_ch3	Mbinu ya kasha/box lililopakwa rangi  \${m1_ch3},  A) Unawinda wanyamapori?  B) Ulizaliwa Novemba (mwezi wa kumi na moja) au Disemba (mwezi wa kumi na mbili)?	Kumbuka, kama jibu lako ni:  Ndiyo/hapana kwa maswali **MAWIILI** bonyeza mraba wa **KIJANI**  Kama Ndiyo kwa swali **MOJA** tu bonyeza mraba wa **KIJIVU**
m1_dq_ch3	DQ  Mtu Namba \${m1_ch3}, Je, unawinda wanyamapori?	Tafadhali jibu maswali moja kwa moja
m1_privacy_ch3	Kutokana na jibu lako, unafikiri ninaweza kusema Mtu Namba \${m1_ch3} aliwinda?	
m1_dice_ch3	Umepata upande wa kete wenye namba ngapi?	Ili niangalie kama majibu yako ni sahihi  Kama mhojiwa hapendi kujibu andika 0
m1_bean_ch3	Umehamisha ya rangi gani?	Ili niangalie kama majibu yako ni sahihi
Collect test data – 3 <sup>rd</sup> character		
m1_C_C	Chagua kadi kwa Mtu Namba **\${m1_ch4}**	Elezea kwa kifupi shughuli zilizoandikwa kwenye kadi  \${m1_ch4_attributes}
m1_rrt_ch4	Mbinu ya Kete  Mtu Namba \${m1_ch4}, je unawinda wanyamapori?	Kumbuka, kama ukirusha kete ukapata:  1 sema *Ndiyo* 2 sema *Hapana* 3, 4, 5 au 6 *jibu swali kwa ukweli*
m1_uct_ch4	Mbinu ya tarakimu/namba  Mtu Namba \${m1_ch4}, unajihusisha na shughuli ngapi kati ya hizi?	Kumbuka, usiniambie ni shughuli gani niambie idadi

m1_bean_note3	Mbinu ya Maharagwe  Mtu Namba \${m1_ch4}, Je, unawinda wanyamapori?	*Kumbuka, kama jibu lako ni*  *Ndiyo hamisha harage zambarau *  *Hapana hamisha harage njano•
m1_crosswise_ch4	Mbinu ya kasha/box lililopakwa rangi  \${m1_ch4},  A) Unawinda wanyamapori?  B) Ulizaliwa Novemba (mwezi wa kumi na moja) au Disemba (mwezi wa kumi na mbili)?	Kumbuka, kama jibu lako ni:  Ndiyo/hapana kwa maswali **MAWIILI** bonyeza mraba wa **KIJANI**  Kama Ndiyo kwa swali **MOJA** tu bonyeza mraba wa **KIJIVU**
m1_dq_ch4	DQ  Mtu Namba \${m1_ch4}, Je, unawinda wanyamapori?	Tafadhali jibu maswali moja kwa moja
m1_privacy_ch4	Kutokana na jibu lako, unafikiri ninaweza kusema Mtu Namba \${m1_ch4} aliwinda?	
m1_dice_ch4	Umepata upande wa kete wenye namba ngapi?	Ili niangalie kama majibu yako ni sahihi  Kama mhojiwa hapendi kujibu andika 0
m1_bean_ch4	Umehamisha ya rangi gani?	Ili niangalie kama majibu yako ni sahihi
Review of method 1		
m1_understand	Unafikiri umeelewa vizuri namna ya kujibu maswali?	
m1_answerase	Ni kwa kiasi gani umeona ni rahisi kujibu maswali kwa kutumia mbinu hii?	
m1_privacy	Unafikiri majibu yako ni ya usiri kiasi gani kwa kutumia mbinu hii?	
m1_comfort	Kama ulijihusisha na shughuli yoyote kama uwindaji wa wanyamapori, utajisikia vizuri kiasi gani kujibu maswali haya kwa uwazi kutumia mbinu hii?	
m1_comments	Una maoni yoyote ya kuongezea?	Kitu cho chote wanachosema kuhusu mbinu hii
m1_enumunder	\${interviewer}, unafikiri mhojiwa alielewa mbinu hii vizuri kiasi gani?	
m1_enumhonesty	\${interviewer}, ulihisi kama mhojiwa alikuwa anakusudia kukosea majibu?	Mfano, alikuwa anaogopa kutoa majibu ya kweli
Section 5 was repeated four further times, once more for each of the remaining methods.		

Section 10. Respondents review of SQTs		
quest_pref	Mbinu pendelevu	Maswali machache yafuatayo yanahusu jinsi ambavyo unapendakujibu maswali.
method_best	Ni mbinu gani umeona ni rahisi kuelewa?	
method_comfort	Ni mbinu gani imekufanya kuwa vizuri zaidi katika kujibu maswali?	
method_privacy	Ni kwa mbinu ipi unafikiri majibu yako ni ya faragha?	
method_prefer	Kama mtafiti atataka kukuuliza maswali kama umefanya shuguli yoyote isiyo halali ungependelea kutumia mbinu gani kujibu maswali?	1 = Njia inayopendelewa zaidi 5 = Njia isiyopendelewa zaidi
most_prefer_why	Kwanini unapendelea zaidi mbinu hii?	
least_prefer_why	Kwanini hupendelei mbinu hii zaidi?	
pref_gender	Je uko huru zaidi kuzungumza na mtafiti wa jinsia gani?	
location_choice	Ungependelea kufanyia mahojiano wapi?	
location_other	Jina la sehemu *nyingine* ambayo ungependa kufanyia mahojiano:	
preferred_time	Mwisho ni wakati gani ungependa kuhojiwa?	
thank_you	Mwisho wa mahojiano Asante kwa kushiriki	Una maswali yoyote ya kuniuliza?
adults_present	Je walikuwepo watu wazima wengine (juu ya miaka 18) wakati wa mahojiano	
Section 11. Interviewer comments		
survey_engage	Je muhojiwa ameonyesha ushirikiano kwa kiwango gani?	
survey_ease	Kumhoji huyu mtu kulikuwaje?	
loc	Mahojiano yalifanyika wapi?	
other_comments	Maoni ya ziada	
comments	Una maoni yoyote au mrejesho?	Andika maoni yoyote au mrejesho

## Chapter 5

Table A7.1. Survey instrument used in the main questionnaire in English, with Kiswahili translation

