Win-win? Balancing people's uses of nature with biodiversity No Net Loss



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Abstract

Governments, businesses and lenders worldwide are increasingly adopting a 'No Net Loss' (NNL) objective for biodiversity, often partly achieved through biodiversity offsetting as the last step in a hierarchy of mitigation measures (avoidance, minimisation, remediation and offsetting). Offsets aim to balance residual losses of biodiversity caused by development in one location with commensurate gains at another. For offsets to be effective, they need to be designed and implemented to satisfy ecological, economic and social needs. Incorporating the values that people place on nature, including biodiversity, into offset designs can help to make them more sustainable and equitable.

While ecological challenges to achieve NNL are debated, the associated gains and losses for local people have received less attention. International best practice suggests that offsets should make local people 'no worse off', but there is a lack of clarity concerning how to achieve this with regard to people's use and non-use values for nature, especially given the inevitable trade-offs when compensating biodiversity losses with gains elsewhere. This is particularly a challenge for countries such as Uganda, where poor people depend on natural resources; badly planned offsets can exacerbate poverty, and development and offset impacts can vary spatially, temporally, and by location, gender and livelihood.

I conceptualise the 'no worse off' principle, and propose a definition for determining whether people are 'no worse off, or preferably better off' in the context of biodiversity NNL: project-affected people (appropriately aggregated) should perceive the component of their wellbeing associated with biodiversity losses and gains to be at least as good as a result of the development project and associated biodiversity offset, throughout the project lifecycle, than if the development had not been implemented.

I then explore how this 'no worse off' principle and definition can be operationalised, using the Bujagali and Isimba Hydropower Projects and the associated Kalagala Offset in south-

eastern Uganda as a case study. I use a human wellbeing framework to evaluate local people's perceived social impacts (both positive and negative) of the two hydropower projects on their perceived wellbeing. I explore how these perceived impacts vary geographically and between socio-demographic groups, thereby providing insight into what appropriate aggregation unit (individual, household, interest group, village or region) could potentially be used when measuring impacts on people's wellbeing. Once the perceived social impacts have been identified, I use a mixed-methods approach to understand the cultural dynamics of the study area and, in particular, the perceived impacts of the development projects and offset on local people's nature-based cultural values. This aims to address the lack of empirical research on incorporating people's non-use cultural values associated with nature into a biodiversity NNL strategy for individual developments, including biodiversity offsetting. Lastly, I use a stated preference choice experiment to solicit local people's preferences for different proposed compensatory activities as part of a biodiversity offset, with the aim of improving the benefits that offsets generate for people. This provides an empirical example of how choice experiments can be used to inform socially acceptable biodiversity offset designs.

The research findings highlight the importance of designing project-level NNL strategies that account for the use and non-use values that local people attribute to nature. This will help improve the social acceptability of a combined development and biodiversity offset, and provide insight into how governments, financial institutions and developers can design, implement and maintain equitable and sustainable project-level NNL strategies that protect nature but also leave local people 'no worse off, or preferably better off'.

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Author Contributions

Chapter 1: Introduction

This chapter is entirely my own work and has been reviewed by E.J. Milner-Gulland, Julia Baker and Joseph Bull.

Chapter 2: Theoretical background and case study

This chapter is entirely my own work and has been reviewed by E.J. Milner-Gulland, Julia Baker and Joseph Bull.

Chapter 3: No Net Loss for people and biodiversity

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Chapter 4: Changes in wellbeing that result from impacts on nature from major infrastructure developments

I conceived the research questions with input and guidance from E.J. Milner-Gulland, Julia Baker and Joseph Bull. I carried out the data collection and analyses and wrote the chapter. The chapter was reviewed by E.J. Milner-Gulland, Julia Baker and Joseph Bull.

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Chapter 7: Discussion

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Table of Contents

Chapter 1: Introduction 18

1.1 Research statement 19

1.2 Aims and objectives 24

1.3 Thesis outline 25

1.4 Thesis framing 29

1.5 Positionality, biases and limitations 33

Chapter 2: Theoretical background and case study 39

2.1 Introduction 40

2.2 Biodiversity No Net Loss 40

2.3 The mitigation hierarchy 42

2.4 Biodiversity offsetting as a tool for achieving biodiversity No Net Loss 44

2.5 International guidance for biodiversity NNL and biodiversity offsetting 50

2.6 Benefits and challenges facing biodiversity NNL strategies and biodiversity offsets.. 55

2.7 Social impacts of economic development and biodiversity NNL strategies 64

2.8 Uganda: national context 73

2.9 Case study: regional context 92

2.10 Why Uganda and this case study? 104

2.11 Current projects in Uganda working on NNL / NG of biodiversity and biodiversity offsets… 105

Chapter 3: No Net Loss for people and biodiversity 107

3.1 Introduction 108

3.2 Conceptualising the ‘no worse off’ principle for NNL of biodiversity 113

3.3 Defining ‘no worse off’ in the context of biodiversity NNL 127

3.4 Discussion 127

Chapter 4: Changes in wellbeing that result from impacts on nature from major infrastructure developments 130

4.1 Introduction 131

4.2 Methods 135

4.3 Results 151

4.4 Discussion 185

Chapter 5: Incorporating people's nature-based cultural values into biodiversity NNL strategies for a development project 198

5.1 Introduction 199

5.2 Background 203

5.3 Methods 207

5.4 Results 218

5.5 Discussion 239

5.6 Conclusion 255

Chapter 6: Local preferences for implementing socially-acceptable biodiversity offsets 256

6.1 Introduction 257

6.2 Material and methods 261

6.3 Results 272

6.4 Discussion 285

Chapter 7: Discussion 291

7.1 Overview 292

7.2 The 'no worse off' principle 293

7.3 Trade-offs and win-win optimism 312

7.4 Implications for biodiversity NNL strategies and practical application of the 'no worse off' principle 317

7.5 Future research 320

7.6 Conclusion 324

References 325

Appendix A: Supplementary information for Chapter 4 344

Appendix B: Supplementary information for Chapter 5 399

Appendix C: Supplementary information for Chapter 6 425

List of Figures

Figure 1-1: Conceptual framework for the thesis. Boxes represent the main research themes and are numbered by chapter; arrows indicate the logical flow. Dotted lines indicate the four components of the thesis. The term ‘no net loss’ is abbreviated as ‘NNL’. 26

Figure 2-1: Steps of the traditional mitigation hierarchy 43

Figure 2-2: A schematic illustration of a biodiversity offsetting strategy. Biodiversity at A is removed for the development of a dam; a Central Forest Reserve (CFR) at B, is expanded as part of the offset to compensate for this loss and achieve a NNL of biodiversity 46

Figure 2-3: Map of Uganda..... 75

Figure 2-4: Map of the study site, with the dotted purple outline showing the extent of the Kalagala Offset catchment 93

Figure 3-1: Spatial redistribution of gains and losses from the development and offset, leading to social inequity 120

Figure 3-2: The degree of aggregation and the level at which social gains and losses associated with biodiversity-related impacts of the combined development project and offset can be measured 124

Figure 4-1: Framework used for studying human wellbeing in this chapter, based on that used by Britton & Coulthard (2013) and Beauchamp et al. (2018), drawing from the World Bank’s “Voices of the Poor” (VoP; Naraya et al. 2000) and Wellbeing in Developing Countries (WeD)..... 136

Figure 4-2: Schematic representation of the study area with study villages shown as red dots..... 137

Figure 4-3: Frequency at which the five wellbeing domains were mentioned in each village, aggregated across individuals per village..... 158

Figure 4-4: Proportion of respondents not affected, who have gained or who have lost land, income and food production as a result of the dam..... 176

Figure 5-1: Diagrammatic representation of the three themes emerging from the thematic analysis of the elements of general cultural heritage. Relative circle sizes depict the frequency that each theme was mentioned during the FGDs; arrows indicate the direction in in which the themes interact 223
Figure 5-2: Most frequently mentioned codes (in blue), under Theme 1: spiritual beliefs, rituals and ceremonies, and associated quotations from FGDs (in green)..... 225
Figure 5-3: Most frequently mentioned codes (in blue), under Theme 2: nature, and associated quotations from FGDs (in green)..... 228
Figure 5-4: Most frequently mentioned codes (in blue), under Theme 3: changes in cultural heritage, and associated quotations from FGDs (in green)..... 231
Figure 5-5: Proportion of respondents in each village responding to whether the dam had affected sacred sites in their village..... 233
Figure 6-1: Economic valuation techniques. Modified from Choi et al. (2010) and Vega & Alpizar (2011) 262

List of Tables

Table 2-1: Averted loss and restoration biodiversity offsets 47

Table 2-2: Benefits of NNL strategies and biodiversity offsets 56

Table 2-3: Challenges facing NNL strategies and biodiversity offsets 59

Table 2-4: International, regional and national environmental legislation and policies in Uganda 80

Table 2-5: Major hydropower projects in Uganda (adapted from Olanya 2016)..... 86

Table 3-1: Values assigned to biodiversity and whether these values are captured by biodiversity offsetting 109

Table 4-1: Variables included in the cumulative link mixed models 149

Table 4-2: Characteristics of respondents 151

Table 4-3: Top ten cultural salience scores and associated frequency of wellbeing components, aggregated by respondents in all villages and named during the individual questionnaire 156

Table 4-4: Results from a CLMM with a logit link function of how people feel their life has been over the past year, with respect to predictor variables 160

Table 4-5: Top ten wellbeing components, aggregated by respondents in all villages, named as being reasons why life has been hard (n = 830) or good (n = 216) over the past year 161

Table 4-6: Results from a CLMM with a logit link function of how people feel the dam has affected their ability to lead a good life, with respect to predictor variables..... 167

Table 4-7: Top ten wellbeing components, aggregated by respondents in all villages, named as being reasons why people feel angry (n = 84), sad (n = 327) or happy (n = 556) about the dam's construction in the study area 169

Table 4-8: Results of a CLMM with a logit link function for how people feel the dam has affected their household relationships, with respect to predictor variables 180

Table 5-1: Variables included in the cumulative link mixed models 215

Table 5-2: CLMM results with logit link function of perceptions of the importance of cultural heritage to wellbeing compared to other factors, with respect to predictor variables 221
Table 5-3: Applying the mitigation hierarchy to manage impacts to people's nature-based cultural values, using the Bujagali Hydropower Project and Kalagala Offset case study and a hypothetical model case study in which different considerations for incorporating cultural heritage fully are explored 248
Table 6-1: Attributes (offset activities) and levels used in the choice experiment 268
Table 6-2: Characteristics of respondents 273
Table 6-3: Marginal rates of substitution for significant RPL model parameter estimates for the pooled data and individual villages. All values are relative to the 'sustainable livelihoods' attribute and 2.5% and 97.5% confidence intervals are in parentheses. Non-significant estimates are shown as a dash 278
Table 6-4: Likelihood ratio test of parameter equality between the pooled model and the model with villages separated 281
Table 6-5: RPL model parameter estimates and standard errors for the pooled village choice data, with both the mean effect and the interactions with socio-demographic variables. Standard errors are in parentheses, significant coefficients are in bold. Significance thresholds are 1% (***), 5% (**) and 10% (*) 282

Acronyms and abbreviations

AIC	Akaike Information Criterion
AOI	Area of Influence
BACI	Before-After-Control Intervention
BBOP	Business and Biodiversity Offsets Programme
BNS	Basic Necessities Survey
CBD	Convention on Biological Diversity
CE	Choice Experiment
CFR	Central Forest Reserve
CLMM	Cumulative Link Mixed Model
CV	Contingent Valuation
DEO	District Environmental Officer
DFID	Department for International Development
DRC	Democratic Republic of Congo
EFA	Exploratory Factor Analysis
EIA	Environmental Impact Assessment
eMBeD	The Mind, Behaviour, and Development Unit
ESIA	Environmental and Social Impact Assessment
EU	European Union
FGD	Focus Group Discussion
GIIP	Good International Industry Practice
GNH	Gross National Happiness
HPI	Happy Planet Index
IAIA	International Association for Impact Assessment
ICDP	Integrated Conservation and Development Programme
ICT	Information, Communications and Technology
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
KII	Key Informant Interview
KMO	Kaiser-Meyer-Olkin
LC1	Village Local Council / Chairman
MEA	Millennium Ecosystem Assessment
MNL	Multinomial Logit
MoWE	Ministry of Water and Environment
MRS	Marginal Rate of Substitution
NAADS	National Agricultural Advisory Services

NBSAPII	National Biodiversity Strategy and Action Plan
NCA	Natural Capital Accounting
NEA	National Environment Act
NEAP	National Environment Action Plan
NEMA	National Environmental Management Authority
NEMP	National Environment Management Policy
NFA	National Forest Authority
NG	Net Gain
NGO	Non-governmental Organisation
NNL	No Net Loss
ODK	Open Data Kit
PAP	Project-affected Persons
PES	Payment for Ecosystem Services
RAs	Research Assistants
REDD+	Reducing Emissions from Deforestation and forest Degradation
RP	Revealed Preference
RPL	Random Parameters Logit
SEAT	Socio-Economic Assessment Toolbox
SIA	Social Impact Assessment
SLA	Sustainable Livelihoods Approach
SLO	Social Licence to Operate
SMP	Sustainable Management Plan
SOUL	Supporting Opportunities for Ugandans to Learn Foundation
SP	Stated preference
ToR	Terms of Reference
UGX	Ugandan Shillings
UNDP	United Nations Development Program
UNESCO	United Nations Education, Scientific and Cultural Organisation
UWA	Uganda Wildlife Authority
VHT	Village Health Team
VIF	Variable Inflation Factor
VoP	Voices of the Poor
WeD	Wellbeing in Developing Countries
WTP	Willingness-to-pay

Chapter 1

Introduction



Children in one of the study villages

1.1 Research statement

No Net Loss of biodiversity

Thirty-one years after the term “sustainable development” emerged from the Brundtland Commission, scientists and practitioners are still searching for practical solutions to reconcile economic development with environmental protection and social fairness (BBOP 2014). Social fairness in this context is the equitable distribution of benefits and costs of development, and an overall well-functioning society (Dobson 1998; Kuehn 2000; Gross 2007). Economic development is increasing worldwide and, coupled with human population growth, is increasing existing pressures on the environment and the services it provides for flora, fauna and human communities (McKinney 2002; Pauchard et al. 2006; Pickett et al. 2013). Current predictions indicate that the world economy is projected to grow at an average rate of approximately 3% per annum over the next 50 years, doubling in size by 2032 and nearly doubling again by 2050 (Johansson et al. 2012; PwC 2013). Development projects, defined as any project deemed necessary to improve the living conditions or future prospects of people in a given area (Ribeiro 2009), create significant economic opportunities, and hence are difficult for any country to relinquish no matter how developed, even if they threaten valuable biodiversity (from genes to populations, species and ecosystems; Virah-Sawmy et al. 2014). The trade-off between economic development and biodiversity conservation can be greatest in economically poor developing countries and regions hosting unique biodiversity (Virah-Sawmy et al. 2014). Consequently, the interface between economic development and conservation is likely to intensify over the next few decades and achieving sustainable economic growth that meets human needs and preserves the environment is a major challenge (Kormos et al. 2014; Bennett et al. 2017a).

Both national legislation and international guidelines (e.g. the International Finance Corporation (IFC) Performance Standards) exist to guide the design, construction, operation and decommissioning of development projects. Thus, many projects are required to comply with Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources, which includes a 'No Net Loss' (NNL) objective for certain biodiversity components. NNL of biodiversity is an increasingly influential concept in environmental management, being embraced by governments, businesses and lenders world-wide (Bull et al. 2016; Maron et al. 2016). Simply put, NNL approaches require that impacts on biodiversity caused by an economic development project be quantified and that commensurate gains in biodiversity be achieved through additional conservation actions, in order to demonstrate that gains in biodiversity are equal to, or greater than, the losses incurred from the project (Bull et al. 2013; Bull et al. 2017a). Achieving a NNL objective typically requires projects to follow a 'mitigation hierarchy', often applied in Environmental and Social Impact Assessment (ESIA) and management planning processes. After evaluating the potential negative environmental impacts of a project, developers seeking NNL of biodiversity follow a hierarchy of measures where they sequentially avoid or minimise impacts wherever possible, then remediate if the impacts are temporary, and finally offset predicted impacts (BBOP 2012d; Pilgrim et al. 2012; Bull et al. 2013). Biodiversity offsetting is therefore the last option to compensate for any residual, unavoidable negative impacts on biodiversity from development projects, either on-site or at an alternative location (Bennett et al. 2017a).

Biodiversity offsetting is a contentious approach to environmental management, but if designed and implemented within appropriate habitats and to good practice standards, offers the potential to balance economic development with more responsible environmental and social stewardship (Virah-Sawmy et al. 2014). However, both the use of biodiversity offsetting and the validity of biodiversity NNL continue to be widely debated. In particular, concerns surrounding the technical challenges (Bull et al. 2013; Gardner et al. 2013; Maron

et al. 2016), governance issues (Bull et al. 2013; Maron et al. 2016), ethical aspects (Ives & Bekessy 2015; Spash 2015) and lack of evidence of actual effectiveness (Lindenmayer et al. 2017; May et al. 2017) have been raised. Nevertheless, the last decade has seen an increase in the uptake of NNL targets for biodiversity and, as of 2015, approximately 69 countries had formal national offset policies in place or under development (Maron et al. 2016).

Social impacts of biodiversity No Net Loss

It is well-recognised that socio-political factors are often primary determinants of the success or failure of interventions (Mascia et al. 2003). The past years have seen an upsurge in the consideration of social issues associated with NNL strategies and biodiversity offsetting (Maron et al. 2016; Bidaud et al. 2017; Sonter et al. 2018). While NNL is framed around 'biodiversity', discussions about social impacts in environmental policy often use the term 'nature', the "physical and biological world not manufactured or developed by people" (Sandifer et al. 2015). This is because elements of the environment valued by people are not limited to living organisms and ecosystems, but also extend to landscapes. Aside from its intrinsic value, people value nature for its use (e.g. consumptive uses and ecosystem services) and non-use (e.g. spiritual, cultural, religious, aesthetic, artistic, educational, scientific, and sense-of-place) values (Pearson 2016). However, whether NNL strategies for individual development projects, including biodiversity offsetting, capture all of the values assigned to nature is questioned (Apostolopoulou & Adams 2015; Moreno-Mateos et al. 2015).

Furthermore, losses and gains in nature under project-level NNL strategies can have significant impacts on local people's wellbeing, particularly in low-income countries where people are heavily reliant on natural resources for their daily subsistence (Bidaud et al. 2017). These social impacts have parallels with those caused by conservation

interventions, such as protected areas (Bidaud et al. 2017). For example, biodiversity offsets could negatively impact local people's wellbeing by restricting their access to natural resources, but may have a positive impact through creating employment opportunities and eco-tourism (Koh et al. 2014). Offsets can also impact different people to those impacted by biodiversity loss at the original development site, particularly if they are geographically separated. In addition, offsets can affect socio-demographic groups differently. For example, poor or less politically powerful communities or individuals may pay a disproportionate cost for biodiversity conservation as part of an offset, whilst wealthy or more powerful communities or individuals secure benefits (Martin et al. 2013; Bidaud et al. 2017). This unequal distribution of costs and benefits associated with gains and losses in nature under project-level NNL strategies can have implications for environmental justice and distributional equity.

Perceptions of inequity and unfairness can undermine the effectiveness and long-term success of a NNL strategy (Sommerville et al. 2010; Maron et al. 2016). Thus, it is vital to include local people in the design and implementation of NNL strategies (procedural equity) whilst also respecting knowledge systems, values, social norms and rights of all local people (recognitional equity; Law et al. 2017). This will help identify what aspects of nature people value and prioritise for their wellbeing, including less tangible values such as nature-based cultural heritage values, which may be overlooked. Methods such as economic nonmarket valuation techniques (e.g. choice experiments) can also play an important role, providing insights into what offset activities people are more likely to prefer and support (Scholte et al. 2016; Burton et al. 2017; Rogers & Burton 2017).

Trade-offs and the elusive win-win

Over the past few decades, various approaches have been implemented with the aim of conserving biodiversity while simultaneously furthering local social and economic

development (McShane et al. 2011). However, evidence (and often hindsight) indicates that trade-offs can and do occur and that initiatives that simultaneously achieve positive economic development outcomes, as well as both conservation of natural resources and improvement of broader wellbeing in the affected areas, appear to be the exception rather than the norm (Wells & McShane 2004; Sunderland et al. 2007; McShane et al. 2011; Daw et al. 2015). Thus, it has been suggested that the belief in 'win-win' situations is misguided (McShane et al. 2011; Minteer & Miller 2011)

Depending on the values that people assign to nature, some trading of different natural elements under NNL strategies may be acceptable, whilst others may not be and could be considered 'taboo' (Bull et al. 2017b). Certain components of nature may be irreplaceable to an individual, household or community and as such, it may not be possible to achieve NNL with respect to the values that people place on nature, rather than the actual nature itself. A new challenge is emerging: to find ways to recognise and accommodate trade-offs that are involved in advancing conservation, economic development and social equity (Daw et al. 2015).

Despite the challenges of achieving 'win-win' solutions, development for national economic benefit should not only strive for NNL of biodiversity but also account for (and compensate for) the multiple social impacts that developments and any associated offsets have on local people, such as affecting people's access to nature. International good practice guidance, such as that produced by the Business and Biodiversity Offsets Programme (BBOP), calls for biodiversity offsets to make local people 'no worse off, or preferably better off' (BBOP 2012a). However, there is a lack of clarity concerning how to achieve this with regard to people's use and non-use values for nature, especially given the inevitable trade-offs when compensating biodiversity losses with gains elsewhere.

1.2 Aims and objectives

The overall aim of my research is to explore how people's use and non-use values of nature can be incorporated into the concept of biodiversity NNL. The results provide insight into how governments, financial institutions and developers can design, implement and maintain equitable, socially acceptable and sustainable NNL strategies that protect nature but also leave local people 'no worse off, or preferably better off'. The focus of this thesis is on the achievement of biodiversity NNL at the individual development project level throughout the mitigation hierarchy as a whole, rather than focusing on biodiversity offsets alone. Using the Bujagali and Isimba Hydropower Projects and associated Kalagala Offset in south-east Uganda as a case study, the main objectives are to:

1. Explore what is meant by leaving local people 'no worse off' within the context of NNL of biodiversity, and to investigate the potential challenges of achieving this alongside biodiversity NNL.
2. Understand local conceptualisations of wellbeing, perceived changes in wellbeing owing to economic development projects, and how development projects seeking NNL of biodiversity can avoid and then minimise their impact on people's wellbeing.
3. Investigate the importance of nature-based cultural values to people's wellbeing, how these values are impacted by economic development projects, and ways these values can be managed and compensated for in project-level NNL strategies.
4. Assess local people's preferences for different proposed compensatory activities as part of a biodiversity offset, with the aim of improving social outcomes of existing, planned offsets.

This research is contributing to a new set of international good practice principles aimed at organisations involved in economic development projects seeking to achieve NNL or a net gain (NG) of biodiversity. The principles bridge the gap between ecological and social

aspects of biodiversity NNL and aim to ensure that biodiversity NNL projects generate sustainable and equitable outcomes. Furthermore, Uganda has updated its 1994 National Environment Management Policy (NEMP) and 1995 National Environment Act (informed by the NEMP) to address key gaps in existing policies, such as those pertaining to biodiversity offsetting, payment for ecosystem services (PES) and climate change. This new Environmental Bill is currently before Parliament for approval. Thus, at a national level, this research and the development of good practice principles aim to provide the Ugandan Government with recommendations to strengthen these policies as well as to provide insights and recommendations regarding the potential development of a national biodiversity offset policy. At a local level, the research on social aspects of the Kalagala Offset is complemented by ecological research on the offset. This work is being undertaken by a Ugandan-based NGO, Nature Uganda, and both social and ecological findings are contributing to ongoing policy development for the Bujagali and Isimba Hydropower Projects and the associated Kalagala Offset.

1.3 Thesis outline

This thesis is divided into four parts: i) background information; ii) conceptualisation of the 'no worse off' principle; iii) operationalising the 'no worse off' principle using the Bujagali and Isimba Hydropower Projects and the associated Kalagala Offset case study; and iv) synthesis and application of the research (Figure 1-1).

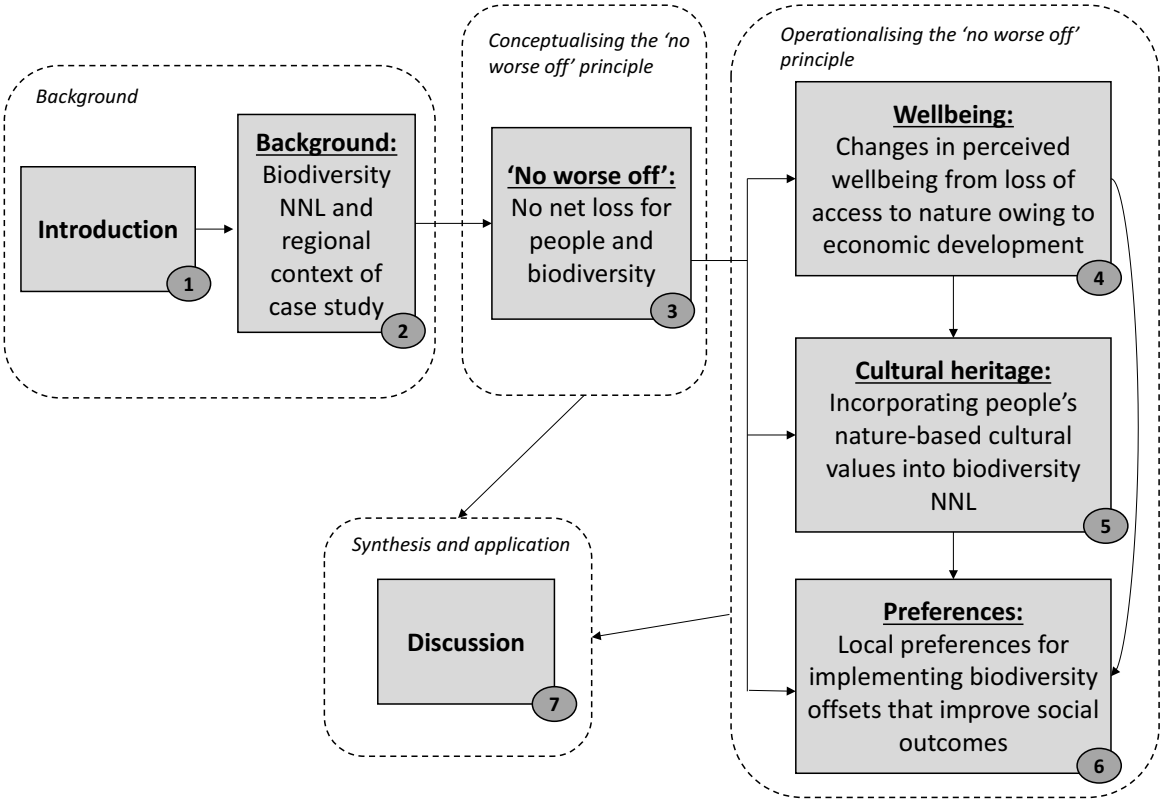


Figure 1-1: Conceptual framework for the thesis. Boxes represent the main research themes and are numbered by chapter; arrows indicate the logical flow. Dotted lines indicate the four components of the thesis. The term 'no net loss' is abbreviated as 'NNL'.

In addition to this first introductory chapter, the thesis comprises a further six chapters and is structured as follows:

Chapter 2:

The first part of Chapter 2 reviews what is meant by NNL of biodiversity, the mitigation hierarchy, biodiversity offsetting, and the advantages and challenges facing NNL strategies and biodiversity offsetting. This is followed by a review of the social impacts arising from economic development projects and NNL strategies, and how these are being measured and managed in practice. The second part of the chapter sets out the contextual

background in which my research takes place. The chapter introduces Uganda and the selected case study used throughout the thesis, namely the Bujagali and Isimba Hydropower Projects on the Victoria Nile River and the Kalagala Offset Project. The chapter concludes with an explanation of why Uganda and this case study were selected and how my research contributes to ongoing biodiversity NNL research in Uganda.

Chapter 3:

This chapter conceptualises the 'no worse off' principle in the context of biodiversity NNL, by addressing three questions: a) no worse off of in terms of what? b) no worse off for whom? and c) no worse off compared to what? The evaluation of social gains and losses associated with NNL of biodiversity is explored, followed by a discussion on the spatial and temporal distribution of impacts of a development project and associated offset on local people's biodiversity-related wellbeing. The implications of the level at which these social gains and losses are measured (e.g. individual, household, interest group, village or region) and hence, the degree of aggregation, is also discussed. The chapter concludes by presenting a definition for the 'no worse off' principle.

Chapter 4:

This chapter explores how the 'no worse off' principle can be operationalised, by applying the concept of 'wellbeing' to gain a better, more nuanced understanding of the multi-layered social impacts that local people experience from economic development projects. A human wellbeing framework is applied to evaluate how local people conceptualise a change in their perceived wellbeing as a result of loss of access to nature owing to the Bujagali and Isimba Hydropower Projects and associated Kalagala Offset. I use a bottom-up mixed-methods approach to explore, first, local conceptualisations of wellbeing within a landscape where the development context varies between locations and, second, how local people perceive changes in their wellbeing as a result of the effects of an infrastructure project on their

natural surroundings. This approach allowed me to capture the dynamic nature of wellbeing as well as the multidimensionality and heterogeneity of local people's perceptions in the study area. This provides insight into the appropriate aggregation unit (individual, household, interest group, village or region) that could potentially be used when measuring impacts to people's wellbeing.

Chapter 5:

The previous chapter identified that the hydropower projects had significant impacts on cultural heritage in the study area, thereby negatively affecting local people's wellbeing. Given the importance of cultural heritage in the study area (a number of sacred sites occur within or adjacent to the Victoria Nile River (e.g. waterfalls, stones, caves, shrines and trees)), I explore the challenges of incorporating people's nature-based cultural values into project-level NNL design for development projects. Using a mixed-methods approach, I assess people's value orientations and attitudes towards nature-based cultural heritage (using the Kellert Typology), explore people's perceptions concerning how important cultural heritage in general is to their wellbeing and evaluate the perceived impacts of the hydropower projects on cultural heritage. This further contributes to operationalising the 'no worse off' principle by exploring how these impacts on nature-based cultural heritage can be included in the mitigation hierarchy and ultimately incorporated into project-level NNL strategies.

Chapter 6:

In this chapter, I use a stated preference choice experiment to solicit local people's preferences for different proposed compensatory activities as part of a biodiversity offset, linked to the two hydropower developments, with the aim of improving social outcomes of the existing, planned offsets. Specifically, I explore what compensatory actions people who are immediately dependent on natural resources prefer as part of a biodiversity offset and

whether these preferences differ geographically and between socio-demographic groups. The results from this chapter provide an empirical example of how choice experiments can inform biodiversity offset design and assist in operationalising the 'no worse off' principle.

Chapter 7:

This final chapter provides a synthesis of my research findings. It highlights my key conclusions, reflects on challenges, limitations and opportunities, and explores the implications for environmental management, in particular, biodiversity NNL strategies. The chapter concludes by suggesting directions for future research.

1.4 Thesis framing

The term 'conservation social science' refers to the traditions of using social science to understand and improve conservation policy, practice and outcomes and draws on a number diverse social science theories and methodologies, each with their own strengths and weaknesses (Mascia et al. 2003; Bennett et al. 2017b). Common social science fields drawn on include the classical disciplines of sociology, anthropology, psychology, economics, geography and history, applied social science disciplines such as law, development studies and education and the interdisciplinary fields of political ecology, human ecology and ethno-ecology etc. (Bennett et al. 2017b). Thus, to overcome the limitations of any one field, social sciences commonly use multiple or mixed methods in their research (e.g. qualitative and quantitative analytic techniques, participant observation, among others; Bennett et al. 2017b).

Bennett et al. (2017b) identify 18 sub-fields of the conservation social sciences. Therefore, I am aware that various different framings could be used to approach and understand the research presented in this thesis. One such framing is that of political ecology, which seeks

to unravel the political, economic and social forces at work in environmental access, management and transformation (Robbins 2012). Political ecology is an interdisciplinary approach that aims to understand both environmental and political change in ways that can enhance environmental and social justice, without imposing *a priori* notions about each, and investigates how processes of power (economic, social and political) shape human-environment relationships (Forsyth 2008; Bennett et al. 2017b). The field places social ethics at the core of its agenda and can adopt a position "that privileges the rights and concerns (often livelihood based) of the poor over those of powerful political and economic elites" (Bryant & Jarosz 2004: 808). Thus, the consequences of environmental change are understood not only in terms of biodiversity loss or transformation, but also in terms of the distribution of economic benefits and costs, and issues of marginalisation and social vulnerability (Adams 2015).

Historical examinations of conservation science and development suggest that *apolitical* approaches, which tend to dominate research on conservation and development, have led to both inequity and project failures (Robbins 2012). For example, people using this approach may argue that global environmental change is the result of population growth and the inadequate adoption and implementation of 'modern' economic techniques of management, exploitation and conservation (Robbins 2012). *Apolitical* approaches to environmental management and conservation tend to attempt to find 'win-win' outcomes where economic growth ('development') can occur alongside environmental conservation (Robbins 2012). This has led to discourse over the notion of 'sustainable development' which may reflect the dominant reductionist and utilitarian views that reinvent 'nature' as 'capital', as opposed to thinking about nature and culture (Escobar 1996). Thus, since poverty is believed to be a cause, and an effect, of environmental degradation, the narrative may be that economic growth (or expansion of capitalist markets) is needed to eliminate poverty, and in turn, protect the environment (Escobar 1996).

There have also been critiques about the framing of 'development', as it depicts economic development as positivist, paternalistic and a new form of colonialism (Adams 2015). In the Western World, economic development is often presented as "a humanitarian and moral concern, as an ethical obligation on behalf of the rich to help and care for those less fortunate" (Naz 2006: 74). This perspective has been criticised for viewing economic development as a 'technical solution', rather than a political problem, even though developments may extend the power of the government against the interests of the poor (Ferguson 1990; Adams 2015). This casts the political dimensions of poverty, inequity and unemployment as 'technical problems' which can be solved through interventions by technical experts (Ferguson 1990). The same could be said of 'classical' conservation planning (Adams 2015).

On the other hand, the burgeoning field of political ecology seeks to expose flaws in these dominant approaches to conservation and development favoured by corporate, state and international authorities, and aims to demonstrate the undesirable impacts of policies, particularly from the point of view of local people, marginalised and vulnerable groups (Robbins 2012). Therefore, research in political ecology draws attention to the neoliberal capitalist system that depends upon economic growth in an attempt to reconcile wealth accumulation, poverty alleviation, and increasingly, environmental protection (Fletcher 2017).

Furthermore, political ecology commonly argues that the environment we take for granted is actually a social construct, and asserts that nature and society are essentially undivided (Robbins 2012; Escobar 1996). This is contrary to the conceptual dichotomy between nature and humans which is characteristic of the Western worldview in the modern era and in particular, conservation activities that have historically sought to separate humans from nature (Fletcher 2017). This critique has been applied to mechanisms that aim to compensate for human activities which damage natural systems, or to compensate people

for refraining from using nature. These include market-based mechanisms such as Payments for Ecosystem Services, and in particular, biodiversity offsetting (Robertson 2000; Büscher et al. 2012; Apostolopoulou & Adams 2015).

Whilst I acknowledge the political ecology appraisal of 'development', this is not how I chose to frame my research as I am not critiquing the concept of development, nor the hydropower development itself. I agree with the political ecology viewpoint that the current 'business as usual' approaches to conservation and development need to be improved, such that more socially equitable forms of environmental governance are achieved (Bennett et al. 2017b). Moreover, I recognise the viewpoint that economic development should not necessarily be a 'given' and that a 'no development' scenario should be considered as an option whenever large-scale development is planned. Concerns have been raised that this first step in the mitigation hierarchy, avoidance, is often ignored, misunderstood and poorly applied by developers, practitioners and regulators (Villarroya et al. 2014; Phalan et al. 2018).

Nevertheless, the premise of my thesis is that development has already taken place (the Bujagali dam was completed in 2012 and construction of the Isimba dam is underway). Therefore, I use a more of a pragmatic framing for my thesis, based on the 'Western' notion of what economic development and conservation is. I then use an empirical approach to explore how the negative impacts of the already-started economic development (hydropower) on local communities can be alleviated. My research is therefore more in line with the framings of environmental economics and the highly interdisciplinary field of conservation science (Bennett et al. 2017b). I apply mixed methods from several social science fields to explore whether win-win environmental and socio-economic outcomes are possible or where trade-offs are required (McShane et al. 2011). Although I may be more inclined to a conservation science standpoint, my work still draws heavily on the literature covering aspects of inequity, social justice and wellbeing, and attempts to understand impacts from the point of view of the local communities.

1.5 Positionality, biases and limitations

When conducting social science research, such as that in this thesis, it is widely acknowledged that one's positionality (background, expertise, theoretical perspectives and the multiple, unique experiences that situate each) can bias one's epistemology (Takacs 2003; Moon et al. 2019). Thus, there have been calls for researchers working in interdisciplinary fields such as development and conservation to integrate self-reflection into their work, recognising and accepting that it is an inherent part of the research process, shaping the exploration, interpretation and communication of research findings (Pasgaard et al. 2017; Beauchamp et al. 2018b; Moon et al. 2019). Reflexivity can also make the researcher more aware of potentially asymmetrical or exploitative relationships (England 1994).

The following sections present a self-ethnography, establishing my background as a conservation and development professional, followed by reflections on my scientific approach, biases and limitations to my research.

1.5.1 My background and experience

I have always had a passion and affinity for countries in Africa, particularly their nature and people. Growing up in South Africa and Lesotho, I was exposed to poverty, lack of infrastructure and services (e.g. regular water and electricity outages) and political instability from a young age. But I was also fortunate enough to spend many holidays in the 'bush', with regular visits to game/nature reserves. My interest in wildlife and the environment led me to do an undergraduate and post-graduate Honour's degree (at Stellenbosch University, South Africa) in Biodiversity and Ecology, followed by a Master's degree (at the University of Oxford) in Zoology. After my Master's (and prior to embarking on my DPhil) I was employed as an Environmental Scientist at SRK Consulting in

Johannesburg, South Africa. SRK is an international company and employs engineers and scientists to provide professional technical consultancy services to the mining and metals sectors. I was with SRK for nearly five years and gained significant experience in and exposure to environmental and social consulting, mostly linked to large-scale mining projects in the Democratic Republic of Congo (DRC). It was during this time that I developed an interest in sustainable development, and discovered a newfound interest in the social impacts associated with the extractives industry in developing countries, mostly in Africa.

Through my work on three large, and controversial, mining projects in the DRC, I became acutely aware of the negative impacts that these projects can have on local people (e.g. physical and economic displacement, influx of migrant labour etc.), but also the potential benefits that these projects can offer (e.g. community development, employment etc.). I spent a considerable amount of time in the DRC, carrying out field work activities and engaging with the clients, NGOs, affected communities and indigenous people, notably the Mbuti. I was able to witness first-hand the sensitive and political nature of these projects, and their potential to violate human rights (especially pertaining to those involved in artisanal and small-scale mining activities, an illegal activity in DRC). This was especially apparent through my work on a mine planned to be constructed in a fragile post-conflict region (the Ituri District, north-eastern DRC).

My interest (and passion) now lies firmly in seeking ways for economic development activities to go ahead sustainably in developing countries (especially in Africa), whilst safeguarding human rights, contributing to poverty alleviation and protecting the environments in which they operate. I am, however, aware that these terms (e.g. ‘poverty alleviation’ and ‘sustainable development’) have been critiqued as ethnocentric and based on ‘Western’ values (Naz 2006). I saw this DPhil as an opportunity to build on my experience in sustainable development, but also to expand on my social science and conservation knowledge base, for example, through learning new techniques and

methodologies drawn from a variety of fields (e.g. economics, social science and anthropology). In addition, my research also gave me the opportunity to contribute to conservation and development policy in Uganda.

1.5.2 My research approach

The solid scientific foundation that I gained from my higher education, combined with my experience as an environmental consultant, proved extremely useful in the design and implementation of my doctoral research. I approached my research and data collection, as far as possible, in a professional and systematic yet pragmatic way. By remaining cognisant of the limitations associated with my approach, I was able to remain open-minded and flexible, adapting and refining my approach accordingly, but equally remaining mindful about what was realistic and practically feasible, especially given financial and time constraints. Nevertheless, I recognise that there are a number of limitations to my scientific approach.

Upon reflection, my worldview and philosophical perspective (which drives the way my research is conducted, influences how I create knowledge, and how I derive meaning from my data) and hence, my approach to research is that of a more 'pragmatic positivist' (Moon & Blackman 2014). As such, knowledge from my research has been gained through the scientific method and my findings are aimed at delivering practical outcomes and informing conservation policy. However, by acknowledging the limitations of positivism (that it can be inadequate for fully understanding the interactions between people and their environment and accounting for the subjective nature of human reasoning and choices), I took a person-centred relativist perspective (Evely et al. 2008). By doing so, my research ascribed a greater role to human emotions, social norms, values, beliefs, cultural backgrounds and experience than is characteristic of a standard positivist approach (Moon & Blackman 2014), which helped me gain a deeper understanding of the complex relationship between people and nature.

1.5.3 Biases and limitations

Despite having significant experience with stakeholder engagement activities, particularly interacting and working with remote African communities, I by no means have all the skills and understanding required to carry out a thorough anthropological and ethnographic study. Carrying out interdisciplinary research, such as that presented in my thesis, meant that I drew on a range of fields including social science, anthropology and environmental economics. Whilst this was a great opportunity for me to learn about several new fields, the time constraints of conducting this research meant that I was unable to gain a deep, thorough understanding of each field. Hence, I felt that I often just 'scratched the surface' of certain topics.

Moreover, I am aware that my background, experience and overall positionality could have inadvertently introduced biases into my research and results. My position as a female, white, middle-class Western researcher working in rural Uganda must be acknowledged, as well as the fact that I come from a different cultural background, with different values, attitudes and reference points to the people living in the study villages. As a result, it is impossible to entirely eliminate cultural biases when undertaking research such as this, meaning that I may have unintentionally imposed my outsider ontological frames onto interpretations of the data and findings, particularly in Chapters 4 (wellbeing) and 5 (cultural heritage; Tayeb 2001). In addition, the 'researcher effect' (where the presence of the researcher may influence the participant's responses) is a well-recognised limitation and source of bias in all branches of social science, but especially in cross-cultural research such as mine (Tayeb 2001).

In an attempt to minimise the 'researcher effect' as far as possible, I employed two male and two female research assistants (RAs)/enumerators who were from Jinja and the surrounding areas. They were all fluent in the two local dialects (*Lusoga* and *Luganda*) and were also familiar with and respectful of the cultural traditions and customs in the villages

(e.g. women, regardless of age, kneel to greet strangers and men). The use of local RAs was aimed at making participants feel more comfortable when answering the questionnaires and participating in the FGDs. I also ensured that I was not present when the RAs were carrying out the individual questionnaires.

Before data collection commenced, I spent two days training my RAs, where I explained my research aims and objectives, provided an introduction into biodiversity NNL and biodiversity offsetting and described the methods that we would be using. I spent time making sure they were all familiar with the approved interview protocols, knew how to administer questionnaires in a culturally sensitive manner and knew how to operate the surveys on the nexus android tablets (e.g. by practicing with one another). In addition, discussions were carried out to agree on the most appropriate translations to use for certain terms (e.g. for nature, cultural heritage and wellbeing). I do recognise that employing RAs from my study villages might have made respondents even more comfortable and forthcoming with their answers, particularly with regard to sensitive topics such as cultural heritage. However, this would have meant that I needed to employ at least six RAs, one from each village (with budgetary implications), and would have significantly increased the amount of time that I spent on training, particularly regarding the use of electronic tablets for data collection. It would also have introduced unknown biases based on their position within the social structures of the villages they were from. Thus, I chose to employ RAs from Jinja and the surrounding area, all with a minimum of an undergraduate degree.

In an effort to bridge the cultural gap between myself (the white Western researcher) and my respondents, and to try build good relationships with the communities, my RAs and I spent about eight months in the study villages. During this time, my RAs taught me a few of the *Busoga* and *Buganda* tribes' traditions as well as some sayings in the local languages (e.g. greetings, basic vocabulary, thank you and goodbyes). I was however, by no means proficient in the local dialects, meaning that my engagement with the local languages was

limited. Furthermore, owing to the nature of my research objectives, a trade-off existed. I spent the eight months spread across six villages in the study area as opposed to remaining in a single village. This potentially limited my understanding of the intricate and complex indigenous cosmologies in each village, but on the other hand, allowed me to explore geographical variations in my data.

On a final note, as a Western conservation and sustainable development professional, I recognise that I am biased towards the notions of 'sustainable development' and 'win-wins'. I also am predisposed with the desire to contribute to poverty alleviation in Africa and to help 'those less fortunate'. I do, however, recognise that in some framings, this could be construed as adopting a paternalistic attitude towards those 'less fortunate' individuals living in the 'Third World' and perpetuating the idea of the 'West's' superiority (Escobar 1996).

Chapter 2

Theoretical background and case study



Itanda Rapids in the Kalagala Offset catchment

2.1 Introduction

This chapter provides a theoretical background to the thesis. It starts by reviewing definitions of 'no net loss' (NNL) of biodiversity, the mitigation hierarchy and biodiversity offsetting. Next, a summary of the benefits and challenges facing NNL strategies and biodiversity offsets, at both the policy and individual project levels, is provided, as well as a review of key international guidelines that specify the need for NNL. This is followed by a discussion on the relationship between people and nature, what social impacts from economic development and NNL strategies are, as well as how they are measured and managed as part of the Environmental and Social Impact Assessment (ESIA). The penultimate section of the chapter describes the national context of Uganda, including environmental policies, threats to biodiversity, hydropower development and NNL commitments. The chapter concludes with a description of the regional context for the case study used throughout this thesis.

2.2 Biodiversity No Net Loss

Over recent decades, governments, businesses and lenders have been increasingly adopting environmental policies and legislation that incorporate a NNL or 'net gain' (NG) of biodiversity objective (Bull et al. 2016; Maron et al. 2018). Having existed since at least the 1970s, biodiversity NNL policies continue to emerge and a significant number of countries worldwide already have national NNL policies in place (Maron et al. 2016; Bull et al. 2017b). In addition, a range of businesses are making voluntary corporate statements and policies related to NNL and are encouraging governments to adopt related policy commitments (Rainey et al. 2015).

NNL policies are intended to go beyond traditional environmental impact mitigation measures that only focus on significant impacts, and help relieve tension between conservation and development by enabling economic development projects to be built and operated with no overall loss of biodiversity (Gardner et al. 2013). NNL requires that biodiversity losses from economic development be quantified, and any unavoidable impacts be fully compensated by commensurate gains, in order to achieve a neutral net outcome, resulting in an overall NNL of biodiversity (Bull & Brownlie 2015; Bull et al. 2017a). To be able to demonstrate that biodiversity losses and gains balance out (or the gains outweigh the losses in the case of NG) relative to a predetermined reference scenario (counterfactual or fixed baseline) is therefore a key element of NNL (Bull & Brownlie 2015). It must be recognised that the term 'net' does, however, indicate that some biodiversity loss at a development site is inevitable and that biodiversity exchanges may not be perfectly balanced (Gardner et al. 2013).

Biological diversity is defined by the Convention on Biological Diversity (CBD) as "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems" (CBD 1992); in other words, biological diversity from genetic to ecosystem levels (Brownlie & Botha 2009). However, demonstrating NNL of biodiversity using the definition from the CBD is practically difficult, if not impossible, thus, NNL policies use surrogates for biodiversity or a specific set of biological targets (e.g. charismatic or threatened species), without claiming that all biodiversity is represented (Bull et al. 2016). Decisions therefore need to be made about what simplification of biodiversity is acceptable, as oversimplification can fail to present biodiversity in a balanced manner (Moilanen & Kotiaho 2018). The Business and Biodiversity Offset Programme (BBOP), a partnership between civil society and private sector organisations, financial institutions, conservation experts, governments and intergovernmental organisations (BBOP 2012d; Kormos et al. 2014), specifies that there

should be NNL of biodiversity on the ground with respect to species composition, habitat structure, ecosystem functioning and people's use and cultural values associated with biodiversity (BBOP 2012a). Thus, depending on what biodiversity targets are used (e.g. species, habitats, ecosystem services), NNL policies are typically based on the requirement to demonstrate neutral outcomes for those selected targets (Bull et al. 2016). Different NNL policies therefore have different goals. For example, under the International Finance Corporation (IFC) Performance Standard 6, NNL of biodiversity is required for some habitats, while a NG of biodiversity is required for areas designated as Critical Habitat according to IFC criteria (IFC 2012b). Some legislation aims to achieve a NNL of acreage and function of biodiversity (e.g. in the U.S), while others aim for a NNL of ecosystem services (e.g. wetland regulation under the French Water Act) and specific components of biodiversity (e.g. endangered and threatened species conservation banking in the US).

2.3 The mitigation hierarchy

Good practice for seeking to achieve biodiversity NNL is founded on the 'mitigation hierarchy', which comprises a series of sequential steps that developers follow in order to avoid and then manage negative impacts on the environment (Figure 2-1; ten Kate et al. 2004; Moilanen et al. 2009). The mitigation hierarchy is implemented through national planning processes and often formalised within the ESIA process, a legal requirement and standard practice on large development projects in most countries (Niner et al. 2018; Phalan et al. 2018).

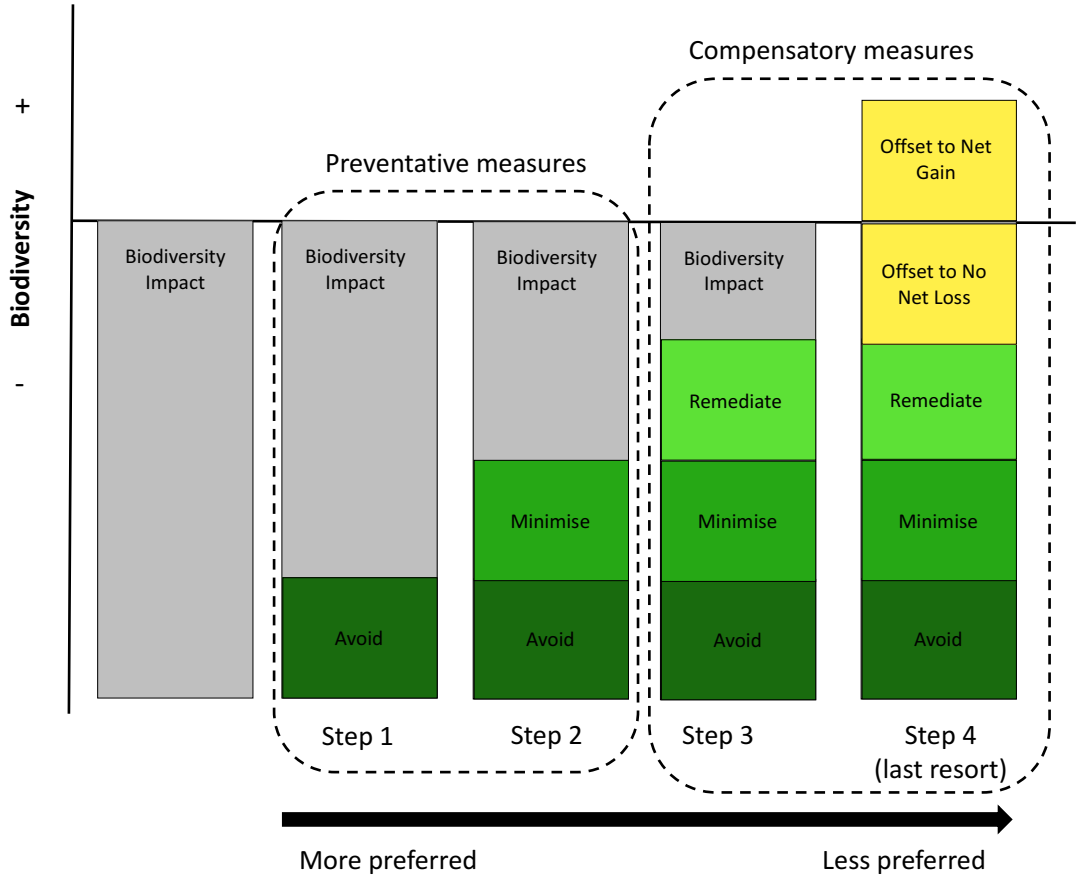


Figure 2-1: Steps of the traditional mitigation hierarchy

After estimating the potential biodiversity related impacts of a development activity, the first step in the hierarchy aims at avoiding the impact on biodiversity, for example by selecting alternative locations for development (Phalan et al. 2018). After all measures to avoid impacts have been considered as far as possible, the second step pertains to minimising the impact on biodiversity, both before and during the development, for example by using environmentally friendly construction methods (Arlidge et al. 2018). Where these preventative measures (avoidance and minimisation) are not feasible, compensatory measures are employed (remediation and offsetting). The third step is to remediate environmental damage within the development footprint, for example, by reseeding affected land (Arlidge et al. 2018). The final step involves measures to compensate for any residual,

unavoidable impacts on the environment through, for example, biodiversity offsetting. Biodiversity offsetting is therefore intended as a last resort for developers seeking to compensate for unavoidable damage after having applied the mitigation hierarchy (Kiesecker et al. 2010; Bull et al. 2013). Biodiversity offsets are rarely adequate for achieving NNL of biodiversity alone, but rather their success depends on the extent to which the prior steps in the mitigation hierarchy are applied (Gardner et al. 2013). The mitigation hierarchy is widely applied in industrial sectors such as mining, energy and manufacturing, but to a lesser extent in sectors such as agriculture, fisheries, forestry and wildlife trade (Rainey et al. 2015; Arlidge et al. 2018).

2.4 Biodiversity offsetting as a tool for achieving biodiversity No Net Loss

2.4.1 What are biodiversity offsets?

NNL policies, which incorporate biodiversity offsets, grew out of national legislation in both the United States (e.g. US Water Resources Act) and several other countries such as Germany and France (Bull et al. 2016). Currently, offsets are being implemented worldwide and examples include native grassland in Australia, fish habitat in Canada, rainforest in Brazil, animal species in the United States (McKenney & Kiesecker 2010; Bull et al. 2013), Great Ape habitat in the Republic of Guinea and Sierra Leone (Kormos et al. 2014), and mining projects in Madagascar (Bidaud et al. 2017).

Biodiversity offsets are “measurable conservation outcomes that result from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development after appropriate prevention and mitigation measures have taken place” (BBOP 2013). There are a number of other definitions used by governments and

private sector companies, for example, the Western Australia Environmental Protection Authority defines offsets as “environmentally beneficial activities undertaken to counterbalance an adverse environmental impact, aspiring to achieve ‘no net loss’ or a ‘net environmental benefit’” (ICMM IUCN 2012). Rio Tinto, on the other hand, defines offsets as “conservation actions leading to measurable gains for biodiversity on the ground, designed to compensate for the unavoidable residual impacts of Rio Tinto’s project developments on significant biodiversity” (ICMM IUCN 2012). Despite the different definitions, the purpose of an offset is to demonstrate a balance between a project’s impact on biodiversity and the benefits achieved through the offset (BBOP 2013).

Essentially, offsets seek to compensate for losses in biodiversity in one area (and at one time) by creating equivalent gains elsewhere, either within or outside of the development footprint (Figure 2-2; Apostolopoulou & Adams 2015). This involves measuring both the residual losses to biodiversity caused by the project (after avoidance, minimization and remediation) and the conservation gains achieved through the offset such that there is no overall reduction in the type, amount or condition of biodiversity over space and time (McKenney 2005; BBOP 2012c). There are three criteria which, in combination, make offsets unique compared to other forms of compensation: 1) the transparent and comparable quantification of biodiversity loss and gain at both the development and offset sites; 2) they demonstrate that a NNL of biodiversity (at the very least) has been achieved; and 3) they compensate for the residual impacts on biodiversity from development activities and serve as a replacement for these unavoidable negative impacts (BBOP 2009a; Bull et al. 2013). Biodiversity offsets are just one of a number of environmental stewardship approaches. For example, education initiatives, capacity building, training and research also have positive environmental contributions, but differ from offsets in that they are not measurable as quantitative biodiversity outcomes (ICMM IUCN 2012). Activities where equivalence in gains and losses of biodiversity is not demonstrated cannot qualify as a biodiversity offset and should be referred to as compensatory measures (Niner et al. 2018).

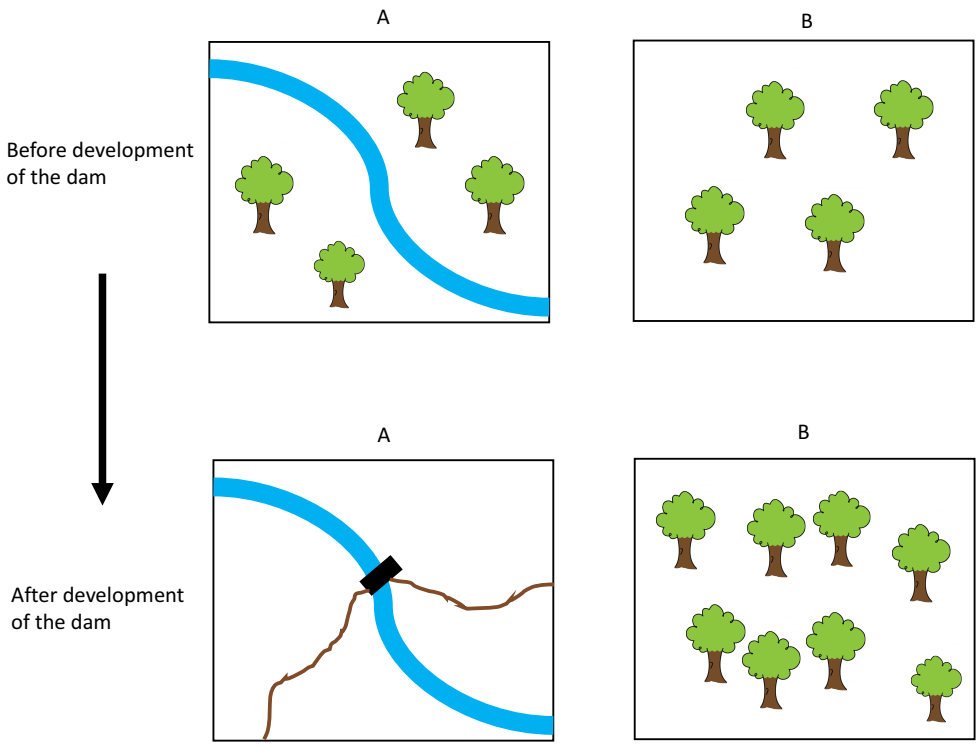


Figure 2-2: A schematic illustration of a biodiversity offsetting strategy. Biodiversity at A is removed for the development of a dam; a Central Forest Reserve (CFR) at B, is expanded as part of the offset to compensate for this loss and achieve a NNL of biodiversity

2.4.2 Types of biodiversity offsets

Biodiversity offsets can be classified based on the type of conservation used to generate biodiversity gains (Maron et al. 2012). There are two main types: averted loss offsets and restoration offsets (Table 2-1). These need not be mutually exclusive and both types can be put in place simultaneously at a single site (ICMM IUCN 2012). One issue to remain cognisant of, particularly when implementing averted loss offsets, is leakage. For example, the removal of human pressures on an offset area will lead to biodiversity gains, but these

pressures may simply relocate to another location, negatively impacting a new environment (Moilanen & Kotiaho 2018). Offsets can be 'prospective' or 'retrospective'. Prospective offsets are when the decision to undertake an offset is made prior to any development impacts, while retrospective offsets are those offsets decided upon after the project impacts have already taken place (ten Kate & Crowe 2014).

Table 2-1: Averted loss and restoration biodiversity offsets

Type of offset	Description
Averted loss	Protection of existing biodiversity from further threats such as over exploitation, deforestation, overfishing and grazing (ICMM IUCN 2012; Moreno-Mateos et al. 2015). Offset activities could include natural resource management and alternative livelihood projects for people who extract natural resources unsustainably, and creating, expanding and strengthening protected areas through, for example, land purchases and contractual agreements (Gardner et al. 2013).
Restoration	Restoration, enhancement or re-establishment of biodiversity in degraded habitats, as well as the creation of new habitat (ICMM IUCN 2012; Moreno-Mateos et al. 2015). Restoration refers to activities that attempt to return an area (or some features) to their original ecological condition prior to some anthropogenic effect, for example, through the removal of invasive species or reintroduction of native species (Gardner et al. 2013).

Regardless of type, all biodiversity offsets need to demonstrate 'additionality', meaning that any gains from the offset need to be caused by the offset actions, rather than other factors

such as government policies (ICMM IUCN 2012). Thus, offset activities need to be a new contribution to conservation over and above what would have happened in the business-as-usual scenario (McKenney & Kiesecker 2010). Offsets should therefore not be counted towards national environmental goals (Moilanen & Kotiaho 2018). For example, in the case of an offset funding a new protected area, a key consideration is whether the percentage increase in the protected area would have otherwise been achieved. If the answer is yes, then the activities cannot qualify as a valid offset (Maron et al. 2016).

2.4.3 Flexibility in biodiversity offsets

A number of offset policies and programmes strive to achieve ecological equivalence (defined as an equal value of a biodiversity component or set of components) between the affected and offset biodiversity elements (McKenney & Kiesecker 2010; Quétier & Lavorel 2011; Bull et al. 2015b). This trading in-kind means that, ideally, offsetting activities should create or preserve 'like-for-like' habitat, meaning that the gains from the biodiversity offset should be similar (or ecologically equivalent) to the biodiversity components impacted by a development project (Quétier & Lavorel 2011; Virah-Sawmy et al. 2014). However, in practice, no two components of biodiversity (nor two locations) will ever be exactly the same and, as a result of the complexity of biodiversity, true 'like-for-like' exchanges are virtually impossible (Bull et al. 2015b). The underlying assumption for in-kind offsets is that if trades in biodiversity are demonstrated as similar enough in terms of biodiversity components or associated ecosystem functions, they can be treated as equivalent (Quétier & Lavorel 2011; Bull et al. 2015b).

Owing to the difficulties in defining ecological equivalence and the constraints that this places on offset systems (e.g. restricting a range of possible locations and preventing the efficient use of limited conservation funds), it has been suggested that flexible offset systems should be considered (Habib et al. 2013). Although trading in-kind is encouraged by international good practice guidelines (e.g. BBOP and IFC), it has been argued that in

some instances, conservation objectives could be better served by trading out-of-kind (Habib et al. 2013; Bull et al. 2014b; Bull et al. 2015b). This trading could involve flexibility by type (trade of one component of biodiversity for another), flexibility in space (when an offset site is located away from the development site for which it is providing compensation) and flexibility in time (losses will be immediate whereas full restoration or averted loss gains only materialise after time; Bull et al. 2015b; Moilanen & Kotiaho 2018). For example, the flexibility in space allows conservation efforts (and limited conservation funds) to be focused on areas where long-term conservation benefits are more likely (ten Kate et al. 2004). Moreover, flexible trades in biodiversity can allow biodiversity offsets to focus on priority conservation ecosystems and species, leading to 'trading-up' (Bull et al. 2015b). During these trades, the offset is not ecologically equivalent to the impacted area but ensures the conservation and protection of other sites with more significant biodiversity components (Gardner et al. 2013; Virah-Sawmy et al. 2014). Some policies allow for both in-kind and out-of-kind trades, for example, habitat types are exchangeable in the UK (Bull et al. 2013). It has been suggested however that these out-of-kind exchanges in biodiversity, including trading-up, should not be referred to as biodiversity offsets as they involve trades across dissimilar biodiversity and therefore do not comply with ecological equivalence (Bull et al. 2016; Niner et al. 2018).

Flexibility is often unavoidable, meaning that decisions are needed about the degree of flexibility allowed (Moilanen & Kotiaho 2018). Judgements need to be made regarding the acceptability of different kinds of exchanges associated with flexible offsets, which in turn depend on societal values placed on different biodiversity components and ecosystems (Gardner et al. 2013). In the case of trading out-of-kind, the proposed offset may not be the same as the ecosystem being lost, but the potential to increase conservation may be more important to stakeholders than achieving ecological equivalence (ten Kate et al. 2004; Wilcox & Donlan 2007). Moreover, an area lost may be of low ecological value (e.g. containing many invasive species), but the offset could be used to generate habitat of a

higher conservation value whilst still maintaining the same ecological functionality (e.g. habitat for pollinators). On the other hand, direct equivalence and like-for-like may be more appropriate in cases where unique habitats or endangered species are concerned (ten Kate et al. 2004). When considering these biodiversity exchanges, it must be recognised that there are limits (or thresholds) to what can be offset. For example, some biodiversity impacts from the development project cannot be compensated for in a socially acceptable manner (e.g. extinction of a species; ICMM IUCN 2012). The irreplaceability and vulnerability of biodiversity are key concepts that need to be explored when evaluating and determining the ecological constraints of an offset (BBOP 2012b).

2.5 International guidance for biodiversity NNL and biodiversity offsetting

Various international guidelines assist in the design, implementation and long-term maintenance of NNL strategies and biodiversity offsets for both individual projects and government policies, some of which are briefly described below.

2.5.1 The Business and Biodiversity Offsets Programme (BBOP)

Forest Trends (a non-profit organisation founded in 1996) established BBOP in 2004. BBOP is an international collaboration of 80 organisations (as of 2014) including government agencies, companies, NGOs and financial institutions, of which the International Union for Conservation of Nature (IUCN) was a founding member. They are involved in developing best practice on biodiversity offsets as well as in following the mitigation hierarchy in order to achieve NNL or a NG of biodiversity (IUCN 2014). The BBOP Secretariat and Executive Committee felt that many of the BBOP objectives have been met

over the last decade and made the decision to close BBOP at the end of 2018, leaving a lasting legacy in the field.

BBOP developed a Standard on Biodiversity Offsets (released in January 2012), with the aim of helping companies, lenders, governments, civil societies and auditors to determine whether international good practice has been followed in navigating through the mitigation hierarchy and establishing sustainable conservation programmes to achieve NNL or NG of biodiversity (BBOP 2013). This Standard comprises a hierarchy of 10 guiding Principles (fundamental statements about the desired outcome) for the design, implementation and long-term maintenance of offsets as well as for verifying their success. It is accompanied by a set of Guidance Notes containing additional detail on the criteria of the Standard. BBOP has also developed guidelines and methodologies in the form of handbooks and resource papers.

2.5.2 IFC Performance Standards and Equator Principles

The growing interest for companies to adopt biodiversity NNL strategies and biodiversity offsetting as a means of risk management has largely been influenced by its uptake by major financial institutions (Benabou 2014). The main actor in this field is the IFC, the World Bank's private sector financing branch. Clients seeking project finance from the IFC (and other banks that have adopted the Equator Principles) are required to follow a set of eight Performance Standards on social and environmental sustainability. Performance Standards 1 and 6, in particular, specify the use of the mitigation hierarchy for the protection and conservation of biodiversity and acknowledge the use of biodiversity offsets as one such tool (IFC 2012d). Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources, requires private sector projects that receive investment to achieve NNL of biodiversity in areas of natural habitat, where feasible, and a NG of biodiversity for which a 'critical habitat' is designated (IFC 2012b). Critical habitats in this context are areas of high biodiversity value, and include habitats supporting critically

endangered and/or endangered species, habitats important for endemic and/or restricted-range species, habitats supporting globally significant concentrations of migratory species and/or congregatory species, highly threatened and/or unique ecosystems and areas associated with key evolutionary processes (IFC 2012b). A number of multilateral banks, such as the Inter-American Development Bank, either follow the IFC Performance Standards or have developed similar strategies themselves (Benabou 2014).

The Equator Principles III (effective from 4 June 2013) are based on the IFC Performance Standards, as well as on the World Bank Group's Environmental, Health and Safety Guidelines (EHS Guidelines). The Equator Principles comprise 10 principles and are a risk management framework, adopted by financial institutions, that assist in determining, evaluating and managing environmental and social risks of projects. Currently, 94 financial institutions in 37 countries have adopted the Equator Principles. The Equator Principles are currently under review, with their fourth iteration being developed in 2018 and 2019.

2.5.3 Other development banks

Aside from the IFC, several other development banks have policies relating to biodiversity NNL and biodiversity offsets. The Asian Development Bank has a Safeguard Policy Document (2009) that prioritises avoidance, minimisation and mitigation but also recognises the use of biodiversity offsets as a last resort. The European Investment Bank has an Environmental and Social Policy (2008) that recognises the mitigation hierarchy, with the aim of achieving NNL or a NG of biodiversity. The Inter-American Development Bank also has an Environmental and Safeguards Compliance Policy (2006) that encourages the use of the mitigation hierarchy, including biodiversity offsets (ICMM IUCN 2012).

2.5.4 Convention on Biological Diversity (CBD)

The CBD is a multilateral treaty with the objective of developing national strategies for the conservation and sustainable use of biological diversity. The Convention is governed by the Conference of the Parties (CoP), which consists of all governments (and regional economic integration organisations) that have ratified the treaty. The first meeting of the parties to the Convention took place in 1994 (CoP1).

It was during the 8th CoP (2006) that the CBD took its first stance on biodiversity offsets, and during the 9th CoP (2008) that the consideration of “biodiversity offset mechanisms where relevant and appropriate while ensuring that they are not used to undermine unique components of biodiversity” was recognised as a way to explore new and innovative financial mechanisms to increase funding to support the Convention's objectives (IUCN 2014). The CBD also has a guidance document on biodiversity offsetting, which was drafted by BBOP in 2010.

Biodiversity offsetting has the potential to assist the 193 Parties to the CBD in meeting their commitments to “take effective and urgent action to halt the loss of biodiversity in order to ensure that by 2020 ecosystems are resilient and continue to provide essential services, thereby securing the planet’s variety of life, and contributing to human well-being, and poverty eradication” (CBD COP X Decision 2 (Strategic Plan for Biodiversity 2011-2020); IUCN 2014).

2.5.5 European Union Biodiversity Strategy to 2020

The European Union (EU) Biodiversity Strategy to 2020 has the objective of “halting the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, and restoring them in so far as feasible, while stepping up the EU contribution to averting global biodiversity loss” (IUCN 2014). The Strategy comprises six targets, one of which is “by

2020, ecosystems and their services are maintained and enhanced through the establishment of Green Infrastructure and the restoration of at least 15% of degraded ecosystems" (Target 2). Action 7 under this Target aims to "ensure no net loss of biodiversity and ecosystem services" and comprises two complementary sub-actions, 7a and 7b (Tucker et al. 2013). Sub-action 7b specifies that "the Commission will carry out further work with a view to proposing by 2015 an initiative to ensure that there is no net loss of ecosystems and their services (e.g. through compensation of offsetting schemes)" (Tucker et al. 2013).

2.5.6 International Union for Conservation of Nature (IUCN)

Members of the IUCN, the world's oldest and largest global environmental organisation, adopted Resolution 110 at the World Conservation Congress in Jeju in 2012, which required them to establish a working group to develop an IUCN general policy on biodiversity offsets (IUCN 2014). The resulting IUCN Biodiversity Offsets Policy was published in 2016 and provides a framework to guide the design, implementation and governance of biodiversity offset projects, including guidance on when offsets are, and are not, an appropriate conservation tool.

2.5.7 Corporate NNL policies

A range of companies and businesses have made corporate statements and policies related to NNL over the past years. In addition, there has been an increasing trend for biodiversity offsets to become an integral part of corporate responsibility programmes (Virah-Sawmy et al. 2014). Rainey et al. (2015) identified 32 companies (as of 31 December 2011) that have set public, company-wide, environmental NNL or net positive impact goals. The earliest adoption of a NNL / net positive goal was in 2001, by Solid Energy, a coal-focused energy company. Since then, there has been a sizable increase in the number of companies world-wide committing to these goals. Mining companies are leading the way,

with the majority of the 32 companies identified as setting NNL goals falling in this sector (Rainey et al. 2015). They are followed by companies in the energy and manufacturing sectors.

2.6 Benefits and challenges facing biodiversity NNL strategies and biodiversity offsets

Different views exist on the concept of NNL and use of biodiversity offsetting, ranging from outright rejection to qualified acceptance to enthusiastic acceptance, making it a contentious conservation tool (Maron et al. 2016). For example, Curran et al. (2014) suggest that offsetting losses of old growth habitat generates a net loss of biodiversity because of time delays between losses and gains, and restoration failure. In response, Quétier et al. (2015) argue that offsets are not appropriate for old growth habitats and alternative, prior steps in the mitigation hierarchy should have been implemented in such cases. The 'reductionist' nature of offsetting (i.e. reducing or limiting nature to exchangeable units) has been criticised, with suggestions that the process includes the commodification, privatisation and 'marketization' of nature (Robertson 2000; Apostolopoulou & Adams 2015; Spash 2015). Others counter that offsets are often divorced from their proper context in the mitigation hierarchy, and that residual impacts from development which were uncompensated and unmeasured are now being addressed (von Hase & ten Kate 2017). Vaissière et al. (2017) also argue that offsetting does not lead to the 'marketization' of biodiversity. As a result, there are different views on the appropriateness of offsetting among academics (e.g. Apostolopoulou & Adams 2015), non-governmental organisations (NGOs) and practitioners (e.g. von Hase & ten Kate 2017), local planning authorities, landowners, and businesses (Coralie et al. 2015; Sullivan & Hannis 2015; Taherzadeh & Howley 2017).

However, adopting biodiversity NNL strategies and embracing biodiversity offsets have a number of benefits to various stakeholders if good practice is followed (Table 2-2). It can be particularly beneficial to businesses, helping them to manage risk, secure better biodiversity outcomes from their development projects, build good stakeholder relations and generate a 'social licence to operate' (SLO; BBOP 2013; Virah-Sawmy et al. 2014; Rainey et al. 2015). Offsets can also help governments encourage companies to contribute towards conservation, and help conservation organisations secure larger, more effective conservation projects (Saenz et al. 2013). Finally, NNL strategies and biodiversity offsets can be beneficial for nature, for example, by providing additional funds for conservation (Pilgrim & Bennun 2014).

Table 2-2: Benefits of NNL strategies and biodiversity offsets

Benefits from following good practice to:	Description	Examples of references
Businesses	• Allow companies to improve their assessment and management of business risks and opportunities. • Improved relationships with governments, civil society and conservation organisations in order to fully address all biodiversity impacts of their activities and to enhance their contribution to biodiversity conservation and sustainable development. • Assist with securing a SLO and good relations with stakeholders, thereby avoiding conflict and/or resentment in local communities.	ten Kate et al. (2004); Brownlie & Botha (2009); BBOP (2013); Saenz et al. (2013); Sonter et al. (2014); Virah-Sawmy et al. (2014); Rainey et al. (2015); Richert et al. (2015)

Benefits from following good practice to:	Description	Examples of references
	• Businesses that strive to manage their impacts on biodiversity and set targets to achieve NNL of biodiversity may improve their reputation and gain several competitive advantages such as access to capital, operational cost effectiveness (through avoiding compliance costs and fines for non-compliance), increased access to land and resources (through government grants), employee satisfaction and retention and operational sustainability.	
Governments, conservation organisations and local communities	• Offer government regulatory authorities a means of encouraging companies to contribute to conservation and ensuring that development projects are planned sustainably. • Conservation organisations are able to use and influence NNL / biodiversity offsets to secure more and better conservation as well as additional funding for conservation activities. • Ensure that business planning incorporates national and/or regional conservation planning priorities. • Benefit to local communities as offsets provide functioning and productive ecosystems during and after development as well as provide additional conservation outcomes outside of the project area,	ten Kate et al. (2004); Wilcox & Donlan (2007); Saenz et al. (2013)

Benefits from following good practice to:	Description	Examples of references
	which in turn may support livelihoods and amenity. • Provide local communities with the opportunity to negotiate the best environmental, economic and social outcomes at a community or landscape scale.	
Conservation organisations	• Assist in conserving areas with a higher biodiversity value than those being lost (in the case of out-of-kind offsets and trading-up). • Facilitate cost-effective conservation gains for species, thereby optimising a conservation intervention. • Geographically flexible biodiversity offsets allow conservation efforts (and funding) to be focused in areas where long-term conservation benefits will be experienced and contribute to ecological corridors. • Act as an innovative financing mechanism for protected areas.	ten Kate et al. (2004); Wilcox & Donlan (2007); Gjertsen et al. (2014); Pilgrim and Bennun (2014)

However, concerns have been raised about the achievability of NNL as a practical goal, especially given the technical challenges, governance issues and lack of evidence of actual effectiveness (Table 2-3). A primary concern is that if biodiversity offsets are not implemented in accordance with the mitigation hierarchy and other good practice principles, they could provide developers with a 'licence to trash' the environment, rather than avoiding or minimising impacts (Gardner et al. 2013). In some cases, impact avoidance and

minimisation might turn out to be more expensive than the offset, meaning that there might be a tendency for these steps to be skipped, with a focus on offsets immediately (Quétier et al. 2014; Spash 2015; Moilanen & Kotiaho 2018). Thus, there is the potential for offsets to undermine crucial prior steps in the mitigation hierarchy (Gardner et al. 2013) and allow development to take place in areas where impacts should have been avoided or effectively minimised (McKenney & Kiesecker 2010).

Table 2-3: Challenges facing NNL strategies and biodiversity offsets

Challenge	Description	Examples of references
Technical challenges		
Currency	• Selecting which metric to use to quantify biodiversity loss and gain (currency). • There are a number of different metrics (e.g. habitat hectares) used but none objectively capture the full extent of biodiversity. Moreover, a challenge is how to use these metrics in combination with qualitative information. • Striking a balance between an easily calculated metric, but one that is comprehensive enough to ensure valued biodiversity components are not lost in offset exchanges.	McKenney & Kiesecker (2010); Bull et al. (2013); Gardner et al. (2013); Maron et al. (2016)
Reference scenarios	• Defining appropriate reference scenarios against which to measure and demonstrate NNL of biodiversity. • Fixed reference scenario (e.g. a baseline), where achieving NNL is compared to the	Bull et al. (2013); Maron et al. (2018)

Challenge	Description	Examples of references
	current or some future state of the environment. • Dynamic reference scenario (e.g. a counterfactual), which accounts for trends in biodiversity, what would have occurred if the policy had not been implemented.	
Equivalence	• Demonstrating ecological equivalence between affected and offset biodiversity components. • In-kind offsetting (like-for-like trades) should be encouraged and out-of-kind offsetting should be prevented unless 'trading-up' from losses that have little or no conservation value.	Gibbons and Lindenmayer (2007); McKenney & Kiesecker (2010); Bull et al. (2013); Gardner et al. (2013)
Additionality	• Only biodiversity benefits that are additional to a baseline scenario over and above what would have happened in the business-as-usual scenario. • Demonstrating additionality (new contribution to conservation) of offset activities and, in particular, when and how protecting existing biodiversity (such as that in protected areas) can be considered a gain.	McKenney & Kiesecker (2010); Wissel and Watzold (2010); Quétier & Lavorel (2011); Gardner et al. (2013)
Uncertainty	• The outcomes of an offset scheme are uncertain and measures need to be put in place to maximise the probability that an offset will deliver comparable and lasting biodiversity outcomes. • Accounting for uncertainty in the offset process with the use of multipliers, a factor	Moilanen et al. (2009); Bull et al. (2013); Gardner et al. (2013); Evans et al. (2015)

Challenge	Description	Examples of references
	that increases the amount of biodiversity gains required by the offset.	
Longevity	• How long a biodiversity offset should last to compensate fully for the development impact, and ensuring that it is designed to endure for this time in a dynamic environment. • Offsets can be designed to last in perpetuity or for as long as the development impact lasts. The former design makes the assumption that the development impacts are irreversible whilst the latter assumes that there is potential to reverse damage at the development site. • Offsets should last for at least as long as the negative impacts from the development and be adaptively managed to account for ongoing external change.	Gibbons & Lindenmayer (2007); McKenney & Kiesecker (2010); Bull et al. (2013); Gardner et al. (2013)
Time lag	• If an offset scheme is created after the development activities commence, there will be a temporal gap between the development impacts occurring and the benefits associated with the offset accruing. • Biodiversity loss from the development is guaranteed while future gains may be realised late or not at all. • Deciding whether or not to allow for a time lag between establishing the development (and hence impacts arising) and the benefits from an offset accumulating. If a time lag is	Gibbons & Lindenmayer (2007); Bekessy et al. (2010); McKenney & Kiesecker (2010); Bull et al. (2013); Gardner et al. (2013); Maron et al. (2016)

Challenge	Description	Examples of references
	acceptable, decisions need to be made about how long the time lag can be. • Biobanking (systems that provide already established and measurable offsets) can act as a savings bank and could be an attractive solution to time lags.	
Thresholds	• There are limits to what can be offset and, as a result, offsets (both in-kind and out-of-kind) may not be an appropriate option. • Certain areas or components of biodiversity should not be compensated for because they are too important.	Brownlie & Botha (2009); Bekessy et al. (2010); Arlidge et al. (2018)
Governance challenges		
Capacity	• Capacity for design, implementation, maintenance and monitoring is often limited. • Lack of resources or institutional capacity to monitor and evaluate activities to ensure compliance. • Capacity, roles and responsibilities become compounded as the number of actors increases, such as through the involvement of third-party offset providers. • Lack of understanding about biodiversity offsets amongst governments and regulatory authorities.	Pilgrim et al. (2012); Maron et al. (2016); Brownlie et al. (2017)
Compliance, monitoring and evaluation	• Developers may not comply with the mitigation hierarchy. • Structuring an offset scheme to ensure funds are available for monitoring and auditing for the life of the offset rarely occurs.	Bekessy et al. (2010); Bull et al. (2013); Maron et al. (2016)

Challenge	Description	Examples of references
	• Lack of clarity on who is responsible for ongoing maintenance of an offset, monitoring and legal enforceability. • Lack of guidance on the design of monitoring programmes. • Legislation changes during an offset scheme.	
Evidence		
Evidence of effectiveness	• Lack of evidence of actual effectiveness. • Success of biodiversity offset schemes has rarely been subject to empirical evaluation, particularly after the offset has been implemented.	Gibbons & Lindenmayer (2007); Gardner et al. (2013); Curran et al. (2014); Maron et al. (2016); Lindenmayer et al. (2017); May et al. (2017)

In addition, the ethical implications of NNL policies and biodiversity offsetting have been raised (Ives & Bekessy 2015; Moreno-Mateos et al. 2015; Spash 2015). For example, many biocentric objections to offsetting argue that reducing nature to exchangeable units violates its intrinsic value (Spash 2015; Maron et al. 2016). Moreover, different people assign different values to biodiversity for a number of reasons beyond its ecological condition or composition and, as a result, offset schemes need to consider which values are relevant and whose values should be taken into account during their design and implementation (Ives & Bekessy 2015). Evans et al. (2015) emphasise that scientists and policy-makers involved in the offsetting process need to recognise that they are not operating in isolation, but should also draw from and be answerable to wider societal values. This leads to another

contested issue pertaining to social challenges and, in particular, how to capture the values that society attributes to biodiversity when trading biodiversity (Apostolopoulou & Adams 2015; Moreno-Mateos et al. 2015; Maron et al. 2016). Social and ethical considerations are likely to be just as important, if not more so, as the technical considerations for the successful implementation of NNL policies (Bull et al. 2017b).

Tackling these technical, governance, ethical and social challenges facing NNL strategies and biodiversity offsets will be crucial to help minimise the risks associated with them (Maron et al. 2016). This will also allow for more informed judgements to be made about whether NNL policies and biodiversity offsets should be pursued and encouraged as a policy instrument, and in what context (Maron et al. 2016). However, until more evidence becomes available, controversy on whether, and under what circumstances, NNL can be achieved will persist (Gardner et al. 2013).