Question::Kiswahili	Hint::Kiswahili
Section 1: Location	
Region	For interviewer to answer
District	For interviewer to answer
What is the district?	For interviewer to answer
Village	For interviewer to answer
Sub-village	For interviewer to answer
Which is the nearest protected area?	For interviewer to answer
Who is conducting the interview?	For interviewer to answer
What type of respondent is being interviewed?	
Can you provide more information on why the respondent is part of the snowball sample?	"For interviewer to answer: Were we given their information? Who gave us their information? What behaviours do we think they do? Did they approach us?"
1. Jinsia ya mhojiwa?	
Section 2: Consent	
"Read the information sheet to the respondent, either from the sheet of paper or the phone:	
Jina langu naitwa \${interviewer} ni mtafiti msaidizi katika mradi unaotekelezwa na chuo kikuu cha Bangor kilichoko Uingereza. Ningependa kukukaribisha kushiriki katika utafiti huu mfupi. Lengo la utafiti huu ni kuelewa juu ya maisha yakoje kwa watu kama nyinyi mnaoishi karibu na hifadhi. Nakuomba kushiriki kwasababu unaishi eneo hili ambalo lipo karibu na [Jina la hifadhi]. Kwa ujumla tunatarajia kuzungumza na wanakijiji 2,000-3,000 ambao wanaishi karibu na hifadhi. Kama unakubali kushiriki nitakuuliza maswali machache na kujaza majibu yako kwenye kifaa hiki. Sitachukua jina lako au anwani yako na majibu yako yatakuwa ni siri. Kipengele cha kwanza cha maswali kinakuhusu wewe na kaya yako, halafu nitakuuliza kuhusu shughuli mbalimbali ambazo unawezakuwa umewahikufanya au hujawahi ndani ya hifadhi Baada ya hapo nitakuuliza maswali kuhusu maoni yako na uzoefu wako wa kuishi katika eneo hili. Mahojiano haya yatachukua muda wa dk45 mpaka saa moja. Kwasababu sitaandika jina lako Majibu yako hayatahusianishwa na wewe na haitawezekana kukutambua kutoka kwenye majibu tuliyoandika. Taarifa utakazozitoa hazitatolewa kwa mtu yoyote nje ya timu hii ya utafiti na itatumika tu na watafiti wa timu hii walioko Uingereza. Majibu yako pamoja na wale watu wengine 2,000-3,000 yatatumika kuandika ripoti. Utafiti huu umethibitishwa na Kamati ya Maadili ya Chuo kikuu cha Bangor. Kama hautapenda kushiriki katika mahojiano haya ni sawa, pia unaruhusiwa kuondoka kama utapata dharura au ukibadilisha mawazo wakati wowote tafadhali niambie na nitasitisha mahojiano mara moja. Je, una swali lolote la kuniuliza kabla hatujaendelea? Kama una wasiwasi wowote tafadhali wasiliana nasi kwa namba (mpe kadi ya mawasiliano) Je, utapenda kushiriki katika utafiti huu? "	
"Nakiri kwamba nimesoma/ kusomewa fomu ya [Conservation and Human Behavior-ConHuB] yaani Uhifadhi wa Mazingira na tabia za watu] na nimeelewa juu ya utafiti huu. Nilipewa nafasi ya kuuliza maswali na kupewa majibu yanayoridhisha. Naelewa kuwa kushiriki kwangu ni kwa hiari na niko huru kujitoa muda wowote nikipata dharura, na nikijitoa taarifa nilizotoa kwenye mjadala zitafutwa. Naelewa kwamba majibu niliyotoa yatatumika kwa kusudi lililotolewa kwenye fomu ya ConHuB ya ushiriki wa mahojiano Kwa taarifa hapo juu nakubali kushiriki kwenye mjadala huu "	
Thank the respondent for their time	If you want to return to the previous question, just swipe backwards.
Section 3: COVID-19 Precautions	



Wakati tunaelewa kwamba Serikali ya Tanzania imetangaza kutokuwa na ugonjwa wa COVID-19, kwasababu ni ugonjwa wa hatari , tunachukua tahadhari ili kuhakikisha usalama wetu na wa kila mmoja tunayekutana naye endapo kuna maambukizi ambayo serikali haijagundua bado.	" If the guide has not already explained our COVID-19 precautions then explain to the respondent: 1. That the team are clear of symptoms 2. That we wear masks to protect ourselves and the respondent 3. That we will be working outside and maintaining social distancing 4. We will be washing hands frequently "
Kuna mtu yeyote kwenye kaya yako ambaye ana dalili za COVID-19 ambazo zimeonekana wiki iliyopita? Hizi ni: kikohozi kipya na endelevu,kupumua kwa shida, homa kali, kupoteza uwezo wa kutambua harufu na ladha ya chakula hivi karibuni?	
Thank the respondent for their time, explain that even though the sick individual may not have COVID-19 we do not want to put other respondents at risk if they do have COVID-19. Wish them or their household member a quick recovery	
Section 4: Respondent demographics	
Nitakuuliza mswali machache kuhusu wewe na watu wengine wa kaya yako, Ninaposema kaya ninamaanisha wale wote wanaokula pamoja na kulala kwenye nyumba moja ni kijuimuisha na watoto waliopo shule za bweni.	
2. Una umri gani?	If the respondent does not know their age ask for a best estimate. To skip question enter -99
3a. Wewe ni kabila gani?	
3b. Tafadhali taja kabila lako	
4. Umeishi kwenye kijiji hiki kwa miaka mingapi?	Round to the nearest whole number (e.g. 5 months = 0 yrs, 6 months = 1 yr). To skip question enter -99
5. Je, unasoma shule kwa sasa?	
6. Umesoma shule kwa miaka mingapi?	Includes primary and secondary school. To skip question enter -99
7. Watu wangapi wengine unaishi nao kwenye kaya yako? Watu wazima na watoto	
Section 5a: RRT questions for men	
"Sasa nitakuuliza baadhi ya maswali kwa njia tofauti. Namna nitakavyokuuliza haya maswali ni kama mchezo, na kama tunavyojua kwa kila mchezo kuna kanuni ambazo unapaswa kufuata.	
Kwanza kabisa nitakupa kete na hiki kikombe, na nitakuomba utikise kete ndani ya hiki kikombe, kama hivi [Tikisa kete], tikisa kete sawasawa kabisa.	
Nitakuomba utazame ndani ya kikombe kuona namba gani imetokea kwenye kete[Tazama ndani ya kikombe].	
Kama ukitikisa kete ikatokea **1,2,3 au 4** unapaswa kujibu swali langu [kulingana na shughuli unazofanya] jibu lako linaweza kuwa **NDIYO** au **HAPANA**.	
Kama ukitikisa kete ukapata **5** ni lazima ujibu **NDIYO** kwenye swali langu. * Hata Kama hili sio jibu sahihi*	
Kama ukitikisa kete ukapata **6** ni lazima ujibu **HAPANA** kwenye swali langu * Hata Kama hili sio jibu sahihi*	

<p>Ni muhimu kutokuniambia ni namba gani umepata kwenye kete yako, hiyo ni siri yako.</p> <p>Sasa tufanye jaribio kwanza, nitajibu swali. Tazama, natikisa kete ndani ya kikombe, na sasa nitatazama ndani ya kikombe kuona ni namba ngapi ya kete nimepata. Sawa. Kwa hiyo sasa najua ni namba ngapi nimepata, na sasa nitatazama kwenye kadi hii kujikumbusha namna ya kujibu: 1,2,3, au 4 ninapaswa kujibu kulingana na shughuli ninazofanya. Kama nimepata 5, nitasema tu NDIYO na kama nimepata namba 6, nitasema tu HAPANA.</p> <p>Sasa tufikirie kuhusu swali.... Je, nilizidisha kiwango cha mwendo nilipokuwa nikiendesha gari mjini wiki iliyopita? Ninaangalia namba niliyopata kwenye kete yangu tena {Angalia ndani ya kikombe}. Sawa, jibu langu ni NDIYO Sasa, unaona, huwezi kujua kama nimesema NDIYO kwasababu kweli nilizidisha mwendo wa gari wiki iliyopita, au nimesema NDIYO kwasababu kete imeonyesha namba 5. Hii inamaanisha kwamba haufahamu chochote nyeti kuhusu mimi, kwahiyo wote tuko salama. Sasa tujaribu.</p> <p>Wakati huu zungusha kete ndani ya kikombe. Hakikisha unatikisa sawasawa kisha angalia ndani ya kikombe kuona umepata namba ngapi.</p> <p>Swali langu ni kwamba: Je, umekula maharage leo?</p> <p>Kwa kufuata kanuni ya kete, jibu lako ni nini, kumbuka kama kete imeonyesha namba 1,2,3 au 4 unapaswa kujibu kulingana na shughuli unazofanya, jibu lako linaweza kuwa NDIYO au HAPANA. Ingawa ukipata namba 5, unapaswa kujibu NDIYO na kama ukipata 6, unapaswa kujibu HAPANA (Onyesha kwenye kadi ya kete). SAWA. Hivyo jibu lako lilikuwa X{Taja jibu lililotolewa}, lakini ona, siwezi kusema kama umejibu X {Taja jibu lililotolewa}, kwasababu ndio shughuli yako ya kweli unayoifanya, au kwasababu kete imeonyesha namba X{sema 5 kama jibu lilikuwa NDIO, sema HAPANA kama jibu lilikuwa 6}.</p> <p>Je, umelewa?</p> <p><b>**Rudia mfano mpaka muhojiwa atakapoelewa namna ya kujibu**</b> Sasa naona umelewa mbinu hii, hivyo nitakuuliza maswali halisi. "</p>	
1. How many times did you practice the method before the respondent understood?	For interviewer to answer. To skip question enter -99
2. Kwa miezi 12 iliyopita uliwindi ndani ya \${protected_area_name} kwa mf Ndege: Kware, Kanga, wanyama wadogo: Digi digi, swala, wanyama wakubwa: Nyati, Twiga au wengine?	
3. Kwa miezi 12 iliyopita umekuwa ukivua samaki ndani ya \${protected_area_name}?	
4. Kwa miezi 12 iliyopita ulipeleka mifugo ndani ya \${protected_area_name} kwaajili ya malisho au maji?	
5. Kwa miezi 12 iliyopita ulivuna mbao au vifaa vya kujengea ndani ya \${protected_area_name}?	
6. Kwa miezi 12 iliyopita uliingia ndani ya \${protected_area_name} bila kibali?	
Section 5b: RRT questions for women	
<p>"Sasa nitakuuliza baadhi ya maswali kwa njia tofauti. Namna nitakavyokuuliza haya maswali ni kama mchezo, na kama tunavyojua kwa kila mchezo kuna kanuni ambazo unapaswa kufuata.</p> <p>Kwanza kabisa nitakupa kete na hiki kikombe, na nitakuomba utikise kete ndani ya hiki kikombe, kama hivi [Tikisa kete], tikisa kete sawasawa kabisa.</p> <p>Nitakuomba utazame ndani ya kikombe kuona namba gani imetokea kwenye kete[Tazama ndani ya kikombe].</p> <p>Kama ukitikisa kete ikatokea <b>**1,2,3 au 4**</b> unapaswa kujibu swali langu [kulingana na shughuli unazofanya] jibu lako linaweza kuwa <b>**NDIYO**</b> au <b>**HAPANA**</b>.</p>	