2.7 Social impacts of economic development and biodiversity NNL strategies

2.7.1 The relationship between people and nature

People's livelihoods and ways of life are intricately linked to the natural environment (Pollnac & Poggie 2008; Milner-Gulland et al. 2014). Regardless of how reliable and rigorous an environmental protection measure is, it is likely to be ignored or ineffective if it does not reflect the environmental qualities that society understands and cares about (Robertson & Hull 2001). Conservation projects, economic development activities and NNL strategies will be more successful if they are tailored to the attitudes, preferences and behaviours of people and engage with them transparently (Ban et al. 2013).

Values, defined as desirable, trans-institutional goals, varying in importance, that serve as guiding principles in the life of a person or other social entity (Schwartz 1994), have often been raised in discussions on how to develop a more sustainable relationship between people and the natural environment (Dietz et al. 2005). People value nature for different reasons, and these values vary among stakeholders. For example, some people focus their efforts on conserving biodiversity for its intrinsic value; the idea that biodiversity has a value of its own (Nunes & van den Bergh 2001), measured in terms of species richness, endemism, population viability and rarity (BBOP 2012c). On the other hand, people may value certain biodiversity components for their use (such as medicinal plants, building materials, fuelwood and water resources) and non-use values (such as sacred sites, recreation and spiritually important species; BBOP 2012c).

Nature and the services it provides are essential for human wellbeing (Millennium Ecosystem Assessment 2005), and various terms have been used to describe people's relationship with nature, including ecosystem services, natural capital and nature's contribution to people. Ecosystem services are the "benefits that people obtain from nature", and comprise provisioning (e.g. food, water, timber), regulating (e.g. floods, climate, water quality, pollution), supporting (e.g. soil formation, nutrient recycling), and cultural services (e.g. education, scientific research, reflection, recreation, and aesthetic experience; Millennium Ecosystem Assessment 2005). The concept of ecosystem services, popularised by the Millennium Ecosystem Assessment (MEA), has made significant progress towards conceptualising and valuing nature's material (use) and non-material (non-use) benefits to people (Lau et al. 2018). Natural capital is the biotic and abiotic components of ecosystems (other than humans) that contribute to the generation of ecosystem goods and services (Guerry et al. 2015). Both ecosystem services and natural capital aim to bridge the gap between the environment and economics by specifying the value of nature to society in economic terms to make it more explicit (Claret et al. 2018).

However, much debate surrounds these concepts, particularly the fact that research has primarily focused on the economic valuation of the material benefits, thereby commodifying nature, with less attention to the benefits such as cultural heritage which are harder to value in economic terms (Chan et al. 2012; Díaz et al. 2018). Although an understanding of these intrinsic and use/non-use value framings (i.e. protecting nature for human's sake or protecting nature for its value, independent of people) is vital to the success of conservation activities, thinking only in these terms may overlook the inherent relationship between people and nature (Chan et al. 2016). Relational values include people's preferences, principles and virtues associated with relationships. These underpin how an individual relates to the natural world in order to live a satisfied and fulfilled life (i.e. their wellbeing; Ross et al. 2018).

The ecosystem services concept has been critiqued for depicting a one-way flow of services from nature to people, overlooking the fact that people often contribute to the conservation, maintenance and enhancement of nature (Comberti et al. 2015; Chapter 5). For example, the mutualistic, reciprocal nature of the relationships between people and nature are often (but not exclusively) evidenced in traditional and indigenous rural societies (Comberti et al. 2015; Chapter 5). From an historical ecological stance, landscapes are shaped by numerous and varied historical interactions between human societies and nature, and as such, little or no region can be classified as truly 'pristine' or 'wild' (Balée 2013; Comberti et al. 2015). This inherent relationship between nature and people can be neglected in current environmental management systems, and particularly in approaches that are perceived as 'commodifying nature' (e.g. biodiversity offsets; Büscher et al. 2012; Apostolopoulou & Adams 2015). This human-nature dichotomy characteristic of the dominant perspectives of the 'Western World' could potentially perpetuate inequality and unequal power dynamics in conservation activities (Fletcher 2017). Considering relational values offers a way to transcend this dichotomy, and reflect aspects of cultural identity, social cohesion and social and moral responsibility towards nature (Ross et al. 2018). This could lead to a better

understanding of motivations for nature conservation (Chan et al. 2016). Therefore, development and conservation practices would benefit from adopting a more integrated approach, accounting for the relationship between people and nature. This is particularly true for development projects that impact indigenous communities for whom cultural values are of great importance (Heiner et al. 2019).

In conservation, there has been a recent shift from thinking about nature's services, to thinking about nature's contribution to people (Díaz et al. 2018). 'Nature's contribution to people' is a conceptual framework that builds on the ecosystem service framework, developed within the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES; Díaz et al. 2018). This approach specifically recognises the key role that culture plays in defining the links between people and biodiversity, and also emphasises the role that indigenous and local knowledge can play in understanding how nature contributes to people (Díaz et al. 2018). This thesis focuses on nature's contribution to people and the impacts that biodiversity NNL policies have on nature as opposed to biodiversity alone. This is because people value aspects of the environment that extend beyond living organisms, habitats and ecosystems, to include landscapes, seascapes and natural features such as waterfalls.

2.7.2 What constitutes a social impact?

If economic development projects are to be sustainable and equitable, economic, environmental and social impacts need to be managed across the development project's lifecycle (Franks & Vanclay 2013). This requires a thorough understanding of the potential environmental and social changes caused by a project (Slootweg et al. 2001). Implementation of development projects typically leads to many dynamic, multi-layered social impacts (Box 1; Vivoda & Fulcher 2017; Jijelava & Vanclay 2018). For example, potential positive social impacts (or gains) include: employment opportunities; improved infrastructure such as road upgrades; access to more (and a greater range of) healthcare

services; improved education services; and improved access to water, sanitation and power (Vivoda & Fulcher 2017). On the other hand, potential negative social impacts (or losses) include: physical or economic displacement; erosion of cultural values; social change; marginalisation of some groups; and immigration (Vivoda & Fulcher 2017).

Box 1: What are social impacts from economic development?

Social impacts are changes to one or more of the following:

- People's way of life – how they live, work, play and interact with one another on a day-to-day basis;
- Culture – their shared beliefs, customs, values and language or dialect;
- Community – its cohesion, stability, character, services and facilities;
- Political systems – the extent to which people are able to participate in decisions that affect their lives, the level of democratisation that is taking place, and the resources provided for this purpose;
- Environment – the quality of the air and drinking water; the availability and quality of the food; the level of hazard or risk, dust and noise they are exposed to; the adequacy of sanitation, their physical safety, and their access to and control over resources;
- Health and wellbeing – health is a state of complete physical, mental, social and spiritual wellbeing and not merely the absence of disease or infirmity;
- Personal and property rights – particularly whether people are economically affected, or experience personal disadvantage which may include a violation of their civil liberties;
- Fears and aspirations – perceptions about safety; fears about the future of their community, and aspirations for their future and the future of their children.

(Source: Vanclay 2003)

Furthermore, environmental impacts from development can also have significant impacts on local people and vice versa; and social impacts can have negative consequences for the environment (Slootweg et al. 2001). For example, rural residents in Lesotho experienced changes in their relationship with the environment owing to the development of a large hydropower dam. They reported losing access to important sources of food and medicinal plants, access to forests and wooded areas that were submerged by the reservoir, access to some of the best arable land in the river basin areas, and access to building resources (Tilt et al. 2009). Social, economic and environmental impacts are inextricably linked, and a change in one of these aspects is likely to trigger a change in another (Vanclay 2003).

Social impacts associated with NNL strategies and biodiversity offsets are not inherently different to those arising from traditional protected areas (Bidaud et al. 2018). Prevalent negative social impacts associated with conservation interventions and protected areas (and which could potentially be experienced from NNL strategies) include:

- Physical displacement of households and/or land holders (West et al. 2006; Adams & Hutton 2007);
- Exacerbation of poverty (Adams et al. 2004);
- Restricted access to natural resources and restrictions on their use, loss of livelihoods (Adams & Hutton 2007);
- Restrictions on access to religious and cultural sites (Springer 2009);
- The loss of future land use options, with potentially significant economic costs (Norton-Griffiths & Southey 1995);
- Conflicts arising from enforcement activities (Springer 2009); and
- Destruction to land tenure systems, fuelling of social conflict between groups and ethnic tensions (West et al. 2006).

On the other hand, conservation interventions (and potentially NNL strategies) may have positive social impacts in that they have the potential to provide local communities with benefits such as:

- Revenue-sharing, social services (such as health and education);
- Establishment of alternative income generating activities (Springer 2009);
- Improved ecosystem services (Adams & Hutton 2007);
- Employment opportunities; and
- Land leasing and independent locally owned commercial activities (such as curios and cultural performances; Adams & Hutton 2007).

The social impacts associated with conservation, both positive and negative, have been considered in practice since the 1980s, through approaches such as integrated conservation and development programmes (ICDPs) and community-based natural resource management (Adams & Hutton 2007; Springer 2009). Thus, valuable lessons about social impacts and ways to manage them can be learnt from ICDPs, alternative livelihood projects, protected area implementation and the increased focus on incentive-based conservation interventions, such as Payment for Ecosystem Services (PES) and Reduced Emissions from Deforestation and Forest Degradation (REDD+) projects. Some of the obstacles faced by these initiatives and the lessons learnt could be applied to future land use planning activities (including biodiversity offsets) to guide their development and implementation, thereby increasing their chances of being more effective and equitable (Blomley 2010).

2.7.3 How are social impacts from development evaluated and manged?

In practice, ESIAs are widely used for environmental planning and decision-making, and therefore serve as a means of incorporating biodiversity offsets into existing corporate

procedures and management systems (BBOP 2009b). In most countries, developers are required to obtain an environmental licence, via an ESIA, before any activities can commence. ESIAs have been legally adopted in most countries world-wide (Villarroya et al. 2014). The ESIA process examines the environmental consequences of a planned development project and aims to manage and mitigate its impacts (both social and ecological) as far as possible (Kiesecker et al. 2010). Should offsetting be included as part of an ESIA, the developer would be required, within the ESIA, to demonstrate that the mitigation hierarchy has been followed and that residual adverse impacts are removed or reduced to an acceptable level (BBOP 2009b). All ESIAs include a Social Impact Assessment (SIA).

SIA is “the process of evaluating, monitoring and managing the intended and unintended social consequences, both positive and negative, of planned interventions (policies, programs, plans and projects) and any social changes invoked by those interventions" (Vanclay 2003; Vanclay et al. 2015). SIAs began in the early 1970s after it became evident that modifying the environment altered people’s cultural and social structures (Burdge & Vanclay 1996; Esteves et al. 2012). The primary objective of an SIA is to bring about a more sustainable and equitable biophysical and human environment, ensuring that development projects maximise their benefits and minimise their costs to local people (Vanclay 2003). A key activity in an SIA is to identify risks and potential negative social impacts in advance of a project in order to identify appropriate management, mitigation and compensation measures to be undertaken to minimise the undesirable consequences of the development project (Tilt et al. 2009; Vanclay et al. 2015). This corresponds with Principle 1 of the Rio Declaration (1992) which acknowledged that “human beings are at the centre of concerns for sustainable development” (Tilt et al. 2009).

The consideration of social impacts has both ethical and practical foundations (Springer 2009). Ethical viewpoints focus on legal human rights frameworks and social justice,

recognising that local people have the right to use natural resources (Springer 2009). From a practical perspective, stakeholders can significantly influence the success, timeline and cost of projects (Esteves et al. 2012). Without free, prior and informed consent, integrated local involvement, clear benefit sharing and community ownership, projects are likely to erode local support, making them less sustainable (Vanclay et al. 2015; Palmer-Fry et al. 2017).

There are standards, policies and legislation in place to guide the evaluation and management of social impacts from economic development (e.g. the IFC Performance Standards, Anglo American's Socio-Economic Assessment Toolbox (SEAT) and the International Association of Impact Assessment (IAIA) principles), as well as to safeguard the rights of local and indigenous people (e.g. IFC Performance Standard 7 and FPIC (Free, Prior and Informed Consent)). Requirements for social impact management also accompany loan agreements from multilateral financial institutions (Franks & Vanclay 2013). In addition, many leading practice companies have developed voluntary corporate policies and practices for the management of social impacts, partly to improve corporate social responsibility and performance (Franks & Vanclay 2013). Increasingly, SIAs carry equal weight to ESIAs in influencing decisions about a development project and decisions that change policy (Burdge & Vanclay 1996). Nevertheless, some still argue that the management of social impacts has not received the same amount of attention as environmental impacts and that the legislative framework has historically favoured environmental impact evaluation (Esteves et al 2012; Franks & Vanclay 2013).

Project developers are typically required to have measures in place to compensate for material losses that households experience as a result of the development (Tilt et al. 2009). In the case where resettlement cannot be avoided, there needs to be full and fair compensation for lost assets (e.g. crops and houses) and any distress or inconvenience caused (Vanclay et al. 2015). A Resettlement Action Plan should be developed that details

the operational process of the resettlement procedures, including detailed strategies for: compensating losses, relocating and rebuilding, and ensuring that affected people are afforded the opportunity to improve their incomes, income-producing activities and standards of living that they had before the development project affected them (Vanclay et al. 2015). This plan is usually accompanied by a Livelihoods Restoration and Enhancement Plan to restore and enhance people's livelihoods after they have been resettled (Vanclay et al. 2015). Developers are also required to develop rural or community development plans to address some of the socio-economic changes that the area experiences as a result of the development (Tilt et al. 2009). For example, these plans can be designed to provide skills training and alternative income-generating activities (Tilt et al. 2009).

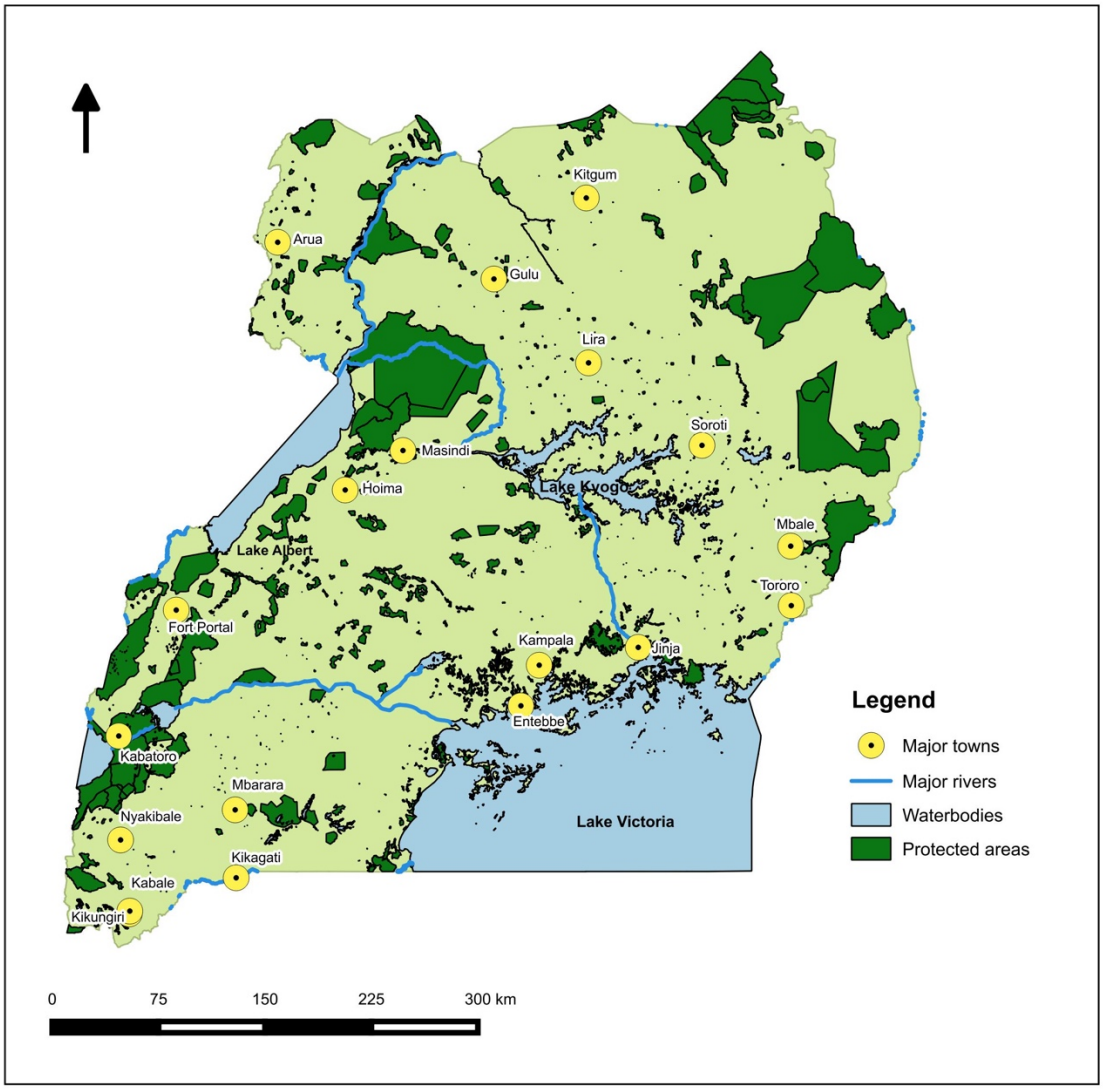
2.8 Uganda: national context

2.8.1 Biological resources

Uganda, a landlocked country that straddles the equator (Figure 2-3), is one of the smallest states in East Africa. The variety of topographical features, high range of altitudes and large climatic variation, coupled with an overlap between the savannahs of East Africa and the rainforests of West Africa, have resulted in Uganda ranking among the top ten most biodiverse countries in the world (NEMA 2002; Uganda Wildlife Policy 2014; NEMA 2016b). Uganda hosts seven out of Africa's 18 plant kingdoms and harbours more than half of all African bird species (NEMA 2002, 2014). The rich biodiversity is distributed across both terrestrial and aquatic ecosystems, with a third of the country covered by fresh water bodies and wetlands (NEMA 2010; NPA 2013). Lake Victoria, the world's largest tropical freshwater lake, occupies the south-eastern part of the country, is the source of the Nile River and supports a large number of endemic cichlids (Winterbottom & Eilu 2006). Most of Uganda's endemic species are associated with the mountains and forests of the Albertine

Rift Valley, which is in the western part of the country and recognised globally as a 'biodiversity hotspot' (Plumptre et al. 2003).

In addition to intrinsic values, Uganda's biological resources have a high economic value locally, nationally and internationally. The rich biodiversity represents one of the vital economic resources of the country, with its services and products contributing millions of US Dollars (USD) per year to the country's economy (NEMA 2002). For example, biodiversity and nature forms the foundation for Uganda's important tourism industry, which makes up a substantial part of the economy (9.2% of Uganda's GDP in 2012; WCS 2014), and is a major source of employment, investment, revenue generation and foreign exchange. It is estimated that the gross economic output resulting from biological resource use in the fisheries, forestry, tourism, agriculture and energy sectors exceeds USD 546 million a year and several sectors that have been targeted for economic growth in the future (such as agriculture, hydropower generation and tourism) depend directly on biodiversity (NEMA 2002).



Layer source: World Resources Institute, DIVA-GIS, MIT Geo Web



Figure 2-3: Map of Uganda

Moreover, biodiversity supports economic outputs indirectly (estimated to be at least USD 200 million per year) as it provides services and functions that support human consumption and production (NEMA 2002). Given their subsistence way of life, a large proportion of the rural population depend on biodiversity, amongst other things, for food, agriculture, cultural values, health and shelter (NEMA 2014, 2016b). This includes some of the country's poorest and most vulnerable people, such as women, female-headed households and the landless (NEMA 2002). It is estimated that forests and trees contribute about USD 173 million to the total annual income of households in Uganda (Obua et al. 2010). Some biological resources are also culturally significant to Ugandans, for example, sacred species and natural sites such as groves, springs, and caves which are sites of worship, rituals and offerings (Infield & Mugisha 2013). There are also various plant species that have medicinal value and a large proportion of Uganda's population (both rural and urban) depend directly on medicinal herbs to treat a myriad of illnesses (Ssegawa & Kasenene 2007).

The health of Uganda's biodiversity is therefore inextricably linked to both sustainable and equitable socio-economic development and poverty alleviation (NEMA 2002). As a result, degradation and loss of biodiversity will slow the country's long-term economic growth, create risks for businesses and will have significant negative impacts on those who depend on the ecosystem services and natural resources (NEMA 2002). Hence, biodiversity conservation is a priority in the country, and the Ugandan Government has developed legislation and a number of policies to ensure that conservation and sustainable management of the country's biological resources is promoted (NEMA 2002, 2016b).

2.8.2 Environmental legislation and policies

International level

The Ugandan Government made a commitment to promote international cooperation in the sustainable management and use of global biological resources by signing the CBD and

several other conventions, protocols and agreements (NEMA 2002; Table 2-4). The CBD promotes the conservation of biological diversity, its sustainable use and a fair and equitable sharing of its benefits. The Ugandan Government signed it in June 1992, and ratified it in September 1993 (NEMA 2002). The Strategic Plan for Biodiversity 2011-2020, and its Aichi Targets, was adopted by all Parties to the CBD in 2010 and its mission is to "take effective and urgent action to halt the loss of biodiversity in order to ensure that by 2020 ecosystems are resilient and continue to provide essential services, thereby securing the planet's variety of life, and contributing to human wellbeing, and poverty eradication" (Decision CBD/COP/X/2).

Regional level

Uganda is a signatory to various regional protocols and agreements (Table 2-4).

National level

At a national level, Uganda has several policies and laws that support actions to protect the environment, including the conservation and sustainable use of biodiversity. Policies express the Government's intent and commitments while the laws and legal framework provide the legal foundation for the implementation of the policies. The key national policy framework for the management of biodiversity in Uganda is the 1994 National Environment Management Policy (NEMP), with one of its aims being to "enhance health and quality of life of all Ugandans and promote long-term sustainable economic development through sound environmental and natural resources management and use" (NEMA 2016b). Several sectoral policies support the NEMP (Table 2-4).

There are also legal frameworks for the management of biodiversity in Uganda. The 1995 Constitution of the Republic of Uganda promotes the protection of fundamental and other human rights and freedoms, including the right to a clean and healthy environment.

Objective XIII of the National Constitution requires the State “to protect important natural resources, including land, water, wetlands, minerals, oils, fauna, and flora on behalf of the people of Uganda” (Constitution of the Republic of Uganda 1995). The Constitution is supported by various frameworks, including the NEMP, the 1994 National Environment Action Plan (NEAP) and the 1995 National Environment Act (NEA) Cap 153. The NEA, the basis of which was provided by the 1994 NEMP (produced as part of the NEAP), provides for the overall management, coordination and monitoring of environment management and conservation in Uganda (NEMA 2016b). It also provides for the protection and conservation of all natural resources in Uganda as well as promoting international cooperation in the field of the environment (NEMA 2016b). Part VI of the NEA provides for the establishment of environmental standards and Part VII for the management of the environment, including the protection of natural heritage sites (NEA 1995). Part IX of the NEA specifies that The National Environmental Management Authority (NEMA) of Uganda may issue an environmental restoration order or environmental easement to any person in respect of any matter relating to the management of the environment and natural resources (NEA 1995). Several other sectors also have legislation pertaining to biodiversity management (Table 2-4).

NEMA, established in 1995, is the National Focal Point for the CBD in Uganda and is the principal agency in Uganda responsible for coordinating, monitoring, regulating and supervising environmental management in the country (NEMA 2016a). Other institutions responsible for biodiversity conservation and management in Uganda include: the Ministry of Water and Environment (MoWE), the Ministry of Tourism and Antiquities, the Ministry of Agriculture, Animal Industry and Fisheries, the Uganda Wildlife Authority (UWA), the National Forest Authority (NFA) and the Uganda National Council for Science and Technology.

NEMA operates under the NEA and, with support from the United Nations Development Program (UNDP), is coordinating the review of the 1994 NEMP. A draft policy document was produced for public comment in December 2014 and has been reviewed by the top Policy Committee at the MoWE, for subsequent adoption by the Policy Committee on Environment (NEMA 2016a). This updated Policy takes into account lessons learnt from its implementation since 1994. It also addresses gaps in the 1994 Policy and includes new emerging issues, in order to make the policy more effective in addressing environmental management in Uganda (Final Draft NEMP 2014). The updated NEMP indicates Uganda's commitment to "social and economic development that is environmentally sustainable and which will bring the benefits of a better life to all" and should be the foundation of sustainable socio-economic development in Uganda (Final Draft NEMP 2014).

The draft 2014 NEMP contains a section on the development of strategies and guidelines for the implementation of biodiversity offsets. At the same time, NEMA is coordinating the revision and update of the 1995 NEA (with support from the Norwegian Government) to reflect key gaps in the original Act, including PES and biodiversity offsetting. This new National Environment Bill 2016 will replace the existing NEA. The new policy and bill, although behind schedule, are currently before Parliament for approval. According to NEMA's Annual Corporate Report for the 2015 / 206 financial year (NEMA 2016a), this delay is owing to administrative and bureaucratic procedures as well as the parliamentary elections which led to the emergence of new members of Parliament and new Cabinet Ministers who needed time to familiarise themselves with the policy, institutional frameworks and legal regime.

In addition to the laws and policies, NEMA has updated the National Biodiversity Strategy and Action Plan (NBSAPII), which is the main instrument for implementing the CBD at the country level, and is used to guide biodiversity and conservation. It provides the Government with a framework for implementing its obligations under the CBD, as well as

the setting of conservation priorities, channelling of investments and building capacity for the conservation and sustainable use of biodiversity in Uganda (NEMA 2016a). Its goal is "to enhance biodiversity conservation, management and sustainable utilisation and fair sharing of its benefits by 2025" (NEMA 2016b). By using the Strategic Plan for Biodiversity 2011-2020 and its Aichi Targets as a framework, Uganda has developed its own set of national biodiversity targets. Thus, the NBSAPII allows Uganda to demonstrate its commitment to the achievement of the Strategic Plan for Biodiversity 2011-2020 and its Aichi Targets, whilst also having its own national targets (NEMA 2016b).

Table 2-4: International, regional and national environmental legislation and policies in Uganda

Level	Environmental legislation and policies
International conventions, protocols and agreements	Convention on Biological Diversity (CBD)
	Cartagena Protocol on Biosafety
	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
	Convention on Wetlands of International Importance Especially as Water Fowl Habitat (the Ramsar Convention)
	United Nations Convention to Combat Desertification (UNCCD)
	United Nations Framework Convention on Climate Change (UNFCCC)
	Convention on the Protection of the World Cultural and Natural Heritage, Paris
	Convention Relating to the Preservation of Flora and Fauna in their Natural State, London
	African Convention on the Conservation of Nature and Natural Resources, Algiers

Level	Environmental legislation and policies
	Lusaka Agreement on Cooperative Enforcement Operations Directed at Illegal Trade in Wild Fauna and Flora
	International Treaty on Plant Genetic Resources for Food and Agriculture
Regional treaties, protocols and agreements	East African Community Treaty
	East African Community Protocol on Environment and Natural Resources Management
	Protocol for Sustainable Development of Lake Victoria Basin
	Convention for the Establishment of the Lake Victoria Fisheries Organization (LVFO)
	East African Community Protocol on Wildlife Conservation and Law Enforcement
	Tripartite Management Agreement for Trans-Boundary Wildlife Protected Area
	Cooperative Framework Agreement on the River Nile
National policies	National Policy framework:
	National Environment Management Policy (NEMP)
	Sectoral policies that support the NEMP:
	Uganda Wildlife Policy (2014)
	Forestry Policy (2001)
	Land Policy (2000)
	National Wetlands Policy (1995)
	Tourism Policy (2003)

Level	Environmental legislation and policies
	Fisheries Policy (2003)
	National Agriculture Policy (2009)
	Decentralization Policy (1993)
	National Gender Policy (1997)
	National Culture Policy (2006)
	National Population Policy (1995)
	Education Policy (1992)
	National Community Development Policy (2015)
National laws and legal frameworks	Constitution of the Republic of Uganda (1995)
	National Environment Action Plan (NEAP) (1994)
	National Environment Act (NEA) Cap 153 (NEA 1995).
	Legislation in other sectors:
	Forestry and Tree Planting Act (2003)
	Wildlife Act, Cap 200
	Local Government Act (1997)
	Land Act, Cap 227
	Water Act, Cap 152
	Plant Protection Act, Cap 31
	Animal Breeding Act (2001)
	Fisheries Act, Cap 197
	Tourism Act (2008)

Level	Environmental legislation and policies
	Animal Diseases Act (1964) Amended (2006), Cap 218
	The Animals (Prevention of Cruelty) Act (1964)
	Agricultural Chemicals Act, Cap. 29

2.8.3 Threats to biodiversity

The rate of total biodiversity loss in Uganda is estimated at about 1% per annum, mostly as a result of habitat loss, alien invasive species, poverty, over-exploitation of resources, pollution and economic development (NEMA 2010, 2016b). Additionally, a high proportion of vegetation has been modified or reduced in quality and range over time as a result of cutting, cultivation, burning, grazing and other anthropogenic actions (Winterbottom & Eilu 2006; Ssegawa & Kasenene 2007). It is estimated that deforestation is occurring at a rate of 55 000 hectares per year, with the majority occurring outside of protected areas (Winterbottom & Eilu 2006; Ssegawa & Kasenene 2007). The agricultural sector is the main driver of land cover change and deforestation (NEMA 2002, 2010). Although large-scale agriculture is increasing, it is not widespread in Uganda (NEMA 2016b). Instead, subsistence farming dominates the agricultural landscape (more than 70% of the Ugandan population consider themselves to be small-scale farmers) and has expanded into wetlands, grasslands and forests (NEMA 2010, 2016b). Moreover, agriculture is the main source of livelihood and employment in Uganda, particularly amongst the rural population, and almost all traditional crop exports (such as coffee, cotton, tobacco) and food crops (such as maize, beans, cassava) are grown by smallholders (NEMA 2016b).

Over-exploitation and over-harvesting from commercial operations, such as logging, or from local practices, such as medicinal plant harvesting and over-fishing, are also depleting

Uganda's biodiversity (USAID 2006). Charcoal and fuelwood collection is a major threat, with biomass being the dominant energy resource for households as well as for small and medium sized industries such as tea processing and sugar production (Obua et al. 2010; USAID 2015). Uganda's push for a modern economy has led to thousands of tonnes of fuelwood being used to burn bricks for construction (Obua et al. 2010). Woody biomass is used to generate approximately 92% of Uganda's energy and fuelwood contributes more than 96% of energy for cooking in Uganda (USAID 2015). In order to address deforestation from fuelwood and charcoal collection, Uganda's National Forest Authority (NFA) facilitates tree planting activities that aim to meet the short-term needs for timber (USAID 2006). However, these activities focus on introduced species (such as *Eucalyptus spp*. and *Pinus spp*.) which pose a threat to native species. Furthermore, in an attempt to modernise agriculture, the National Agricultural Advisory Services (NAADS) program has focused on introducing 'improved varieties' of crops and trees (USAID 2006), which, according to local communities, do not fare as well as the native species (Griffiths Pers. Obs.).

Poverty, expansion of informal settlements and high population growth rates are increasing pressure on the environment (Obua et al. 2010; Final Draft NEMP 2014). Uganda has one of the highest population growth rates in the world, doubling almost every 20 years, and with an increasing population comes the need for more land for subsistence agriculture, and more fuelwood and charcoal for energy (NEMA 2002; WCS 2014). It is estimated that population growth rates in Uganda approach 3% per annum, while the average population growth rate is 1.3% (Ssegawa & Kasenene 2007). Human population density in Uganda is high, averaging 102 people / km^2 compared to a global average of 42 people / km^2 (Ssegawa & Kasenene 2007). It is estimated that approximately 85% of the population is reliant on natural resources for their livelihood, especially poor communities (Final Draft NEMP 2014). Thus, the demand for natural resources is unlikely to decline in the near future unless poverty is urgently addressed (NEMA 2016b).

As with many other developing economies, Uganda is currently experiencing unprecedented levels of investment in its economic development. Energy and transportation infrastructure development, oil and gas, and Information, Communications and Technology (ICT) have been identified as key priorities by the Ugandan Government, which is reflected in national budgets (Background to the budgets, 2010/11, 2011/12 and 2013/14). Investment in these sectors is boosting Uganda's economy and enabling the country to capitalise on its potential to be a major oil producer within East Africa, and make use of its significant renewable energy resources, most notably hydropower, geothermal, solar and wind, as well as supporting the country's fast-growing agricultural sector. If these economic activities are not managed properly, they could have severe consequences for the environment. For example, oil exploration activities pose a major threat to the biodiversity both within and outside of protected areas in the Albertine Rift; the construction of hydropower dams can lead to waterfalls, islands and agricultural land being submerged; and mining of clay for brick-making can threaten wetland biodiversity (USAID 2015). Therefore, realising these economic benefits requires sustainable use of the country's natural resources. Left unchecked, national-level economic development can have severe consequences for the environment and for poor, rural populations who rely on natural resources for their income and livelihoods.

2.8.4 Hydropower – the good and the bad

The Uganda Vision 2040 and the National Development Plan (NDP) highlight the need to increase power generation in the country, increase transmission and distribution, improve access to electricity and strengthen the institutional policy and legal framework (NDP 2015). The aim is to increase the country's power generation capacity from 825MW in 2012 to 2500MW in 2020 by investing in the necessary infrastructure to facilitate the exploitation of the abundant renewable energy sources (NDP 2015). Economic history from advanced economies shows that growth and development are inextricably linked to the use of

electricity as a form of energy (NDP 2015). In this regard, the lack of adequate and reliable power in Uganda is consistently quoted as being one of the top five constraints on Uganda's economic development (Tumwesigye et al. 2011). Only 5% of Uganda has access to the grid and less than 2% in rural areas (Tumwesigye et al. 2011).

Uganda has extensive potential renewable energy resources, most notably hydropower, geothermal, solar and wind (NEMA 2016b). Despite its potential for electricity production, Uganda spends billions of Ugandan shillings (UGX) annually on power subsidies and its power tariff is one of the highest in the world (Tumwesigye et al. 2011). As a result, most people cannot afford the electricity tariffs and instead revert to the use of charcoal and fuelwood, in turn leading to deforestation (Tumwesigye et al. 2011). A move towards renewable energy sources could help to address the country's increasing energy demands, whilst allowing for economic growth, and at the same time reducing the country's dependence on charcoal and fuelwood. Not only can hydropower benefit Uganda at a national level, but it can also provide benefits at a local level in terms of employment opportunities (both skilled and unskilled labour), irrigation, flood control, tourism and the improvement of services (for example, the creation of roads, recreational facilities etc.; Koch 2002). As a result, hydropower development is one of the Government's priorities, with a number of major projects (Table 2-5) and several smaller hydropower projects completed, underway or planned.

Table 2-5: Major hydropower projects in Uganda (adapted from Olanya 2016)

Hydropower project	Capacity (megawatts)	Year completed or completion expected	River
Completed			
Nalubaale (formerly known as Owen Falls dam)	180	1954	Nile River

Kiira (also known as the Owen Falls Extension)	200	2000	Nile River
Bujagali	250	2012	Nile River
Under construction			
Isimba	183	2018	Nile River
Karuma	600	2018	Nile River
Ayago	600 - 840	2023	Nile River
Proposed			
Murchison Falls	700	NA	Nile River
Oryang	392	NA	Nile River
Uhuru	350	NA	Nile River
Kiba	300	NA	Nile River

As with any form of economic development, trade-offs exist between the engineering and environmental goals of hydropower (Winemiller et al. 2016), and in the past there have been heated debates over the pros and cons of building large dams (Tilt et al. 2009). Hydropower dams transform rivers and affect both freshwater and terrestrial ecosystems by fragmenting channels, altering river flows, flooding river islands and modifying wetlands, riverbanks and floodplains (Jones et al. 2016a; Lees et al. 2016). Owing to inundation from the dam, previously continuous terrestrial habitats will be confined to highly fragmented land-bridge island archipelagos comprised of former hilltops, which can lead to local extinctions and degradation of remnant terrestrial communities (Jones et al. 2016a). In order to maximise hydropower potential, dams are usually built on waterfalls and rapids and therefore replace turbulent river sections with still waterbodies, which impacts river flow, temperature regimes and sediment transportation (Beck et al. 2012; Lees et al. 2016; Winemiller et al. 2016). These river ecosystems often host unique fish that are adapted for

life in fast-flowing water (Winemiller et al. 2016). Furthermore, the shift from fast-flowing (lotic) to more still (lentic) waters will favour more generalist or invasive species over the more specialist, range-restricted and endemic species that require fast-flowing water (Lees et al. 2016). Large dams regularly reduce fish diversity, impede movements that connect populations and allow migratory species to complete their lifecycles, reduce the natural cycle of flood pulses and can mask or even eliminate triggers necessary for the onset of fish spawning (Lees et al. 2016; Winemiller et al. 2016). Linear infrastructure associated with hydropower dams, such as the construction of new roads and transmission lines, can result in deforestation, habitat clearance and habitat fragmentation (Jones et al. 2014; Lees et al. 2016). This infrastructure can constitute a large proportion of the total area impacted by a dam and can also lead to landscape fragmentation (Jones et al. 2014).

There are also negative social and cultural impacts arising from hydropower development and its accompanying infrastructure on local communities living both upstream and downstream. Construction can lead to physical and economic displacement, including loss of access to fertile agricultural and grazing land, loss of fishing grounds, loss of access to burial grounds and culturally significant areas, and loss of the natural resources (including medicinal herbs, forests, papyrus, mud and sand) that many people living close to the river rely on for their wellbeing and livelihoods (Kaygusuz 2004; Tilt et al. 2009; Beck et al. 2012; Jones et al. 2016a). In many parts of the world (including Uganda), fish and other riverine resources (such as papyrus and sand) are essential for sustaining human livelihoods by providing food and financial security (Beck et al. 2012). Moreover, loss of access to fishing and river ecosystems may mean that these communities will revert to agriculture, thereby potentially leading to more habitat clearance and deforestation. Growing global concern about the social impacts associated with large dam projects resulted in the formation of the World Commission on Dams in 1998 (Tilt et al. 2009).

Uganda's Energy Policy recognises that energy development and environmental damage are intricately linked and identifies the need to mitigate both the physical and environmental impacts created by energy development, especially hydropower (NEMA 2016b). The Policy's goal is to "meet the energy needs of the Ugandan population for social and economic development in an environmentally sustainable manner" (The Energy Policy for Uganda 2002). This led to the creation on the Renewable Energy Policy for Uganda (2007), which aims to increase the use of modern renewable energy and to make it a substantial part of the national energy consumption (The Renewable Energy Policy for Uganda 2007).

The move towards development (including hydropower), together with Uganda's population growth, places significant pressure on the country's biodiversity (WCS 2014). Uganda therefore faces the task of managing the country's natural resources while ensuring that much-needed socio-economic development is allowed to expand and the valuable biodiversity is conserved (Final Draft NEMP 2014).

2.8.5 No net loss of biodiversity in Uganda

Through implementing the mitigation hierarchy (featuring biodiversity offsetting as a last resort), development projects, such as hydropower, can seek to reduce and minimise their negative impacts on biodiversity and even achieve NG. The adoption of policies requiring implementation of the mitigation hierarchy, with an objective of NNL or a NG, could therefore be a significant step towards managing the impact of development projects and protecting the valuable biodiversity, and has gained momentum in Uganda in recent years.

There is an increasing awareness among the Ugandan public sector, investors and the private sector of the value of NNL / NG policies and commitments. Moreover, there are several internationally funded projects being carried out in Uganda by NGOs, businesses and academics to provide support to the Government, developers and industry to expand

and improve on the application of the mitigation hierarchy, to develop national biodiversity offsetting guidelines and to improve capacity within Uganda to implement these guidelines.

A detailed gap analysis for Uganda's current legal and policy frameworks with respect to NNL / NG and the requirement for implementing the mitigation hierarchy was carried out in 2017, with a focus on those laws and policies primarily used for the conservation and management of biodiversity as well as those that impact on these resources (Nabanyumya et al. 2017). The analysis showed that, with the exception of the Uganda Wildlife Policy (2014) (Section 2.5 (f)), there is no provision in Uganda's existing laws and policies that explicitly requires NNL / NG of biodiversity or the implementation of the mitigation hierarchy, including biodiversity offsets (Nabanyumya et al. 2017). The Uganda Wildlife Policy (2014) aims at providing guidance to the conservation and development of wildlife resources, with a goal of conserving wildlife resources in a cost-effective manner that contributes to the sustainable development of the nation and maximises the benefits for the people of Uganda (Uganda Wildlife Policy 2014). One specific objective of the policy (Objective 7) is to "ensure net positive impacts of exploration and development of extractive industries and other forms of development in wildlife conservation areas" and one strategy to meet this objective is to "pursue biodiversity offsets and payments for ecosystem services initiatives, where mitigation is inappropriate" (Uganda Wildlife Policy 2014). ESIAs are a legal requirement in Uganda to identify, manage and mitigate the ecological and social impacts of development projects. However, the requirement for implementing the mitigation hierarchy or implementing measures to ensure NNL / NG of biodiversity is not fully integrated into Uganda's ESIA system (Nabanyumya et al. 2017). Regulation 14(1)(i) of Uganda's Environmental Impact Assessment Regulations, SI No.13/1998, does require "…measures proposed for eliminating, minimising, or mitigating adverse impacts …" but this does not fully encompass all stages in the mitigation hierarchy (The Environmental Impact Assessment Regulations No. 13/1998 1998; Nabanyumya et al. 2017). Moreover, there is no requirement for NNL / NG of biodiversity in these regulations (Nabanyumya et al. 2017).

The country is, however, making progress towards agreeing NNL / NG commitments. Some of the emerging policies and legal frameworks provide for the implementation of the mitigation hierarchy and the need for achieving NNL / NG of biodiversity (Nabanyumya et al. 2017). Most notable include the revised NEMP and draft National Environment Bill 2016, as well as the draft Environmental Impact Assessment (EIA) regulations 2016 (Nabanyumya et al. 2017). One of the objectives of the draft NEMP is "to conserve and manage sustainably the country's terrestrial and aquatic biological diversity in support of national socio-economic development" and one of the 11 strategies to achieve this objective is strategy (xi), "develop strategies and guidelines for implementation of Biodiversity Offsets" (Final Draft NEMP 2014). The new National Environment Bill, 2016 also contains provisions that require NNL / NG of biodiversity; for example, section 4 specifies the need "to require the application of the mitigation hierarchy in environmental assessments, to avoid and minimise impacts, achieve restoration targets and for residual impacts, deliver biodiversity offsets" as well as "to promote the use of economic instruments and compensatory measures in environmental management" (Nabanyumya et al. 2017). Section 105 of the Bill is dedicated to the application of the mitigation hierarchy, biodiversity offsets and other compensation mechanisms (Nabanyumya et al. 2017). Part VI of the Draft Environment (Environment Assessment) Regulations 2016 is devoted to the mitigation hierarchy, biodiversity offsets, PES and environmental management and monitoring plans (Nabanyumya et al. 2017).

Despite finding that there is no legislative or policy provision explicitly requiring NNL / NG of biodiversity in Uganda, the analysis does show that the existing laws and policies are supportive of and provide a good foundation for the introduction of modifications that explicitly require NNL / NG and the implementation of the mitigation hierarchy, which can be seen in some of the new emerging Bills and draft policy frameworks (Nabanyumya et al. 2017). However, these new Bills and policies need to be accompanied by relevant national guidelines on NNL / NG, including biodiversity offsetting, in order to provide practical step-

by-step protocols to be followed by practitioners (Nabanyumya et al. 2017). Nevertheless, if these draft policies and Bills are passed and implemented, they will provide the legal foundation for the protection of biodiversity as part of economic development in Uganda.

2.9 Case study: regional context

The Bujagali Hydropower Project and associated Kalagala Offset, and the Isimba Hydropower Project along the Victoria Nile River in Uganda have been selected as the case study for this DPhil research and are located in the Buikwe, Jinja, Kamuli and Kayunga Districts of Uganda, close to the town of Jinja (Figure 2-4). The Kalagala Offset was one of the first biodiversity offsets in Uganda, with the aim of compensating for the residual environmental impacts of the Bujagali Hydropower Project. Currently, the Isimba Hydropower Project is being constructed downstream and could potentially have an impact on the integrity of the Kalagala Offset, thereby reducing the overall effectiveness of the offset.

2.9.1 Context

The Victoria Nile River (forming the upper section of the Nile River) drains from the northern end of Lake Victoria, west of the city of Jinja, and flows north-west to Lake Albert. The river is punctuated by rapids and waterfalls, which have large hydropower generation potential. This has led to the development of several hydropower projects, with others either currently under construction or planned for the future. The rapids have also led to the growth of a thriving tourism industry, with white water rafting being a major source of income for the area and providing direct employment opportunities with the rafting companies or indirect employment, for example, through restaurants and arts and crafts stalls. Thus, the potential impact of the hydropower projects on the local tourism industry is a contentious issue in the region.

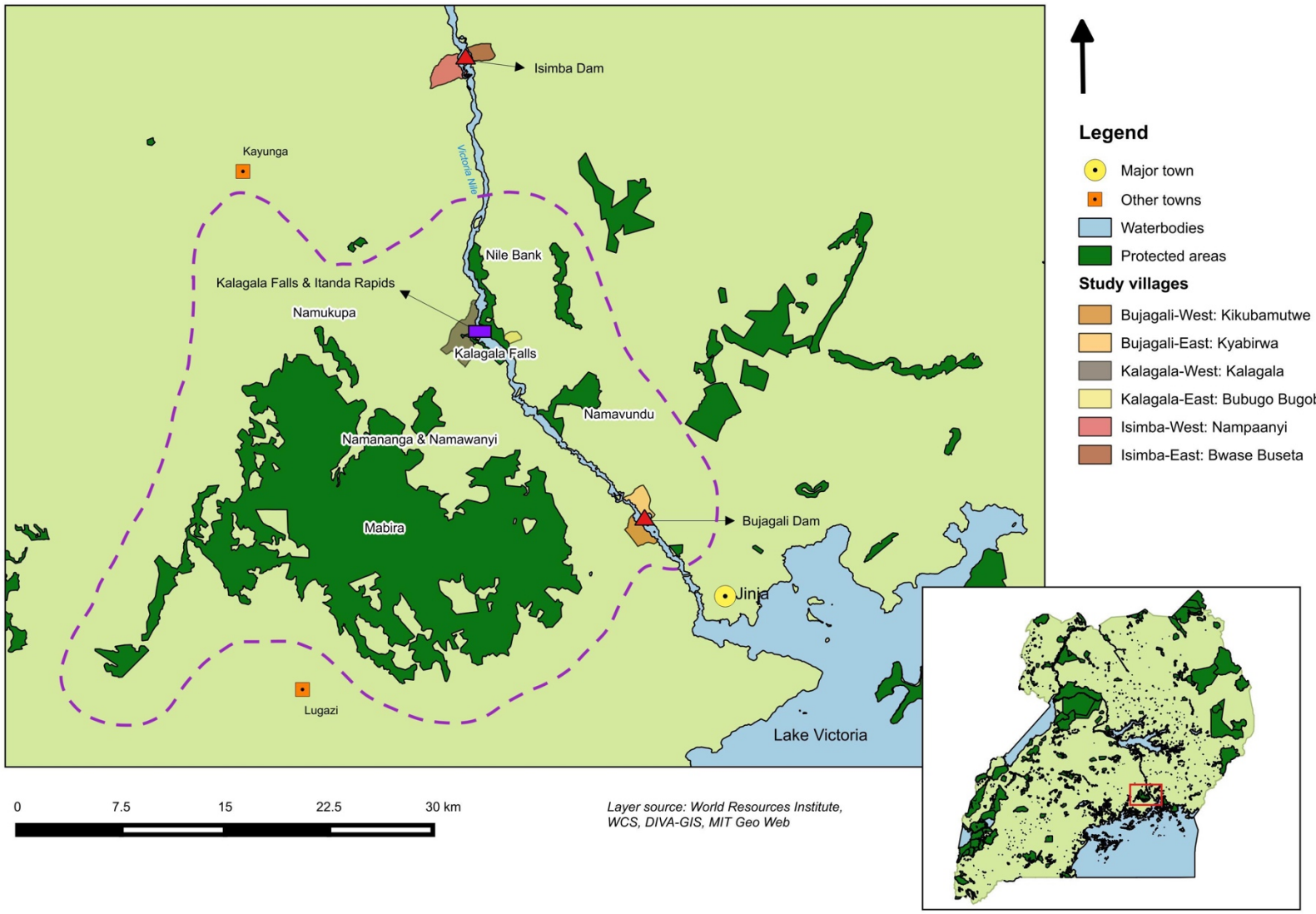


Figure 2-4: Map of the study site, with the dotted purple outline showing the extent of the Kalagala Offset catchment

Central Forest Reserves (CFRs)

Six CFRs are located in close proximity to the river, including a large CFR to the west (Mabira). Forests that are found on public land are called forest reserves, an area reserved by law for forestry purposes, including protection of ecologically important areas and production of forest goods and services (Obua et al. 2010). These reserves can also include grassland and bushland within the reserved land. Uganda's forest reserves were gazetted with the aim of ensuring a continuous supply of forest goods and services for the people of Uganda (Obua et al. 2010). CFRs are protected for ecological, forestry and tourism purposes as well as for the enhancement of a clean and healthy environment for the common good of the Ugandan population (Obua et al. 2010; USAID 2015). There are 65 CFRs in Uganda (with a total area of 840 100ha), which are crucial for biodiversity conservation (Obua et al. 2010). The National Forest Authority (NFA) is mandated to manage all CFRs in the country. Mabira was demarcated in 1932 and is the largest CFR in the study area, occupying an area of approximately 30 000ha (Twesigye 2008). It is an Important Bird Area and is recognised globally as one of the critical biodiversity forests, providing habitat for several endemic species, including a tree (*Caesalpinia volensii*) and a number of butterflies and moths that are unique to Mabira (Ministry of Water and Environment 2009; NatureUganda 2011).

All of the reserves in the study area are, however, highly degraded and encroached upon, with local communities using the natural resources for fuelwood and medicinal herbs, or opting to cultivate the fertile soils in the reserve (V. Griffiths Pers. Obs.). For example, about 90% of the Kalagala Falls CFR (on the west bank, adjacent to the river) has been completely cleared of all natural vegetation and approximately 90-95% of the original vegetation in both the Nile Bank and Namavundu CFRs (on the east bank, adjacent to the river) has been lost owing to agricultural encroachment (Ministry of Water and Environment 2009). There are few indigenous trees remaining in the CFRs in the area, having been

replaced with exotics such as *Pinus Callibea, Eucalyptus* and *Terminalia* (Ministry of Water and Environment 2009). There have been efforts by the NFA to restore the integrity of the Kalagala Falls CFR by replanting approximately 84ha (Ministry of Water and Environment 2009). Obua et al. (2010) also attribute the decline in the quality and extent of forest resources to a number of additional factors, including: a) policy deficiencies relating to the private sector and local communities over land tenure, access rights and responsibilities for forest resource management; b) despite the improvement in forest regulations at the central government level, the institutional capacity and structures to regulate environmental and forest management at the local level is weak owing to inadequate funding; and c) failure of the Government to provide alternative (and affordable) energy resources. Moreover, the demand for a modernised economy and rural transformation has triggered Government decisions to "degazette" forest reserves, with the land being given to investors (Obua et al. 2010).

As mentioned above, the Ugandan agriculture industry is dominated by smallholder subsistence farming, with the majority of the population relying on it for their livelihoods (NEMA 2016b). Given the significance of agriculture, increasing and modernising agricultural productivity (thereby raising smallholder incomes) could provide a significant development opportunity for Uganda (Jeary et al. 2018). The Ugandan Government has therefore been encouraging a shift from subsistence farming to commercial agriculture (Mwavu et al. 2018). However, with Uganda's commercial agricultural expansion and intensification comes the need for large-scale land acquisitions and the conversion of natural habitats, meaning that a trade-off exists between agriculture and conservation (Jeary et al. 2018). For example, in 2001, Kakira Sugar Works Limited (the largest sugar factory in Uganda in terms of yield), benefitted from a contentious takeover of 1 200ha of the Butamira CFR in the Jinja District (Twesigye 2008; NatureUganda 2011). Presently, wetlands and forest habitats in Uganda are under threat from both small-scale and

commercial agriculture and already, much of Uganda's forest has been replaced with intensive agriculture (Jeary et al. 2018).

The exponential growth of sugarcane farming in the *Busoga* region (where my case study is located) over the years has turned the region into a "sugar belt", leading to widespread deforestation, soil fertility deterioration and pollution of streams (Jeary et al. 2018). This expansion is further fuelled by sugarcane's multiple end products (besides refined sugar) and the fact that it could be used for other products such as ethanol and biofuels (Zommers et al. 2012; Jeary et al. 2018). In 2007, the Ugandan Government received, and tabled for discussion, a proposal to expand the Sugar Corporation of Uganda Limited's (SCOUL) sugar production (NatureUganda 2011). The Government announced that it would degazette the Mabira CFR and give 7 100ha of land within the reserve (about 24% of the total area) to SCOUL to cultivate sugarcane (NatureUganda 2011; Hönig 2014). SCOUL, jointly owned by the Uganda Government (24%) and the Mehta Group (76%; a conglomerate based in India), was the first sugar factory to be established in Uganda (in about 1924) and is currently the third largest manufacturer of sugar in Uganda (NatureUganda 2011).

The proposed degazettment of Mabira proved extremely contentious and resulted in civil unrest, with debates centering around the need to conserve biodiversity and permanent forests in Uganda, but also the need to expand sugar cane production for the benefit of Uganda's economy (NatureUganda 2011). Uganda's President, Yoweri Museveni, justified this decision to 'give away' part of the CFR on the grounds that the country needed to boost its economy, stating that this proposal was an economic 'goldmine', would create jobs, and that no other land was available (Zommers et al. 2012; Hönig 2014). This proposal however, received massive opposition from Ugandan civil society organisations, who launched the 'Save Mabira Crusade', with religious and other institutions, donor groups, environmental lawyers, bankers and journalists joining in (Twesigye 2008). The campaign became

profoundly policicised, gained international visibility and turned into a mass mobilisation, pitting the Ugandan Government against a range of international donors, the political opposition, the Buganda Kingdom, civil society organisations, conservation bodies and local communiites (Hönig 2014). Public resistence was generated through the media, petitions, rallies, demonstrations and other activities, and the nation was encouraged to boycott SCOUL's products (Twesigye 2008). The campaign challenged the legal, social, economic and moral grounds on which the proposal was based and was able to discredit the proposed donation of Mabira CFR (Twesigye 2008).

Owing to mounting pressure, the Mabira Forest proposal was eventually abandoned, but this did not stop it being put back on the political agenda in August 2011 and January 2013 (Hönig 2014). Again, responses from the 'Save Mabira Crusade' campaign pressurised the Government into shelving its plans (Hönig 2014). Nevertheless, continued interest still exists in sugar plantation expansion and concerns have been raised that the Ugandan Government is reassessing the Mabira proposal (Zommers et al. 2012). Thus, Mabira CFR is still at risk of being given away for sugarcane plantations (Obua et al. 2010). Despite the current 'truce', tensions still exist between the Government and members of the campaign, with many stakeholders (including local communities) having lost trust in Government's ability to manage the country's natural resources and allow for more responsible stewardship of the environment (Muyomba-Tamale 2011). A further threat to Mabira is the construction of the new Kampala-Jinja highway, which will pass through the forest. This historical and ongoing context is likely to have influenced responses to my research questions, particularly as regards the Choice Experiment (Chapter 6), which asks for preferences for compensation options including better management of the CFRs.

NGOs in the region

Some NGOs and charities are active in the area, for example Soft Power Education and the Supporting Opportunities for Ugandans to Learn Foundation (SOUL). Soft Power Education is a British registered charity and Ugandan NGO, aiming to improve quality of life in rural areas through education. They focus on infrastructure development in the primary education sector (refurbishing existing classrooms and building new ones), support special education needs awareness, improve sanitation at schools, and promote environmental conservation through education. SOUL is an NGO registered in the United States and Uganda and focuses on education (e.g. through student sponsorship programmes), women's empowerment (e.g. running women's business cooperatives that teach women employable skills and financial basics), food security (e.g. through creating commercial fish ponds and working with women to create chicken cooperatives), and health (e.g. through training Village Health Teams (VHT)). A general observation from my time in the field is that the further away from Jinja (for example near the Isimba dam), the fewer NGOs are seen to be operating in the villages.

Government organisations such as the NAADS operate in the area. NAADS falls within the Ministry of Agriculture, Animal Industry and Fisheries and is responsible for public agricultural advisory / extension services, with the aim of increasing farmers' access to information, knowledge and technology for profitable agricultural production. One of NAADS' activities is the provision of services and products to villages in rural areas, such as seedlings (tea, citrus, mangoes and cocoa), poultry and fish hatcheries, provision of livestock, farming equipment and handling, and storage facilities for produce. However, it has been reported that only certain members of a village benefit from the NADDS programmes (V. Griffiths. Pers. Obs.).

2.9.2 Bujagali Hydropower Project

Construction of the 250MW Bujagali Hydropower Project, approximately 8km downstream of Jinja, commenced in 2007 and was completed in 2012. It included the construction of a 28m high earth-fill dam, spillway, a power station housing five turbines, and an 80–100km transmission line from Jinja to Kawanda. In total, the project required a land take of approximately 125ha for newly inundated land (from the reservoir) and permanent facilities. The hydropower project doubled Uganda's electricity supply, reducing load-shedding and replacing expensive thermal power generation (Esmail 2017). There were eight lenders for the project, one of which was the World Bank Group.

Good International Industry Practice (GIIP) was followed during the construction of the hydropower project, including the World Bank Group's Safeguard Policies and IFC Performance Standards. Uganda's national legislation and policies were also followed. An ESIA was carried out in 2006 (R.J. Burnside International Limited 2006), in collaboration with a local Ugandan consultancy, and was approved by NEMA. The ESIA was accompanied by a Resettlement Action Plan, and a detailed evaluation of the potential impacts on cultural heritage in the region. Negative impacts from the dam included physical and economic displacement, and the flooding of the Bujagali Falls displaced the social, economic and cultural activities and benefits that accrued from the Falls.

2.9.3 Kalagala Offset

The World Bank's financing for the construction of the Bujagali Hydropower Project was contingent on a biodiversity offset being developed to compensate for the project's residual environmental damage. In 2007, the World Bank and Ugandan Government signed an Indemnity Agreement to create an offset. This led to the creation of the Kalagala Offset, to ensure that the Mabira ecosystem was ecologically secure and to promote its socio-

economic values. The Mabira ecosystem comprises (Ministry of Water and Environment 2009):

- Kalagala Falls and Itanda Rapids and associated waters and islands (20km downstream of the Bujagali dam);
- Mabira, Kalagala Falls, Nile Bank, Namakupa, Namawanyi, Namananga and Namavundu CFRs;
- Natural and modified ecosystems up to 3–5km from either side of the Victoria Nile River bank, and people living within this geographical area, and their social and economic activities; and
- Cultural assets whose values are associated with the Kalagala Falls and Itanda Rapids.

Specific obligations for the Kalagala Offset include (Ministry of Water and Environment 2009):

- Setting aside the Kalagala Falls and Itanda Rapids sites to protect their natural habitat and ecological, social and spiritual values in conformity with sound social and environmental standards. These sites were selected owing to their similarities with the Bujagali Falls in terms of islands, waterfalls, cultural assets and tourism potential;
- Carrying out tourism development activities at the Kalagala Falls site, in conformity with sound environmental and social standards;
- Not to develop power generation that could adversely affect the ability to maintain the Kalagala Falls; and
- Conserve and improve, through a sustainable management programme and budget, the present ecosystems of the Mabira, Kalagala Falls and Nile Bank CFRs.

It is estimated that approximately 37 000 people directly interact with the Kalagala Falls and Itanda Rapids area and will therefore be impacted (both negatively and positively) by the creation of the Kalagala Offset (Ministry of Water and Environment 2009). There are a

number of cultural assets located at the Kalagala Falls and Itanda Rapids, for example: the *Musoke* worship rocks on the riverbanks at Itanda; the Kalagala CFR contains tree and plant species with herbal and medicinal values; and the *Buganda, Busoga* and *Bunyaro* worship three spirits that dwell in large boulders near the river (Ministry of Water and Environment 2009).

The Government of Uganda, in partnership with the IUCN, prepared a detailed Sustainable Management Plan (SMP) for the Kalagala Offset for a ten-year period (2010–2019; Ministry of Water and Environment 2009). This document provides information on the management strategies and actions to be implemented to safeguard the integrity of the Kalagala Falls and Itanda Rapids and associated ecological, social and economic values. This will promote sustainable utilisation and development of the natural resources associated with the Kalagala Falls and Itanda Rapids and secure the integrity of the CFRs associated with the offset. The SMP also addresses a number of social issues such as sharing costs and benefits accrued from the offset, livelihoods and community development, ecotourism, and sustainable land use and management in the landscape adjacent to the offset.

The Water Management and Development Project began in 2013, with financing from the World Bank. Component 1 of the project supports priority activities within the SMP, and as set out by Esmail (2017), includes:

- Restoration activities for degraded areas (15 000ha) within the Mabira ecosystem;
- Demarcation of Mabira CFR, Kalagala Falls Area and protected areas including riverbanks (this has been initiated);
- Boundary plantings with exotic flora; and
- Ecological-socioeconomic baseline study for the Mabira ecosystem.

2.9.4 Isimba Hydropower Project

Two new hydropower projects (Isimba and Karuma) are currently under construction and will be major additions to the national power pool and help to reduce loadshedding (switching off part of the electricity network in a scheduled and controlled manner, to share the available electricity among all customers). Construction of the 183MW Isimba Hydropower Project began in 2013 and includes the construction of a dam and spillway, power station and turbines as well as a 40km transmission line and associated substations. The project is being constructed 40km downstream of the Bujagali dam (also downstream of the Kalagala Falls and Itanda Rapids) and construction is scheduled to be completed at the end of 2018, with commissioning commencing thereafter. The hydropower project is financed by the Export-Import Bank of China, a state-owned bank solely owned by the Government of China (Esmail 2017).

The initial Environmental Impact Assessment (EIA), SIA and resettlement plan were carried out in 2013 (Ministry of Energy and Mineral Development 2013). However, owing to insufficient attention being given to the mitigation measures for any impacts of the Isimba dam on the Kalagala Offset, the document was subsequently reviewed and revised in 2015. These measures have now been outlined in an EIA Addendum and Long-term Conservation Options Report (Environment & Resource Management Consultant 2017).

During a workshop, NEMA's Director mentioned that NEMA met with the World Bank to discuss the Isimba Hydropower Project and its potential impacts on the Kalagala Offset, most notably the potential impact on the Kalagala Falls and Itanda Rapids, and an endemic fish species found in the Victoria Nile River downstream of Kalagala and upstream of Isimba. Studies showed that the Isimba dam reservoir will change the river's environment, threatening the survival of the fish species. However, after much discussion between the developers and the Government of Uganda, it was agreed that the height of the dam would be reduced, reducing the reservoir area and protecting the falls, rapids and the fish species.

2.9.5 Challenges facing the management of the Kalagala Offset

There are a number of challenges to environmental and social management of the Kalagala Offset area. A stakeholder and institutional analysis was carried out by Esmail (2017) for the Bujagali and Isimba Hydropower Projects and Kalagala Offset, which revealed ambiguities in the coordination responsibilities and communication between governmental entities and other involved players. This limited the effectiveness of monitoring, reporting and implementation, together with actions required to meet environmental and social goals, which appears to have stemmed from weak institutional capacity at both national and local government administrative levels. Ambiguities in terms of responsibilities and ownership have created secondary knock-on effects, often at the expense of biodiversity and local community wellbeing. This is particularly evident with regards to the discrepancies between aspiration and actuality of the initial development objectives that enabled financial lending by the ten development banks or agencies involved in Bujagali. Another finding was that although the Government of Uganda is responsible for the implementation and financing of the Kalagala Offset SMP, there was no clear plan for mobilisation of funds, nor was a strategic financial plan developed.

At a local level, I found that the naming of the Kalagala Offset was a sensitive issue in the study area, particularly between the *Buganda* and *Busoga* tribes (on either side of the Victoria Nile River). Although the offset is called the 'Kalagala Offset' (named after the area on the western side of the river), the tribe on the eastern bank of the river felt that it should be called the 'Kalagala Itanda Offset', incorporating areas on both sides of the river, not just the area on the western side. Nevertheless, according to the SMP, both Districts (on either side of the river) have acceded to the name and have agreed to focus on the equitable benefits sharing from development programmes associated with the offset.

2.10 Why Uganda and this case study?

Aside from it being a highly biodiverse country experiencing extensive investment in national infrastructure, Uganda was selected as a case study because the country is committed to sustainable development. The concept of NNL / NG of biodiversity and biodiversity offsetting has gained significant traction in Uganda in recent years, and has recently led to the inclusion of biodiversity offsetting into three revised environmental laws and policies (the NEA, NEMP and EIA Regulations). Moreover, there is an increasing awareness about the concept in several government Ministries and Departments (e.g. the Ministry of Tourism, Wildlife and Antiquities, the Ministry of Energy and Mineral Development, the MoWE, UWA) as well as amongst local NGOs, academics and the private sector (e.g. Total and Tullow). Uganda is therefore one of a small group of leading African nations on this topic.

While the concept of biodiversity offsetting was first introduced into the 2014 Uganda Wildlife Policy, there is no systematic process for designing, implementing and monitoring biodiversity offsets. It is also evident that the revised NEMP, NEA and EIA Regulations do not consider these details either. Furthermore, these laws and policies focus on biodiversity offsetting as opposed to NNL / NG of biodiversity. Thus, detailed guidance on NNL / NG principles and the mitigation hierarchy is needed, as well as best practice guidelines on biodiversity offsetting, to accompany or supplement the revised laws and policies.

The Bujagali and Isimba Hydropower Projects and the Kalagala Offset were selected as a case study within Uganda based on NEMA's recommendation. NEMA expressed a need to better understand how to manage the Kalagala Offset and improve the implementation of the SMP. They also expressed the need to understand how the Isimba Hydropower Project may affect the Kalagala Offset and what measures could be taken to ensure the offset's integrity. At an international level, lessons from this case study will enable a better

understanding of what NNL of biodiversity means for local people's use and cultural values associated with biodiversity. The work will also help governments, NGOs, academia and businesses to identify the most effective ways to achieve a NNL of biodiversity without making local people worse off. Furthermore, it will help to understand the true costs and benefits that local people experience from national economic development, and its resulting gains and losses of biodiversity (especially through biodiversity offsetting).

2.11 Current projects in Uganda working on NNL / NG of biodiversity and biodiversity offsets

There are two projects currently addressing NNL / NG commitments in Uganda:

Achieving NNL for communities and biodiversity in Uganda

This is a three-year project (April 2016–April 209) funded by the Department for International Development, UK's Darwin initiative. The project is led by the University of Oxford, in collaboration with NEMA, Nature Uganda, the International Institute for Environment and Development (IIED), Wild Business Ltd and the Wildlife Conservation Society (WCS) Uganda. The DPhil research activities presented in this thesis are financially and logistically supported by this Darwin Project and represent a significant contribution towards helping it achieve its aims and objectives.

The intended outcome of the Darwin Project is for Government, developers and NGOs to work collaboratively on NNL / NG and biodiversity offsets that genuinely reflect local people's needs and values, support poverty alleviation in the long-term and are implemented equitably. The Darwin Project aims to work at a local, national and international level to support governments, NGOs and businesses to integrate local poverty alleviation, wellbeing, equity and cultural heritage into biodiversity offsets to ensure NNL to

both biodiversity and local people in Uganda. In addition, it aims to generate a set of lessons learned that have international applicability.

The COMBO Project: Conservation, impact Mitigation and Biodiversity Offsets in Africa

This is a four-year project (2016–2019) funded by the Agence Francaise Développment (AFD), the Fonds Français pour l'Environnement Mondial (FFEM) and the Mava Foundation. It is led by the Wildlife Conservation Society (WCS), Forest Trends and Biotope. The project aims to reconcile economic development in Africa with conservation of biodiversity and ecosystem services and to achieve improved biodiversity outcomes from better development and industry practice in four African countries: Uganda, Guinea, Madagascar and Mozambique. The project works with governments, developers and industry to expand and improve the application of the mitigation hierarchy. In addition, it will develop institutional, legal and financial mechanisms for offset implementation, support the uptake of best practice in the public and private sectors, monitor these initiatives, and develop lessons learnt. The project aims to build national and regional capacity by sharing lessons learnt drawn from Africa and global experiences for NNL activities with a wide range of involved stakeholders.

With WCS being a partner on the 'NNL for communities and biodiversity' project and Forest Trends being involved in an advisory capacity, the two projects are intended to be closely integrated. Through collaboration, the two projects will ensure that the detailed lessons learnt from the Bujagali and Isimba Hydropower Projects and the Kalagala Offset case study will inform national and global policy advice emanating from the WCS-led project.

Chapter 3

No Net Loss for people and biodiversity



Victoria Nile River bank in the Kalagala Offset catchment

3.1 Introduction

Governments, businesses and lenders worldwide are adopting a 'No Net Loss' (NNL) objective for biodiversity, often sought through biodiversity offsetting as the last stage of a hierarchy of mitigation actions. Offsets aim to balance residual losses of biodiversity caused by development in one location with commensurate gains at another location (Bull et al. 2013). Quantitatively and demonstrably achieving NNL goes beyond a general requirement to compensate for biodiversity losses from development. However, viewpoints on offsets differ (Curran et al. 2014; Quétier et al. 2015) and the validity of NNL is debated, including its technical challenges (Bull et al. 2013; Gardner et al. 2013; Maron et al. 2016; Maron et al. 2018), governance issues (Bull et al. 2013; Maron et al. 2016) and potential effectiveness (Lindenmayer et al. 2017; May et al. 2017).

Offsetting has received particular criticism, including for its "reductionist" nature (Robertson 2000; Apostolopoulou & Adams 2015; Spash 2015). Whether biodiversity offsetting captures all values associated with biodiversity (from genes to populations, species and ecosystems) is also questioned (Table 3-1). Consequently, the appropriateness of offsets is debated, with political, economic and ecological uncertainties affecting the delivery of NNL as a conservation goal (Maron et al. 2016). Yet biodiversity offsets are implemented worldwide at an increasing rate and some authors highlight that offsets enable residual negative impacts from development, previously uncompensated and unmeasured, to be addressed (von Hase & ten Kate 2017).

Table 3-1: Values assigned to biodiversity and whether these values are captured by biodiversity offsetting

Philosophical viewpoint towards nature	Type of value	Description	Offsetting commentary	Reference
Biocentric	Intrinsic / inherent value	The value that a living entity has in itself, for what it is, independent of a valuer, and not only as a means for human ends. Biodiversity has the right to exist regardless of function and it is morally right to conserve biodiversity aside from human interests.	Some disagreement with market-based conservation schemes because, ethically, the commodification of biodiversity for exchanges is incompatible with its intrinsic value. Some biodiversity trades may be seen as morally and ethically unacceptable (i.e. taboo). Biodiversity should be valued for what it is, rather than what it does, thus it is not open to quantification or monetary transactions.	Daw et al. (2015); Ives & Bekessy (2015); Moreno-Mateos et al. (2015); Spash (2015); Sullivan & Hannis (2015); Maron et al. (2016); Bull et al. (2017)

Philosophical viewpoint towards nature	Type of value	Description	Offsetting commentary	Reference
Anthropocentric	Use / utilitarian (instrumental)	The direct (consumptive and non-consumptive) and indirect uses that humans derive from biodiversity. Consumptive uses include: fuelwood, medicinal plants. Non-consumptive uses include: recreation and the support and protection provided by biodiversity, in the form of ecosystem services (pollution control, flood control, nutrient cycling, climate regulation).	Characterising biodiversity as a set of tradeable units or credits often narrows the focus to isolated ecosystem attributes. On the other hand, a focus on ecosystem services (e.g. using ecosystem valuation techniques) reduces biodiversity to a benefit provided for humans, representing a shift from compensating for ecological components (i.e. ecosystem attributes, habitats and species) to the monetization of biodiversity, risking biodiversity loss. No single surrogate can entirely capture biodiversity because not all biodiversity attributes are measurable or substitutable. Offsetting does not account for the social ties between people and particular habitats and ecosystems, meaning exchanges of ecological losses and gains can be divorced from ecological, cultural, socio-economic and political contexts.	BBOP (2009a); Apostolopoulou & Adams (2015); Moreno-Mateos et al. (2015); Sonter et al. (2018)

Philosophical viewpoint towards nature	Type of value	Description	Offsetting commentary	Reference
Anthropocentric	Relational	Benefits that people derive from biodiversity (spiritual, cultural, religious, aesthetic, artistic, educational, scientific, and sense-of-place), inspire deep attachment in human communities. This includes relational values which underpins how one relates to the natural world in order to live a satisfied and fulfilled life. Biodiversity is valued irrespective of human use, but the value is regarded as being to humans rather than regardless of human interests.	Reducing biodiversity to units that can be measured in offset metrics does not take into account the cultural or historic importance of place. Owing to their intangible nature, non-use values, including cultural ecosystem services, are difficult to measure and thus cannot be quantified by, for example, ecosystem service valuation. Qualitative valuation methods (including perceptions) can provide insight into their relationship with humans. Furthermore, these values are often linked with history and space, meaning that the loss and recreation of these values is often problematic because the actual value itself will be lost and the 'compensated' value may not capture this value, nor will it target the same affected people.	BBOP (2009a); Apostolopoulou & Adams (2015); Moreno-Mateos et al. (2015); Sullivan & Hannis (2015); Chan et al. (2016)

People's use and non-use values associated with biodiversity should be considered when designing, implementing and maintaining offsets, but these topics have received less attention in the literature than ecological issues (Benabou 2014; Maron et al. 2016; Bidaud et al. 2017). The potential social impacts of offsetting have been noted, particularly in low-income countries where local people depend on natural resources (Bidaud et al. 2015; Sonter et al. 2018). Offsets can cause social disparity and inequity (BenDor et al. 2008), as well as possible benefits such as alternative livelihood options (Gardner et al. 2013). International guidelines, such as those produced by the Business and Biodiversity Offsets Programme (BBOP), advocate that biodiversity offsets should achieve NNL and preferably a 'net gain' of biodiversity without making local people worse off, and preferably ensuring they are better off (BBOP 2012a).

This 'no worse off' principle is implicitly equivalent to a NNL requirement, applied to people rather than biodiversity, but it is not clearly defined in a social context, nor is there clarity on who is responsible for deciding which costs and benefits to people are acceptable. This leads to concerns about environmental justice, especially with respect to the distribution of costs and benefits. For example, sometimes the poor pay a disproportionate cost for biodiversity conservation whereas the wealthy secure benefits (Martin et al. 2013). Moreover, there is a lack of clarity on how to achieve this 'no worse off' principle with regard to people's localised use and non-use values for biodiversity, which are often associated with specific geographical areas. Fulfilling the 'no worse off' principle is particularly challenging in cases where poor people depend on natural resources; badly planned offsets can exacerbate poverty, and the impacts of developments and their associated offsets can vary across spatial-temporal scales, and by location, gender and livelihood. The challenge therefore is demonstrably to fulfill the 'no worse off' principle when seeking NNL for biodiversity.

In this chapter, a framework has been devised to address this challenge. I explore the implications of ensuring people are no worse off and preferably better off in the context of NNL of biodiversity, proposing a definition that can be used to demonstrate that the 'no worse off' principle has been fulfilled when seeking NNL of biodiversity. The approach is based on the achievement of biodiversity NNL throughout the mitigation hierarchy as a whole, rather than focusing on biodiversity offsets. Despite movement in policy and academic discourse to address the social impacts of offsetting (Bidaud et al. 2017; Bull et al. 2017b; Rogers & Burton 2017), the 'no worse off' principle cannot be fulfilled until there is improved specificity on what it means and who should be no worse off.

3.2 Conceptualising the 'no worse off' principle for NNL of biodiversity

Maron et al. (2016) group controversial aspects around biodiversity offsetting into four broad categories, one of which is social challenges – how to capture the values of biodiversity held by society and ensure that they are reflected in biodiversity trades. They suggest that three questions need answering, namely:

a) NNL of what?

b) NNL for whom? and;

c) NNL compared to what?

I consider how each of these questions can be answered, within a framework that ensures people are no worse off, and preferably better off, after a development and offsetting project that seeks to achieve NNL of biodiversity, than they were before the project (hereafter referred to as 'no worse off').

A range of different people may be directly or indirectly, and locally or more distantly, affected by actions to achieve biodiversity NNL at the project, landscape or policy levels. Here I focus on actions to achieve NNL of biodiversity at the project level and on impacts on local people (i.e. those individuals living in and around the project and potential offset sites), including indigenous people, local communities, people pursuing livelihoods based on farming, fishing, ecotourism and other biodiversity related activities, as well as those with cultural associations with biodiversity (BBOP 2009a). These people are likely to be most severely affected by NNL biodiversity activities, including offsets, especially marginalised and voiceless people in developing countries (e.g. Bidaud et al. 2017).

3.2.1 No worse off: of what?

Social impacts are "social and cultural consequences to human populations of any public or private actions that alter the ways in which people live, work, play, relate to one another, organise to meet their needs and generally cope as members of society" (Burdge & Vanclay 1996). They can be positive (benefits or gains) or negative (costs or losses). Negative impacts from development and conservation (including offsets) create a need to compensate local people for hardships they endure (Pechacek et al. 2013). Existing models for compensation include using cash or goods to compensate for losses of livelihoods, income, property and health (Pechacek et al. 2013). Also used are performance- or incentive-based compensation payments such as payments for ecosystem services (PES; Pechacek et al. 2013).

Biodiversity offsets are a specific type of compensation for the residual biodiversity losses incurred after applying the rest of the mitigation hierarchy. The distinction between offsetting and other compensation measures is that offsets aim to quantifiably and demonstrably reach NNL of biodiversity by fully compensating for any residual impacts on biodiversity (BBOP 2009a). To emphasise, the focus here is upon those social impacts caused by

losses and gains in biodiversity under a NNL strategy, i.e. not all the social impacts a development might have.

Demonstrably fulfilling the 'no worse off' principle means that the social gains associated with the changes in biodiversity caused by a development and accompanying offset must be at least equal to any social losses. This requires measuring the social impacts, in order to apply the mitigation hierarchy first to avoid, and then minimise, negative effects on people's use and non-use values of biodiversity. As a last resort, any residual impact must then be compensated for so that people are no worse off as a result of achieving NNL of biodiversity.

Evaluating social gains and losses associated with NNL of biodiversity

Economic tools (e.g. stated preference approaches) can be used to assess the impacts of development and offsets on local people's biodiversity-based incomes, livelihoods and amenities (BBOP 2009a). Some metrics are used to assess progress towards more equitable conservation (e.g. the Gini coefficient, the Thiel index and the 20:20 ratio; Law et al. 2017). However, these equity metrics tend to measure inequality and do not consider fairness or distributive justice (Law et al. 2017). Also, economic approaches are less able to capture the cultural and social dimensions of people's relationships with biodiversity, and may miss how these are affected by biodiversity-related impacts from a development project and its offset.

Measures of human wellbeing can be used to tease apart the multifaceted impacts that a development project's biodiversity NNL strategy may have on people's lives. Wellbeing moves away from externally defined unidimensional indicators (such as income) that do not reflect people's priorities, towards a multidimensional approach, thereby allowing a wider spectrum of costs and benefits to be accounted for (Milner-Gulland et al. 2014; Woodhouse et al. 2015). Wellbeing is "a positive physical, social and mental state" (Summers et al.

2012; Woodhouse et al. 2015), that encompasses the objective, material aspects of people's lives (housing, income, livelihoods, health and the environment), relational aspects (community networks and empowerment) and subjective components that capture an individual's assessment of their own circumstances (how happy they are with their current situation; Woodhouse et al. 2015). Ecosystem services – the benefits that people obtain from nature – are essential for human wellbeing (Millennium Ecosystem Assessment 2005). Daw et al. (2016) use the term "ecosystem service elasticity" to describe how wellbeing changes in response to increases or declines in ecosystem quality. Activities that affect biodiversity may: a) directly impact wellbeing; b) directly impact the flow of ecosystem services, with indirect effects on wellbeing; or c) affect social relations, inducing secondary impacts on other components of wellbeing (Stephanson & Mascia 2014). Wellbeing has already been applied in an offsetting context (Bidaud et al. 2017).

In order to determine whether local people are no worse off in terms of their wellbeing as a result of a development's biodiversity NNL strategy, all three wellbeing dimensions (material, subjective and relational) must be considered. Although focusing on the tangible costs and benefits to wellbeing and who benefits or incurs the costs (distributional equity) is important, people's attitudes towards the development project and offset are also important because perceptions of unfairness are reflected in reduced wellbeing. This can be addressed by including local people in the decision-making process (procedural equity) and ensuring that their rights, interests, concerns and grievances are addressed (recognitional equity); both are advocated for in international best practice guidelines on biodiversity NNL (BBOP 2012a). Soliciting local people's preferences for different offset activities can help inform the design of a NNL and offset policy and ultimately influence its social acceptability (Burton et al. 2017; Rogers & Burton 2017).

Several frameworks exist for evaluating wellbeing impacts, including the Happy Planet Index (HPI), Wellbeing in Developing Countries (WeD) framework and the Voices of the

Poor (VoP; Agarwala et al. 2014; Woodhouse et al. 2015). These frameworks draw upon environmental sciences, economics, psychology, sociology and anthropology, and each has strengths and limitations (see Agarwala et al. 2014). I propose using the interdisciplinary framework described by Woodhouse et al. (2015) for evaluating impacts on wellbeing from losses and gains in biodiversity caused by a NNL strategy. This framework combines objective and subjective valuation. Moreover, the framework links VoP wellbeing domains with perspectives from WeD, and provides a structured guide to evaluating wellbeing, making it accessible to practitioners (Woodhouse et al. 2015). The VoP domains provide a checklist of themes to consider when evaluating wellbeing, whilst the three-dimensional perspective of WeD (objective / material, subjective and relational) helps to delineate the questions asked and type of data collected to evaluate wellbeing (Woodhouse et al. 2015). The framework also emphasises the need for both quantitative and qualitative understandings and presents nine guiding principles for social impact evaluation. This framework, in combination with the economic valuation tools suggested by BBOP (BBOP 2009a), can answer the 'of what' question when achieving 'no worse off', by identifying how different components of wellbeing might be affected by biodiversity NNL strategies, and by informing designs for biodiversity NNL that enhance wellbeing (Woodhouse et al. 2015).

3.2.2 Who is no worse off?

The distribution of costs and benefits is vital to consider when evaluating social impacts of biodiversity NNL. Equitably designed NNL activities, including offsets, need "the sharing among stakeholders of the rights and responsibilities, risks and rewards associated with a project and offset in a fair and balanced way, respecting legal and customary arrangements" (BBOP 2013). However, even with technical processes in place to calculate ecological equivalence, offsets can create outcomes that are socially, spatially and temporally uneven (Apostolopoulou & Adams 2015; Mandle et al. 2015). In the previous

section, quantifying and assessing social impacts of biodiversity NNL in terms of 'local people's' wellbeing is proposed. 'Local people' is defined according to the World Bank Guidelines and the Third Phase of Environmental Program (PE3), funded by the World Bank. These guidelines use the term Project-affected Persons (PAPs) in relation to social impacts in general (i.e. for people who will be physically displaced or whose source of income and standard of living would be negatively affected by a restriction of access to the natural resources affected by World Bank-funded projects; World Bank 2015). PAPs is proposed because the World Bank guidelines are well recognised and accepted in academic and practitioner circles, and are widely incorporated into thinking on NNL of biodiversity (e.g. International Finance Corporation (IFC) Performance Standard 6). Furthermore, in line with the social safeguards of World Bank-funded projects, the documentation specifies the need to pay particular attention to poor and vulnerable groups (including indigenous people) who could be marginalised. The PAP households can be divided into 'major' or 'minor', with people in the former relying on natural resources (in the impacted area) as their main or only source of livelihood; and people in the latter not being dependent on natural resources as their main source of livelihood.