<p>Kama ukitikisa kete ukapata **5** ni lazima ujibu **NDIYO** kwenye swali langu. * Hata Kama hili sio jibu sahihi*</p> <p>Kama ukitikisa kete ukapata **6** ni lazima ujibu **HAPANA** kwenye swali langu * Hata Kama hili sio jibu sahihi*</p> <p>Ni muhimu kutokuniambia ni namba gani umepata kwenye kete yako, hiyo ni siri yako.</p> <p>Sasa tufanye jaribio kwanza, nitajibu swali. Tazama, natikisa kete ndani ya kikombe, na sasa nitatazama ndani ya kikombe kuona ni namba ngapi ya kete nimepata. Sawa. Kwa hiyo sasa najua ni namba ngapi nimepata, na sasa nitatazama kwenye kadi hii kujikumbusha namna ya kujibu: 1,2,3, au 4 ninapaswa kujibu kulingana na shughuli ninazofanya. Kama nimepata 5,nitasema tu NDIYO na kama nimepata namba 6, nitasema tu HAPANA.</p> <p>Sasa tufikirie kuhusu swali.... Je, nilizidisha kiwango cha mwendo nilipokuwa nikiendesha gari mjini wiki iliyopita? Ninaangalia namba niliyopata kwenye kete yangu tena {Angalia ndani ya kikombe}. Sawa, jibu langu ni NDIYO Sasa, unaona,huwezi kujua kama nimesema NDIYO kwasababu kweli nilizidisha mwendo wa gari wiki iliyopita, au nimesema NDIYO kwasababu kete imeonyesha namba 5. Hii inamaanisha kwamba haufahamu chochote nyeti kuhusu mimi, kwahiyo wote tuko salama. Sasa tujaribu.</p> <p>Wakati huu zungusha kete ndani ya kikombe. Hakikisha unatikisa sawasawa kisha angalia ndani ya kikombe kuona umepata namba ngapi.</p> <p>Swali langu ni kwamba: Je, umekula maharage leo?</p> <p>Kwa kufuata kanuni ya kete, jibu lako ni nini, kumbuka kama kete imeonyesha namba 1,2,3 au 4 unapaswa kujibu kulingana na shughuli unazofanya, jibu lako linaweza kuwa NDIYO au HAPANA. Ingawa ukipata namba 5, unapaswa kujibu NDIYO na kama ukipata 6, unapaswa kujibu HAPANA (Onyesha kwenye kadi ya kete). SAWA. Hivyo jibu lako lilikuwa X{Taja jibu lililotolewa},lakini ona, siwezi kusema kama umejibu X {Taja jibu lililotolewa}, kwasababu ndio shughuli yako ya kweli unayoifanya, au kwasababu kete imeonyesha namba X{sema 5 kama jibu lilikuwa NDIO, sema HAPANA kama jibu lilikuwa 6}.</p> <p>Je, umeelewa?</p> <p>**Rudia mfano mpaka muhojiwa atakapoelewa namna ya kujibu** Sasa naona umeelewa mbinu hii, hivyo nitakuuliza maswali halisi. "</p>	
1. How many times did you practice the method before the respondent understood?	For interviewer to answer. To skip question enter -99
2. Kwa miezi 12 iliyopita ulimshauri mtu yoyote kwenye kaya yako kuwinda wanyamapori ndani ya \${protected_area_name} mf Ndege: Kware au Kanga Wanyama wadogo: Digidigi au Swala, Wanyama wakubwa: Nyati, Twiga au wengine?	
3. Kwa miezi 12 iliyopita ulimshauri mtu yoyote kwenye kaya yako kuvua samaki ndani ya \${protected_area_name}?	
4. Kwa miezi 12 iliyopita ulimshauri mtu yoyote kwenye kaya yako kupeleka mifugo ndani ya \${protected_area_name} kwaajili ya malisho au maji?	
5. Kwa miezi 12 iliyopita ulimshauri mtu yoyote kwenye kaya yako kuvuna mbao au vifaa vya kujengea ndani ya \${protected_area_name}?	
6. Kwa miezi 12 iliyopita uliingia ndani ya \${protected_area_name} bila kibali?	
Section 6: Review of RRT	
7. \${interviewer}, unafikiri mhojiwa alielewa mbinu hii vizuri kiasi gani?	
8. \${interviewer}, any comments on RRT section?	For interviewer, if no comments leave blank
Section 7: Thank you	
Tunapenda kujifunza jinsi maisha ya watu yanavyobadilika kadiri muda unavyokwenda. Je utakuwa tayari kushiriki mahojiano yajayo na timu yetu katika kipindi cha miezi kumi na mbili ijayo?	

Kama Ndio, nitaandika jina lako, namba ya simu na jira nukta ya nyumba yako ili tuweze kukupata tutakapo rudi. Licha ya kupata taarifa hizi majibu yako yataendelea kuwa siri na hayatatolewa kwa mtu yoyote nje ya timu ya utafiti wala kuonyesha utambulisho wako popote	
2. Tafadhali niambie jina lako ili tuweze kukutafuta tena baada ya muda wa miezi 12	
3. Jina lako maarufu ni lipi?	
4. Tafadhali nitajie namba yako ya simu ili tuweze kukutafuta tena baada ya muda wa miezi 12	
5. GPS location	If you are not at the respondent's house then SKIP this question. Automatically records the GPS location when accuracy is less than 20m. You may have to be outside to get a good location
Mshukuru mhojiwa kwa muda wake	
\$(interviewer}. where is the interview being conducted?	For interviewer to answer
\$(interviewer}, what is the "other" location?	For interviewer to answer
\$(interviewer}, any notes to record? Or unusual circumstances? E.g. other people present, disruptions etc	For interviewer to answer

Table A7.4. Survey instrument used in the experimental questionnaire in English, with Kiswahili translation

Question::Kiswahili	Hint::Kiswahili
Section 1: Location	
Nani anafanya mahojiano?	
Mkoa	
Wilaya	
Jina la kijiji	Andika jina la kijiji.
Jina la kitongoji	Andika jina la kitongoji
Hifadhi iliyokaribu hapa ni ipi	**Usimwulize mhojiwa hili**
Section 2: Consent	
<p>Habari, Jina langu ni \$(interviewer} na ninamsaidia X anayetoka chuo kikuu cha X Uingereza, kufanya utafiti. Utafiti wa X unahusu kuelewa njia nzuri ya kuuliza maswali kuhusu utumiaji wa rasilimali.</p> <p>Tutauliza watu wengi kujibu maswali ya utafiti huu ili tuweze kuelewa jinsi watu wanavyopenda kujibu maswali kuhusu matumizi ya rasilimali asili. Taarifa utakayotupatia ni ya muhimu sana katika kuhakikisha kwamba tutauliza maswali kwakutumia njia sahihi.</p> <p>Mahojiano yanakadiriwa kuchukua takribani dakika 25. Taarifa yoyote utakayotupatia itakuwa ya siri, hii inamaana sitaandika jina lako au taarifa yoyote ambayo itaweza kukutambulisha binafsi au kaya yako. Majibu yako hayatatolewa kwa mtu yoyote kwa njia yoyote ambayo mtu anaweza</p>	

<p>kuhusianisha majibu yako na wewe. Nitaandika majibu yako yote kwenye simu hii. Majibu yako yote yatahifadhiwa kwenye kompyuta salama ambayo inaweza kutumiwa na XXX tu.</p> <p>Mwisho wa utafiti XXX ataandika ripoti ya majibu ya utafiti. Taarifa hii itatumika kusaidia watafiti wengine kufanya tafiti zinazokidhi mahitaji ya jamii. Matokeo mengine yanaweza kuchapishwa kimataifa ili watu wengine katika mataifa mbalimbali waweze kujifunza kupitia uzoefu wetu wa kufanya kazi katika jamii hizi.</p> <p>Tafadhali kumbuka tunajitegemea na hatuhusiani na upande wowote, uwe wa Serikali au Mashirika yasiyokuwa ya serikali na tunamtazamo usiofungamana na upande wowote. Tuna kibali kutoka Serikali ya Tanzania na Serikali ya kijiji ya kufanya utafiti huu. Japokuwa ushiriki ni wa hiari. Unaweza kuwa huru kujiondoa wakati wowote bila kutoa sababu. Kama utajiondoa nitafuta majibu yako. Kama hautakuwa huru kujibu baadhi ya maswali unarususiwa kutokujibu. Kama utataka kuruka swali au mada tafadhali sema.</p> <p>Utafiti huu umerejewa na kupewa kibali cha kimaadili kupitia chuo kikuu cha X. Kama una swali lolote, tafadhali niulize na nitajitahidi niwezavyo kukujibu.</p> <p>Kama utakuwa na wasiwasi au unataka kutoa malalamiko nitakupa mawasiliano ya mtu unayeweza kuzungumza naye.</p>	
Je, mhojiwa ametoa ridhaa yake ya ushiriki?	
Mshukuru mshiriki na maliza mahojiano.	
Taja jinsia ya mshiriki	
Section 3: Covid-19 Precautions	
<p>Wakati tunaelewa kwamba Serikali ya Tanzania imetangaza kutokuwa na ugonjwa wa COVID 19, kwasababu ni ugonjwa wa hatari, tunachukua tahadhari ili kuhakikisha usalama wetu na wa kila mmoja tunayekutana naye endapo kuna maambukizi ambayo serikali haijagundua bado.</p>	<p>If the guide has not already explained our COVID precautions then explain to the respondent:</p> <ol style="list-style-type: none"> <li>1. That the team are clear of symptoms</li> <li>2. That we wear masks to protect ourselves and the respondent</li> <li>3. That we will be working outside and maintaining social distancing</li> <li>4. We will be washing hands frequently</li> </ol>
<p>Kuna mtu yeyote kwenye kaya yako ambaye ana dalili za COVID19 ambazo zimeonekana wiki iliyopita?</p> <p>Hizi ni:</p> <ul style="list-style-type: none"> <li>• kikohozi kipya na endelevu</li> <li>• kupumua kwa shida</li> <li>• homa kali</li> <li>• kupoteza uwezo wa kutambua harufu na ladha ya chakula hivi karibuni</li> </ul>	
Thank the respondent for their time, explain that even though the sick individual may not have COVID we do not want to put other respondents at risk if they do have COVID. Wish them or their household member a quick recovery	If yes,
Section 4: Participant demographics	

Jinsia ya mshiriki	
Una umri gani?	Kama hawafahamu waombe wakadirie umri wao
Wewe ni kabila gani?	
Tafadhari ainisha kabila lako	
Ipi ni lugha yako ya msingi unayozungumza?	
Tafadhali taja lugha hiyo	
Umesoma kwa miaka mingapi?	Weka kadirio la miaka Kama hakuna weka 0 Kama hana uhakika, andika DK Kwa Stashahada/Shahada- ongeza idadi ya miaka zaidi
Unaweza kusoma?	
Ni rahisi kiasi gani kwako kusoma?	Soma machaguo kwa mhojiwa
Section 5: Introducing RRT	
<p>Lengo la kipengele kifuatacho ni kufahamu ni jinsi gani ungependa kujibu maswali.</p> <p>Tunapoulizwa maswali juu ya matumizi ya rasilimali asili, wakati mwingine hatupendi kusema ukweli.</p> <p>Tunaweza tukaona aibu juu ya majibu yetu, tunaweza tusimwamini mtu anayetuuliza maswali au tunaweza tukaogopa kwamba tutaingia matatizoni tukisema ukweli.</p> <p>Japokuwa kwetu sisi watafiti tunapouliza maswali kuhusu rasilimali asili ni muhimu sana kupata majibu sahihi na ya kweli.</p> <p>La sivyo taarifa tutakayoipata haitakuwa sahihi na hatutaweza kutoa mapendekezo mazuri kwa jamii.</p>	
<p>Ili kutatua tatizo hili, watafiti wamegundua njia malumu ya kuuliza maswali ambayo inawaruhusu watu kutoa majibu ya kweli, lakini mtafiti hawezi kusema kama mhojiwa anajihusisha na shughuli hizo.</p> <p>Ningependa kujaribu moja ya mbinu hizi na wewe ili kuona kama unaielewa na kupata maoni yako.</p> <p>Sihitaji kufahamu kama ni kitu ambacho wewe au kaya yako mnakifanya, ninapenda tu kuelewa njia sahihi kwa mtafiti kuuliza maswali kuhusu hili.</p>	
<p>Ili kuhakikisha haujibu maswali haya kuhusu wewe mwenyewe ningependa kukufahamisha kuhusu watu wa kubuni.</p> <p>Hapa nina watu 14 (wakubuni). Kila mmoja anamiliki au kufanya shughuli mbalimbali.</p> <p>Tunapojaribu mbinu mbalimbali za kujibu maswali, ningependa ufikirie wewe ni mmoja wa watu hawa wa kubuni na unipe majibu ambayo wangenipa.</p> <p>Je, umeelewa?</p>	