PAPs are interpreted as people affected directly or indirectly (either positively or negatively) by losses and gains in biodiversity from NNL strategies. PAPs might fall within the 'area of influence' (AOI) specified in a project's Environmental and Social Impact Assessment (ESIA). According to IFC Performance Standard 1, an AOI encompasses areas that are directly affected by a project's activities and areas where the project's activities indirectly affect the biodiversity and ecosystem services upon which people's livelihoods depend (IFC 2012a). However, operationalising this concept requires ensuring that people affected by biodiversity NNL strategies are identified and appropriately compensated, which can be difficult. For example, experience from a REDD+ (Reducing Emissions from Deforestation and forest Degradation) project in Madagascar demonstrated that the households that were

more socio-politically powerful, more food secure and less remote, were more likely to be identified for compensation (Poudyal et al. 2016).

Spatial gains and losses

Positive and negative impacts on wellbeing, as a result of losses and gains in biodiversity, can be experienced at both the development and offset locations. Offsets may create land-use restrictions and exclude local communities from accessing the offset site, thereby negatively affecting their wellbeing. In contrast, benefits may arise from the offset through, for example, the creation of employment opportunities and eco-tourism (Koh et al. 2014). Therefore, the people negatively affected by a biodiversity NNL strategy might not be the same as those who receive benefits.

Offset designs can exacerbate social inequality by not considering how location affects the biodiversity people rely on (Mandle et al. 2015). For example, when offsets are close to the development (Fig 3-1a), PAPs affected by the offset are often the same as those affected by the development. When offsets are located further away (Fig 3-1b), PAPs affected by the development project may lose access to biodiversity, whereas PAPs 'hosting' the offset may benefit, for example, from job opportunities and improved ecosystem services, but may sustain losses such as restricted access to natural resources.

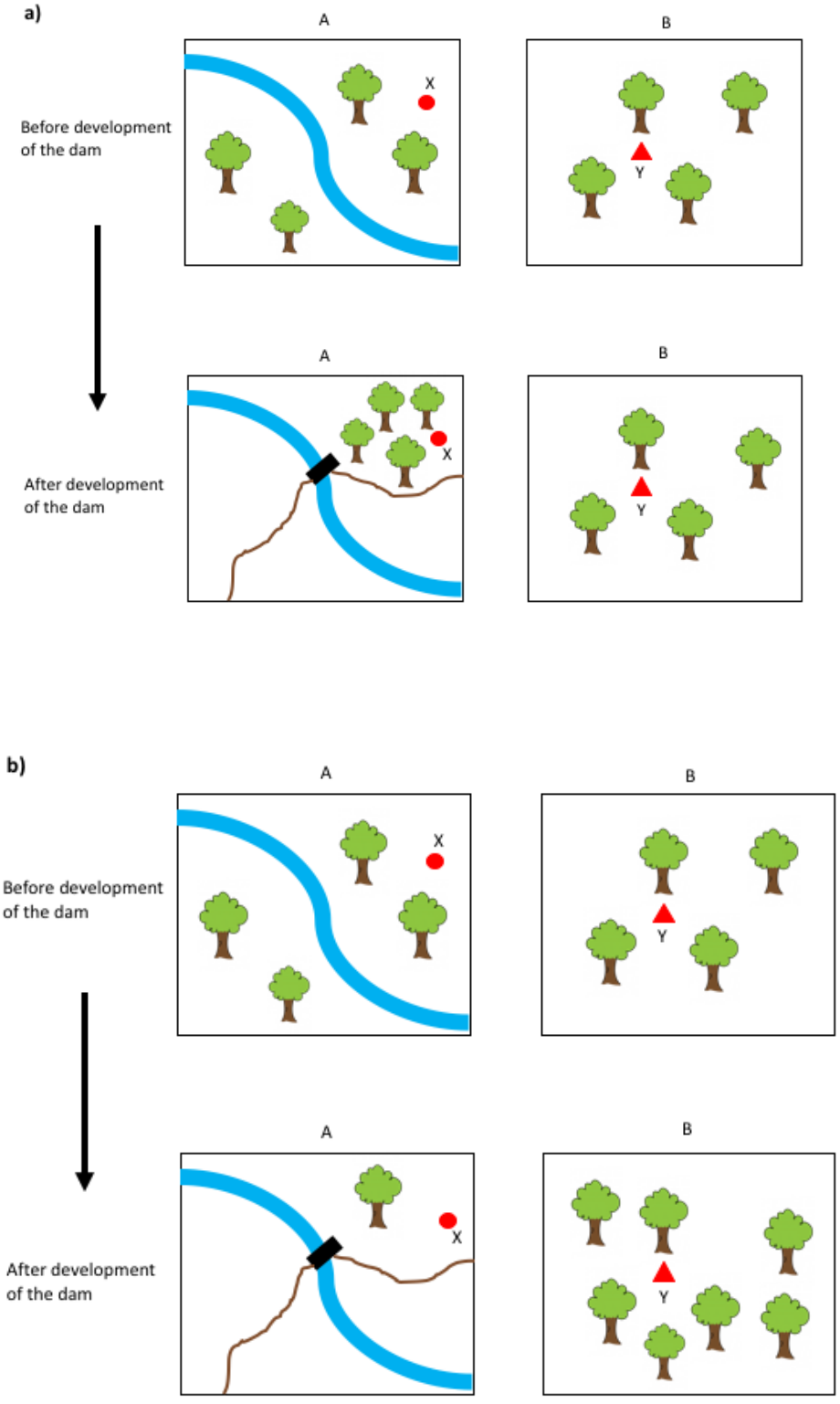


Figure 3-1: Spatial redistribution of gains and losses from the development and offset, leading to social inequity

a) Village X will be impacted by the development of the dam. If the offset is established in close proximity to the dam (rather than in the forest), the same village, Village X, will experience the gains and losses from the offset. b) Village X is still impacted by the development of the dam. However, if the offset is established at an alternative geographical location, for example, a Forest Reserve at site B, a new village (Village Y) will be impacted by the offset and any gains that accrue from the offset will not be experienced by Village X. This will lead to a redistribution of the gains and losses accumulating from the combined offset and development between Villages X and Y.

Koh et al. (2014) recommend that the distance between the impacted (development) and offset sites is minimised to ensure that the same PAPs live at both sites. However, as this is not always feasible or the best decision in ecological terms, safeguards are needed to ensure the equitable distribution of costs and benefits between spatially separated PAPs. As spatial exchanges in biodiversity are central to biodiversity offsetting, trade-offs with social equity implications will be, to some extent, unavoidable (Maron et al. 2016). This raises a key ethical concern: how to address the disparities between gains and losses to PAPs associated with spatial exchanges in biodiversity, and how to ensure that PAPs in all affected areas are no worse off?

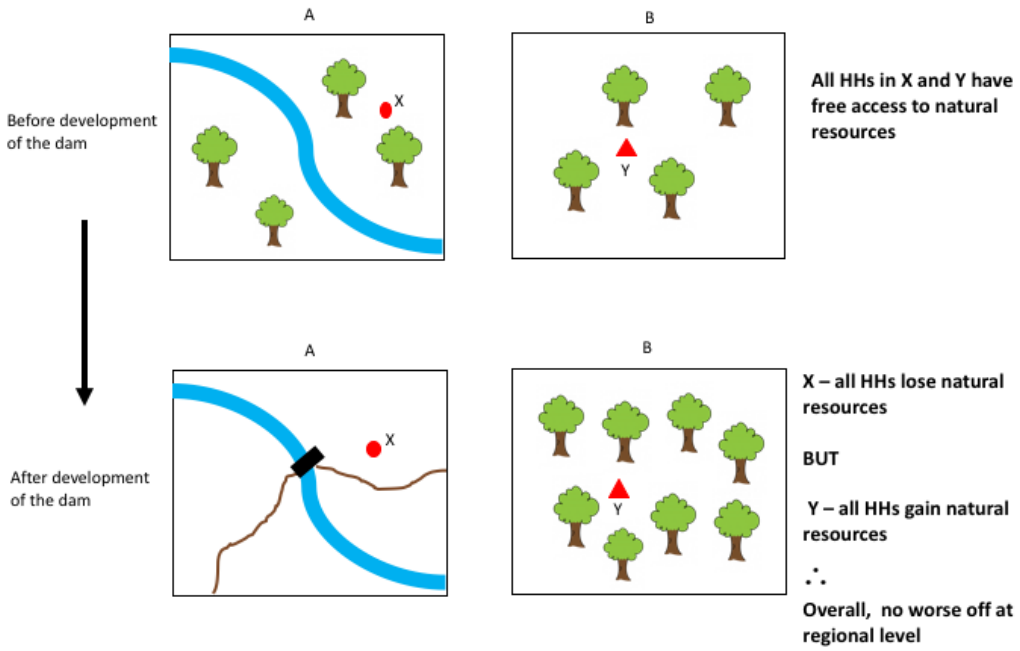
At what level should social gains and losses be aggregated?

The level (individual, household, interest group, village or region) at which social gains and losses are balanced affects whether, and at what level, people are no worse off as a result of NNL of biodiversity. Communities are not static, homogenous and generalizable entities (Blom et al. 2010). Evaluating social impacts incurred from losses and gains in biodiversity at the regional level will not show effects on an individual's wellbeing, especially if aggregating by villages (Fig 3-2a), or households (Fig 3-2b; Daw et al. 2011). Nor will it

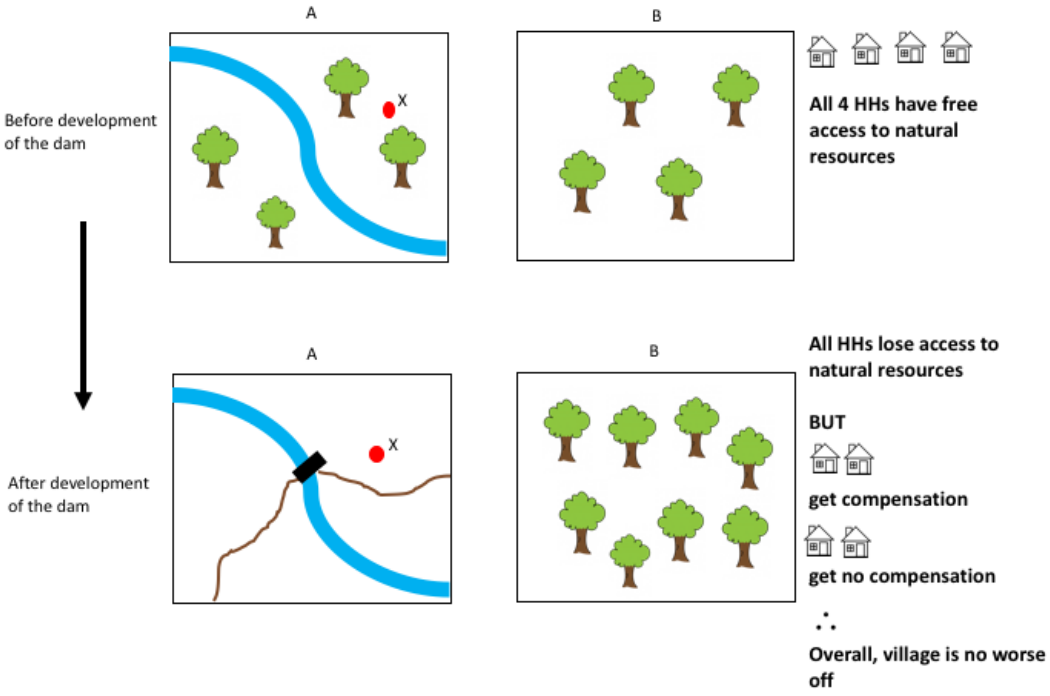
show variations between individuals and sub-groups of a particular socio-economic status, gender, age, location or ethnicity. This is especially important where disadvantaged and vulnerable individuals (such as those living in poverty, the landless, the elderly, women- and child-headed households, ethnic minorities and those reliant on natural resources) could experience more severe adverse impacts from the proposed activities more severely than others (IFC 2012d). Evaluating social impacts at the household level, thereby aggregating by individuals in a household (Fig 3-2c), or at the individual level, with no aggregation (Fig 3-2d), could overcome these issues. However, measuring and policing 'no worse off' at the individual level would be challenging and costly, and is unlikely to be feasible in most cases.

Daw et al. (2011) suggest that the greater the inequality in a system, the more fundamental the issues relating to the unequal distribution of gains and losses are, thus the greater the need to disaggregate. I propose, therefore, that the identity of the PAPs and the existing inequality in the system should be understood first. Baseline assessments form part of ESIAs and usually involve a random sample of households. This information can be used to assess the potential impacts experienced by different PAPs (e.g. different ages, gender, livelihoods and reliance on natural resources), and to identify the appropriate level of aggregation to measure and assess social impacts from biodiversity NNL strategies. Thereafter, the appropriate aggregation units can be chosen transparently, reflecting the main groupings of gain and loss profiles. For example, if gains and losses associated with NNL of biodiversity vary between villages but not within them, aggregating at the village level may be acceptable. However, should certain groups of PAPs (e.g. different genders or livelihoods) experience the gains and losses from NNL strategies differently, aggregating at the interest group or demographic group is more appropriate.

a) No worse off at regional level (aggregating villages)



b) No worse off at village level (aggregating households in village)



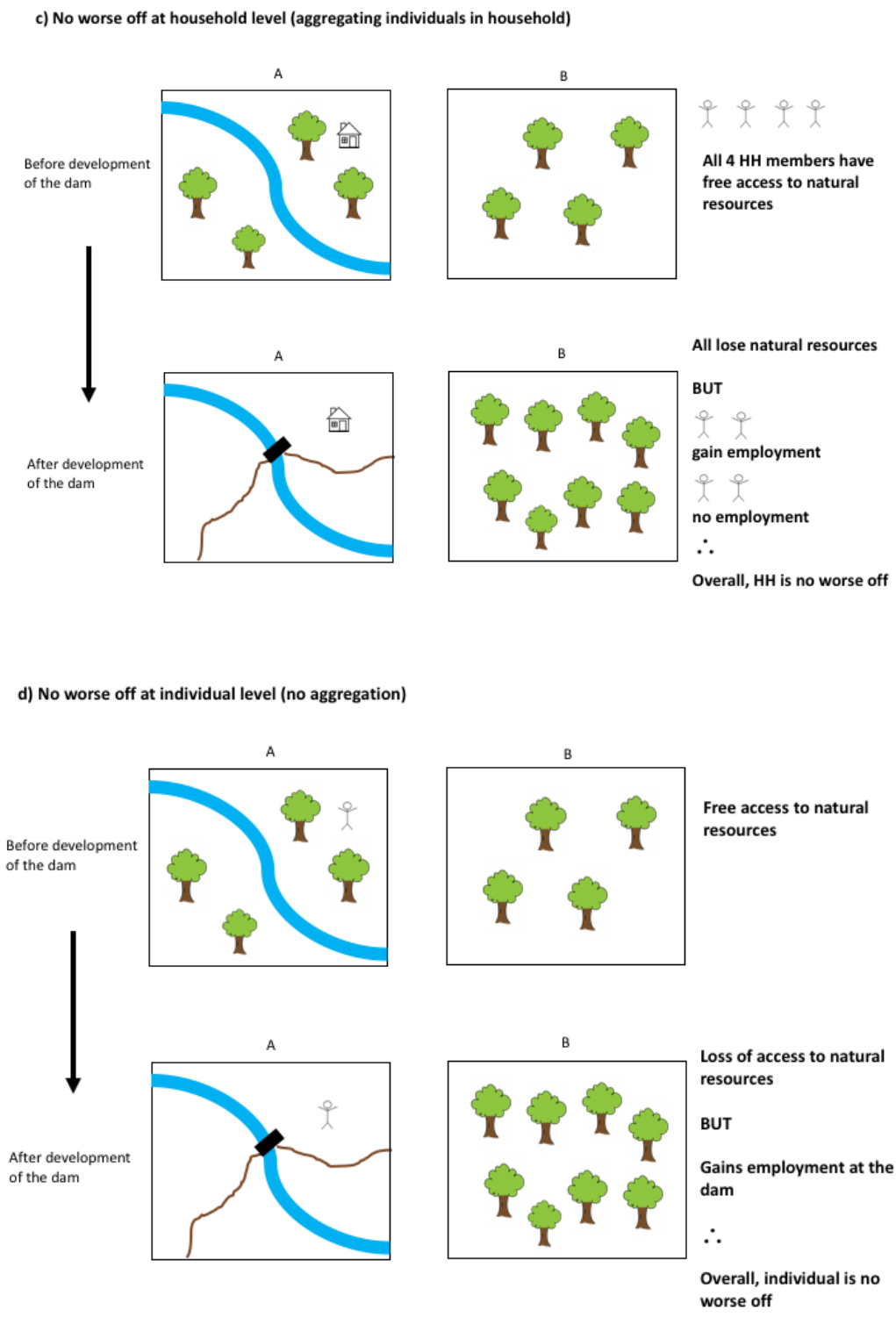


Figure 3-2: The degree of aggregation and the level at which social gains and losses associated with biodiversity-related impacts of the combined development project and offset can be measured

Note: temporal considerations have been left out for this example. i) Measuring social impacts at the regional level and aggregating by villages. ii) Measuring social impacts at the village level and aggregating by households. iii) Measuring social impacts at the household (HH) level and aggregating individuals in the household. Iv) Measuring social impacts at the individual level (individual loses access to natural resources but gains employment at the dam. If employment balances out the loss of access to natural resources, the individual will be 'no worse off').

Temporal gains and losses

If an offset is created after development commences, there will be a temporal gap between biodiversity losses from the development and biodiversity gains accruing from the offset (Bull et al. 2013). Biodiversity loss from development is therefore guaranteed, whereas future gains may be realised late or not at all (Bekessy et al. 2010; Bull et al. 2013; Gardner et al. 2013). Even if an offset is developed immediately, it may take time to mature and for the gains to accrue, meaning that people experiencing biodiversity loss could be negatively affected for a period.

People tend to place more value on what they have now rather than what they may have in the future and to be risk averse, meaning people will weight immediate losses of biodiversity much more strongly than future biodiversity gains (Bull et al. 2017b). For example, people living near Ambatovy in Madagascar perceived that the donation of fruit tree seedlings would potentially benefit their community, but only after the trees had matured. In the meantime, they were negatively affected by land restrictions that were put in place immediately (Bidaud et al. 2017). Temporal aspects therefore must be considered when ensuring that people are no worse off from biodiversity NNL. Therefore, it is recommended that developers compensate PAPs for the biodiversity-related losses they experience from the biodiversity NNL strategy throughout the project's lifecycle. Activities

to compensate fully for negative impacts incurred by PAPs from biodiversity NNL strategies should be identified with the participation of the people concerned (e.g. using Choice Experiments; Pienaar et al. 2014)

3.2.3 No worse off relative to what?

Answering this question requires an explicit counterfactual scenario (Bull et al. 2014a; Maron et al. 2016). The balance of power between interest groups may determine whether an externally or internally valid approach to specifying counterfactuals is taken (i.e. one that makes sense to external parties or to the local people directly affected; Palmer-Fry et al. 2017). Following currently accepted international industry best practice, for example the Equator Principles and IFC Performance Standards, developers may decide that 'no worse off' can be demonstrated with respect to an externally-valid counterfactual. Quasi-experimental designs using control groups (households or villages selected based on their similarity to the study group) are one way to assess the magnitude of an intervention's impact on wellbeing, from an external perspective (e.g. Clements & Milner-Gulland 2015). However, people affected by biodiversity NNL strategies may compare themselves to their own perceptions of change, compared to a relevant 'other' group, which will determine whether they feel better or worse off as a result of the biodiversity NNL strategy (Woodhouse et al. 2015).

Based on these considerations, I recommend that the baseline and counterfactual used to assess change in wellbeing should be both acceptable to external parties and reflect PAPs' experiences. This requires consultations and qualitative assessments that include the relational and subjective elements of wellbeing. Particularly for PAPs suffering major wellbeing impacts, and for vulnerable groups, perceived wellbeing must be used to assess 'no worse off' rather than partial, or externally-derived, assessments of 'objective' wellbeing (such as change in income).

3.3 Defining ‘no worse off’ in the context of biodiversity NNL

The following definition for ‘no worse of’ in the context of development projects seeking to achieve NNL of biodiversity is proposed:

> *Project-affected people (appropriately aggregated) should perceive the component of their wellbeing associated with biodiversity losses and gains to be at least as good as a result of the development project and associated biodiversity offset, throughout the project lifecycle, than if the development had not been implemented.*

This definition answers the questions regarding ‘no worse off’ in terms of: a) what? “*Perceived wellbeing as a result of biodiversity losses and gains”* from a NNL strategy, b) who? “*PAPs appropriately aggregated”*, and c) relative to what? “*If the development had not been implemented”*. The caveat of “*throughout the project lifecycle*” refers to ensuring temporal lags and uncertainties are accounted for, and "*at least as good as a result of the development project and associated biodiversity offset*" refers to how ‘no worse off’ is evaluated (i.e. relative to an appropriate baseline and counterfactual).

3.4 Discussion

There are international calls to address social impacts when seeking to achieve biodiversity NNL (BBOP 2012d; Maron et al. 2016; Bidaud et al. 2017). I propose an approach to operationalise the requirement that biodiversity NNL should be achieved ‘without making local people worse off’.

The potentially inequitable distribution of gains and losses from biodiversity conservation, and associated environmental justice issues, are well documented (Balmford & Whitten

2003; Martin et al. 2013), and have received attention in the biodiversity offsetting literature (Bidaud et al. 2016; Maron et al. 2016; Bull et al. 2017). The resulting social consequences can create both positive and negative feedbacks for conservation interventions (Pascual et al. 2014). For example, negative impacts on equity (e.g. the elite capture of benefits) can trigger negative feedbacks that erode a scheme's legitimacy, reduce stakeholder participation and cause conflicts that undermine ecological outcomes (Travers et al. 2017). Conversely, positive feedbacks (e.g. local empowerment and increased resource access) can improve ecological outcomes by enhancing a scheme's legitimacy, increasing local buy-in and participation and increasing accountability. Engaging local people at the start of the development lifecycle is vital to understand thoroughly their use of, and cultural values associated with, biodiversity and how these affect their wellbeing. This will provide insight into their perspective on the severity of impacts and thus inform the design of fairer and more effective biodiversity NNL projects.

It is important that the 'no worse off' principle is seen as additional, rather than as an alternative, to the need to ensure biodiversity NNL. PAPs may be 'no worse off' if other benefits accrue from an environmentally destructive project. Conversely, a development plus offset might achieve NNL of biodiversity but the associated losses of access to biodiversity could negatively affect PAPs' wellbeing. Thresholds are already part of biodiversity NNL theory and are used to determine which impacts are not acceptable and must be avoided under the mitigation hierarchy (Bull et al. 2013). Common examples are the extinction of a species or destruction of a habitat considered irreplaceable. The use and non-use values PAPs place on biodiversity components affected by a development and offset project could similarly be used as the basis for specifying social thresholds when implementing and maintaining biodiversity NNL activities.

Clarifying the social impacts from gains and losses in biodiversity may tempt project implementers to monetize people's relationships with biodiversity. However, it is vital to

capture the full range of values (use and non-use) associated with biodiversity, which are often context-specific and place-based, with some not being amenable to quantitative measurement. This is particularly important when balancing potentially competing values for biodiversity during the design and implementation of a NNL strategy.

International policy, country-specific legislation and the academic literature call for people to be no worse off, and preferably better off, when seeking to achieve NNL of biodiversity. However, to date there has been no concrete description of this ‘no worse off’ principle in the context of biodiversity NNL. As a first step, I propose a definition that clarifies the elements required for an equitable and socially acceptable biodiversity NNL project, and a framework for applying this definition in practice. The next steps are to operationalise this framework for real-world case studies, and to scale it up to the policy level, in order to address the challenging issues involved in measuring and balancing changes in wellbeing among PAPs in time and space.

Chapter 4

Changes in wellbeing that result from impacts on nature from major infrastructure developments



Fish from the Victoria Nile River

4.1 Introduction

The effect of economic development on human lives has been considered for several decades, with the need to mitigate social impacts when planning and implementing development activities being widely recognised and accepted (Burdge & Vanclay 1996). Recently, there has been increasing recognition of the social impacts arising from losses of biodiversity caused by development projects and measures to compensate for these losses, particularly biodiversity offsets and policies that aim to achieve No Net Loss (NNL) of biodiversity (Maron et al. 2016; Bidaud et al. 2017; Sonter et al. 2018).

Losses and gains in biodiversity under project-level NNL strategies can significantly affect local people's wellbeing, particularly in low-income countries where people are heavily reliant on natural resources for their daily subsistence (Bidaud et al. 2017). Development for regional or national economic benefit should therefore not only aim for NNL of biodiversity, but also account (and compensate) for the multiple impacts that any losses and gains in biodiversity have on Project-affected Persons (PAPs). In this context, PAPs include people whose source of income and standard of living would be affected (negatively or positively) by gains and losses in biodiversity at both the development and biodiversity offset sites (World Bank 2015). Considering the effects of the development and offset on the wellbeing of PAPs will help ensure that PAPs are left 'no worse off, or preferably better off' in terms of their perceived wellbeing as a result of the development project and associated biodiversity offset, throughout the project lifecycle, than if the development had not been implemented (Chapter 3).

Achieving this 'no worse off' principle would help address environmental injustice issues and perceptions of fairness, as well as protect the rights of local people. Furthermore, it would help manage business risk, build good stakeholder relationships and assist with

gaining a social licence to operate (SLO), all of which contribute to the success and long-term sustainability of a biodiversity NNL strategy (BBOP 2009a). However, demonstrably achieving the 'no worse off' principle, thereby managing and mitigating the impact of biodiversity offsets and NNL strategies on PAPs' wellbeing, requires a thorough understanding of the magnitude and distribution of the many dynamic and multi-layered social impacts (both positive and negative) associated with losses and gains of biodiversity. One recommendation is to use a human wellbeing framework to evaluate the impacts of NNL strategies on local people (Chapter 3).

Human wellbeing is "a positive physical, social and mental state" (Summers et al. 2012; Woodhouse et al. 2015). It has its origins in development economics and social psychology, and synthesises contributions from diverse sources of development thinking and social theory (Deneulin & McGregor 2010; Armitage et al. 2012). Wellbeing is a central concept in public policy, particularly in the domains of health and international development (Coulthard 2012). Over the past decades, thinking about development and social progress has shifted away from a narrow uni-dimensional focus on wealth and poverty (e.g. income), to a more multi-dimensional holistic evaluation of the human condition, reflecting the importance of social, psychological and cultural needs required to thrive (Armitage et al. 2012; Coulthard 2012; Agarwala et al. 2014).

The publication of the Millennium Ecosystem Assessment (MEA) in 2005 was one of the first large scale efforts to incorporate human wellbeing into ecosystem dynamics (Armitage et al. 2012), thereby influencing thinking around sustainable development (Coulthard et al. 2018). The MEA led to greater international recognition that humans depend on healthy and functioning ecosystems, and highlights the intricate and diverse links between human wellbeing and the environment (Abunge et al. 2013; Biedenweg & Gross-Camp 2018). The MEA wellbeing framework draws heavily on the World Bank funded 'Voices of the Poor' (VoP) research by Naraya et al. (2000) and both consider wellbeing to encompass five

primary domains (material, health, security, social relations and freedom of choice and action) across these three dimensions (objective, relational and subjective; Naraya et al. 2000; Woodhouse et al. 2015).

According to the three-dimensional framework developed by the Wellbeing in Developing Countries (WeD) research group at the University of Bath, wellbeing can be understood in terms of three interacting dimensions: i) the objective, material components of people's lives (e.g. food, income, shelter and natural resources); ii) relational aspects (what people do and how they interact with others to achieve their needs and quality of life); and iii) subjective experiences (people's own perceptions of how they feel about their situation and quality of life; Britton & Coulthard 2013; Woodhouse et al. 2015). This combines the objective circumstances of a person with their subjective evaluation of those circumstances (Britton & Coulthard 2013). Objective indicators show tangible changes and are often sought by funders, developers and policy-makers, but subjective indicators of wellbeing provide insight into people's feeling and experiences, which impact on their participation and acceptance of initiatives (Woodhouse et al. 2015). Therefore, to successfully measure wellbeing, both objective and subjective indicators need to be considered (Woodhouse et al. 2015), and all three dimensions are important for a full assessment of wellbeing (Britton & Coulthard 2013).

Conservation science is increasingly using the concept of human wellbeing as a way of measuring, monitoring and managing the socio-economic and cultural impacts of loss of access to natural resources on local people (Milner-Gulland et al. 2014; Palmer-Fry et al. 2017; Beauchamp et al. 2018b). Wellbeing is an holistic concept that can help conservation decision-makers understand the complex relationship between people and nature (Palmer-Fry et al. 2017). This knowledge assists conservation organisations with making informed decisions about the social context in which they operate, leading to the creation of more

locally legitimate and socially just management strategies (Stephanson & Mascia 2014; Woodhouse & McCabe 2018).

The learning and experience gained from using human wellbeing frameworks in conservation could be extremely useful if applied to a project-level biodiversity NNL strategy for individual developments. This is because the application of wellbeing frameworks to conservation already focuses on people's use of, and relationships to, nature. Measuring impacts on wellbeing (including subjective and relational impacts alongside material impacts) will help tease apart the complex, multifaceted social impacts that development projects and NNL strategies might have on PAPs, thereby providing a deeper form of impact assessment (Chapter 3). Human wellbeing has already been successfully applied to explore the social impacts, and subsequent injustices, of a biodiversity offset associated with a large mining project in Madagascar (Bidaud et al. 2017).

This chapter uses a human wellbeing framework to evaluate the impacts of two large-scale hydropower projects on PAPs in south-eastern Uganda. Construction of the Bujagali dam was completed in 2012 and construction of the Isimba dam (downstream) is nearing completion (Chapter 2). I aim to use this case study to explore how the ‘no worse off’ principle set out in Chapter 3 can be operationalised, by applying the concept of wellbeing to gain a better, more nuanced understanding of the multi-layered social impacts that local people experience from large infrastructure projects. This information could provide insight into what PAPs perceive are the impacts from development on their relationship to nature, and how development projects seeking NNL of biodiversity can minimise their impact on local people’s wellbeing.

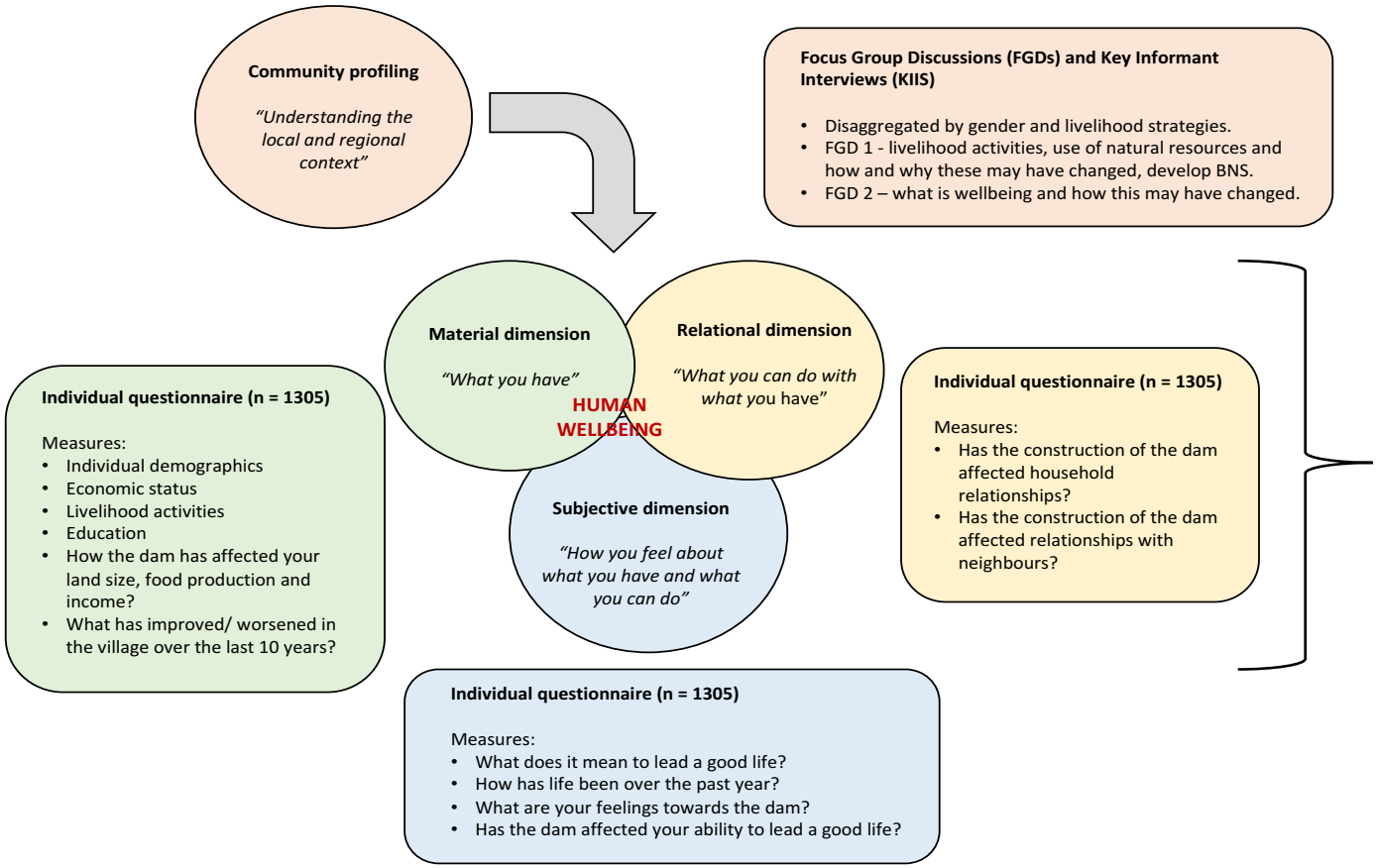
The objectives of this chapter are to: a) understand local conceptualisations of wellbeing within a landscape where the context of a development project varies between locations; b) explore how local people perceive changes in their wellbeing as a result of the effects of an infrastructure project on their natural surroundings; and c) explore how these

conceptualisations of wellbeing and changes in perceived wellbeing vary geographically and between socio-demographic groups. This final objective will provide insight into which aggregation unit (individual, household, interest group, village or region) would be most appropriate when measuring impacts on wellbeing.

4.2 Methods

4.2.1 Methodological framework

A bottom-up mixed-methods approach was used, which assisted with capturing the dynamic nature of wellbeing as well as the multidimensionality and heterogeneity of local people's perceptions in the study area. Figure 4-1 depicts the framework used for exploring human wellbeing in this chapter. The framework was applied to six villages in the study area, experiencing different levels of hydropower development, i.e. two villages at Bujagali (approximately 8km downstream of the town of Jinja), where construction is complete, two at Kalagala (downstream of Bujagali, within the Kalagala Offset), where no construction activities are taking place, and two at Isimba (40km downstream of Bujagali), where construction is underway (described in Chapter 2; Figure 2-4 and Figure 4-2 below).



Material	•Secure and adequate livelihoods •Enough food and food security •Assets e.g. land, natural resources, livestock, housing
Health	•Feeling strong and well •Access to health services •Having a healthy mental state and physical environment
Social relations	•Good relations with family, community, and country •Dignity e.g. not being a burden •Ability to help others and fulfil social obligations
Security	•Confidence in future and predictability •Peace •Personal physical security and safety
Freedom of choice and action	•Sense of control and power •Ability to pursue what you value doing and being, meet aspirations

Figure 4-1: Framework used for studying human wellbeing in this chapter, based on that used by Britton & Coulthard (2013) and Beauchamp et al. (2018), drawing from the World Bank's "Voices of the Poor" (VoP; Naraya et al. 2000) and Wellbeing in Developing Countries (WeD)

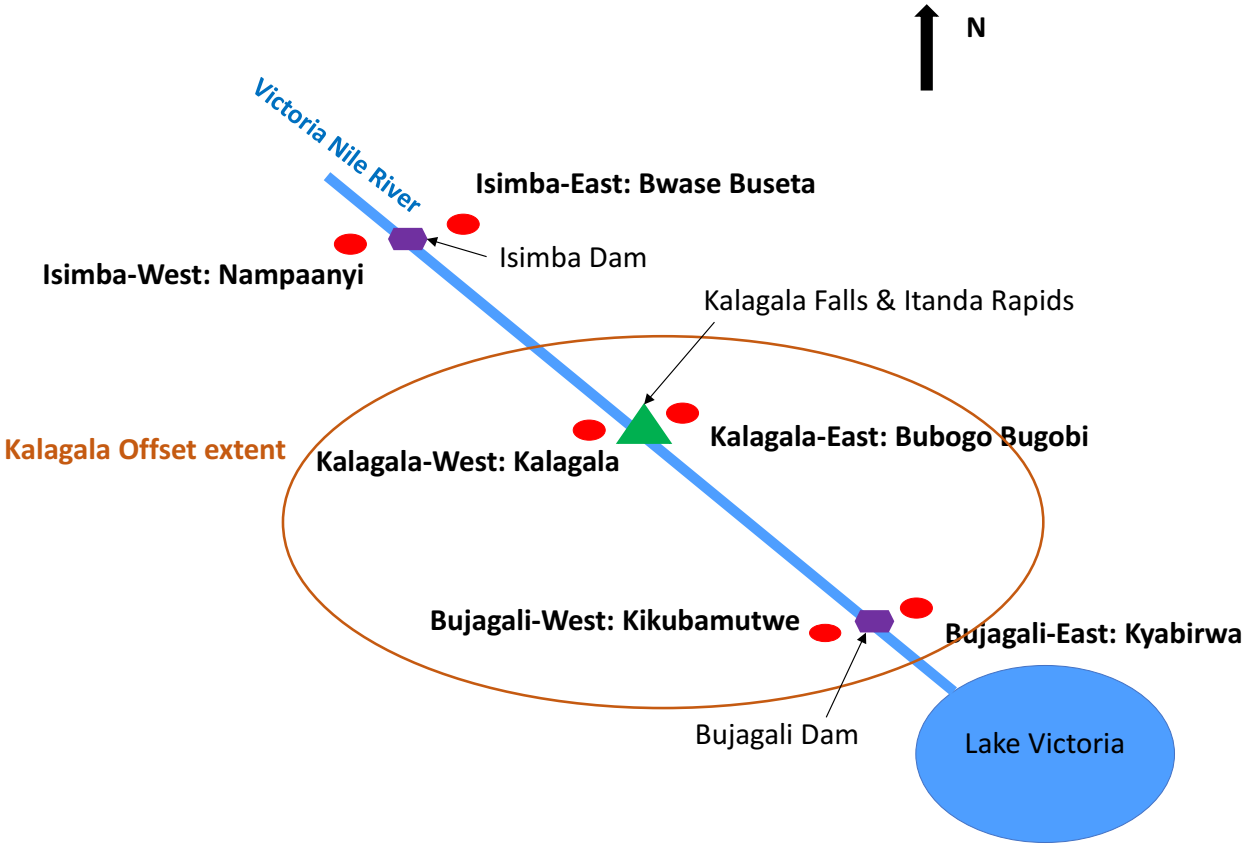


Figure 4-2: Schematic representation of the study area with study villages shown as red dots

4.2.2 Livelihoods and natural resource use in the study area

The areas along the Nile River are densely populated and cultivated, poverty is widespread and local communities are reliant on the river and its adjacent biodiversity for their livelihoods (fishing, medicinal herbs, sand mining, local tourism activities, and papyrus and palm leaves for arts and crafts). Subsistence agriculture (for household consumption and retail) is the main livelihood activity in the area, and is carried out by both men and women, young and old. Other major livelihood activities include livestock rearing, fishing, small businesses (such as restaurants, fish mongering, vegetable stalls and tailoring), manual labour and '*boda boda*' motorbike taxi services. Fishing, manual labour and *boda boda* driving is predominantly done by men. Many people also have a secondary livelihood (and

a few even have a tertiary) to supplement their main livelihood.

Most of the natural resources collected by households in the study area include: fuelwood, fish, medicinal herbs, palm leaves, fodder for livestock, sand, papyrus and clay. On average, households tend to collect two to three different types of natural resources, but some collect up to eight types. Natural resources are mostly collected from people's own property but other sources include another person's farmland, vegetation along the Nile River, forests in the surrounding area, the Victoria Nile River itself, and islands in the river. Natural resources are used predominantly for fuel (as specified by 95% of respondents), followed by food, traditional medicine, sold at markets for income, for arts and crafts, as fodder for livestock, building materials and household materials (e.g. brooms).

When asked about where households source their water, the majority of the people in the sampled villages (72%) said they got it from a village borehole. Some people reported using roof catchment techniques, the river and protected springs. A relatively large proportion of people sampled (23%) said they had access to piped water to their household.

4.2.3 Data collection

Qualitative and quantitative data were collected during two trips to the study area – a scoping trip in April to May 2016 and a second trip from September 2016 to February 2017. The first step involved community profiling, where Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs) were used to gain a general understanding of the local and regional context, understand population dynamics and find out what challenges the community faces. The second step involved conducting individual questionnaires with members of the community to collect quantitative data. These methods were supplemented with participant observation and informal discussions with community members, which I used to triangulate the findings and interpretations from the FGDs, KIIs and individual questionnaires.

The considerable amount of time that I spent in the six villages for my data collection (two months during the scoping trip and six months during the next trip) and the fact that I did not conduct the individual interviews (they were conducted by my research assistants), meant that I had plenty of opportunities to observe the day to day activities in the villages. I also observed how members of the community interacted with and helped each other. In addition, I held informal discussions with individuals (both male and female), many of whom could speak English (e.g. the Local Council Chairman (LC1), health care practitioners and people working for NGOs or government agencies). Sometimes these 'off the record' discussions would relate to my work, which helped me gain a deeper understanding of the region, village and case studies. On other occasions, the discussions would cover unrelated topics, such as politics in Uganda and South Africa and what it was like to live in the U.K. I found these informal discussions and spending time in the village (even if it was colouring in with the younger children not yet in school), helped me build good relationships with the communities.

Four FGDs were undertaken in each village, with participants aggregated according to their gender and livelihood strategy: a) women relying on natural resources for their main livelihoods (such as farming and fishing); b) men relying on natural resources for their livelihoods; c) all other women in the village (including those that are retired, studying, unemployed, shopkeepers, businesswomen, labourers etc.); and d) all other men in the village. The aim of these FGDs was to understand what the main livelihoods and uses of natural resources were in the study area, how and why these may have changed over the years, and to explore the perceived impacts of the hydropower dams on livelihoods and natural resource use. The second part of the FGD was dedicated to discussing and generating a list of Basic Necessity Survey items and services, used to create a localised index of socio-economic status (see Appendix A-1 for the FGD protocol).

A further four FGDs (with the same groupings but different participants) were carried out in each village. The aim of these FGDs was to explore (at a village level) what people in the study area understand wellbeing to mean, define a set of wellbeing indicators, find out why these components are important to wellbeing and whether they have improved or worsened over the last ten years, and why. A list of wellbeing components was compiled prior to the FGDs (based on a literature review) and used to prompt discussions on wellbeing components that were not brought up by the participants. This was only done towards the end of the discussion, allowing participants to give a comprehensive overview of wellbeing first. Lastly, these FGDs explored participants' perceived impacts of the hydropower dams on their wellbeing (see Appendix A-2 for the FGD protocol).

KIIs, making use of semi-structured interviews, were held with people with specialised knowledge in the village, such as the village Local Council Chairman (LC1), people working for non-governmental organisations (NGOs), village elders and other people working for government. These interviews served as a means of ground-truthing the information obtained from the FGDs and provided more specific details about certain matters raised during the FGDs. This qualitative information was used to inform the content of the individual questionnaire.

Individual questionnaires were undertaken in all six villages (see Appendix A-3 for the questionnaire). Households were randomly selected from a list compiled by the local Village Health Teams (VHTs) or the LC1. VHTs are people selected by their own community to serve as the community’s initial point of contact for healthcare, promoting the health and wellbeing of their village members. They also ensure that village records are kept up to date. Each household was numbered and a random number generator in Microsoft Excel used to generate the list of households surveyed. A total of 1305 respondents were interviewed (490 individuals from 317 households at Bujagali, 489 individuals from 289 households at Kalagala and 326 individuals from 178 households at Isimba). In total, 511

men and 794 women were interviewed. To maintain a consistent proportion of individuals sampled per village, more individuals were sampled in the four villages at Bujagali and Kalagala. Where possible, the household head and another family member were interviewed at the respondent's home, in order to capture intra-household variation, particularly by gender and age. Four local enumerators were trained to undertake the questionnaire interviews in either *Luganda* or *Lusoga* (the local dialects) and assist with the FGDs.

The questionnaire comprised a structured interview, collecting general socio-demographic data (e.g. gender, education level, age, primary livelihood and length of time lived in the village) and information on household poverty / economic status (measured using a Basic Necessities Survey (BNS); Davies 2016). This was followed by focusing on personal conceptualisations of wellbeing for the respondents. Participants were first asked “for yourself, what does it mean to lead a good life?”, where they were able to free-list factors, elucidating the important components of wellbeing for individuals in the villages. Free-listing avoided categories being imposed and responses were not prompted. Respondents were then asked several questions which targeted the three wellbeing domains, including whether they felt that the hydropower dams had affected their perceived wellbeing. The questionnaire ended with questions for the research assistants, to assess how forthcoming and honest they thought the respondent was during the interview based on their own judgement. Open Data Kit (ODK) was used to manage the data collection on Nexus Android tablets, and audio recording devices were used to record the majority of the interviews, with the permission of the respondent.

The questionnaire was piloted in a separate village, Buloba Central (n = 74), located on the western bank of the Nile River in the study area, near the Bujagali dam. This village is similar to the main villages sampled but was selected for the pilot because it is located slightly downstream of the Bujagali dam, not directly opposite it like the other villages. The

pilot provided an opportunity to check respondents' understanding of the questions as well as for the enumerators to practice administering the questionnaire. Feedback from the surveyed respondents and enumerators was used to refine the questionnaire.

4.2.4 Ethical considerations

All protocols and procedures used for the social data collection went through a rigorous ethical review by bodies at both Oxford University and the Uganda National Council for Science and Technology. The committees provided valuable feedback on the study protocols and procedures, ensuring that they were in compliance with relevant ethical standards. Ethical clearance was received from the Research and Ethics Committee at Oxford University (Ref No: R43209/RE001) as well as from the National HIV/AIDS Research Committee at the Uganda National Council for Science and Technology (ARC 179). In addition, a research permit was received from the Ugandan National Research Council of Science and Technology (NS 558).

All participants were over 18 years old, none of them had diminished autonomy, and best practice guidelines as well as Ugandan guidelines were applied during all interviews and discussions. Before each household interview and FGD in the villages, the aims and potential implications of the research were explained to participants and their consent sought. Given that many participants were illiterate, I was not able to use a consent form and participant sheet. Instead, I recorded the interviews with participants' permission, which gives a recorded verbal consent. Participants' privacy was respected and surveys were stopped if a participant wished. As the research collected personal data of a sensitive nature (e.g. ethnicity, resource use), data protection was of the highest priority. No disclosure of any data that could place participants at risk of criminal or civil liability occurred and all data are being treated in the strictest confidence.

Collecting data of a sensitive nature could be a potential ethical issue. For example, I asked respondents in the villages about their religion, ethnicity, cultural heritage (including beliefs in spirits) and their use of natural resources in the project area. When asked these questions, all respondents were offered the opportunity to decline to answer or withdraw from the survey altogether if they so wished. No respondents withdrew from participating in the household survey. The use of local research assistants was aimed at making participants feel comfortable when answering the questionnaires and participating in the FGDs. At the end of the questionnaire or FGD, all participants were given a culturally acceptable gift (such as soap and salt, as advised by in-country project partners) as a reimbursement for their time.

Before the research commenced, I also followed the correct protocol and procedures for obtaining permission to work in the villages in the study area. Local authorities (District Environmental Officers (DEOs)) were contacted first to notify them of the research and to get their permission to work in the area. The DEOs then took me to the selected villages, and provided an introduction to the LC1s. I introduced my research to the LC1s and obtained their permission to work in the village. The LC1 (or his representative) assisted with selecting participants for the FGDs. Surveyed households were randomly selected from the VHTs and LC1's household lists and before interviews commenced, the LC1 (or his representative) introduced me and the research assistants to the household head and other members present.

Household survey data were collected electronically (with the use of tablets) and FGD data collected with the use of field notes. Some interviews were recorded to assist with translations as well as to triangulate with the handwritten notes. Data were transferred and stored in password protected Microsoft Excel spreadsheets that only I have access to. At the end of my DPhil, I will hand the data over to my supervisor, making sure that all participant names have been removed and that the data is anonymised. In terms of Oxford

University regulations, the minimum retention period for research data is three years after publication or public release of the work. No individuals will be named in research outputs and publications, although village names will be given. The dataset will not be passed on to third parties or re-used for other purposes that are not covered by the original ethical permissions.

4.2.5 Data analysis

Measuring socio-economic status

Household poverty / socio-economic status was calculated using the BNS methodology (refer to Appendix A-4 for the methodology used to calculate BNS scores). Two further methods were used, allowing household poverty measures to be triangulated. One measure was a subjective ranking of poverty, where respondents were asked to select how well off they were compared to other households in the village (better off, about average, worse off, don't know / would rather not say). The other measure was an external rating by the enumerators (better off, about average, worse off). The three measures were compared, and found to be adequately correlated (Appendix A-5). Therefore, the BNS score was selected as the more robust measure of the three to reflect socio-economic status.

Qualitative analysis

A form of narrative analysis was used to analyse the qualitative data from both the individual questionnaire and FGDs. This is a family of methods which uses story-based techniques to interpret narratives (Riessman 2008; Hards 2012). Narrative approaches are beneficial as they tend not to impose a priori categories on the data but instead allow respondents to present the information they see as relevant, often stressing individual experience (Hards 2012).

Coding of responses followed an iterative process, with codes being used to denote key themes arising from the specific research questions. Coding allows data to be organised into meaningful groups and can be either data- or theory-driven. The coding of responses to each research question was based on the former, where codes were informed by the data / response (Braun & Clarke 2006). In addition, codes were semantic, meaning that they identify features in the data that appear interesting but nothing other than what the respondent has said is assumed (Braun & Clarke 2006). Coding was performed manually in Microsoft Excel. The frequency of codes mentioned with respect to each research question was measured to provide an indication of the importance of each code. Information from the FGDs and individual interviews provided insights into how people in the six villages conceptualise wellbeing and how they perceive any change in their wellbeing as a result of the hydropower developments.

Salience analysis

Codes generated from responses to the research question: “for yourself, what does it mean to lead a good life?” represented various components of wellbeing and were categorised into one of the five wellbeing domains (material, health, social relations, security or freedom of choice and action). This allowed the frequency of each wellbeing component and wellbeing domain to be calculated as well as to explore whether the domains and frequencies differed between socio-demographic groups and villages.

The free-listed wellbeing components were analysed using the cultural salience concept (Harvey & Bernard 2006). For each wellbeing component, a salience score was calculated as:

$$Salience = \frac{1 + Length_i - Position_i}{Length_i}$$

where length is the number of wellbeing components mentioned by person *i* and position is the rank given to that component. The cultural salience score for each wellbeing component was then calculated as:

$$Cultural\ salience = \frac{\sum Salience_i}{n_i}$$

where *n* is the number of respondents.

Cultural salience for each wellbeing component was aggregated across all respondents and indicates the relative importance of a wellbeing component to the culture of the studied community (Papworth et al. 2013). Salience scores range from 0 to 1, with a score of 1 meaning that the component was mentioned first by all respondents. This process assumes that the more important components will be mentioned earlier in the free-list, and by more respondents (Papworth et al. 2013; Beauchamp et al. 2018b). Therefore, components with a low salience score indicate that the item was ranked low (named later on the free-list) by many respondents, or alternatively ranked highly (named earlier on the free-list) by few respondents (Beauchamp et al. 2018b). Salience and frequency of mention were compared to separate out these two components of salience. Analyses were carried out in Microsoft Excel.

Statistical analysis

Non-parametric and parametric univariate statistics were used for preliminary analysis and exploration of the data. These were followed by cumulative link mixed models (CLMMs), fitted with the Laplace approximation (Christensen & Christensen 2015), to assess which socio-demographic variables influence: a) how respondents felt their life has been over the past year (an indication of subjective wellbeing); b) respondents' perceptions about how the dam has affected their ability to lead a good life (i.e. overall wellbeing); and c) whether

respondents feel that the hydropower dams have affected household relationships (relational wellbeing). Ordered Likert scale indicators served as response variables, whilst socio-demographic variables (e.g. gender, age, education level, primary livelihood, economic status and time lived in the village), a measure of subjective wellbeing and people's feelings towards the dam served as fixed effects explanatory variables. 'Village' was included in the models as a random effect to account for the hierarchical nature of the dataset. As more than one individual per household was often sampled, the variable 'household' was nested within 'village'. See Table 4-1 for a summary of all model variables. Positive parameter estimates from the CLMM indicate the likelihood of a more positive response compared to the baseline condition, whilst negative estimates indicate the likelihood of a more negative response. Threshold coefficients indicate the values of the coefficients at which probable outcomes switch between different levels of the response variable.

Prior to modelling, collinearity among explanatory variables was tested using a correlation matrix and a Variable Inflation Factor (VIF) test. None of the variables were significantly correlated. A full (global) fixed effects model was first created with all of the a priori explanatory variables and compared to a global mixed effects model to evaluate the effect of the random variable, village. This was done using a likelihood ratio test and if significant, the final models were fitted with village as a random effect. This was followed by stepwise variable selection, with model selection based on Akaike Information Criterion (AIC) values. If candidate models had a ΔAIC value greater than four, the model with the lowest AIC was selected as the most parsimonious model. Models were run with a logit link function and a flexible threshold and the conditional modes of the random effect (village and household) extracted. Model validation was performed by testing the proportional odds assumption. Each model was also checked for over-dispersion by comparing the residual deviance with the residual degrees of freedom. All statistical modelling was carried out in R version 3.2.1

(R Core Team 2015) and the package ‘ordinal’ was used to fit the model (Christensen & Christensen 2015) and ‘ranef’ to extract the conditional modes of the random effect.

Table 4-1: Variables included in the cumulative link mixed models

Variable	Data type	Variable type	Description
Dependent variables			
Life_been_over_past_yr	Ordinal	Response	Perception on how life has been over the past year (subjective wellbeing), using a Likert scale with 0 defined as hard, 1 so-so and 2 good.
Dam_affected_wellbeing	Ordinal	Response	Perception on how the dam has affected their ability to lead a good life, using a Likert scale with -2 defined as very negatively, -1 negatively, 0 neutral, 1 positively and 2 very positively.
Dam_affected_hh_relationships	Ordinal	Response	Perception on how the dam has affected household relationships, using a Likert scale with -2 defined as strong negative, -1 negative, 0 no effect, 1 positive and 2 strong positive
Independent variables			
Village	Categorical	Random	Village in which the respondent lives (6 level factor)
Household	Categorical	Random	Household (in village) in which the respondent lives

Variable	Data type	Variable type	Description
Subjective wellbeing	Categorical (ordinal)	Explanatory	How people feel their life has been over the past year, using a Likert scale with 0 defined as hard, 1 so-so, 2 good (3 level factor)
Feelings towards dam	Categorical	Explanatory	How people feel about the dam, using a Likert scale with 0 no feelings, 1 angry, 2 sad, 3 happy (4 level factor)
Gender	Categorical	Explanatory	Gender of the respondent (2 level factor)
Education level	Categorical	Explanatory	Respondent's reported level of education (4 level factor: no education, primary, secondary or college / university)
Primary livelihood	Categorical	Explanatory	Respondent's reported main income generating activity (4 level factor: tourism, salaried employment, self-employed, uses natural resources)
Time lived in village	Categorical (ordinal)	Explanatory	Number of years the respondent reported to have lived in the village (4 level factor: <5 years, 5-9 years, >10 years, not sure)
Age	Categorical (ordinal)	Explanatory	Reported age of the respondent (4 level factor: 18-30, 31-45, 46-60, 60+)
Economic status	Continuous	Explanatory	Poverty score (BNS score) of the respondent household

4.3 Results

4.3.1 Characteristics of respondents

Of the total sample (1305 individuals), 39% were male (n = 511) and 61% were female (n = 794). Most were below the age of 45 (65%, n = 848) and the majority had a primary school level of education (54%, n = 701). Most respondents had lived in their village for more than 10 years (86%, n = 1127), and a large proportion used natural resources for their primary livelihood or were self-employed (Table 4-2). Village economic status (based on the sampled households' average BNS score, on a scale of 0, poorest, to 1, least poor) was fairly similar across the six villages; Bujagali-West was the least poor (0.60) whilst Isimba-West is the poorest (0.45).

Based on the enumerators' ranking (and therefore subject to some degree of subjectivity), almost all of the respondents were willing to answer the questionnaire (95%; n = 1233), most had a good understanding of the questions (moderate and above; 92%; n = 1197) and most appeared to be honest in answering (87%; n = 1132).

Table 4-2: Characteristics of respondents

Characteristic	Number
No. individuals sampled	1305
No. HHs	784
No. people per village	
Bujagali-West: Kikubamutwe	246
Bujagali-East: Kyabirwa	244
Kalagala-West: Kalagala	245

Characteristic	Number
Kalagala-East: Bubugo Bugobi	244
Isimba-West: Nampaanyi	162
Isimba-East: Bwase Buseta	164
Gender	
Males	511
Females	794
Age	
18-30 years	429
31-45 years	419
46-60 years	292
60+	165
Education level	
Primary school	701
Secondary school	341
College / university	38
No formal education	225
Time respondent has lived in the village	
<5 years	99
5-9 years	73
>10 years	1127
Not sure	6
Primary livelihood	
Tourism	5
Salaried employment	63
Uses natural resources	961
Self-employed	276
Average household poverty score (based on the Basic Necessities Survey) in each village	
Bujagali-West: Kikubamutwe	0.60
Bujagali-East: Kyabirwa	0.55
Kalagala-West: Kalagala	0.55
Kalagala-East: Bubugo Bugobi	0.54
Isimba-West: Nampaanyi	0.45
Isimba-East: Bwase Buseta	0.48
Respondent willing to answer questions? (answered by research assistants)	

Characteristic	Number
Yes	1233
Moderately	31
A little	39
Not at all	1
Not answered	1
Did the respondent understand the questions? (answered by research assistants)	
Yes	780
Moderately	417
A little	98
Not at all	9
Not answered	1
Was the respondent honest when answering the questions? (answered by research assistants	
Yes	1132
Moderately	107
A little	64
Not at all	1
Not answered	1

4.3.2 Local conceptualisations of wellbeing

A total of 38 wellbeing components were mentioned in response to the question “for yourself, what does it mean to lead a good life?”; 22 material components, five each for health, social relations and security components, and one freedom of choice component (refer to Appendix A-6 for the full list). In most cases, there was a linear relationship between the frequency at which a wellbeing component was mentioned across individuals and its cultural salience (see graph representing the relationship in Appendix A-7). This indicates that there is not much heterogeneity between individuals in what is important for a good life.

Of the top ten most culturally salient wellbeing components in the study area, listed in Table 4-3, eight fall within the material domain and two within the health domain. The top three components fall within the material domain. The most frequent response to this question was 'food', mentioned by 56% of respondents across the villages and with the highest salience score (0.44). Respondents emphasised that food was important for energy and hence being able to work and earn an income, and that three meals a day with a balanced diet of vegetables and animal protein were needed.

"[Life is good] when one has enough food because one can't live on an empty stomach, the rest of the [basic] necessities can always be gotten".

(Male, aged 46-60, Bujagali-East: Kyabirwa)

The next most frequently mentioned component, also with the next highest salience score, was 'employment and income' (frequency = 43%; salience score = 0.34), followed by 'shelter' (frequency = 29%; salience score = 0.19). When talking about employment and income, respondents said that a daily income was preferable in order to take care of family expenses and acquire basic necessities (e.g. food, school fees and health care). In terms of shelter, respondents said that everyone needs a good, clean and comfortable home, with a metal roof that does not leak, cemented floors, brick walls and furniture. These results correspond with the free-lists generated during the FGDs, where the most frequently mentioned wellbeing components in the FGDs were food, employment and income, and the first-mentioned components were income and employment, food and shelter.

"Employment is important for acquiring all the basic needs such as water, food and a family (a wife)".

(Bujagali-West: Kikubamutwe, men's FGD)

The next most frequently mentioned wellbeing domain was health, with the component 'feeling healthy and strong' having the highest salience score for this domain (0.14) and

being the most frequently mentioned health component (19%) across all villages. Respondents said that this is vital in order to be able to work well and earn an income to support their families. Feeding well and having access to proper health care facilities (as opposed to traditional medicine) were needed in order to achieve this. The next most salient item was 'health services' (0.13). This item was actually the third most frequently mentioned wellbeing component (31%) but it was often ranked lower on the free-list, leading to its lower cultural salience value. This corresponds with the items free-listed in the FGDs, where the third most frequently mentioned item (after food and income) was health services. Respondents said that health care should be free, within walking distance from their household and be equipped with all the necessary facilities, services and affordable medicine (which is often not the case).

"[A good life] is being very healthy to be able to work and get all the basic necessities and thus live a fulfilled life".

(Female, aged 46-60, Bujagali-East: Kyabirwa)

The social relations domain was only mentioned by 13% of respondents and the security domain by 6%. Apart from two individuals, respondents' conceptualisation of wellbeing did not include any elements related to the freedom of choice domain. No wellbeing components in these three domains fall under the top ten wellbeing components.

When comparing the six villages, slight differences in the frequency of components named in each wellbeing domain were observed (Figure 4-3). In all villages, the most frequently mentioned domain was the material domain (frequencies > 90%), followed by health, social relations and security. Appendix A-8 gives the results of tests for equality of proportions between each village for each domain (material, health, social relations and security). No variation in wellbeing conceptualisation was found between villages on the east and west banks of the Nile River.

Table 4-3: Top ten cultural salience scores and associated frequency of wellbeing components, aggregated by respondents in all villages and named during the individual questionnaire

Wellbeing domain	Component named	Frequency (%)	Cultural salience
Material	Food	56	0.44
Material	Employment and income	43	0.34
Material	Shelter	29	0.19
Material	Basic necessities on the BN list	20	0.15
Material	Clothing	26	0.14
Health	Feeling healthy and strong	19	0.14
Health	Health services	31	0.13
Material	Access to water	14	0.10
Material	Education services	22	0.08
Material	Land for homestead and agriculture	11	0.08

The importance of components in the health domain decreased downstream, further away from the town of Jinja. Respondents in the two villages adjacent to the Bujagali dam (Bujagali-West and Bujagali-East) found the wellbeing components in the health domain to be more important, followed by those downstream at the Kalagala Offset site (Kalagala-West and Kalagala-East) and finally by those adjacent to the Isimba dam (Isimba-West and Isimba-East). This pattern was also observed with wellbeing components in the social relations domain.

The degree of economic development being experienced by the villages appeared to lead to a variation in the prioritisation of wellbeing components in the security domain. Villages located near the Bujagali dam (construction completed several years ago) found these components most important, followed by those adjacent to the Isimba dam (construction

underway) and finally those in the Kalagala Offset area (no construction taking place). Construction of the dams would have led to an influx of migrant labour, potentially having negative effects on feelings of security.

"*My land was taken, I was almost raped by a casual worker at the dam, and my daughter was raped by the dam workers".*

(Female, aged 60+, Bujagali-West: Kikubamutwe)

Slight differences were observed between the socio-demographic groups (Appendix A-9). Women tended to prioritise wellbeing components in the health and social relations domain more than men. Older people (> 46 years) referred to components in the health domain slightly more frequently than younger people (probably because they rely more on the healthcare centres), and mentioned components in the security domain less frequently than younger people. Younger people named components in the social relations domain more than older people and tended to name components in the material domain slightly less frequently. More educated people (with secondary or university / college degrees) mentioned components in the health and security domains more frequently than less educated people.

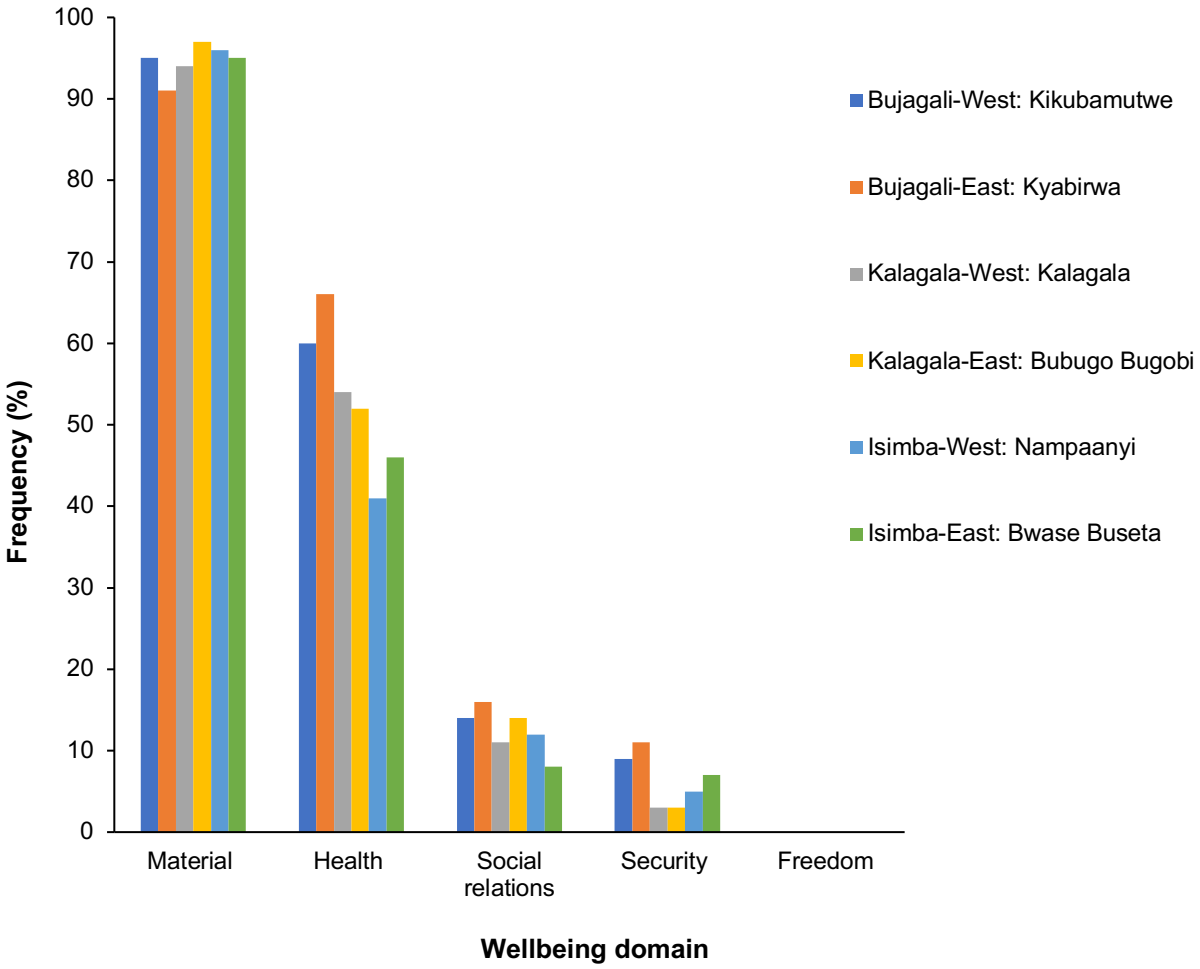


Figure 4-3: Frequency at which the five wellbeing domains were mentioned in each village, aggregated across individuals per village

4.3.3 How life has been over the past year: subjective wellbeing

The next question continued to explore people's conceptualisation of wellbeing but specifically explored people's subjective wellbeing. Respondents were asked to choose how their life has been over the past year: hard, so-so or good. The majority said that their life has been hard (64%; n = 830/1305), whilst considerably fewer said their life has been so-so (20%) or good (17%).

Three socio-demographic variables have a significant effect on responses to how life has been over the past year, namely age, education level and economic status (Table 4-4). When compared to the model's baseline conditions (18 – 30 years old, no education and poor), people aged 31 – 45 were more likely to say that their life had been hard over the past year. People with higher education levels (secondary and college / university) and the less poor were more likely to say that their life has been so-so or good over the past year. Responses from the six villages did not differ significantly nor did men and women's responses. However, four FGDs (two male and two female) stated that women's lives and wellbeing had improved over the past year. They said that this had to do with female emancipation and empowerment, as women were now more aware of their rights and laws that protect them from abuse. Men, on the other hand, often stated that their lives had become hard and difficult owing to female emancipation.

"Women are no longer abused in the homes and can even own property owing to women emancipation".

(Bujagali-East: Kyabirwa, women's FGD)

"Worsened due to women emancipation and the current domestic policies. Women are aggressive and no longer obedient because they know that the law favours them. They connive with children and make life hard for men yet men can't even beat them because of the law. So, the men resort to leaving their homes which is also a crime due to the fact that women can't support homes by themselves".

(Kalagala-West: Kalagala, men's FGD)

Table 4-4: Results from a CLMM with a logit link function of how people feel their life has been over the past year, with respect to predictor variables

Variable	Estimate	Std. Error	CI (2.5%)	CI (97.5%)	Significance
Gender – Male	-0.10	0.14	-0.36	0.17	
Age – 31-45	-0.43	0.18	-0.78	-0.09	*
Age – 46-60	-0.20	0.15	-0.49	0.10	
Age – 60+	-0.21	0.13	-0.46	0.05	
Education – Primary	0.23	0.21	-0.17	0.63	
Education – Secondary	0.63	0.24	0.17	1.10	**
Education – College / university	0.72	0.41	-0.09	1.53	.
Economic status	1.21	0.53	0.16	2.25	*
Threshold coefficients					
0/1	1.69	0.32			
1/2	2.93	0.34			

*Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1*

Baselines: female, 18-30 years old, no education and poor

Thresholds: 0 = Hard; 1 = So-so; 2 = Good

The ten most frequently mentioned reasons why respondents said their life has been hard or good over the last year are presented in Table 4-5 (see Appendix A-10 for the full list). Reasons have been aggregated across all six villages (as there was no significant

difference between villages in the model) and categorised into one of the five wellbeing domains. People who said that their life was so-so attributed this to a combination of the reasons others gave for life being hard or good. Most of the time, several reasons were given per response, falling into multiple wellbeing components. The components mentioned here (and their associated frequencies) also serve as an indication of what aspects of wellbeing are important to people in the study area and what they think they need in order to lead a good life.

Table 4-5: Top ten wellbeing components, aggregated by respondents in all villages, named as being reasons why life has been hard (n = 830) or good (n = 216) over the past year

Wellbeing domain	Component named	Frequency (%)
Why life has been hard over the past year		
Health	Unhealthy	45
Material	Low / no income	36
Material	Prolonged dry season / climate change	23
Material	Poor / failed harvest	23
Social relations	Family member died	17
Material	Food shortage	17
Material	High prices of commodities	11
Material	Unable to afford school fees	9
Material	Limited / no land	6
Material	Unable to afford basic necessities	6
Why life has been good over the past year		
Health	Good health	30
Material	Enough food	22
Material	Enough money	22
Material	Had a good harvest	20
Material	Had an income generating activity	14

Wellbeing domain	Component named	Frequency (%)
Material	Could afford access to all the basic necessities	10
Social relations	A family member was able to take care of them	8
Material	Could afford access to education services	7
Material	Good weather conditions	6

As with the local conceptualisation of wellbeing, the majority of reasons for life being hard or good over the past year fell within the material domain, one in the health domain and one in the social relations domain. Respondents did list several wellbeing components in the security domain, but none of these fell within the top ten wellbeing components. No respondents mentioned wellbeing components in the freedom of choice domain, again indicating that people's conceptualisation of wellbeing did not include any elements related to that domain.

Contrary to the findings to the first question, where the most frequently mentioned wellbeing component fell in the material domain (food), the most frequently mentioned wellbeing component in response to why life has been hard or good over the past year, in both instances, had to do with health. This indicates that physical health is an important factor when people think about the main reasons for their recent wellbeing, even if it does not feature so strongly in more abstract conceptualisations. People who said their life has been hard because of illness tended to refer to either themselves being sick and therefore unable to work, farm, earn an income and provide food for the family, or a family member being sick and them having to spend money on healthcare and medication. Illnesses frequently mentioned included malaria, tuberculosis, HIV/AIDS, arthritis, high blood pressure, among others. On the other hand, people frequently attributed life being good to the fact that they were healthy and disease free.

"[Life has been hard this past year because] I fell sick, my daughter also fell sick and therefore I had little money to keep me going since most of the money was spent on our medication".

(Male, aged 31-45, Kalagala-East: Bubogo Bugobi)

"[Life has been good this past year because] I was healthy and able to work therefore I always had some little money on me so that in case of any challenge like sicknesses, I could solve it without hardship".

(Female, aged 46-60, Kalagala-West: Kalagala)

After health, the following wellbeing components in the material domain influenced people's lives over the past year: income, prolonged dry season and climate change, failed or poor harvests, food shortages, high prices of commodities, being able to afford all of the basic necessities and being able to afford education services. Several of these components were interlinked. Often respondents attributed food shortages and lack of income to poor or failed harvests, which in turn was attributed to the prolonged dry season and climate change. Subsistence farming is the main livelihood activity in the study area, with people also growing cash crops such as coffee for market sale and additional income. Moreover, owing to a lack of income, respondents said they were unable to afford basic necessities (e.g. bedding and school fees). People at all levels felt that education was important for their children as this will help them gain employment in the future, thereby allowing them to look *after their family and parents.*

"[Life has been hard because] the dry season was long, my crops dried up and since it is my main income generating activity I had very low incomes to support my family".

(Female, aged 46-60, Bujagali-East: Kyabirwa)

"[Life has been good because] there was enough rainfall and therefore we had enough food in the household".

(Male, aged 46-60, Isimba-West: Nampaanyi)

The social relations domain was third in the top ten wellbeing components. Components mentioned in this domain show how important family and family relationships are to people living in the study area. A high proportion of people said their life was hard over the past year owing to a relative or family member passing away (17%) and in some cases this person was the main 'bread-winner' in the family. Other people said that their life had been good because they were being supported by a family member; either parents, a husband or children were taking care of them (8%).

"[My life has been good because] my husband provides everything I need".

(Female, aged 18-30, Kalagala-East: Bubugo Bugobi)

Although not in the top ten frequently mentioned components, 4% of the respondents also said that their life had been hard because they were supporting a large family and extended relatives. On the other hand, 3% of people who said that their life had been good acknowledged that this was because their husband only had one wife and that they had a small family to support, meaning they could afford many of the basic necessities needed to live a good life.

"We could access all what we wanted because we had a small family".

(Female, aged 31-45, Kalagala-East: Bubugo Bugobi)

During the time that the respondents were giving reasons why their lives had been either good, so-so or bad over the past year, and before any specific questions pertaining to the dam were asked, impacts of the Bujagali and Isimba dams on their lives and wellbeing began to emerge. Although not in the top ten most frequently mentioned reasons, some

people (less then 10% of respondents) said their life had been hard because the dam procured some of their farming land, resettled people, reduced tourism (negatively affecting income), restricted access to fishing sites (reducing income), affected river water levels which in turn reduced the amount of fish, cleared natural resources which people relied on for their livelihoods, resulted in an influx of people moving into their village (leading to increased HIV/AIDS), and that rock blasting affected fish breeding sites, cracked their houses and led to miscarriages in both people and livestock.

4.3.4 Perceived impacts of hydropower development on wellbeing in the study area

In order to further explore how people perceived impacts of the hydropower dams on their wellbeing, respondents were asked “has the dam affected your ability to lead a good life?”. The highest percentage of respondents said that the dams had a negative impact on their wellbeing (36%; n = 465/1305) whilst 18% said the dams had a very negative impact. Some 29% were neutral about the impact, whereas only 8% and 1% said that the dams had a positive or very positive effect on their wellbeing, respectively. Contrary to this, however, when asked about their feelings towards the dams, the majority of respondents said that they were happy about the dams (43%; n = 556/1305), whilst considerably fewer were sad (25%), had no feelings (18%) or were angry (6%).

A CLMM was used to explore the effect of several socio-demographic variables on people’s responses to how the dam had affected their ability to lead a good life, as well as another two explanatory variables: subjective wellbeing (how people’s life had been over the past year) and feelings towards the dams (Table 4-6). Results show that, when compared to the model baseline conditions (female, 18-30 years old, no education, having no feelings towards the dam, and life over the past year being so-so), men and older people (60+ years old) were more likely to report that the dam had had a negative effect on their wellbeing,

whilst young people (18-30 years old) were more neutral. Education did not have a significant impact. Compared to people with no feelings about the dam development, people who were angry and sad were more likely to feel that the dam had negatively impacted their wellbeing, with angry people being the most negative. On the other hand, people who were happy about the dam's development felt that the dam had less of a negative impact on their wellbeing (parameter estimates fall between thresholds 1 and 2, negative-neutral). People who said that their life had been hard over the past year were more likely to report that the dam had negatively impacted their ability to lead a good life.

Looking at differences between villages, most of the respondents in the two Kalagala villages reported that they had only heard about the dams, and so, their construction had had a neutral effect on their wellbeing. These villages are located adjacent to the river where no hydropower development is taking place.

"I only hear about [the dams] but I don't feel anything about [their] existence"

(Male, aged 60+; Kalagala-West: Kalagala)

"I just hear about [the dams] but I have never seen them".

(Female, aged 31-45; Kalagala-East: Bubugo Bugobi)

Looking at people's feelings towards the dam, the majority of respondents in Kalagala-East, followed by Kalagala-West, had no feelings about the construction of the dams in the study (Fishers exact test: $p < 0.05$). However, the two villages adjacent to the Isimba dam reported that the dam had had a strong negative effect on their wellbeing, followed by the two villages adjacent to the Bujagali dam.

Table 4-6: Results from a CLMM with a logit link function of how people feel the dam has affected their ability to lead a good life, with respect to predictor variables

Variable	Estimate	Std. Error	CI (2.5%)	CI (97.5%)	Significance
Gender – Male	-0.29	0.14	-0.56	-0.01	*
Age – 31-45	0.16	0.17	-0.17	0.50	
Age – 46-60	0.17	0.15	-0.12	0.46	
Age – 60+	-0.32	0.13	-0.58	-0.06	*
Education – Primary	-0.03	0.20	-0.42	0.37	
Education – Secondary	0.08	0.24	-0.39	0.55	
Education – College / university	0.21	0.43	-0.63	1.05	
Feelings towards dam – angry	-3.79	0.40	-4.57	-3.01	***
Feelings towards dam – sad	-1.18	0.22	-1.61	-0.76	***
Feelings towards dam – happy	0.57	0.19	0.20	0.93	**
Life been over the past year – hard	-0.41	0.17	-0.76	-0.07	*
Life been over the past year – good	0.13	0.23	-0.32	0.57	
Threshold coefficients					
0/1	-3.14	0.62			
1/2	0.19	0.59			

Variable	Estimate	Std. Error	CI (2.5%)	CI (97.5%)	Significance
2/3	2.96	0.61			
3/4	5.36	0.68			
Random effects (intercepts)					
Kalagala-West (Kalagala)	1.58				
Kalagala-East (Bubugo Bugobi)	1.74				
Bujagali-West (Kikubamutwe)	-0.17				
Bujagali-East (Kyabirwa)	-0.07				
Isimba-West (Nampaanyi)	-1.40				
Isimba-East (Bwase-Buseta)	-1.58				

*Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1*

Baselines: female, 18-30 years old, no education, no feelings towards the dam and life over the past year being so-so

Thresholds: 0 = Very negatively; 1 = Negatively; 2 = Neutral; 3 = Positively; 4 = Very positively

Qualitative questions in the individual questionnaire were used to explore people's reasoning behind why they felt angry, sad or happy towards the dam. These insights were supplemented with discussions from the focus groups. The reasons were categorised into one of the five wellbeing domains and the top ten most frequently mentioned responses are listed in Table 4-7. For a full list of responses, refer to Appendix A-11. These were also the same reasons given during the FGDs about ways in which the dams have impacted on

people's wellbeing in the study area. The majority of wellbeing components, and the most frequently named, fall within the material wellbeing domain. Considerably fewer components fall in the social relations, health and security domains. No components in the freedom of choice domain were mentioned.

Table 4-7: Top ten wellbeing components, aggregated by respondents in all villages, named as being reasons why people feel angry (n = 84), sad (n = 327) or happy (n = 556) about the dam's construction in the study area

Wellbeing domain	Component named	Frequency (%)
Angry		
Material	Lost livelihoods / source of income	40
Material	Lost land to the dam	40
Material	Lost access to natural resources (e.g. fish, fuelwood, medicinal herbs, papyrus etc.)	39
Material	Loss of tourism	33
Material	Rock blasting damaging houses	30
Material	Compensation received was too little / unfair	24
Social relations	Cultural heritage has been destroyed	18
Material	Deforestation leading to drought and climate change	15
Material	Nature has been destroyed	15
Material	Promised services were never delivered	14
Sad		
Material	Lost land to the dam	35
Material	Rock blasting damaged houses	34
Material	Lost livelihoods / source of income	25
Material	Lost access to natural resources (e.g. fish, fuelwood, medicinal herbs, papyrus etc.)	20

Wellbeing domain	Component named	Frequency (%)
Material	Loss of tourism	19
Health	Rock blasting affected people's health	15
Material	Electricity is not free / rates are too high	11
Material	Deforestation leading to drought and climate change	10
Health	Rock blasting affecting livestock's health	9
Happy		
Material	Provided electricity	37
Material	Employment opportunities	22
Material	Development for the region and village	20
Material	Going to provide electricity	19
Material	Improvement of services in the village	17
Material	Development for the country	8
Material	Establishment of factories	4
Material	Able to build new, modern houses	4
Material	Compensation received	4

Perceived negative impacts of the dam on wellbeing

One of the most frequently mentioned reasons as to why people were sad or angry about the dams and why their wellbeing had been negatively impacted was that they had lost farming and grazing land to the dam, which in turn had a negative impact on their food supply and income. Although many respondents acknowledged that they had received compensation for their land (although a few said they had not), many of them said it was too little or unfair as it did not take into account the true value of their land. Moreover, some people spent their compensation money unwisely, saying that it was wasted on extravagant material items such as cars. People reported that they now have smaller plots of farming land, which cannot support their household consumption, let alone cash crops for income. Owing to monoculture, the land is infertile, further affecting crop yields. Some people have changed occupations altogether and now run small businesses. In addition to farming on

their own land, people used to farm along the banks of the river, where the soil was more fertile. However, they have since been displaced owing to the construction of the dam and, as riparian farming is against the law, the National Environment Management Authority (NEMA) has been restricting their access to the area. However, physical displacement was not raised as a reason why people felt sad or angry about the dams during the individual questionnaires. This was brought up by FGDs in Bujagali-West, with people saying that owing to relocation, the demand for products has reduced, greatly affecting businesses and income.

"[I feel sad about the dam because] I lost land which was my source of income through farming".

(Female, aged 18-30; Bujagali-West: Kikubamutwe)

"[I feel angry about the dam because] our fertile land was taken and compensation charges were very low; is not commensurate with the value of land in the village".

(Male, aged 46-60; Bujagali-East: Kyabirwa)

This was followed by the impact of the dams on their income and livelihood activities and the loss of access to natural resources. In some areas, access to the Victoria Nile River has been restricted, negatively affecting those who rely on fishing for their livelihood and household food consumption. This activity was primarily undertaken by men, and many have now had to turn to manual labour (sometimes in neighbouring villages) to earn a living. Furthermore, respondents said that when they are allowed to fish, the fluctuating water levels from the dams have reduced the number of fish in the river as well as the number of species, resulting in smaller catches. This has also negatively affected women who used to have restaurants to cater to the fishermen.

"[I feel angry about the dam because] fish stock has declined due to increased water levels, affecting fish breeding and thus their multiplication for our use."

(Male, aged 46-60, Bujagali-East: Kyabirwa)

A number of people also said that they used to rely on the natural resources along the river and on the islands for their livelihoods, for example, selling clay and sand for construction and using papyrus and palm leaves for making traditional arts and crafts. They also relied on forests along the riverbanks for fuelwood, fruit and medicinal herbs. Many people also complained that the clearing of vegetation and forests along the river as part of the dam construction has led to a decrease in rainfall and to soil infertility, which has negatively affected their harvests, food production and income. They also complained that the dams have polluted the river water, which they used to access for drinking water and for their livestock.

"[I feel angry about the dam because] we no longer access natural resources like fish, fruits and fuelwood, our farm produce lacks ready market, many youths are jobless, there is low economic activities, our soils are infertile partly because the wild which is very instrumental in causing rains was destroyed."

(Male, aged 18-30, Bujagali-East: Kyabirwa)

"[I feel angry about the dam because] we lost our sources of income because we could earn from arts and crafts but the papyrus and palm leaves were slashed".

(Female, aged 18-30, Isimba-East: Bwase Buseta)

Many people also stated that the dams had destroyed the surrounding nature and aesthetics of the area, especially the sacred sites that used to be located at the waterfalls near the Bujagali and Isimba dams. These sacred sites were home to spirits where people would go and worship them (e.g. asking for wealth, twins and a good life; see Chapter 5).

"[I feel angry about the dam because it] destroyed the Bujagali spiritual site which was of great importance to my family. We used to go to that site to consult spirits and ask for what we wanted and we used to get our wishes".

(Female, aged 46-60; Kalagala-West: Kalagala)

Another frequently mentioned reason why people were unhappy about the dams and why they had negatively impacted their wellbeing was because of the loss of tourism, leading to unemployment and loss of livelihoods. White water rafting is a major tourist attraction in the region and is a large source of employment for local people (R.J. Burnside International 2006). However, the development of the Bujagali dam, in particular, resulted in the flooding of waterfalls and rapids used for rafting, forcing the rafting activities to move further downstream. This led to a large number of people becoming unemployed as many residents were employed as tour guides, assisted with the rafting activities or had small businesses (e.g. restaurants and craft shops) that catered to the tourists. In addition, the sacred sites used to serve as a tourist attraction before they were destroyed. Many people complained that they did not benefit from employment during the dams' construction, and that if they did want employment, they often had to pay bribes to top officials in their village. Many respondents said that, owing to the high levels of unemployment in their villages, there was a large amount of theft and, in particular, moral degeneration amongst the youth who cannot find jobs.

"My livelihood was destroyed [by the dam]. I used to have income from tourism related activities, I would fish well and also sell my agricultural products to tourists who used to visit the village but now they no longer come because the falls were destroyed".

(Male, aged 31-45, Bujagali-East: Kyabirwa)

"Our local leaders demanded bribes from our husbands in order to be employed in the Dam".

(Female, aged 31-45, Bujagali-West: Kikubamutwe)

"The youths don't have jobs since the majority depended on the wild for survival hence leading to theft, alcoholism, indecent dressing and playing cards".

(Female, aged 31-45, Bujagali-West: Kikubamutwe)

At the Bujagali dam, 51% of respondents in Bujagali-West had lost land, 64% had lost income and 64% had lost food production. Similarly, in Bujagali-East, 54% lost land, 78% lost income and 63% lost food production. At the Isimba dam, 70% of the respondents in Isimba-West reported losing land, 72% lost income and 80% reported losing food production, whilst in Isimba-East 16% reported losing land, 64% lost income and 46% reported losing food production (Figure 4-4). The number of people whose land, income and food production had not been impacted was highest in the villages around the Kalagala Falls (Figure 4-4).

The impact of rock blasting was also brought up as a reason why people were angry or sad about the dams and why they thought the dams had negatively impacted their wellbeing. People said that the rock blasting had caused cracks in their houses, for which they were not compensated. They were also of the opinion that rock blasting had negatively affected their health (e.g. leading to high blood pressure, heart attacks, causing people to go deaf and leading to miscarriages) and the health of their livestock (e.g. leading to deaths, eggs not hatching and miscarriages). They also said that rock blasting in the river has destroyed fish breeding grounds, reducing the number of fish in the river and caused fish to migrate. Moreover, they said that the rock blasting had created significant noise and air pollution.

"The rock blasting at the dam has damaged our houses and led to miscarriages in pregnant women and animals, yet we have not been compensated".

(Female, aged 18-30, Isimba-East: Bwase Buseta)

People were also sad and angry about the dams because they said the developers had promised them new or improved services. For example, people said they were assured that new boreholes, schools and hospitals would be constructed as well as a new bridge to Busia (a town in the Eastern region of Uganda). However, according to respondents, none of these services have been delivered. Moreover, when electricity was brought to the village, some respondents expected to be connected to the power grid and to receive electricity for free. Many others complained that the electricity tariffs are too high so they are unable to connect to the power.

"We were hoodwinked by being promised heaven on earth like construction of hospitals, schools and other social amenities; these have not been done".

(Male, aged 31-45, Bujagali-East: Kyabirwa)

"We were told we would benefit from the dam project by having free of charge power, that's why I accepted to sell my land at a meagre pay".

(Male, aged 60+, Bujagali-East: Kyabirwa)

Although not in the top ten most frequently mentioned reasons, the influx of migrant labour and job seekers into the villages adjacent to the dams was raised as another reason why people were angry or sad about the dams and believed they had negatively affected their wellbeing. Respondents said that this had not only led to an increase in the population, thereby leading to competition for limited resources (e.g. land), but the prevalence of diseases such as HIV/AIDS in the villages had increased as well as pregnancies amongst young girls.

"Some of the workers who came from other Districts brought H.I.V and left our girls with children who have become fatherless".

(Female, aged 31-45, Bujagali-West: Kikubamutwe)

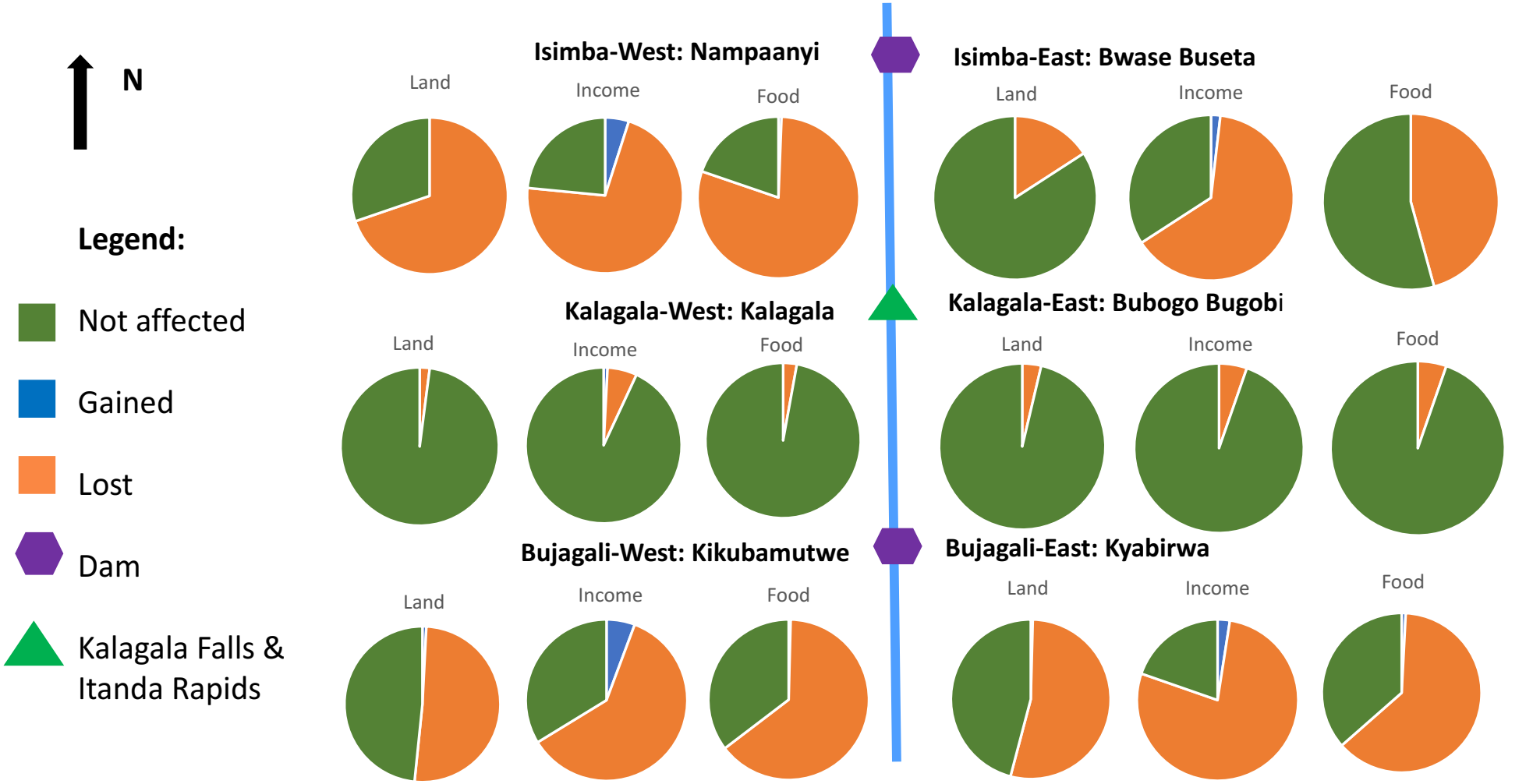


Figure 4-4: Proportion of respondents not affected, who have gained or who have lost land, income and food production as a result of the dam

Perceived positive impacts of the dam on wellbeing

Despite the array of perceived negative impacts associated with the dams, 43% of people in the study area were happy about the development of the dams and felt that they have positively affected their wellbeing. The most frequently mentioned reason was the provision (or potential provision) of electricity to the village and households, followed by employment opportunities associated with the dam and generation of electricity, as well as the hope that the dams would generate development in their village and region (Table 4-7). Some people even said that the provision of electricity would reduce people's reliance on fuelwood, thereby reducing the rate of deforestation. Indeed, albeit small in percentage terms, some respondents said that they had gained income as a result of the dams; 14 people in Bujagali-West (6%), six in Bujagali-East (3%), two in Kalagala-West (0.8%), eight in Isimba-West (5%) and three in Isimba-East (2%; Figure 4-4).

"I am hopeful about the benefits that are likely to accrue from the dam, like employment opportunities and electrification of the village".

(Female, 60+, Isimba-East: Bwase Buseta)

"[I am happy about the dams because an] increase in supply of electricity in the country means increased rural electrification".

(Female, aged 46-60, Kalagala-East: Bubugo Bugobi)

Owing to electricity being extended into the region, people said that services would be (or had already been) improved. For example, new roads might be developed, a bridge might be built between the *Buganda* and *Busoga* Kingdoms, electricity had reached their town centre, crime had reduced, market centres have been built and hospitals will have better facilities with electricity. The developers at the Bujagali dam have supplied the villages with boreholes, clean water and, in some instances, piped water. Furthermore, the increased

power supply could attract and encourage the establishment of factories and other small businesses in the region, which would in turn generate more employment opportunities. Many people acknowledged that the creation of the dams will support development of the entire country and that the increased power supply means electricity will be more reliable, thereby reducing load shedding (intentionally engineered electrical power shutdown) throughout the country. Some respondents even said that the Government's income will be increased and that more tax will be received.

"[I am happy about the dams because] we know that due to electricity, more factories will be built, hence more job opportunities".

(Male, aged 46-60, Kalagala-East: Bubugo Bugobi)

"I am happy because I expect the dam to bring a big development to the country".

(Male, aged 46-60, Kalagala-West: Kalagla)

Another frequently mentioned reason why people were happy about the dams was because they received compensation for their land. Respondents said that their existing land had increased in value considerably, and that they used the compensation money received from the dam developers to build new, modern houses for their family. Some respondents thought the dams might act as tourist attractions, creating further employment activities, whilst others acknowledged that they have benefited in other ways from the dams, for example, through the creation of sustainable livelihood schemes and tree planting activities, instigated by the dam developers.

"People who lost their land to the dam managed to use their compensation to buy land and build houses better than those they had earlier and whoever lost land to the dam was fully and handsomely compensated".

(Female, aged 18-30, Bujagali-West: Kikubamutwe)

"Many people benefited from sustainable livelihoods schemes that were set up by the dam like technical skills enhancement projects such training people tailoring"

(Female, aged 18-30, Bujagali-West: Kikubamutwe)

4.3.5 Perceived impacts of the dams on relational wellbeing

To explore the perceived impact of the dams on the relational dimension of wellbeing, respondents were first asked what effect the dams had on their household relationships. The majority of the people said that the dams had no impact on household relationships (85%; n = 1046/1305), whilst fewer said it had a strong negative (4%) or negative effect (10%). Very few respondents said that it had a strong positive (0.4%) or positive effect (0.2%).

Results show that, although the majority of both genders said that the dams had no effect on household relationships, several socio-demographic variables did have an effect on people's perceived impact of the dams on household relationships, as well as on subjective wellbeing (how people's life has been over the past year) and people's feelings towards the dam (Table 4-8). When compared to the model baseline conditions (female, 18-30 years old, no education, poor, living in the village for < 5 years, having no feelings towards the dam and life being so-so over the past year), men were more likely to report that the dam had negatively affected their household relations. Middle-aged people (46–60) were more likely to say that the dams had positively affected their household relationships. Less poor people reported less of a negative impact on household relationships. People who had lived in the village for longer (5 years and more) were more negative than people who had lived in the village for a shorter time (< 5 years).

People who felt angry or sad about the dams were more likely to feel that household relationships had been negatively affected. People with no feelings towards the dams and

those who were happy about them tended to say that the dams had had no effect on their household relationships. People who said that their life had been good over the past year were more likely to say that the dams had a positive effect on household relationships.

Only the two villages located near the Kalagala Offset (where no development had occurred) reported that the dams had a more neutral or positive effect on their household relationships. All remaining villages were more likely to report that the dams had negatively affected their household relationships, with the most negative being the two villages adjacent to Bujagali dam.

Table 4-8: Results of a CLMM with a logit link function for how people feel the dam has affected their household relationships, with respect to predictor variables

Variable	Estimate	Std. Error	CI (2.5%)	CI (97.5%)	Significance
Gender – Male	-0.66	0.23	-1.11	-0.21	**
Age – 31-45	0.33	0.31	-0.27	0.93	
Age – 46-60	0.54	0.25	0.04	1.04	*
Age – 60+	-0.03	0.22	-0.45	0.39	
Education – Primary	0.18	0.34	-0.48	0.84	
Education – Secondary	0.31	0.40	-0.47	1.09	
Education – College / university	0.78	0.80	-0.79	2.34	
Economic status	2.60	1.00	0.64	4.57	**
Time lived in village – 5-9 years	-1.93	0.64	0.64	4.57	**

Variable	Estimate	Std. Error	CI (2.5%)	CI (97.5%)	Significance
Time lived in village – >10 years	-0.97	0.54	-3.19	-0.67	.
Time lived in village – not sure	1.05	2.78	-2.03	0.09	
Feelings towards dam – angry	-1.80	0.46	-4.40	6.51	***
Feelings towards dam – sad	-0.62	0.37	-2.71	-0.89	.
Feelings towards dam – happy	0.42	0.35	-1.35	0.10	
Life been over the past year – hard	0.38	0.29	-0.18	0.94	
Life been over the past year – good	1.14	0.40	0.35	1.94	**
Threshold coefficients					
0/1	-4.41	0.97			
1/2	-2.26	0.91			
2/3	7.31	1.05			
3/4	8.58	1.21			
Random effects (intercepts)					
Kalagala-West (Kalagala)	1.08				
Kalagala-East (Bubugo Bugobi)	0.66				

Variable	Estimate	Std. Error	CI (2.5%)	CI (97.5%)	Significance
Bujagali-West (Kikubamutwe)	-0.98				
Bujagali-East (Kyabirwa)	-1.35				
Isimba-West (Nampaanyi)	-0.63				
Isimba-East (Bwase-Buseta)	-0.87				

*Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1*

Baselines: female, 18-30 years old, no education, lived in the village for less than 5 years, no feelings towards the dam and life over the past year being so-so

Thresholds: 0 = Strong negative; 1 = Negative; 2 = No effect; 3 = Positive; 4 = Strong positive

Secondly, respondents were asked how the dams had affected relationships with their neighbours and village. Again, the majority of the people said that the dams had no impact on relationships with their neighbours (83%), whilst a few said it has had a strong negative (5%) or negative effect (10%). Only one person in Bujagali-East said that the dams had had a positive effect on relationships with their neighbours.

No significant difference was found in responses between socio-demographic groups (e.g. gender, age, education, primary livelihood and poverty); however, significant differences were found between villages (χ^2 = 28.61, df = 5, $p < 0.05$). As with the responses to household relationships, the majority of the people in the two Kalagala villages, where no development is occurring, said that the dams had no effect on their relationships with neighbours. Respondents in the remaining four villages (near the dams) were more likely to say that the dams had a negative effect on relationships with neighbours. The most

negative were respondents in villages adjacent to the Bujagali dam, followed by those in the two villages located near the Isimba dam. This is the same pattern observed when looking at the impact that the dams had on household relationships. People who said that their life had been hard or so-so over the past year were more likely to say that the dams had a strong negative impact on relationships with neighbours, whilst those whose life had been good were more likely to remain neutral (χ^2 = 6.98, df = 3, p < 0.05). No significant relationship existed between how people felt about the development of the dams and whether or not they felt the dams had impacted relationships with their neighbours.

The main reason why people felt relationships (both within the household and with neighbours) had improved as a result of the dams had to do with employment. People said that they are now able to treat themselves, for example, by buying meat and watching television. Furthermore, men admitted that they often become tough on their household when they are poor and have little income, often transferring their anger onto their wife. Unemployment, poverty, inability to provide the basic necessities, loss of income through loss of access to natural resources and increased theft in the village were several reasons given as to why the dams had negatively influenced relationships (both within the household and with neighbours) in the study area.

"My wife doesn't give me due respect because I can no longer fully provide for the home [because of the dams]".

(Male, aged 31-45, Isimba-East: Nampaanyi)

The most frequent reason given for why the dams had negatively affected household relationships had to do with conflict arising from sharing money received as compensation. For a full list of reasons, refer to Appendix A-12. People complained that the compensation was not shared equally between family members, family members vanished with the money, conflicts arose between families living on the same piece of land regarding who

should receive the compensation payment, and some family members who were not entitled to compensation created conflict by demanding a share. Wives said that their husbands vanished with the compensation money, spent it without consulting them or decided to marry additional wives. Another frequently mentioned reason was the fact that the rock blasting activities had led to illnesses (and in some cases death) in the family, miscarriages and men being unable to perform their conjugal duties.

"When we got compensated, my husband got money and ran away from home. He is now married somewhere else".

(Female, aged 46-60, Bujagali-West: Kikubamutwe)

"Sharing the compensation fund from land brought [household and family] conflicts of who should take the biggest share".

(Male, aged 31-45, Bujagali-East: Kyabirwa)

"My manhood was weakened by rock blasting, which [is] still going on".

(Male, aged 60+, Isimba-East: Nampaanyi)

In response to why people believe their relationships with neighbours had been negatively affected, the most frequent response was displacement of neighbours and the fact that their neighbours have moved away from the village in search of jobs elsewhere. This had led to a decline in the market for goods and agricultural produce. These were also given as reasons why people felt sad or angry about the dams and why they felt they had negatively affected their wellbeing. During the FGDs, respondents said that it was important to have good relationships with one's neighbours so that they can be called on for help during emergencies, neighbours tend to share items, help with functions and help looking after livestock and children. Other reasons included disagreements between community

members who did and did not receive compensation, migrant labour was the cause of broken marriages and damaged village relationships, and some village members had to pay bribes to local leaders in order to be employed at the dams. For a full list of reasons, refer to Appendix A-12.

"Most of our good neighbours migrated to other villages because their land was bought off and taken by the Dam".

(Male, aged 31-45, Isimba-West: Bwase Buseta)

"Many youths I used to fish with migrated to Itanda Falls where fish can easily be got".

(Male, aged 18-30, Bujagali-East: Kyabirwa)

"Our local council members demanded bribes from us to access employment at the Dam".

(Male, aged 31-45, Bujagali-West: Kikubamutwe)

4.4 Discussion

This chapter uses a mixed-methods approach, first, to understand local conceptualisations of wellbeing in a landscape where the construction of infrastructure projects varies between villages and, second, to explore what local people perceive to have been the impacts of hydropower dams on their wellbeing. This will help tease out the perceived impact on natural resources and how this also affects people's wellbeing. This is the first step in examining how the 'no worse off' principle can be operationalised in practice and provides insight into how development projects seeking NNL of biodiversity can minimise their impact on local people's wellbeing.

The ‘no worse off’ principle is defined as:

> *Project-affected people (appropriately aggregated) should perceive the component of their wellbeing associated with biodiversity losses and gains to be at least as good as a result of the development project and associated biodiversity offset, throughout the project lifecycle, than if the development had not been implemented (Chapter 3).*

The following sections discuss how the findings from this chapter can contribute to operationalising aspects of this principle.

4.4.1 Project-affected Persons’ wellbeing conceptualisations

Wellbeing is a social construct; thus, it is important that it is defined by the individuals and communities where wellbeing is evaluated (Woodhouse et al. 2015). Finding out which wellbeing dimensions and domains are prioritised across a landscape (as well as how they vary) is a useful means of understanding what people in the study area value most, and can serve as a baseline against which projects and interventions (e.g. NNL strategies) can assess their impact on local people’s wellbeing (Beauchamp et al. 2018b).

For this study, PAPs were people living in close proximity to the hydropower developments (Bujagali and Isimba dams) and whose source of income and standard of living has been affected (negatively or positively). Although the dams’ biodiversity offset activities have yet to be implemented, PAPs sampled in this study also included people living adjacent to the Kalagala Falls and Itanda Rapids, within the Kalagala Offset, who could be affected (positively or negatively) by any future offset activities (Chapter 2).

Whilst acknowledging the importance of context specificity, this study found that conceptualisations of wellbeing were consistent in the study area. Local people were found to prioritise the material domain of wellbeing; of the five wellbeing domains (material, health,

social relations, security and freedom of choice), the material domain was most frequently mentioned by respondents in all six villages, with food, employment and income and shelter being the three most culturally salient wellbeing components. Owing to the rural nature of the study area, high levels of poverty and poor living conditions, it is unsurprising that respondents considered material components to be vital for their everyday needs and wellbeing. Poverty is usually understood in terms of material deprivation (McGregor & Sumner 2010) and approximately 19.7% of the Ugandan population lives below the poverty line (UNDP 2014). The local people highlighted food and a balanced diet as being particularly important to their wellbeing, as well as supporting several other material wellbeing components. For example, having enough food provides people with energy to work and farm, cultivate their own food, earn an income (e.g. to buy protein), and provide their families with the basic necessities. Ugandans (particularly in rural areas) face problems of malnutrition and famine, with many households in the study area reporting that they often only have one meal a day. About 40% of deaths among Ugandan children are attributed to malnutrition, and micro-nutrient deficiencies and undernourishment are common in the wider population, mostly owing to inadequate food intake (The Uganda Food and Nutrition Policy 2003).

This links strongly with the health domain, which was also found to be central to people's wellbeing in the study area. Feeling healthy and strong was the most culturally salient wellbeing component in this domain, followed by access to healthcare services. The social relations and security domains were mentioned less often. They are strongly linked, in that respondents said that it was most important to live in peace, be worry free and to be able to support and look after one's family. This demonstrates how important the family unit is in the study area and indicates that wellbeing is a function of household-level factors as opposed to the wider community.

These results correspond with similar studies that explore components of wellbeing required for a good life. Beauchamp et al. (2018b) found that the most culturally salient wellbeing components in a rural area in Cambodia fell within the material domain, namely land and food, followed by the health domain, namely healthcare services. Abunge et al. (2013) found that the most important wellbeing components in a small-scale coastal fishery in Kenya were health, a job, money and a good house. The 'Voices of the Poor' (VoP) seminal research by Naraya et al. (2000) found that the ideas of wellbeing were strikingly similar across the range of participants in their study (over 60 000 poor men and women, across 60 countries) and that "the same dimensions and aspects of wellbeing are repeatedly expressed across continents, countries and cultures".

However, both my study and that by Beauchamp et al. (2018b) found that people's conceptualisations of wellbeing did not include any components related to the freedom of choice domain. In a Ugandan context, this may reflect the importance of traditional cultural 'norms' in society, where women are usually subordinate to men. Although not brought up in the individual questionnaire (and hence not coded), FGDs often brought up female emancipation in their village, with women now being more aware of their rights and that they are entitled to take part in decision-making, particularly at the household level. Conversely, results from Abunge et al. (2013) demonstrated the importance and high priorities that people place on freedom and self-determination in fisheries in Kenya. One methodological limitation of asking purely open-ended questions (e.g. what does it mean to live a good life?) is that some wellbeing components might not be mentioned during the FGD (Abunge et al. 2013). This is not an indication of their lack of importance but may simply be owing to a lack of thought from the participants or lack of time to mention them. Hence it is important not to over-interpret absent wellbeing domains (Abunge et al. 2013).

In relation to the 'no worse off' definition, therefore, the results suggest that the material and health wellbeing domains and, in particular, the ability to produce enough food for one's

family, would be particularly important to consider when thinking about how a development project (the dams, in this case) might affect people's wellbeing in this area.

4.4.2 Appropriately aggregated Project-affected Persons

When evaluating the impacts of a development project and the associated biodiversity NNL strategies on wellbeing, a decision is needed on the appropriate scale to measure the impacts. The components of wellbeing and their relative importance will change depending on whose wellbeing is being assessed (individuals, households, communities, national and global stakeholders; Daw et al. 2011; Agarwala et al. 2014). Thus, when designing and implementing interventions, it is important to understand what differences in wellbeing exist between groups of people, for example, by geographical area, socio-economic status, gender, ethnicity or time (Daw et al. 2011; Coulthard et al. 2018).

Aggregating people across large scales to measure their wellbeing can obscure variations between individuals (or groups of individuals), including who the winners and losers are from exchanges in biodiversity and nature (Daw et al. 2011; Agarwala et al. 2014; Dawson & Martin 2015). This may lead to environmental injustice issues and result in misleading generalisations being made about the impacts experienced (Daw et al. 2011; Agarwala et al. 2014; Dawson & Martin 2015; Chapter 3). For example, different individuals may value aspects of the environment differently based on how it contributes to their wellbeing (i.e. collecting fuelwood may be important for one person’s income but might be important for another person’s survival; Dawson & Martin 2015). This could lead to marginalised and more disadvantaged groups, whose status differs considerably from the average, being overlooked (Dawson & Martin 2015). Social disaggregation will therefore reveal the plurality of different values attached to nature and the environment (Coulthard et al. 2018). Thus, the scale at which wellbeing impacts associated with losses and gains in biodiversity are measured (e.g. individual, household, interest group, village or region) will influence whether local communities are found to be ‘no worse off’ as a result of the combined

development and offset activities (Chapter 3). When it comes to compensating individuals for impacts arising from project-level NNL strategies, there is also no 'one size fits all' solution; what one village (or one individual) may consider as a 'benefit' to their wellbeing may not be the same as another village (or individual; see Chapter 6).

Previous studies have found the importance of wellbeing components to differ between groups of people, particularly socio-demographic groups. For example, a study of Masaai pastoralists in northern Tanzania found conceptualisations of wellbeing to differ between genders and age groups (Woodhouse & McCabe 2018). Both this study and mine found that women tended to focus more on the relational aspects of their lives than men when discussing wellbeing. This could be because women in the study area tend to be more actively involved in the community (e.g. forming women's saving groups). Britton and Coulthard (2013) also found that women rated community relationships higher than men in Northern Ireland fishing communities. Disaggregation into increasingly smaller sub-groups enables a better, more accurate, understanding of how biodiversity NNL activities affect different groups of people's wellbeing, particularly marginalised and vulnerable groups. Measuring impacts on wellbeing at the household or individual level, with no aggregation, could overcome many challenges that face aggregated analyses, but is not always practically feasible, especially within a development context, given time and budgetary constraints. Therefore, when selecting an aggregation unit, it is essential to understand the dynamics of the social systems and ensure that the choice of aggregation groups aims to deliver equitable outcomes. Furthermore, the choice of aggregation unit must be justified and communicated transparently. Daw et al. (2011) suggest that the greater the inequality in the system, and hence the more issues there are about unequal distribution of costs and benefits, the greater the need to disaggregate people when measuring impacts on wellbeing associated biodiversity NNL activities.

Heterogeneity in wellbeing conceptualisations and prioritisations was observed in the study area, particularly across geographies and locations experiencing different degrees of economic development. This has significant implications for landscape level conservation and development plans (Woodhouse & McCabe 2018). The importance of components in the health and social relations domain decreased downstream, further away from the town of Jinja. Villages become more rural and isolated the further downstream one travels, with fewer NGOs operating in these villages and services being more limited. In addition, the villages furthest downstream (at Isimba) were the poorest of the six villages, having the lowest average household poverty scores (based on the BNS scores). Thus, people in these villages may be more concerned with the material components required to live a good life. Geographical variations in wellbeing conceptualisations have been found in other studies (e.g. Beauchamp et al. 2018; Woodhouse and McCabe 2018). This indicates that it may not be appropriate to measure the impacts of biodiversity NNL on wellbeing at a landscape level (aggregating by villages), thereby generalising the results across the region. Instead, the six villages in this study fell into three groups, categorised by their remoteness from the urban centre.

This suggests that when aggregating PAPs to consider the wellbeing impact of the dam development, it would be important to use an area's accessibility and presence of facilities to structure ‘no worse off’ assessments. Other than that, there seems to be relative consistency across the study landscape in what matters to people's perceived wellbeing, with minor gender, age and village-level variations.

4.4.3 Perceived impacts of hydropower projects on Project-affected Persons’ wellbeing

When exploring perceptions about the impacts of the dams on wellbeing, heterogeneity was observed between socio-demographic groups. One of the reasons men were more

likely to report that the dams had a negative effect on their wellbeing could be because their livelihood activities (particularly fishing) were more negatively affected than women's. Ugandan fisheries are dominated by men and it is considered a 'taboo' for women to enter the waters as this jeopardises the chances of a successful catch (Nunan 2006). Men in the study area reported a loss in livelihoods and reduced income, which they said was because the dams restricted their access to the river for fishing, and also caused fluctuating water levels which reduced the amount of fish in the river.

People's perceptions about how the dams have affected their wellbeing varied geographically, with the proximity of the dams to a village having a significant effect. The impact of interventions, including development, is highly context dependent and may vary over the life of the project. For example, the construction of infrastructure or start of an intervention may immediately affect people's wellbeing but, in the longer term, benefits to wellbeing may accrue (Pullin et al. 2013). Furthermore, wellbeing conceptualisations have temporal fluidity, constantly changing according to people's changing aspirations, adaptations and social interactions (Milner-Gulland et al. 2014). It is therefore difficult to compare quality of life before and after development because what matters to people in their assessment of their wellbeing is likely to have changed over time and to have been changed by the intervention itself (Milner-Gulland et al. 2014). At the time of this study, Isimba dam construction was nearing completion, whereas construction of the Bujagali dam was completed in 2012, so there have been five years for the Bujagali dam's benefits to accrue. People at Isimba may be experiencing and anticipating negative effects from the construction phase and, consequently, feel the dam is negatively affecting their wellbeing. In contrast, people living near Bujagali dam might have had time to adapt to the presence of the dam, with it becoming a 'normality' in their lives, and also time to experience the dam's benefits.

The impacts that people described in this study demonstrate how development impacts on different components of wellbeing are intricately linked; change in one wellbeing component (e.g. from development or a biodiversity NNL strategy) can affect other wellbeing components. For example, people perceive vegetation clearance and deforestation from dam construction as reducing rainfall and extending the dry season, which in turn they perceive as negatively affecting their crop harvest and yields, thereby negatively affecting food supply, income and health. Similarly, a study by Bidaud et al. (2017) found that a mine development and associated biodiversity offset in Madagascar had intertwined positive and negative effects on all five dimensions of local people's wellbeing. In particular, they found that development and offset activities were considered to have a negative impact on good social relations owing to conflicts arising from the distribution of training activities and donations, but positive benefits on the material dimension through creating conservation restrictions, as people perceived this as having a positive impact on the forest and hence the amount of water available for agriculture.

Investigating these perceived impacts on wellbeing (using questions that target the different wellbeing dimensions), and identifying which components are important to people's wellbeing and why they are prioritised, will allow for a deeper understanding of what effect development and project-level biodiversity NNL strategies could have on people's lives, than general ESIA methods. Detailed discussions in the case study area helped uncover some perceived impacts from development that might not have been considered in traditional impact assessments such as ESIAs. For example, people's perception that rock blasting had greatly affected their lives was apparent, based on the number of times it was mentioned. One of the more obvious reasons was that people perceived rock blasting to have caused cracks in their houses. However, discussions revealed more troubling reasons behind the negative impacts of rock blasting that might not have been considered without consultations. People in the study area perceived rock blasting to be the cause of miscarriages in both women and livestock, as well as health problems (e.g. high blood

pressure, heart attacks and deafness) and even deaths amongst people and livestock. Therefore, local beliefs about how a development project affects people need to be taken into account when designing compensation schemes and management measures in an attempt to compensate (or better, dispel or remediate) negative perceptions and attitudes towards a development project.

As no biodiversity offset activities were being undertaken (or had been) at the time of my study, I was unable to explore people's perceived impacts on their wellbeing as a result of gains and losses in biodiversity associated with the biodiversity offset. However, respondents raised concerns about the negative impacts arising from other activities to preserve the biodiversity of the area, independent of the offset. These impacts will be similar to those associated with the offset activities when they are eventually implemented. All rivers in Uganda have a 100m protection zone (from the highest watermark of the river) and no activity is allowed to take place in this zone (The National Environment (Wetlands; River Banks and Lake Shores Management) Regulations No. 3/2000. 2000). Despite this, members of the local communities are farming in the riparian zones along the rivers. In my study, many respondents complained about losing access to these zones and that their farming lands were being cleared by the NEMA in an attempt to restore the riparian biodiversity in the protection zone. In addition, people often farm in the fertile soils of the Central Forest Reserves (CFRs). As future biodiversity offset activities include restoring and rehabilitating the degraded CFRs, access for local people will be restricted and no farming activities will be allowed. Therefore, it is important to understand people's preferences for offset activities in advance, in order to work with them to produce outcomes that are beneficial to both people and biodiversity (see Chapter 6).

4.4.4 Implications for biodiversity NNL strategies and the 'no worse off' principle

These results reveal which wellbeing components are of particular value and prioritised by people in a rural landscape where different areas are experiencing different effects from an infrastructure project. They further indicate what people perceive to be the most important impacts (both positive and negative) on their wellbeing as a result of hydropower development, either eroding or enhancing their support for the project. Many of the perceived positive and negative impacts were similar across the two development sites (Bujagali and Isimba) and will not be unique to these projects. They will, however, be specific to low-income countries, such as Uganda, with high levels of poverty and where a large proportion of the population relies on natural resources for their livelihoods.

The study also demonstrates the importance of measuring impacts on the relational and subjective dimensions of wellbeing, alongside impacts on the more quantifiable and immediately apparent material dimensions, when evaluating the impacts of development projects and biodiversity NNL strategies on local people. The 'business as usual' approach to development tends to focus more on the material, objective dimension, either underplaying or ignoring the other two wellbeing dimensions (McGregor & Sumner 2010). Applying a wellbeing framework that also uses a subjective and relational line of inquiry, will highlight aspects of people's lives that may not be captured by economic, objective approaches, but might still be equally important (Coulthard et al. 2011). Impacts perceived by local people, and the ones that they perceive as having the biggest effect on their lives, may not be the same as those described and evaluated by practitioners when conducting SIAs and ESIAs. As a result, people's beliefs regarding significant negative social impacts (e.g. from rock blasting) may be overlooked during the impact assessment process, and, consequently, compensation measures for them may not be considered. It is important to "put local people at the centre of the evaluation" by using participatory approaches that ask

them to: a) define wellbeing, thereby allowing for a locally grounded conception of what wellbeing is; and b) define the impacts of a particular project, as locally perceived impacts will represent people's perspectives of their own circumstances, which may predict their support (or lack of support) for the project (Woodhouse et al. 2015; Rasolofoson et al. 2018).

Participatory approaches used to measure subjective wellbeing must be viewed as complementary to quantitative impact evaluation approaches that use objective wellbeing measures (Rasolofoson et al. 2018). But understanding local perceptions may prove more valuable than studies evaluating quantitative impacts, as this will provide insight into what activities people are more likely to support, thereby increasing the legitimacy and acceptability of projects (Rasolofoson et al. 2018). Nevertheless, like all methodological approaches, it has been acknowledged that subjective wellbeing evaluations are challenging (Agarwala et al. 2014; Rasolofoson et al. 2018). Not only can they be time consuming, but subjective measures and perceptions of impacts can also be influenced by people's mood, cultural norms and timing (Rasolofoson et al. 2018).

In conclusion, evaluating a development project and NNL strategy's impact on biodiversity and the associated repercussions for the three human wellbeing dimensions (material, subjective and relational) is important, as it provides a more rounded and nuanced understanding of the local context in which an intervention takes place (Palmer-Fry et al. 2017). Furthermore, it can help enhance the visibility of cultural values and provide a better understanding of their spatial and temporal dynamics. This knowledge is particularly important since the success of interventions (including NNL strategies) is dependent on understanding the priorities and incentives of local people (Beauchamp et al. 2018b). Therefore, in order to have a more holistic understanding of people's relationship with nature, and to capture all nature-based values that might be affected by NNL strategies, qualitative techniques, in conjunction with economic assessments, are needed.

Understanding people's wellbeing priorities, and how they vary geographically and between socio-demographic groups, will help in identifying a wide range of positive and negative impacts, including some of the subtler impacts, that local people experience from NNL strategies. This will help developers and practitioners design and implement more equitable, sustainable and effective project-level biodiversity NNL strategies.

Chapter 5

Incorporating people's nature-based cultural values into biodiversity NNL strategies for a development project



Sacred cave

5.1 Introduction

Culture encompasses a range of use and non-use values, some of which have little to do with nature (e.g. those associated with historic buildings), whilst others (e.g. associated with natural areas and use of wild products) are inextricably linked to it (Daniel et al. 2012). Human societies have been interacting with their environments for thousands of generations, resulting in human cultures shaping, and being shaped by, nature (Pretty 2011; Millennium Ecosystem Assessment 2005). Thus, conservation and development activities need to depart from the traditional human-nature dichotomy notion and incorporate a worldview that is commonly held by indigenous people and traditional rural societies; that human communities are part of nature, and cannot be meaningfully separated from it, and have a role in contributing positively to its flourishing (Comberti et al. 2015). This inherent, mutualistic, relationship between nature and culture has led people to protect (or degrade) culturally important species, habitats and landscapes (Dudley et al. 2009; Anthwal et al. 2010; Smith & Andindilile 2017; Holmes et al. 2018), has shaped individual and collective cultural identities (Stephenson 2008), and influenced knowledge, belief systems and traditional practices (Pretty 2009). Heritage values, cultural identity, knowledge systems, religions, social interactions and other amenity services (e.g. aesthetic enjoyment, recreation, artistic and spiritual fulfilment, and intellectual development) all contribute to an individual's quality of life and general wellbeing (Millennium Ecosystem Assessment; Russel et al. 2013; Schneider 2018).

People's attempts to protect nature have a long history, with community conserved areas, manifesting in the form of sacred natural sites, being one of the oldest forms of habitat protection (Dudley et al. 2009; Pretty et al. 2009; Anthwal et al. 2010). Sacred natural sites range from forests, trees, caves, lakes, rivers, waterfalls, and mountains to entire landscapes – and surveys suggest that in some countries, sacred natural sites outnumber

protected areas (Dudley et al. 2009; Smith & Andindilile 2017). Many mainstream faiths and local belief systems worldwide have long believed that nature is instilled with sacred value, owing to the residence of a local deity, spirit or ancestral spirit (Rutte 2011; Baker et al. 2018). Moreover, some floral and faunal species are considered sacred because of their connection to religious beliefs, taboos, folklore and myths (Baker et al. 2018). For example, Ethiopian hyaenas are tolerated because it is believed that they eat evil spirits (Holmes et al. 2018).

These cultural beliefs are valuable for conservation, as they have led local communities and indigenous people to protect sacred landscapes, habitats and species (Dudley et al. 2009; Anthwal et al. 2010; Smith & Andindilile 2017). Studies have found that some sacred forests have a higher species diversity than surrounding areas, and also preserve a high diversity of medicinally important plant species (Mgumia & Oba 2003; Ormsby & Bhagwat 2010). However, cultural beliefs can also impede conservation efforts. For example, the Zebu killing snake (*fandrefiala; Ithycyphus perineti*) in Madagascar is persecuted because people believe it can transform into a sharp, spear-like form, drop from trees and harm people and livestock (Holmes et al. 2018). There are several other cases where animals are killed for social and cultural reasons (e.g. skins used in traditional ceremonies; Dickman et al. 2015). Thus, it is necessary to recognise the ways in which different cultures interact with nature, as this leads them to forge different relationships with their local environment, and will aid the development of effective strategies to conserve nature (Pretty et al. 2009).

Many sacred sites and species the world over have been lost or are threatened owing to changes in traditional values, cultural practices and leadership (Ormsby & Bhagwat 2010; Rutte 2011). More formal education has led to a decline in respect for elders and traditional healers, younger generations are losing interest in the sacred site traditions, traditional cultures are being replaced by mainstream religion, and urbanisation is leading to a loss of some of these traditional beliefs and practices (Metcalfe et al. 2010; Ormsby & Bhagwat

2010). This, coupled with the rising demand for agricultural land, tourism and economic development, places significant pressure on these sacred sites, often leading to their destruction or disappearance, with potentially negative consequences for at least those groups of local people who use them (Metcalfe et al. 2010; Rutte 2011).

There are standards, guidelines and legislation in place to shape the assessment of development impacts on the cultural heritage of Project-affected Persons (PAPs). One such example is the International Finance Corporation (IFC) Performance Standard 8: Cultural Heritage, which recognises the importance of cultural heritage for current and future generations and aims to protect cultural heritage from the adverse impacts of development projects (IFC 2012). The Standard emphasises the use of the mitigation hierarchy, with avoidance of cultural impacts being prioritised as far as possible (IFC 2012c). Cultural heritage impact assessments are undertaken as part of the Environmental and Social Impact Assessment (ESIA), or as a sub-component of the Social Impact Assessment (SIA) process, in order to understand how a new development project could potentially affect local people's culture and way of life (including indigenous people; Partal & Dunphy 2016). In addition, several international frameworks exist to inform management of the world's cultural heritage (Tengberg et al. 2012). Examples include the United Nations Education, Scientific and Cultural Organisation (UNESCO) Convention Concerning the Protection of the World Cultural and Natural Heritage from 1972, the UNESCO Convention for Safeguarding of the Intangible Cultural Heritage (ICH 2003) and the UNESCO Convention on the Protection and Promotion of the Diversity of Cultural Expressions (2005). Moreover, the Convention on Biological Diversity (CBD) also requires signatory states "to protect and encourage the customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation or sustainable use" (CBD 1992). At the national level, one of the objectives of the Uganda National Cultural Policy is to conserve, protect and promote the country's cultural heritage (UNCP 2006). Uganda has ratified the Convention for the Safeguarding of the Intangible Cultural Heritage, meaning that the

government is duty-bound to respect and protect the intangible heritage of all communities, groups and individuals. It is also required to raise local, national and international knowledge of the importance of the country's heritage.

Recently, there has been a shift in thinking surrounding NNL policies and biodiversity offsets, with the need to account for social aspects increasingly being recognised (Maron et al. 2016; Bidaud et al. 2017). The Business and Biodiversity Offsets Programme (BBOP), specifies the need to give explicit treatment to social and cultural values of biodiversity during the offsetting process, but also acknowledges that, owing to high irreplaceability of certain biodiversity components, it may not be possible to achieve NNL with respect to areas of high cultural or spiritual significance (BBOP 2012c). Whether biodiversity offsetting captures all of the values that people assign to biodiversity (e.g. intrinsic, use and non-use) is questioned (Apostolopoulou & Adams 2015; Moreno-Mateos et al. 2015; Table 3-1; Chapter 3). BBOP's guidance states that, during the design of NNL strategies, explicit attention needs to be paid to the socio-economic and cultural values attributed to biodiversity and nature, thereby ensuring that the needs of local people are adequately considered (BBOP 2012c). However, there is a lack of empirical research on incorporating people's non-use cultural values associated with nature into project-level NNL strategies such as biodiversity offsetting, respecting the inherent complexity and place-based value of cultural heritage.

Understanding cultural beliefs, appreciating different worldviews, and recognising the ways in which different cultures interact with and value nature, is essential if conservation initiatives are to be successful (Infield & Mugisha 2013). Apart from an ethical standpoint, focusing on people's nature-based cultural values can help justify and motivate conservation initiatives (including NNL strategies) that are not only meaningful to different groups of people but also align with communities' own conservation priorities, respecting the rights of local and indigenous communities (Infield 2001; Infield et al. 2018). This is a

powerful means of building community support for conservation whilst also creating partnerships between conservation agencies and local communities (Infield 2001; Infield et al. 2018). Considering nature-based cultural values can therefore enhance the equity, efficacy and social acceptability of conservation efforts (Ormsby & Bhagwat 2010), including NNL strategies such as biodiversity offsets.

In this chapter, I explore the challenges of incorporating people's nature-based cultural values into biodiversity NNL strategies for individual development projects, using the Bujagali and Isimba Hydropower Projects and Kalagala Offset as a case study. I investigate whether, and how, NNL of biodiversity can be achieved whilst ensuring that local people are 'no worse off' in terms of their perceived wellbeing, particularly with regards to their nature-based cultural values. My objectives are to: a) assess people's value orientations and attitudes towards nature-based cultural heritage; b) explore people's perceptions concerning how important cultural heritage in general is to their wellbeing; c) investigate people's perceptions concerning the specific aspects of cultural heritage which are important to people in the study area; d) evaluate the case study's development impacts on cultural heritage as perceived by local people; and e) explore ways that these impacts on nature-based cultural heritage can be managed and incorporated into project-level NNL strategies, thereby operationalising the 'no worse off' principle (Chapter 3).

5.2 Background

5.2.1 Ethnicity and cultural heritage in the study area

The majority of the people in the study area are Ugandan, with a few immigrants from Tanzania, Kenya, South Sudan and the Democratic Republic of Congo (DRC). There are many diverse ethnicities in Uganda, a number of which occur in the study area, such as *Alur, Banyole, Basamia, Jopadhola, Batoro* and *Mugwere*. The western side of the Victoria

Nile River falls within the *Buganda* Kingdom whilst the eastern side of the river falls within the *Busoga* Kingdom. The dominant ethnicities / tribes in the villages sampled were *Basoga* (46% of the population), *Baganda* (9%) and *Bagisu* (11%). Despite the Kingdoms, there was a strong presence of the *Bagisu* tribe in Kalagala-West (approximately 48% of the sampled population).

The most popular religions in the villages sampled were Muslim (31%), Protestant (30%) and Catholic (27%). There were a few people who belonged to other religions such as Pentecostal, Isa Masiah and Seventh Day Adventist, or opting to follow a traditional religion. Traditional religious beliefs remain important in the study area, particularly the belief that spirits control all aspects of their lives. These traditional beliefs are practiced through diviners, caretakers, interpreters, traditional doctors and herbalists, who interact with the spirits (R.J. Burnside International Limited 2006). Spiritual practices occur at the individual / household level and at the community level. At the individual / household level, the spirits of family ancestors are often honoured at shrines, and these can be moved if the household moves (R.J. Burnside International Limited 2006). At the community level, these practices are associated with an ecological feature (e.g. river rapids and waterfalls, trees and stones), each of which has a resident spirit that is worshipped by the community (R.J. Burnside International Limited 2006).

I found that a number of these sacred sites occur throughout the study area, with several found within or adjacent to the Victoria Nile River (e.g. waterfalls, stones, caves, shrines and trees). Waterfalls and rapids house spirits (e.g. the Itanda rapids and Bubugo waterfalls at Kalagala-East and Kalagala waterfall at Kalagala-West) that are worshipped by some members of the local communities, who visit them to ask for wealth, a good marriage, twins, a good harvest and rainfall, amongst other things. People bathe in the water near the waterfalls and rapids, as they believe this action washes away bad luck; and mix the water with medicinal herbs to treat illnesses. There are also shrines, sacred trees (e.g. a *Ficus*

tree with a spirit called '*Nakibinge*' at Kalagala-West), stones (e.g. '*Nalongo*' or 'mother of twins' at Kalagala-West and the Kiyunga site at Isimba-East), caves (e.g. one that houses the spirit '*Musoke*' at Kalagala-West) and springs / swamps that never dry up along the riverbanks (e.g. *Kitaapo* spiritual site at Kalagala-East) that are worshipped. People take offerings (whatever they could afford at the time) to the spirits in the form of coffee beans, eggs and money, and often make animal sacrifices (most common are chickens and goats). *Ficus* trees are used to create bark cloth (an ancient craft in southern Uganda), which is used to decorate shrines and sacred places as well as for other traditional purposes such as covering instruments, traditional dress and various household uses.

5.2.2 Compensation for flooding of sacred sites at Bujagali and Isimba

The construction of the Bujagali and Isimba dams led to the inundation of sacred sites, affecting villages on both the east and west banks of the Victoria Nile River. Impacts on 'cultural property' (sites having archaeological, paleontological, historical, religious and unique natural values) were evaluated by specialised local consultants as part of the Bujagali dam ESIA (R.J. Burnside International Limited 2006) and Isimba dam SIA (Ministry of Energy and Mineral Development 2013). A detailed Cultural Property Management Plan was compiled for the Bujagali dam in 2001, and updated in 2010. A Cultural Resources Management Plan was compiled for the Isimba dam SIA.

In the Bujagali dam ESIA, impacts on cultural property were first evaluated at the individual level, relating primarily to family graves and small family shrines. According to the ESIA, PAPs did not object to moving the graves or shrines as it is a common occurrence when PAPs move in or out of an area. Households were offered compensation in accordance with Ugandan law and the developers paid for the transfer ceremonies. The ESIA then evaluated impacts on cultural property at the community level (most notably the Bujagali

Falls). Extensive consultations and focus group discussions were carried out with different stakeholders, including the owners of the sacred sites, the communities where the sites occurred, mediums who specialise in interceding between humans and spirits, and Ugandan and international cultural property specialists. Consultations and surveys helped to understand the spiritual importance within the Bujagali area, map out the affected sacred sites and ensure that the compensation measures emanated directly from the PAPs themselves and were agreed upon by the spiritual leaders. Village committees were set up to oversee the cultural mitigation programme, to determine the number of sacred sites to be relocated, the ceremonies to be performed (including who should conduct them, when they should be carried out, what physical items were required during the ceremonies, and their cost). Consultations and negotiations were also carried out with three groups of custodians of the Bujagali Falls spirits: i) *Nabamba Bujagali*; ii) *Ntembe Waguma* and *Lubaale Nfuudu*, who are the caretakers on the East Bank; and iii) *Nalongo Nakisita* who is the medium for the same spirit on the West bank. During the consultations, they were each asked to design a plan detailing the ceremonies and requirements needed for the appeasement and relocation of the spirits at Bujagali. However, the three groups never agreed on the process, so three individual transfer rituals were carried out on separate days. This was followed by settlement rituals for each spirit at the new sacred site. The costs of the relocation and appeasement ceremonies were paid by the developer. Ceremonies were carried out in September 2001 and all three groups signed documentation acknowledging that the compensation had been adequate and that construction of the dam could proceed. Neither the ESIA nor the Cultural Property Management Plan provided details about where the spirits were eventually relocated. According to respondents in my study, the Bujagali spirits were relocated to a new sacred site at a village called Namezi. However, some respondents said that the spirits were not happy at this new site and *Nabamba Bujagali* now keeps them in shrines at his house in Bujagali-East.

Cultural property to be impacted by the Isimba dam was identified as part of the SIA. According to the SIA, PAPs were amenable to relocation of the spirits but only after rituals and ceremonies were performed. However, as documented in the SIA, PAPs stated that the spirits were associated with the river and could not be relocated further inland away from the riverbank. The relocation of sacred sites was a specified requirement in the SIA and, according to the SIA mitigation measures, "the project will provide equitable compensation to all affected owners, to relocate their cultural assets". However, according to respondents in my study, the sacred sites have been destroyed by the dam construction yet no relocation ceremonies were performed.

5.3 Methods

5.3.1 Data collection

Eleven Key Informant Interviews (KIIs) were undertaken with representatives from the Ugandan Government's Ministry of Water and Environment and from leading non-governmental organisations (NGOs) in Uganda: Nature Uganda, the Jane Goodall Institute and the Wildlife Conservation Society, Uganda; with District Environmental Officers from the four Districts that the case study falls into; two Uganda cultural heritage consultants; and geography and social science professors at Uganda's Makerere University (see Appendix B-1 for the interview protocol). All of these individuals were chosen because of their extensive experience working in conservation and environmental management, as well as with local communities, particularly in Uganda's rural areas. The KIIs helped me to gain a broad understanding of what cultural heritage consists of in Uganda, why it may be important to people in rural settings and how best to approach the subject during Focus Group Discussions (FGDs). This last question was particularly important as, during my

scoping trip, I found that cultural heritage was a sensitive topic in the study area and several people (particularly women) were not willing to discuss it with me.

At the case study sites, six villages were sampled, all experiencing different levels of hydropower development, i.e. two villages at Bujagali, where construction is complete, two at Kalagala, where no construction activities are taking place, and two at Isimba, where construction is underway (described in Chapter 2; Figure 2-4 and Figure 4-2 in Chapter 4). Four cultural heritage FGDs were undertaken in each village (separate to those described in Chapter 4), with participants aggregated according to their gender and livelihood strategy: a) women relying on natural resources for their main livelihoods (such as farming and fishing); b) men relying on natural resources for their livelihoods; c) all other women in the village (including those that are retired, studying, unemployed, shopkeepers, businesswomen, labourers etc.); and d) all other men in the village. The aim of the FGDs was to learn about people's perceptions of cultural heritage and traditions in the study area, the role that nature plays in culture and traditions, what sacred sites and spirits reside in the area, local people's perceptions on whether (and how) the hydropower developments have affected cultural heritage, and how (and whether) lost cultural heritage can be compensated for according to local people (see Appendix B-2 for the FGD protocol). Many of the FGDs digressed and included lively discussions and comparisons with my own culture, with much laughter ensuing. For example, one women's focus group wanted to learn about myths and sayings in my British and South African cultures and another wanted to know if these cultures had traditional dances. I found that this informal, friendly approach to the FGDs, combined with my openness and willingness to discuss my own culture, made participants feel more at ease, and hence, I found them more forthcoming about their own culture and traditions.

The same individual questionnaire was undertaken in all six villages; refer to Chapter 4 for a description on how the questionnaire was administered, how participants were selected

and sample sizes for each village. Ethical considerations were carefully considered throughout (also see Chapter 4 for details). The questionnaire comprised a structured interview, collecting pertinent socio-demographic data (including gender, education level and age) and information on household poverty / economic status (measured using a Basic Necessities Survey (BNS); Davies 2016). This was followed by questions related to wellbeing (see Chapter 4), as well as questions to explore the perceived importance of cultural heritage to the respondent's wellbeing and how they felt the construction of the hydropower dams had affected cultural heritage in the area. The questionnaire was first piloted in a separate village, Buloba Central (n = 74; described in Chapter 4).

I spent about eight months in total in the study villages, observing the day to day activities in the villages, and having informal discussions with members of the communities, sometimes relating to my work, and other times about different topics (e.g. sport, myself, climate change and life in the U.K.). I found this helped me build good relationships in the community. My research assistants and I were invited to visit several sacred sites in the study area, accompanied by a spiritual or village leader who explained their significance. I found these visits vital to my understanding of sacred sites. We also had the privilege of visiting the main spiritual leader in the Busoga Kingdom, '*Bujagali'*, and observed several traditional ceremonies (e.g. the *Bagisu* circumcision ceremonies). These informal discussions and observations served to triangulate the findings and interpretations from the FGDs and individual questionnaires.

5.3.2 Kellert Typology: measuring attitudes towards nature-based cultural heritage

Various authors have developed typologies or classification systems to explore human attitudes towards nature and the different ways in which they value it (Jones et al. 2016b). Examples include exploring human attitudes towards landscapes (Stephenson 2008; Jones

et al. 2016b), wetlands and rivers (Seymour et al. 2011), forests (Manning et al. 1999) and wildlife and nature (Trainor 2006). The best known and most widely used is Kellert's attitude typology, which systematically addresses people's relational values with nature, and is founded on decades of long-term empirical research (Kellert & Wilson 1995; Ross et al. 2018). Kellert's typology builds on the biophilia hypothesis, which suggests that there is a human dependence on nature that extends far beyond material and physical benefits, to encompass human desire for aesthetic, intellectual, cognitive and even spiritual meaning and satisfaction (Kellert & Wilson 1995). Kellert's typology defines nine valuations of nature or "nine basic ways people attach meaning to and derive benefits from nature" as follows: utilitarian, naturalistic, ecologistic-scientific, humanistic, aesthetic, symbolic, moralistic, dominionistic and negativistic (Kellert & Wilson 1995). Each valuation or category of the typology presents a basic human relationship and dependence on nature which provides some measure of an individual's ability to survive, thrive and attain individual fulfilment (Kellert & Wilson 1995). The set of nine relational values reflect the range of emotional, intellectual and physical connections with nature, principally individual (Ross et al. 2018).

The Kellert typology has proven useful in understanding and managing conflicts between people and wildlife. For example, it has been used to measure attitudes amongst sheep farmers towards predators in Norway (e.g. Vkters⊘ et al. 1999) and attitudes towards bear conservation in North America (Kellert 1994). The typology also helps understand what values people assign to animals and ecosystems. For example, is an assigned value towards a particular species associated with a moralistic or perhaps an ecologistic-scientific held value, and is this the reasoning behind the protection of the species (Jones et al. 2016b)? More recently, Herrmann et al. (2013) used the Kellert typology, in conjunction with local story-telling and folktales, to understand cultural relationships and spiritual beliefs between humans and two negatively perceived carnivores, the kodkod and puma, in Chile. The aim was to identify barriers to conservation and aid the development of locally suited felid conservation practices. They found that the resulting stories could be grouped

according to the Kellert type that best described it, giving insights into the positive, negative and absent associations with the felids.

This chapter expands on the Kellert typology, and uses it in a new setting to identify people's attitudes towards nature-based cultural heritage. This typology is useful as it includes values that lead to both positive and negative attitudes (dominionistic and negativistic) towards cultural heritage (Herrmann et al. 2013). Respondents' attitudes towards cultural heritage were measured using a Likert-type response to 24 statements corresponding to the nine types of value for nature (see Appendix B-3 for the statements). All statements centred around cultural heritage associated with nature. Positive and negative framings of the typology statements were used to minimise response bias, and statement order was randomised. The respondent was asked to select the response to the statement they agreed with; these responses ranged from strong agreement, agreement, neutral, disagreement or strong disagreement. There was also an option of 'do not know / would rather not say'.

5.3.3 Data analysis

Kellert typology

Responses to the Kellert typology statements were coded as per the coding protocol in Appendix B-4. Any negatively framed statements were reverse coded. Respondents who selected the option 'don't know / would rather not say' to any of the statements (n = 434/1305) were excluded from the analysis as these responses would not fall into a typology. More than half of these respondents only selected the option 'don't know / would rather not say' to one statement (276/434). The overall sample size was therefore 871 individuals, 475 women and 396 men. The distribution of responses was plotted and examined for each of the 24 statements to check whether respondents understood the statement and to see if there were any unusual or highly contradictory responses that

needed to be further explored. Cronbachs alpha (Cronbach 1951), the most common measure of scale reliability, was used to measure internal consistency between the statements in each typology. The higher the alpha value, the more the items have shared covariance and, consequently, are more likely to measure the same underlying concept (Field 2013).

The assumption of nine types of value for nature was tested using an Exploratory Factor Analysis (EFA). This technique is used for identifying clusters of variables, and aims to reduce a set of variables into a smaller set of dimensions called 'factors', allowing for an understanding of what constructs underlie the data (Field 2013). Before the EFA was undertaken, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was used to examine the appropriateness of the data for the EFA, with high values (between 0.5 and 1.0) indicating that an EFA is appropriate. A parallel analysis was then used to establish the number of factors in the data, extracting factors until the eigenvalues of the actual data set were less than the corresponding eigenvalues of a simulated data set. The results of the analysis and scree plot suggest the number of factors to extract.

A maximum likelihood EFA was undertaken with an oblique rotation (direct oblimin). The maximum likelihood technique is a fitting procedure that allows the statistical significance of factor loadings to be estimated, assumes respondents are randomly selected and allows for generalisations to be made from the sample participants to a wider population. An oblique rotation method was used as it allows for a certain amount of correlation between the variables. The EFA investigated whether there are consistent value orientations within the sample. Analyses were calculated using R version 3.2.1 (R Core Team 2015) and the 'psych' package (Revelle 2018).

Correlates of importance of cultural heritage

Non-parametric and parametric univariate statistics were first used to analyse and explore the data. Cumulative link mixed models (CLMMs) models, fitted with the Laplace approximation (Christensen & Christensen 2015), were then used to assess which socio-demographic variables influence people's perceptions about: i) the importance of nature-based cultural heritage to wellbeing; and ii) the relative importance of cultural heritage to wellbeing compared to other factors (e.g. food and shelter). Ordered Likert scale indicators served as response variables, whilst socio-demographic variables (e.g. gender, age, education level, primary livelihood, economic status and time lived in the village) served as fixed effects explanatory variables. 'Village' was included in the models as a random effect to account for the hierarchical nature of the dataset. As more than one individual was often sampled per household, the variable 'household' was nested within 'village'. See Table 5-1 for a summary of all model variables. Positive parameter estimates from the CLMM indicate the likelihood of a more positive response compared to the baseline condition, whilst negative estimates indicate the likelihood of a more negative response. Threshold coefficients indicate the values of the coefficients at which probable outcomes switch between different levels of the response variable (importance of cultural heritage to wellbeing).

Prior to modelling, collinearity among explanatory variables was tested using a correlation matrix and a Variable Inflation Factor (VIF) test. None of the variables were significantly correlated. A full (global) fixed effects model was first created with all of the a priori explanatory variables and compared to a global mixed effects model to evaluate the effect of the random variable, village. This was done using a likelihood ratio test and, if significant, the final models were fitted with village as a random effect. This was followed by stepwise variable selection, with model selection based on Akaike Information Criterion (AIC) values. If candidate models had a ΔAIC value greater than four, the model with the lowest AIC was

selected as the most parsimonious model. Models were run with a logit link function and a flexible threshold and the conditional modes of the random effect (village and household) extracted. Model validation was performed by testing the proportional odds assumption. Each model was also checked for over-dispersion by comparing the residual deviance with the residual degrees of freedom. All statistical modelling was carried out in R version 3.2.1 (R Core Team 2015) and the package ‘ordinal’ was used to fit the model (Christensen & Christensen 2015) and ‘ranef’ to extract the conditional modes of the random effect.

Table 5-1: Variables included in the cumulative link mixed models

Variable	Data type	Variable type	Description
Dependent variables			
Heritage_NB_to_wellbeing	Ordinal	Response	Perception of importance of cultural heritage to wellbeing, using a Likert scale with -2 defined as not at all important, -1 not very important, 0 neutral, 1 important and 2 very important.
Relative_NB_of_heritage_to_wellbeing	Ordinal	Response	Perception of the relative importance of cultural heritage to wellbeing compared to other factors, using a Likert scale with -2 defined as one of the least important, -1 not very important, 0 neutral, 1 important and 2 one of the most important factors.
Independent variables			
Village	Categorical	Random	Village in which the respondent lives (6 level factor)
Household	Categorical	Random	Household (in village) in which the respondent lives
Gender	Categorical	Explanatory	Gender of the respondent (2 level factor)
Education level	Categorical	Explanatory	Respondent's reported level of education (4 level factor: no education, primary, secondary college / university)

Variable	Data type	Variable type	Description
Primary livelihood	Categorical	Explanatory	Respondent's reported main income generating activity (4 level factor: tourism, salaried employment, self-employed, uses natural resources)
Time lived in village	Categorical (ordinal)	Explanatory	Number of years the respondent reported to have lived in the village (4 level factor: <5 years, 5 -9 years, >10 years, not sure)
Age	Categorical (ordinal)	Explanatory	Reported age of the respondent (4 level factor: 18-30, 31-45, 46-60, 60+)
Economic status	Continuous	Explanatory	Poverty score (BNS) of the respondent's household

Thematic analysis

A thematic analysis was used to analyse the data from the 24 FGDs, following the six-phase guide specified by Braun and Clarke (2006). This is a widely-used method in qualitative research, used to identify, analyse and report patterns (themes) within data (Braun & Clarke 2006). Themes capture something important within the data in relation to the research question and can be identified in one of two ways in a thematic analysis: a data-led inductive 'bottom-up' approach or a theory-based deductive or 'top down' approach (Braun & Clarke 2006). The inductive approach means that themes identified are driven by the data itself whereas the deductive approach is driven by the research question(s) and is more analyst-driven (Braun & Clarke 2006). The thematic analysis presented in this chapter followed a deductive 'top down' approach. Additionally, themes can have two levels: semantic or latent. Themes identified in this analysis are at the semantic level, meaning that they were "identified within the explicit or surface meanings of the data", and nothing other than what the participant said was looked at or assumed (Braun & Clarke 2006).

Following the six-phase guide, which allows for clarity and rigor in the thematic analysis process as well as flexibility to move between the phases, information from the FGDs was first read and re-read with notes on initial ideas for themes and codes being made. FGD transcripts were then coded with data being organised in a meaningful and systematic way. Each FGD discussion was read several times in order to check and confirm the coding. Some extracts were left un-coded, some were coded once and some were coded many times. Coding was performed manually in Microsoft Excel. The codes were then analysed, relationships between them examined and similar codes grouped into potential overarching themes. The frequency of codes mentioned in each FGD question was measured to provide an indication of the importance of each code. Preliminary themes were reviewed and modified slightly to generate the final themes (see Appendix B-5 for themes and codes).

5.4 Results

5.4.1 Characteristics of respondents

Refer to Section 4.3.1 in Chapter 4 for the respondents' characteristics.

5.4.2 Value orientations and attitudes towards nature-based cultural heritage

Cronbach's alpha values for the relationship between answers to individual questions within a value type were relatively low (0.09-0.53; Appendix B-6). This suggests that the nine types of value for nature within the overarching typology were not that distinct and people did not fall into specific groups. Therefore, the same person could give different answers to statements supposed to measure the same construct. The best-defined value types were the naturalistic (0.52) and negativistic (0.53). Distributions of statement responses, including the reverse phrased ones, were consistent, indicating that people understood and paid attention to the phrasing of the question, apart from two questions which was excluded (see Appendix B-6). The response frequencies for the 24 statements are presented in Appendix B-7. Distributions for statements in the dominionistic and negativistic typologies were found to have particularly wide spreads, indicating that respondents were less unified in their responses. These are the questions that explicitly mentioned sacred sites and spirits.

The Kaiser-Meyer-Olkin (KMO) measure verified the sampling adequacy for the EFA (KMO = 0.84), and all KMO values for individual statements were greater than 0.56. Based on the parallel analysis and scree plot results, seven factors were extracted. Factor loadings after oblique rotation and the communality values for each of the statements are presented in Appendix B-8. The communalities of the variables are low, indicating that, for most of the

variables, there is a large amount of variance unexplained by the factors. Extracting more factors (e.g. nine) did not improve these values. The EFA results therefore showed that there are no clear clusters, suggesting that people are heterogeneous in their value orientations and attitudes towards nature-based cultural heritage.

5.4.3 Perceptions of the importance of cultural heritage in general to wellbeing

Most questionnaire respondents said that cultural heritage is important (46%; n = 596/1305) or very important (31%) to their wellbeing.

"Cultural heritage is a person's identity. You need a few other things to supplement one towards living a good life".

(Bujagali-East: Kyabirwa, men's FGD)

Only 4% said it was not at all important.

"One cannot survive without things like water, food, fuelwood but they can survive without cultural heritage".

(Kalagala-East: Bubugo Bugobi, women's FGD)

Separate CLMMs were used to explore: i) how important people think cultural heritage is to their wellbeing in absolute terms; and ii) how important they think cultural heritage is to their wellbeing compared to other factors. As the results from the two models were consistent, I present only the results of the model for how important cultural heritage is to wellbeing compared to other factors, which provided stronger associations (Table 5-2). Refer to Appendix B-9 for the results of the model exploring how important cultural heritage is to wellbeing in absolute terms.

Gender, education level, poverty, primary livelihood and the time lived in the village had significant effects on the relative importance of cultural heritage to wellbeing (Table 5-2). Compared to the baselines (female, no education, salaried employment and not sure how long they have lived in the village), men and the less poor found cultural heritage to be comparatively very important, whilst respondents with higher education levels found it less important than other factors (with people holding college / university degrees finding it to be the least important). People employed in the tourism sector and who had lived in the village the shortest (< 5 years) also found cultural heritage less important to wellbeing than other factors to wellbeing (compared to the baselines: salaried employment and those unsure of how long they have lived in the village). Age did not have a significant effect on responses and was hence removed from the model.

The dissimilar intercept values for the six villages indicate that people living in the different villages have different feelings about how important cultural heritage is to wellbeing. Responses differed depending on which bank of the river villages were on, with those on the west bank finding cultural heritage more important than those on the east bank for Kalagala and Bujagali, and the reverse for Isimba. There were also differences between geographical areas. In Kalagala-West, where the sacred sites are still intact (as no development is taking place), cultural heritage was seen as a comparatively important factor contributing to wellbeing. The Bujagali area (where the cultural sites were submerged by the dam in 2012) also found cultural heritage to be comparatively important, while the villages in the Isimba area and Kalagala-East did not.

Table 5-2: CLMM results with logit link function of perceptions of the importance of cultural heritage to wellbeing compared to other factors, with respect to predictor variables

Variable	Estimate	Std. Error	CI (2.5%)	CI (97.5%)	Significance
Gender – Male	0.35	0.14	0.07	0.62	*
Education – Primary	-0.41	0.21	-0.82	-0.01	*
Education – Secondary	-0.95	0.24	-1.41	-0.48	***
Education – College / university	-1.36	0.47	-2.29	-0.44	**
Economic status	2.76	0.64	1.50	4.02	***
Livelihood – Self-employed	-0.15	0.38	-0.91	0.60	
Livelihood – Tourism	-2.05	1.09	-4.19	0.08	.
Livelihood – Uses natural resources	-0.04	0.37	-0.75	0.68	
Lived in village < 5 years	-1.97	1.15	-4.24	0.29	.
Lived in village 5 – 9 years	-0.81	1.17	-3.10	1.48	
Lived in village > 10 years	-1.77	1.12	-3.97	0.43	
Threshold coefficients					
0/1	-4.23	1.25			
1/2	-2.79	1.24			
2/3	-2.36	1.23			
3/4	-0.48	1.23			

Variable	Estimate	Std. Error	CI (2.5%)	CI (97.5%)	Significance
Random effects (intercepts)					
Kalagala-West (Kalagala)	0.44				
Kalagala-East (Bubugo Bugobi)	-0.79				
Bujagali-West (Kikubamutwe)	0.16				
Bujagali-East (Kyabirwa)	0.09				
Isimba-West (Nampaanyi)	-0.37				
Isimba-East (Bwase-Buseta)	-0.19				

*Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1*

Baselines: female, no education, salaried employment and not sure how long they have lived in the village.

Thresholds: 0 = One of the least important; 1 = Not very important; 2 = Neutral; 3 = Important; 4 = One of the most important

5.4.4 The most important aspects of general cultural heritage

Three themes emerged from the FGD thematic analysis of people's perceptions of cultural heritage. These are ordered in terms of frequency mentioned during the FGDs: i) spiritual beliefs, rituals and ceremonies, ii) nature; and iii) changing cultural heritage (Figure 5-1).

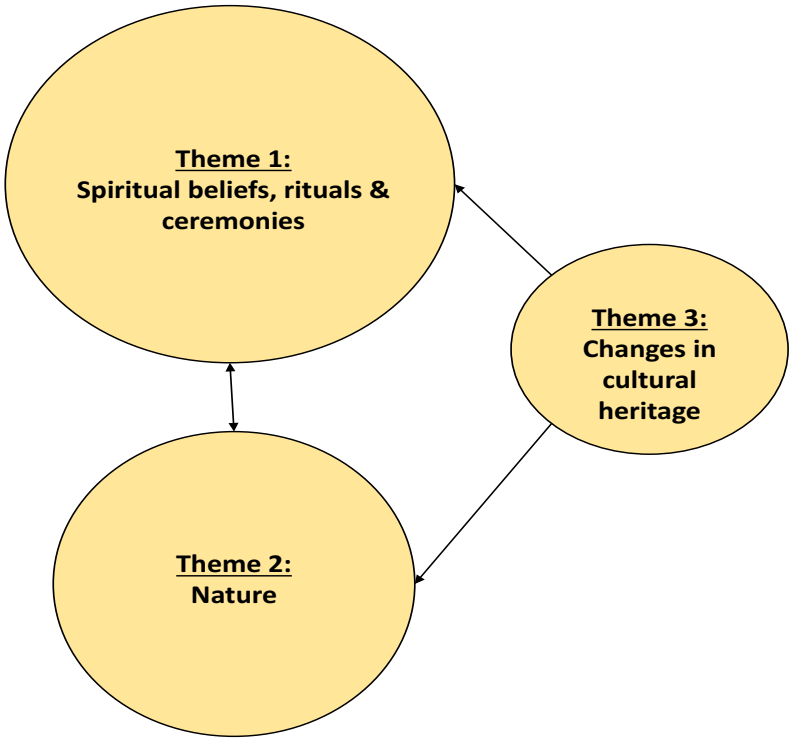


Figure 5-1: Diagrammatic representation of the three themes emerging from the thematic analysis of the elements of general cultural heritage. Relative circle sizes depict the frequency that each theme was mentioned during the FGDs; arrows indicate the direction in in which the themes interact

Theme 1: Spiritual beliefs, rituals and ceremonies

The theme 'spiritual beliefs, rituals and ceremonies' was mentioned the most. It encompasses many elements of cultural heritage, such as myths and stories, rituals, mainstream religion and spirits, that can be considered 'intangible' by Western cultures (Figure 5-2). When focus groups were asked what first comes to mind when they think about cultural heritage, spirits were most frequently mentioned by respondents, brought up more during meetings with men. Respondents described how their communities visit spirits to thank them for the year and to ask for wealth, children, twins, a good marriage, good

food yields, rain and cures for illnesses, among others. According to some respondents, other tribes do not worship spirits as much as the Basoga (the *Basoga* and *Baganda* are the dominant tribes in the study area). They worship spirits using songs, dances and by bringing them offerings such as animal sacrifices and money. A few respondents mentioned the use of human sacrifices when asking spirits for wealth, but no one stated that this took place in their village.

According to the FGD participants, rituals and traditional ceremonies are performed for numerous reasons, often to appease the spirits. Starting at birth, there are rituals and ceremonies carried out by parents to thank the spirits for blessing them, particularly if they have twins. Later in life, there are introduction ceremonies: male circumcision (particularly amongst the *Bagishu*, who circumcise boys during even years); female circumcision (amongst the *Sabinys*); clitoris elongation (amongst the *Basoga* and *Baganda*). There are then ceremonies and rituals associated with traditional marriage, which include dowries. Upon death, last funeral rights are carried out to send away the spirit of the deceased. Rituals are also conducted for certain other events; for example, during first harvest traditions, rituals are undertaken to thank the spirits, and sometimes before eating the harvest, people take a portion to the spirits. Spirits are an integral part of myths and stories.

This theme shows a strong focus on spirits and the fact that they underlie many ceremonies and rituals in the study area. As spirits reside in natural features (sacred natural sites), this theme links to the second theme, ‘nature’.

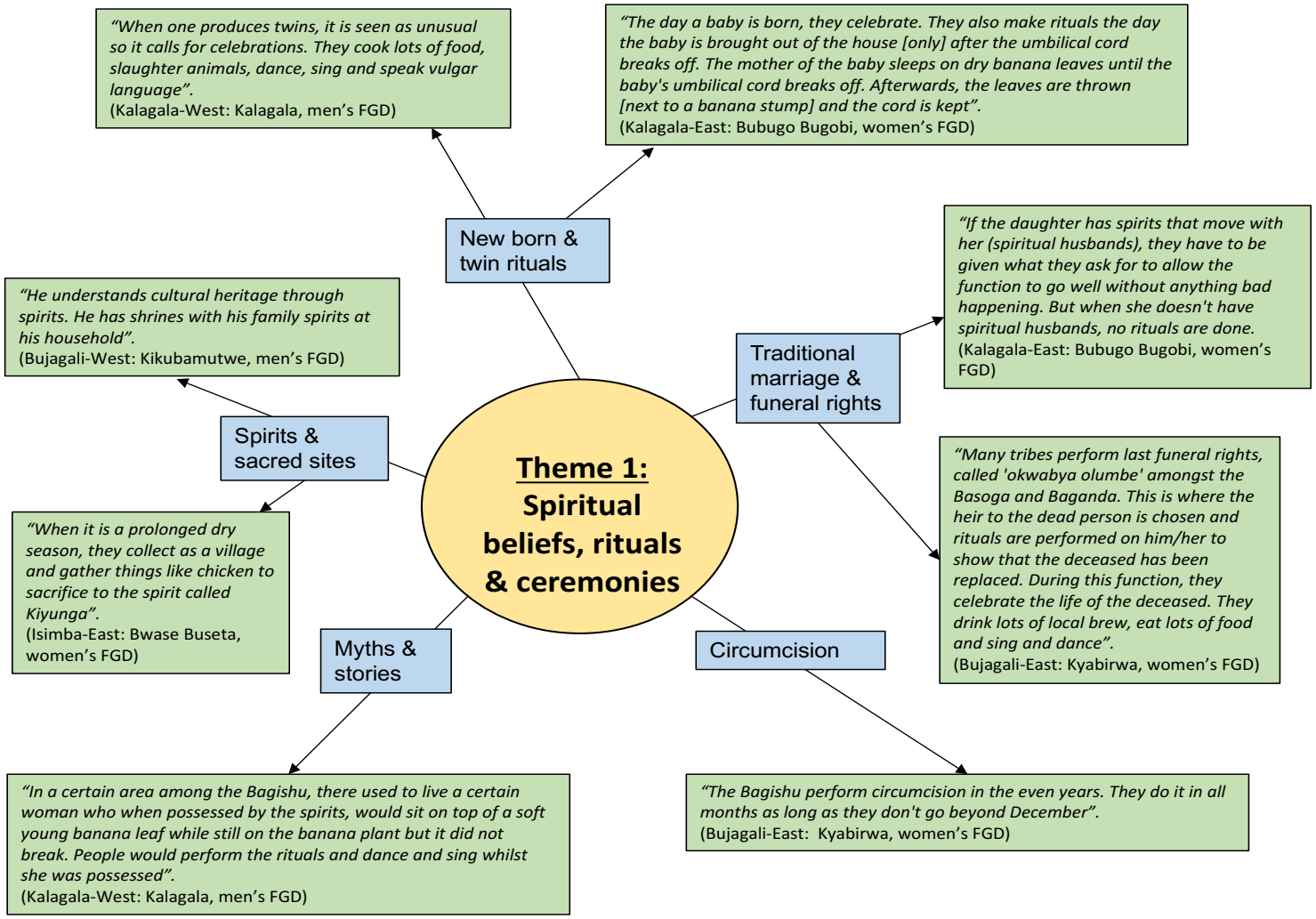


Figure 5-2: Most frequently mentioned codes (in blue), under Theme 1: spiritual beliefs, rituals and ceremonies, and associated quotations from FGDs (in green)

Theme 2: Nature

The next most frequent codes mentioned during the FGDs when people were asked about the term ‘cultural heritage’, were nature and sacred sites (Figure 5-3). Sacred sites are usually in the form of natural features in the environment, ranging from forests, trees, caves, lakes, rivers, waterfalls and mountains to entire landscapes. One FGD question specifically explored the role of nature in cultural heritage and the most frequent uses in order of salience, according to participants, were: medicinal herbs, herbs used in ceremonies, sacred sites, spirits living in nature, accessing / harvesting natural resources, totems and bark cloth.

Several floral species in the Central Forest Reserves (CFRs; which form part of the Kalagala Offset) have medicinal properties and are used by people to treat illnesses such as malaria, headaches, stomach problems, wounds and burns. These medicinal herbs are often used as ‘first aid’ when hospitals are far away and/or western medicine is too expensive. Moreover, some respondents said that when western medicine fails, the only way to heal a person is to use traditional medicine. Apart from medicinal properties, many herbs and other natural resources are used during ceremonies and rituals (linked with Theme 1). For example, new born babies are bathed in herbs for good luck, and herbs are placed on dead bodies to escort the deceased into their new lives.

Sacred sites (particularly the Itanda rapids near Kalagala-East and the Kalagala falls near Kalagala-East) were brought up by FGDs in all six villages. Waterfalls are associated with sacred water which, when mixed with herbs, is used during rituals to cure illnesses, wash away bad luck and to bless people. According to respondents, most sacred stones have an unusual shape (e.g. chair or basin). Shrines at the sacred sites are built out of natural resources (e.g. grass, stones and sand) and people place pots, coffee beans and light fires

at the shrines whilst worshipping the spirits. In addition to sacred sites, people also have shrines with family / ancestral spirits at their homes.

Aside from its medicinal value and housing spirits, nature has other uses for cultural purposes. Natural resources (e.g. papyrus and clay) are used for traditional arts and crafts (e.g. baskets and mats) and some plant and animal species are considered sacred, and are therefore protected by respondents. For example, every clan is named after an animal or plant (a totem), which they are not allowed to eat. Bark cloth, a traditional fabric used by the *Baganda* and *Basoga* tribes, is made from the internal bark of a local *ficus* tree. It is worn as traditional dress during ceremonies and when visiting sacred sites, as well for seating, covering musical instruments, covering stones at sacred sites and to construct shrines.