<p>Mtu Namba Moja anakula matunda ya aina tofauti, nayo ni:</p> <ul style="list-style-type: none"> <li>• Embe</li> <li>• Parachichi</li> <li>• Papai</li> <li>• Nanasi</li> </ul>	Kwa mfano, hapa tunaye Mtu Namba Moja.
Section 6: Practicing RRT	
<p>Jinsi ya kujibu maswali haya ni kama mchezo na katika kila mchezo kuna sheria ambazo unapaswa kuzifuata.</p> <p>Kwanza kabisa nitakupa kete uizungushe.</p> <p>Kama ukizungusha kete na ukapata **1, 2, 3, au 4** unapswa **kusema kweli**</p> <p>Kama ukizungusha kete na ukapata **5** lazima useme **Ndiyo**</p> <p>*Hata kama ndiyo sio jibu sahihi, bado unapaswa kusema ndiyo*</p> <p>Kama ukizungusha kete na ukapata **6** unapaswa kusema **Hapana**</p> <p>*Hata kama hapana sio jibu la kweli unapaswa kusema hapana*</p> <p>Unaelewa?</p> <p>Sasa tujaribu *[Zungusha kete]* Umepata namba gani? Ni Jibu gani unapswa kutoa?</p> <p>Tujaribu kwa mfano.</p> <p>Huyu ni Mtu Namba Moja. Swali langu kwa "Mtu Namba Moja, je, unakula parachichi?"</p> <p>Nazungusha kete. Nimepata XX, jibu langu linapswa kuwa XX</p> <p>Umeelewa?</p> <p>Mhojiwa alikuwa anafahamu kuhusu kete?</p>	
<p>Sasa tutajaribu na Mtu Namba Mbili.</p> <p>Mtu Namba Mbili unakula:</p> <p>Embe</p> <p>Tikiti</p> <p>Chungwa</p> <p>Ndizi</p>	*Chagua kadi kwa Mtu Namba Mbili*
<p>Mtu Namba Mbili, je, unakula parachichi?</p> <p>Kumbuka, kama ukirusha kete ukapata:</p> <p>**1, 2, 3 au 4** jibu swali kwa **ukweli**</p>	<p>Andika idadi ya majaribio yaliyofanyika kabla ya muhojiwa kutoa jibu sahihi</p> <p>Kama mhojiwa hapendi kujibu andika '999'</p>

**5** sema **ndiyo** **6** sema **hapana**	
Section 7: Collecting data – This section was repeated 6 times, once for each of the study behaviours	
Elezea kwa kifupi shughuli zilizoandikwa kwenye kadi:  \${character 1_attributes} Mtu Namba \${character 1}, \${behaviour 1}?	Chagua kadi kwa Mtu Namba **\${character 1}**
Kumbuka, kama ukirusha kete ukapata: **1, 2, 3 au 4** jibu swali kwa **ukweli** **5** sema **ndiyo** **6** sema **hapana**	Rejea 'Hifadhi' kama \${pa_type}.
Kutokana na jibu ulilotoa, unafikiri nitaweza kusema kama Mtu Namba \${character 1}, \${behaviour 1}?	
Umepata upande wa kete wenye namba ngapi? Ili niangalie kama majibu yako ni sahihi.	Kama mhojiwa hapendi kujibu andika 0
Elezea kwa kifupi shughuli zilizoandikwa kwenye kadi:  \${character 2_attributes} Mtu Namba \${character 2}, \${behaviour 1}?	Chagua kadi kwa Mtu Namba **\${character 2}**
Kumbuka, kama ukirusha kete ukapata: **1, 2, 3 au 4** jibu swali kwa **ukweli** **5** sema **ndiyo** **6** sema **hapana**	Rejea 'Hifadhi' kama \${pa_type}.
Kutokana na jibu ulilotoa, unafikiri nitaweza kusema kama Mtu Namba \${character 2}, \${behaviour 1}?	
Umepata upande wa kete wenye namba ngapi? Ili niangalie kama majibu yako ni sahihi	Kama mhojiwa hapendi kujibu andika 0
Section: 8 Review of RRT	
Unafikiri umelewa vizuri namna ya kujibu maswali?	
Ni kwa kiasi gani umeona ni rahisi kujibu maswali kwa kutumia mbinu hii?	
Unafikiri majibu yako ni ya usiri kiasi gani kwa kutumia mbinu hii?	
Je, utakuwa huru kiasi gani kujibu maswali kwa ukweli kuhusu mada nyeti kwa kutumia mbinu hii?	
Una maoni yoyote ya kuongezea?	Kitu cho chote wanachosema kuhusu mbinu hii
Section 9: Interviewer feedback	
Mwisho wa mahojiano Asante kwa kushiriki	Una maswali yoyote ya kuniuliza?
\${interviewer}, unafikiri mhojiwa alielewa mbinu hii vizuri kiasi gani?	



\$_{interviewer}\$, ulihisi kama mhojiwa alikuwa anakusudia kukosea majibu?	Mfano, alikuwa anaogopa kutoa majibu ya kweli
\$_{interviewer}\$, je muhojiwa ameonyesha ushirikiano kwa kiwango gani?	
\$_{interviewer}\$, kumhoji huyu mtu kulikuwaje?	
Una maoni yoyote au mrejesho?	Andika maoni yoyote au mrejesho

## Chapter 6

Table A.7.5. Full vignette descriptions and their Kiswahili translations used in Experiment 1 – which assessed the perceived fairness of sanctions

Block	Vignette	Kiswahili
1	1	1. Mtu mwenye mamlaka kutoka nje ya jamii yako amekamatwa na askari wa wanyamapori akichunga mifugo ndani ya hifadhi. Askari wa wanyamapori akamruhusu kuendelea bila kumchukulia hatua yoyote.
1	2	2. Mtu asiye na mamlaka kutoka nje ya jamii yako amekamatwa na askari wa wanyamapori akiwinda wanyamapori ndani ya hifadhi. Askari wa wanyamapori akapokea rushwa na akamruhusu kuendelea.
1	3	3. Mtu mwenye mamlaka kutoka nje ya jamii yako amekamatwa na askari wa wanyamapori akiwinda wanyamapori ndani ya hifadhi. Askari wa wanyamapori akataifisha nyara na kumuonya asiwinde tena.
1	4	4. Mtu asiye na mamlaka kutoka kwenye jamii yako amekamatwa na askari wa wanyamapori akichunga mifugo ndani ya hifadhi. Askari wa wanyamapori akataifisha mifugo na kumuonya asichunge huko tena.
1	5	5. Mtu mwenye mamlaka kutoka kwenye jamii yako amekamatwa na askari wa wanyamapori akiwinda wanyamapori ndani ya hifadhi. Askari wa wanyamapori akamuweka chini ya ulinzi na kumfungulia mashtaka.
1	6	6. Mtu asiye na mamlaka kutoka nje ya jamii yako amekamatwa na askari wa wanyamapori akichunga mifugo ndani ya hifadhi. Askari wa wanyamapori akamuweka chini ya ulinzi na kumfungulia mashtaka.
1	7	7. Mtu asiye na mamlaka kutoka kwenye jamii yako amekamatwa na askari wa wanyamapori akiwinda wanyamapori ndani ya hifadhi. Askari wa wanyamapori akamruhusu kuendelea bila kumchukulia hatua yoyote.
1	8	8. Mtu mwenye mamlaka kutoka kwenye jamii yako amekamatwa na askari wa wanyamapori akichunga mifugo ndani ya hifadhi. Askari wa wanyamapori akapokea rushwa na akamruhusu kuendelea kuchunga.
2	9	9. Mtu asiye na mamlaka kutoka nje ya jamii yako amekamatwa na askari wa wanyamapori akiwinda wanyamapori ndani ya hifadhi. Askari wa wanyamapori akamruhusu kuendelea bila kumchukulia hatua yoyote.
2	10	10. Mtu mwenye mamlaka kutoka nje ya jamii yako amekamatwa na askari wa wanyamapori akichunga mifugo ndani ya hifadhi. Askari wa wanyamapori akamuweka chini ya ulinzi na kumfungulia mashtaka.
2	11	11. Mtu mwenye mamlaka kutoka kwenye jamii yako amekamatwa na askari wa wanyamapori akichunga mifugo ndani ya hifadhi. Askari wa wanyamapori akamruhusu kuendelea bila kumchukulia hatua yoyote.
2	12	12. Mtu asiye na mamlaka kutoka nje ya jamii yako amekamatwa na askari wa wanyamapori akichunga mifugo ndani ya hifadhi. Askari wa wanyamapori akataifisha mifugo na kumuonya asichunge huko tena.
2	13	13. Mtu mwenye mamlaka kutoka nje ya jamii yako amekamatwa na askari wa wanyamapori akiwinda wanyamapori ndani ya hifadhi. Askari wa wanyamapori akapokea rushwa na akamruhusu kuendelea.

2	14	14. Mtu mwenye mamlaka kutoka kwenye jamii yako amekamatwa na askari wa wanyamapori akiwinda wanyamapori ndani ya hifadhi. Askari wa wanyamapori akataifisha nyara na kumuonya asiwinde tena.
2	15	15. Mtu asiye na mamlaka kutoka kwenye jamii yako amekamatwa na askari wa wanyamapori akiwinda wanyamapori ndani ya hifadhi. Askari wa wanyamapori akamuweka chini ya ulinzi na kumfungulia mashtaka.
2	16	16. Mtu asiye na mamlaka kutoka kwenye jamii yako amekamatwa na askari wa wanyamapori akichunga mifugo ndani ya hifadhi. Askari wa wanyamapori akapokea rushwa na akamruhusu kuendelea kuchunga.
3	17	17. Mtu asiye na mamlaka kutoka nje ya jamii yako amekamatwa na askari wa wanyamapori akiwinda wanyamapori ndani ya hifadhi. Askari wa wanyamapori akataifisha nyara na kumuonya asiwinde tena.
3	18	18. Mtu mwenye mamlaka kutoka nje ya jamii yako amekamatwa na askari wa wanyamapori akiwinda wanyamapori ndani ya hifadhi. Askari wa wanyamapori akamuweka chini ya ulinzi na kumfungulia mashtaka.
3	19	19. Mtu mwenye mamlaka kutoka kwenye jamii yako amekamatwa na askari wa wanyamapori akichunga mifugo ndani ya hifadhi. Askari wa wanyamapori akataifisha mifugo na kumuonya asichunge huko tena.
3	20	20. Mtu asiye na mamlaka kutoka kwenye jamii yako amekamatwa na askari wa wanyamapori akichunga mifugo ndani ya hifadhi. Askari wa wanyamapori akamuweka chini ya ulinzi na kumfungulia mashtaka.
3	21	21. Mtu mwenye mamlaka kutoka kwenye jamii yako amekamatwa na askari wa wanyamapori akiwinda wanyamapori ndani ya hifadhi. Askari wa wanyamapori akamruhusu kuendelea bila kumchukulia hatua yoyote.
3	22	22. Mtu asiye na mamlaka kutoka kwenye jamii yako amekamatwa na askari wa wanyamapori akiwinda wanyamapori ndani ya hifadhi. Askari wa wanyamapori akapokea rushwa na akamruhusu kuendelea.
3	23	23. Mtu asiye na mamlaka kutoka nje ya jamii yako amekamatwa na askari wa wanyamapori akichunga mifugo ndani ya hifadhi. Askari wa wanyamapori akamruhusu kuendelea bila kuchukulia hatua yoyote.
3	24	24. Mtu mwenye mamlaka kutoka nje ya jamii yako amekamatwa na askari wa wanyamapori akichunga mifugo ndani ya hifadhi. Askari wa wanyamapori akapokea rushwa na akamruhusu kuendelea kuchunga.
4	25	25. Mtu mwenye mamlaka kutoka kwenye jamii yako amekamatwa na askari wa wanyamapori akichunga mifugo ndani ya hifadhi. Askari wa wanyamapori akamuweka chini ya ulinzi na kumfungulia mashtaka.
4	26	26. Mtu asiye na mamlaka kutoka nje ya jamii yako amekamatwa na askari wa wanyamapori akichunga mifugo ndani ya hifadhi. Askari wa wanyamapori akapokea rushwa na akamruhusu kuendelea kuchunga.
4	27	27. Mtu mwenye mamlaka kutoka kwenye jamii yako amekamatwa na askari wa wanyamapori akiwinda wanyamapori ndani ya hifadhi. Askari wa wanyamapori akapokea rushwa na akamruhusu kuendelea.
4	28	28. Mtu mwenye mamlaka kutoka nje ya jamii yako amekamatwa na askari wa wanyamapori akichunga mifugo ndani ya hifadhi. Askari wa wanyamapori akataifisha mifugo na kumuonya asichunge huko tena.
4	29	29. Mtu mwenye mamlaka kutoka nje ya jamii yako amekamatwa na askari wa wanyamapori akiwinda wanyamapori ndani ya hifadhi. Askari wa wanyamapori akamruhusu kuendelea bila kumchukulia hatua yoyote.
4	30	30. Mtu asiye na mamlaka kutoka kwenye jamii yako amekamatwa na askari wa wanyamapori akichunga mifugo ndani ya hifadhi. Askari wa wanyamapori akamruhusu kuendelea bila kumchukulia hatua yoyote.
4	31	31. Mtu asiye na mamlaka kutoka nje ya jamii yako amekamatwa na askari wa wanyamapori akiwinda wanyamapori ndani ya hifadhi. Askari wa wanyamapori akamuweka chini ya ulinzi na kumfungulia mashtaka.
4	32	32. Mtu asiye na mamlaka kutoka kwenye jamii yako amekamatwa na askari wa wanyamapori akiwinda wanyamapori ndani ya hifadhi. Askari wa wanyamapori akataifisha nyara na kumuonya asiwinde tena.

Table A7.6. Respondents in Tanzania were randomly allocated to one of the following vignettes in Experiment 2, which assessed the impact of corruption and norms on willingness to comply.

Vignette	Compliance	Corruption	English	Kiswahili
1	high	low	Members of your community rarely break rules by entering the Protected Area to collect resources. If caught breaking rules by a ranger, it is very likely that offenders will face criminal charges or fines.	Wanajamii wa jamii yenu huvunja sheria mara chache kwa kuingia ndani ya Hifadhi kukusanya rasilimali. Kama wakikamatwa na askari wa wanyamapori wakivunja sheria, kuna uwezekano mkubwa kwamba wakoaji watakabiliwa na mashtaka ya jinai au faini.
2	low	high	Members of your community often break rules by entering the Protected Area to collect resources. If caught breaking rules by a ranger, it is very likely that offenders can pay a bribe and avoid any criminal charges.	Wanajamii wa jamii yenu huvunja sheria mara nyingi kwa kuingia ndani ya Hifadhi kukusanya rasilimali. Kama wakikamatwa na askari wa wanyamapori wakivunja sheria, kuna uwezekano mkubwa kwamba wakoaji wanaweza kutoa rushwa na kuepuka mashtaka yoyote ya jinai.
3	high	high	Members of your community rarely break rules by entering the Protected Area to collect resources. If caught breaking rules by a ranger, it is very likely that offenders can pay a bribe and avoid any criminal charges.	Wanajamii wa jamii yenu huvunja sheria mara chache kwa kuingia ndani ya Hifadhi kukusanya rasilimali. Kama wakikamatwa na askari wa wanyamapori wakivunja sheria, kuna uwezekano mkubwa kwamba wakoaji wanaweza kutoa rushwa na kuepuka mashtaka yoyote ya jinai.
4	low	low	Members of your community often break rules by entering the Protected Area to collect resources. If caught breaking rules by a ranger, it is very likely that offenders will face criminal charges or fines.	Wanajamii wa jamii yenu huvunja sheria mara nyingi kwa kuingia ndani ya Hifadhi kukusanya rasilimali. Kama wakikamatwa na askari wa wanyamapori wakivunja sheria, kuna uwezekano mkubwa kwamba wakoaji watakabiliwa na mashtaka ya jinai au faini.