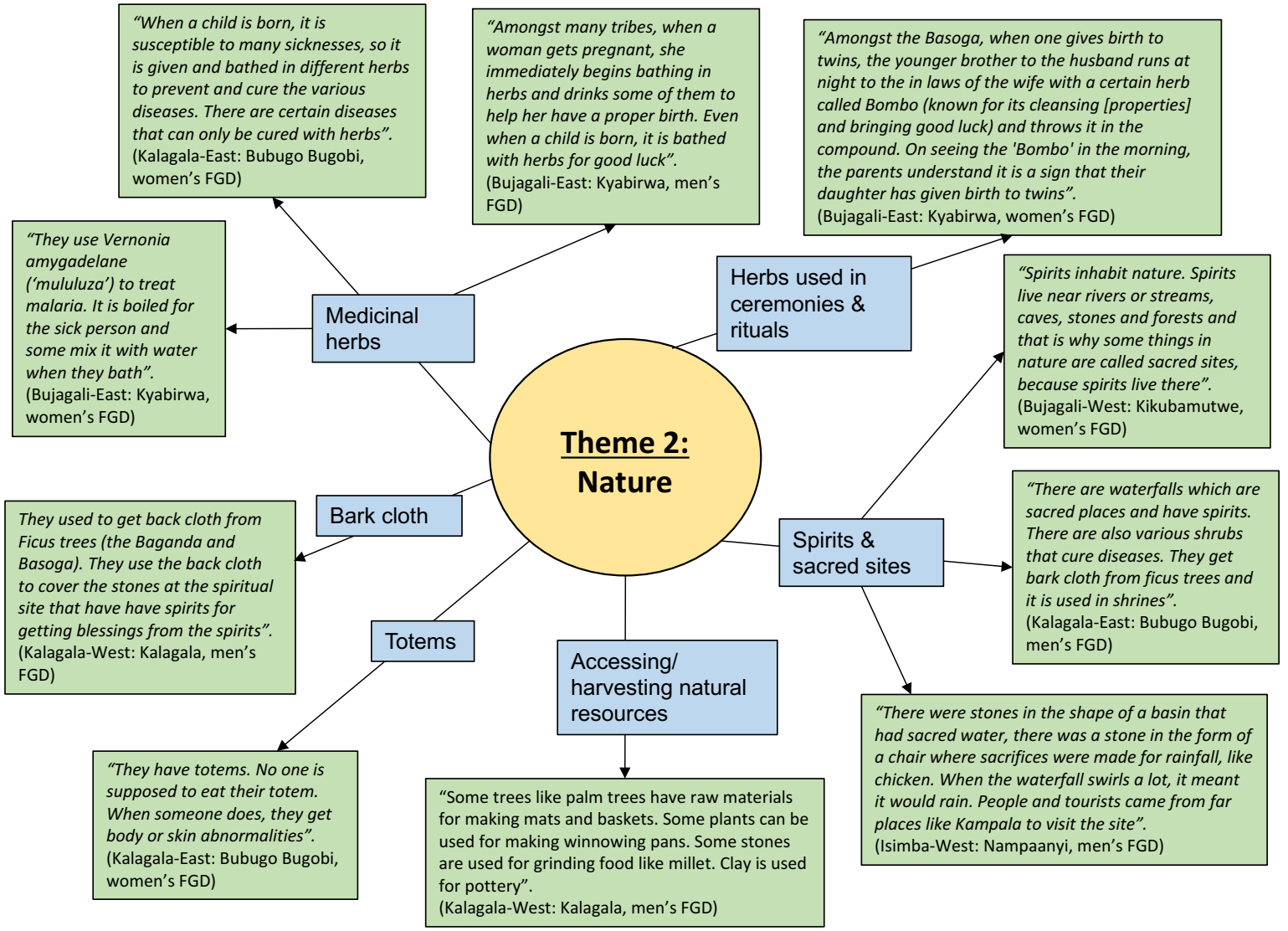


Figure 5-3: Most frequently mentioned codes (in blue), under Theme 2: nature, and associated quotations from FGDs (in green)

Theme 3: Changes in cultural heritage

The next most frequently raised code when FGDs were asked about the term cultural heritage, was how it is changing (Figure 5-4). The majority felt that cultural heritage and traditions have changed for the worse, and have become less important to their communities over the last few decades. The main reasons for this change, ranked in order of importance, were: the influence of mainstream religion, western culture and modernity, spirits, sacred sites, loss of medicinal herbs, development projects, changes in access to natural resources, climate change and the commercialisation of cultural heritage.

Respondents said that the uptake and spread of mainstream religion was the main reason behind the loss of cultural heritage and traditions. For example, instead of carrying out twin and new born rituals, people prefer church baptisms, and many traditional practices, such as worshipping spirits, contradict mainstream religion and raise suspicion. People who chose to keep their shrines were sometimes isolated by the village, and some even had their shrines destroyed. Nevertheless, there are still people in the villages who believe in the spirits and practise both mainstream religion and traditional cultures. Western cultures, modernity and education have also influenced cultural heritage. This has led to changes to traditional dress (e.g. women can wear trousers) as well as changes to traditional gender roles and manners (e.g. women do not always kneel when greeting). In addition, the use of western medicine has diminished the use of traditional herbs. According to a few male FGDs, laws and policies have also changed, which has led to women's emancipation. One male FGD complained that men used to control women and household finances and were negative about this changing. Women are now able to become heirs, are more educated and sometimes sit on chairs (as opposed to mats). Culture and traditions are also disappearing because the older generations have the knowledge but the youth are no longer interested.

Many respondents stated that poverty was having a negative effect on cultural heritage. Rituals and ceremonies (e.g. circumcision) are expensive, so were only carried out when people can afford them, or not at all. On the other hand, religious ceremonies, such as baptisms, are much cheaper. Cultural heritage has also become highly monetised with some people using spirits as a way of making money. Groups acknowledged that owing to unemployment, poverty and population growth, forests have been over-harvested, trees cut down for fuelwood, charcoal and money. This has led to the destruction of medicinal herbs, sacred trees and natural resources used for shrines, musical instruments, traditional arts and crafts. Moreover, the trees are not replaced or, if they are, they are replaced with exotic species, which has meant that native trees with medicinal properties have been lost. Respondents said that the seasons are changing (because of deforestation which leads to climate change), negatively affecting their planting and harvesting times, affecting first harvest traditions, and reducing the availability of medicinal herbs.

Finally, the impact of economic development on cultural heritage was frequently raised. During the FGDs in all six villages, participants mentioned that construction of the hydropower dams (Isimba and Bujagali) have destroyed sacred sites, disturbed spirits and cleared medicinal herbs. All six villages explained how riverbanks and islands with forests, medicinal herbs, natural resources, sacred sites and shrines were submerged. In addition to the dams, respondents also mentioned other projects that have negatively affected cultural heritage, which included a factory that destroyed graveyards and disturbed spirits, and a development by a private investor (near the Kalagala falls) that restricted access to forests and medicinal herbs.

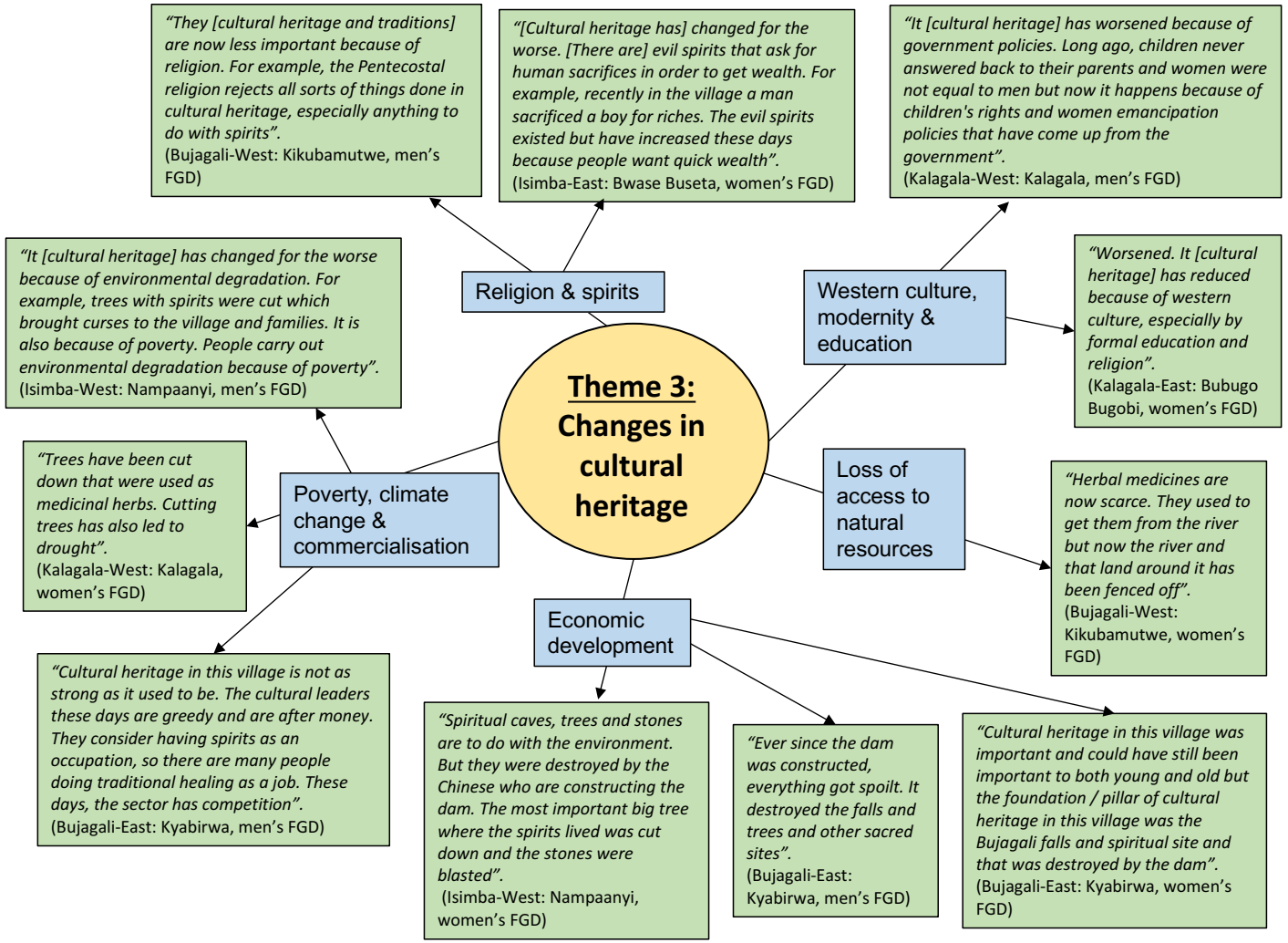


Figure 5-4: Most frequently mentioned codes (in blue), under Theme 3: changes in cultural heritage, and associated quotations from FGDs (in green)

5.4.5 Local perceptions on the impact of hydropower development on nature-based cultural heritage

After exploring what aspects of cultural heritage were most important to people in the study area, specific questions in the FGDs and individual questionnaire were used to investigate their perception of the impact of the hydropower developments (Bujagali and Isimba) on cultural heritage and sacred sites.

First, I enquired whether respondents in each village were aware of the hydropower developments impacting sacred sites and, if so, what they felt these impacts were. There was a significant association between village and individual response (χ^2 = 376.55, df = 10, $p < 0.05$; Figure 5-5). The highest proportion of people who reported that there had been an impact was found in Bujagali-East and Isimba-West, the villages closest to the Bujagali and Isimba dams respectively. Conversely, the highest proportion of people who said there had been no impact was in the Kalagala region (Kalagala-West and Kalagala-East). Those respondents said they were too far away to have been impacted by the Bujagali dam, but raised concerns about the potential impact of the Isimba dam. In particular, they were concerned that the dam would submerge the Kalagala Falls and Itanda Rapids (sacred sites) near the villages. Some respondents in Kalagala-East said they had already noticed that the Itanda Rapids were no longer as 'vigorous' as they used to be. Respondents in Kalagala-West said that since the Bujagali sacred site was destroyed, they had noticed an increase in the number of people visiting the sacred site at their village.

"We only hear about Bujagali dam but it is very far away from this village to affect cultural heritage. However, we are afraid that after the construction of Isimba dam, there will be back flow of water that will flood the spiritual site and destroy the sacred waterfalls".

(Kalagala-West: Kalagala, women's FGD)

More men acknowledged that sacred sites in their village had been destroyed, whilst more women said that they did not know (χ^2 = 48.64, df = 2, p < 0.05). More educated people knew that sacred sites had been impacted, whilst less educated people (with either no education or a primary school degree) tended not to know (χ^2 = 31.18, df = 6, p < 0.05). People who had lived in the village longer were more aware that sacred sites had been destroyed (χ^2 = 8.98, df = 2, p < 0.05). There was no significant difference between age groups, primary livelihoods and poverty levels.

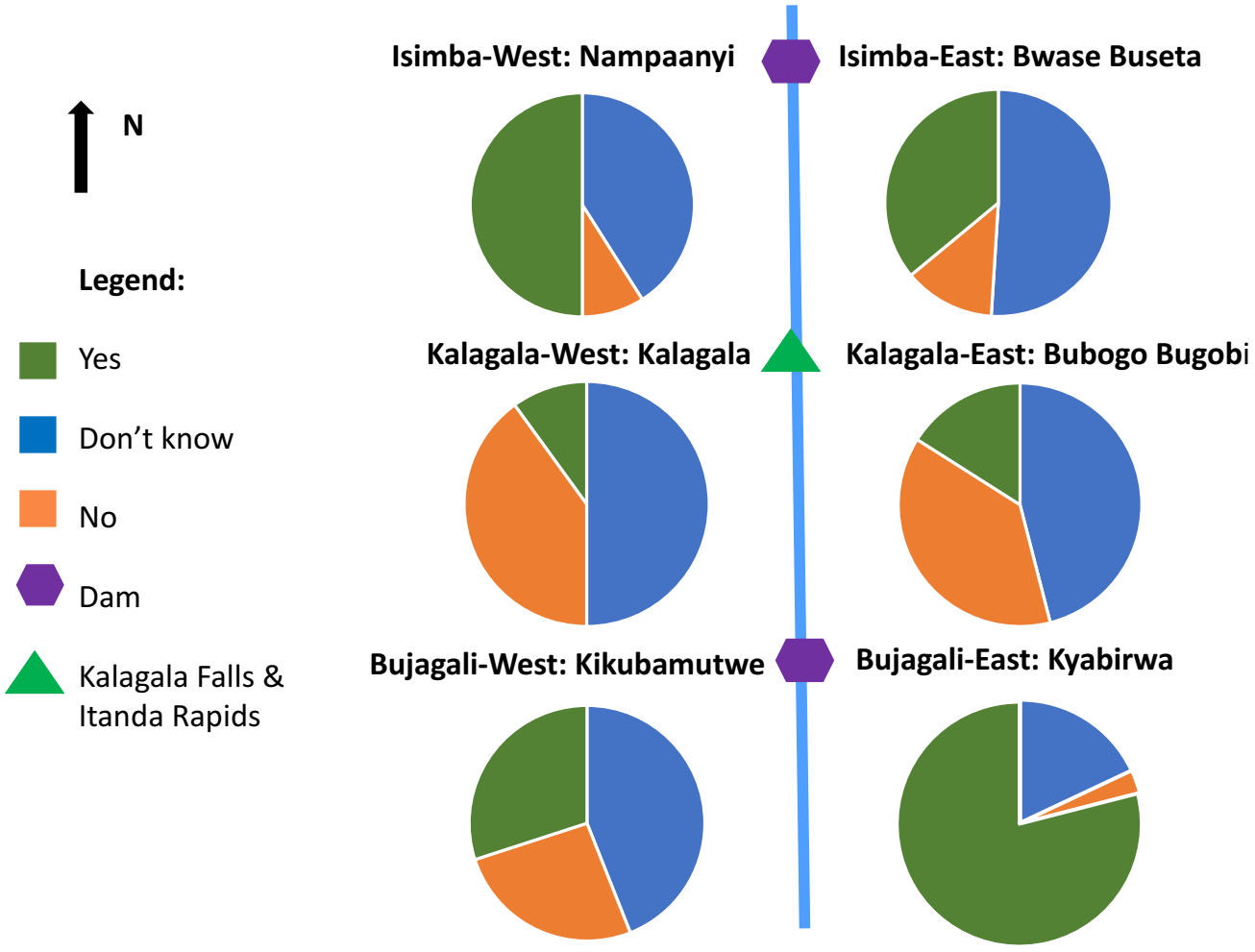


Figure 5-5: Proportion of respondents in each village responding to whether the dam had affected sacred sites in their village

The Bujagali sacred site is the most well-known site amongst people in the study area. The caretaker for the site and spirits, *Nabamba Bujagali*, resides in Bujagali-East and is the overall spiritual leader for Busoga. According to respondents, he was chosen by the spirits and has looked after them his whole life. The myth that he used to sail across the river on a mat also extended to Bujagali-West. Respondents reported that people used to travel from all over the country to visit the sacred site. They also noted that the site was a source of employment for village residents who were employed as guards and guides, and a source of income as visitors and tourists would pay to access the sites.

Respondents complained that rock blasting activities (associated with both the Bujagali and Isimba dams) disturbed the spirits at these sites, and caused them to migrate or 'wander' around the village disturbing people. People at Isimba-West believe that the spirits are angry as they have not been relocated or compensated. They believe this is one of the reasons behind miscarriages and unexplained deaths in their village. Respondents also said that people now have to travel great distances to visit other sacred sites, but they are not the same as the ones lost.

> *"The dam has destroyed waterfalls which used to habit the spirits. The dam also destroyed all the trees where spirits used to live and the rock blasting activity chased away the spirits".*
>
> *(Isimba-East: Bwase Buseta, women's FGD)*

For those who reported that sacred sites had been affected by the dams (n = 465/1305), I explored how they felt about the dam's impact on these sacred sites. Overall 64% (n = 181/465) were either very sad (39%) or sad (25%) whilst 33% had no change in feelings; only 3% were happy. There was also a significant difference in feelings between the villages (Kruskal-Wallis $\chi^2 = 33.34$, df = 5, $p < 0.05$), but no apparent geographical pattern in relation to the dams was observed. On average, respondents in Isimba-East and Kalagala-West felt very sad, whilst the other villages, on average, stated that they felt sad. Bujagali-West

and Kalagala-East had the highest number of respondents who had no change in feelings about the dams' impacts on sacred sites. Responses also differed between genders (Mann-Whitney U test: $W = 33186$, $p < 0.05$), with men on average stating that they felt sad about the sacred sites' destruction. Conversely, women reported no change in feelings. The poorer people were, the sadder they were about the destruction of the sacred sites (Spearman's rank correlation rho: $S = 13400000$, $rho = 0.16$, $p < 0.05$).

"[People are] very sad. All spiritual sites that were of help to us have been destroyed".

(Isimba-East: Bwase Buseta, men's FGD)

Third and finally, of the people who reported that sacred sites had been destroyed ($n = 465$), there was a significant correlation between their feelings towards the dam construction and how the destruction of the sacred sites made them feel (Spearman's rank correlation rho: $S = 10813000$, $rho = 0.32$, $p < 0.05$). The angrier people were about the dam, the sadder they felt about the destruction of sacred sites. People with no feelings towards the dam had no change in feelings about the destruction of the sites. There was also a significant correlation between how the destruction of the sacred sites made them feel and how they felt that their wellbeing had been impacted ($n = 465$, Spearman's rank correlation rho: $S = 10195000$, $rho = 0.36$, $p < 0.05$). Those who felt that their wellbeing had been negatively affected by the dams were sadder about the sacred sites being destroyed.

"[People are] very sad and angry because the spirits are not settled. They keep disturbing people in the village".

(Isimba-West: Nampaanyi, men's FGD)

5.4.6 Compensation for nature-based cultural heritage impacts

For those people who said that sacred sites had been affected by the dams (n = 465/1305), I explored whether they were aware of any compensation that had taken place and, if so, whether it had compensated for the loss of the sites. There was a significant association between village and their response about compensation (Fisher's exact test: $p < 0.05$); most respondents in all six villages said that there had not been any compensation for the sacred sites. However, the highest proportion of respondents who acknowledged compensation (and the lowest proportion saying 'no') were in Bujagali-East (the only site where compensation had occurred; as documented in the ESIA). During FGDs, they said that the sacred site's caretaker / spiritual leader, *Nabamba Bujagali*, had been paid to relocate the spirits to a village called Namezi. Conversely, the highest proportion of people who averred that no compensation had been administered was in the Isimba villages (91% in Isimba-East and 90% in Isimba-West). During the FGDs, these participants said that village meetings were held with developers, but that nothing had been forthcoming. These participants said that they now had nowhere to worship spirits as the other sites were far away and transport was expensive. Women were more likely than men to say that no compensation had taken place ($\chi^2 = 4.80$, df = 1, $p < 0.05$). On average, respondents who said that no compensation had taken place were slightly poorer (average BNS = 0.54), than those who said that compensation had occurred (average BNS = 0.58, independent t-test t = -2.62, df = 139.38, $p < 0.05$).

"The spiritual site was destroyed that used to help us, yet no compensation was done. We have no other spiritual site to go to".

(Isimba-West: Nampaanyi, men's FGD)

"There were spiritual sites on the land that was taken by the dam. The dam compensated for the land but not the spirits".

(Bujagali-West: Kikubamutwe, men's FGD)

During the FGDs, respondents in all six villages were asked how impacts on sacred sites and spirits could be compensated. Some believed that compensation was impossible, and felt that the sites were place-specific and it was therefore difficult to recreate the same environment as that being lost. Conversely, others felt that spirits could be relocated, although it was a complicated and expensive process. The most common way to relocate spirits (deciphered through discussions in several FGDs) is to carry out rituals that involve singing, dancing, drumming and animal sacrifices. During this time, the spirits are consulted, possess the spiritual leader, tell him whether they are happy to be moved and what rituals / ceremonies need to be performed. Most importantly, the spirits tell the spiritual leader where they want to be moved to, as they require specific natural habitats with hills, caves, stones, rivers or waterfalls. Several FGDs pointed out the difficulty in finding new sites, such as a waterfall, as every existing waterfall is already home to a different spirit, which will not want to be relocated, or not take kindly to a new spirit. Further, spirits are 'site-specific', meaning that some need places with water and waterfalls whilst others need land with trees and stones. Thus, water spirits cannot be relocated to land. Spirits are also unique, so one cannot compensate for the loss of a sacred site and spirit in one area (e.g. Bujagali or Isimba) by protecting one at another site (e.g. Kalagala); the spirits must be relocated.

"Once the spiritual site is demolished, it will be the end and it cannot be gotten back".

(Kalagala-West: Kalagala, men's FGD)

"It is impossible for Kalagala spiritual site to compensate for Isimba spiritual site. It is like having a mother. If a person kills your mother, can that person compensate by giving you another mother? Will you be able to get another mother?"

(Isimba-West: Nampaanyi, men's FGD)

"The cultural heritage site, Bujagali, had sacred waterfalls, shrines, an old tree of around 100 years and stones. However, all this was destroyed by the dam and can't be found anywhere else".

(Bujagali-East: Kyabirwa, men's FGD)

Of the respondents who acknowledged that compensation had occurred (n = 92/1305), the majority said that it had not made up for the loss of the sacred sites (47%; n = 43/92), whilst only a few said that it did (13%). Respondents in Bujagali-East said that they were not happy as the compensation only benefitted a few people, whilst many people who used to visit and use the site had been negatively affected. Moreover, they said that the new sacred site at Namezi was artificial and therefore not as valuable as the old sacred site at Bujagali, as it had no nature such as medicinal herbs, waterfalls, stones and trees. It is also about 2 km away from the old site, so many people had stopped worshipping at the site as it was too far away. According to focus group participants, Namezi was chosen because the developers could get land there, not because it was the site selected by the spirits. As a result, several groups said that the spirits had decided to stay with *Nabamba Bujagali* at his home. The compensation process was further complicated as once word spread, another person, called "*Nfuundu*", appeared claiming he was the legitimate caretaker. According to the Bujagali ESIA, both caretakers were compensated.

"Bujagali relocated the spirits to a village called Namezi but the spiritual site at Namezi is not of as much value as the spiritual site that was at Bujagali".

(Bujagali-East: Kyabirwa, men's FGD)

"The old spiritual site was much better because it had sacred falls where people got water to bath off bad luck. It had a sacred tree where people took their offerings and worshipped around it. The new site has no nature like herbs which people would bath in for good luck, no falls and no stones".

(Bujagali-East: Kyabirwa, men's FGD)

5.5 Discussion

5.5.1 Value orientations and attitudes towards nature-based cultural heritage

The Kellert typology has proven useful for identifying public attitudes towards certain species, understanding and managing human-wildlife conflict (Kellert 1994; Vkters⊘ et al. 1999) and understanding cultural relationships and spiritual beliefs between humans and carnivores (Herrmann et al. 2013). However, in this study, the same person tended to answer differently to different statements that measured the same construct. Consequently, the Kellert typology was not able to consistently typologise people's value orientations and attitudes towards the nature-based cultural heritage. A limitation in this study was that the 24 statements were designed based on information gained during a short two-month scoping trip. As time was limited, I was unable to gain a detailed understanding of cultural heritage in the study area and people's relationship to nature. As a result, the design of my statements may not have been accurate or appropriate for their purpose. Alternatively, the results could indicate that the Kellert typology was an unsuitable method to describe the many and varied dimensions of cultural beliefs associated with nature in the study area. Cultural heritage is complex, constantly changing and can be interpreted and valued in various ways by different groups of people (Tengberg et al. 2012). Hence, the nine Kellert typologies may not have been apt for describing and capturing people's value orientations

and attitudes towards the nature-based cultural heritage in this study area. Although the use and validity of the Kellert typology has been widely tested, this has been predominantly in a Western context and Western cultures (Ross et al. 2018). Therefore, further exploration of the applicability of the Kellert typology to other cultures, especially indigenous peoples, and in different settings would be worthwhile (Ross et al. 2018).

5.5.2 Studying and interpreting cultural heritage requires detailed research

As the results from the Kellert typology indicate, studying cultural values is complex and challenging, especially owing to the sensitive nature of the topic. For example, my fieldwork involved 24 cultural heritage FGDs, key informant interviews, direct observations and anonymous individual questionnaires over an eight-month period trying to explore cultural heritage as thoroughly as possible. This was, however, still insufficient time to gain a detailed understanding of the rich, complex and site-specific cultural values of people living in the study area. In particular, it is impossible to entirely eliminate cultural biases when undertaking cross-cultural research such as this, meaning that outsider ontological frames may have been inadvertently imposed onto data interpretations (Tayeb 2001). For example, my position was as a white 'Western' female with a different cultural background and reference points to the people in the study area. Furthermore, I did consider the 'researcher effect' (where the presence of the researcher may influence the participant's responses; Tayeb 2001), and tried to minimise it by ensuring that I was not present during the individual questionnaires. I also used local research assistants from the study area to administer the questionnaires and help facilitate the FGDs. Nevertheless, on this basis, there are limitations to my research, which is not an exhaustive exploration of cultural heritage in the study area.

Cultural values may be hard to articulate and community members may not always be willing to share cultural knowledge easily or openly, particularly with outsiders or uninitiated insiders (Infield et al. 2018). During my scoping trip, I found that cultural heritage and, in particular, spirits and sacred sites were a sensitive topic in the study area and not everyone was willing to talk openly about them. For example, one women's focus group meeting refused to talk about cultural heritage and worshipping the spirits. They insisted they had no knowledge about sacred sites in their village (Bujagali-East) whilst some participants were overheard discussing that they could not reveal in public that they believed in the spirits, and that owing to the advent of mainstream religion, people who worship spirits were called pagan and stigmatised. A study by Byers et al. (2001) also found that local people in Zimbabwe were sometimes reluctant to reveal information about sacred sites, making it challenging to ascertain whether they truly did not know the local sacred sites, or knew but were reluctant to talk openly about them. Thus, it appears that, in my study, women may have been more circumspect in their responses than men and could potentially have been less willing to talk about cultural heritage and spirits than men.

Men tended to be more forthcoming about cultural heritage and, in particular, about sacred sites and spirits, than women in all six villages. In addition, more men acknowledged that there were no sacred sites at all in the study area, stating that they have been destroyed, and feeling sad about it. This is interesting because several FGDs said that it was mostly women who visited the spirits to ask for children, twins and a good marriage, and who used medicinal herbs. Perhaps these sites were very personal and private to women, meaning that they were less inclined to divulge details about them. The influence of gender on cultural heritage beliefs varies widely between cultures and geographies. Studies have found that women often have a better knowledge about medicinal plant species than men, and in some regions in Africa, women dominate the traditional healing profession (Mathibela et al. 2015). Conversely, respondents in a study in Western Cameroon specified that women have nothing to do with sacred sites, considering them 'male affairs' (Kamga-

Kamdem 2010). Interestingly, in that study further investigation revealed that women played an important role in the management of sacred areas, but that this role was often ignored and hidden (Kamga-Kamdem 2010). Although not Africa based, a study in Nepal found that men had a greater awareness and knowledge of place-based spiritual values than women (Spoon 2012).

In general, respondents were less likely to admit that they personally visited sacred sites and worshiped spirits, but were happier to generalise and speak about other people in the village. Although the individual questionnaire was confidential (and this was explained at the start of each interview), the questions were directed to the individual rather than generalising about the village as a whole. This may have been one of the reasons why there were such heterogeneous responses to the Kellert Typology statements. Conversely, FGDs concentrated on village activities in general, which is perhaps why participants were more comfortable discussing sacred sites and spirits in these forums. This suggests that despite being more public, FGDs may actually be less sensitive in some instances.

5.5.3 Is cultural heritage an important component of people's perceived wellbeing?

The majority of respondents said that cultural heritage was important, if not one of the most important factors, to their wellbeing, even compared to basic needs like food and shelter. However, the importance of cultural heritage to wellbeing varied by village, being the highest in Kalagala-West. Of all of the villages sampled, the sacred sites at this location were intact, well maintained, well known in the region (second to the Bujagali sacred sites), acted as a tourist attraction and are being protected as part of the Kalagala Offset. Conversely, the importance of cultural heritage was rated lowest in Kalagala-East. This was unexpected because the village is on the opposite bank to Kalagala-West, and the sacred sites in this village are also being protected as part of the Kalagala Offset. There were no

clear socio-demographic differences between the villages that could explain this finding. However, the different tribal compositions could explain this as Kalagala-East falls in the *Busoga* Kingdom whilst Kalagala-West falls in the *Baganda* Kingdom. It could also be because the sacred sites on the east bank appeared to be less well known to local people and were less of a tourist attraction.

Individuals with higher education levels were more informed about sacred sites being impacted, but found cultural heritage to be less important to wellbeing. In Africa, the spread of nationalised formal education, conversion to mainstream religion and increased immigration into villages has reduced traditional worldviews (Holmes et al. 2018). This corresponds with results from my thematic analysis, where respondents attributed changes in the importance of cultural heritage to modernisation, westernisation and education, among other factors.

It was surprising that age did not have a significant effect on responses to the importance of cultural heritage to wellbeing, as younger respondents tended to be more educated. For example, older women in Ghana were more likely to believe that vultures bring bad luck whilst younger men (who tend to have formal, western-informed education) were less likely to have this belief (Campbell 2009; Holmes et al. 2018). Studies have shown that youth no longer respect traditional sacred places and that knowledge transmission to the younger generations is declining (Bhagwat & Rutte 2006). This was mentioned during the FGDs. Another interesting finding was that less poor people found cultural heritage to be one of the most important factors to their wellbeing compared to other factors. Perhaps poorer people place a higher value on basic necessities (e.g. food and shelter) than less poor people, who could more easily afford them.

In summary, people in the study area perceived cultural heritage to be an important component of their wellbeing despite notable geographical variation and socio-demographic differences. This indicates the importance of including people's cultural

values of nature when evaluating how losses and gains in nature from NNL affect people's wellbeing.

5.5.4 Incorporating nature-based cultural values into project-level biodiversity NNL strategies for development projects

Conflicts often arise between spiritual values and economic benefits. National economic benefits often out-compete local spiritual values within the decision-making process for development projects owing to new markets, the need for development and spiritual values becoming irrelevant because of 'modernisation' (Rutte 2011). The Bujagali and Isimba Hydropower Projects and the Kalagala Offset case study is an example of a trade-off between nationally significant economic development projects and local people's nature-based cultural values. The need to increase power generation within Uganda has been identified as a priority for the country (Chapter 2). However, to maximise hydropower potential dams have to be built which inundate waterfalls and rapids, many of which have spiritual value to local people. Hydropower development, and hence impacts on sacred sites, are often unavoidable, not only in Uganda but in countries worldwide. On the other hand, there are cases where cultural values have taken precedence, influencing the design of the development project so as not to impact on cultural heritage. For example, the A21 Tonbridge highways project runs through the High Weald, an historically important landscape in England, dating back to the Medieval and Saxon periods. There is also a scheduled ancient monument (Castle Hill Fort) located close to the northern end of the scheme. The scheme accounted for this cultural heritage and was designed to retain the historic form of the landscape and avoided destroying the fort. The trade-off was that the scheme affected features of less significant cultural value because of the road alignment, although these impacts were mitigated as far as possible, which included carefully removing a historic building to re-instate it within a museum (A21 Tonbridge to Pembury Dualling Statement of Case 2010).

Although increasingly being included into government policies, cultural heritage is still a relatively new aspect of public policy, with cultural impact assessments having only been in practice for the last two decades, primarily in countries with indigenous populations, such as New Zealand and Australia (Partal & Dunphy 2016). Whether cultural impacts are addressed sufficiently in the ESIA process has been questioned, with criticism that they are often included as a subsidiary part of the ESIA (Partal & Dunphy 2016). For example, cultural impact assessments have been called the “less well-developed” aspect of impact assessment, with limited information on how to perform them (Partal & Dunphy 2016). Moreover, as found in this study, cultural heritage is a sensitive topic and, in particular, spirits and sacred sites. Thus, local people may not feel comfortable voicing cultural values during the ESIA process (particularly to an outsider). There is often insufficient time in the ESIA process for practitioners to build trust with the communities so that the respondents openly talk about cultural values, which is especially important when communities experience anxiety associated with a pending major project development. Traditional ESIA methods could therefore fail to reveal the richness and diversity of cultural values in the area. Furthermore, my results indicate that impacts on cultural heritage components are not conducive to rapid assessment or relatively short-term research. A thorough understanding of how developments potentially affect nature-based cultural heritage therefore requires in-depth specialist research by people who communities trust.

Accordingly, before managing and mitigating development impacts on nature-based cultural heritage, an understanding of the ways that people value and use nature for their culture and why it is important to their wellbeing is needed, which is not often a requirement in ESIAs. Once the cultural impacts (and who experiences these impacts) have been fully understood, the mitigation hierarchy can be applied to the impacts on both biodiversity and cultural heritage (as specified by IFC PS8; Table 5-3). If the first two preventative steps in the mitigation hierarchy (avoidance and minimisation of impacts) are unachievable fully or in-part, trade-offs could exist between a development project, the activities undertaken to

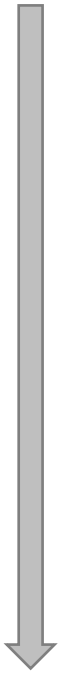
ensure NNL of biodiversity, and the impact of both the project and any associated biodiversity offset on people's cultural values associated with nature. Thus, as the last stage of the mitigation hierarchy (offset), a key decision is how to compensate people when a development project affects their nature-based cultural values, with the aim to ensure that they are 'no worse off'. However, it is vital to recognise that it may not always be possible to fully compensate people for negative cultural heritage impacts incurred from either a development or its associated offset, owing to the high irreplaceability of certain components for affected people (e.g. if spiritual sites are damaged, destroyed or rendered inaccessible (Koh et al. 2017)). In these instances, it must be recognised that the outcomes of a development and its associated offset for people cannot be sustainable or equitable, even if biodiversity NNL is achieved (Bull et al. 2018). For example, the right to herd reindeer is an important tradition for the indigenous Sami people in Sweden but a mining project directly impacted reindeer grazing land and migratory routes (Koh et al. 2017). Consultations were held between the impacted Sami people and the developer to negotiate compensation for reindeer husbandry losses. An agreement was signed, influencing the location of mining operations and specifying monetary compensation for additional costs incurred by the Sami (e.g. feeding). Nevertheless, according to consultations with the affected Sami, the compensation could not substitute for the losses of land and hence the Sami still oppose the mining activities (Koh et al. 2017).

In my study, most respondents (both men and women) specified that compensation for lost sacred sites is possible, provided the correct procedures are followed to consult with and relocate the spirits. Comprehensive engagement is needed not only between developers and spiritual leaders, but also with the broader community in order to understand (as far as possible) the values attached to the impacted sacred site. This can help to avoid elite capture (Brockington 2003), which respondents raised as a concern during the FGDs, as many of them said they were not consulted, only the spiritual leaders. Discussions and negotiations can then follow between all interested and affected parties to decide on the

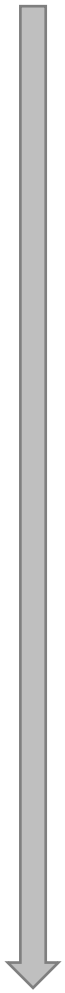
relocation procedure, agree on a new location for the sacred sites that is mutually acceptable (i.e. minimising travel distance), whilst at the same time, respecting local people's beliefs and traditions.

All features of culturally important sites should be evaluated and compensated for if affected by the development. Although in our study area, spirits were the main cultural values attached to affected sites, values which may be particularly important in other settings include sense of place, identity and social interactions. 'Sense of place' is a concept used to describe those characteristics that make a place special or unique as well as those that foster a sense of authentic human attachment and belonging (Hernández-Morcillo et al. 2013). Natural features in the environment are often associated with the identity of individuals, a community or a society, providing intergenerational experiences, and can also be settings for community interactions which are important for cultural ties (Daniel et al. 2012). It has also been shown that attractive landscapes elicit stronger emotional responses among individuals (Hausmann et al. 2016; Hausmann et al. 2017). Thus, development can change or negatively affect locally distinct characteristics in the landscape and their cultural meanings, which can disconnect communities from their past (Stephenson 2008). FGDs raised the aesthetic value of sacred sites and how important nature and natural features are. If the new location for the sacred site is not aesthetically pleasing (e.g. too artificial, or a sacred site around water being moved to land), the local people may not value it as much as the original site and, consequently, may avoid the site altogether. It has been suggested that 'sense of place' is one of the most neglected cultural aspects and that more information is needed on how to include it into conservation decision-making (Millennium Ecosystem Assessment 2005; Hausmann et al. 2016).

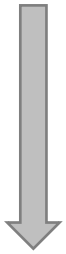
Table 5-3: Applying the mitigation hierarchy to manage impacts to people's nature-based cultural values, using the Bujagali Hydropower Project and Kalagala Offset case study and a hypothetical model case study in which different considerations for incorporating cultural heritage fully are explored

	Mitigation hierarchy	Bujagali Hydropower Project & Kalagala Offset	Considerations for incorporating cultural heritage
More preferred 	Avoid (Preventative measure)	A hydropower dam is generally constructed in a valley or at a place where the river narrows, and where the natural riverbed level drops rapidly and dramatically. This is because hydropower generation uses the "head difference" (the difference between the water level stored in the dam and the water level downstream of the dam) to drive water through the turbines that generate electricity. There is a natural head difference between the upstream and downstream of waterfalls and rapids in a river, making these locations ideal sites for hydropower dams.	Avoid hydropower development altogether by investing in other renewable energy sources that have less impact on the waterfalls and rapids (e.g. solar power, wind, geothermal). However, the many large rivers in Uganda, and particularly the Victoria Nile, offer huge hydropower potential. Thus, if hydropower is selected, find an optimal location for the dam taking all environmental and social aspects, including cultural heritage, into account. This may not be possible as most waterfalls and rapids in Uganda house spirits and sacred sites. However, some sites may be culturally more valuable than others, and moving the

	Alternative power generation technologies were not considered. Alternative hydropower sites were considered as part of the ESIA. However, of all the alternative locations, the Bujagali site was considered to have the lowest environmental impact whilst still generating substantial amounts of power. Development of Bujagali dam unable to avoid impact on sacred sites: rapids, waterfalls, sacred stones, sacred trees and shrines were inundated.	location will result in damaging less valuable sites. Therefore, if a hydropower dam is deemed necessary and unavoidable for economic growth and national development, move on to next step in the mitigation hierarchy, minimising the impacts to nature-based cultural heritage.
Minimise (Preventative measure)	The Bujagali dam was unable to minimise the impact on sacred sites and spirits as they were submerged by the reservoir.	The impact of a dam on waterfalls could be reduced by using a 'run of river' power station. This scheme diverts part of the river water going over the waterfalls into a pipeline or tunnel, allowing it to by-pass the waterfall, and flow through the turbine to generate power. At the same time, the remaining water still flows over the waterfall. However, run of river power stations require a fairly large river with lots of water, and are usually only suitable for smaller capacity power stations.



		Another alternative could be to construct a dam as far upstream as possible to maximise the 'head difference' and divert water around the waterfall to the turbines, but at the same time, make provision within the dam outlets that will allow enough water to still flow through the waterfall. Both cases create a trade-off, however. The more water that is let through to flow over the waterfall, the less that is being used to generate power. Other measures to minimise impact could be to ensure that construction activities do not take place at culturally significant times. If none or only some of these minimisation measures are feasible, move on to next step in the mitigation hierarchy.
Remediate (Compensatory measure)	Flooded sacred sites (and disturbed spirits) cannot be restored or rehabilitated.	If impacts of the hydropower project are permanent, sacred sites cannot be restored, as the aesthetics of the area have been altered, waterfalls inundated and spirits disturbed.

Less preferred 	Offset (Compensatory measure)	Comprehensive engagement was carried out with affected groups, notably the spiritual leaders. Compensation was agreed upon, and included agreeing on a new sacred site and paying for ceremonies to relocate the spirits at Bujagali to a village called Namezi. Sacred sites (and associated cultural values) downstream at the Kalagala site are being protected as part of the Kalagala offset.	However, remediation may be possible for temporary impacts. Comprehensive stakeholder engagement must be carried out between the developer, local communities and spiritual leaders to agree on acceptable compensation activities. In terms of what is acceptable, this is to be decided on in negotiation with spiritual leaders and all affected communities / groups of PAPs. Some of the shrines, sacred stones and sacred trees on land could potentially be relocated to new areas away from the dam and/or its reservoir. Compensation to take the form of paying for spirit relocation ceremonies and construction of new sacred sites that are as similar as possible to the sites being lost. Thus, based on this compensation, people may be 'no worse off' even if the exact nature and location of their sacred site has changed. However, achieving biodiversity NNL and the 'no worse off' principle in terms of nature-based cultural

heritage may not be possible, despite compensation efforts. This is owing to high irreplaceability of certain biodiversity components. Thus, it may not be possible to achieve NNL with respect to areas of high cultural or spiritual significance (BBOP 2012c).

5.5.5 Achieving the 'no worse off' principle for people, alongside biodiversity NNL

I propose that fulfilling the 'no-worse-off' principle means ensuring that local people's wellbeing is not negatively impacted by the combination of a development project and its biodiversity NNL activities (e.g. an offset; Chapter 3). This requires a decision on the scale (i.e. regional, village, interest group, household or individual) used to evaluate impacts to people's nature-based cultural heritage, and how these affect their perceived wellbeing.

The results from this study demonstrate geographical variation, with differences in how important cultural heritage is to people's wellbeing existing between the six villages. Therefore, it may not be appropriate to use a regional scale (aggregating villages) when measuring impacts on cultural heritage and wellbeing and evaluating whether the 'no worse off' principle has been achieved. However, it may not be appropriate to use the village scale (aggregating households and interest groups) either, as these results demonstrate variations in the importance of cultural heritage to wellbeing between different interest groups (socio-demographic groups). Furthermore, individuals within interest groups, as well as individuals within the same household, were found to value cultural heritage differently. Therefore, ideally, measuring impacts on cultural heritage at the individual level is to be favoured, but determining whether every individual is 'no worse off' as a result of the combined development and offset activities is not practically feasible. Changes in wellbeing (in part owing to impacts to cultural heritage) should consider people at the scale at which potential impacts are predicted to be significant (defined in accordance with ESIAs). In this case, therefore, people may need to self-define as potentially impacted by loss of cultural heritage in order to participate in discussions about ways to avoid, mitigate or compensate for these losses. Even then, there are major challenges if certain groups (e.g. women) are both highly affected by lost cultural heritage and not comfortable discussing it in public or with outsiders.

Demonstrating the 'no-worse-off' principle also requires measuring impacts on people's wellbeing, including those on cultural heritage values. This is challenging because the value of cultural heritage is not often a calculable outcome (Hernández-Morcillo et al. 2013). In some instances, economic valuation techniques (e.g. choice experiments) can be used to measure the value of certain cultural aspects such as ecotourism, landscape aesthetics and sense of place (Daniel et al. 2012; Hernández-Morcillo et al. 2013; Hausmann et al. 2017). However, many cultural values, such as religious and spiritual values, do not conform well to economic assumptions and are therefore often resistant to monetary valuation owing to their incommensurability (Chan et al. 2012; Hernández-Morcillo et al. 2013). In addition, people's feelings about the cultural values associated with nature may change over time. As a result, economic valuation methods can downplay cultural values (Infield et al. 2018). It has been found that the most frequently studied cultural aspects are the easiest to measure (e.g. recreation and tourism), which can lead to a significant gap between considering what matters to local people and what is easy to measure (Milcu et al. 2013).

"Projects like Isimba dam take people's land unwillingly and when they [the developers] are compensating, they pay for the economic value of the trees and other plants but don't compensate for the spirits that live in those trees so the spirits punish the care takers, not knowing that the land has been taken forcefully"

(Isimba-West: Nampaanyi, men's FGD)

A mixed methods approach can address this challenge, where quantitative techniques (e.g. formal surveys) are coupled with qualitative techniques (e.g. FGDs, participant observation, participatory scenario planning etc.). Although the methods used in this chapter are similar to those often employed during the ESIA process (i.e. individual questionnaires and FGDs), a deeper understanding of the development-related cultural impacts on local people was gained by focusing on impacts on wellbeing, as well as conducting in depth FGDs on cultural heritage alone. A focus on wellbeing (as suggested in Chapter 4) was beneficial as

many wellbeing components (e.g. life satisfaction, social cohesion and sense of purpose) are in part derived from the fulfilment of spiritual and cultural values (Schneider 2018).

5.6 Conclusion

This chapter demonstrates: a) the importance of nature-based cultural values to people's wellbeing within a geographical region affected by a large development project; b) how they differ between villages and groups of people; c) why cultural values need to be taken into account in biodiversity NNL strategies; and d) how an understanding of the importance of cultural values can be used to help operationalise the 'no worse off' principle. Moreover, the study illustrates how complex and difficult understanding cultural heritage can be but that ignoring cultural values, or failing to account for them adequately (e.g. in a rapid ESIA), can lead to undermining people's wellbeing. Taking time to understand people's cultural attitudes and beliefs through a mixed methods approach, including comprehensive engagement, is therefore important when designing and implementing initiatives (including NNL strategies) that are successful and sustainable (Jones et al. 2008; Schneider 2018). This may help to improve the social outcomes (and acceptability) of development projects and their associated offsets, assisting with the design of equitable NNL strategies that leave local people 'no worse off'.

Chapter 6

Local preferences for implementing socially-acceptable biodiversity offsets



Conducting an interview with a respondent

6.1 Introduction

Biodiversity offsets are the last step in a hierarchy of mitigation measures (avoidance, minimisation, remediation and offsetting) used to compensate for residual biodiversity losses caused by development, in order to achieve No Net Loss (NNL) of biodiversity (Habib et al. 2013; Apostolopoulou & Adams 2015; Maron et al. 2016). Offsets aim to balance economically important development with the conservation of biodiversity and ecosystem services (Bull et al. 2013; Gardner et al. 2013). For offsets to be effective, they need to be designed and implemented in a way that satisfies ecological, economic and social needs (Burton et al. 2017). Most research has focused on offset design and implementation from an ecological perspective (Madsen et al. 2010; Quétier & Lavorel 2011; Habib et al. 2013). However, social and ethical considerations are just as important if biodiversity NNL strategies are to be successful (Bull et al. 2017b). This has led to a recent body of work exploring the social costs of offsetting (Benabou 2014; Bidaud et al. 2017), ethical dimensions (Ives & Bekessy 2015; Spash 2015), and public attitudes towards offsetting (Scholte et al. 2016; Bull et al. 2017a; Burton et al. 2017; Rogers & Burton 2017; Vaissière et al. 2018).

Understanding and incorporating the use and non-use values that people place on nature can help to design and implement more equitable offsets (BenDor et al. 2008). Perceptions of equity, the fair or just treatment of individuals or groups, influence people's attitudes towards, and acceptance of, conservation activities (including offsets), affecting their long-term sustainability (Sommerville et al. 2010; Law et al. 2017). For example, if people affected by the development are different from those who benefit from the offset (distributional equity), perceptions of this unfairness can undermine the effectiveness and long-term success of the offset (Sommerville et al. 2010; Maron et al. 2016). In addition, the inclusion of local people in the decision-making process (procedural equity) is vital for

acceptance of interventions such as offsets. There is also a need to respect knowledge systems, values, social norms and rights of all stakeholders (recognitional equity; Law et al. 2017). As populations are not homogenous entities (Law et al. 2017), engagement provides insight into what trade-offs are acceptable or not to particular groups (e.g. loss of nature in exchange for financial gains; Bull et al. 2017b). Moreover, local people can hold values for nature that are difficult to quantify, such as cultural values (Chapter 5). Understanding local people's perceptions, preferences and values through engagement during the design and implementation of an offset scheme has the potential to: a) reduce implementation costs; b) encourage ownership; c) build trust and reduce conflict; and d) ensure that decisions are better suited to local social-cultural and environmental contexts (Sterling et al. 2017). Overall, this will help to design NNL strategies for individual development projects (including offsets) that are more acceptable to local people (Pilgrim & Ekstrom 2014; Bull et al. 2017b), that meet conservation objectives, and leave local people 'no worse off' in terms of their perceived wellbeing (Chapter 3).

Quantifying preferences using economic nonmarket valuation techniques such as choice experiments (CEs) can provide important insights into what activities and policies are more likely to be supported (Scholte et al. 2016; Burton et al. 2017; Rogers & Burton 2017). International best practice guidelines for designing and implementing offsets, such as those produced by the Business and Biodiversity Offsets Programme (BBOP), encourage the use of economic tools like choice experiments to evaluate the impacts of development and offsetting on local people's biodiversity-based livelihoods and amenities (BBOP 2009a). Such tools provide additional insights compared to the stakeholder consultations that accompany the typical Environmental and Social Impact Assessment (ESIA) process.

CEs investigate people's preferences as a function of the attributes of the policy or good being evaluated, and the characteristics of individuals affected by the policy (Moro et al. 2013; Johnston et al. 2017). The method has its origins in consumer theory, in that

respondents' preferences are not for the product itself but for the characteristics it possesses (Lancaster 1966). In stating their preference between choice alternatives, it is assumed that individuals will choose the alternative that yields the highest individual benefit (utility) to them, whatever the nature of these benefits (e.g. selfish versus altruistic). CEs provide insight into the relative importance to individuals of different attributes describing a policy option or good, and their willingness to give up some of one attribute to have more of another (Keane et al. 2016). They have become a widely used method for environmental valuation in the past two decades (Adamowicz et al. 1998; Hoyos 2010), having been adopted in diverse fields ranging from bushmeat hunting (Moro et al. 2013; Nielsen et al. 2014; Travers et al. 2017), to designing payments for ecosystem services (PES) schemes (Beharry-Borg et al. 2013; Greiner et al. 2014) and agri-environmental subsidy schemes (AES) (Christensen et al. 2011), as well as to investigate new opportunities to promote and support conservation at sites where biodiversity is not considered of high social value (Hausmann et al. 2017). CEs have also been used to study consumer preferences and drivers behind the illegal wildlife trade (Hinsley et al. 2015; Hanley et al. 2017; Nuno et al. 2018), to gauge visitors' support for various rhino management and conservation options in private ecotourism game reserves in South Africa (Lee & Du Preez 2016), motivations of trophy hunters (Fischer et al. 2014), and to identify which birding sites appeal most to birders (Steven et al. 2017). In addition, they have been used for the economic valuation of cultural heritage sites (Choi et al. 2010) and to quantify the social wellbeing derived from maritime conservation policies, with an emphasis on cultural heritage (Durán et al. 2015). Furthermore, CEs can be used to evaluate the effect of socio-demographic factors on an individual's preferences and behaviour, thereby allowing interventions to be designed that achieve fairer, more equitable and more sustainable outcomes for all members of local communities (Keane et al. 2016). 'Best practice' standards for the design, implementation and analysis of CEs are now emerging (Johnston et al. 2017), which allow policy-makers to have more confidence in interpreting the results of CE studies.

Recently, CEs have been used to explore people's attitudes towards biodiversity offsetting activities. For example, Rogers and Burton (2017) use a CE to demonstrate that Australians prefer offsets to be implemented by a third party or the Government, that direct offset activities (e.g. improving degraded habitat) are preferred over indirect activities (e.g. a research programme), and that people were strongly against locating an offset away from the impacted site. Burton et al. (2017) show that Australians are more willing to support offset policies which protect a species that is more endangered as opposed to the species impacted by the proposed development (i.e. offsets that 'trade-up'). Scholte et al. (2016) on the other hand, found that although there was overall support for the idea of biodiversity offsets in Scotland, the extent to which people were willing to offset impacts from urban development varied between respondents, with those opposing developments not willing to accept additional benefits from development despite the potential for woodland restoration. Vaissière et al. (2018) found that farmers in Northern France preferred not to sign up to biodiversity offsetting contracts that required them to convert arable cropland into grassland. However, including a monetary bonus was found to increase the likelihood of farmers signing up to the contracts, albeit at an increased cost for the developers.

In this chapter, I use the Bujagali and Isimba Hydropower Projects in Uganda and the associated Kalagala Offset to explore: 1) what compensatory activities 'Project-affected Persons' (PAPs) prefer as part of a biodiversity offset; 2) whether observable socio-demographic variables influence these preferences; 3) whether these preferences differ between geographically separate villages; and 4) whether preferences differ between villages experiencing different economic effects from the projects. This study provides an empirical example of how CEs can inform the design of socially-acceptable biodiversity NNL strategies and biodiversity offsets. This will contribute to operationalising the 'no worse off' principle, by ensuring that biodiversity NNL strategies for development projects leave local people 'no worse off' (or preferably better off) in terms of their perceived wellbeing (Chapter 3).

6.2 Material and methods

6.2.1 Background to choice modelling

Since the 1960s, several valuation techniques that rely on economic theory of consumer choice have been developed to assess the economic desirability of environmental policies (Broch & Vedel 2012). Using economic techniques to value biodiversity and incorporating those values into a decision-making process can be a useful way to demonstrate the importance of biodiversity protection to the general public (Cerda et al. 2013), as well as to provide an understanding of the broader economic value of these biological assets to society (Choi et al. 2010). Measurements of economic value could therefore assist with the development of better-targeted policies as well as help secure more effective support and funding for conservation initiatives (Choi et al. 2010).

Economic valuation techniques make use of either stated preference (SP) data, where individuals make choices based on hypothetical situations, or revealed preference (RP) data, where individuals' choices are based on real markets (Broch & Vedel 2012; Hensher et al. 2015). Auctions, for example, have been used as a method to create markets and RP data (Broch & Vedel 2012). Although RP data is advantageous as it reflects actual choice behaviour, it is often not possible to obtain RP data as not all products and services are traded on the market (Mangham et al. 2009). Moreover, the aim of many economic valuation techniques is to estimate total economic value, which includes both use values (such as activities and services) and non-use values (such as educational values) that are not normally captured by market transactions and RP data (Choi et al. 2010). Thus, SP data may be preferable to estimate total economic value as it estimates both use and non-use values (Figure 6-1).

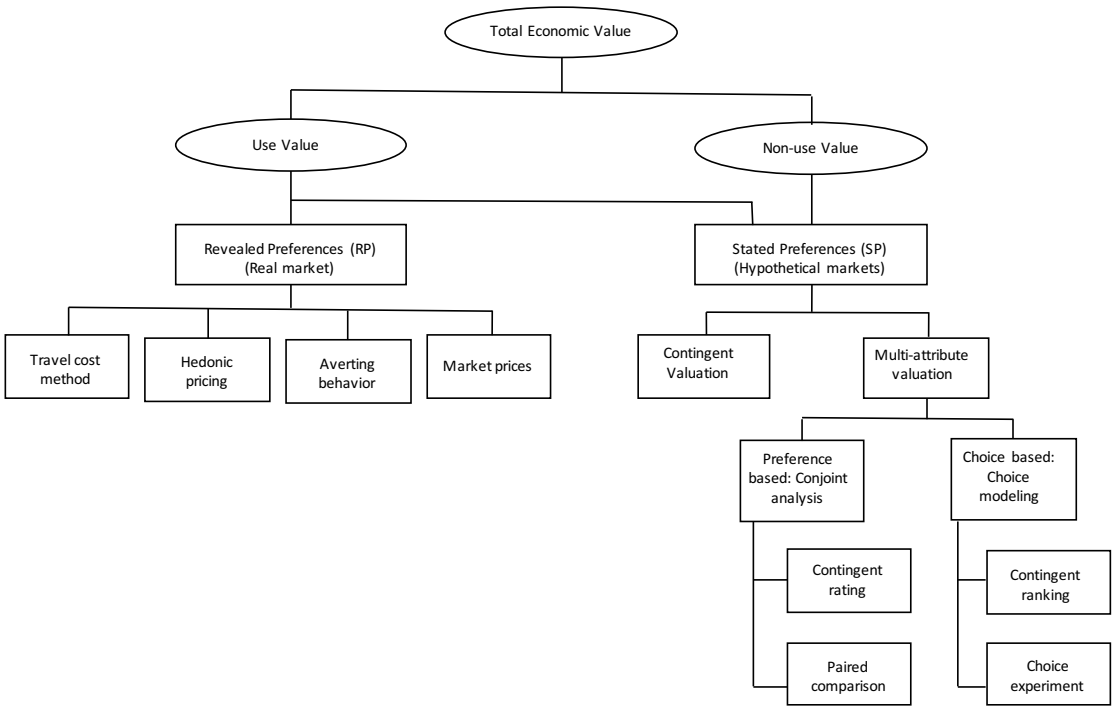


Figure 6-1: Economic valuation techniques. Modified from Choi et al. (2010) and Vega & Alpizar (2011)

Contingent valuation (CV) is one technique that uses SP data. It is a direct survey approach to estimating consumer preferences and has gained acceptance amongst both academics and policy-makers as a powerful methodology for estimating the monetary value of environmental changes (Hanley et al. 2001). In a CV survey, respondents are asked to express their willingness-to-pay (WTP) for a good (or its change; Choi et al. 2010). WTP information can be elicited in several ways, including dichotomous choice (respondents are asked to say 'yes' or 'no' to a proposition), payment cards (where respondents are asked to choose from a list of prices the one that best reflects their WTP for the good) and auction bidding (respondents are asked to say 'yes' or 'no' to escalating or descending stated prices; Choi et al. 2010). However, a number of challenges exist with CV, such as cognitive

burden, acquiescence bias (yea-saying) and hypothetical or strategic bias. This has led to other stated preference methods, such as multi-attribute valuation (and, in particular, choice modelling), becoming more popular (Hanley et al. 2001; Choi et al. 2010; Vega & Alpizar 2011).

Two techniques, differing according to the measurement scale used, belong to this multi-attribute family, namely: conjoint analysis (a preference based approach where individuals are asked to rate alternatives scenarios on a cardinal scale) and choice modelling (a choice based approach which asks individuals to choose, using an ordinal scale, among competing alternatives; Adamowicz et al. 1998; Vega & Alpizar 2011). Contingent rating (a form of conjoint analysis) is an exercise where individuals are presented with a number of scenarios and asked to rate them individually on a scale from one to ten (Hanley et al. 2001). The technique does not involve a direct comparison of alternative choices and as strong assumptions (that are not always consistent with consumer theory) need to be made in order to transform the ratings into utilities, this technique is not widely used in environmental economics (Hanley et al. 2001). Paired comparison, another form of conjoint analysis, is an exercise where respondents are asked to choose their preferred alternative out of a set of two choices and to indicate the strength of their preference on a numeric scale (Hanley et al. 2001).

Choice modelling approaches, a family of survey-based methods for modelling preferences for goods, where goods are described in terms of their attributes and the levels that these take, have also gained popularity (Hanley et al. 2001). One approach is contingent ranking, which requires respondents to rank a set of alternative options, characterised by a number of attributes which are offered at different levels across options (Hanley et al. 2001). One limitation with this method, however, is the cognitive burden associated with ranking choices with so many attributes and levels (Hanley et al. 2001). Thus, in terms of cognitive requirements from the respondents, CEs are the simplest of the choice modelling

approaches (Vega & Alpizar 2011). While CV focuses on a precise scenario and gathers information about the respondent's choice regarding that scenario, CEs attempt to understand a respondent's preference over the attributes / characteristics of the scenario rather than the specific scenario itself (Adamowicz et al. 1998).

CEs have been used to explore human preferences that influence people's behaviours in different environmental contexts. The technique is based on economic theory as it is an application of the 'characteristic theory of value' (Lancaster 1966), combined with 'random utility theory' (Manski 1977). The latter assumes that individuals choose one good over another based on the benefit that the attributes of the chosen good provide (Lancaster 1966; Hanley et al. 2006). This means that a change in one attribute could result in a change in the choice from one attribute to another. Choice experiments therefore assume that people's preferences are revealed through the choices that they make (Greiner et al. 2014). Initially developed by Louviere and Hensher (1982) and Louviere and Woodworth (1983), CEs have been widely used in the marketing, transportation and psychology literature (Adamowicz et al. 1998). The first application of a CE in environmental economics was by Adamowicz et al. (1994). Since then, CEs have become a widely used method for environmental valuation (Hoyos 2010).

6.2.2 Data collection

The study was undertaken in six villages along the Victoria Nile River in Uganda experiencing different levels of hydropower development, i.e. two villages at Bujagali (approximately 8km downstream of the town of Jinja), where construction is complete; two at Kalagala (downstream of Bujagali, within the Kalagala Offset), where no construction activities are taking place; and two at Isimba (40km downstream of Bujagali), where construction is underway (described in Chapter 2; Figure 2-4 and Figure 4-2 in Chapter 4).

These areas are highly populated and cultivated, poverty is widespread and local communities rely on the river and its associated freshwater and riparian biodiversity for their livelihoods. Several Central Forest Reserves (CFRs) occur along the river, as well as a large CFR to the west (Mabira), but these reserves are highly degraded and encroached upon. The Mabira CFR has been threatened with degazttment for the last decade, with proposals to allocate land in the reserve to sugarcane cultivation (NatureUganda 2011). This proved extremely contentious in the region and, although the proposal was abandoned, Mabira is still at risk (e.g. by the construction of the new Kampala-Jinja highway; Chapter 2). Sites along the river are culturally significant to local communities, particularly rapids and waterfalls. These rapids create the large hydropower potential but have also led to a thriving tourism industry, with white water rafting being a major source of income for the area and local communities. Refer to Chapter 2 for a more detailed description of the study area.

The CE formed part of a larger questionnaire implemented in respondents' homes, used to gather socio-demographic information including gender, level of education and age, as well as asking how long the respondent had lived in the village. This was followed by questions to explore how the construction of the dams had affected the individuals' ability to lead a good life (a proxy for wellbeing). Household poverty was measured using a Basic Necessities Survey (BNS; Davies 2016). Refer to Chapters 4 and 5 for more details on the individual questionnaire and Chapter 4 for ethical considerations.

All households were randomly selected and, where possible, the household head and another family member were interviewed. A total of 1215 individuals were interviewed (424 individuals from 286 households at Bujagali, 472 individuals from 283 households at Kalagala and 319 individuals from 178 households at Isimba).

6.2.3 Attribute selection and choice experiment design

During the CE, respondents were presented with three hypothetical alternatives per choice set, representing realistic offset scenarios, which differed in terms of characteristics or 'attributes' and their levels. In each choice set, respondents were asked to select their most preferred alternative. A conditional choice design was used, meaning that the choice sets did not include a fourth 'opt-out' alternative.

Attributes and levels were chosen to represent the four main offset obligations (described in Chapter 2): a) setting aside the Kalagala Falls and Itanda Rapids downstream of the Bujagali dam to protect their natural habitat and ecological, social and spiritual values; b) enabling tourism development activities at the Kalagala Falls site; c) not developing power generation in the future that could adversely impact the Kalagala Falls and Itanda Rapids; and d) conserving, through a sustainable management program, the ecosystems of three CFRs. These were kept consistent with the Kalagala Offset Sustainable Management Plan (Ministry of Water and Environment 2009) to ensure they were both feasible and practicable, but also aimed to improve social outcomes (through compensation), in addition to those taking place independent of the offset activities. This was accomplished by undertaking a literature review, then a focus group meeting with national and local Ugandan Government representatives who were familiar with the offset management plan. The resulting attributes and levels were discussed with representatives from the Ministry of Water and Environment (MoWE; the Government body coordinating the Kalagala Offset) to ensure their feasibility. All attributes had levels that included: a) the current situation (baseline); b) a compensatory activity with a small additional social benefit to the local community or individual compared to the baseline; or c) a compensatory activity with a large additional social benefit to the local community or individual. Five attributes, each comprising three or four levels were chosen, namely: the creation of sustainable livelihood schemes to supplement livelihood incomes and reduce reliance on CFRs; employment to

monitor and evaluate the status of the CFRs; tourism revenue-sharing with investment earmarked for community development or restoration and management of the CFRs; a tree planting / clearing programme in the CFRs; and payments to access spiritual sites (Table 6-1). The detailed attributes and levels are presented in Appendix C-1.

CEs often include a monetary attribute which allows respondents' marginal WTP for changes in attribute levels to be calculated (Scholte et al. 2016). A monetary attribute was not deemed necessary in this case, as I was interested in establishing the relative importance of a diverse set of activities, rather than placing a monetary value on offset outcomes (Aravena et al. 2014; Rogers & Burton 2017). Moreover, it may be inappropriate to ask about the personal cost incurred in achieving an offset, as it is usually a legal requirement and the financial responsibility of the developer (or Government), not the public, to cover the cost of an offset (Burton et al. 2017; Rogers & Burton 2017). Instead, trade-offs were calculated using the Marginal Rate of Substitution (MRS) between the five non-monetary attributes.

Attributes and levels were arranged into choice sets using statistical design theory (refer to Appendix B for an example of a choice set used in the study). An unlabelled efficient design (a fractional factorial design) was used to create the choice sets using the specialised software Ngene. The efficiency of the design was optimised based on the Bayesian D-error (procedure described in Appendix C-2). Presenting a large number of choice sets to a respondent places a significant cognitive burden on them. Therefore, I designed blocks of six choice sets per respondent; the order in which they were presented was randomised. Each choice card showed the attribute levels pictorially. A preceding section of the questionnaire explained the CE and gave background information on each attribute and level. Debriefing questions followed the CE, providing a qualitative assessment of attribute non-attendance (i.e. whether the respondent ignored some of the attributes whilst making

their choices). The CE section from the individual questionnaire is presented in Appendix C-3.

The questionnaire and CE was piloted in a separate, seventh village in the study area, with data collected for 74 respondents. The pilot test checked the respondents' understanding of the attributes, levels and choice task and showed that the CE and supporting questionnaire were clear, easy to understand and user-friendly. The choice data from the pilot CE were analysed and the resulting parameter estimates used to generate a more statistically efficient experimental design for use in the main survey.

Table 6-1: Attributes (offset activities) and levels used in the choice experiment

Offset and compensatory activity (attribute)	Different options to choose from (levels)
Sustainable livelihood schemes Environmentally friendly business enterprises established to enhance household incomes. Any household can participate in the scheme, provided they stop cutting down trees in the CFRs.	1. No scheme implemented 2. Participants earn UGX (Ugandan Shillings) 500 000 / year from scheme 3. Participants earn UGX 1 000 000 / year from scheme
Monitoring and evaluation employment Residents employed to assist with monitoring and evaluating the status of the CFRs. Work includes monitoring who enters the CFRs and ensuring that only people who are allowed to enter and use the CFR's natural resources do so.	1. No employment 2. 70 people employed 3. 140 people employed

Offset and compensatory activity (attribute)	Different options to choose from (levels)
Tourism revenue-sharing and sustainable investment A proportion of the tourism revenue derived from the river rafting permits will be paid into a fund and earmarked for **either** the restoration and management of the CFRs **or** community development	1. No revenue-sharing 2. USD 3 per rafting permit for management and restoration of the CFRs 3. USD 3 per rafting permit for community development in the villages
Native tree planting programme and alien tree removal in the CFRs Residents employed to remove alien trees from the CFRs and plant native tree seedlings. They will be employed for a further two years to assist with the maintenance of the new seedlings.	1. Clearing alien trees and planting of indigenous trees 2. Clearing of alien trees in the CFR only 3. Planting of native trees in the CFR only 4. No tree planting and alien tree clearing in the CFR
Access to spiritual sites at the Kalagala Falls and Itanda Rapids Money charged to visit the site will be used to pay the guides and any extra will be used to improve the site (through protection, maintenance and keeping it clean).	1. Mixed payment – free access for community and UGX 1 000 paid by visitors 2. All pay – visitors pay UXG 1 000 and community pays UGX 500. 3. Free access to everyone

6.2.4 Data analysis

Choice data from all villages were first pooled for analysis, and then analysed separately. Data were first explored with a multinomial logit model (MNL), followed by a random parameters logit model (RPL), which takes into account preference heterogeneity and error correlation across each respondent's choices (RPL model described in Appendix C-4) Dummy coding was used to capture non-linear preference variation across attribute levels. As an 'opt-out' option was not included in the experimental design, alternative-specific constants (ASCs) were not included in the models. The RPL models were estimated using Nlogit 5 and 500 Halton draws were used to simulate distributions of attributes that were assumed to be normal. A Krinsky-Robb test (Krinsky & Robb 1986) was undertaken for the pooled sample results, using 2000 draws, indicating whether respondents distinguished between the different options (levels) within the same attribute.

It has been shown that socio-demographic factors often influence people's choices (Glenk et al. 2011; Shoyama et al. 2013; Keane et al. 2016). Studies investigating, for example, the adoption of agroforestry practices in rural African communities found that gender, level of education, age, household poverty, household security, marital status and land tenure all significantly influenced adoption (Glover et al. 2013; Mfitumukiza et al. 2017; Sanou et al. 2017). To investigate preference heterogeneity, a RPL model was run using the pooled choice data, with six socio-demographic variables interacted multiplicatively with all the attributes and levels. I explored the effect of: gender, age, education level, poverty, how long a respondent had lived in the village, and whether they thought that the hydropower dams affected their ability to lead a good life. It was hypothesised that people who had lived in the village longer were more likely to value investment that benefitted the village rather than individuals. I also hypothesised that people who felt their wellbeing had changed negatively as a result of the dams may also be disillusioned with any associated

compensation activities and may therefore have more negative attitudes towards potential offset activities.

After establishing which attributes and levels significantly influenced choices, the relative importance of each attribute was compared between villages and with the pooled sample to see whether attribute preferences differed between villages. The size of attribute parameters resulting from the RPL models is not directly comparable across villages as the estimated parameters are confounded by their scale factors (i.e. error variance heterogeneity; Swait & Louviere 1993). Thus, I calculated ratios of attribute coefficients, representing the MRS between attributes, showing the rate at which respondents were willing to trade off one desirable attribute against another. Since the scale factor cancels out in this calculation, the MRS expresses the attribute values on common commensurable scales for comparisons (Lancaster 1966). The MRS (and associated confidence intervals) was calculated by dividing attribute parameter estimates by a numeraire that was: a) significant in all villages; and b) had the lowest average coefficient of variation. The 'sustainable livelihood schemes' attribute was significant in all choice sets and was found to have the lowest average coefficient of variation; it was therefore selected as the numeraire. MRS was calculated using R version 3.2.1 (R Core Team 2015).

A likelihood ratio test (Greene 1997) was carried out to test the null hypothesis that all six villages had the same preference parameters. If the null hypothesis is rejected, it can be concluded that the model parameters for the separate villages are statistically different to each other as well as to those of the pooled data. A formal comparison of each attribute-to-numeraire ratio (MRS) for each of the villages and the pooled data was carried out in R, using the approach proposed by Poe et al. (1994). Results indicated whether there is a significant difference in each individual attribute parameter between villages.

6.3 Results

6.3.1 Characteristics of respondents

Of the total sample (1215 individuals), 38% were male and 62% were female; 65% were below the age of 45, 54% had a primary school level of education, and 87% had lived in their village for more than 10 years (Table 6-2). Average household poverty levels (based on the basic necessities score) were similar across the six villages, but Bujagali-West was the least poor, whilst Isimba-West was the poorest. When asked how the construction of the dams (Bujagali and Isimba) had affected their ability to lead a good life (i.e. wellbeing), 9% said either positively or very positively, 30% were indifferent, 8% said they did not know or would rather not say, and 53% said negatively or very negatively.

When participants were asked to rate the difficulty of the CE, a similar number found the CE hard and easy; 48% finding it hard or very hard, and 43% finding it easy or very easy. The vast majority of the respondents were sure or very sure of their choices (88%). 45% and 38% of the respondents said they paid attention or strong attention to all of the attributes when they were read out, whereas only 6% and 10% said that they paid no or not much attention to some of the attributes. Interviewers rated 38% of the respondents as finding the CE difficult or very difficult, 29% medium and 34% easy or very easy. All of these results suggest that the CE was appropriately pitched and reliably answered.

Table 6-2: Characteristics of respondents

Characteristic	Number
No individuals sampled	1215
No. HHs	747
No. people per village	
Bujagali-West (Kikubamutwe)	240
Bujagali-East (Kyabirwa)	184
Kalagala-West (Kalagala)	235
Kalagala-East (Bubugo Bugobi)	237
Isimba-West (Nampaanyi)	156
Isimba-East (Bwase Buseta)	163
Gender	
Males	467
Females	748
Age	
18-30 years	397
31-45 years	387
46-60 years	274
60+ years	157
Education level	
Primary school	652
Secondary school	316
College/university	34
No formal education	213
Time respondent has lived in the village	
<5 years	90
5-9 years	67
>10 years	1053

Characteristic	Number
Not sure	5
Whether the dam has affected the respondents wellbeing	
Very positively	12
Positively	96
Neutral	363
Negatively	431
Very negatively	212
Don't know/ would rather not say	101
Average household poverty score (based on the Basic Necessities Survey) in each village	
Bujagali-West (Kikubamutwe)	0.60
Bujagali-East (Kyabirwa)	0.57
Kalagala-West (Kalagala)	0.55
Kalagala-East (Bubugo Bugobi)	0.54
Isimba-West (Nampaanyi)	0.45
Isimba-East (Bwase Buseta)	0.48
How hard / easy respondent found the questions	
Very hard	191
Hard	393
No feeling	103
Easy	431
Very easy	97
How sure respondent is of their answers	
Very sure	576
Sure	491
No feeling	114
Unsure	31
Very unsure	3

Characteristic	Number
How much attention respondent paid to the attributes when they were read out	
Didn't pay much attention to some	121
Paid no attention to some	74
Paid attention to all of them	542
Paid strong attention to all of them	459
Not sure	19
CE difficulty (ranked by interviewer)	
Very difficult	182
Difficult	274
Medium	348
Easy	259
Very easy	152

6.3.2 Preferences for offset activities

Looking first at the choice data, pooled between all villages, and without interactions with socio-economic variables, mean RPL model parameter estimates reflect the sample's values for marginal utility (or disutility) that would be derived from the attributes and levels, along with the variation of preferences around these means (Appendix C-5). The Pseudo R-squared and Akaike Information Criterion (AIC) values report decent fits for all models. All attributes and levels have a significant effect on choices at least at the 5% level, with the exception of the planting of native trees.

Clearing of alien trees and neither visitors nor residents paying to access spiritual sites were the only attribute levels with negative parameter estimates, showing that respondents disliked these choices. The reference levels of no tree planting / clearing and mixed

payment to access spiritual sites (residents do not pay but visitors pay) were the preferred options. Respondents felt most negative towards no one paying to visit spiritual sites.

The offset and compensatory activity with the highest marginal utility value in the pooled data (and therefore the most preferred activity) was tourism revenue-sharing. Of the two revenue-sharing options, investing revenues in community development was almost twice as favoured as investment in CFR management (MRS ratio = 165.7 vs 88.3; Table 6-3). The next highest MRS ratio (about half the value of CFR management) was for tree planting / clearing; the planting of native trees was most preferred, then combined tree planting / clearing, with the reference level (no tree planting / clearing) next, and clearing of alien trees last. Next, respondents preferred for everyone (residents and visitors) to pay for access to spiritual sites. This activity was preferred over the reference level of mixed payment, with no payment last. Respondents preferred sustainable livelihood schemes where they earned higher amounts of money, followed by schemes employing the most people. However, preferences for these two activities (MRS ratio = 1.0 for sustainable livelihood schemes (baseline) and 0.9 for employment; Table 6-3) were very similar and much smaller than preferences for the other attributes and levels.

There was a statistically significant difference between the two tourism revenue-sharing attribute levels (investment in CFR and investment in community development) as well as between the two levels in the payment to access spiritual sites attribute (visitors and residents pay; neither visitors nor residents pay). The three tree planting/clearing programme attribute levels also had significant differences, except for the planting of native trees level vs combined tree planting/clearing (Appendix C-6).

Geographical variation in marginal utility values was evident, with respondents in the different villages having significantly different preferences for choice alternatives (Table 6-3; Likelihood ratio test: χ^2 statistic = 306.84, df = 90, $p < 0.01$; Table 6-4). In particular,

preferences in Bujagali-West were more likely to differ significantly from those of other villages and from the pooled data (Appendix C-7). Three attributes had consistently positive effects on choice across all villages, namely, sustainable livelihood schemes, employment and tourism revenue-sharing (both investing in the CFRs and investing in community development). As with the pooled sample, respondents in all villages preferred sustainable livelihood schemes that yield the greatest amount of money. In all villages, revenue invested in community development was preferred over investment in the CFRs, but both were more preferable than the reference level of no revenue-sharing. Activities that employed more people were preferred over the reference level, but not by much.

Inter-village differences were particularly observed with the tree planting / clearance programme and payment to access spiritual sites, both in statistical significance and preferences for different levels (Table 6-3). Three villages had statistically significant positive utilities for planting of native trees, two of which also had significant positive utilities for combined planting / clearing. Two other villages had statistically significant negative utilities for clearing alien trees. There were no obvious correlations between geographical location and utilities related to tree planting/clearing (e.g. with respect to proximity to the CFRs). However significant preferences with respect to access to spiritual sites were only observed in the Bujagali villages, although villages at both the Bujagali and Isimba dams have lost their spiritual sites as a result of the dams' construction. Respondents in Bujagali-West had significantly positive utility for everyone paying to access the spiritual sites, while those in Bujagali-East had significantly negative utility for no-one paying, with respect to the baseline of visitors paying and residents not (Table 6-3).

Table 6-3: Marginal rates of substitution for significant RPL model parameter estimates for the pooled data and individual villages. All values are relative to the 'sustainable livelihoods' attribute and 2.5% and 97.5% confidence intervals are in parentheses. Non-significant estimates are shown as a dash

Attribute / level	Pooled village data	Bujagali-West Kikubamutwe	Bujagali-East Kyabirwa	Kalagala-West Kalagala	Kalagala-East Bubugo Bugobi	Isimba-West Nampaanyi	Isimba-East Bwase Buseta
Location	**-**	**Bujagali (Construction complete)**	**Bujagali (Construction complete)**	**Kalagala (no development)**	**Kalagala (no development)**	**Isimba (Construction underway)**	**Isimba (Construction underway)**
	Ratio [CIs]	**Ratio [CIs]**	**Ratio [CIs]**	**Ratio [CIs]**	**Ratio [CIs]**	**Ratio [CIs]**	**Ratio [CIs]**
Employment	0.9	2.1	0.5	0.9	0.7	0.7	0.7
	[0.7; 1.1]	[1.2; 5.4]	[0.2; 1.3]	[0.6; 1.5]	[0.5; 1.2]	[0.4; 1.5]	[0.4; 1.4]
Revenue-sharing – investing in Central Forest Reserve	88.3	175.5	51.3	108.3	85.0	75.5	70.8
	[75.3; 106.3]	[105.2; 407.4]	[35.2; 91.1]	[76.4; 165.8]	[60.4; 128.4]	[43.7; 135.6]	[39.0; 124.4]

Attribute / level	Pooled village data	Bujagali-West Kikubamutwe	Bujagali-East Kyabirwa	Kalagala-West Kalagala	Kalagala-East Bubugo Bugobi	Isimba-West Nampaanyi	Isimba-East Bwase Buseta
Revenue-sharing – investing in community development	165.7 [136.7; 207.7]	399.0 [223.8; 1016.1]	86.7 [49.0; 188.9]	157.5 [95.8; 275.8]	95.7 [50.6; 174.4]	207.5 [128.4; 395.5]	234.8 [149.4; 415.4]
Tree planting programme – Planting of native trees	46.4 [32.0; 57.8]	-	69.7 [30.7; 89.3]	50.0 [12.6; 78.5]	66.2 [34.8; 95.2]	-	-
Tree planting programme – Clearing alien trees	-24.9 [-50.8; -5.3]	-132.7 [-450.1; -34.8]	-	-	-	-	-52.9 [-144.4; -5.1]
Tree planting programme – Planting native trees and clearing alien trees	38.9 [19.5; 58.2]	-	86.6 [10.6; 125.3]	-	50.8 [8.4; 94.3]	-	-
Visitors and residents pay to access the spiritual sites	20.5 [7.6; 33.7]	71.6 [19.7; 214.4]	-	-	-	-	-

Attribute / level	Pooled village data	Bujagali-West Kikubamutwe	Bujagali-East Kyabirwa	Kalagala-West Kalagala	Kalagala-East Bubugo Bugobi	Isimba-West Nampaanyi	Isimba-East Bwase Buseta
Visitors and residents do not pay to access the spiritual sites	-9.4 [-17.8; -2.0]	-	-17.0 [-40.6; -2.6]	-	-	-	-

Table 6-4: Likelihood ratio test of parameter equality between the pooled model and the model with villages separated

Log likelihood function: pooled model	-5794.91
Log likelihood function: sum of village models	-5641.49
χ^2 statistic	306.84
Degrees of freedom	90
Significance level	$p < 0.01$

To investigate preference heterogeneity further, I interacted six socio-demographic variables with attribute levels (Table 6-5). The most significant differences between demographic groups related to poverty: less poor people (with higher basic necessities scores) had significantly higher preferences for tourism revenue-sharing and the combined planting / clearing of trees, but more negative attitudes towards sustainable livelihood schemes. Respondents who had reported that their lives had been positively affected by the dams had significantly more negative attitudes towards tourism revenue-sharing being used for community development. They also had more positive preferences for clearing of alien trees and planting of native trees. More educated people were significantly more negative in their preferences towards tourism revenue-sharing, whether it was for CFR management or for development. Men were significantly more positive towards investment in CFRs than women. Those who had lived in the village the longest, and younger people, tended to prefer sustainable livelihood schemes, while older people were more likely to prefer employment generation.

Table 6-5: RPL model parameter estimates and standard errors for the pooled village choice data, with both the mean effect and the interactions with socio-demographic variables. Standard errors are in parentheses, significant coefficients are in bold. Significance thresholds are 1% (***), 5% (**) and 10% (*)

Attribute / level	Mean RPL model estimate	Socio-demographic variable interaction					
		Gender (male)[a]	Education level[b]	Time lived in village[c]	BNS score[d]	Dam-related wellbeing change[e]	Age[f]
Sustainable livelihood schemes	0.016 [0.010]	0.004 [0.004]	-0.002 [0.003]	**0.009 *** [0.003]**	**-0.022 * [0.012]**	0.002 [0.002]	**-2.5e-04 ** [1.2e-04]**
Employment	**0.028 *** [0.008]**	0.001 [0.003]	-0.54427D-04 [0.002]	-0.003 [0.002]	-0.003 [0.009]	-0.001 [0.001]	**1.5e-0.4 * [0.9e-04]**
Revenue-sharing – investing in Central Forest Reserve	0.599 [0.751]	**0.517 ** [0.238]**	**-0.410 ** [0.174]**	0.026 [0.199]	**3.773 *** [0.853]**	-0.145 [0.104]	0.001 [0.008]
Revenue-sharing – investing in community development	**3.864 *** [1.447]**	-0.077 [0.467]	**-0.872 ** [0.342]**	0.433 [0.374]	**4.479 *** [1.654]**	**-0.968 *** [0.205]**	-0.004 [0.016]
Tree planting programme – Planting of native trees	-0.808 [1.275]	-0.124 [0.434]	0.250 [0.312]	0.061 [0.331]	1.785 [1.520]	**0.325 * [0.185]**	-0.005 [0.015]

Tree planting programme – Clearing alien trees	-1.447 [1.448]	0.358 [0.506]	-0.191 [0.0364]	-0.058 [0.372]	1.937 [1.754]	**0.378 * [0.213]**	-0.023 [0.017]
Tree planting programme – Planting native trees and clearing alien trees	**-2.624 *[1.493]**	-0.058 [0.525]	-0.262 [0.376]	0.488 [0.376]	**5.210 *** [1.855]**	0.224 [0.220]	-0.020 [0.018]
Visitors and residents pay to access the spiritual sites	0.751 [0.903]	0.247 [0.317]	0.083 [0.227]	-0.037 [0.225]	-0.770 [1.120]	-0.185 [0.133]	0.014 [0.011]
Visitors and residents do not pay to access the spiritual sites	-0.345 [0.535]	-0.050 [0.176]	-0.100 [0.128]	0.031 [0.138]	0.187 [0.616]	0.051 [0.076]	-0.001 [0.006]
Standard deviations of parameters							
Sustainable livelihood schemes	**0.027 *** [0.002]**						
Employment	**0.007 *** [0.001]**						
Revenue-sharing – investing in Central Forest Reserve	**2.065 *** [0.127]**						
Revenue-sharing – investing in community development	**3.315 *** [0.228]**						
Tree planting programme – Planting of native trees	0.156 [0.255]						
Tree planting programme – Clearing alien trees	**1.129 *** [0.135]**						

Tree planting programme – Planting native trees and clearing alien trees	**0.974 *** [0.238]**
Visitors and residents pay to access the spiritual sites	**0.709 *** [0.132]**
Visitors and residents do not pay to access the spiritual sites	**0.862 *** [0.123]**
Model fit	
Log likelihood function	-5671.060
Pseudo R-squared	0.290
AIC/N	1.579

a Gender: Female = 0; Male = 1

b Education level: No education = 0; Primary = 1; Secondary = 2; College/ University = 3

c Time lived in village: Not sure = 0; < 5 years = 1; 5 – 9 years = 2; > 10 years = 3

d BNS score: low BNS scores = high level of poverty; high BNS = low level of poverty

e Dam-related wellbeing change: Don't know/ would rather not say = 0; Very negatively = 1; Negatively = 2; Neutral = 3, Positively = 4; Very positively = 5

f Age: Average age was taken for each category. 18-30 = 24; 31-45 = 38; 45-60 = 53; 61+ = 67

6.4 Discussion

6.4.1 Preferences for compensatory actions as part of an offset in a natural resource dependent context

The results show that PAPs in the study area tend to prefer compensatory activities (for the impacts that people incur from the dams' effects on biodiversity) that benefit the whole village, rather than individually targeted activities. Overall, tourism revenue-sharing was most preferred, with revenues invested in community development; this was sometimes twice as preferred as the next activity. Owing to high poverty levels in Uganda (about 19.7% of the population live below the poverty line; UNDP 2014), it is unsurprising that people would prefer activities that contribute to improvements in community-level facilities, such as the building of schools, clinics, roads and providing potable water. Uganda has one of the highest population growth rates, doubling almost every twenty years (NEMA 2002), and with an increasing population, coupled with high poverty levels, comes the need for more and improved services in rural areas. In addition, tourism revenue-sharing is frequently carried out by the Ugandan Wildlife Authority (UWA), particularly amongst communities living in close proximity to national parks. This might mean that the concept is readily understood.

The next two most-preferred compensatory activities involved improving the degraded CFRs in the study area, either through directing revenue-sharing to CFR management or a tree planting/clearance scheme. The large gap between these activities and the most preferred activity, community development, could be attributed to the historical and ongoing context around the degazettment of the Mabira CFR. This contentious issue may have influenced respondents' choices, particularly as the CE asks for preferences for compensation options including better management of the CFRs. Approximately 85% of

Uganda's population is reliant on natural resources for their livelihood (Final Draft NEMP 2014) and fuelwood contributes more than 96% of energy for cooking (USAID 2015). In addition to fuelwood, non-timber forest products are used for various subsistence activities including charcoal, medicinal herbs, food and crafts such as drums, brooms and mats (Tugume et al. 2016). These products also contribute significantly to household livelihoods and income that can be used for school fees and other expenditures (Tugume et al. 2016). If people in the study area continue to have access to the CFRs as part of the offset (albeit restricted and monitored), they will benefit from the restoration and maintenance of the CFR. People in the study area were also found to associate the planting of trees with rainfall generation (Chapter 4). Many respondents reported prolonged dry seasons as having significant negative impacts on their subsistence farming activities (their main livelihood) and most attributed this to climate change (Chapter 4). This observation corresponds with findings from other studies in Uganda. For example, Tugume et al. (2016) found that people around the Mabira CFR (falling within the Kalagala Offset catchment) recognised the non-financial benefits of forests and, in particular, their importance in rainfall formation. Mfitumukiza et al. (2017) and Obua et al. (2006) found that farmers in Uganda attributed an increase in the severity and frequency of droughts to anthropogenic factors such as deforestation, overstocking and over-grazing, wetland degradation and bush burning.

Provisioning of natural resources and climate regulation may also explain why respondents opposed the removal of alien trees in the CFRs. Alien species such as Paper Mulberry and Eucalyptus are prevalent across Uganda, are fast growing and are a valuable source of timber and fuelwood for local communities (USAID 2006). It has been demonstrated that households in Uganda living in areas with alien species harvest higher quantities of firewood, charcoal and poles than those living in areas without them (Mungatana & Ahimbisibwe 2012). In some cases, local people are aware of the invasiveness of a species and its potential to compromise conservation efforts, but still place a high value on the tangible benefits they derive from them (Mungatana & Ahimbisibwe 2012). This could

create a conflict between the objectives of NNL for biodiversity (e.g. removal of alien species) and NNL for the wellbeing of local people (who value alien trees) if biodiversity NNL activities and compensatory activities for PAPs are undertaken in the same areas. There was no apparent geographical pattern in PAPs' preferences for tree planting / clearing between the east or west banks of the river, or between villages experiencing different effects from the dams or in more or less proximity to a CFR. This may be because all respondents value trees for the same reasons and all the CFRs near each village are equally degraded.

After revenue-sharing and tree planting / clearance, respondents preferred that people pay to access spiritual sites, with some even having negative attitudes towards free access. Visitor and residents' payments would support the tour guides and assist with the sites' upkeep, benefitting those village members who use the spiritual sites, but potentially also benefitting the entire village by attracting tourists. However, results indicated that people in both villages at Bujagali felt most strongly about access to spiritual sites. This is surprising because the sacred sites at Bujagali have either been lost or disturbed, whilst those at Kalagala are intact and attract visitors who have to pay to access the sites. Perhaps respondents at Bujagali used to experience benefits from tourists and visitors paying to access the spiritual sites, and know how valuable this income can be. This corresponds with results found in Chapter 4, which found that respondents in Kalagala-West and the two villages at Bujagali, saw cultural heritage as a comparatively important factor contributing to their wellbeing, although it was found most important in Kalagala-West.

Despite significantly influencing choice, preferences for compensatory activities as part of an offset that could benefit only a few individuals (e.g. sustainable livelihood schemes and employment) were relatively low. At most, two people per village would be employed by the Government to assist with monitoring and evaluating the status of the CFRs, while only those who agreed to stop harvesting in the CFR would be allowed to participate in the

sustainable livelihood schemes. Perhaps respondents felt that it was unlikely that they themselves would be the recipients of these benefits and hence preferred activities benefitting the whole village, or perhaps they actively preferred more socially equitable activities despite lower opportunities for individual benefit.

6.4.2 Influence of socio-demographic variables on preference

The findings suggest a degree of preference heterogeneity in the sample. The fact that more educated people had negative attitudes towards revenue-sharing may be because they were more sceptical about revenue-sharing benefits actually reaching the villages and were better informed about how carefully these processes need to be managed. For example, tourism revenue-sharing is widely applied around Ugandan protected areas, but is often criticised for revenue not reaching local communities, creating distrust and resentment (Franks & Twinamatsiko 2017). People who had lived in the village the longest were the most positive about sustainable development enterprises, perhaps because people who have a strong attachment to a place are more likely to want to improve it (Gifford & Nilsson 2014). The fact that older people placed a higher value on employment than younger people could be because, in rural areas, the elderly do not receive a pension and are therefore reliant on their social networks for care and economic support (Golaz et al. 2017). Men's preferences for investment in the CFRs could be explained by some studies that found that men were more positive towards tree conservation on farms and more likely to establish plantations than women were (Sanou et al. 2017). In some cultures, women may not be allowed to plant trees (Glover et al. 2013) or their personal and household activities may constrain their participation in activities such as managing the CFRs (Sanou et al. 2017). For example, in some regions in Uganda it is taboo for women to plant trees as this demonstrated land ownership (Mukasa et al. 2012).

6.4.3 Implications for biodiversity NNL strategies for development projects

This chapter shows how CEs could be used to design NNL and offset activities for individual development projects that reflect the preferences of local communities, thereby identifying more locally socially-acceptable offset activities (Burton et al. 2017). However, there is a limitation to CEs that needs to be recognised when interpreting the results. This economic approach is based on the assumption that people's different values (e.g. cultural values versus community development values) are fungible. In most instances, however, this is not the case and some values cannot be interchanged. Therefore, careful attention needs to be paid when selecting attributes and efforts must be made to understand how people value these proposed attribute activities.

Nevertheless, the method provides a new way to engage stakeholders in offset design. I found that the respondents felt comfortable answering the CE survey, understood the concept and were interested in the outcome. Focus group meetings to design the attributes and levels for the CE provided an opportunity for discussion of what types of offsets are feasible and could address both social and biodiversity needs. Having focus groups for both implementing agencies and local people provided an opportunity for open discussion and new ideas to emerge. Reporting results back to the study villages also offered an opportunity for discussion of the reasons behind the results. Furthermore, reporting the results to the Government will encourage the consideration of social acceptability in future offset activities being designed in the study area. It is increasingly recognised that greater investment in community engagement via various participatory approaches, including CEs, can lead to more sustainable and resilient interventions (Christie et al. 2006; LaRiviere et al. 2014; Travers et al. 2017), and help businesses and development gain a 'social license' to operate (Kemp et al. 2006).

CEs can also identify which socio-demographic factors influence people's preferences, thereby allowing for the design of targeted biodiversity NNL strategies which benefit both biodiversity and people. For example, offsets could be designed to improve gender equity or target the worst-off in society, or those who feel particularly negative wellbeing impacts of developments (bearing in mind any incentives for strategic answers: Johnston et al. 2017). These results emphasise that offsets (as part of a NNL strategy) need to be tailored not only to compensate for residual biodiversity damage, but also to account for the needs and wants of the local communities impacted by development-related biodiversity loss. This will help to ensure that they are left 'no worse off' (or preferably better off) as a result of the combined offset and development (Chapter 3). Choice experiments provide one tool to support this approach.

Chapter 7

Discussion



Victoria Nile River

7.1 Overview

A consistent theme throughout this thesis is the need to account for people's use and non-use values for nature in order to design and implement equitable, socially acceptable and sustainable biodiversity No Net Loss (NNL) strategies for individual economic development projects. This is reinforced by moral arguments (e.g. human rights and ethical reasons) to leave people 'no worse off', a practical rationale (e.g. gaining a social licence to operate (SLO)), and policy or regulatory requirements (e.g. International Finance Corporation (IFC) Performance Standards; BBOP 2012d; Bidaud et al. 2018). Extensive research already exists in both the conservation and development fields exploring the effects of economic development projects on people's lives. For example, there is consensus in international environmental and conservation policy circles that conservation activities should 'do no harm' to local people (e.g. CBD 1992; BBOP 2012, IUCN World Parks Congress 2014), with conservation interventions being designed to incorporate goals such as poverty alleviation and sustainable livelihoods alongside biodiversity conservation outcomes (Beauchamp et al. 2018a). Similarly, the many dynamic, multi-layered social impacts of economic development projects are widely recognised, such that in addition to managing and mitigating these impacts, academics, practitioners and developers recognise the need to focus on delivering long-term positive outcomes from development projects (Burdge & Vanclay 1996; Franks & Vanclay 2013; Vivoda & Fulcher 2017; Jijelava & Vanclay 2018). However, the social aspects of biodiversity NNL strategies have, until recently, received less attention than the ecological aspects, and whether they include all people's values associated with nature is questioned (Apostolopoulou & Adams 2015; Ives & Bekessy 2015; Moreno-Mateos et al. 2015; Table 3-1 in Chapter 3).

The overall aim of my research is to address this gap, by investigating how people's values for nature can be balanced with biodiversity NNL at the level of individual development

projects. This study endeavours to overcome the disconnect between theory and practice that research is so often criticised for (Knight et al. 2008). I focus on low-income developing countries, where local people are heavily reliant on natural resources for their livelihoods, with Uganda as my case study. To realise this aim, I first conceptualised the 'no worse off' principle, where three key questions emerged: a) no worse off for whom? b) no worse off of in terms of what? and c) no worse off compared to what? I then explored these questions in detail using empirical research on the Bujagali and Isimba Hydropower Projects and associated Kalagala Offset in Uganda, which also served to operationalise the 'no worse off' principle.

These questions represent three major challenges to be addressed if biodiversity NNL strategies for individual development projects are to be designed and implemented to leave local people 'no worse off and preferably better off'. In this last chapter, I discuss how my research has contributed to addressing these questions and the challenges and opportunities facing their operationalisation. I then discuss whether it is possible to achieve both biodiversity NNL and the 'no worse off' principle, followed by the implications that my research has for NNL strategies and the practical application of the 'no worse off' principle. I end by suggesting directions for future research.

7.2 The 'no worse off' principle

In Chapter 3 I laid out the conceptual framework underpinning a new principle for development projects seeking NNL of biodiversity to ensure that local people are 'no worse off'. The principle states that these projects should achieve an outcome whereby:

> *Project-affected people (appropriately aggregated) should perceive the component of their wellbeing associated with biodiversity losses and gains to be at least as*

good as a result of the development project and associated biodiversity offset, throughout the project lifecycle, than if the development had not been implemented.

7.2.1 No worse off for whom?

Consequences for Project-affected Persons (PAPs; those who are significantly impacted, either directly or indirectly, by gains and losses in nature as a result of the combined development project and biodiversity offset) should be measured and managed by following the mitigation hierarchy, which has compensation as a last resort. These people are the ones who should benefit from any compensation activities and they should perceive the compensation received to be commensurate with the residual losses incurred. However, identifying PAPs and understanding what is meant by 'significantly impacted' (i.e. how impacted does an individual have to be to qualify as a PAP?) is challenging. Measuring the significance of an impact is arguably one of the most difficult, yet crucial, components of the Social Impact Assessment (SIA) process (Joyce & MacFarlane 2001). Impacts need to be defined on a project-by-project basis, using professional judgement, and their significance depends on the impacts' level of intensity, duration and geographical extension (Roche 2000; Joyce & MacFarlane 2001). Thus, it is likely that the criteria used to define significance are determined by a combination of objective and subjective measures and will ultimately depend on who is carrying out the evaluation (Roche 2000; Joyce & MacFarlane 2001).

Throughout this thesis, PAPs are interpreted as people who will be physically displaced or whose source of income and standard of living will be negatively affected by a restriction of access to natural resources (or gains and losses in nature) as a result of the combined development and biodiversity offset (World Bank 2015). However, owing to the spatial and temporal distribution of these nature-related impacts on their wellbeing, PAPs affected by losses of nature at a development site may not be the same as those affected by the biodiversity offset. Moreover, PAPs can be directly or indirectly affected by losses and gains

in nature associated with the combined offset and development project. Identifying directly affected PAPs is relatively straightforward as they usually reside in close proximity to the development and biodiversity offset sites and a direct causal relationship is evident (Joyce & MacFarlane 2001). However, identifying PAPs who are indirectly affected is more challenging as many people, often further afield from the development and offset sites, could qualify as being indirectly affected. For example, downstream water users are often overlooked during assessments of PAPs (Vanclay et al. 2015). In my study, respondents at Kalagala, located downstream of Bujagali, perceive that they have been indirectly affected by the Bujagali dam construction, even though they reside relatively far away from the directly impacted Bujagali site (Figure 2-4; Chapter 2). Respondents said that the river water levels fluctuate because of the dam, reducing the amount (and species) of fish in the river, and negatively impacting their livelihoods (Chapter 4). This is a common indirect social impact experienced by communities downstream of large dams, as the reduced river flow changes fish breeding habitats, reducing the amount of fish and negatively affecting people who rely on fishing for their livelihood (Vanclay 1999).

Judgements therefore need to be made by ESIA practitioners as to the indirectly affected PAPs that should be included in the impact assessment. A line needs to be drawn on how significantly impacted an indirectly affected individual has to be to qualify as a PAP, as it is not feasible to evaluate the social impacts on every single PAP. Environmental and Social Impact Assessments (ESIAs) and SIAs often use an Area of Influence (AOI) or a 'Social Area of Influence' to delineate areas that will be directly and indirectly affected by a development project's activities as well as to identify the communities (nearby and distant) likely to be affected, both directly and indirectly (IFC 2012a; Vanclay et al. 2015). This means that PAPs in the vicinity of the development project and offset will generally fall within the AOI. However, defining and delineating the extent of an AOI can be difficult and sometimes ambiguous, especially when it comes to including areas of indirect impact, and deciding on which indirectly affected PAPs fall within the AOI. For example, it cannot simply

be assumed that the intensity of social impacts experienced decreases with increasing distance from the project and offset site (Vanclay et al. 2015). There is no standard methodology on how to define an AOI, and the AOI will vary from case to case depending on project type (e.g. linear infrastructure, energy, extractives, etc.) and impact type (e.g. different AOIs will exist for evaluating noise, air quality, water, etc.). Defining the AOI therefore relies on the professional expertise and experience of the ESIA practitioner and that of the competent authority assessing the ESIA.

One of the first steps in the SIA process that helps overcome the challenges of defining an AOI or Social Area of Influence, is the scoping phase, partly informed by a social profiling exercise (Franks & Vanclay 2013). This exercise is the process of understanding the communities and stakeholders that will potentially be impacted (directly or indirectly) by the development project, and includes: a) a thorough stakeholder analysis; b) discussions on the socio-political settings; c) an assessment of the differing needs, interests, values and aspirations of the various sub-groups of the affected communities, including a gender analysis; d) an assessment of their impact history (i.e. their experience of past projects and other historical events); e) a discussion of trends happening in those communities; f) a discussion of assets, strengths and weaknesses of the communities; and g) optionally the results of an opinion survey (Vanclay et al. 2015). While there are legitimate challenges with defining the AOI or Social Area of Influence for SIAs, using the scoping phase effectively and prioritising issues through social profiling can assist in allocating resources efficiently, allowing for more in-depth analyses of the key impacts on PAPs (Esteves et al. 2012).

In my research, I engaged with PAPs in six villages directly adjacent to the hydropower projects and falling within the Kalagala Offset catchment (Figure 2-4; Chapter 2). This by no means encompasses all PAPs in the study area as many other villages along the river have been affected, either directly or indirectly, by development impacts on nature.

However, for the purpose of this research, it would not have been feasible to study all PAPs and, instead, a small representative sample was selected. In addition, the extent of the Kalagala Offset catchment (Figure 2-4, Chapter 2) is extremely large, encompassing many villages. Thus, PAPs affected by the offset (e.g. those near the Mabira Central Forest Reserve (CFR)) will be different to those located adjacent to the river, being directly or indirectly affected by the Bujagali dam. Therefore, it may not be practically feasible to measure social impacts on every PAP in the offset catchment and ensure that every PAP is 'no worse off', especially as some may not be impacted at all.

One solution is to aggregate PAPs in order to measure the social impacts experienced from gains and losses in nature associated with the combined development and offset projects. Measuring social impacts at a large aggregation unit (e.g. village or region) will often be simpler, faster and less costly than measuring impacts at the individual level. However, people in the same location and within the same community can have multiple, varied, interacting and sometimes conflicting interests and concerns (Waylen et al. 2013). Therefore, aggregation might lead to social inequity and environmental injustice issues when it obscures variations between individuals (or groups of individuals), and hides who the 'winners' and 'losers' are from the nature-related impacts of developments and associated biodiversity NNL activities (Daw et al. 2011; Agarwala et al. 2014; Dawson & Martin 2015). Aggregating people and using averages to characterise them may also lead to disadvantaged and marginalised groups of people, whose status differs from the average, being overlooked (Dawson & Martin 2015). It has been suggested that over-simplistic assumptions are often made when the conservation sector engages with the concept of 'community'. Contrary to what is often assumed, communities are not unified, homogenous, cohesive units with shared norms, but instead have strong social structuring (e.g. via wealth, caste and livelihoods) and comprise individuals with varying attitudes and behaviours (Agrawal & Gibson 1999; Waylen et al. 2013).

When exploring people's perceptions about the impacts of the dams on their wellbeing in Chapter 4, heterogeneity was observed between socio-demographic groups. Men were more likely to say that the dam had negatively affected their wellbeing than women. Similar heterogeneity was found in Chapter 5, with perceptions about how important cultural heritage is to wellbeing varying depending on socio-demographic groups, particularly gender, education level, poverty, primary livelihood and the time lived in the village. This supports the point that there is social heterogeneity within a community, and that the processes that connect people need to be understood, rather than assuming that all people near the development or offset site are one cohesive unit (Agrawal & Gibson 1999; Waylen et al. 2013). Heterogeneity between socio-demographic groups has been found in other studies too. For example, a study of Maasai pastoralists in northern Tanzania found conceptualisations of wellbeing to differ between genders and age groups (Woodhouse & McCabe 2018). Britton and Coulthard (2013) found that women rated community relationships higher than men in Northern Ireland fishing communities. A study on the social impacts of the Lesotho Highlands Water Project found that women were more vulnerable than men to the negative consequences of the project, reporting increased workloads, reduced access to natural resources, less access to compensation benefits from the project, and having almost no access to formal work opportunities (Tilt et al. 2009).

One of the reasons behind the assumption of community homogeneity is that people living within the same geographic location (e.g. in rural areas of developing countries) may hold similar occupations, depend on the same natural resources in the same way, have the same language and belong to the same ethnic group (Agrawal & Gibson 1999). However, this is not always the case. A study by Seymour et al. (2011) found that although they lived in the same area, rural communities and individuals within these communities were heterogonous in the values that they assigned to the same river in south-eastern Australia. Chapter 4 demonstrated geographical heterogeneity in wellbeing conceptualisations and prioritisations in the study area, particularly across locations experiencing different degrees

of economic development. For example, the importance of the health and social relations wellbeing domains decreased downstream (increasing in distance from the town of Jinja), where villages became poorer and more remote. In addition, the results from the choice experiment (CE) in Chapter 6 found that preferences for compensatory activities as part of an offset differed geographically. Geographical variation, particularly in wellbeing conceptualisations, has also been observed in Cambodia (Beauchamp et al. 2018b) and Tanzania (Woodhouse & McCabe 2018). Moreover, social impacts of development (e.g. hydropower) also differ depending on geographical scales. For example, communities living near the dam site or reservoir may experience significant negative impacts, but communities living downstream may in fact benefit owing to increased reliability of irrigation water supply (Tilt et al. 2009). Thus, the findings from one village (or from one community) cannot be extrapolated to another village (or community) even though they are in the same study area, as it may result in misleading generalisations being made (Daw et al. 2011; Agarwala et al. 2014; Dawson & Martin 2015). Thus, when it comes to compensating for impacts arising from project-level NNL strategies (to ensure that local people are left 'no worse off'), there is no 'one size fits all' solution; what one village (or one individual) may consider as a 'benefit' to their wellbeing may not be the same as another village (or individual; Chapter 6).

It is therefore essential to understand the dynamics of the social system when selecting an aggregation unit to measure and assess impacts (Coulthard et al. 2018). If carried out comprehensively, the SIA social profiling exercise will be a valuable first step towards understanding the social complexity of a study area and assist ESIA practitioners with identifying the most appropriate aggregation unit. Daw et al. (2011) suggest that the greater the inequality in the system, the greater the need to disaggregate people when measuring impacts on wellbeing. The SIA process already recognises that different socio-demographic groups (and individuals within those groups) have different interests and hence different perceptions of the impacts that they will experience (Roche 2000). For example, men of

working age may be favourable towards a development project owing to potential job opportunities, whilst older women may be concerned about the social and cultural impacts (Vanclay et al. 2015). A gender analysis is required during the social profiling exercise to understand how men and women are differentially affected, but one also needs to take care to appreciate that women are not homogenous, nor are men (Vanclay et al. 2015). Any further inequality in the system should also be identified during the social profiling exercise. This will allow for the impacts on wellbeing resulting from losses and gains in nature to be measured and assessed at the scale at which potentially significant impacts are incurred, helping to identify how the poor, vulnerable and marginalised groups are affected. The results from my research indicate that perceived impacts on wellbeing from NNL strategies at my case study site should at least be measured at the interest group level (e.g. different socio-demographic groups). However, there is a trade-off between aggregation unit, budget and time, meaning that there is no perfect basic unit for evaluating whether people are 'no worse off'. Expert judgements need to be made by the ESIA practitioner on a project-by-project basis. However, regardless of the aggregation unit selected, the choice must be justifiable and communicated transparently.

7.2.2 No worse off in terms of what?

Demonstrably achieving the 'no worse off' principle proposes that local people should be left 'no worse off' in terms of their perceived wellbeing from a development's NNL strategy. In order to do this, a thorough understanding of the magnitude and distribution of the dynamic impacts (both positive and negative) associated with gains and losses of nature is needed. My research suggests that a human wellbeing framework could be applied to evaluate and measure the perceived social outcomes from biodiversity NNL (Chapter 3) and demonstrates how this can be done in practice (Chapter 4). This provides a more nuanced understanding of the impacts experienced by local people than measures of single economic indicators such as economic status. It could also overcome the challenge that

costs and benefits experienced by an individual are not symmetrical, meaning that a cost will be felt far more than a benefit.

Wellbeing is complex and multi-dimensional, so operationalising the concept and measuring wellbeing require the inclusion of many wellbeing components. A thorough measure of wellbeing requires that all wellbeing dimensions (material, relational and subjective) and domains (material possessions, health, security, social relations and freedom of choice and action) affected by biodiversity losses and gains from NNL strategies be measured separately (Britton & Coulthard 2013; Beauchamp et al. 2018b). This wide array of components could make understanding, monitoring and robust measurements of changes to wellbeing an impractically large and impossible task (White 2009; Palmer-Fry et al. 2017). Thus, one disadvantage facing (and potentially limiting) the uptake of this proposed wellbeing approach is that measuring and assessing wellbeing may appear to be an unmanageable task to ESIA and SIA practitioners, especially given their limited time and expertise in wellbeing evaluations (White 2009; Woodhouse et al. 2015). One solution could be for practitioners and policy-makers to select and measure a manageable subset of wellbeing components from a pre-existing pool of appropriate wellbeing indicators (e.g. Bossel 2002; Palmer-Fry et al. 2017).

ESIAs and SIAs tend to focus on measuring impacts on the simpler, more quantifiable, material aspects of wellbeing (e.g. economic status and livelihood activities), excluding subjective and relational elements. It is recognised that many mitigation policies specified in ESIAs and SIAs lack emphasis on the social and cultural impacts and that losses, such as social connection to lands, are challenging to evaluate in a cost-benefit analysis (Tilt et al. 2009). A focus on wellbeing and incorporating wellbeing assessments into the social profiling exercise carried out during the SIAs could therefore address this. However, unless clear guidance exists, specifying that subjective and relational wellbeing dimensions need to be evaluated could potentially complicate the baseline and impact assessment

procedures employed in ESIAs and SIAs. These procedures are generally already well-established, with a series of international best practice principles, published by the International Association for Impact Assessment (IAIA), available to guide professionals involved in ESIAs and SIAs. The principles specify the need to follow the precautionary principle, namely, to preserve social and cultural diversity and account for equity (Tilt et al. 2009). One document emerging from the IAIA principles is the International Principles for Social Impact Assessment (Vanclay 2003). The fact that these procedures are already well-developed could possibly make the concept of wellbeing less appealing to adopt, despite its apparent significant benefits.

On the other hand, several prominent interdisciplinary wellbeing frameworks have been widely accepted and adopted in practice (Agarwala et al. 2014). This could encourage the uptake of wellbeing evaluations as part of the ESIA and SIA processes. Currently, the most influential objective indicator of wellbeing is the United Nations Development Programme's (UNDP) Human Development Index (HDI; King et al. 2014). It measures wellbeing by aggregating four objective indicators (life expectancy at birth, mean years of schooling, expected years of schooling, and gross national income per capita) across three dimensions: health, education and living standards (UNDP 2011). In the late 1990s, the UK Department for International Development (DFID) adopted the sustainable livelihoods approach (SLA), developed by Chambers and Conway (1992; Agarwala et al. 2014). This approach is used to assess the vulnerability of a population according to their assets and entitlements, in order to inform poverty reduction interventions (King et al. 2014). The Happy Planet Index (HPI) and happiness economics, an aggregate of both subjective and objective measures of wellbeing, have been adopted by the New Economics Foundation, which attempts to measure sustainable wellbeing per unit of resource consumption (Agarwala et al. 2014). Bhutan's gross national happiness (GNH) index is used for policy-making in the country, and the Bhutanese Government aims to increase the GNH (Uchida

& Oishi 2016). One or a combination of the above approaches could form a practical framework for wellbeing assessment.

A second disadvantage to wellbeing assessments is that individuals with less experience measuring wellbeing may not get robust, trustworthy results, compared to individuals who have been trained in wellbeing evaluations and have experience applying them (Woodhouse et al. 2016). Moreover, a comprehensive measurement and understanding of the complex, culturally specific and context-dependent wellbeing priorities and conceptualisations, particularly subjective and relational dimensions, require a participatory approach (e.g. Beauchamp et al. 2018b; Woodhouse & McCabe 2018; Chapter 4). Understanding how impacts on sensitive topics, such as cultural heritage, affect people's wellbeing using participatory approaches requires experience, sensitivity, a considerable amount of time and can be costly (King et al. 2014). In addition, multiple methods (e.g. qualitative and quantitative mixed methods) are required, that need to be carried out in a culturally sensitive manner, building trust amongst the local communities (Woodhouse et al. 2015, 2016). Specific attention also needs to be paid to the composition of the research team, using independent individuals who speak the local languages and who are ideally from the study area, which will go a long way to building trust in the local community (King et al. 2014). Even then, some groups of people may not be willing to discuss the topic (e.g. women), and some impacts (e.g. to sacred sites) may not be fully understood as a part of an ESIA and SIA (Chapter 5).

Employing economic tools and participatory approaches alongside wellbeing evaluations is a useful approach to find out what compensatory activities people prefer and are more likely to support as part of a NNL strategy, aimed at leaving them 'no worse off' in terms of their wellbeing. Greater investment in community engagement via various participatory approaches can lead to more sustainable and resilient interventions (Christie et al. 2006; LaRiviere et al. 2014), as well as assisting businesses and developers to gain a 'social

licence' to operate (Kemp et al. 2006). The tools used in my research could provide additional insights compared to the stakeholder consultations that accompany the typical ESIAs. For example, results from my CE demonstrated that communities preferred compensatory activities that benefited the wellbeing of the wider community (e.g. community development and restoration of the CFRs as opposed to activities that would only benefit a few individuals' wellbeing (e.g. sustainable livelihood schemes and employment). CEs are, however, only participatory up to a point, as they are designed to get participants to reveal their preferences indirectly. Furthermore, the attributes and levels that I used for the CE were limited in their scope as they were not entirely participatorily designed. Although they were designed based on consultations and Focus Group Discussions (FGDs) with national and local Ugandan Government representatives who were familiar with the Kalagala Offset Sustainable Management Plan, I did not carry out any consultations with the local communities to discuss the attributes and levels. Thus, the compensation measures presented as part of the attributes and levels were not chosen by the local communities and so may not truly reflect the activities they would prefer, but rather the activities that the Ugandan Government (and I) thought they would prefer. CEs are technical, difficult to carry out, and often require the specialised expertise of an economist during the design and analytical phases. Moreover, significant time needs to be invested in training research assistants on how to carry out the CE correctly. In addition, a poorly designed CE can provide misleading results about preferences, perhaps even channelling people into giving answers that the developer would like to hear. Thus, despite the benefits of CEs, if carefully used by technical specialists, there will be reluctance to adopt them as a mainstream tool in the ESIA and SIA processes.

Other more participatory approaches, such as participatory scenario building and modelling, could be used to include local people in the design and implementation of offset activities, and may be better received by local actors (Enfors et al. 2008; Oteros-Rozas et al. 2015). Scenario planning exercises can be carried out with stakeholders during

workshops or focus group discussions, with the aim of describing multiple plausible alternative future scenarios that highlight relationships between environmental factors, management choices and system dynamics in a way that can inform decision-making (Enfors et al. 2008). However, participatory approaches may not always be amenable to rapid impact assessments, meaning that more time may need to be dedicated to the ESIA and SIA processes. They also require experienced facilitators as well as a bigger, more interdisciplinary team, including anthropologists and social scientists who know the study area and understand the local people (King et al. 2014; Woodhouse et al. 2016). This may not always be practically feasible, however, owing to the time and budgetary constraints that accompany ESIAs. Social research, capacity building and consultation take time, and SIAs and ESIAs are rarely carried out within a timeframe that is adequate for gathering reliable cultural and social data (Joyce & MacFarlane 2001). This may lead to a trade-off between qualitative and quantitative approaches, as well as between what is practically feasible and the degree and depth of participation (Palmer-Fry et al. 2017). Nevertheless, it is recognised that using participatory approaches in the ESIA and SIA processes can lead to better decision-making by accessing and incorporating local knowledge (Mahmoudi et al. 2013). In summary, if measuring the impact of a NNL strategy on wellbeing and using participatory approaches to design compensatory activities are to become standard practice in ESIAs and SIAs, national governments and financial institutions need to make them requirements. Moreover, technical guidance (and training) detailing how to measure impacts on wellbeing needs to be available for ESIA and SIA practitioners. Despite considerable progress being made in SIA methodologies over the last decades, the methodology, techniques and approach still need to be improved (Mahmoudi et al. 2013) and the inclusion of wellbeing frameworks could be a positive first step.

On a different note, an avenue for future research would be to explore which trades between wellbeing domains as part of an offset are acceptable to PAPs and which are not. Compensation measures often attempt to improve people's material wellbeing (e.g. through

monetary compensation or the creation of alternative livelihood schemes), but these measures may be rejected if they are perceived as undermining other important aspects of wellbeing such as social relations. Bidaud et al. (2017) demonstrated an example of the trade-off between the material and social relations wellbeing domains, leading to negative perceptions about the development and biodiversity offset activities. They found that material benefits arising from a development project (e.g. donated chickens and agricultural equipment) were erosive to social relations by causing conflicts within the community around the distribution of the benefits.

Although not explored in my study, some compensatory activities involving a substitution or trade between wellbeing domains may be acceptable to local people so long as, overall, they perceive their wellbeing to be at least as good as a result of the biodiversity NNL strategy. When designing biodiversity offsets from an ecological perspective, international good practice guidelines (e.g. BBOP and IFC), encourage trading 'in-kind' (creating or preserving 'like-for-like' habitat), thereby demonstrating ecological equivalence (Habib et al. 2013; Bull et al. 2015b; Chapter 2). Achieving positive social outcomes as part of an offset may be better served by trading 'out-of-kind' in terms of wellbeing components, and especially by 'trading up'. For example, decreased satisfaction in income (material domain) could possibly be compensated for by improvements in satisfaction in social and family relations (social relations domain; Agarwala et al. 2014).

Another direction for future work could be to explore the acceptability of trades in wellbeing over time. Decisions about time lags and uncertainty are often raised as a technical challenge during the ecological design of a biodiversity offset as part of a NNL strategy (Bull et al. 2013; Gardner et al. 2013; Maron et al. 2016). In practice, biodiversity offsets usually involve trading certain and immediate losses of biodiversity for less certain and potentially delayed gains (Maron et al. 2016). This is generally unacceptable owing to the risk of offset failure in the future, especially with regards to restoration offsets (Bekessy et al. 2010).

Unlike gains and losses in biodiversity, a temporal gap between the loss of wellbeing associated with a development impact and accrual of wellbeing benefits associated with the combined offset and development may be acceptable. Local people may be willing to accept an immediate loss in their perceived wellbeing and instead wait for benefits to their wellbeing to accrue in the future. For example, many respondents in my study were sad about the development of the dams, but many acknowledged the future benefit because the dams will attract development and investment to the region and their village, thereby improving their wellbeing in the long-term. However, as with biodiversity, there is the risk that these wellbeing gains might never materialise or, if they do, might not meet the local people's expectations. Therefore, the more socially acceptable approach would not allow for time during which the wellbeing of affected people is diminished; in other words, time lags should be avoided. Regardless, trades in wellbeing still ought to demonstrate additionality, whereby the social outcomes from the biodiversity NNL project should demonstrably exceed any existing obligations (i.e. something that would have occurred anyway, without the development and biodiversity offset).

7.2.3 No worse off compared to what?

In order to determine whether the outcome of a biodiversity NNL strategy has been achieved, a reference scenario needs to be specified against which to measure gains and losses in nature (Maron et al. 2013; Bull et al. 2014a; Maron et al. 2018). However, depending on which reference scenario is selected, different environmental outcomes will be reached, as each scenario captures a different environmental trend against which biodiversity NNL is to be achieved (Bull et al. 2014a; Maron et al. 2018). For example, using a fixed reference scenario refers to the baseline of the present or future state of biodiversity without development, whilst a dynamic reference scenario (or counterfactual) accounts for the background biodiversity trend over time (Maron et al. 2018).

Specifying a reference scenario against which to measure social gains and losses from the combined development and biodiversity offset is paramount to determining whether PAPs are left 'no worse off'. ESIAs and SIAs make use of baseline studies in order to understand the current situation of a system prior to the development taking place. Baselines in SIAs serve as an appraisal of the state of a community or sub-groups of people before project activities occur (Franks & Vanclay 2013). This static or fixed reference scenario provides a benchmark against which potential social impacts can be anticipated and change measured. Fixed reference scenarios are advantageous because of their simplicity (Maron et al. 2018), and as a result they are favoured in traditional ESIAs and SIAs. However, understanding the baseline of the current system in question alone is often not adequate when evaluating the success of a NNL strategy, and there is the need to project counterfactuals, that is, the expectations of what would have occurred in the absence of the intervention (Bull et al. 2015a). Specifying counterfactuals to measure gains and losses in biodiversity from development projects and NNL strategies allows for a more rigorous measurement and attribution of impact (i.e. the difference between the outcome of the intervention and the estimated outcome in the absence of the intervention), that makes for a better understanding of true project outcomes (Bull et al. 2014a; Bull et al. 2015a; Bladon et al. 2018). Moreover, social baseline assessments carried out as part of the SIA process need to account for the dynamics of social changes that are already underway in the communities, which are not driven by the economic development project (Joyce & MacFarlane 2001).

However, developing counterfactuals is harder than baselines, as counterfactuals are subject to additional sources of uncertainty, particularly because they involve predicting plausible environmental trends (Bull et al. 2015a; Bladon et al. 2018). Defining a counterfactual to measure social gains and losses is further complicated as externally or internally valid approaches can be taken to specify a counterfactual (i.e. one that makes sense to external parties, such as the developer, or one that makes sense to the PAPs

directly affected; Chapter 3). Externally valid approaches tend to be dominant in practice (Palmer-Fry et al. 2017). Thus, in following international best practice guidelines (e.g. IFC Performance Standards), developers may decide that the 'no worse off' principle can be demonstrated with respect to an objective, externally-valid counterfactual. Measuring the impacts of a project on wellbeing in an externally valid way could be done with quasi-experimental designs using control groups (households or villages selected based on their similarity to the study group; e.g. Clements & Milner-Gulland 2015). However, these designs require technical, quantitative analytical skills, which may limit their use (Woodhouse et al. 2016), particularly in ESIAs.

Another challenge with externally-valid counterfactuals is that perceptions of wellbeing are not static, as people's situations vary over time (Milner-Gulland et al. 2014). Thus, perceived wellbeing has temporal fluidity and is shaped by people's continually changing aspirations, adaptations to new circumstances and the resultant social interactions. Therefore, comparing a persons' quality of life before and after an intervention is difficult (Milner-Gulland et al. 2014). For this reason, finding an appropriate control group against which to measure and compare impacts is not always possible. People often compare their situation with others, for example with what their neighbours have and how well off they appear, especially if they appear to have more or are getting wealthier. Consequently, people affected by the offset and development may compare themselves against their own perceptions of change, compared to 'another' group which they see as relevant. This will determine whether they feel better or worse off as a result of the offset and development. The result can be an internally valid, but not externally valid, counterfactual. Both internally and externally valid approaches are important, as internal validity will often determine the local social sustainability of the NNL strategy whilst external validity ensures that, by focusing on project comparisons, NNL strategies lead to more wide-reaching benefits, with potentially better returns on environmental investments (Palmer-Fry et al. 2017).

The impact of development projects on people's perceived wellbeing is highly context dependent and may vary over the life of the project. In addition, what matters to people in their assessment of their wellbeing and perceived impacts of an intervention is also likely to have been changed by the intervention itself (Milner-Gulland et al. 2014). For example, the Bujagali and Isimba hydropower projects had different impacts on people's perceived wellbeing (Chapter 4). PAPs at Isimba perceived their wellbeing to be more negatively affected compared to those at Bujagali. At the time of this study, construction of the Isimba dam was nearing completion, whereas construction of the Bujagali dam was completed in 2012, allowing five years for any benefits from the Bujagali dam to accrue. People at Isimba may be experiencing and anticipating negative effects presently from the construction phase of the dam, and consequently feel the dam is negatively affecting their wellbeing. On the other hand, at Bujagali, people's perceptions about the inconvenience and negative impacts on their wellbeing during construction of the dam may have faded over the five years since construction, and they have had time to adapt to the new conditions.

Over time, people will also become accustomed to any improved social outcomes resulting from biodiversity NNL strategies and potentially become reliant on them. According to biodiversity NNL theory, offsets should last for at least as long as the impact of the development (Bull et al. 2013). Therefore, developers should ensure that the desired social outcomes from a NNL strategy last for at least as long as the impacts of the development and biodiversity offset. Development projects might have a designated lifespan ranging from a few years or less to many decades or more, depending on the nature of the project. It is increasingly recognised that many projects (e.g. in the energy and extractive sectors) need to plan for closure early in the project's lifecycle (Vanclay et al. 2015). Closure of a project can have both direct social impacts (e.g. communities become dependent on the project for their income) and indirect impacts (e.g. environmental pollution can continue long after closure, significantly affecting the livelihoods and health of local communities; Vanclay et al. 2015). Should the NNL strategy (and development project) not be in place in

perpetuity, the loss of any social outcomes associated with the strategy could have a significant negative impact on the peoples' general wellbeing. Thus, a closure strategy needs to take into account the social impact that the loss of a biodiversity NNL strategy will have on PAPs.

The counterfactual against which to measure changes in biodiversity and wellbeing can be decreasing (biodiversity and/or wellbeing are reducing over time), stable, or increasing (biodiversity and/or wellbeing improving over time). Counterfactuals used in biodiversity NNL assessments should accurately reflect the biodiversity trend (without the development project) as far as possible (Bull et al. 2015a). Conversely, it could be argued that counterfactuals used to measure changes in wellbeing (i.e. in order to implement the 'no worse off' principle) should only be used if people's wellbeing is stable or going to improve (without the development project). Should wellbeing be declining without the development, then the baseline wellbeing at the point at which the project is to be developed could instead be required to be maintained (i.e. a fixed reference scenario / baseline). Hence, a reference scenario against which to measure the 'no worse off' principle could well be best defined asymmetrically, meaning that a fixed baseline is required when wellbeing is declining or static, and a counterfactual is required when wellbeing is increasing.

A limitation to my study is that I could not fully explore how counterfactuals could be developed and operationalised as part of my case study, because it was a 'post-hoc' analysis. Although fixed socio-economic baselines were developed as part of the ESIAs for both the Bujagali and Isimba hydropower projects (by R.J. Burnside International Limited 2006 and the Ministry of Energy and Mineral Development 2013 respectively), the assessments were limited to quantifiable material elements (e.g. economic status, livelihoods and socio-demographic profile of the study area), leaving out impacts on subjective and relational wellbeing components as they were not required for the ESIA. Therefore, it was not possible to compare my findings, which evaluated perceived impacts

of the dams on people's wellbeing, with people's perceptions of their original wellbeing from surveys carried out before the development, to see whether their overall wellbeing was maintained or changed over time.

It is possible to construct a baseline or counterfactual post-hoc or after the project has started using carefully designed surveys, for example based on recall data (Woodhouse et al. 2015). However, caution is needed when assessing people's recollection of pre-project conditions as this recall is likely to be biased (Woodhouse et al. 2015), especially if people are asked to remember how their quality of life was five years ago (e.g. in the case of Bujagali). An area of future work could be to develop a baseline or counterfactual against which to judge wellbeing outcomes from the combined development project and biodiversity offset. This will contribute to demonstrably achieving the 'no worse off' principle. The framework devised by Bull et al. (2015a) for developing counterfactuals in the context of a biodiversity offset in Uzbekistan could be one example of how to do this. Based on primary and secondary data sets, the framework analyses the historical socio-ecological trends of the target (e.g. a habitat of species), including patterns of social, institutional, economic and physical change, to develop a combination of baselines and qualitative counterfactuals which could be used to guide decision-making. This framework has been successfully applied by Bladon et al. (2018) to develop social, ecological and institutional counterfactuals for fisheries management planning in Bangladesh.

7.3 Trade-offs and win-win optimism

In theory, the 'no worse off' principle is seen as additional, rather than an alternative, to the need to ensure biodiversity NNL. Thus, one should not be achieved at the expense of the other, meaning that ecological and social goals should be aligned as much as possible. However, in reality, trade-offs are ubiquitous and initiatives that achieve economic development, whilst conserving nature and improving the wellbeing of local communities,

are difficult to realise and appear to be elusive (Wells & McShane 2004; Sunderland et al. 2007; Daw et al. 2015). Win-win scenarios (the simultaneous achievement of positive environmental and development outcomes) are strived for because they appear to be ethical, efficient and highly marketable. However, this win-win optimism may be flawed and there is recognition that many situations on the ground involve competing, rather than complementary, social, economic and ecological goals (McShane et al. 2011). This raises the question whether it is actually feasible to achieve both NNL of biodiversity and the 'no worse off' principle in practice, whilst still allowing for sustainable economic development, and, further, whether it is possible to achieve a win-win scenario where a net gain of biodiversity is achieved and local people perceive themselves as being left better off.

Results from the CE in Chapter 6 demonstrate an example of this trade-off between development, conservation objectives and wellbeing. Local people were found to place a high value on the restoration and maintenance of their CFRs and opposed the removal of alien trees in these reserves. Alien species such as Paper Mulberry and Eucalyptus are fast growing and are a valuable source of timber and fuelwood for local communities (USAID 2006). Furthermore, people in the study area were found to associate trees with rainfall generation (Chapter 4). Many respondents reported prolonged dry seasons as having significant negative impacts on their subsistence farming activities (their main livelihood) and most attributed lack of rainfall to climate change. This could create conflict between the objectives of NNL for biodiversity (e.g. removal of alien species) and NNL for the wellbeing of local people (who value alien trees) if biodiversity NNL activities and compensatory activities for PAPs are undertaken in the same areas.

Consideration of these social, economic and ecological trade-offs (real, potential and perceived) will result in better designed, more resilient and more sustainable initiatives and, importantly, the ability to recognise when and why this may not be possible (McShane et al. 2011). Moreover, the acknowledgement of conflicting views and interests permits

constructive compromises to emerge, encouraging and promoting dialogue, creativity and learning (Hirsch et al. 2011). In the example from my case study, one compromise could be to refrain from removing alien trees in the buffer zone around a CFR, thereby allowing local residents continued access to them.

Understanding and resolving trade-offs can be difficult when people have diverse relationships with nature. Depending on what value they attribute to nature, trades in nature under biodiversity NNL strategies will fall into different trade-off categories (Bull et al. 2017b). People have 'sacred' values such as justice and human life, which they are not willing to trade for more 'secular values' such as money (Daw et al. 2015). Moreover, some nature components may be irreplaceable to an individual, household or community (BBOP 2012c). Trade-offs that pit sacred values against secular values are morally incommensurable, leading to 'taboo' trade-offs (Daw et al. 2015; Bull et al. 2017b). Thus, there are limits or thresholds to what can be traded, and as a result biodiversity offsets may not be a viable option in all situations (Brownlie & Botha 2009; Bekessy et al. 2010; BBOP 2012b). For example, biodiversity offsets could not be used to compensate for impacts that result in global extinction of a species (BBOP 2012b; Pilgrim et al. 2012). On the other hand, 'routine' trade-offs between secular values are morally acceptable as they tend not to involve value conflicts and can be rationally evaluated with cost-benefit logic (Daw et al. 2015). 'Tragic' trade-offs, trades between different sacred values, are more complicated because the unavoidable loss of one sacred value in exchange for a gain in another could be reasoned as ethically acceptable (Daw et al. 2015; Bull et al. 2017b). Therefore, a limitation of the CE used in Chapter 6 is that this economic approach is based on the assumption that people's different values (e.g. cultural values versus community development and more 'secular' values) are fungible. In most instances, however, this is not the case.

Chapter 5 demonstrated a trade-off between nationally significant economic development projects (i.e. Bujagali and Isimba Hydropower Projects) and local people's nature-based cultural values (i.e. sacred sites). National economic benefits often outweigh local spiritual values within the decision-making process for development projects owing to new markets, the need for development and spiritual values becoming irrelevant because of 'modernisation' (Rutte 2011). Respondents said that compensation in the form of relocation ceremonies for the impacted sacred sites and the construction of new sacred sites was acceptable provided that the correct ceremonies and procedures were followed. Moreover, the new site needed to be as similar as possible to the old site. This means that, with such a relocation exercise, people may feel 'no worse off' even if the exact nature and location of their sacred site has changed. However, achieving biodiversity NNL and the 'no worse off' principle in terms of nature-based cultural heritage may not have ever been possible at this site, owing to the high irreplaceability of some natural elements (e.g. waterfalls). This is despite comprehensive engagement activities carried out during the ESIA and agreement on compensation efforts with spiritual leaders. Therefore, it may not be possible to achieve either NNL of biodiversity or the 'no worse off' principle with respect to areas of high cultural or spiritual significance (BBOP 2012c).

Hard choices will emerge about what trade-offs are acceptable as each choice, even the best one, will involve some form of loss (McShane et al. 2011), as it is not practically feasible to ensure that every individual PAP believes they are 'no worse off'. Decisions will also need to be made about what the best acceptable (but also feasible) alternative is when designing biodiversity NNL strategies, if NNL of biodiversity objectives and the 'no worse off' principle's objectives conflict. To do this, ways to identify and communicate these trade-offs are needed (Hirsch et al. 2011). This will involve employing mixed methods (e.g. collecting quantitative data through surveys and qualitative data through FGDs) and participatory processes amongst local communities to better understand what they value and which trade-offs will be socially acceptable. Despite the array of perceived negative

impacts associated with the Bujagali and Isimba dams, just under half of the people sampled were happy about the development of the dams and felt that the dams had positively affected their wellbeing. They were willing to accept trade-offs (e.g. losing access to natural resources) as they recognised the need for national economic development and that the dams could generate development in their village and region. Moreover, some respondents were willing to trade off their current wellbeing against their children's future wellbeing, acknowledging that in the long-term the dam will benefit future generations through attracting development to the region.

An understanding of different priorities amongst different groups of people is needed, particularly as there is no 'one size fits all' solution when progressing through the mitigation hierarchy and, as a last resort, designing compensation schemes. For example, the CE found that men had different priorities to women when it came to compensatory activities, being significantly more positive towards investment in CFRs than women. Thus, compensatory programmes need to be designed and tailored to account for different priorities amongst socio-demographic groups. For example, a rural development plan for a large hydropower development in Lesotho accounted for gender dynamics within a community by providing different training to men and women (welding and masonry training for men and dairy and poultry training for women; Tilt et al. 2009). The process of public participation, listening to local voices and including them in the design and implementation of project-level biodiversity NNL strategies, is therefore essential to help compensation measures target local people's priorities. This will help to ensure that local people are 'no worse off' and to build support and trust for the initiative, whilst also having positive social and environmental outcomes.

7.4 Implications for biodiversity NNL strategies and practical application of the 'no worse off' principle

The previous sections discussed the practical challenges of identifying PAPs and defining an AOI, adopting wellbeing measurements and economic valuation techniques such as choice experiments, developing counterfactuals and addressing trade-offs between NNL of biodiversity and the 'no worse off' principle. Addressing these challenges and accounting for them in the design and implementation of project-level biodiversity NNL strategies will go a long way to operationalising the 'no worse off' principle.

It is unlikely that the 'no worse off' principle will gain traction and uptake with developers and ESIA and SIA practitioners unless guidance is in place to assist those involved in economic development projects seeking to achieve NNL of biodiversity. To address this, a set of 'good practice principles' are currently being drafted to guide and support commissioning agencies and investors, company directors and sustainability managers, consultants, competent authorities, auditors, contractors, policy-makers, academics and the general public to ensure that NNL projects generate sustainable and equitable outcomes. The research presented in this thesis forms the basis of these principles.

IFC Performance Standard 5 (land acquisition and involuntary resettlement) and Performance Standard 6 (biodiversity conservation and sustainable management of living natural resources) together clearly indicate that people negatively affected by biodiversity offsets should be compensated for their loss (Bidaud et al. 2018). However, this specification could be missed if the standards were read in isolation. Furthermore, BBOP standards acknowledge that offsets may have negative impacts on local people and that these impacts need to be managed, with equity being listed as a key principle (BBOP 2009a). Although international standards, and their incorporation into national policies, express the need for local costs associated with biodiversity offsets and NNL strategies to

be mitigated, this does not always happen in practice; hence a gap exists between the standards and policies and their implementation. For example, both the offsets associated with the Ambatovy mine and Rio Tinto mine in Madagascar have been criticised for their negative impact on local people (Bidaud et al. 2018). Clarification on the meaning and interpretation of the international standards, development of incentives to encourage companies to comply with them, better integration between social and environmental studies, and acknowledgment of the very real local costs, will go a long way towards addressing this policy-implementation gap.

It has been argued that the onus should be placed on lenders (e.g. the World Bank) to ensure that capacity is in place to guarantee that there is proper oversight to ensure that these international commitments are met during the offsetting process (Bidaud et al. 2018). This is particularly important for instances when the state does not have the capacity to properly conduct the monitoring required to ensure compliance with its own national policies and international standards. Government departments, companies and civil society organisations often lack sufficient capacity and resources to understand, develop and implement comprehensive environmental policies correctly (Quétier et al. 2014; Phalan et al. 2018). For example, with my case study, while the oversight of the Kalagala Offset is the responsibility of the Ugandan Government, there have been shortcomings in ensuring that commitments specified in the Offset Sustainable Management Plan have been attained (Esmail 2017). This stems from weak institutional capacity at both national and local government administrative levels and ambiguities in terms of responsibilities and ownership (Chapter 2).

In practice, the best way to encourage the uptake of the ‘no worse off’ principle, and the specialised approaches used and recommended in my thesis, is for them to be specified in the Terms of Reference (ToR) from a commissioning agency or international financial institution, such as the World Bank. Even if ESIA practitioners recognise the benefits of

measuring impacts on wellbeing and understanding local priorities for offset measures, they are unlikely to include these approaches in their bids (owing to budgetary and time constraints in a competitive tendering environment), unless the lender requires them and can evaluate the proposals. Furthermore, time will need to be invested in training practitioners on how to carry out these methods. This will be particularly challenging for practitioners in developing countries, such as Uganda, who may not have access to training nor the capacity to carry out these new methods. Engaging with developers, commissioning agencies, financial institutions and practitioners about the 'no worse off' principle and the need to include it in their ToR is, however, a positive first step towards raising awareness about the need for equitable NNL strategies for individual development projects.

It should not only fall on the ESIA practitioners to specify the need to meet the 'no worse off' principle and carry out these techniques, but rather also on the developer, commissioning agency or lenders. Owing to their specialised and technical nature, financial institutions and organisations such as the World Bank should be responsible for appointing (and paying for) specialists required to carry out wellbeing assessments and economic valuation techniques. For example, the World Bank already has an internal behavioural sciences team, The Mind, Behaviour, and Development Unit (eMBeD), that works with project teams, governments, scientists and practitioners to contribute to the global effort to eliminate poverty and increase equity. Perhaps new specialists could be added to this team or existing members trained to carry out wellbeing assessments for large infrastructure projects. In addition, natural capital accounting (NCA) could be another technique adopted to support the assessment of NNL for both people and biodiversity. Natural capital is the stock of nature (biotic and abiotic) that combine to produce a flow benefits to local people through ecosystem services (e.g. clean air, food, water, shelter, medicine, climate regulation etc.; Guerry et al. 2015). NCA integrates natural resource and economic analysis, demonstrating how natural resources contribute to the economy and how the economy affects natural resources, and has been identified as a vehicle for mainstreaming

the value of nature into decision-making and development policies (King et al. 2017; Vardon et al. 2017). Addressing social aspects of biodiversity NNL may be more expensive in the short-term, but will lead to significant savings in the long-term as they will aid the design and implementation of more equitable, socially acceptable and sustainable biodiversity NNL strategies for individual development projects.

7.5 Future research

My research has focused on incorporating people's use and non-use values associated with nature into project-level NNL strategies, using a case study in Uganda. However, a significant limitation to my work was that no offset activities were actually taking place at the time of my study. This is despite the fact that a biodiversity offset was agreed upon by the World Bank and the Ugandan Government (with an Indemnity Agreement being signed in 2007; R.J. Burnside International Limited 2006) and a Sustainable Management Plan for the offset up to 2019 (Ministry of Water and Environment 2009) being established, detailing the activities that were supposed to be underway (Chapter 2). Subsequent to my research, the Kalagala Offset has drawn significant international attention, with independent audits of the offset activities being carried out (The Biodiversity Consultancy, Pers. Com.), debate surrounding the potential impact that the Isimba Hydropower Project could have on the offset (http://www.monitor.co.ug/Business/World-Bank-decide-Bujagali-Isimba-dam-row/688322-3805150-15tgyje/index.html) and an ESIA Addendum being compiled to evaluate the potential impact of the Isimba Hydropower Project on the Kalagala Offset area (Environment & Resource Management Consultant 2017). In addition, the World Bank is undertaking a refinancing project for the Bujagali Hydropower Project (https://www.devex.com/news/world-bank-refinancing-of-uganda-s-bujagali-hydropower-scheme-under-the-spotlight). Therefore, my research will hopefully inform the refinancing project and, in particular, the update of the Kalagala Offset Sustainable Management Plan.

The research presented in this thesis will be used to develop industry briefing notes for international audiences, including the World Bank, as well as for national and local Government agencies (notably the Ministry of Water and Environment, the Ministry of Energy and the National Environment Management Authority (NEMA)) and other stakeholders in Uganda, including non-governmental organisations (NGOs), consultants, developers and academics. Hopefully the results will assist by informing the development of equitable, socially acceptable biodiversity offset activities as part of the Kalagala Offset.

Another limitation is that much of the conceptual thinking behind the thesis evolved after the case study site had already been selected. Although this case study was recommended by in-country project partners, in retrospect, a more appropriate case study could have been selected that would have allowed me to explore local people's perceived impacts on wellbeing and cultural heritage resulting from gains and losses in nature associated with a biodiversity offset that had been implemented. As it was, I was only able to explore the perceived social impacts stemming from the two hydropower development projects, and compare them with an area where an offset was planned, but not yet implemented. The study by Bidaud et al. (2017), on the other hand, used an existing, well-established biodiversity offset in Madagascar to explore the impacts on local people's wellbeing. However, unlike my work, Bidaud et al. (2017) did not study the perceived impacts that the economic development (a major nickel mine, Ambatovy) had on local people's wellbeing. Thus, an area for future research would be to find an appropriate case study that would allow the perceived impacts on wellbeing from both the implemented offset and development project to be evaluated and compared. Perhaps even a Before-After-Control-Intervention (BACI) design could be used whereby villages experiencing the intervention (e.g. offset and development activities) and control villages that are as similar as possible but not experiencing the intervention are selected. These control villages would represent the counterfactual. Social change in the control village is assumed to be taking place over time and would be similar to that experienced in the intervention villages in the absence of

the intervention (Woodhouse et al. 2016). In the BACI design, baseline data on wellbeing indicators would then be collected from both the control and intervention villages, before the intervention starts, as well as information on the indicators after the intervention. For example, Clements and Milner-Gulland (2015) used a BACI design to evaluate the impact of three payment for ecosystem service (PES) interventions on deforestation and wellbeing in Cambodia.

In addition, further research is needed on how the application of first three steps in the mitigation hierarchy (avoidance, minimisation and remediation) can be strengthened in order to manage impacts on wellbeing and cultural heritage resulting from NNL strategies. These steps should be applied long before biodiversity offsetting and compensation are even considered as an option. However, much of the research to date has instead focused on the social impacts arising from the last stage of the hierarchy, biodiversity offsetting (Bidaud et al. 2017; Sonter et al. 2018; and to an extent, this thesis). Concerns have been raised that the first step in the hierarchy, avoidance, is often ignored, misunderstood and poorly applied by developers, practitioners and regulators (Villarroya et al. 2014; Phalan et al. 2018). A renewed focus on these early stages in the hierarchy, particularly avoidance, as early on in the planning process as possible, could help to limit the impacts of large-scale development projects on biodiversity (Phalan et al. 2017), but also on local people's wellbeing, before measures such as offsetting and compensation need to be considered.

Another avenue for future work would be to scale up the research presented in this thesis from project-level biodiversity NNL strategies and apply it to wider national policy levels. There is a need for a more strategic and coherent approach to address the global loss of biodiversity as a cohesive whole and to better balance nature conservation and economic development (Arlidge et al. 2018). Traditionally the mitigation hierarchy is carried out on a project-by-project basis and often at small spatial extents, leading to the underestimation of cumulative impacts resulting from multiple current (or future) development projects

(Saenz et al. 2013). Design and implementation of biodiversity NNL policies therefore need to take into account the wider landscape context, aggregating the impact of individual development projects and allowing for the identification of current and future threats to the long-term maintenance of achieving the required conservation outcomes (Kiesecker et al. 2010; Gardner et al. 2013). Blending mitigation decision-making with landscape-level conservation planning can assist in identifying instances where proposed development and conservation priorities conflict (Saenz et al. 2013). One suggestion is that a global mitigation hierarchy framework, capable of being implemented at both project and national levels, could be used to measure all human impacts on biodiversity (Arlidge et al. 2018). This framework would act as a foundation for considering the relationship between conservation and economic development, informing policy-makers how sustainable development could be achieved globally.

International guidelines (such as those of BBOP) emphasise the importance of an offset design to take into account any foreseeable future development activities that may affect the long-term outcomes of an offset, including development by third parties, such as government agencies or the private sector (BBOP 2012d). Cumulative impact assessments are often carried out as part of the ESIA process, but it has been suggested that cumulative social impacts require greater attention in both project-level and strategic assessments (Esteves et al. 2012). Therefore, more research is needed on the cumulative social impacts associated with several project-level NNL strategies. For example, an ESIA Addendum found that the Isimba Hydropower Project will have a negative impact on the existing Kalagala Offset, thus the impacts on the existing offset will need to be offset (Environment & Resource Management Consultant 2017). However, even if this is possible, the displaced offset will still create a spatially unequal distribution of costs and benefits between villages and PAPs in the area, and more research is needed on how to achieve the ‘no worse off’ principle at a wider landscape level.

7.6 Conclusion

Demonstrably achieving biodiversity NNL from an ecological perspective is difficult enough, with several technical, ethical and governance challenges existing (Chapter 2). However, accounting for the social impacts associated with biodiversity losses and gains under NNL strategies can make the concept even more complicated. My study does not intend to add to the complexity of biodiversity NNL strategies, but rather to use a grounded approach to demonstrate why it is important (and necessary) to account for local people's biodiversity-related values and ensure that they are left 'no worse off' by developments and their associated biodiversity NNL strategies. When combined with international good practice guidelines (e.g. BBOP and the IFC Performance Standards), the research presented here provides valuable insight into how equitable biodiversity NNL strategies can be designed and implemented. However, further work is still needed on how to fully and practically operationalise the 'no worse off' principle and how to scale it up to national level NNL policies. As a start, these results provide insight into how governments, financial institutions and developers can design, implement and maintain equitable, socially acceptable and sustainable project-level NNL strategies that conserve nature but also leave local people 'no worse off or preferably better off'.

References

A21 Tonbridge to Pembury Dualling Statement of Case 2010. The highways Agency, UK.

Abunge, C., S. Coulthard, and T. M. Daw. 2013. Connecting marine ecosystem services to human well-being: insights from participatory well-being assessment in Kenya. Ambio **42**:1010-1021.

Adamowicz, W., J. Louviere, and M. Williams. 1994. Combining revealed and stated preference methods for valuing environmental amenities. Journal of environmental economics and management **26**:271-292.

Adamowicz, W. L., P. Boxall, M. Williams, and J. Louviere. 1998. Stated preference approaches for measuring passive use values: choice experiments and contingent valuation. American Journal of Agricultural Economic **80**:64-75.

Adams, W. M., R. Aveling, D. Brockington, B. Dickson, J. Elliott, J. Hutton, D. Roe, B. Vira, and W. Wolmer. 2004. Biodiversity conservation and the eradication of poverty. Science **306**:1146-1149.

Adams, W. M., and J. Hutton. 2007. People, parks and poverty: political ecology and biodiversity conservation. Conservation and Society **5**:147-183.

Adams, W. M. 2015. The political ecology of conservation conflicts, in: S. M. Redpath, R. J. Gutiérrez, K. A. Wood and J. C. Young (Eds.), Conflicts in conservation: navigating towards solutions. Cambridge University Press, Cambridge, U.K, pp. 64-78.

Agrawal, A., and C. C. Gibson. 1999. Enchantment and disenchantment: the role of community in natural resource conservation. World development **27**:629-649.

Agarwala, M., G. Atkinson, B. Fry, K. Homewood, S. Mourato, J. Rowcliffe, G. Wallace, and E. J. Milner-Gulland. 2014. Assessing the relationship between human well-being and ecosystem services: A review of frameworks. Conservation and Society **12**:437-499.

Anthwal, A., N. Gupta, A. Sharma, S. Anthwal, and K. I. H. Kim. 2010. Conserving biodiversity through traditional beliefs in sacred groves in Uttarakhand Himalaya, India. Resources, Conservation and Recycling **54**:962-971.

Apostolopoulou, E., and W. M. Adams. 2015. Biodiversity offsetting and conservation: reframing nature to save it. Oryx:1-9.

Aravena, C., P. Martinsson, and R. Scarpa. 2014. Does money talk? — The effect of a monetary attribute on the marginal values in a choice experiment. Energy Economics **44**:483-491.

Arlidge, W. N., J. W. Bull, P. F. Addison, M. J. Burgass, D. Gianuca, T. M. Gorham, C. Jacob, N. Shumway, S. P. Sinclair, and J. E. Watson. 2018. A Global Mitigation Hierarchy for Nature Conservation. BioScience **68**:336-347.

Armitage, D., C. Béné, A. T. Charles, D. Johnson, and E. H. Allison. 2012. The interplay of well-being and resilience in applying a social-ecological perspective. Ecology and Society **17**.

Baker, L. R., A. A. Tanimola, and O. S. Olubode. 2018. Complexities of local cultural protection in conservation: the case of an Endangered African primate and forest groves protected by social taboos. Oryx **52**:262-270.

Balée, W. 2013. Cultural forests of the Amazon: a historical ecology of people and their landscapes. University of Alabama Press, Alabama, U.S.A.

Balmford, A., and T. Whitten. 2003. Who should pay for tropical conservation, and how could the costs be met? Oryx **37**:238-250.

Ban, N. C., M. Mills, J. Tam, C. C. Hicks, S. Klain, N. Stoeckl, M. C. Bottrill, J. Levine, R. L. Pressey, T. Satterfield, and K. M. A. Chan. 2013. A social–ecological approach to conservation planning: embedding social considerations. Frontiers in Ecology and the Environment **11**:194-202.

BBOP (Business and Biodiversity Offsets Programme). 2009a. Biodiversity Offset Cost-Benefit Handbook. BBOP, Washington, DC, USA.

BBOP (Business and Biodiversity Offsets Programme). 2009b. The relationship between biodiversity offsets and impact assessment: A BBOP Resource Paper. BBOP, Washington, DC, USA.

BBOP (Business and Biodiversity Offsets Programme). 2012a. Guidance Notes to the Standard on Biodiversity Offsets. BBOP, Washington, DC, USA.

BBOP (Business and Biodiversity Offsets Programme). 2012b. Resource Paper: Limits to what can be offset. BBOP, Washington, DC, USA.

BBOP (Business and Biodiversity Offsets Programme). 2012c. Resource paper: No net loss and loss-gain calculations in biodiversity offsets. BBOP, Washington, DC, USA.

BBOP (Business and Biodiversity Offsets Programme). 2012d. Standard on biodiversity offsets. BBOP, Washington, DC, USA.

BBOP (Business and Biodiversity Offsets Programme). 2013. To no net loss and beyond: an overview of the Business and Biodiversity Offsets Programme (BBOP). BBOP, Washington, DC, USA.

BBOP (Business and Biodiversity Offsets Programme). 2014. To no net loss of biodiversity and beyond: A summary of conference discussions. London, UK.

Beauchamp, E., T. Clements, and E. Milner-Gulland. 2018a. Assessing medium-term impacts of conservation interventions on local livelihoods in Northern Cambodia. World Development **101**:202-218.

Beauchamp, E., E. Woodhouse, T. Clements, and E. Milner-Gulland. 2018b. “Living a good life”: conceptualizations of well-being in a conservation context in Cambodia. Ecology and Society **23**.

Beck, M. W., A. H. Claassen, and P. J. Hundt. 2012. Environmental and livelihood impacts of dams: common lessons across development gradients that challenge sustainability. International Journal of River Basin Management **10**:73-92.

Beharry-Borg, N., J. C. R. Smart, M. Termansen, and K. Hubacek. 2013. Evaluating farmers’ likely participation in a payment programme for water quality protection in the UK uplands. Regional Environmental Change **13**:633-647.

Bekessy, S. A., B. A. Wintle, D. B. Lindenmayer, M. A. McCarthy, M. Colyvan, M. A. Burgman, and H. P. Possingham. 2010. The biodiversity bank cannot be a lending bank. Conservation Letters **3**:151-158.

Benabou, S. 2014. Making up for lost nature? A critical review of the international development of voluntary biodiversity offsets. Environment and Society: Advances in Research **5**:103-123.

BenDor, T., N. Brozovic, and V. G. Pallathucheril. 2008. The Social Impacts of Wetland Mitigation Policies in the United States. Journal of Planning Literature **22**:341-357.

Bennett, G., A. Chavarria, F. Ruef, and A. Leonardi. 2017a. State of European Markets 2017 Biodiversity Offsets and Compensation. Forest Trends, Washington, DC, USA.

Bennett, N. J., R. Roth, S. C. Klain, K. Chan, P. Christie, D. A. Clark, G. Cullman, D. Curran, T. J. Durbin, G. Epstein, and A. Greenberg, et al. 2017b. Conservation social science: Understanding and integrating human dimensions to improve conservation. Biological Conservation **205**:93-108.

Bhagwat, S. A., and C. Rutte. 2006. Sacred groves: potential for biodiversity management. Frontiers in Ecology and the Environment **4**:519-524.

Bidaud, C., M. Hrabanski, and P. Meral. 2015. Voluntary biodiversity offset strategies in Madagascar. Ecosystem Services **15**:181-189.

Bidaud, C., K. Schreckenberg, M. Rabeharison, P. Ranjatson, J. Gibbons, and J. P. G. Jones. 2017. The sweet and the bitter: intertwined positive and negative social impacts of a biodiversity offset. Conservation and Society **15**:1-13.

Bidaud, C., K. Schreckenberg, and J. P. Jones. 2018. The local costs of biodiversity offsets: Comparing standards, policy and practice. Land Use Policy **77**:43-50.

Biedenweg, K., and N. Gross-Camp. 2018. A brave new world: integrating well-being and conservation. Ecology and Society **23**.

Bladon, A. J., E. Y. Mohammed, L. Ali, and E. Milner-Gulland. 2018. Developing a frame of reference for fisheries management and conservation interventions. Fisheries Research **208**:296-308.

Blom, B., T. Sunderland, and D. Murdiyarso. 2010. Getting REDD to work locally: lessons learned from integrated conservation and development projects. Environmental Science and Policy **13**:164-172.

Blomley, T. 2010. Development and Gorillas?: assessing fifteen years of integrated conservation and development in South-Western Uganda. International Institute for Environment and Development (IIED), London, UK.

Bossel, H. 2002. Assessing viability and sustainability: a systems-based approach for deriving comprehensive indicator sets. Conservation ecology **5**.

Braun, V., and V. Clarke. 2006. Using thematic analysis in psychology. Qualitative research in psychology **3**:77-101.

Britton, E., and S. Coulthard. 2013. Assessing the social wellbeing of Northern Ireland's fishing society using a three-dimensional approach. Marine Policy **37**:28-36.

Broch, S. W., and S. E. Vedel. 2012. Using choice experiments to investigate the policy relevance of heterogeneity in farmer agri-environmental contract preferences. Environmental and Resource Economics **51**:561-581.

Brockington, D. 2003. Injustice and conservation: is “local support” necessary for sustainable protected areas? Policy Matters **12**:22-30.

Brownlie, S., and M. Botha. 2009. Biodiversity offsets: adding to the conservation estate, or ‘no net loss’? Impact Assessment and Project Appraisal **27**:227-231.

Brownlie, S., A. von Hase, M. Botha, J. Manuel, Z. Balmforth, and N. Jenner. 2017. Biodiversity offsets in South Africa–challenges and potential solutions. Impact Assessment and Project Appraisal **35**:248-256.

Bryant, R. L. and L. Jarosz. 2004. Ethics in political ecology: a special issue of political ecology, Introduction: thinking about ethics in political ecology. Political Geography **23**:807-812.

Bull, J. W., K. B. Suttle, A. Gordon, N. J. Singh, and E. J. Milner-Gulland. 2013. Biodiversity offsets in theory and practice. Oryx **47**:369-380.

Bull, J. W., A. Gordon, E. A. Law, K. B. Suttle, and E. J. Milner-Gulland. 2014a. Importance of baseline specification in evaluating conservation interventions and achieving No Net Loss of biodiversity. Conservation Biology **28**:799-809.

Bull, J. W., E. J. Milner-Gulland, K. B. Suttle, and N. J. Singh. 2014b. Comparing biodiversity offset calculation methods with a case study in Uzbekistan. Biological Conservation **178**:2-10.

Bull, J. W., and S. Brownlie. 2015. The transition from No Net Loss to a Net Gain of biodiversity is far from trivial. Oryx:1-7.

Bull, J., N. Singh, K. Suttle, E. Bykova, and E. J. Milner-Gulland. 2015a. Creating a frame of reference for conservation interventions. Land Use Policy **49**:273-286.

Bull, J. W., M. J. Hardy, A. Moilanen, and A. Gordon. 2015b. Categories of flexibility in biodiversity offsetting, and their implications for conservation. Biological Conservation **192**:522-532.

Bull, J. W., A. Gordon, J. E. Watson, and M. Maron. 2016. Seeking convergence on the key concepts in ‘no net loss’ policy. Journal of Applied Ecology **53**:1686-1693.

Bull, J. W., A. L. Abatayo, and N. Strange. 2017a. Counterintuitive proposals for trans-boundary ecological compensation under ‘no net loss’ biodiversity policy. Ecological economics **142**:185-193.

Bull, J. W., S. P. Lloyd, and N. Strange. 2017b. Implementation gap between the theory and practice of biodiversity offset multipliers. Conservation Letters **10**:656-669.

Bull, J. W., J. Baker, V. F. Griffiths, J. P. G. Jones, and E. J. Milner-Gulland. 2018. Ensuring No Net Loss for people as well as biodiversity: good practice principles. https://doi.org/10.31235/osf.io/4ygh7.

Burdge, R. J., and F. Vanclay. 1996. Social Impact Assessment: a contribution to the state of the art series'. Impact Assessment Bulletin **14**:59-86.

Burton, M., A. Rogers, and C. Richert. 2017. Community acceptance of biodiversity offsets: evidence from a choice experiment. Australian Journal of Agricultural and Resource Economics **61**:95-114.

Büscher, B., S. Sullivan, K. Neves, J. Igoe, and D. Brockington. 2012. Towards a synthesized critique of neoliberal biodiversity conservation. Capitalism nature socialism **23(2)**:4-30.

Byers, B. A., R. N. Cunliffe, and A. T. Hudak. 2001. Linking the conservation of culture and nature: a case study of sacred forests in Zimbabwe. Human Ecology **29**:187-218.

Campbell, M. 2009. Factors for the presence of avian scavengers in Accra and Kumasi, Ghana. Area **41**:341-349.

CBD (Convention on Biological Diversity). 1992. The Convention on Biological Diversity. Available from: https://www.cbd.int/doc/legal/cbd-en.pdf (accessed February 2016).

Cerda, C., A. Ponce, and M. Zappi. 2013. Using choice experiments to understand public demand for the conservation of nature: a case study in a protected area of Chile. Journal for nature conservation **21**:143-153.

Chan, K. M. A., T. Satterfield, and J. Goldstein. 2012. Rethinking ecosystem services to better address and navigate cultural values. Ecological Economics **74**:8-18.

Chan, K. M. A, P. Balvanera, K. Benessaiah, M. Chapman, S. Díaz, E. Gómez-Baggethun, R. Gould, N. Hannahs, K. Jax, S. Klain, et al. 2016. Opinion: Why protect nature? Rethinking values and the environment. Proceedings of the National Academy of Sciences **113**:1462-1465.

Choi, A. S., B. W. Ritchie, F. Papandrea, and J. Bennett. 2010. Economic valuation of cultural heritage sites: A choice modeling approach. Tourism Management **31**:213-220.

Christensen, R. H. B., and M. R. H. B. Christensen. 2015. Package 'ordinal'. Stand **19**:2016.

Christensen, T., A. B. Pedersen, H. O. Nielsen, M. R. Mørkbak, B. Hasler, and S. Denver. 2011. Determinants of farmers' willingness to participate in subsidy schemes for pesticide-free buffer zones—A choice experiment study. Ecological Economics **70**:1558-1564.

Christie, M., N. Hanley, J. Warren, K. Murphy, R. Wright, and T. Hyde. 2006. Valuing the diversity of biodiversity. Ecological economics **58**:304-317.

Claret, C., M. J. Metzger, M. Kettunen, and P. ten Brink. 2018. Understanding the integration of ecosystem services and natural capital in Scottish policy. Environmental Science and Policy **88**:32-38.

Clements, T., and E. J. Milner-Gulland. 2015. Impact of payments for environmental services and protected areas on local livelihoods and forest conservation in northern Cambodia. Conservation Biology **29**:78-87.

Comberti, C., T. F. Thornton, V. W. de Echeverria, and T. Patterson. 2015. Ecosystem services or services to ecosystems? Valuing cultivation and reciprocal relationships between humans and ecosystems. Global Environmental Change **34**:247-262.

Constitution of the Republic of Uganda. 1995. Available at: http://www.gov.ug/sites/default/files/Publications/Constitution_of_Uganda_1995.pdf (Accessed: 8 June 2015).

Coralie, C., O. Guillaume, and N. Claude. 2015. Tracking the origins and development of biodiversity offsetting in academic research and its implications for conservation: A review. Biological Conservation **192**:492-503.

Coulthard, S. 2012. What does the debate around social wellbeing have to offer sustainable fisheries? Current Opinion in Environmental Sustainability **4**:358-363.

Coulthard, S., D. Johnson, and J. A. McGregor. 2011. Poverty, sustainability and human wellbeing: A social wellbeing approach to the global fisheries crisis. Global Environmental Change **21**:453-463.

Coulthard, S., J. A. McGregor, and C. White 2018. Multiple dimensions of wellbeing in practice, Ecosystem services and poverty alleviation: trade-offs and governance. Routledge, London, UK.

Cronbach, L. J. 1951. Coefficient alpha and the internal structure of tests. Psychometrika **16**:297-334.

Curran, M., S. Hellweg, and J. Beck. 2014. Is there any empirical support for biodiversity offset policy? Ecological Applications **24**:617-632.

Daniel, T. C., A. Muhar, A. Arnberger, O. Aznar, J. W. Boyd, K. M. A. Chan, R. Costanza, T. Elmqvist, C. G. Flint, and P. H. Gobster. 2012. Contributions of cultural services to the ecosystem services agenda. Proceedings of the National Academy of Sciences **109**:8812-8819.

Davies, R. 2016. The Basic Necessities Survey (BNS). Monitoring and Evaluation News. Avaiable at: http://mande.co.uk/special-issues/the-basic-necessities-survey/ (Accessed 2016).

Daw, T. I. M., K. Brown, S. Rosendo, and R. Pomeroy. 2011. Applying the ecosystem services concept to poverty alleviation: the need to disaggregate human well-being. Environmental Conservation **38**:370-379.

Daw, T. M., S. Coulthard, W. W. Cheung, K. Brown, C. Abunge, D. Galafassi, G. D. Peterson, T. R. McClanahan, J. O. Omukoto, and L. Munyi. 2015. Evaluating taboo trade-offs in ecosystems services and human well-being. Proceedings of the National Academy of Sciences of the United States of America **112**:6949-6954.

Daw, T. M., C. C. Hicks, K. Brown, T. Chaigneau, F. A. Januchowski-Hartley, W. W. Cheung, S. Rosendo, B. Crona, S. Coulthard, and C. Sandbrook. 2016. Elasticity in ecosystem services: exploring the variable relationship between ecosystems and human well-being. Ecology and Society **21**.

Dawson, N., and A. Martin. 2015. Assessing the contribution of ecosystem services to human wellbeing: a disaggregated study in western Rwanda. Ecological Economics **117**:62-72.

Deneulin, S., and J. A. McGregor. 2010. The capability approach and the politics of a social conception of wellbeing. European Journal of Social Theory **13**:501-519.

Díaz, S., U. Pascual, M. Stenseke, B. Martín-López, R. T. Watson, Z. Molnár, R. Hill, K. M. A. Chan, I. A. Baste, and K. A. Brauman. 2018. Assessing nature's contributions to people. Science **359**:270-272.

Dickman, A., P. J. Johnson, F. van Kesteren, and D. W. Macdonald. 2015. The moral basis for conservation: how is it affected by culture? Frontiers in Ecology and the Environment **13**:325-331.

Dietz, T., A. Fitzgerald, and R. Shwom. 2005. Environmental Values. Annual Review of Environment and Resources **30**:335-372.

Dobson, A. 1998. Justice and the Environment: Conceptions of Environmental Sustainability and Theories of Distributive Justice. Oxford University Press, Oxford, UK.

Dudley, N., L. Higgins-Zogib, and S. Mansourian. 2009. The links between protected areas, faiths, and sacred natural sites. Conservation Biology **23**:568-577.

Durán, R., B. A. Farizo, and M. X. Vázquez. 2015. Conservation of maritime cultural heritage: A discrete choice experiment in a European Atlantic Region. Marine Policy **51**:356-365.

Enfors, E. I., L. J. Gordon, G. D. Peterson, and D. Bossio. 2008. Making investments in dryland development work: participatory scenario planning in the Makanya catchment, Tanzania. Ecology and Society **13**:42.

England, K. V. L. 1994. Getting personal: reflexivity, positionality, and feminist research. Professional Geographer **46**:80-89.

Environment & Resource Management Consultant. 2017. Addendum environmental and social impact of the Isimba Hydropower Project on the Kalagala Offset area. Ministry of Energy and Mineral Development, Kampala, Uganda.

Escobar, A. 1996. Construction nature: Elements for a post-structuralist political ecology. Futures **28(4)**:325-343.

Esmail, N. 2017. Stakeholder and institutional analysis: achieving no net loss for communities and biodiversity in Uganda. Wild Business Ltd for University of Oxford, London, UK.

Esteves, A. M., D. Franks, and F. Vanclay. 2012. Social impact assessment: the state of the art. Impact Assessment and Project Appraisal **30**:34-42.

Evans, D. M., R. Altwegg, T. W. J. Garner, M. E. Gompper, I. J. Gordon, J. A. Johnson, and N. Pettorelli. 2015. Biodiversity offsetting: what are the challenges, opportunities and research priorities for animal conservation? Animal Conservation **18**:1-3.