Table A7.7. Survey instrument in English and Kiswahili

Question (Kiswahili)	Response options (Kiswahili)
Section 1: Survey location (interviewer completes)	
Region	
District	
What is the district?	
Village	
Sub-village	
Which is the nearest protected area?	
Who is conducting the interview?	
What gender is the respondent?	
Section 2: Experimental design details (not shown to respondent)	
Vignette order: \${v_order}	
Vignettes selected from block: \${block}	

Scenario number: \${rand_scenario}	
Section 3: Consent	
<p>Jina langu naitwa \${interviewer} ni mtafiti msaidizi katika mradi unaotekelezwa na chuo kikuu cha Bangor kilichoko Uingereza. Ningependa kukukaribisha kushiriki katika utafiti huu mfupi.</p> <p>Lengo la utafiti huu ni kuelewa juu ya maisha yakoje kwa watu kama nyinyi manoishi karibu na hifadhi. Nakuomba kushiriki kwasababu unaishi eneo hili ambalo lipo karibu na [Jina la hifadhi]. Kwa ujumla tunatarajia kuzungumza na wanakijiji 200-300 ambao wanaishi karibu na hifadhi.</p> <p>Kama unakubali kushiriki nitakuuliza maswali machache na kujaza majibu yako kwenye kifaa hiki. Sitachukua jina lako au anwani yako na majibu yako yatakuwa ni siri. Kipengele cha kwanza cha maswali kinakuhusu wewe na kaya yako, halafu nitakuuliza kuhusu shughuli mbalimbali ambazo unawezakuwa umewahikufanya au hujawahi ndani ya hifadhi Baada ya hapo nitakuuliza maswali kuhusu maoni yako na uzoefu wako wa kuishi katika eneo hili. Mahojiano haya yatachukua muda wa dk45 mpaka saa moja.</p> <p>Kwasababu sitaandika jina lako Majibu yako hayatahusianishwa na wewe na haitawezekana kukutambua kutoka kwenye majibu tuliyoandika. Taarifa utakazitoa hazitatolewa kwa mtu yoyote nje ya timu hii ya utafiti na itatumika tu na watafiti wa timu hii walioko Uingereza. Majibu yako pamoja na wale watu wengine 200-300 yatumika kuandika ripoti.</p> <p>Utafiti huu umethibitishwa na Kamati ya Maadili ya Chuo kikuu cha Bangor. Kama hautapenda kushiriki katika mahojiano haya ni sawa, pia unaruhusiwa kuondoka kama utapata dharura au ukibadilisha mawazo wakati wowote tafadhali niambie na nitasitisha mahojiano mara moja.</p> <p>Je, una swali lolote la kuniuliza kabla hatujaendelea?</p> <p>Kama una wasiwasi wowote tafadhali wasiliana nasi kwa namba (mpe kadi ya mawasiliano)</p> <p>Je, utapenda kushiriki katika utafiti huu?</p>	Ndiyo / Hapana
<ul style="list-style-type: none"> <li>• Nakiri kwamba nimesoma/ kusomewa fomu ya [Conservation and Human Behavior-ConHuB] yaani Uhifadhi wa Mazingira na tabia za watu] na nimeelewa juu ya utafiti huu.</li> <li>• Nilipewa nafasi ya kuuliza maswali na kupewa majibu yanayoridhisha.</li> <li>• Naelewa kuwa kushiriki kwangu ni kwa hiari na niko huru kujitoa muda wowote nikipata dharura, na nikijitoa taarifa nilizotoa kwenye mjadala zitafutwa.</li> <li>• Naelewa kwamba majibu niliyotoa yatumika kwa kusudi lililotolewa kwenye fomu ya ConHuB ya ushiriki wa mahojiano</li> </ul> <p>Kwa taarifa hapo juu nakubali kushiriki kwenye mjadala huu</p>	Ndiyo / Hapana
Section 4: COVID-19 precautions	

Wakati tunaelewa kwamba Serikali ya Tanzania imetangaza kutokuwa na ugonjwa wa COVID 19, kwasababu ni ugonjwa wa hatari , tunachukua tahadhari ili kuhakikisha usalama wetu na wa kila mmoja tunayekutana naye endapo kuna maambukizi ambayo serikali haijagundua bado.	
Kuna mtu yeyote kwenye kaya yako ambaye ana dalili za COVID19 ambazo zimeonekana wiki iliyopita?	Ndiyo / Hapana
Hizi ni: • kikohozi kipya na endelevu; • kupumua kwa shida; • homa kali; • kupoteza uwezo wa kutambua harufu na ladha ya chakula hivi karibuni?	
Mshukuru muhojiwa kwa muda wake, mueleze kwamba ingawa mgonjwa anaweza akawa hauguwi COVID hatuhitaji kuweka washiriki wengine katika hatari kama watakuwa wanaugua COVID. Watakie wao au wanakaya/mwanakaya kupona haraka	
Section 5: Respondent demographics	
Nitakuiliza mswali machache kuhusu wewe na watu wengine wa kaya yako, Ninaposema kaya ninamaanisha wale wote wanaokula pamoja na kulala kwenye nyumba moja ni kijuimuisha na watoto waliopo shule za bweni.	
1. Una umri gani?	
2. Wewe ni kabila gani?	
2b. Tafadhali taja kabila lako	
3. Umeishi kwenye kijiji hiki kwa miaka mingapi?	
4. Je, unasoma shule kwa sasa?	
5. Umesoma shule kwa miaka mingapi?	
6. Watu wangapi wengine unaishi nao kwenye kaya yako? Watu wazima na watoto	
7. Wanakaya wangapi ambao wana umri wa miaka 13 au zaidi, wamemaliza angalau miaka 7 ya shule?	
8. Je, kwenye kaya kuna watoto ambao wako kati ya umri wa miaka 7 na 18 ambao hawaendi shule?	
Section 6: Multi-dimensional measure of poverty	
1. Je, ni shughuli gani kuu ya kujikimu katika kaya yako?	
2. Je, kuna umeme au Solar kwenye makazi yenu ya kudumu?	
3. Je, kaya yako ina choo?	
3a. Taja ni aina gani ya choo	
3b. Taja aina 'nyingine' ya choo?	
4. Je, choo cha kaya yako kinatumiwa na Kaya nyingine?	
5a. Chanzo kikuu cha maji ya kunywa kwenye kaya yako ni kipi?	
5b. Taja chanzo 'kingine' cha maji ya kunywa kwenye kaya yako?	
6. Unatumia dakika ngapi kwenda na kurudi kwenye chanzo kikuu cha maji kwa kutembea au kutumia usafiri unaoutumia mara kwa mara kwenda kufata maji?	

7a. Sakafu ya nyumba yenu ya kudumu imetengenezwa na nini?	
7b. Taja aina nyingine ya sakafu?	
8a. Taja chanzo kikuu cha nishati ya kupikia kwenye kaya yako?	
8b. Taja chanzo 'kingine' cha nishati ya kupikia kwenye kaya yako?	
9. Je, kwenye kaya yako kuna mtoto yeyote wa chini ya umri wa miaka 18 amefariki katika kipindi cha miaka 5 iliyopita?	
10. Je, ni watoto wangapi wa chini ya umri wa miaka 18 wamefariki kwenye kaya yako katika kipindi cha miaka 5 iliyopita?	
Sasa, nitakuuliza maswali juu ya upatikanaji wa chakula kwenye kaya yako katika kipindi cha miezi 12 iliyopita.	
11. Katika kipindi cha miezi 12 iliyopita, ni mara ngapi kumekosekana chakula cha aina yo yote, nyumbani kwako kutokana na ukosefu wa rasilimali ya kujipatia chakula?	
12. Katika kipindi cha miezi 12 iliyopita, ni mara ngapi mwanakaya yeyote amelala njaa usiku kwa sababu hakuna chakula cha kutosha?	
13. Katika kipindi cha miezi 12 iliyopita, ni mara ngapi mwanakaya yeyote kwenye kaya yako ameshinda mchana kutwa na kulala usiku kucha bila kula kitu chochote kwasababu hakuna chakula cha kutosha?	
Maswali yafuatayo ni juu ya vitu unavyovimiliki wewe na kaya yako.	
14. Kaya yako inamiliki radio ngapi?	
15. Kaya yako inamiliki runinga ngapi?	
16. Kaya yako inamiliki simu ngapi za mkononi?	
17. Kaya yako inamiliki baiskeli ngapi?	
18. Kaya yako inamiliki Pikipiki ngapi?	
19. Kaya yako inamiliki majokofu mangapi?	
20. Kaya yako inamiliki magari mangapi?	
Maswali yafuatayo yanahusu jinsi unavyojichukulia wewe binafsi na kaya yako, tafadhali jibu kwa uwiano wa nakubali kabisa na kutokukubali kabisa	
21. Kaya yako ni masikini	Nakubali kabisa, Nakubali, Kutokufungamana, Kutokukubaliana, Hukubaliani kabisa, Kupendelea kutokujibu, Sijui
22. Kaya yako inafuraha	
23. Kaya yako inamafanikio	
24. Wanajamii wana utayari wa kusaidiana (mf. Kwenye kazi, chakula au kifedha)	
25. Uaminifu baina ya wanajamii katika kijiji hiki ni mkubwa	
26. Migogoro baina ya watu na familia katika jamii hii inatokea mara kwa mara	
27. Ukubwa wa ardhi unayomiliki kwa sasa unaonyesha mafanikio yako	
28. Idadi ya ng'ombe uliyonayo kwa sasa inaonyesha mafanikio yako	
29. Unafikiri familia ya watu watano inahitaji kuwa na ekari ngapi ili kuwa na maisha mazuri?	
30. Je, wewe una ekari ngapi?	