Evely, A. C., I. R. A. Fazey, M. Pinard, and X. Lambin. 2008. The influence of phislosophical perspectives in integrative research: a conservation case study in the Caingorms National Park. Ecology and Society **13**:52.

Field, A. 2013. Discovering statistics using IBM SPSS statistics. Sage Publications, London, UK.

Final Draft NEMP (National Environment Management Policy for Uganda). 2014. Available at: http://www.nemaug.org/reports/DRAFT_FINAL_NEMP_2014_Dec_20143.pdf (Accessed: 8 June 2015).

Fischer, A., L. C. Naiman, A. Lowassa, D. Randall, and D. Rentsch. 2014. Explanatory factors for household involvement in illegal bushmeat hunting around Serengeti, Tanzania. Journal for Nature Conservation **22**:491-496.

Fletcher, R. 2017. Connection with nature is an oxymoron: A political ecology of “nature-deficit disorder”. The Journal of Environmental Education **48(4)**:226-233.

Forsyth, T. 2008. Political ecology and the epistemology of social justice. Geoforum **39(2)**:756-764.

Franks, D. M., and F. Vanclay. 2013. Social Impact Management Plans: Innovation in corporate and public policy. Environmental Impact Assessment Review **43**:40-48.

Franks, P., and M. Twinamatsiko 2017. Lessons learnt from 20 years of revenue sharing at Bwindi Impenetrable National Park, Uganda. International Institute for Environment and Development (IIED), London, UK.

Ferguson, J. 1990. The anti-politics machine. Cambridge University press, Cambridge, U.K.

Gardner, T. A., A. Von Hase, S. Brownlie, J. M. Ekstrom, J. D. Pilgrim, C. E. Savy, R. T. Stephens, J. Treweek, G. T. Ussher, G. Ward, and K. Ten Kate. 2013. Biodiversity offsets and the challenge of achieving no net loss. Conservation Biology **27**:1254-1264.

Gibbons, P., and D. B. Lindenmayer. 2007. Offsets for land clearing: No net loss or the tail wagging the dog? Ecological Management and Restoration **8**:26-31.

Gifford, R., and A. Nilsson. 2014. Personal and social factors that influence pro-environmental concern and behaviour: A review. International Journal of Psychology **49**:141-157.

Gjertsen, H., D. Squires, P. H. Dutton, and T. Eguchi. 2014. Cost-effectiveness of alternative conservation strategies with application to the Pacific leatherback turtle. Conservation Biology **28**:140-149.

Glenk, K., M. Lago, and D. Moran. 2011. Public preferences for water quality improvements: implications for the implementation of the EC Water Framework Directive in Scotland. Water Policy **13**:645.

Glover, E. K., H. B. Ahmed, and M. K. Glover. 2013. Analysis of Socio-Economic Conditions Influencing Adoption of Agroforestry Practices. International Journal of Agriculture and Forestry **3**:178-184.

Golaz, V., S. O. Wandera, and G. Rutaremwa. 2017. Understanding the vulnerability of older adults: extent of and breaches in support systems in Uganda. Ageing and Society **37**:63-89.

Greene, W. H. 1997. Econometric Analysis (3rd ed.). Prentice-Hall International, London, UK.

Greiner, R., M. Bliemer, and J. Ballweg. 2014. Design considerations of a choice experiment to estimate likely participation by north Australian pastoralists in contractual biodiversity conservation. Journal of Choice Modelling **10**:34-45.

Gross, C. 2007. Community perspectives of wind energy in Australia: The application of a justice and community fairness framework to increase social acceptance. Energy Policy **35**:2727-2736.

Guerry, A. D., S. Polasky, J. Lubchenco, R. Chaplin-Kramer, G. C. Daily, R. Griffin, M. Ruckelshaus, I. J. Bateman, A. Duraiappah, and T. Elmqvist. 2015. Natural capital and ecosystem services informing decisions: From promise to practice. Proceedings of the National Academy of Sciences **112**:7348-7355.

Habib, T. J., D. R. Farr, R. R. Schneider, and S. Boutin. 2013. Economic and ecological outcomes of flexible biodiversity offset systems. Conservation Biology **27**:1313-1323.

Hanley, N., S. Mourato, and R. E. Wright. 2001. Choice modelling approaches: a superior alternative for environmental valuatioin? Journal of economic surveys **15**:435-462.

Hanley, N., R. E. Wright, and B. Alvarez-Farizo. 2006. Estimating the economic value of improvements in river ecology using choice experiments: an application to the water framework directive. Journal of environmental management **78**:183-193.

Hanley, N., O. Sheremet, M. Bozzola, and D. C. MacMillan. 2017. The Allure of the Illegal: Choice Modelling of Rhino Horn Demand in Vietnam. Conservation Letters **11**:1-8.

Hards, S. 2012. Tales of transformation: The potential of a narrative approach to pro-environmental practices. Geoforum **43**:760-771.

Harvey, R., and R. Bernard. 2006. Research methods in anthropology: qualitative and quantitative approaches. Rowman Altmira, Maryland, USA.

Hausmann, A., R. O. B. Slotow, J. K. Burns, and E. Di Minin. 2016. The ecosystem service of sense of place: benefits for human well-being and biodiversity conservation. Environmental conservation **43**:117-127.

Hausmann, A., R. Slotow, I. Fraser, and E. Di Minin. 2017. Ecotourism marketing alternative to charismatic megafauna can also support biodiversity conservation. Animal Conservation **20**:91-100.

Heiner, M., D. Hinchley, J. Fitzsimons, F. Weisenberger, W. Bergmann, T. McMahon, J. Milgin, L. Nardea, J. Oakleaf, D. Parriman, et al. 2019. Moving from reactive to proactive development planning to conserve Indigenous community and biodiversity values. Environmental Impact Assessment Review **74**:1-13.

Hensher, D. A., J. M. Rose, W. H. Greene, D. A. Hensher, W. H. Greene, and J. M. Rose 2015. Applied choice analysis. Cambridge University Press, Cambridge, UK.

Hernández-Morcillo, M., T. Plieninger, and C. Bieling. 2013. An empirical review of cultural ecosystem service indicators. Ecological indicators **29**:434-444.

Herrmann, T. M., E. Schüttler, P. Benavides, N. Gálvez, L. Söhn, and N. Palomo. 2013. Values, animal symbolism, and human-animal relationships associated to two threatened felids in Mapuche and Chilean local narratives. Journal of ethnobiology and ethnomedicine **9**:41.

Hinsley, A., D. Verissimo, and D. L. Roberts. 2015. Heterogeneity in consumer preferences for orchids in international trade and the potential for the use of market research methods to study demand for wildlife. Biological Conservation **190**:80-86.

Hirsch, P. D., W. M. Adams, J. P. Brosius, A. Zia, N. Bariola, and J. L. Dammert. 2011. Acknowledging conservation trade-offs and embracing complexity. Conservation Biology **25**:259-264.

Holmes, G., T. A. Smith, and C. Ward. 2018. Fantastic beasts and why to conserve them: animals, magic and biodiversity conservation. Oryx **52**:231-239.

Hönig, P. 2014. Civil society and land use policy in Uganda: the Mabira Forest case. Africa Spectrum **49**:53-77.

Hoyos, D. 2010. The state of the art of environmental valuation with discrete choice experiments. Ecological economics **69**:1595-1603.

ICMM IUCN. 2012. Independent report on biodiversity offsets. Available at: http://www.icmm.com/biodiversity-offsets (Accessed October 2017).

IFC (International Finance Corporation). 2012a. Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts. IFC, Washington, DC, USA.

IFC (International Finance Corporation). 2012b. Performance Standard 6: Biodiversity conservation and sustainable management of living natural resources. IFC, Washington, DC, USA.

IFC (International Finance Corporation). 2012c. Performance Standard 8: Cultural heritage. IFC, Washington, DC, USA.

IFC (International Finance Corporation). 2012d. Performance Standards on Environmental and Social Sustainability. IFC, Washington, DC, USA.

Infield, M. 2001. Cultural values: a forgotten strategy for building community support for protected areas in Africa. Conservation Biology **15(3)**: 800-802.

Infield, M., and A. Mugisha. 2013. Culture, values and conservation: a review of perspectives, policies and practices. Fauna & Flora International, Cambridge UK.

Infield, M., A. Entwistle, H. Anthem, A. Mugisha, and K. Phillips. 2018. Reflections on cultural values approaches to conservation: lessons from 20 years of implementation. Oryx **52**:220-230.

IUCN (International Union for Conservation of Nature). 2014. Biodiversity offsets technical study paper. Gland, Switzerland.

Ives, C. D., and S. A. Bekessy. 2015. The ethics of offsetting nature. Frontiers in Ecology and the Environment **13**:568-573.

Jeary, K., M. Kandel, G. Martiniello, and R. Twongyirwe. 2018. Conservation and agriculture: finding an optimal balance? In: C. Sandbrook, C. J. Cavanagh and D. M. Tumusiime (Eds.), Conservation and development in Uganda. Routledge, Oxford, U.K., Part IV, pp. 189-205.

Jijelava, D., and F. Vanclay. 2018. How a large project was halted by the lack of a social Licence to operate: Testing the applicability of the Thomson and Boutilier model. Environmental Impact Assessment Review **73**:31-40.

Johansson, A., Y. Guillemette, F. Murtin, D. Turner, G. Nicoletti, C. de la Maisonneuve, P. Bagnoli, G. Bousquet, and F. Spinelli. 2012. Long-term growth scenarios. OECD Economic Policy Paper Series.

Johnston, R. J., K. J. Boyle, W. Adamowicz, J. Bennett, R. Brouwer, T. A. Cameron, W. M. Hanemann, N. Hanley, M. Ryan, and R. Scarpa. 2017. Contemporary guidance for stated preference studies. Journal of the Association of Environmental and Resource Economists **4**:319-405.

Jones, J. P. G., M. M. Andriamarovololona, and N. Hockley. 2008. The importance of taboos and social norms to conservation in Madagascar. Conservation Biology **22**:976-986.

Jones, I. L., J. W. Bull, E. J. Milner-Gulland, A. V. Esipov, and K. B. Suttle. 2014. Quantifying habitat impacts of natural gas infrastructure to facilitate biodiversity offsetting. Ecology and Evolution **4**:79-90.

Jones, I. L., N. Bunnefeld, A. S. Jump, C. A. Peres, and D. H. Dent. 2016a. Extinction debt on reservoir land-bridge islands. Biological Conservation **199**:75-83.

Jones, N., S. Shaw, H. Ross, K. Witt, and B. Pinner. 2016b. The study of human values in understanding and managing social-ecological systems. Ecology and Society **21**:15.

Joyce, S. A., and M. MacFarlane. 2001. Social impact assessment in the mining industry: current situation and future directions. International Institute for Environment and Development (IIED), Mining, Minerals and Sustainable Development, London, UK.

Kamga-Kamdem, S. L. 2010. Ancestral Beliefs and Conservation: The Case of Sacred Sites in Bandjoun, West Cameroon in Verschuuren B. Sacred Natural Sites. Conserving Nature and Culture p:123-124.

Kaygusuz, K. 2004. Hydropower and the world's energy future. Energy Sources **26**:215-224.

Keane, A., H. Gurd, D. Kaelo, M. Y. Said, J. de Leeuw, J. M. Rowcliffe, and K. Homewood. 2016. Gender differentiated preferences for a Community-based conservation initiative. PloS one **11**:e0152432.

Kellert, S. R. 1994. Public attitudes toward bears and their conservation. Bears: Their Biology and Management **9**:43-50.

Kellert, S. R., and E. O. Wilson 1995. The biophilia hypothesis. Island Press, Washington, DC, UK.

Kemp, D., R. Boele, and D. Brereton. 2006. Community relations management systems in the minerals industry: combining conventional stakeholder-driven approaches. International Journal of Sustainable Development **9**:390-403.

Kiesecker, J. M., H. Copeland, A. Pocewicz, and B. McKenney. 2010. Development by design: blending landscape-level planning with the mitigation hierarchy. Frontiers in Ecology and the Environment **8**:261-266.

King, M. F., V. F. Renó, and E. M. Novo. 2014. The concept, dimensions and methods of assessment of human well-being within a socioecological context: a literature review. Social indicators research **116**:681-698.

King, S., M. Eigenraam, C. Obst, M. Vardon, and D. Juhn. 2017. The role of natural capital accounting for biodiversity conservation–revisited. UN Environment World Conservation Monitoring Centre (UNEP-WCMC), Cambridge, UK.

Knight, A. T., R. M. Cowling, M. Rouget, A. Balmford, A. T. Lombard, and B. M. Campbell. 2008. Knowing but not doing: selecting priority conservation areas and the research-implementation gap. Conservation Biology **22**:610-617.

Koch, F. H. 2002. Hydropower—the politics of water and energy: Introduction and overview. Energy Policy **30**:1207-1213.

Koh, N. S., T. Hahn, and C. Ituarte-Lima. 2014. A comparative analysis of ecological compensation programs: the effect of program design on the social and ecological outcomes. Working Paper, Uppsala University. Available at: http://www.diva-portal.org/smash/get/diva2:772933/FULLTEXT01.pdf.

Koh, N. S., T. Hahn, and C. Ituarte-Lima. 2017. Safeguards for enhancing ecological compensation in Sweden. Land Use Policy **64**:186-199.

Kormos, R., C. F. Kormos, T. Humle, A. Lanjouw, H. Rainer, R. Victurine, R. A. Mittermeier, M. S. Diallo, A. B. Rylands, and E. A. Williamson. 2014. Great apes and biodiversity offset projects in Africa: the case for national offset strategies. PLoS One **9**:e111671.

Krinsky, I., and A. L. Robb. 1986. On approximating the statistical properties of elasticities. The Review of Economics and Statistics **68**:715-719.

Kuehn, R. 2000. A taxonomy of environmental justice. Environmental Law Reporter **30**:10681–10703.

Lancaster, K. J. 1966. A new approach to consumer theory. Journal of political economy **74**:132-157.

LaRiviere, J., M. Czajkowski, N. Hanley, M. Aanesen, J. Falk-Petersen, and D. Tinch. 2014. The value of familiarity: effects of knowledge and objective signals on willingness to pay for a public good. Journal of Environmental Economics and Management **68**:376-389.

Lau, J. D., C. C. Hicks, G. G. Gurney, and J. E. Cinner. 2018. Disaggregating ecosystem service values and priorities by wealth, age, and education. Ecosystem Services **29**:91-98.

Law, E. A., N. J. Bennett, C. D. Ives, R. Friedman, K. J. Davis, C. Archibald, and K. A. Wilson. 2017. Equity trade-offs in conservation decision making. Conservation Biology **32**:294-303.

Lee, D. E., and M. Du Preez. 2016. Determining visitor preferences for rhinoceros conservation management at private, ecotourism game reserves in the Eastern Cape Province, South Africa: A choice modeling experiment. Ecological Economics **130**:106-116.

Lees, A. C., C. A. Peres, P. M. Fearnside, M. Schneider, and J. A. Zuanon. 2016. Hydropower and the future of Amazonian biodiversity. Biodiversity and conservation **25**:451-466.

Lindenmayer, D. B., M. Crane, M. C. Evans, M. Maron, P. Gibbons, S. Bekessy, and W. Blanchard. 2017. The anatomy of a failed offset. Biological Conservation **210**:286-292.

Louviere, J. J., and D. A. Hensher 1982. Design and analysis of simulated choice or allocation experiments in travel choice modeling. Transportation Research Record **890**:11-17.

Louviere, J. J., and G. Woodworth. 1983. Design and analysis of simulated consumer choice or allocation experiments: an approach based on aggregate data. Journal of Marketing Research **20**:350-367.

Madsen, B., N. Carroll, and K. Moore Brands. 2010. State of Biodiversity Markets Report: Offset and Compensation Programs Worldwide. Ecosystem Marketplace, Forest Trends, Washington, DC, USA.

Mahmoudi, H., O. Renn, F. Vanclay, V. Hoffmann, and E. Karami. 2013. A framework for combining social impact assessment and risk assessment. Environmental Impact Assessment Review **43**:1-8.

Mandle, L., H. Tallis, L. Sotomayor, and A. L. Vogl. 2015. Who loses? Tracking ecosystem service redistribution from road development and mitigation in the Peruvian Amazon. Frontiers in Ecology and the Environment **13**:309-315.

Mangham, L. J., K. Hanson, and B. McPake. 2009. How to do (or not to do)… Designing a discrete choice experiment for application in a low-income country. Health policy and planning **24**:151-158.

Manning, R., W. Valliere, and B. Minteer. 1999. Values, ethics, and attitudes toward national forest management: An empirical study. Society and Natural Resources **12**:421-436.

Manski, C. F. 1977. The structure of random utility models. Theory and decision **8**:229-254.

Maron, M., R. J. Hobbs, A. Moilanen, J. W. Matthews, K. Christie, T. A. Gardner, D. A. Keith, D. B. Lindenmayer, and C. A. McAlpine. 2012. Faustian bargains? Restoration realities in the context of biodiversity offset policies. Biological Conservation **155**:141-148.

Maron, M., J. R. Rhodes, and P. Gibbons. 2013. Calculating the benefit of conservation actions. Conservation Letters **6**:359-367.

Maron, M., C. D. Ives, H. Kujala, J. W. Bull, F. J. F. Maseyk, S. Bekessy, A. Gordon, J. E. M. Watson, P. E. Lentini, P. Gibbons, H. P. Possingham, R. J. Hobbs, D. A. Keith, B. A. Wintle, and M. C. Evans. 2016. Taming a Wicked Problem: Resolving Controversies in Biodiversity Offsetting. BioScience **66**:489-498.

Maron, M., S. Brownlie, J. W. Bull, M. C. Evans, A. von Hase, F. Quétier, J. E. Watson, and A. Gordon. 2018. The many meanings of no net loss in environmental policy. Nature Sustainability **1**:19.

Martin, A., S. McGuire, and S. Sullivan. 2013. Global environmental justice and biodiversity conservation. The Geographical Journal **179**:122-131.

Mascia, M. B., J. P. Brosius, T. A. Dobson, B. C. Forbes, L. Horowitz, M. A. McKean, and N. J. Turner. 2003. Conservation and the social sciences. Conservation Biology **17**:649-650.

Mathibela, M. K., B. A. Egan, H. J. Du Plessis, and M. J. Potgieter. 2015. Socio-cultural profile of Bapedi traditional healers as indigenous knowledge custodians and conservation partners in the Blouberg area, Limpopo Province, South Africa. Journal of ethnobiology and ethnomedicine **11**:49.

May, J., R. J. Hobbs, and L. E. Valentine. 2017. Are offsets effective? An evaluation of recent environmental offsets in Western Australia. Biological Conservation **206**:249-257.

McGregor, A., and A. Sumner. 2010. Beyond business as usual: what might 3-D wellbeing contribute to MDG momentum? IDS Bulletin **41**:104-112.

McKenney, B. 2005. Environmental offset policies, principles, and methods: a review of selected legislative frameworks. Biodiversity Neutral Initiative **85**.

McKenney, B. A., and J. M. Kiesecker. 2010. Policy development for biodiversity offsets: a review of offset frameworks. Environmental Management **45**:165-176.

McKinney, M. L. 2002. Urbanization, Biodiversity, and Conservation. BioScience **52**:883.

McShane, T. O., P. D. Hirsch, T. C. Trung, A. N. Songorwa, A. Kinzig, B. Monteferri, D. Mutekanga, H. V. Thang, J. L. Dammert, M. Pulgar-Vidal, M. Welch-Devine, J. Peter Brosius, P. Coppolillo, and S. O'Connor. 2011. Hard choices: Making trade-offs between biodiversity conservation and human well-being. Biological Conservation **144**:966-972.

Metcalfe, K., R. Ffrench-Constant, and I. Gordon. 2010. Sacred sites as hotspots for biodiversity: the Three Sisters Cave complex in coastal Kenya. Oryx **44**:118-123.

Mfitumukiza, D., B. Barasa, and A. Ingrid. 2017. Determinants of agroforestry adoption as an adaptation means to drought among smallholder farmers in Nakasongola District, Central Uganda. African Journal of Agricultural Research **12**:2024-2035.

Mgumia, F. H., and G. Oba. 2003. Potential role of sacred groves in biodiversity conservation in Tanzania. Environmental Conservation **30**:259-265.

Milcu, A., J. Hanspach, D. Abson, and J. Fischer. 2013. Cultural ecosystem services: a literature review and prospects for future research. Ecology and Society **18:**44.

Millennium Ecosystem Assessment. 2005. Ecosystems and human well-being: synthesis. Washington, DC, USA.

Milner-Gulland, E. J., J. A. McGregor, M. Agarwala, G. Atkinson, P. Bevan, T. Clements, T. Daw, K. Homewood, N. Kumpel, J. Lewis, S. Mourato, B. Palmer Fry, M. Redshaw, J. M. Rowcliffe, S. Suon, G. Wallace, H. Washington, and D. Wilkie. 2014. Accounting for the impact of conservation on human well-being. Conservation Biology **28**:1160-1166.

Ministry of Energy and Mineral Development 2013. Social Impact Assessment for proposed Isimba HPP (dam and reservoir). Kampala, Uganda.

Ministry of Water and Environment 2009. Kalagala Offset sustainable mangement plan (2010-2019). Popular version, Kampala, Uganda.

Minteer, B. A., and T. R. Miller. 2011. The New Conservation Debate: Ethical foundations, strategic trade-offs, and policy opportunities. Biological Conservation **144**:945-947.

Moilanen, A., and J. S. Kotiaho. 2018. Fifteen operationally important decisions in the planning of biodiversity offsets. Biological Conservation **227**:112-120.

Moilanen, A., A. J. A. van Teeffelen, Y. Ben-Haim, and S. Ferrier. 2009. How Much Compensation is Enough? A Framework for Incorporating Uncertainty and Time Discounting When Calculating Offset Ratios for Impacted Habitat. Restoration Ecology **17**:470-478.

Moon, K. and D. Blackman. 2014. A guide to understanding social science research for natural scientists. Conservation Biology **28(5):**1167-1177.

Moon, K., D. A. Blackman, V. M. Adams, R. M. Colvin, F. Davila, M. C. Evans, S. R. Januchowski-Hartley, N. J. Bennett, H. Dickinson, C. Sandbrook, and K. Sherren, et al. 2019. Expanding the role of social science in conservation through an engagement with philosophy, methodology, and methods. Methods in Ecology and Evolution **10(3):**294-302.

Moreno-Mateos, D., V. Maris, A. Béchet, and M. Curran. 2015. The true loss caused by biodiversity offsets. Biological Conservation **192**:552-559.

Moro, M., A. Fischer, M. Czajkowski, D. Brennan, A. Lowassa, L. C. Naiman, and N. Hanley. 2013. An investigation using the choice experiment method into options for reducing illegal bushmeat hunting in western Serengeti. Conservation Letters **6**:37-45.

Mukasa, C., A. Tibazalika, A. Mango, and H. N. Muloki. 2012. Gender and forestry in Uganda: policy, legal and institutional frameworks. Working Paper 89. CIFOR, Bogor, Indonesia.

Mungatana, E., and P. B. Ahimbisibwe. 2012. Qualitative impacts of Senna spectabilis on distribution of welfare: A household survey of dependent communities in Budongo Forest Reserve, Uganda. Natural Resources Forum **36**:181-191.

Muyomba-Tamale, L. 2011. Local government councils' performance and public service delivery in Uganda: Mukono District Council score-card report 2009/10. ACODE Policy Research Series, No. 45, Kampala, Uganda.

Mwavu, E., V. Kalema, F. Bateganya, P. Byakagaba, D. Waiswa, T. Enuru, and M. Mbogga. 2018. Expansion of Commercial Sugarcane Cultivation among Smallholder Farmers in Uganda: Implications for Household Food Security. Land **7(2)**:73.

Nabanyumya, R., S. Shaukha, and R. Naluwairo. 2017. Gap analysis of the legal and policy frameworks for delivery of no net loss (or net gain) of biodiversity in Uganda. WCS Uganda, Kamapla, Uganda.

Naraya, D., R. Patel, K. Schafft, A. Rademacher, and S. Koch-Schulte. 2000. Can anyone hear us? Voices of the poor. The World Bank.

NatureUganda. 2011. The economic valuation of the proposed degaxettement of mabira Central Forest Reserve. NatureUganda, Kampala, Uganda.

Naz, F. 2006. Arturo Escobar and the development discourse: an overview. Asian affairs **28(3)**:64-84.

NDP (National Development Plan). 2015. Government of Uganda Second National Development Plan 2015/16 - 2019/20. Kampala, Uganda.

NEA (The National Environment Act, Cap 153). 1995. Available at: http://www.nemaug.org/images/laws/National_Environment_Act.pdf (Accessed: 8 June 2015).

NEMA (National Environment Management Authority). 2002. National Biodiversity Strategy and Action Plan. NEMA, Kampala, Uganda.

NEMA (National Environment Management Authority). 2010. State of the Environment Report for Uganda 2010. NEMA, Kampala, Uganda.

NEMA (National Environment Management Authority). 2014. Fifth National Report to the Convention on Biological Diversity. NEMA, Kampala, Uganda.

NEMA (National Environment Management Authority). 2016a. Annual Corporate Report 2015/2016. NEMA, Kampala, Uganda.

NEMA (National Environment Management Authority). 2016b. National Biodiversity Strategy and Action Plan II (2015 – 2025). NEMA, Kampala, Uganda.

Nielsen, M. R., J. B. Jacobsen, and B. J. Thorsen. 2014. Factors determining the choice of hunting and trading bushmeat in the Kilombero Valley, Tanzania. Conservation Biology **28**:382-391.

Niner, H. J., J. A. Ardron, E. G. Escobar, M. Gianni, A. Jaeckel, D. O. Jones, L. A. Levin, C. R. Smith, T. Thiele, and P. J. Turner. 2018. Deep-Sea Mining With No Net Loss of Biodiversity—An Impossible Aim. Frontiers in Marine Science **5**:53.

Norton-Griffiths, M., and C. Southey. 1995. The opportunity costs of biodiversity conservation in Kenya Ecological Economics **12**:125-139.

NPA (Uganda National Planning Authority). 2013. Uganda Vision 2040. Uganda.

Nunan, F. 2006. Empowerment and institutions: Managing fisheries in Uganda. World Development **34**:1316-1332.

Nunes, P. A. L. D., and J. C. J. M. van den Bergh. 2001. Economic valuation of biodiversity: sense or nonsense? Ecological Economics **39**:203–222.

Nuno, A., J. M. Blumenthal, T. J. Austin, J. Bothwell, G. Ebanks-Petrie, B. J. Godley, and A. C. Broderick. 2018. Understanding implications of consumer behavior for wildlife farming and sustainable wildlife trade. Conservation Biology **32**:390-400.

Obua, J., J. G. Agea, S. Namirembe, S. P. Egadu, and P. Mucunguzi. 2006. The potential of Acacia senegal for dryland agroforestry and gum arabic production in Uganda. Journal of the Drylands **1**:186-193.

Obua, J., J. G. Agea, and J. J. Ogwal. 2010. Status of forests in Uganda. African Journal of Ecology **48**:853-859.

Olanya, D. R. 2016. 8 Dams, water and accountability in Uganda. Land and Hydropolitics in the Nile River Basin: Challenges and New Investments. Routledge, p166-181.

Ormsby, A. A., and S. A. Bhagwat. 2010. Sacred forests of India: a strong tradition of community-based natural resource management. Environmental Conservation **37**:320-326.

Oteros-Rozas, E., B. Martín-López, T. M. Daw, E. L. Bohensky, J. R. Butler, R. Hill, J. Martin-Ortega, A. Quinlan, F. Ravera, and I. Ruiz-Mallén. 2015. Participatory scenario planning in place-based social-ecological research: insights and experiences from 23 case studies. Ecology and Society **20**:32.

Palmer-Fry, B., M. Agarwala, G. Atkinson, T. Clements, K. Homewood, S. Mourato, J. M. Rowcliffe, G. Wallace, and E. J. Milner-Gulland. 2017. Monitoring local well-being in environmental interventions: a consideration of practical trade-offs. Oryx **51**:68-76.

Papworth, S., E. Milner-Gulland, and K. Slocombe. 2013. The natural place to begin: the ethnoprimatology of the Waorani. American Journal of Primatology **75**:1117-1128.

Partal, A., and K. Dunphy. 2016. Cultural impact assessment: a systematic literature review of current methods and practice around the world. Impact Assessment and Project Appraisal **34**:1-13.

Pascual, U., J. Phelps, E. Garmendia, K. Brown, E. Corbera, A. Martin, E. Gomez-Baggethun, and R. Muradian. 2014. Social Equity Matters in Payments for Ecosystem Services. BioScience **64**:1027-1036.

Pasgaard, M., N. Dawson, L. V. Rasmussen, M. Enghoff, and A. Jensen. 2017. The research and practice of integrating conservation and development: Self-reflections by researchers on methodologies, objectives and influence. Global Ecology and Conservation **9**:50-60.

Pauchard, A. B., M. Aguayo, A. E. Penã, and R. Urrutia. 2006. Multiple effects of urbanization on the biodiversity of developing countries: the case of a fastgrowing metropolitan area (Concepción, Chile). Biological Conservation **127**:272–281.

Pearson, R. G. 2016. Reasons to conserve nature. Trends in Ecology and Evolution **31**:366-371.

Pechacek, P., G. Li, J. Li, W. Wang, X. Wu, and J. Xu. 2013. Compensation payments for downsides generated by protected areas. Ambio **42**:90-99.

Phalan, B., G. Hayes, S. Brooks, D. Marsh, P. Howard, B. Costelloe, B. Vira, A. Kowalska, and S. Whitaker. 2018. Avoiding impacts on biodiversity through strengthening the first stage of the mitigation hierarchy. Oryx **52**:316-324.

Pickett, E. J., M. P. Stockwell, D. S. Bower, J. I. Garnham, C. J. Pollard, J. Clulow, and M. J. Mahony. 2013. Achieving no net loss in habitat offset of a threatened frog required high offset ratio and intensive monitoring. Biological Conservation **157**:156-162.

Pienaar, E. F., L. S. Jarvis, and D. M. Larson. 2014. Using a choice experiment framework to value conservation-contingent development programs: An application to Botswana. Ecological Economics **98**:39-48.

Pilgrim, J. D., and L. Bennun. 2014. Will Biodiversity Offsets Save or Sink Protected Areas? Conservation Letters **7**:423-424.

Pilgrim, J. D., S. Brownlie, J. M. M. Ekstrom, T. A. Gardner, A. von Hase, K. t. Kate, C. E. Savy, R. T. T. Stephens, H. J. Temple, J. Treweek, G. T. Ussher, and G. Ward. 2012. A process for assessing the offsetability of biodiversity impacts. Conservation Letters **6**:376-384.

Pilgrim, J. D., and J. M. M. Ekstrom. 2014. Technical conditions for positive outcomes from biodiversity offsets. An input paper for the IUCN Technical Study Group on Biodiversity Offsets. Gland, Switzerland.

Plumptre, A. J., M. Behangana, E. Ndomba, T. Davenport, C. Kahindo, R. Kityo, P. Ssegawa, G. Eilu, D. Nkuutu, and I. Owiunji. 2003. The biodiversity of the Albertine Rift. Albertine Rift Technical reports No. 3. Wildlife Conservation Society, Kampala, Uganda.

Poe, G. L., E. K. Severance-Lossin, and M. P. Welsh. 1994. Measuring the difference (X—Y) of simulated distributions: A convolutions approach. American Journal of Agricultural Economics **76**:904-915.

Pollnac, R. B., and J. J. Poggie. 2008. Happiness, well-being and psychocultural adaptation to the stresses associated with marine fishing. Human Ecology Review:194-200.

Poudyal, M., B. S. Ramamonjisoa, N. Hockley, O. S. Rakotonarivo, J. M. Gibbons, R. Mandimbiniaina, A. Rasoamanana, and J. P. Jones. 2016. Can REDD+ social safeguards reach the 'right'people? Lessons from Madagascar. Global Environmental Change **37**:31-42.

Pretty, J. 2011. Interdisciplinary progress in approaches to address social-ecological and ecocultural systems. Environmental Conservation **38(2):**127-139.

Pretty, J., B. Adams, F. Berkes, S. F. De Athayde, N. Dudley, E. Hunn, L. Maffi, K. Milton, D. Rapport, and P. Robbins. 2009. The intersections of biological diversity and cultural diversity: towards integration. Conservation and Society **7**:100-112.

Pullin, A. S., M. Bangpan, S. Dalrymple, K. Dickson, N. R. Haddaway, J. R. Healey, H. Hauari, N. Hockley, J. P. G. Jones, T. Knight, C. Vigurs, and S. Oliver. 2013. Human well-being impacts of terrestrial protected areas. Environmental Evidence **2**:19.

PwC (PriceWaterhouseCoopers). 2013. World in 2050 - The BRICs and beyond: prospects, challenges and opportunities. UK.

Quétier, F., and S. Lavorel. 2011. Assessing ecological equivalence in biodiversity offset schemes: Key issues and solutions. Biological Conservation **144**:2991-2999.

Quétier, F., B. Regnery, and H. Levrel. 2014. No net loss of biodiversity or paper offsets? A critical review of the French no net loss policy. Environmental Science and Policy **38**:120-131.

Quétier, F., A. J. Van Teeffelen, J. D. Pilgrim, A. von Hase, and K. ten Kate. 2015. Biodiversity offsets are one solution to widespread poorly compensated biodiversity loss: a response to Curran et al. Ecological Applications **25**:1739-1741.

R Core Team 2015. R: A Language and Environment for Statistical Computing. R Foundation for Statistical Computing, Vienna, Austria.

R.J. Burnside International Limited 2006. Bujagali Hydropower Project Social and Environmental Assessment Report. Main Report.

Rainey, H. J., E. H. B. Pollard, G. Dutson, J. M. M. Ekstrom, S. R. Livingstone, H. J. Temple, and J. D. Pilgrim. 2015. A review of corporate goals of No Net Loss and Net Positive Impact on biodiversity. Oryx **49**:232-238.

Rasolofoson, R. A., M. R. Nielsen, and J. P. Jones. 2018. The potential of the Global Person Generated Index for evaluating the perceived impacts of conservation interventions on subjective well-being. World Development **105**:107-118.

Revelle, W. 2018. Using the psych package to generate and test structural models.

Ribeiro, J. M. 2009. Procurement of Goods, Works and Services in Development Projects: With an Overview of Project Management. Presses inter Polytechnique.

Richert, C., A. Rogers, and M. Burton. 2015. Measuring the extent of a Social License to Operate: The influence of marine biodiversity offsets in the oil and gas sector in Western Australia. Resources Policy **43**:121-129.

Riessman, C. K. 2008. Narrative methods for the human sciences. Sage, Thousand Oakes, California, USA.

Robbins, P. 2012. Political ecology: A critical introduction. Second edition. John Wiley & Sons Ltd, U.K.

Robertson, M. M. 2000. No net loss: wetland restoration and the incomplete capitalization of nature Antipode **32**:463-493.

Robertson, D. P., and R. B. Hull. 2001. Betond biology: toward a more public ecology for conservation Conservation Biology **15**:970-979.

Roche, C. 2000. Impact assessment: seeing the wood and the trees. Development in Practice **10**:543-555.

Rogers, A. A., and M. P. Burton. 2017. Social preferences for the design of biodiversity offsets for shorebirds in Australia. Conservation Biology **31**:828-836.

Ross, H., K. Witt, and N. A. Jones. 2018. Stephen Kellert's development and contribution of relational values in social-ecological systems. Current opinion in environmental sustainability **35**:46-53.

Russell, R., A. D. Guerry, P. Balvanera, R. K. Gould, X. Basurto, K. M. A. Chan, S. Klain, J. Levine, and J. Tam. 2013. Humans and nature: how knowing and experiencing nature affect well-being. Annual Review of Environment and Resources **38**:473-502.

Rutte, C. 2011. The sacred commons: conflicts and solutions of resource management in sacred natural sites. Biological Conservation **144**:2387-2394.

Saenz, S., T. Walschburger, J. C. González, J. León, B. McKenney, and J. Kiesecker. 2013. Development by design in Colombia: making mitigation decisions consistent with conservation outcomes. PloS one **8**:e81831.

Sandifer, P. A., A. E. Sutton-Grier, and B. P. Ward. 2015. Exploring connections among nature, biodiversity, ecosystem services, and human health and well-being: Opportunities to enhance health and biodiversity conservation. Ecosystem Services **12**:1-15.

Sanou, L., P. Savadogo, E. E. Ezebilo, and A. Thiombiano. 2017. Drivers of farmers' decisions to adopt agroforestry: Evidence from the Sudanian savanna zone, Burkina Faso. Renewable Agriculture and Food Systems:1-18.

Schneider, H. 2018. What role for culture in conservation? Oryx **52**:199-200.

Scholte, S. S. K., B. T. van Zanten, P. H. Verburg, and A. J. A. van Teeffelen. 2016. Willingness to offset? Residents' perspectives on compensating impacts from urban development through woodland restoration. Land Use Policy **58**:403-414.

Schwartz, S. H. 1994. Are there universal aspects in the structure and contents of human values? Journal of Social Issues **50**:19-45.

Seymour, E., A. Curtis, D. J. Pannell, A. Roberts, and C. Allan. 2011. Same river, different values and why it matters. Ecological Management and Restoration **12**:207-213.

Shoyama, K., S. Managi, and Y. Yamagata. 2013. Public preferences for biodiversity conservation and climate-change mitigation: A choice experiment using ecosystem services indicators. Land Use Policy **34**:282-293.

Slootweg, R., F. Vanclay, and M. van Schooten. 2001. Function evaluation as a framework for the integration of social and environmental impact assessment. Impact Assessment and Project Appraisal **19**:19-28.

Smith, T. A., and W. Andindilile. 2017. Assemblages of forest conservation in Tanzania: gradients between chiefs, snakes, spirits and witches. Third World Thematics: A TWQ Journal **2**:316-337.

Sommerville, M., J. P. G. Jones, M. Rahajaharison, and E. J. Milner-Gulland. 2010. The role of fairness and benefit distribution in community-based Payment for Environmental Services interventions: A case study from Menabe, Madagascar. Ecological Economics **69**:1262-1271.

Sonter, L. J., D. J. Barrett, and B. S. Soares-Filho. 2014. Offsetting the impacts of mining to achieve no net loss of native vegetation. Conservation Biology **28**:1068-1076.

Sonter, L. J., J. Gourevitch, I. Koh, C. C. Nicholson, L. L. Richardson, A. J. Schwartz, N. K. Singh, K. B. Watson, M. Maron, and T. H. Ricketts. 2018. Biodiversity offsets may miss opportunities to mitigate impacts on ecosystem services. Frontiers in Ecology and the Environment **16**:143-148.

Spash, C. L. 2015. Bulldozing biodiversity: The economics of offsets and trading-in Nature. Biological Conservation **192**:541-551.

Spoon, J. 2012. Tourism meets the sacred: Khumbu Sherpa place-based spiritual values in Sagarmatha (Mount Everest) National park and buffer zone, Nepal. Pages 113-123. Sacred Natural Sites. Routledge.

Springer, J. 2009. Addressing the social impacts of conservation: Lessons from experience and future directions. Conservation and Society **7**:26.

Ssegawa, P., and J. M. Kasenene. 2007. Medicinal plant diversity and uses in the Sango bay area, Southern Uganda. Journal of Ethnopharmacology **113**:521-540.

Stephanson, S. L., and M. B. Mascia. 2014. Putting people on the map through an approach that integrates social data in conservation planning. Conserv Biol **28**:1236-1248.

Stephenson, J. 2008. The Cultural Values Model: An integrated approach to values in landscapes. Landscape and urban planning **84**:127-139.

Sterling, E. J., E. Betley, A. Sigouin, A. Gomez, A. Toomey, G. Cullman, C. Malone, A. Pekor, F. Arengo, and M. Blair. 2017. Assessing the evidence for stakeholder engagement in biodiversity conservation. Biological Conservation **209**:159-171.

Steven, R., J. C. R. Smart, C. Morrison, and J. G. Castley. 2017. Using a choice experiment and birder preferences to guide bird-conservation funding. Conservation Biology **31**:818-827.

Sullivan, S., and M. Hannis. 2015. Nets and frames, losses and gains: Value struggles in engagements with biodiversity offsetting policy in England. Ecosystem Services **15**:162-173.

Summers, J., L. Smith, J. Case, and R. Linthurst. 2012. A review of the elements of human well-being with an emphasis on the contribution of ecosystem services. Ambio **41**:327-340.

Sunderland, T. C. H., C. Ehringhaus, and B. M. Campbell. 2007. Conservation and development in tropical forest landscapes: a time to face the trade-offs? Environmental Conservation **34**:276-279.

Swait, J., and J. Louviere. 1993. The role of the scale parameter in the estimation and comparison of multinomial logit models. Journal of marketing research:305-314.

Taherzadeh, O., and P. Howley. 2017. No net loss of what, for whom?: stakeholder perspectives to Biodiversity Offsetting in England. Environment, Development and Sustainability **20:**1807-1830.

Takacs, D. 2003. How does your positionality bias your epistemology? Thought & Action 27. Availabale at: https://repository.uchastings.edu/faculty_scholarship/1264/.

Tayeb, M. 2001. Conducting research across cultures: Overcoming drawbacks and obstacles. International Journal of Cross Cultural Management **1(1):**91-108.

ten Kate, K., J. Bishop, and B. Ricardo. 2004. Biodiversity offsets: Views, experience, and the business case. IUCN, Gland, Switzerland and Cambridge, UK and Insight Investment, London, UK.

ten Kate, K., and M. L. A. Crowe. 2014. Biodiversity Offsets: Policy options for governments. An input paper for the IUCN Technical Study Group on Biodiversity Offsets. IUCN, Gland, Switzerland.

Tengberg, A., S. Fredholm, I. Eliasson, I. Knez, K. Saltzman, and O. Wetterberg. 2012. Cultural ecosystem services provided by landscapes: assessment of heritage values and identity. Ecosystem Services **2**:14-26.

The Energy Policy for Uganda. 2002. Available at: http://energyandminerals.go.ug/downloads/EnergyPolicy.pdf (Accessed: 9 June 2015).

The Environmental Impact Assessment Regulations No. 13/1998 1998. Under Section 107 of the National Environment Act Cap 153. Available at: http://www.nemaug.org/index.php/publications/environmental-laws (Accessed: 8 June 2015).

The National Environment (Wetlands; River Banks and Lake Shores Management) Regulations No. 3/2000. 2000. Under Section 107 of the National Environmental Act Cap 153. Available at: http://www.nemaug.org/index.php/publications/environmental-laws (Accessed: 9 June 2015).

The Renewable Energy Policy for Uganda. 2007. Available at: http://www.rea.or.ug/index.php/policies-and-legislation (Accessed: 9 June 2015).

The Uganda Food and Nutrition Policy. 2003. Available at: https://extranet.who.int/nutrition/gina/sites/default/files/UGA 2003 The Uganda Food and Nutrition Policy.pdf (Accessed August 2018).

Tilt, B., Y. Braun, and D. He. 2009. Social impacts of large dam projects: A comparison of international case studies and implications for best practice. Journal of environmental management **90**:S249-S257.

Trainor, S. F. 2006. Realms of value: Conflicting natural resource values and incommensurability. Environmental Values:3-29.

Travers, H., G. Mwedde, L. Archer, D. Roe, A. Plumptre, J. Baker, A. Rwetsiba, and E. Milner-Gulland. 2017. Taking action against wildlife crime in Uganda. International Institute for Environment and Development (IIED) Research Report. IIED London, UK.

Tucker, G., B. Allen, M. Conway, I. Dickie, K. Hart, M. Rayment, C. Schulp, and A. van Teeffelen. 2013. Policy options for an EU No Net Loss initiative. Report to the European Commission. Institute for European Environmental Policy, London, UK.

Tugume, P., M. Buyinza, E. Kakudidi, P. Mucunguzi, J. Kalema, M. Kamatenesi, and J. Namaalwa. 2016. Non-Timber Forest Products Trade and Community Livelihoods around Mabira Central Forest Reserve, Uganda. Journal of Agricultural Studies **4**:1-13

Tumwesigye, R., P. Twebaze, N. Makuregye, and E. Muyambi. 2011. Key issues in Uganda's energy sector. Pro-Biodiversity Conservationists in Uganda (PROBICOU)/ International Institute for Environment and Development (IIED), London, UK.

Twesigye, B. 2008. SAIIA occasional papers series: analysing key policy and governance issues in Africa and beyond. Lessons from citizen activism in Uganda: saving Mabira Forest. South African Institute of International Affairs (SAIIA), Johannesburg, South Africa.

Uchida, Y., and S. Oishi. 2016. The happiness of individuals and the collective. Japanese Psychological Research **58**:125-141.

Uganda Wildlife Policy 2014. Available at: http://tourism.go.ug/index.php?option=com_phocadownload&view=category&id=1&Itemid=269 (Accessed: 8 June 2015).

UNCP. 2006. The Uganda national culture policy. Ministry of Gender, Labour and Social Development, Kampala, Uganda.

UNDP (United Nations Development Programme). 2011. Human development reports: Indices & data - human development index (HDI). http://hdr.undp.org/en/content/human-development-index-hdi (Accessed August 2018).

UNDP (United Nations Development Programme). 2014. Poverty status report 2014. USA.

USAID (United States Agency for International Development). 2006. Uganda biodiversity and tropical forest assessment. International Resources Group, Washington, D.C., USA.

USAID (United States Agency for International Development). 2015. Uganda environmental threats and opportunities assessment (ETOA). ECODIT, Arlington, Virginia, USA.

Vaissière, A.-C., H. Levrel, and P. Scemama. 2017. Biodiversity offsetting: Clearing up misunderstandings between conservation and economics to take further action. Biological Conservation **206**:258-262.

Vaissière, A.-C., L. Tardieu, F. Quétier, and S. Roussel. 2018. Preferences for biodiversity offset contracts on arable land: a choice experiment study with farmers. European Review of Agricultural Economics **45**:553-582.

Vanclay, F. 1999. Social impact assessment. Handbook of environmental impact assessment **1**:301-326.

Vanclay, F. 2003. International principles for social impact assessment. Impact assessment and project appraisal **21**:5-12.

Vanclay, F., A. M. Esteves, I. Aucamp, and D. M. Franks. 2015. Social Impact Assessment: Guidance for assessing and managing the social impacts of projects.

Vardon, M., S. King, D. Juhn, S. Bass, P. Burnett, C. M. Rodriguez, and S. Johansson. 2017. The Aichi Targets and Biodiversity Conservation–the Role of Natural Capital Accounting. Better Policy through Natural Capital Accounting: Stocktaking and Ways Forward **17**:193.

Vega, D. C., and F. Alpizar. 2011. Choice Experiments in Environmental Impact Assessment. The Toro **3**.

Villarroya, A., A. C. Barros, and J. Kiesecker. 2014. Policy development for environmental licensing and biodiversity offsets in Latin America. PLoS One **9**:e107144.

Virah-Sawmy, M., J. Ebeling, and R. Taplin. 2014. Mining and biodiversity offsets: a transparent and science-based approach to measure "no-net-loss". Environmental Management **143**:61-70.

Vivoda, V., and J. Fulcher 2017. Environmental and Social Impact Assessment. No. Mining Legislation reform Initiative, Working Paper No. 4. Mining Legislation Reform Initiative, AUA Centre for Responsible Mining, Armenia.

Vkters⊘, J., T. Bjerke, and B. r. P. Kaltenborn. 1999. Attitudes toward large carnivores among sheep farmers experiencing different degrees of depredation. Human Dimensions of Wildlife **4**:20-35.

von Hase, A., and K. ten Kate. 2017. Correct framing of biodiversity offsets and conservation: a response to Apostolopoulou & Adams. Oryx **51**:32-34.

Waylen, K. A., A. Fischer, P. J. McGowan, and E. J. Milner-Gulland. 2013. Deconstructing community for conservation: why simple assumptions are not sufficient. Human Ecology **41**:575-585.

WCS (Wildlife Conservation Society). 2014. Uganda biodiversity conservation trust fund study. USAID, Washington, DC, USA.

Wells, M. P., and T. O. McShane. 2004. Integrating Protected Area Management with Local Needs and Aspirations. AMBIO: A Journal of the Human Environment **33**:513-519.

West, P., J. Igoe, and D. Brockington. 2006. Parks and Peoples: The Social Impact of Protected Areas. Annual Review of Anthropology **35**:251-277.

White, S. C. 2009. Bringing wellbeing into development practice (Wellbeing in Developing Countries (WeD) Working Papers; No. WeD Working Paper 09/50). Bath, UK: University of Bath/Wellbeing in Developing Countries research Group.

Wilcox, C., and C. J. Donlan. 2007. Compensatory mitigation as a solution to fisharies bycatch - biodiversity conservation conflicts. Frontiers in Ecology and the Environment **5**:325-331.

Winemiller, K. O., P. McIntyre, L. Castello, E. Fluet-Chouinard, T. Giarrizzo, S. Nam, I. Baird, W. Darwall, N. Lujan, and I. Harrison. 2016. Balancing hydropower and biodiversity in the Amazon, Congo, and Mekong. Science **351**:128-129.

Winterbottom, B., and G. Eilu. 2006. Uganda biodiversity and tropical forest assessment. IRG and USAID, Washington, DC, USA.

Wissel, S., and F. Watzold. 2010. A conceptual analysis of the application of tradable permits to biodiversity conservation. Conservation Biology **24**:404-411.

Woodhouse, E., K. M. Homewood, E. Beauchamp, T. Clements, J. T. McCabe, D. Wilkie, and E. J. Milner-Gulland. 2015. Guiding principles for evaluating the impacts of conservation interventions on human well-being. Philosophical Transactions of the Royal Society B **370**.

Woodhouse, E., E. de Lange, and E. J. Milner-Gulland. 2016. Evaluating the impacts of conservation interventions on human wellbeing. Guidance for practitioners. International Institute for Environment and Development (IIED), London, UK.

Woodhouse, E., and J. T. McCabe. 2018. Well-being and conservation: diversity and change in visions of a good life among the Maasai of northern Tanzania. Ecology and Society **23**.

World Bank 2015. Urban land acquisition and involuntary resettlement: linking innovation and local benefits. Case study report. The World Bank, Washington, DC.

Zommers, Z. A., P. J. Johnson, and D. W. Macdonald. 2012. Biofuels bonanza? Sugarcane production and poverty in villages surrounding Budongo Forest, Uganda. Journal of Eastern African Studies **6(2):**177-195.

Appendix A: Supplementary information for Chapter 4

A-1: Livelihoods Focus Group Discussion protocol

Roles and participants

I will facilitate the meeting and a research assistant will help with translations and note taking. Project specific training will be provided to the research assistants beforehand to ensure that they understand the research, concept of no net loss of biodiversity, biodiversity offsetting, the format of the focus group and its purpose.

The facilitator plays a key role in stimulating, supporting and steering the discussion. I will need to:

- Encourage discussion through asking open ended questions and drawing out people's differences and consensus;
- React neutrally to both verbal and non-verbal responses (there are no right and wrong answers). A facilitator should not favour particular participants or show approval or voice opinions;
- Encourage involvement (ensure every participant gets a chance to speak). When dealing with a particularly dominant person, try steering the discussion away. When dealing with a reluctant participant, sensitively request opinions;
- Probe by asking for clarification and detail on answers;
- Keep the discussion on track: "So how does this relate to…?" If the topics digresses, let the discussion continue in case important issues arise, then summarise and refocus;
- Control the rhythm of the meeting in an unobtrusive way (listen carefully and steer the discussion from topic to topic); and
- Keep to the allocated time.

Each FGD will be separated into men and women and I will ensure that different occupations/livelihood activities are represented in each group. Participants will therefore be intentionally selected to participate in the FGD and the Village LC1 will be asked to assist with selecting individuals to represent the different age, wealth and livelihood groups. Additional participants will be selected in case the person originally selected is unavailable. For example, if the female household head is invited but cannot attend the meeting, rather than inviting the male household head, a female head with the same livelihood activity will be selected from another household. It is necessary that the LC1 or any key informants do not attend the meeting and that the selected participants have not taken part in any other exercises.

During the discussion, some participants may be more vocal than others, thus the facilitator (myself) will play an important role in observing and steering the discussion as well as encouraging everyone to take part and have a say while ensuring not to single out specific individuals. The focus group will

be held in a neutral setting in the village and at a convenient time for all participants. The discussion will last for approximately two and a half hours. At the end of the discussion, participants will be given a culturally acceptable 'gift' to thank people for their time (payment-in-kind).

Materials

The following materials will be required:

- Flip chart with large sheets of paper;
- Poster with the definition of a basic necessity;
- Poster explaining the three types of basic necessities;
- Poster with a list of basic necessities identified before the scoping trip;
- Different colour markers;
- Digital recorder to record the meeting and aid reporting;
- Camera to take pictures of the diagrams and flip chart as well as the group meeting (Photos will be developed locally and copies provided to the participants if they would like them);
- Payment-in-kind Soap or salt).

Introduction (VG to read out)

Hi, my name is Victoria Griffiths and this is (name of research assistant). I am an independent research student at Oxford University in England and we are looking at how people living close to the Victoria Nile River live their lives.

It has been suggested that we meet with you to discuss my research and would like to invite you to participate in a group discussion. It should only take about two and a half hours of your time and refreshments will be provided at the end.

Before we begin, can you please introduce yourselves to the group? I will go first. (Introductions, including my research assistant)

I'll now tell you more about the group discussion.

This is our first visit to the area and we want to learn more about the way of life and opinions of people living here. The aims of this group discussion are to:

- Find out what the main occupations in the area are, in other words, ways in which people make a living;
- Understand how these occupations may have changed over the years;
- Talk about the challenges that people face day-to-day;
- Discuss how projects developed by government, businesses, NGOs and other organisations affect people's lives in the area; and

- Compile a list of what you consider to be basic necessities in your lives and discuss why they are important. I will go into more detail about what a basic necessity is later on.

The information that you give us during this discussion will be used to design more specific questionnaires so that when we come back to the village later in the year, we can conduct more detailed interviews with other people in the village. This discussion will be divided into three parts and we will take a short break half way through.

Thank you for agreeing to meet with us. We hope that you will be able to represent your community and provide us with your own ideas and experiences. What is said during this meeting is private so please do not share the information with anyone else. We will make sure that your answers are kept anonymous and we will not share them with other members of the community, the local authorities or any other authorities. People will have different opinions so it is important that we all respect each other's opinions and give everyone a chance to speak. We will not ask you anything that could get you into trouble and as this is voluntary, you may stop the discussion at any time. If you have any questions, please ask us.

The information that you share with me will be saved in a secure database which can only be accessed with a password. I will analyse the information and the results will be presented as part of my written thesis for my degree qualification. Some of the results may also be published internationally in academic papers, at conferences and on online blogs. At the end of my PhD, I will plan a return trip to Uganda to present my research findings to you.

This study has been reviewed by, and received ethics clearance through, the University of Oxford Central University Research Ethics Committee.

If you have a concern about any aspect of 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 the Research Ethics Committee at the University of Oxford.

Is this ok? (Get agreement from everyone – nodding is fine)

Do you have any questions or concerns so far? (Pause here to give people enough time to think and comment)

Would you like to continue with the meeting? (Get verbal consent from every participant).

Would you mind if we take photos and audio record this meeting so that we can make sure that we don't miss anything important that you tell us? (Get verbal consent; if anyone objects to being recorded or photographed, do not record the meeting).

Note:

Should people ask about how my research will help people in the study area and what the work will be used for, the response will need to be one that does not raise hopes and expectations. Response will be as follows:

Your responses will help me understand the way of life in villages located along the Victoria Nile River, what challenges you experience and how things have changed over the last 10 years. If we know what some of the problems are in the area, then maybe we can begin to find solutions to make people happier. The results from this study will be published and shared with different stakeholders including government, NGOs, and businesses with hope of improving policies and activities in the area.

I do need to make it clear that the results from my study will only be recommendations for the future and that there is no immediate intention by the government, NGOs or any other agencies to implement any of them now.

Section A: Introductions

Before we continue, can each of you take a minute to tell us:

- Your name again;
- How long you have lived in your village; and
- Whether you have a formal position within the village? If so, what is your position?

Section B: Livelihood activities in the area (VG to read out each question)

1. To begin with, what are people's occupations in your village? In other words, how do people make a living? For example, these can be farming activities, fishing, working in a shop, tourism activities and so on.
2. Who mostly does each of these activities?
3. Thinking about everyone in the village, over the last 10 years, what have been the main changes in the occupations that people do? Think about both new occupations and people doing more or less of existing occupations.

(I will check with my research assistants to see whether there was a particular event that happened approximately 10 years ago to help provide people with a landmark in history that they can relate to).

4. What do you think has caused these changes? For example, have things changed and pushed people out of an occupation? Have things changed and attracted people to different occupations?
5. When did these changes happen?
6. Thinking about things that you gather from the wild, such as fish, forest products, wild plants and fuel wood, has anything changed in village member's use of these products?
7. What has changed and why?
8. When did these changes happen?
9. Do you think that projects developed by government, businesses, NGOs and other organisations in the area have negatively affected or improved people's lives?
10. If so, what is the project and in what way has it affected people's lives?

If the hydropower projects have not been mentioned, the following question will be asked.

11. As you know, the Bujagali / Isimba (select depending on village location) dam has been / is being (select depending on village location) built in the area. Do you think that this dam has or has not had any influence on these livelihood changes? If so, please explain why.
12. Do you think that this dam has or has not had any influence on things that people gather from the wild? If so, in what way?

Section C: Defining basic necessities (VG to read out)

We are now going to look at the basic necessities in your lives.

Basic necessities:

> *Are the minimum requirement for living that everyone should be able to have and nobody should have to go without.*

Put the definition of a basic necessity on a board.

Some basic necessities can be material assets such as things people own (for example, knives or having an aluminium roof). Other basic necessities may be access to essential services or security for the family, such as having the ability to send children to high school or having three meals a day. Others may be social, like the ability to trust that things you leave outside your house will not be stolen. It is important to be clear that a basic necessity is not something you *want* or an item which you *would like* in order to have a comfortable lifestyle, it's something that people require in order to live at a minimum level of dignity and comfort in your village.

Put examples of the three types of basic necessities on the board.

Basic necessities will be different between villages and cities, and between countries, depending on how people live their lives and what they see as important. They also vary between groups of people,

for example women may have a different set of necessities than men, and young people than old. This is why we are asking you about how people see basic necessities in your village.

The information that you share with us will be used to design a survey, which will be given to other people in the village during our second visit later in the year. During this survey, people will be shown the list that you create during this meeting and asked to choose which items they think are basic necessities and then indicate which items they have in their household. The presence or absence of these basic necessities will show how comfortably a household lives (I will check with my research assistants on how best to explain this).

1. Before we begin making a list of basic necessities, we first need to agree on the meaning of the definition for a basic necessity, which I gave you before.
2. We will now translate the definition into the local language so that everyone can understand it.

Section D: Creating a list of basic necessities (VG to read out)

We are now going to list items that you think are basic necessities in your lives and talk about why you think these items are basic necessities. We have made a list to act as a starting point, maybe we can start by talking through these and agreeing whether these are truly basic necessities or not, and why. Then we will add any other items that you think should also be included, or change them to make them more relevant to your lives. Then we will think about how many people in the village, approximately, you think have access to these items.

For our survey we are aiming to have a list, which includes things that everyone has as well as things that very few people have. We are also aiming to include some things that everyone thinks are basic necessities, and some things that very few people think are basic necessities. So there is no need for everyone to agree on everything.

1. This is the list of basic necessities that we developed (Put list up on board).
    a. Do you think each of these are basic necessities or not? Why? (Go through each item)

    (Delete or edit items as necessary).

2. Are there any other items that you that you would like to add to this list? Why?

    Using the flipchart, make a list of all the additional items that the participants consider to be basic necessities (the list can be flexible in length but try to obtain at least 30 items per group).

3. Approximately how many people in the village do you think have access to these items? (Using the flip chart, record the number of people that will have access to each item).

Notes for team members:

A good basic necessity list should include:

- Some items everyone thinks is a basic necessity and everyone has (or has access to) (e.g. a knife, having three meals a day);
- Some items that everyone thinks are basic necessities but only a few people will have, but would get as they become less poor and services improve (e.g. toilets, access to electricity or having a mobile phone)
- Some items everyone thinks are a basic necessity, but only wealthy people will have;
- Some items only poor people think are a basic necessity;
- Some items only wealthy people think are a basic necessity;
- Items no one thinks is a necessity now, but maybe in the future they will think it is a necessity (for example in perhaps 10 years' time people might think that having a holiday is a basic necessity); and
- Deliberately include some items, which no one would consider necessities (such as a television), in order to encourage respondents to consider their answers rather than just marking all items as basic necessities.

Section E: Conclusion

Thank you all for the time and information that you have shared with me. This has been a very interesting and enlightening meeting.

Before I go, do you have any questions about the research project or anything that we have discussed that you would like to ask us?

A-2: Wellbeing Focus Group Discussion protocol

Introduction (VG to read out)

Hi, my name is Victoria Griffiths and this is (name of research assistant). I am an independent research student at Oxford University in England and we are looking at how people living close to the Victoria Nile River live their lives.

It has been suggested that we meet with you to discuss my research and would like to invite you to participate in a group discussion. It should only take about two and a half hours of your time and refreshments will be provided at the end.

Before we begin, can you please introduce yourselves to the group? I will go first. (Introductions, including my research assistant)

I'll now tell you more about the group discussion.

This is our first visit to the area and we want to learn more about the way of life and opinions of people living here. The aims of this group discussion are to:

- Explore what you and other people in your village consider to be a good life;
- Understand how different aspects of people's lives in this village combine to make things more or less good at different times. For example, the ways in which your occupations, relationships with other people or sense of security are important contributors to a good life;
- Look at how these things that combine to make a good life have changed over time for different groups of people in the village, and what has caused these changes;
- Discuss how projects developed by government, businesses, NGOs or other organisations affect people's ability to live a good life in the area.

The information that you give us during this discussion will be used to design more specific questionnaires so that when we come back to the village in the latter part of the year, we can conduct more detailed interviews with other people in the village. This discussion will be divided into four parts and we will take a short break half way through.

Thank you for agreeing to meet with us. We hope that you will be able to represent your community and provide us with some of your own ideas and experiences. We realise that what makes for a good life will vary from person to person, and you may not want to share some of the more private and personal things with other people, including us or other people in this group. This is completely fine, and we will not ask you to say anything that could make you uncomfortable. What is said during this meeting is private so please do not share the information with anyone else. We will make sure that your answers are kept anonymous and we will not share them with other members of the community, the local authorities or any other authorities. People will have different opinions so it is important that we all respect each other's opinions and give everyone a chance to speak. We will not ask you anything that could get you into trouble and as this is voluntary, you may stop the discussion at any time. If you have any questions, please ask us.

The information that you share with me will be saved in a secure database which can only be accessed with a password. I will analyse the information and the results will be presented as part of my written thesis for my degree qualification. Some of the results may also be published internationally in academic papers, at conferences and on online blogs. At the end of my PhD, I will plan a return trip to Uganda to present my research findings to you.

This study has been reviewed by, and received ethics clearance through, the University of Oxford Central University Research Ethics Committee.

If you have a concern about any aspect of 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 the Research Ethics Committee at the University of Oxford.

Is this ok? (Get agreement from everyone – nodding is fine)

Do you have any questions or concerns so far? (Pause here to give people enough time to think and comment)

Would you like to continue with the meeting? (Get verbal consent from every participant)

Would you mind if we take photos and audio record this meeting so that we can make sure that we don't miss anything important that you tell us? (Get verbal consent; if anyone objects to being recorded or photographed, do not record the meeting)

Section A: Introductions

Before we continue, can each of you take a minute to tell us:

- Your name;
- How long you have lived in your village; and
- Whether you have a formal position within the village? If so, what is your position?

Section B: Understanding wellbeing (VG to read out)

1. To start, we want to know how you would describe, in general, a person who is living well in this village?
2. What does it mean to live a good life?

In English, there is a term called "wellbeing" which means feeling that you are living a happy and fulfilled life.

Feeling happy and living a fulfilled life can be affected by a range of things, for example:

- Things that you have (such as food security, possession of animals etc.);

- How you feel about your current situation (such as are you happy with what you have); and
- Your social relationships (for example, do you feel that you can and take part in household, village or community decision making?).

3. Is there a term or phrase in your local language that means this?

Allow the discussion to develop a bit before guiding as this will allow us to see what people come up with first. Make sure that people not only discuss material aspects of wellbeing but also subjective and relational wellbeing.

Write key words on the flipchart.

Decide on a term/phrase to describe wellbeing and translate it into the local language.

Notes for team members:

We understand wellbeing as

> *a state which arises where human needs are met, where someone can act meaningfully to pursue their goals, and where someone can enjoy a good quality of life. Thus, wellbeing has to do with having a good life, for example it can be how happy and satisfied you are with your life, how happy you are with what you have (for example food) or whether you feel empowered in the community.*

(Empowered is not just about decision-making. I will discuss this with my research assistants to explore various local meanings of this)

Wellbeing can be though of as:

1. **Material** (what you have) – Food security, children enrolled in primary school, housing quality, access to housing services (water, sanitation, electricity) and possession of key assets (land, livestock, tools).
2. **Subjective** (how you feel about what you have and what you can do) – Feeling confident in the future, feeling strong and well, having a sense of dignity and feeling able to pursue goals.
3. **Relational** (what you can do with what you have) – Participation in decision-making, gender empowerment, ability to cope with unexpected illness and reported domestic violence.

Section C: Identifying the components of wellbeing (VG to read out)

1. I now want you to list the main things that you think are important to the wellbeing of people in this village. In other words, what are the most important things that will lead to a good life in (name of village)?

(Take note of the words or phrases on a flip chart).

(While ensuring not to lead/influence the conservation, make sure that a range of components in all three dimensions are mentioned. It is important to stay neutral in your emphasis).

(For subjective and relational wellbeing components, phrases will need to be used to describe these).

2. Discuss the ways in which each component will affect people's overall wellbeing.

(Make sure to keep it quite general, not focussing on particular individuals, or areas, which might be personal or painful to some people. If the situation does become too personal/painful, listen to what participants have to say and then gently try to steer the conversation onto another topic).

3. We have compiled a list of questions to ask village members about their wellbeing and would like your feedback on whether you think they properly reflect how people in the village think about what makes for a good life.

(Present the questions to the group and find out whether they target wellbeing).

Notes for team members:

- Do not prompt the discussion to start with, rather let the group discuss options themselves;
- Then begin using prompts to cover the 'voices of the poor' and wellbeing in developing countries (WeD) domains (See Appendix A for list of prompts);
- Step in if people are digressing and going off topic as well as if the discussion is getting too sensitive or if the group is starting to lose enthusiasm for the task; and
- As this is a group discussion, components are likely to be at a community level at first. The facilitator needs to make sure to prompt about components that are important at an individual level too.

Section D: How has wellbeing changed? (VG to read out)

1. I now want you to think about how the lives of people in the village have changed over the last 10 years, in terms of overall wellbeing. Have they become worse, remained the same or become better?

(I will check with my research assistants to see whether there was a particular event that happened approximately 10 years ago to help provide people with a landmark in history that they can relate to).

2. How and why do you think they have changed?
3. Thinking about the components of wellbeing that we listed earlier, have certain components improved or worsened? Why?
4. How do you think the wellbeing of different groups of people in the village has changed over the last 10 years? For example, have the lives of the older people become better?

(Put up a list of the different groups of people and ask the participants to draw positive and negative arrows in different colours for the different groups of people).

(Groups will be as follows: young, old, richer, poorer and people with different occupations – this will be based on the occupations listed during the BNS).

5. Do you think that projects developed by government, businesses, NGOs or other organisations in the area have affected people's ability to live a good life in the village?
6. How and why?

If the hydropower projects have not been mentioned, the following question will be asked.

7. As you know, the Bujagali / Isimba (select depending on village location) dam has been / is being (select depending on village location) built in the area. Do you think that this dam has or has not had any influence on people's wellbeing? If so, please explain why.

Section E: Cultural heritage and wellbeing (VG to read out)

I now want to discuss in more detail how things that people do as part of their culture and traditions (such as visiting spiritual sites, particular traditions like dances or songs, ways of doing things that have been passed down, or religious beliefs) affect the wellbeing of people living in this village.

In English there is a term called "cultural heritage" that covers all these things.

1. Is there a term or phrase in your local language that means this? Let's decide on a common understanding of what cultural heritage is and translate it into (local language) so that everyone understands it.

Write key words on the flipchart.

Decide on a term/phrase to describe cultural heritage and translate it into the local language.

Based on discussions with Nature Uganda (NU) and other NGOs about what cultural heritage is in Uganda and why it may be important to people in rural settings, a set of prompts will be developed to aid the discussion.

2. Thinking back to our list of things that you think are important to wellbeing (show list), which of the things that we have already discussed do you think are part of "cultural heritage"?
3. Now that you think about it, are there components of wellbeing related to cultural heritage which we didn't discuss before, but which should be included in this list?
4. Just thinking now about cultural heritage as we defined it above, can you make a list of which elements of cultural heritage are most important to people in this village and why?

(Make a list on the flipchart)

5. Thinking about the parts of cultural heritage, which are to do with nature and the environment (from the list above), which things are particularly important or not as important as other parts of cultural heritage not related to the environment?

6. Why are they more or less important?

7. To which groups of people in your village are these elements of cultural heritage more or less important to?

(Explore the different groups that are defined by the participants)

8. Thinking now only about the important parts of cultural heritage to do with nature and the environment, which you have identified, how have they changed over the last 10 years? Have they changed for the better or worse?
9. Why do you think they have changed?
10. Do you think that projects developed by government, businesses, NGOs or other organisations in the area have affected people's cultural heritage?

If the hydropower projects have not been mentioned, the following question will be asked.

11. Do you think that the Bujagali / Isimba (select depending on village location) dam has or has not had any influence on cultural heritage? If so, please explain why.

Section F: Conclusion

Thank you all for the time and information that you have shared with us. This has been a very interesting and enlightening meeting.

Before I go, do you have any questions about the research project or anything that we have discussed that you would like to ask us?

A-3: Individual questionnaire

Interviewer: _____

Person recording the data: _____

Date: _____

Village: _____

Parish: _____

Sub-county: _____

County: _____

District: _____

Household reference number: _____

Household GPS co-ordinates: _____

Start time: _____

Section A: Individual socio-demographic information (about the <u>respondent only</u>)

We would first like to ask you some questions about yourself:

1. Name: _____
2. Gender: Male / Female
3. Age:

   ☐ 18 - 30 ☐ 31 - 45 ☐ 46 – 60 ☐ 60+

4. Marital status (tick one):

   ☐ Married ☐ Single (never married) ☐ Co-habiting ☐ Widower ☐ Divorced / Separated

5. Nationality: Ugandan / other (please specify): _____

6. Ethnicity (tick one):

☐ Baganda ☐ Basoga ☐ Mugishu ☐ Gishu ☐ Mukonjo ☐ Mugwere

☐ Toro ☐ Banyole ☐ Bagisu ☐ Bakiga ☐ Muteso ☐ Mululi

☐ Other (please specify): _____ ☐ Chooses not to answer

7. Religion (tick one):

☐ Protestant ☐ Catholic ☐ Muslim ☐ Seventh Day Adventist

☐ Traditional Religion ☐ Pentecostal

☐ Chooses not to answer ☐ Other (please specify): _____

8. Level of education (tick one):

☐ Primary ☐ Secondary ☐ College or university ☐ No formal education

Section B: Household socio-demographic information (about the household)

We would now like to ask you some questions about your household. This means that we would like to know about people in your house who regularly share meals and live together, including people who might be away for education but come home for holidays.

1. How many years has your household lived in this village?

☐ < 5 years ☐ 6 – 9 years ☐ > 10 years ☐ Not sure

a) If <10 years (after 2006), where did you live before? _____

b) Why did you move here?

_____

2. What is your status in relation to land ownership (tick one)?

☐Owner ☐ Tenant ☐ Licensee ☐ Unsure

3. Are you the household head? Yes / No

a) If no, define status: _____

4. Including the interviewee, please tell me how many people live in the household:

Age (years)	Number of males in this household	Number of females in this household
Below 18		
19 – 59		
60 +		

Section C: Education

5. How many people in the household are currently at primary school? _____

6. How many people in the household are currently at secondary school? _____

7. How many people in the household are currently at college or university? _____

Section D: Livelihood activities

1. Which activity generates the most money for the household over a year? What is the next most important? And the next? (mark 1, 2 and 3 in the boxes)

☐ Farming
☐ Livestock rearing
☐ Fishing
☐ Boda boda driver
☐ Renting property
☐ Pensioner
☐ Private institution employee
☐ Tourism related activities
☐ Village market sales
☐ Running small businesses
☐ Government employee
☐ Manual labor
☐ Carpentry
☐ Working for someone who runs a small

☐ Other (please specify): business

_____

2. How many adults (> 18 years) in the household contribute money to the total household income? _____

3. How many children (< 18 years) in the household contribute money to the total household income? _____

Section E: Use of natural resources

1. What things does your household currently collect and use from nature in the area?

☐ None
☐ Fish
☐ Medicinal herbs
☐ Palm leaves
☐ Other (please specify): _____
☐ Sand
☐ Fruits
☐ Clay
☐ Fuel wood
☐ Fodder for livestock

2. Where do you collect them (tick all that apply)?

☐ Forests and vegetation along the Nile River
☐ Other forests in the area that I can walk to
☐ My farmland
☐ Other (please specify): _____
☐ In the Nile River
☐ Islands on Lake Victoria and in the Nile River
☐ Other people's farmland

3. What do you use them for (tick all that apply)?

☐ Food for the household
☐ Building materials
☐ Arts and crafts
☐ Traditional medicine
☐ Household materials
☐ Fuel for the household
☐ Cultural or traditional events and practices
☐ To sell at markets
☐ Other (please specify): _____
☐ Fodder for livestock

Section F: Water

1. Where do you obtain water (tick all that apply)?

☐ Protected spring
☐ River
☐ Borehole
☐ Unprotected spring
☐ Piped water
☐ Lake
☐ Roof catchments
☐ Ponds
☐ Other (please specify):

_____

Section H: Basic Necessities Survey

This section is divided into two stages. First go through the list and ask:

1. Which of these items do you think are basic necessities, things that everyone in the village should have and no one should go without (tick boxes below)?

   Then once the list is complete, ask:

2. Which of these items does your household currently have (tick boxes below)?

Item	Are these items a basic necessity? (√)	Do you currently own / have them? (√)
A water source within 1km (or within half an hours walking distance) of the household		
A gas cooker		
Two sets of clothes for every member of the household		
Two goats		
Able to have at least two meals a day		
A paraffin lamp		
All children able to attend primary school		
A pit latrine or other form of toilet		
A solar power lamp		
A kettle		
A mattress for every adult in the household		
At least 3 acres of land		
Access to medical facilities within 5km (or within 2 hours walking distance)		
A television		
Brick walls for your house		
A motorbike		
Two saucepans		
A blanket for every child in the household		
A bank account		
A bicycle		
A water tank/drum		
Property insurance		
A pair of shoes for every member of the household		
A metal roof for your house		
Two cows		
An FM radio		
A mobile telephone		
Access to electricity (from public or generator)		
At least one child able to attend higher education		
A set of chairs (at least two)		
A car		
A fridge		
A concrete floor for your house		

A mosquito net for every member of the household		

Section I: Wellbeing

1. For yourself, what does it mean to lead a good life?

   _____
   _____
   _____
   _____

2. How has life been for you over the past year (tick one)?

   ☐ Good ☐ So-so ☐ Hard ☐ Don't know / would rather not say

3. Can you explain why?

   _____
   _____

4. How has life been compared to last year? (tick one)?

   ☐ Better ☐ No change ☐ Worse ☐ Don't know / would rather not say

5. Can you explain why?

   _____
   _____

6. Compared to other households in the area, how well-off in terms of income is your household (tick one):

   ☐ Worse ☐ About average ☐ Better ☐ Don't know / would rather not say

7. Compared to 10 years ago, do you consider your household to be (tick one):

   ☐ Poorer ☐ The same ☐ Wealthier

   ☐ Don't know / would rather not say

8. What are the reasons for this change?

_____

9. What has improved in the village over the last 10 years?

_____

_____

10. What has become worse in the village over the last 10 years?

_____

_____

_____

11. How often do you go to Jinja?

☐ Never ☐ Every week ☐ Every two weeks ☐ Once a month ☐ Every 3 months

☐ Every 6 months ☐ < Every six months ☐ Don't know / would rather not say

12. Why?

_____

_____

_____

13. Do you feel that accessing Jinja influences your ability to live a good life?

☐ Yes ☐ Maybe ☐ No ☐ Don't know / would rather not say

14. Why?

_____

_____

_____

Section J: Cultural heritage

I am now going to read out some statements and several possible answers. I would like you to pick the answer that you think best represents your feelings. There is no right or wrong answer to these statements and sometimes there will be statements that you disagree with and sometimes statements that you will agree with. We are expecting people to agree with some things and disagree with other things so please note that it is okay to disagree at times. There are also quite a few questions that I will ask you so you do not need to spend a lot of time thinking about the answer.

A: Attitudes towards cultural heritage

1. I enjoy experiencing the beauty of the natural environment

☐ Strong agreement ☐ Agreement ☐ Neutral ☐ Disagreement ☐ Strong disagreement

☐ Don't know / would rather not say

2. There are **no** myths, legends and stories associated with nature in my culture

☐ Strong agreement ☐ Agreement ☐ Neutral ☐ Disagreement ☐ Strong disagreement

☐ Don't know / would rather not say

3. I have a strong attachment to particular plant and animal species because of their importance in my culture and traditions

☐ Strong agreement ☐ Agreement ☐ Neutral ☐ Disagreement ☐ Strong disagreement

☐ Don't know / would rather not say

4. I believe that myths, traditions and beliefs **do not** need to be taught and passed down to future generations

☐ Strong agreement ☐ Agreement ☐ Neutral ☐ Disagreement ☐ Strong disagreement

☐ Don't know / would rather not say

5. Taking part in traditional activities in nature makes me feel happy and comforted

☐ Strong agreement ☐ Agreement ☐ Neutral ☐ Disagreement ☐ Strong disagreement

☐ Don't know / would rather not say

6. It would be a boring experience to help relocate spirits

☐ Strong agreement ☐ Agreement ☐ Neutral ☐ Disagreement ☐ Strong disagreement

☐ Don't know / would rather not say

7. I think that time spent in nature can teach people things outside of the school classroom

☐ Strong agreement ☐ Agreement ☐ Neutral ☐ Disagreement ☐ Strong disagreement

☐ Don't know / would rather not say

8. My religion encourages me to protect nature

☐ Strong agreement ☐ Agreement ☐ Neutral ☐ Disagreement ☐ Strong disagreement

☐ Don't know / would rather not say

9. Cultural traditions, beliefs and ceremonies **do not** help me to bond with other people in the village

☐ Strong agreement ☐ Agreement ☐ Neutral ☐ Disagreement ☐ Strong disagreement

☐ Don't know / would rather not say

10. I would avoid visiting sites with angry spirits

☐ Strong agreement ☐ Agreement ☐ Neutral ☐ Disagreement ☐ Strong disagreement

☐ Don't know / would rather not say

11. Because of my religion, traditional and cultural beliefs and practices are no longer important in my life

☐ Strong agreement ☐ Agreement ☐ Neutral ☐ Disagreement ☐ Strong disagreement

☐ Don't know / would rather not say

12. Sacred sites and traditions such as weaving could be a tourist attraction and bring money to my village

☐ Strong agreement ☐ Agreement ☐ Neutral ☐ Disagreement ☐ Strong disagreement

☐ Don't know / would rather not say

13. Being in charge of cultural events means that you are well respected in the village

☐ Strong agreement ☐ Agreement ☐ Neutral ☐ Disagreement ☐ Strong disagreement

☐ Don't know / would rather not say

14. I will do everything that I can to keep the spirits which live in nature happy

☐ Strong agreement ☐ Agreement ☐ Neutral ☐ Disagreement ☐ Strong disagreement

☐ Don't know / would rather not say

15. Places, plants and animals in the environment are **not** important for my culture and traditions and so do not need to be protected

☐ Strong agreement ☐ Agreement ☐ Neutral ☐ Disagreement ☐ Strong disagreement

☐ Don't know / would rather not say

16. Things that I can find in nature (for example herbs or trees) are useful for my culture and traditions

☐ Strong agreement ☐ Agreement ☐ Neutral ☐ Disagreement ☐ Strong disagreement

☐ Don't know / would rather not say

17. I fear going near certain places in nature as they may bring me bad luck

☐ Strong agreement ☐ Agreement ☐ Neutral ☐ Disagreement ☐ Strong disagreement

☐ Don't know / would rather not say

18. I would not mind if cultural traditions and beliefs changed in the future, meaning that nature becomes less important

☐ Strong agreement ☐ Agreement ☐ Neutral ☐ Disagreement ☐ Strong disagreement

☐ Don't know / would rather not say

19. My favourite cultural tradition is visiting sacred sites in nature

☐ Strong agreement ☐ Agreement ☐ Neutral ☐ Disagreement ☐ Strong disagreement

☐ Don't know / would rather not say

20. Being in nature makes me want to learn more about other people's traditions and cultures

☐ Strong agreement ☐ Agreement ☐ Neutral ☐ Disagreement ☐ Strong disagreement

☐ Don't know / would rather not say

21. There are some parts of the environment of that remind me of important past events

☐ Strong agreement ☐ Agreement ☐ Neutral ☐ Disagreement ☐ Strong disagreement

☐ Don't know / would rather not say

22. I sometimes carry out animal sacrifices when worshipping at a sacred site

☐ Strong agreement ☐ Agreement ☐ Neutral ☐ Disagreement ☐ Strong disagreement

☐ Don't know / would rather not say

23. There is a need to protect and preserve the different cultural beliefs and traditions in my village

☐ Strong agreement ☐ Agreement ☐ Neutral ☐ Disagreement ☐ Strong disagreement

☐ Don't know / would rather not say

24. I look forward to the next time that I will take part in a traditional activity in nature

☐ Strong agreement ☐ Agreement ☐ Neutral ☐ Disagreement ☐ Strong disagreement

☐ Don't know / would rather not say

B: Spiritual sites

1. This is a personal question so please only answer if you feel comfortable, can you tell me what spiritual sites are (or used to be) in the area and why they are important to you?

_____
_____
_____
_____
_____
_____
_____
_____
_____

2. When last did you visit a spiritual site?

☐ A few days ago ☐ A week ago ☐ A month ago ☐ 6 months ago

☐ > 6 months ago ☐ Never ☐ Don't know / would rather not say

C: Wellbeing

3. How important is cultural heritage (all these things mentioned above) to leading a good life, for you?

☐ Not at all important ☐ Not very important ☐ Neutral ☐ Important

☐ Very important ☐ Don't know / would rather not say

4. Thinking about all the other things that help you to lead a good life, such as food, shelter, health, how important is cultural heritage to you, relative to those things?