31. Unafikiri familia ya watu watano inahitaji kuwa na ng'ombe wangapi ili kuwa na maisha mazuri?	
32. Je, wewe unamiliki ng'ombe wangapi?	
33. \${interviewer}, any comments on the poverty section?	
Section 7: Factorial Survey Experiment → \${v_X_q} – represents the vignette number shown to the respondent	
Sasa nitakusomea maelezo mafupi kadhaa ya mwingiliano wa kidhahania/kufikirika kati ya Askari wa wanyamapori wa Hifadhi na watu wanaoingia ndani ya Hifadhi. Kwa kila moja ningependa uzingatie hali hiyo na uniambie unafikiri matokeo ni ya haki kiasi gani.	
Vignette 1 : \${v1_q} Unafikiri ni Haki kiasi gani?	Haki kabisa, Haki, Kutokufungamana, Sio Haki, Sio Haki kabisa, Kupendelea kutokujibu, Sijui
v1b. Unafikiri kuna uwezekano kiasi gani wa hali hii kutokea katika maisha halisi?	Inawezekana kabisa, Inawezekana, Kutokufungamana, Haiwezekani, Haiwezekani kabisa, Kupendelea kutokujibu, Sijui
Vignette 2 : \${v2_q} Unafikiri ni Haki kiasi gani?	Haki kabisa, Haki, Kutokufungamana, Sio Haki, Sio Haki kabisa, Kupendelea kutokujibu, Sijui
v2b. Unafikiri kuna uwezekano kiasi gani wa hali hii kutokea katika maisha halisi?	Inawezekana kabisa, Inawezekana, Kutokufungamana, Haiwezekani, Haiwezekani kabisa, Kupendelea kutokujibu, Sijui
Vignette 3 : \${v3_q} Unafikiri ni Haki kiasi gani?	Haki kabisa, Haki, Kutokufungamana, Sio Haki, Sio Haki kabisa, Kupendelea kutokujibu, Sijui
v3b. Unafikiri kuna uwezekano kiasi gani wa hali hii kutokea katika maisha halisi?	Inawezekana kabisa, Inawezekana, Kutokufungamana, Haiwezekani, Haiwezekani kabisa, Kupendelea kutokujibu, Sijui
Vignette 4 : \${v4_q} Unafikiri ni Haki kiasi gani?	Haki kabisa, Haki, Kutokufungamana, Sio Haki, Sio Haki kabisa, Kupendelea kutokujibu, Sijui
v4b. Unafikiri kuna uwezekano kiasi gani wa hali hii kutokea katika maisha halisi?	Inawezekana kabisa, Inawezekana, Kutokufungamana, Haiwezekani, Haiwezekani kabisa, Kupendelea kutokujibu, Sijui
Vignette 5 : \${v5_q} Unafikiri ni Haki kiasi gani?	Haki kabisa, Haki, Kutokufungamana, Sio Haki, Sio Haki kabisa, Kupendelea kutokujibu, Sijui
v5b. Unafikiri kuna uwezekano kiasi gani wa hali hii kutokea katika maisha halisi?	Inawezekana kabisa, Inawezekana, Kutokufungamana, Haiwezekani, Haiwezekani kabisa, Kupendelea kutokujibu, Sijui
Vignette 6 : \${v6_q} Unafikiri ni Haki kiasi gani?	Haki kabisa, Haki, Kutokufungamana, Sio Haki, Sio Haki kabisa, Kupendelea kutokujibu, Sijui
v6b. Unafikiri kuna uwezekano kiasi gani wa hali hii kutokea katika maisha halisi?	Inawezekana kabisa, Inawezekana, Kutokufungamana, Haiwezekani, Haiwezekani kabisa, Kupendelea kutokujibu, Sijui
Vignette 7 : \${v7_q} Unafikiri ni Haki kiasi gani?	Haki kabisa, Haki, Kutokufungamana, Sio Haki, Sio Haki kabisa, Kupendelea kutokujibu, Sijui

## Appendix 7 – Kiswahili Survey Instruments

v7b. Unafikiri kuna uwezekano kiasi gani wa hali hii kutokea katika maisha halisi?	Inawezekana kabisa, Inawezekana, Kutokufungamana, Haiwezekani, Haiwezekani kabisa, Kupendelea kutokujibu, Sijui
Vignette 8 : \${v8_q} Unafikiri ni Haki kiasi gani?	Haki kabisa, Haki, Kutokufungamana, Sio Haki, Sio Haki kabisa, Kupendelea kutokujibu, Sijui
v8b. Unafikiri kuna uwezekano kiasi gani wa hali hii kutokea katika maisha halisi?	Inawezekana kabisa, Inawezekana, Kutokufungamana, Haiwezekani, Haiwezekani kabisa, Kupendelea kutokujibu, Sijui
Section 8: Scenario	
Tafadhali niambie ni kwa kiwango gani unakubaliana au kutokukubaliana na sentensi zifuatazo	
1. Kukiuka kanuni za hifadhi kuna hatarisha jina zuri la watu katika jamii	Nakubali kabisa, Nakubali, Kutokufungamana, Kutokukubaliana, Hukubaliani kabisa, Kupendelea kutokujibu, Sijui
2. Kanuni za Hifadhi zinasaidia uhifadhi wa bioanuai/viumbe hai	
3. Kanuni za Hifadhi ni haki na zinaendana na sheria	
4. Kuvunja kanuni kunachukuliwa kama kutokuwa mwaminifu kwa wanajamii	
Sasa nitakusomea mazingira ya kufikirika. Kulingana na mazingira nitakuuliza maswali, tafadhali jibu kwa ukweli uwezavyo.	
Fikiria hali zifuatazo. \${scenario}	
5. Ikiwa mazingira haya ni kweli, utakuwa tayari kiasi gani kufuata sheria za hifadhi kwa ujumla?	Utayari kabisa, Utayari, Kutokufungamana, Kutokuwa na utayari, Kutokuwa na utayari kabisa, Kupendelea kutokujibu, Sijui
6. Ikiwa mazingira haya ni kweli, ni mara ngapi utafuata sheria za hifadhi katika miezi ijayo?	Kila wakati, Karibu kila wakati, Mara kwa mara, Nadra, Kamwe, Kupendelea kutokujibu, Sijui
7. Ikiwa mazingira haya ni kweli, ni kwa kiwango gani unaweza kuamua kukiuka kanuni za hifadhi?	Kuamua bila shaka, Kuamua au kutokuamua, Kutokuamua, Kupendelea kutokujibu, Sijui
Section 9: End of survey	
Utafiti sasa umeisha. Asante kwa kushiriki.	
Je, muhojiwa alishiriki kiasi gani katika utafiti/ mahojiano?	Kushiriki sana, Kushiriki, Kutokufungamana, Kutokushiriki, Kutokushiriki kabisa
Umeonaje/ilikuwaje kumuhoji mtu huyu?	Rahisi sana, Rahisi, Kutokufungamana, Ngumu, Ngumu sana
Je, Unachochote cha kuongeza?	