☐ One of the least important ☐ Not very important ☐ Neutral ☐ Important

☐ One of the most important ☐ Don't know / would rather not say

Section J: Dams, wellbeing and cultural heritage

1. What are your feelings towards the construction of the dam?

☐ Happy ☐ No feelings ☐ Sad ☐ Angry ☐ Don't know / would rather not say

2. Why?

_____

_____

3. Has the dam affected your ability to live a good life?

☐ Very negatively ☐ Negatively ☐ Neutral ☐ Positively

☐ Very positively ☐ Don't know / would rather not say

4. Why?

_____

_____

5. How much has the dam (Bujagali or Isimba) affected your household's ability to access the natural resources that you mentioned before (tick one)? (for example: fuel wood, fish, medicinal herbs, palm leaves, papyrus, sand, clay and fruits)

☐ Greatly improved ☐ Improved ☐ Remained the same ☐ Worsened

☐ Greatly worsened ☐ Don't know / would rather not say

6. Why and which resources?

_____

_____

7. Has the dam had an impact on the size of your household's land (circle one)? Yes / No

8. Have you lost or gained land (circle one)? Lost land / gained land

9. If lost land, has this impact been (tick one):

   ☐ Small (lost less than ¼ of my land)

   ☐ Medium (Lost between ¼ - ½ my land)

   ☐ Large (Lost > ½ of my land)

10. If gained land, has this impact been (tick one):

   ☐ Small (gained less than a quarter as much land as I already had)

   ☐ Medium (gained about quarter to a half as much land as I already had)

   ☐ Large (gained more than half as much land as I already had)

11. Has the dam had an effect on your household's income (tick one)? Yes / No

12. If lost income, has this impact been (tick one):

   ☐ Small (lost less than ¼ of my income)

   ☐ Medium (Lost between ¼ - ½ my income)

   ☐ Large (Lost > ½ of my income)

13. If gained income, has this impact been (tick one):

   ☐ Small (gained less than a quarter as much income as I already had)

   ☐ Medium (gained about quarter to a half as much income as I already had)

   ☐ Large (gained more than half as much income as I already had)

14. Has the dam affected your households' food production (tick one)? Yes / No

15. If food production has reduced, has this impact been (tick one):

   ☐ Small (lost less than ¼ of my food production)

   ☐ Medium (Lost between ¼ - ½ my food production)

   ☐ Large (Lost > ½ of my food production)

16. If food production has increased, has this impact been (tick one):

☐ Small (gained less than a quarter as much food production as I already had)

☐ Medium (gained about quarter to a half as much food production as I already had)

☐ Large (gained more than half as much food production as I already had)

5. Has the construction of the dam (Bujagali or Isimba) affected any of the spiritual sites near your village?

Yes / No / Do not know

(if yes, answer the following questions)

6. If yes, in what way?

_____

_____

7. How does this make you feel?

☐ Very sad ☐ Sad ☐ no change in feelings ☐ Happy ☐ Very happy

☐ Don't know / would rather not say

8. Has anything been done because the spiritual sites were affected by the dam (circle one)?

Yes / No

9. What has been done?

_____

_____

10. Does this make up for the loss of the site?

☐ Yes ☐ Slightly ☐ No ☐ Don't know / would rather not say

11. Why?

_____

_____

A-4: Basic Necessities Survey (BNS)

We chose not to use income data as an indicator of wealth as it is susceptible to stochastic events (flooding, poor weather conditions, fires etc.) and can therefore be highly variable both spatially and temporally. Moreover, people may not be inclined to reveal their income accurately during a survey. Instead, wealth was measured using the Basic Necessities Survey (BNS), which generates a household poverty score.

During the BNS, the possession or lack of possession of a predetermined list of basic necessities serves as an indicator of poverty. This method relies on a locally assessed set of assets and services considered to be 'basic necessities'. These can be defined as items that 50% or more of the respondents agree "are basic necessities that everyone should be able to have and nobody should have to go without" (Davies 2016). Some basic necessities can be material assets such as things people own (e.g. a kettle or having a metal roof). Others may be access to essential services or security for the family, such as having the ability to send children to high school or having three meals a day, and some may be social, for example, the ability to trust that things that are left outside a house will not be stolen.

During the questionnaire, respondents were asked whether they thought the item was a basic necessity and then whether or not they owned the item or, in the case of a service, whether or not they had access to it. The list of basic necessities was first compiled from a literature review and then, to determine its applicability, discussed with local communities in the study area during Focus Group Discussions (FGDs). These FGDs were carried out in three villages (one at each site: Bujagali, Kalagala and Isimba) and were separated into men and women and divided by livelihood activities. FGDs were led by myself and four research assistants who were responsible for translating into the local language and recording notes. A total of 12 FGDs were carried out, four per village and each FGD had about 8 – 10 participants. During the FGD, participants were introduced to the concept of basic necessities and what the resulting list of basic necessities will be used for. The final list was created by discussing the preliminary list and then adding (or deleting) additional items that arose during the FGD.

A list of 34 items (assets and services) was compiled (Table 1) that included: i) items that everyone in the group agreed were basic necessities and that the majority of the households would have or have access to; ii) items that everyone agreed were basic necessities that around half of all people would have, but would get as they become less poor and services improved; iii) items that everyone thought were basic necessities, but only some people would have, and others might get as they become less poor and services improved; and iv) items that <50% of people thought were basic necessities. The list (together with the choice experiment (CE) and questionnaire) was piloted in a seventh village and no items were changed following the pilot.

During the analysis, the household poverty score was calculated by adding the weighting for each item that the household has access to or owned. The weighting was calculated from the proportion

of respondents who agreed that the item was a basic necessity (Table 1). Only items where more than 50% of the respondents agreed that they were basic necessities were included in the poverty score. In our study, the only item that was excluded from the analysis was a gas cooker, where 49.74% of the respondents thought it was a basic necessity. For example, if a household owns four items which are thought to be basic necessities by 38%, 20%, 80% and 70% of respondents respectively, the household poverty score will be 0.80 + 0.70 = 1.50. This figure represents the raw BNS score for a household. The poverty score / index was then calculated by dividing the raw BNS score by the maximum possible raw score (the sum of all the weights) and converted into a percentage. A household with a low percentage would have very few basic necessities whilst a household with a high percentage would have most of them and was, on that basis, assumed to be less poor.

Where possible, two people were interviewed per household, meaning that the BNS was carried out twice for a single household. During the analysis, it was observed that often the information provided by these two individuals was contradictory, especially when reporting the possession / lack of possession of items. In these cases, the information provided by the household head, or if no head was present (or if both stated they were heads), the oldest individual, was used to calculate the household poverty score.

Table 1: Items included in the household poverty score, with weighting used for each item and the percentage of households that reported owning or having access to each item

Asset / service	No. HHs who consider it a necessity	% HHs who consider it a necessity (weights)	No. HHs who own / have access to	% HHs who own / have access to
A water source within 1km	774	99.23	641	82.18
A gas cooker *	388	49.74	6	0.77
Two sets of clothes for every member of the household	775	99.36	713	91.41
Two goats	765	98.08	302	38.72
Able to have at least two meals a day	775	99.36	572	73.33
A paraffin lamp	685	87.82	624	80.00
All children able to attend primary school	772	98.97	598	76.67
A pit latrine or other form of toilet	774	99.23	754	96.67

Asset / service	No. HHs who consider it a necessity	% HHs who consider it a necessity (weights)	No. HHs who own / have access to	% HHs who own / have access to
A solar power lamp	659	84.49	163	20.90
A kettle	765	98.08	672	86.15
A mattress for every adult in the household	773	99.10	631	80.90
At least 3 acres of land	771	98.85	156	20.00
Access to medical facilities within 5km	778	99.74	592	75.90
A television	696	89.23	98	12.56
Brick walls for your house	774	99.23	603	77.31
A motorbike	694	88.97	70	8.97
Two saucepans	776	99.49	742	95.13
A blanket for every child in the household	770	98.72	366	46.92
A bank account	655	83.97	128	16.41
A bicycle	710	91.03	300	38.46
A water tank / drum	771	98.85	243	31.15
Property insurance	482	61.79	11	1.41
A pair of shoes for every member of the household	771	98.85	559	71.67
A metal roof for your house	773	99.10	734	94.10
Two cows	767	98.33	106	13.59
An FM radio	762	97.69	464	59.49

Asset / service	No. HHs who consider it a necessity	% HHs who consider it a necessity (weights)	No. HHs who own / have access to	% HHs who own / have access to
A mobile telephone	758	97.18	583	74.74
Access to electricity (from public or generator)	699	89.62	119	15.26
At least one child able to attend higher education	744	95.38	173	22.18
A set of chairs (at least two)	771	98.85	634	81.28
A car	522	66.92	17	2.18
A fridge	501	64.23	29	3.72
A concrete floor for your house	761	97.56	333	42.69
A mosquito net for every member of the household	767	98.33	450	57.69

** Item not considered to be a necessity by at least 50% of the subjects. Therefore, by definition, is not a basic necessity and was excluded from the analysis*

A-5: Measuring socio-economic status

Household poverty / socio-economic status was calculated using:

1. The BNS scores
2. A subjective ranking of poverty, where respondents were asked to select how well off they are compared to other households in the village (better off, about average, worse off).
3. An external rating by the enumerators (better off, about average, worse off).

The three measures were compared, and found to be adequately correlated. Therefore, the BNS score was selected to reflect socio-economic status, as the more robust measure of the three.

Correlation between BNS score and subjective poverty ranking:

Variable	Estimate	Std. Error	Significance
HH ranked about average	0.11	0.01	***
HH ranked better off	0.21	0.01	***
Don't know / would rather not say	0.04	0.01	**

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Correlation between BNS score and external poverty ranking:

Variable	Estimate	Std. Error	Significance
HH ranked about average	0.15	0.01	***
HH ranked better off	0.29	0.01	***

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Correlation between subjective and external poverty ranking:

Pearson's Chi-squared test

X-squared = 413.87, df = 6, p-value < 0.05

Table A-6: Cultural salience score and associated frequency of wellbeing components, aggregated by respondents, named during the individual questionnaire, ranked according to cultural salience

Wellbeing domain	Component named	n	Frequency (%)	Cultural salience
Material	Food	734	56	0.44
Material	Employment and income	563	43	0.34
Material	Shelter	375	29	0.19
Material	Basic necessities on the BN list	262	20	0.15
Material	Clothing	333	26	0.14
Health	Feeling healthy and strong	242	19	0.14
Health	Health services	410	31	0.13
Material	Access to water	183	14	0.10
Material	Education services	287	22	0.08
Material	Land for homestead and agriculture	142	11	0.08
Material	Access to bedding	158	12	0.05
Social relations	Living a happy fulfilled life	93	7	0.05
Health	Sleeping well	78	6	0.04
Material	Livestock	75	6	0.04
Health	Mosquito net	65	5	0.04
Material	Private transport	63	5	0.03
Security	Lives in peace and is worry free	54	4	0.03
Health	Sanitation and hygiene	51	4	0.02
Social relations	Good relationship with family	49	4	0.02
Material	Lighting system	37	3	0.01
Social relations	Dresses well and has dignity	23	2	0.01
Security	Ability to look after the family	21	2	0.01
Material	Entertainment system	18	1	0.01
Material	Roads and public transport	18	1	0.01
Material	Owns / runs a business	14	1	0.01
Material	Mobile phone	9	1	0.00
Material	Market access	7	1	0.00
Security	Security and safety	7	1	0.00
Social relations	Religion	6	0	0.00
Social relations	Good relationship with village	6	0	0.00
Material	Side income	4	0	0.00
Freedom	Freedom of choice	2	0	0.00
Material	Holidays	2	0	0.00
Material	Servants	2	0	0.00

Security	Land and food security	1	0	0.00
Security	Good governance	1	0	0.00
Material	Good environment	1	0	0.00
Material	Natural resources	1	0	0.00

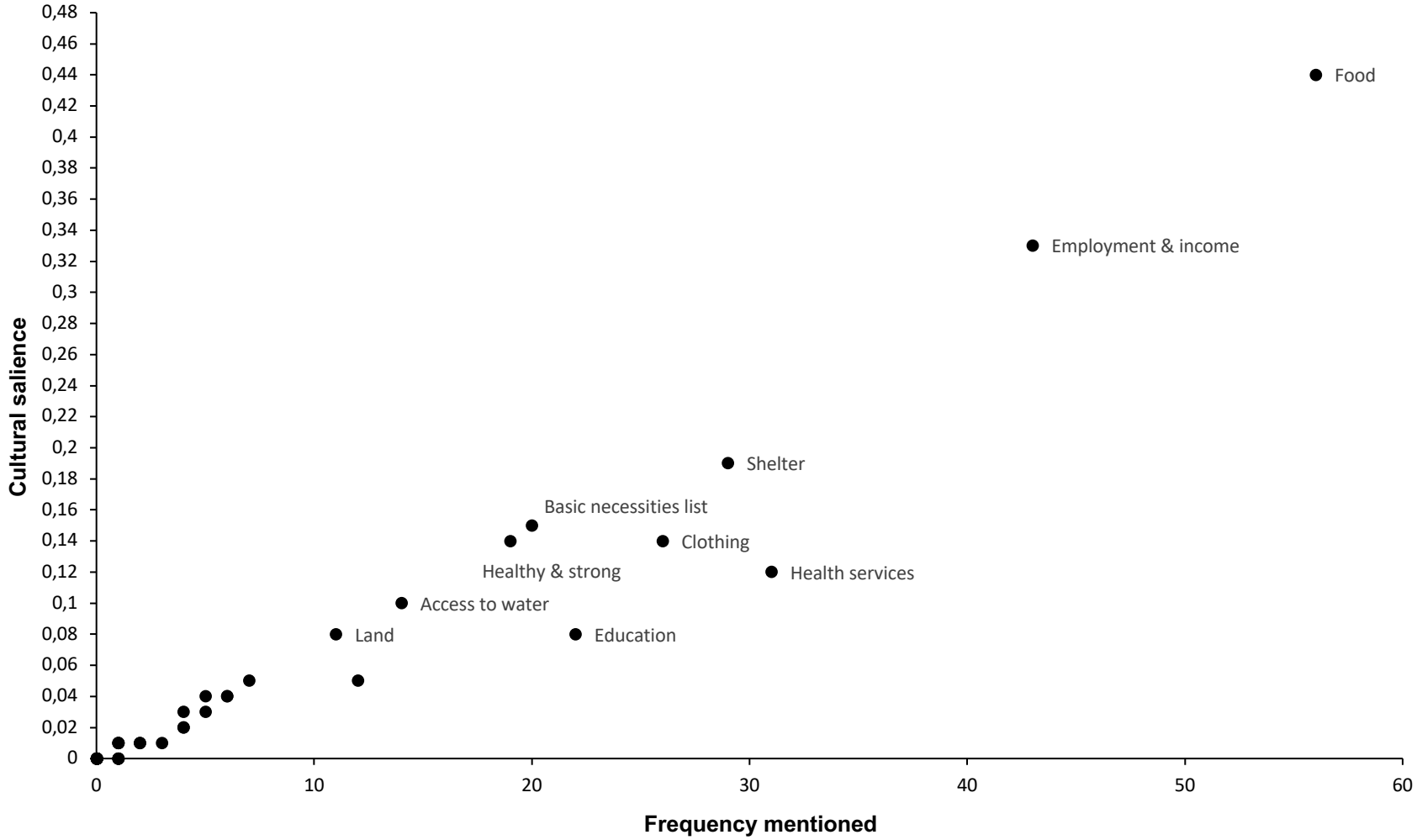


Figure A-7: Relationship between frequency of wellbeing components and their associated cultural salience score, aggregated by respondents. Top ten most culturally salient components are labelled

A-8: Frequency of wellbeing components by village and z-test of proportions between villages

Table 1: Frequency of wellbeing components named during the individual questionnaire, by village and aggregated by wellbeing domain

Wellbeing domain	% Bujagali-West: Kikubamutwe (n = 246)	% Bujagali-East: Kyabirwa (n = 244)	% Kalagala-West: Kalagala (n = 245)	% Kalagala-East: Bubugo Bugobi (n =244)	% Isimba-West: Nampaanyi (n = 162)	% Isimba-East: Bwase Buseta (n = 164)
Material	95	91	94	97	96	95
Health	60	66	54	52	41	46
Social relations	14	16	11	14	12	8
Security	9	11	3	3	5	7
Freedom	0	0	0	0	0	0

Table 2: Two sample z-test for equality of proportions in the material domain, by village

	Bujagali-West: Kikubamutwe		Bujagali-East: Kyabirwa		Kalagala-West: Kalagala		Kalagala-East: Bubugo Bugobi		Isimba-West: Nampaanyi		Isimba-East: Bwase Buseta	
	χ^2	p-value	χ^2	p-value	χ^2	p-value	χ^2	p-value	χ^2	p-value	χ^2	p-value
Bujagali-West: Kikubamutwe	-	-	3.82	0.05	0.17	0.68	0.80	0.37	0.32	0.57	1.58 e-29	1
Bujagali-East: Kyabirwa		-	-	-	2.41	0.12	**7.75**	**0.01**	**4.81**	**0.03**	2.89	0.09
Kalagala-West: Kalagala	-	-	-	-	-	-	1.69	0.19	0.84	0.36	0.13	0.71
Kalagala-East: Bubugo Bugobi	-	-	-	-	-	-	-	-	0.05	0.82	0.67	0.41
Isimba-West: Nampaanyi	-	-	-	-	-	-	-	-	-	-	0.27	0.60

Isimba-East: Bwase Buseta	-	-	-	-	-	-	-	-	-	-	-	-

Bold = significant values

Table 3: Two sample z-test for equality of proportions in the health domain, by village

	Bujagali-West: Kikubamutwe		**Bujagali-East: Kyabirwa**		**Kalagala-West: Kalagala**		**Kalagala-East: Bubugo Bugobi**		**Isimba-West: Nampaanyi**		**Isimba-East: Bwase Buseta**	
	χ^2	**p-value**	χ^2	**p-value**	χ^2	**p-value**	χ^2	**p-value**	χ^2	**p-value**	χ^2	**p-value**
Bujagali-West: Kikubamutwe	-	-	2.32	0.13	1.73	0.19	2.95	0.09	**14.16**	**<0.05**	**7.14**	**0.01**
Bujagali-East: Kyabirwa		-	-	-	**7.99**	**0.01**	**10.40**	**<0.05**	**26.02**	**<0.05**	**16.23**	**<0.05**
Kalagala-West: Kalagala	-	-	-	-	-	-	0.16	0.69	**6.74**	**0.01**	2.23	0.14
Kalagala-East: Bubugo Bugobi	-	-	-	-	-	-	-	-	**4.99**	**0.03**	1.28	0.26
Isimba-West: Nampaanyi	-	-	-	-	-	-	-	-	-	-	1.04	0.31
Isimba-East: Bwase Buseta	-	-	-	-	-	-	-	-	-	-	-	-

Bold = significant values

Table 4: Two sample z-test for equality of proportions in the social relations domain, by village

	Bujagali-West: Kikubamutwe		**Bujagali-East: Kyabirwa**		**Kalagala-West: Kalagala**		**Kalagala-East: Bubugo Bugobi**		**Isimba-West: Nampaanyi**		**Isimba-East: Bwase Buseta**	
	χ^2	**p-value**	χ^2	**p-value**	χ^2	**p-value**	χ^2	**p-value**	χ^2	**p-value**	χ^2	**p-value**
Bujagali-West: Kikubamutwe	-	-	0.63	0.43	0.88	0.35	0.03	0.87	0.38	0.54	3.37	0.07

Bujagali-East: Kyabirwa		-	-	-	2.98	0.08	0.39	0.53	1.71	0.19	**6.22**	**0.01**
Kalagala-West: Kalagala	-	-	-	-	-	-	1.22	0.27	0.05	0.83	1.07	0.30
Kalagala-East: Bubugo Bugobi	-	-	-	-	-	-	-	-	0.58	0.45	**3.89**	**0.048**
Isimba-West: Nampaanyi	-	-	-	-	-	-	-	-	-	-	1.33	0.25
Isimba-East: Bwase Buseta	-	-	-	-	-	-	-	-	-	-	-	-

Bold = significant values

Table 5: Two sample z-test for equality of proportions in the security domain, by village

	Bujagali-West: Kikubamutwe		**Bujagali-East: Kyabirwa**		**Kalagala-West: Kalagala**		**Kalagala-East: Bubugo Bugobi**		**Isimba-West: Nampaanyi**		**Isimba-East: Bwase Buseta**	
	χ^2	**p-value**	χ^2	**p-value**	χ^2	**p-value**	χ^2	**p-value**	χ^2	**p-value**	χ^2	**p-value**
Bujagali-West: Kikubamutwe	-	-	0.63	0.43	**6.14**	**0.01**	**6.14**	**0.01**	1.92	0.17	0.46	0.50
Bujagali-East: Kyabirwa		-	-	-	**10.32**	**<0.05**	**10.24**	**<0.05**	**4.15**	**0.04**	1.85	0.17
Kalagala-West: Kalagala	-	-	-	-	-	-	6.9175 e-05	0.99	0.72	0.40	2.63	0.11
Kalagala-East: Bubugo Bugobi	-	-	-	-	-	-	-	-	0.71	0.40	2.60	0.11
Isimba-West: Nampaanyi	-	-	-	-	-	-	-	-	-	-	0.46	0.50
Isimba-East: Bwase Buseta	-	-	-	-	-	-	-	-	-	-	-	-

Bold = significant values

A-9: Frequency of wellbeing components by socio-demographic factors

Table 1: Frequency of wellbeing components named during the individual questionnaire, by gender and aggregated by wellbeing domain

Wellbeing domain	% Male (n = 511)	% Female (n = 794)
Material	96	94
Health	51	57
Social relations	11	14
Security	7	6
Freedom	0	0

Table 2: Frequency of wellbeing components named during the individual questionnaire, by age and aggregated by wellbeing domain

Wellbeing domain	% 18-30 (n = 429)	% 31-45 (n = 419)	% 46-60 (n = 292)	% 61+ (n = 165)
Material	92	95	97	95
Health	53	54	56	56
Social relations	16	11	11	11
Security	7	8	5	2
Freedom	0	0	0	0

Table 3: Frequency of wellbeing components named during the individual questionnaire, by education level and aggregated by wellbeing domain

Wellbeing domain	% No education (n = 225)	% Primary (n = 701)	% Secondary (n = 341)	% College / university (n = 35)
Material	92	96	92	100
Health	52	53	59	58
Social relations	11	12	16	11
Security	5	5	8	16
Freedom	0	0	0	0

Table 4: Frequency of wellbeing components named during the individual questionnaire, by length of time lived in the village and aggregated by wellbeing domain

Wellbeing domain	% Not sure (n = 6)	% <5 Years (n = 66)	% 5-9 Years (n = 73)	% >10 Years (n = 1127)
Material	100	93	96	95
Health	83	64	73	52
Social relations	0	13	5	13
Security	0	7	7	6
Freedom	0	0	0	0

Table 5: Frequency of wellbeing components named during the individual questionnaire, by primary livelihood and aggregated by wellbeing domain.

Wellbeing domain	% Uses natural resources (n = 961)	% Salaried employment (n = 63)	% Self-employed (n = 276)	% Tourism activities (n = 5)
Material	95	95	94	100
Health	54	60	54	60
Social relations	12	21	14	0
Security	6	11	6	0
Freedom	0	0	0	0

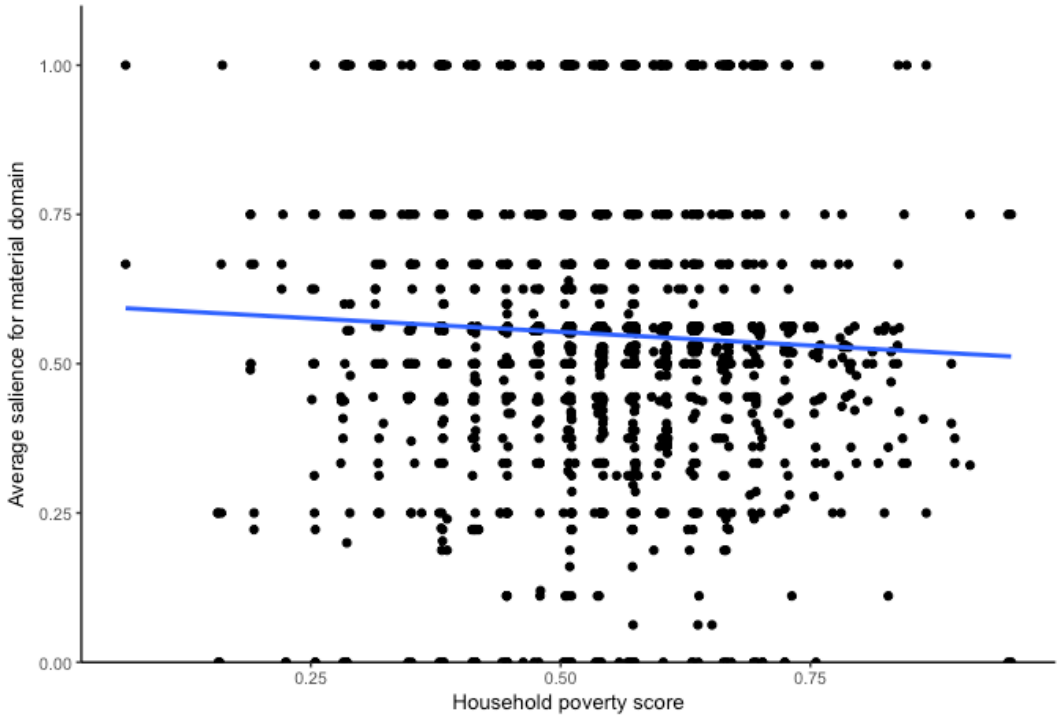


Figure 1: Cultural salience score for material domain (averaged per person) against household poverty score (based on the BN score)

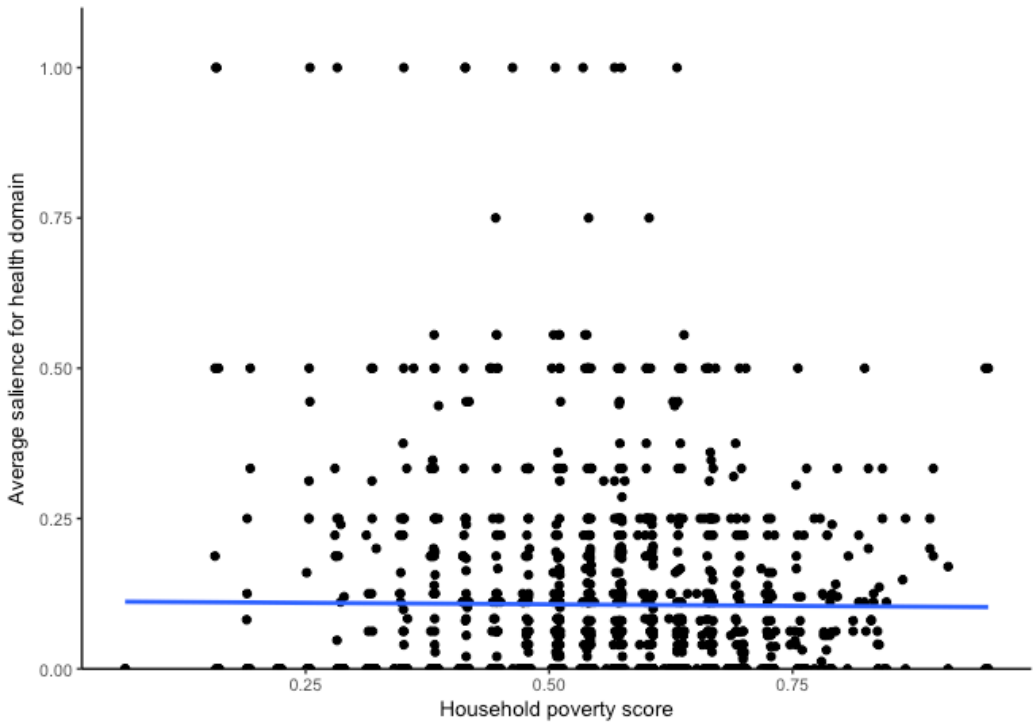


Figure 2: Cultural salience score for health domain (averaged per person) against household poverty score (based on the BN score).

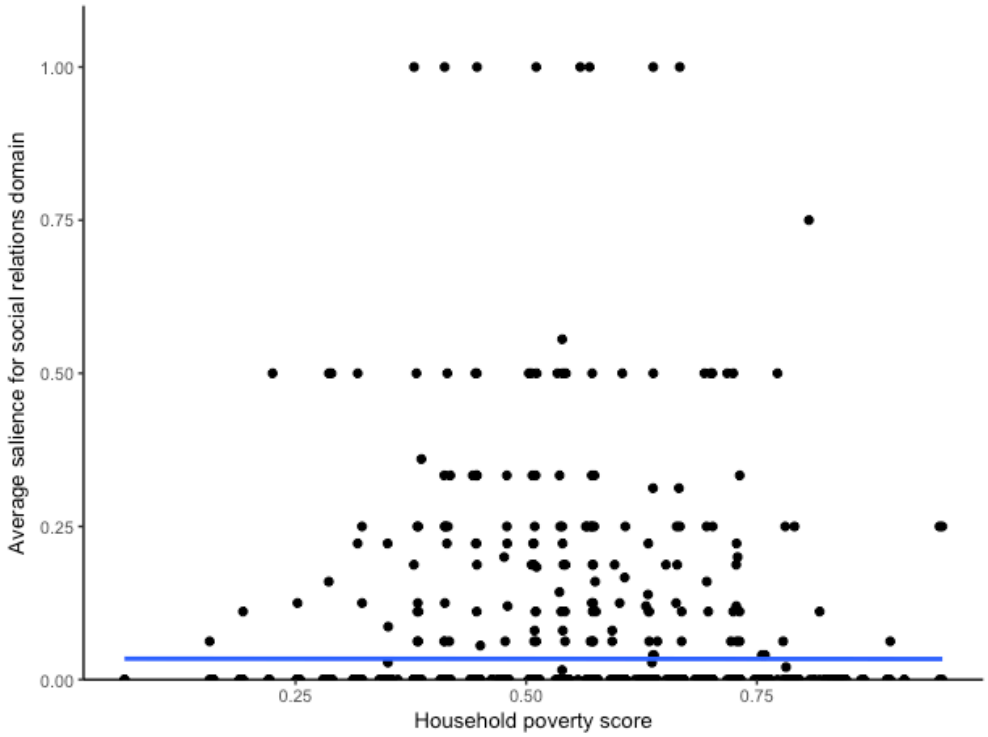


Figure 3: Cultural salience score for social relations domain (averaged per person) against household poverty score (based on the BN score).

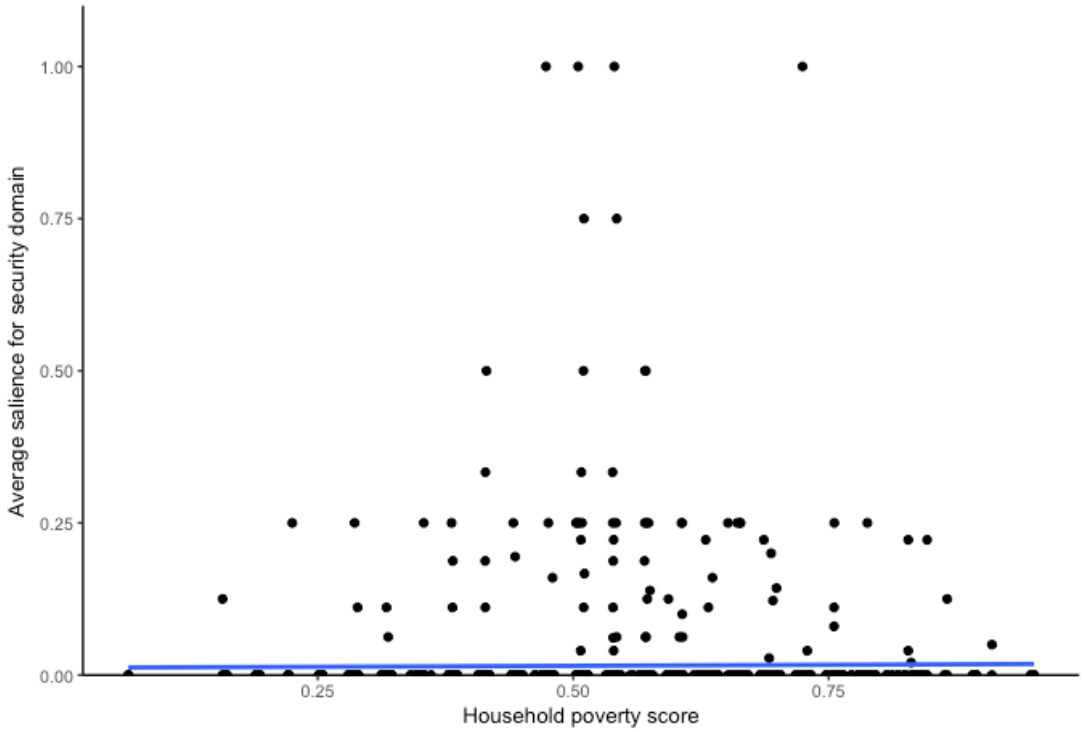


Figure 4: Cultural salience score for security domain (averaged per person) against household poverty score (based on the BN score).

A-10: Reasons why life has been hard and good over the past year

Table 1: Wellbeing components named in response to why life has been hard over the past year, aggregated by village. Items in bold pertain to the dams

Wellbeing domain	Component	n	Frequency (%)
Health	Unhealthy	375	45
Material	Low / no income	297	36
Material	Prolonged dry season / climate change	190	23
Material	Failed / poor harvest	188	23
Social relations	Relative died	144	17
Material	Food shortage	140	17
Material	High prices of commodities	95	11
Material	Unable to afford school fees	71	9
Material	Limited / no land	49	6
Material	Unable to afford basic necessities	46	6
Social relations	Unable to support family	44	5
Material	Unsuccessful business	33	4
Social relations	Large family / caring for extended family members	31	4
Material	**Dam took land used for farming**	20	2
Material	**Restricted access to fishing / lack of fish**	20	2
Health	Old age and unable to work	20	2
Health	**Rock blasting negatively affected people's health**	17	2
Social relations	Family disagreements and divorce	17	2
Social relations	Unhappy	14	2
Health	Unable to afford health care	13	2
Material	Had many problems	12	1
Material	**Rock blasting negatively affected livestock's health**	11	1
Material	Infertile land	11	1
Material	No market for products	11	1

Social relations	Stressed	10	1
Material	**Dam created cracks in shelter**	8	1
Material	Debt	7	1
Material	**Dam affected tourist attractions affecting jobs and income**	6	1
Material	**Dam affected natural resources and income**	6	1
Material	Livestock diseases	6	1
Material	Poor shelter	6	1
Material	Renting property	4	0
Material	No water source	3	0
Security	Attacked by robbers	3	0
Material	No livestock	3	0
Material	Agricultural diseases	3	0
Security	**Resettlement**	3	0
Security	Livestock theft	3	0
Material	Deforestation	2	0
Material	Lost land through forest gazettement	2	0
Security	Went to jail	2	0
Social relations	**People moved because of the dam**	2	0
Material	Lack of transport	2	0
Health	**Dam created air pollution**	1	0
Health	**Dam created water pollution**	1	0
Social relations	**Rock blasting disturbed spirits**	1	0
Security	**Fear of being displaced by dam**	1	0
Social relations	People wanted to sacrifice children	1	0
Material	Long walking distances to farm	1	0
Social relations	Domestic abuse	1	0
Material	**Compensation was unfair**	1	0
Social relations	**In migration because of the dam**	1	0

Table 2: Wellbeing components named in response to why life has been good over the past year, aggregated by village. Items in bold pertain to the dam

Wellbeing domain	Component	n	Frequency (%)
Health	Good health	65	30
Material	Enough food	48	22
Material	Had enough money	47	22
Material	Having a good harvest	44	20
Material	Had an income generating activity	31	14
Material	Afford access to all the basic necessities	22	10
Social relations	Parents / husband / children to take care of them	17	8
Material	Afford access to education services	16	7
Material	Good weather conditions	13	6
Social relations	Lived happily	11	5
Material	Having a successful business	11	5
Social relations	Being able to support the family	9	4
Material	**Could still access the river to fish**	8	4
Health	Afford access to medical care	8	4
Material	**Used to have land before the dam**	7	3
Social relations	Small family size	6	3
Material	Prices of commodities had not yet gone up	5	2
Material	**Used to get money from tourism before the dam**	3	1
Material	Could participate in recreation	3	1
Social relations	Had few responsibilities	3	1
Social relations	Lives alone with no family responsibilities	2	1
Security	No theft	2	1
Material	Leased extra land	2	1
Material	Good access to water	2	1
Material	**No rock blasting**	2	1
Material	Could access natural resources	1	0

Material	Taught good farming practices	1	0
Material	Bought a motorbike	1	0
Material	**House was in good condition before the dam**	1	0
Social relations	Husband only had one wife	1	0
Social relations	Didn’t lose a relative	1	0
Material	Built a house	1	0

A-11: Responses to how people feel about the dams in the study area

Table 1: Wellbeing components named in response to why people are angry about the dam, aggregated by village

Wellbeing domain	Wellbeing component	n	Frequency (%)
Material	Lost livelihoods / source of income	34	40
Material	Lost land to the dam	34	40
Material	Loss of access to natural resources (incl. fish, fuel wood, herbs etc.)	33	39
Material	Loss of tourism	28	33
Material	Rock blasting damaging houses	25	30
Material	Compensation received was too little / unfair	20	24
Social relations	Cultural heritage has been destroyed	15	18
Material	Deforestation leading to drought and climate change	13	15
Material	Nature has been destroyed	13	15
Material	Promised services were never delivered	12	14
Material	Farming land along the river was lost	10	12
Material	Electricity is not free / rates are too high	9	11
Material	Reduced fish / destroyed fishing grounds	9	11
Health	Rock blasting affected people's health	8	10
Health	Rock blasting affected livestock's health	8	10
Material	Rock blasting chased fish away	6	7
Material	No compensation was received from the dam	6	7
Security	Theft and moral degeneration owing to unemployment	6	7
Material	No market for goods and agricultural produce	5	6
Material	Restricted access to the river for water	4	5
Health	Injuries from the dam	3	4
Material	Infertile soil from deforestation	2	2
Social relations	People / neighbours have migrated from the village	2	2
Social relations	Dam created family disputes	1	1

Material	Bribes were needed to be employed by the dam	1	1
Health	Air quality reduced (pollution and lack of trees)	1	1
Health	Noise from rock blasting	1	1
Material	Did not receive employment from the dam	1	1
Social relations	Migrant labour moving into the village	1	1

Table 2: Wellbeing components named in response to why people are sad about the dam, aggregated by village

Wellbeing domain	Wellbeing component	n	Frequency (%)
Material	Lost land to the dam	113	35
Material	Rock blasting damaging houses	110	34
Material	Lost livelihoods / source of income	83	25
Material	Loss of access to natural resources (incl. fish, fuel wood, herbs etc.)	64	20
Material	Loss of tourism	63	19
Health	Rock blasting affected people's health	50	15
Material	Electricity is not free / rates are too high	37	11
Material	Deforestation leading to drought and climate change	32	10
Health	Rock blasting affected livestock's health	30	9
Material	Compensation received was too little / unfair	28	9
Material	Reduced fish / destroyed fishing grounds	28	9
Material	Promised services were never delivered	23	7
Social relations	Cultural heritage has been destroyed	21	6
Social relations	Migrant labour moving into the village	20	6
Material	No market for goods and agricultural produce	19	6
Material	Farming land along the river was lost	19	6
Material	No compensation was received from the dam	15	5
Security	Theft and moral degeneration owing to unemployment	14	4
Material	Did not receive any benefits from the dam	13	4

Material	Did not receive employment from the dam	13	4
Health	Increased prevalence of HIV / AIDS	10	3
Material	Bribes were needed to be employed by the dam	10	3
Social relations	Dam created family disputes	9	3
Social relations	Resettlement occurred	8	2
Material	Restricted access to the river for water	7	2
Social relations	People / neighbours have migrated from the village	7	2
Material	Nature has been destroyed	7	2
Material	Altered river flows	6	2
Health	Injuries from the dam	5	2
Health	Water pollution from dam	5	2
Security	Fear of being affected in the future	5	2
Material	Rock blasting chased fish away	4	1
Material	Infertile soil from deforestation	4	1
Security	Security problems	2	1
Health	Stagnant water, increasing mosquitoes and malaria	1	0
Material	Borehole destroyed	1	0
Social relations	Not consulted about the development	1	0
Material	Increased competition for limited resources	1	0
Material	Wages paid at dam too low	1	0
Material	Paying tax on the dam	1	0

Table 3: Wellbeing components named in response to why people are happy about the dam, aggregated by village

Wellbeing domain	Wellbeing component	n	Frequency (%)
Material	Provided electricity	205	37
Material	Employment opportunities	120	22
Material	Development for the region and village	109	20
Material	Going to provide electricity	106	19

Material	Improvement of services in village	92	17
Material	Development for the country	43	8
Material	Development of factories	24	4
Material	Able to build new, modern houses	23	4
Material	Compensation received	23	4
Material	Reduced load shedding	19	3
Material	Boosted small businesses	18	3
Material	Tourist attraction	14	3
Material	Power tariffs will be reduced	13	2
Security	Benefits will accrue in the future	12	2
Material	Increased land value	9	2
Material	Population increased, more market	7	1
Health	River flow changed, fewer deaths	6	1
Material	Improved education	5	1
Material	Increased government's income	4	1
Material	Benefits from BEL (sustainable livelihood schemes, tree planting)	3	1
Security	Village security improved	3	1
Material	Reduces people's reliance of fuelwood	2	0
Material	Able to get stolen material from the dam	1	0
Material	See VIPs opening the dam	1	0

A-12: Responses to how people feel the dam has affected family relationships and relationships with neighbours

Table 1: Wellbeing components named in response to why people feel the dam has negatively influenced family relationships, aggregated by village

Wellbeing domain	Wellbeing component	n	Frequency (%)
Social relations	Conflict from sharing money from the dam (compensation and earnings)	47	28
Social relations	Lost income, poverty, struggling to provide basic necessities creates conflict	32	19
Social relations	Conflict arising from illness / death from rock blasting	28	17
Social relations	Loss of income from loss of access to natural resources (e.g. herbs and fishing) has created conflict in HH	16	10
Social relations	Family members have to migrate in search of jobs	11	7
Social relations	Migrant labour	10	
Social relations	Families were disrupted by displacement	6	4
Social relations	Miscarriages from rock blasting	4	2
Social relations	Husband has been tough on the wife, because of poverty (from losing jobs) or transferred anger on to wife	4	2
Social relations	Spouse blamed them for loss of land	1	1
Social relations	Wife now has to work	1	1
Social relations	Restricted access to the river	1	1
Social relations	Death in family from working at the dam	1	1

Table 2: Wellbeing components named in response to why people feel the dam has negatively influenced relationships with their neighbours, aggregated by village

Wellbeing domain	Wellbeing component	n	Frequency (%)
Social relations	Displacement of neighbours	56	30
Social relations	People have moved in search of jobs	28	15
Social relations	People paid bribes in order to get a job at the dam	24	13

Social relations	Conflicts relating to compensation	21	11
Social relations	Family conflicts	10	5
Social relations	People are homeless and landless	6	3
Social relations	Increase in theft in the village	5	3
Social relations	People who received money started treating neighbours badly	4	2
Social relations	Neighbours affected by rock blasting	3	2
Social relations	Migrant labour	3	2
Social relations	People who lost land trespass on other people's land	3	2
Social relations	Discrimination in employment at the dam	3	2
Social relations	Conflict between those who support the dam and those who don't	2	1
Social relations	Poverty erodes relationships	2	1
Social relations	Village members have died from the dam	2	1
Social relations	People believe they have been overlooked for compensation	2	1
Social relations	Miscarriages from rock blasting	2	1
Social relations	People treated badly for receiving compensation	1	1
Social relations	People refused to share land at the river	1	1
Social relations	Conflict from losing access to natural resources	1	1

Appendix B: Supplementary information for Chapter 5

B-1: Cultural Heritage Key Informant Interview protocol

Informal guide of topics to be covered during the cultural heritage key informant interviews with project partners

Roles and participants

The main objectives of these interviews will be to:

- Ask for their understanding on what 'traditional cultural heritage' in Uganda is.
- Find out if traditional cultural heritage is important to people living in both rural and urban areas where people are poorer and wealthier respectively, and how the importance might differ as well as how significant this importance is to people's lives.
- Explore the link between religion and traditional cultural beliefs.
- Find out whether traditional cultural beliefs have changed over the decades. For example, are they less / more important nowadays and how have these beliefs changed?
- Discuss the importance of tangible cultural heritage elements that local people in rural settings identify with, for example landscapes, culturally significant species and sacred sites.
- Explore the role that intangible elements of cultural heritage play, such as the importance of myths, traditions, religious and spiritual beliefs.
- How do these cultural beliefs differ between people (different ethnicities, genders, poverty levels, livelihoods and age groups).
- Find out more about the cultural, spiritual and religious beliefs of people in the study area (Bujagali, Kalagala and Isimba).

As cultural heritage is a sensitive topic to address during a questionnaire, I will also discuss the best ways in which I can address the topic in the study area.

Introduction

(As I know all the project partners and people listed above, I will not need to re-introduce myself).

Thanks very much for setting aside the time to meet with me and for agreeing to participate in this short interview which will last for approximately half an hour.

The aim of this interview is for me to find out more about cultural heritage in Uganda. I spent time learning about the different aspects of cultural heritage (and in particular spiritual sites) during my scoping trip in April and May this year. Now that I have a better understanding about cultural heritage,

especially that in the study area, I would like to talk to you about it in more detail and learn about some of your insights.

What is said during this meeting is confidential and I will make sure that your answers are kept anonymous. You can stop at any time and you don't need to answer all questions if you don't want to. The information that you share with me will be saved in a secure database which can only be accessed with a password. I will analyse the information and the results will be presented as part of my written thesis for my degree qualification. Some of the results may also be published internationally in academic papers, at conferences and on online blogs. The thesis will be deposited in the Oxford Research Archive, both online and in print.

This study has been reviewed by, and received ethics clearance through, the University of Oxford Central University Research Ethics Committee and the National HIV/AIDS Research Committee in Uganda.

If you have a concern about any aspect of 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 the Research Ethics Committee at the University of Oxford or the National HIV/AIDS Research Committee in Uganda.

Do you have any questions or concerns so far? (Pause here to give participant enough time to think and comment)

Would you mind if I audio record this meeting so that I can make sure that I don't miss anything important that you tell me? (Get verbal consent; if anyone objects to being recorded, do not record the meeting)

Also, could you please sign and date this informed consent form for my records?

Section A: Cultural heritage

1. In a Ugandan context, what do you understand by the term 'cultural heritage'?
2. To which groups of people in Uganda is cultural heritage important?
3. How important is cultural heritage to people in urban settings? (very low / low / medium / high / very high) Why?
4. How important is cultural heritage to people in rural settings? (very low / low / medium / high / very high) Why?
5. How and why does the importance differ between rural and urban settings?
6. Focusing on rural areas, is cultural heritage important to their wellbeing and ability to lead a good life? For example, as important as material aspects and relationships? Why / why not?
7. Do cultural heritage beliefs differ regionally in Uganda?
8. What elements of cultural heritage are important to people in Uganda?

9. Do you think the importance of cultural heritage has changed over the decades? For example, are they less / more important nowadays? Why / why not?
10. How have these beliefs changed over the years?
11. Does religion influence cultural heritage beliefs? Why / why not?
12. Can you please tell me a bit more about some of the intangible cultural heritage beliefs, such as myths, traditions, religious and spiritual beliefs?
13. Can you tell me a bit more about the importance of tangible cultural heritage elements, particularly those to do with the natural environment? For example, the importance of landscapes, culturally significant species and sacred sites.
14. Do cultural beliefs differ between people? For example, between genders, ethnicities, livelihoods, age groups and the wealthy and poor.
15. If you know, can you tell me a bit more about the different types of cultural heritage (tangible and intangible elements) in the Districts and villages along the Victoria Nile? Particularly in the Bujagali, Kalagala and Isimba areas.
16. If you know, can you tell me a bit more about the spiritual sites along the Victoria Nile River? Particularly at Bujagali, Kalagala and Isimba. How important are / were these sites to the local people, why did they use them and what has happened to the spiritual sites that have been lost because of the dam development?
17. Can you tell me a bit more about the relocation of spiritual sites?
18. Is it possible to compensate for the loss of one spiritual site by protecting another spiritual site elsewhere? Why / why not?

    According to the IFC, compensation is defined as “payment in cash or in kind for an asset or a resource that is acquired or affected by a project at the time the asset needs to be replaced”.

19. How can one go about compensating for the loss of a spiritual site?
20. Cultural heritage is a sensitive topic to discuss with people in villages, what do you think is the best way for me to approach the topic and ask questions about it?

Section B: Conclusion

Thank you for the time and information that you have shared with me. This has been a very interesting and enlightening meeting.

Before I go, do you have any questions about the research project or anything that we have discussed that you would like to ask me?

B-2: Cultural Heritage Focus Group Discussion protocol

Introduction (VG to read out)

Hi, my name is Victoria Griffiths and this is (name of research assistant). I am an independent research student at Oxford University in England.

It has been suggested that we meet with you to discuss my research and I would like to invite you to participate in a group discussion. It should only take about two hours of your time and refreshments will be provided at the end.

Before we begin, can you please introduce yourselves to the group? I will go first. (Introductions, including my research assistant)

I'll now tell you more about the group discussion.

We want to learn more about how things that people do as part of their culture and traditions (such as visiting spiritual sites, particular traditions like dances or songs, ways of doing things that have been passed down, or religious beliefs) affect people's ability to live a good life in this village. We are particularly interested in culture and traditions that relate to natural places.

Thank you for agreeing to meet with us. We hope that you will be able to represent your community and provide us with some of your own ideas and experiences. We realise that what makes for a good life will vary from person to person, and you may not want to share some of the more private and personal things with other people, including us or other people in this group. This is completely fine, and we will not ask you to say anything that could make you uncomfortable. What is said during this meeting is private so please do not share the information with anyone else. We will make sure that your answers are kept anonymous and we will not share them with other members of the community, the local authorities or any other authorities. People will have different opinions so it is important that we all respect each other's opinions and give everyone a chance to speak. We will not ask you anything that could get you into trouble and as this is voluntary, you may stop the discussion at any time. If you have any questions, please ask us.

The information that you share with me will be saved in a secure database, which can only be accessed with a password. I will analyse the information and the results will be presented as part of my written thesis for my degree qualification, but the information from our discussion today will be anonymous. Some of the results may also be published internationally in academic papers, at conferences and on online blogs. At the end of my PhD, I will plan a return trip to Uganda to present my research findings to you. The anonymised data will be kept for a minimum of three years after publication according to Oxford University policy.

This study has been reviewed by, and received ethics clearance through, the University of Oxford Central University Research Ethics Committee and the National HIV/AIDS Research Committee in Uganda.

If you have a concern about any aspect of 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 the Research Ethics Committee at the University of Oxford or the National HIV/AIDS Research Committee in Uganda. If you do not have a telephone, your LC1 will be able to assist you.

Is this ok? (Get agreement from everyone – nodding is fine)

Do you have any questions or concerns so far? (Pause here to give people enough time to think and comment)

Would you like to continue with the meeting? (Get verbal consent from every participant)

Would you mind if we take photos and audio record this meeting so that we can make sure that we don't miss anything important that you tell us? (Get verbal consent; if anyone objects to being recorded or photographed, do not record the meeting)

Section A: Introductions

Before we continue, can each of you take a minute to tell us:

- Your name;
- How long you have lived in your village; and
- Whether you have a formal position within the village? If so, what is your position?

Section B: Cultural heritage and wellbeing

12. When I mention the term 'cultural heritage' (such as cultural traditions, beliefs and myths in this village) what are the first things that come to mind? Let's make a list.
13. Now let's think about different times of year. What different traditional events or ceremonies happen at different times, can we make a list of these? Are there any that have to do with nature and the environment?
14. How about at different stages in people's lives, what types of ceremonies, events or traditions are associated with these? Again, are there any that have to do with nature and the environment?
15. How about beliefs and traditions to do with things that people use or do, like different foods or livelihood activities?
16. What about traditions and beliefs that have to do with things that people use from nature and the environment?
17. Are there different traditions for men and women? Can you give me some examples?
18. Are there different traditions for different groups of people within the village, for example different ethnic groups, or people from different backgrounds? Again, can you give me some examples?

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19. How about myths and stories that people tell in this village, can you tell me a few examples? Are there any that have to do with nature and the environment?
20. How about dances and songs, are there any of these that are especially important to this village? When are they used or carried out, and who by (men/women, different ethnic groups etc.)? Are there any that have to do with nature and the environment?
21. Do you think that the importance of cultural beliefs and practices to do with nature and the environment have changed over the decades in your village? For example, are they less / more important nowadays? Why / why not?
22. There are a number of things that could help people in this village to lead a good life. For example, material things like having a good house and food, relationships such as having a good family relationship and in general being happy with what you have. In comparison to all these things, how important is cultural heritage to people in this village?
    - One of the most important things
    - An important thing, but a few other things are more important
    - Fairly important but less important than most of the things that help us lead a good life
    - Not important at all, compared to these other things

    Can you explain your answer?

    Is cultural heritage more important or less important to certain groups of people in the village? Can you explain your answer?

23. Thinking now only about the important parts of cultural heritage to do with nature and the environment, which you have identified, how have they changed over the last 10 years? Have they changed for the better or worse? Why do you think they have changed?
24. Do you think that projects developed by government, businesses, NGOs or other organisations in the area have affected people's cultural beliefs and practices that are to do with nature? Examples of projects could include the building of schools, hospitals and roads.
25. Do you think that the Bujagali / Isimba (select depending on village location) dam has or has not had any influence on cultural beliefs and practices that are to do with nature in this village? If so, please explain why.
26. Have the people associated with the construction of the dam done anything to try to improve cultural heritage for the villages? What have they done and why?
27. Are people in the village happy with this, indifferent, or unhappy? Why?
28. Thinking about all the things that have made cultural heritage better or worse in the village over the last 10 years, how big has the dam's impact been? Has it had an important impact or not very important impact compared to other things which have changed?
29. Can you tell me a bit more about the sacred sites that have been affected by the dam? What are they and why are they visited?
30. Is there a person in the village whose job it is to look after the site? What is this person's role?
31. Have the spirits been relocated? If so, can you please tell me more about this process? Do people now visit this new sacred site?

32. Could people access these old and new sites freely? Or do they have to pay? Do visitors to the site have to pay?
33. How far do / did people travel to visit these sacred sites?

Section C: Conclusion

Thank you all for the time and information that you have shared with us. This has been a very interesting and enlightening meeting.

Before I go, do you have any questions about the research project or anything that we have discussed that you would like to ask us?

Table B-3: Typology for measuring cultural values and nature (adapted from Kellert 1996)

Type of value for nature	Description (Kellert 1996; Powel et al. 2012)	Application to cultural heritage	Corresponding statement from questionnaire
Utilitarian	• Nature should benefit humans through physical, practical and material exploitation (e.g. people depend on the natural environment as a source of food production, medicines and building supplies). • People may also receive physical and mental rewards from the environment. They often express a desire for recreational benefits such as relaxation or satisfaction from the environment.	• How people use the material elements of the natural environment to satisfy their cultural needs (e.g. collecting medicinal herbs from nature and using nature in traditional ceremonies and traditional dress).	1. Things that I can find in nature (for example herbs or trees) are useful for my culture and traditions 2. Sacred sites and traditions such as weaving could be a tourist attraction and bring money to my village 3. Cultural traditions, beliefs and ceremonies **do not** help me to bond with other people in the village
Naturalistic	• Interest and affection for nature and the outdoors. • Reflects individual's desire for direct experiences with nature and wildlife. • Reflects a high level of comfort and satisfaction when in nature. • Important basis for physical fitness and obtaining various 'outdoor skills' (e.g. climbing, hiking, tracking and orienteering).	• Strong desire to visit and return to cultural heritage sites. • Individuals may feel satisfied and comforted after visiting a sacred site. • Culture and traditions may remind people of past events that are important to the community. • People may experience other	4. Taking part in traditional activities in nature makes me feel happy and comforted 5. I look forward to the next time that I will take part in a traditional activity in nature

Type of value for nature	Description (Kellert 1996; Powel et al. 2012)	Application to cultural heritage	Corresponding statement from questionnaire
	• Many of these activities influence an individual's state of mind (relaxation, tension release, peace of mind, enhanced creativity) and physical wellbeing.	benefits from visiting sacred sites or taking part in traditional activities (e.g. walking with groups of people to a sacred site might be important for social interactions and cohesion in the community).	
Ecologistic-scientific	• Concern for the environment as a system, for interrelationships between wildlife species and natural habitats. • Enhancement of knowledge, awareness, understanding and observation skills. • The need or desire to develop an increased awareness and understanding of the natural environment through interpretation, reading, scientific enquiry and direct observation. • Emphasis on the physical and mechanical functioning of biodiversity (e.g. morphology, taxonomy and physiological processes).	• Reflects the need to teach and pass down traditions, cultural practices, myths and beliefs to future generations • Teaching future generations about the importance of nature so that they appreciate and value nature and its cultural heritage components. • The natural environment can also teach people things that are not necessarily taught in the classrooms.	6. I believe that myths, traditions and beliefs **do not** need to be taught and passed down to future generations 7. I think that time spent in nature can teach people things outside of the school classroom 8. Being in nature makes me want to learn more about other people's traditions and cultures
Aesthetic	• Appreciation of the physical attractiveness, beauty and the appeal of natural habitats (e.g. feelings of awe when observing a	• Individuals' appreciation and awe for the sheer beauty of culturally significant landscapes, species and other environmental features.	9. Places, plants and animals in the environment are **not** important for my culture and traditions and so

Type of value for nature	Description (Kellert 1996; Powel et al. 2012)	Application to cultural heritage	Corresponding statement from questionnaire
	sunset, a charismatic species or a beautiful mountain range). • Strong emotional feelings of intense pleasure evoked from experiencing the physical splendour of the natural world. • Recognising the beauty of the natural environment can raise an awareness and appreciation of balance, symmetry, harmony and grace.	• People may get a 'sense of place' from certain features in the environment and generally enjoy the beauty of a culturally significant area.	do not need to be protected 10. I enjoy experiencing the beauty of the natural environment
Symbolic	• Inspiration from nature in language, art and thought.	• Nature may provide people with ideas or images that could inspire traditional arts and crafts or other visual and creative forms (e.g. traditional dances). • Includes the recounting of stories from direct experience with nature as well as myths and legends associated with the environment. • Religion also has an element of symbolism.	11. There are some parts of the environment of that remind me of important past events 12. There are **no** myths, legends and stories associated with nature in my culture
Humanistic	• Strong emotional appreciation, attachment and affection for aspects of nature. • The humanistic experience of nature can	• Strong affection toward individual species such as sacred flora and fauna as well as other sacred features of the environment (e.g.	13. I have a strong attachment to particular plant and animal species because of their

Type of value for nature	Description (Kellert 1996; Powel et al. 2012)	Application to cultural heritage	Corresponding statement from questionnaire
	often result in strong tendencies to care and nurture individual elements of nature.	sacred landscapes, waterfalls and caves).	importance in my culture and traditions 14. I would not mind if cultural traditions and beliefs changed in the future, meaning that nature becomes less important 15. My favourite cultural tradition is visiting sacred sites in nature
Moralistic	• Ethical concern for nature. • The desire to protect and conserve the natural environment.	• Nature's ability to be a source of moral and spiritual inspiration. • Raising awareness among the local community of the ethical need to respect and protect the environment and its associated tangible and intangible cultural values. • Individuals need to respect the different types of beliefs and traditions practised by different people and to different degrees. • Ethical need to preserve these cultures and traditions that have been practised for centuries. • Religion is also a source of	16. There is a need to protect and preserve the different cultural beliefs and traditions in my village 17. My religion encourages me to protect nature 18. Because of my religion, traditional and cultural beliefs and practices are no longer important in my life

Type of value for nature	Description (Kellert 1996; Powel et al. 2012)	Application to cultural heritage	Corresponding statement from questionnaire
		moralistic views and can influence the ethical need to preserve and protect the environment.	
Dominionistic	• Mastery, physical control, dominance of nature. • Desire to test oneself in natural settings. • Outcomes include feelings of mastery, skill development, goal attainment, physical control and dominance of nature.	• Examples include rights of passage such as when individuals move from childhood to adulthood in traditional societies.	19. It would be a boring experience to help relocate spirits 20. Being in charge of cultural events means that you are well respected in the village 21. I sometimes carry out animal sacrifices when worshipping at a sacred site
Negativistic	• Fear, aversion, alienation from nature due to indifference, dislike or fear.	• Indicates fear of angry spirits associated with sacred sites in the natural environment.	22. I will do everything that I can to keep the spirits which live in nature happy 23. I would avoid visiting sites with angry spirits 24. I fear going near certain places in nature as they may bring me bad luck

B-4: Coding protocol for the Kellert typology statements

The 24 Kellert typology statements were included in a section in the individual questionnaire. Research assistants read out each statement (centred around cultural heritage associated with nature) and the respondent was asked to select the most appropriate answer. Answers were based on a Likert scale: strong agreement, agreement, neutral, disagreement and strong disagreement. There was also an option for the respondent to select an answer which said they choose not to answer or did not know the answer. Statements were framed either positively (e.g. “Things that I can find in nature (for example herbs or trees) are useful for my culture and traditions”) or negatively (e.g. “Places, plants and animals in the environment are **not** important for my culture and traditions and so **do not** need to be protected”).

Responses to these 24 statements were coded for analysis. Responses to positively framed statements were coded as follows: -2 = strong disagreement, -1 = disagreement, 0 = neutral, 1 = agreement and 2 = strong agreement. Respondents who selected the option ‘don’t know / would rather not say’ were excluded. Responses to negatively framed statements were reverse coded as follows: 2 = strong disagreement, 1 = disagreement, 0 = neutral, -1 = agreement and -2 = strong agreement.

Table B-5: Themes and codes emerging from the thematic analysis

Theme 1: Spiritual beliefs, rituals and ceremonies	Theme 2: Nature	Theme 3: Changes in cultural heritage
• Religion • Myths and stories • Ancestors and burial grounds • Spirits • Animal and human sacrifices • New born rituals • Twin rituals • First harvest tradition • Circumcision traditions (male and female) • Clitoris elongation • Last funeral rights and burial traditions • Christmas, birthdays, graduation, get together's • Traditional marriage: preparation, dowry, introduction • Traditional songs and dances • Traditional food and alcohol • Culture differing between tribes • Clans	• Bark cloth • Traditional music and instruments • Totems • Sacred sites • Insects and naming months • Accessing / harvesting natural resources • Medicinal herbs and traditional healers • Traditional arts and crafts • Specific harvesting / planting times • Wearing / using animal skins	• Climate change • People are afraid of cultural heritage • Religion's influence • Culture changing / disappearing • People trying to make money out of cultural heritage • Modernity • Dam's impact • Impact of other projects • Sacred sites destroyed • Traditional dress • Men and women's roles • Manner and behaviour • Teaching younger generations

Misc. code = language

B-6: Cronbach's alpha values for the nine Kellert Typologies

Based on the distribution of responses to the 24 statements, it was decided that one statement in the dominionistic (Question 21; Appendix B-3) and one from the negativistic value type (Question 22; Appendix B-3) should be excluded from the analyses. The dominionistic statement centered around animal sacrifices and responses appeared to reflect a social acceptability bias, meaning that people may be wary about admitting to making sacrifices. The negativistic statement (concerning keeping spirits happy) was excluded because responses contradicted those of two other statements in the same typology. Cronbach's alpha scores were calculated post-exclusion.

Table 1: Cronbachs alpha values for the nine types of value for nature (n = 871)

Value type	Cronbachs alpha
Utilitarian	0.249
Naturalistic	0.520
Ecologistic-scientific	0.187
Aesthetic	0.091
Symbolic	0.154
Humanistic	0.429
Moralistic	0.399
Dominionistic	0.199
Negativistic	0.529

B-7: Response frequencies for all 24 statements (n = 1305)

Type of value for nature	Statement	-2 (Strong disagreement)	-1 (Disagreement)	0 (Neutral)	1 (Agreement)	2 (Strong agreement)	Don't know/ would rather not say
Utilitarian	1. Things that I can find in nature (for example herbs or trees) are useful for my culture and traditions	0.69% (n = 9)	0.54% (n = 7)	0.54% (n = 7)	43.98% (n = 574)	53.49% (n = 698)	0.77% (n = 10)
	2. Sacred sites and traditions such as weaving could be a tourist attraction and bring money to my village	1.30% (n = 17)	1.69% (n = 22)	1.61% (n = 21)	29.35% (n = 383)	60.92% (n = 795)	5.13% (n = 67)
	3. Cultural traditions, beliefs and ceremonies **do not** help me to bond with other people in the village	39.77% (n = 519)	42.22% (n = 551)	5.67% (n = 74)	6.97% (n = 91)	2.84% (n = 37)	2.53% (n = 33)
Naturalistic	4. Taking part in traditional activities in nature makes me feel happy and comforted	4.29% (n = 56)	6.51% (n = 85)	8.74% (n = 114)	49.20% (n = 642)	30.50% (n = 398)	0.77% (n = 10)

Type of value for nature	Statement	-2 (Strong disagreement)	-1 (Disagreement)	0 (Neutral)	1 (Agreement)	2 (Strong agreement)	Don't know/ would rather not say
	5. I look forward to the next time that I will take part in a traditional activity in nature	9.35% (n = 122)	12.18% (n = 159)	11.72% (n = 153)	45.06% (n = 588)	20.00% (n = 261)	1.69% (n = 22)
Ecologistic-scientific	6. I believe that myths, traditions and beliefs **do not** need to be taught and passed down to future generations	62.38% (n = 814)	28.89% (n = 377)	2.07% (n = 27)	2.68% (n = 35)	2.38% (n = 31)	1.61% (n = 21)
	7. I think that time spent in nature can teach people things outside of the school classroom	3.45% (n = 45)	5.29% (n = 45)	1.61% (n = 21)	41.92% (n = 547)	46.51% (n = 607)	1.23% (n = 16)
	8. Being in nature makes me want to learn more about other people's traditions and cultures	2.45% (n = 32)	9.04% (n = 118)	5.67% (n = 74)	53.49% (n = 698)	27.43% (n = 358)	1.92% (n = 25)
Aesthetic	9. Places, plants and animals in the environment **are not**	55.86% (n = 729)	34.33% (n = 448)	1.84% (n = 24)	3.14% (n = 41)	3.68% (n = 48)	1.15% (n = 15)

Type of value for nature	Statement	-2 (Strong disagreement)	-1 (Disagreement)	0 (Neutral)	1 (Agreement)	2 (Strong agreement)	Don't know/ would rather not say
	important for my culture and traditions and so do not need to be protected						
	10. I enjoy experiencing the beauty of the natural environment	1.07% (n = 14)	0.84% (n = 11)	0.46% (n = 6)	29.27% (n = 382)	67.97% (n = 887)	0.38% (n = 5)
Symbolic	11. There are some parts of the environment that remind me of important past events	3.22% (n = 42)	4.37% (n = 57)	1.69% (n = 22)	42.84% (n = 559)	45.13% (n = 589)	2.76% (n = 36)
	12. There are **no** myths, legends and stories associated with nature in my culture	27.97% (n = 365)	37.09% (n = 484)	1.92% (n = 25)	9.20% (n = 120)	8.51% (n = 111)	15.33% (n = 200)
Humanistic	13. I have a strong attachment to particular plant and animal species because of their importance in my culture and traditions	3.91% (n = 51)	5.52% (n = 72)	0.84% (n = 11)	34.33% (n = 448)	53.18% (n = 694)	2.22% (n = 29)

Type of value for nature	Statement	-2 (Strong disagreement)	-1 (Disagreement)	0 (Neutral)	1 (Agreement)	2 (Strong agreement)	Don't know/ would rather not say
	14. I would **not** mind if cultural traditions and beliefs changed in the future, meaning that nature becomes **less** important	47.97% (n = 626)	33.03% (n = 431)	8.51% (n = 111)	5.59% (n = 73)	3.45% (n = 45)	1.46% (n = 19)
	15. My favourite cultural tradition is visiting sacred sites in nature	28.74% (n = 375)	21.15% (n = 276)	12.57% (n = 164)	22.99% (n = 300)	11.34% (n = 148)	3.22% (n = 42)
Moralistic	16. There is a need to protect and preserve the different cultural beliefs and traditions in my village	6.44% (n = 84)	3.45% (n = 45)	7.51% (n = 98)	39.85% (n = 520)	38.01% (n = 496)	4.75% (n = 62)
	17. My religion encourages me to protect nature	0.46% (n = 6)	0.92% (n = 12)	0.69% (n = 9)	49.43% (n = 645)	45.75% (n = 597)	2.76% (n = 36)
	18. Because of my religion, traditional and cultural beliefs and practices are **no longer** important in my life	36.70% (n = 479)	30.88% (n = 403)	8.81% (n = 115)	13.26% (n = 173)	9.50% (n = 124)	0.84% (n = 11)

Type of value for nature	Statement	-2 (Strong disagreement)	-1 (Disagreement)	0 (Neutral)	1 (Agreement)	2 (Strong agreement)	Don't know/ would rather not say
Dominionistic	19. It would be a boring experience to help relocate spirits	47.43% (n = 619)	10.80% (n = 141)	5.36% (n = 70)	20.31% (n = 256)	47.43% (n = 619)	6.51% (n = 85)
	20. Being in charge of cultural events means that you are well respected in the village	11.34% (n = 148)	7.97% (n = 104)	9.27% (n = 121)	43.45% (n = 567)	25.59% (n = 334)	2.38% (n = 31)
	21. I sometimes carry out animal sacrifices when worshipping at a sacred site	60.31% (n = 787)	13.64% (n = 178)	2.84% (n = 37)	8.74% (n = 114)	12.64% (n = 165)	1.84% (n = 24)
Negativistic	22. I will do everything that I can to keep the spirits which live in nature happy	38.31% (n = 500)	13.03% (n = 170)	7.51% (n = 98)	24.52% (n = 320)	13.41% (n = 175)	3.22% (n = 42)
	23. I would avoid visiting sites with angry spirits	6.21% (n = 81)	5.90% (n = 77)	2.91% (n = 38)	25.98% (n = 339)	58.24% (n = 760)	0.77% (n = 10)
	24. I fear going near certain places in nature as they may bring me bad luck	9.81% (n = 128)	8.51% (n = 111)	2.99% (n = 39)	34.94% (n = 456)	42.15% (n = 550)	1.61% (n = 21)

B-8: Exploratory Factor Analysis results

Table 1: Summary of exploratory factor analysis results for the Kellert Typology (n = 871)

	Typology	Statement	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Communality
1	**Naturalistic**	I look forward to the next time that I take part in a traditional activity in nature *(look_forward)*	0.12				**0.58**		0.15	0.48
2	**Naturalistic**	Taking part in traditional activities makes me feel happy and comforted *(happy_comforted)*	0.15				**0.45**	0.12	-0.22	0.38
3	**Ecologistic-scientific**	I believe that myths, traditions and beliefs do not need to be taught and passed down to future generations *(teachings)*	0.10					**0.51**	0.14	0.34
4	**Ecologistic-scientific**	I think that time spent in nature can teach people things outside of the classroom *(teaching_outside_classroom)*			**1.00**					1.00
5	**Ecologistic-scientific**	Being in nature makes me want to learn more about other people's traditions and cultures *(learning)*	0.20			**0.46**				0.33
6	**Utilitarian**	Cultural traditions, beliefs and ceremonies do not help me bond with other people in the village *(village_bonding)*	0.17			**0.43**		0.11	0.15	0.32
7	**Utilitarian**	Sacred sites and traditions such as weaving could be a tourist attraction and bring money to my village *(tourist_attraction)*						0.16		0.05

	Typology	Statement	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Communality
8	**Utilitarian**	Things that I find in nature (e.g. herbs or trees) are useful for my culture and traditions *(useful_nature)*	-0.17			**0.36**	0.25	0.21		0.28
9	**Aesthetic**	I enjoy experiencing the beauty of the natural environment *(beauty_environment)*			0.13		0.12	0.15		0.06
10	**Aesthetic**	Places, plants and animals in the environment are not important for my culture and traditions and so do not need to be protected *(protect_sacred_sites)*				0.20		0.10	**0.39**	0.29
11	**Symbolic**	There are no myths, legends and stories associated with nature in my culture *(myths_nature)*			0.12				**0.46**	0.26
12	**Symbolic**	There are some parts of the environment that remind me of important past events *(past_events)*	0.23			0.21				0.17
13	**Humanistic**	I have a strong attachment to particular plants and animal species because of their importance in my culture and traditions *(species)*	0.22				0.22	0.22		0.21
14	**Humanistic**	I would not mind if cultural traditions and beliefs changed in the future meaning that nature becomes less important *(cultural_changes)*	**0.49**			0.12				0.32
15	**Humanistic**	My favourite cultural tradition is visiting sacred sites in nature *(favourite_tradition)*		-0.21		0.29	**0.36**	-0.11	0.11	0.42

	Typology	Statement	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Communality
16	**Moralistic**	My religion encourages me to protect nature *(religion_protect_nature)*			0.15	0.12		**0.36**	**-0.25**	0.24
17	**Moralistic**	Because of my religion, traditional and cultural beliefs and practices are no longer important in my life *(religion_cultural_heritage)*	**0.68**							0.52
18	**Moralistic**	There is a need to protect and preserve the different cultural beliefs and traditions in my village *(protect_beliefs)*	**0.48**				0.19			0.43
19	**Negativistic**	I would avoid visiting sites with angry spirits *(angry_spirits)*		**0.91**						0.82
20	**Negativistic**	I fear going near certain places in nature as they may bring me bad luck *(bad_luck)*		**0.39**		**-0.**25	0.12	-0.12		0.25
21	**Dominionistic**	I think it would be a boring experience to help relocate spirits *(relocate_spirits)*	-0.16	-0.26		0.17	0.18			0.16
22	**Dominionistic**	Being in charge of cultural events means that you are well respected in the village *(respected)*	**0.32**			**0.34**	0.19	-0.11		0.42
Eigen values (SS loadings)			1.33	1.10	1.09	0.96	0.93	0.62	0.59	
Percentage of total variance			6.00	11.00	16.00	20.00	24.00	27.00	30.00	

Test of the hypothesis that 7 factors are sufficient: Chi square statistic = 200.51 on 98 degrees of freedom; p-value = 4.96e-09

Table 2: Correlation between factors

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
Factor 1	1.00	0.101	0.05	-0.11	-0.06	0.05	0.04
Factor 2	0.11	1.00	-0.22	-0.39	-0.23	0.51	0.34
Factor 3	0.05	-0.22	1.00	0.14	0.03	-0.27	-0.00
Factor 4	-0.12	-0.39	0.14	1.00	0.23	-0.38	-0.01
Factor 5	-0.06	-0.23	0.03	0.23	1.00	-0.21	-0.02
Factor 6	0.05	0.51	-0.27	-0.38	-0.21	1.00	0.12
Factor 7	0.04	0.34	-0.00	-0.01	-0.02	0.19	1.00

B-9: Cumulative link mixed model exploring how important cultural heritage is to wellbeing

Two socio-demographic variables have a significant effect on responses to how important cultural heritage is to wellbeing, namely gender and education (CLMM; Table 1). When compared to the model's baseline conditions (female and no education), gender has a positive parameter estimate whilst education has a negative estimate, implying that males and those with less education are more likely to say that cultural heritage is important to them. Gender has a parameter estimate of 0.66 (above all of the thresholds), indicating a high probability that men find cultural heritage more important to wellbeing than women do (the baseline condition). Age did not have a significant effect on response and was hence removed from the model. Although non-significant, poverty and time lived in the village were left in the model as this led to the lowest AIC value. The coefficients suggest that those who were less poor were more likely to find cultural heritage important, and those who worked in tourism and had lived for longer in the village were less likely to find it important.

Responses also differed between the six villages. Respondents in Kalagala-West found cultural heritage to be the most important to wellbeing, whilst respondents on the opposite side of the river, Kalagala-East, found cultural heritage to be the least important to wellbeing. The next village where respondents found cultural heritage to be important to wellbeing was Isimba-East, and the next village where they thought it was less important was on the opposite bank, Isimba-West. Lastly, respondents in Bujagali-West found it important to wellbeing whilst those on the opposite bank, Bujagali-East, found it less important to wellbeing. This suggests that there was no clear geographical structure to the results.

Table 1: CLMM results with logit link function of perceptions of importance of cultural heritage to wellbeing to predictor variables

Variable	Estimate	Std. Error	CI (2.5%)	CI (97.5%)	
Gender – Male	0.66	0.14	0.38	0.93	***
Education – Primary	-0.29	0.20	-0.68	0.10	
Education – Secondary	-0.64	0.23	-1.09	-0.19	**
Education – College / university	-1.39	0.47	-2.31	-0.48	**
Economic status	0.97	0.62	-0.24	2.19	
Livelihood – Self-employed	-0.39	0.39	-1.15	0.37	
Livelihood – Tourism	-2.05	1.18	-4.36	0.27	.
Livelihood – Uses natural resources	-0.33	0.37	-1.05	0.39	

Variable	Estimate	Std. Error	CI (2.5%)	CI (97.5%)
Lived in village < 5 years	-1.14	1.06	-3.22	0.94
Lived in village 5 – 9 years	-0.55	1.07	-2.65	1.56
Lived in village > 10 years	-1.29	1.03	-3.31	0.73
Threshold coefficients				
0/1	-5.26	1.16		
1/2	-3.94	1.15		
2/3	-3.10	1.15		
3/4	-0.01	1.14		
Random effects (intercepts)				
Bujagali-West (Kikubamutwe)	0.06			
Bujagali-East (Kyabirwa)	-0.10			
Kalagala-West (Kalagala)	0.33			
Kalagala-East (Bubugo Bugobi)	-0.41			
Isimba-West (Nampaanyi)	-0.28			
Isimba-East (Bwase-Buseta)	0.15			

*Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1*

Baselines: female, no education, salaried employment and not sure how long they have lived in the village.

Thresholds: 0 = Not at all important; 1 = Not very important; 2 = Neutral; 3 = Important; 4 = Very important.

References

Kellert, S. R., M. Black, C. R. Rush, and A. J. Bath. 1996. Human culture and large carnivore conservation in North America. Conservation Biology **10**:977-990.

Powell, R. B., M. T. Brownlee, S. R. Kellert, and S. H. Ham. 2012. From awe to satisfaction: immediate affective responses to the Antarctic tourism experience. Polar Record **48**:145-156.

Appendix C: Supplementary information for Chapter 6

Appendix C-1: Attributes and levels

Table 1: Detailed description of attributes and levels used in the choice experiment.

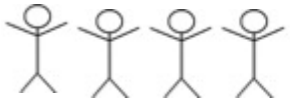
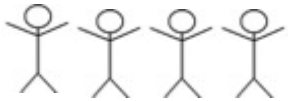
Offset activity (attribute)	Different options to choose from (levels)
Sustainable livelihood schemes Environmentally friendly business enterprises such as bee keeping and horticulture will be established that will help enhance household incomes. There will also be support for the planting of high value trees such as fruit trees on participants' land. Seedlings and technical support will be provided to farmers to plant these trees on their land. Schemes will be supported by the Ugandan Government, for example the Ministry of Water and Environment and the National Forest Authority under their Collaborative Forest Management Plan. Any household in the village would be allowed to participate in the scheme provided they are committed to the implementation of the enterprise as per specified terms and conditions, one of which would be that the participants stop cutting down trees in the CFRs. If there is evidence of a participant cutting down trees in the CFR, the participants' household will be excluded from the scheme for a year. Participating households will be guaranteed to receive a fixed price for their products so that they will not experience price fluctuations. By engaging in these enterprises and following the standards, participating households will have a chance to increase their income so that they can buy things they need like fuelwood, rather than needing to take it from the CFRs.	1. No scheme implemented (baseline) 2. Scheme implemented, participants earn UGX (Ugandan Shillings) 500 000 / year 3. Scheme implemented, participants earn UGX 1 000 000 / year

Offset activity (attribute)	Different options to choose from (levels)
Monitoring and evaluation employment Residents in the villages located in the Kalagala offset and close to the CFRs will be employed by the Government to assist with monitoring and evaluating the status of the CFRs. This work will also include monitoring who is entering the CFRs and helping to ensure that only people who are allowed to enter and use the CFRs' natural resources do so, and so there is less pressure on the CFRs. They will work alongside the Forest Guards contracted by the National Forest Authority, who will continue to work. People employed will earn 200 000 UGX per month and the jobs will last for 5 years. Employment opportunities will be spread evenly across the villages to ensure that people employed are not all from one village.	1. No employment to local residents (baseline) 2. 70 people employed (about one person from each village surrounding the CFRs) 3. 140 people employed (about two people from each village surrounding the CFRs)
Tourism revenue-sharing and sustainable investment With this activity, a proportion of the tourism revenue derived from the river rafting permits will be earmarked for **either** the restoration and management of the CFRs **or** community development in villages located within the Kalagala offset (including those located near the Bujagali and Isimba dams). Community development encompasses activities that will benefit the community as a whole, not just individuals (for example the building of clinics, schools and roads as well as providing potable water). Restoring and managing the CFRs means making sure that only people with permits enter and the amount of fuelwood gathered is limited to what the CFRs can sustain, so that the forest recovers and is available for people to use in the future.	1. There is no money paid to the fund from a proportion of each tourist river rafting permit. This means that no money from rafting will be used for either community development or management and restoration of the CFRs. (baseline) 2. USD 3 / 10 000 UGX per tourist river rafting permit is paid into the fund, which adds up to about 3 000 USD / 10 000 000 UGX per year. This money will be earmarked for management and restoration of the CFRs.

Offset activity (attribute)	Different options to choose from (levels)
In this case, revenue-sharing from rafting permits will happen for permits issued by all rafting companies in the area, not just Adrift. This will follow the Uganda Wildlife Authorities' revenue-sharing guidelines for its national parks, where local communities have a say in what programmes are initiated. Rafting companies will pay money into a fund, which is to be held and monitored by the Ugandan Government (such as the Ministry of Water and Environment).	3. USD 3 / 10 000 UGX per tourist river rafting permit is paid into the fund, which adds up to about 3 000 USD / 10 000 000 UGX per year. This money will be earmarked for community development in the villages.
Native tree planting programme and alien tree removal in the CFRs Paper Mulberry trees are an invasive species and despite being useful to local people, they damage the environment by taking space and water from native trees, and are less good as homes for wildlife like birds. Village residents will be employed to remove these trees from the CFRs. Once the aliens have been cleared, native tree seedlings will be planted. Residents from villages in the Kalagala offset area will be employed to remove alien trees and plant the seedlings. They will also be employed for a further two years to assist with the maintenance of the new seedlings.	1. Clearing alien trees and planting of new indigenous trees (baseline) 2. Clearing of alien trees in the CFR only 3. Planting of native trees in the CFR only 4. No tree planting and alien tree clearing in the CFR
Access to spiritual sites at the Kalagala Falls and Itanda Rapids	1. Free access to community members and a fee of UGX 1 000 to be paid by visitors (mixed payment). Money used for guides. (baseline)

Offset activity (attribute)	Different options to choose from (levels)
At present, village members near the Kalagala Falls and Itanda Rapids are allowed to visit the spiritual sites for free whilst visitors to the area pay UGX 1 000 to visit the sites. This money goes to local community organisations that provide guides to tourists. As part of this offset activity, the money charged to tourists to visit the site will be used to pay the guides and any extra money will be used to improve the site for everyone by ensuring that the sacred sites are protected, maintained and kept clean. The money could also be used to improve existing facilities like the gazebo as well as construct new facilities like toilets.	2. Everyone (including outsiders and community members) will need to pay. Visitors will pay UXG 1 000 to visit the spiritual site whilst community members will pay UGX 500. Extra money used to improve the site for everyone. 3. Free access to everyone (including outsiders and community members). No money for guides or improving the site.

Figure 1: Example of a choice card used in the study

Choice card 5			
	Scenario 1	**Scenario 2**	**Scenario 3**
Sustainable livelihood 	 1 000 000 UGX / year	 1 000 000 UGX / year	 500 000 UGX / year
Employment 	 70	 140	 140
Tourism revenue-sharing 			0 revenue-sharing
Tree planting and removal of alien trees  			 
Access to spiritual sites 	 Visitors – 1000 UGX  Residents – 500 UGX	 Visitors – 0 UGX  Residents – 0 UGX	 Visitors – 1000 UGX  Residents – 500 UGX
Choice:			

Appendix C-2: Creating the efficient design

If a full factorial design were used to create the choice sets for the CE, in which all possible combinations of attribute levels were used, the number of alternatives generated would be too large to present to a respondent (e.g. our design would generate 324 possible alternatives; Hoyos 2010). Therefore, a fractional factorial design was used to reduce the number of alternatives and hence choice sets, where only a fraction of the total number of attribute level combinations are used to create the alternatives (Mangham et al. 2009; Hensher et al. 2015).

Fractional factorial designs can be orthogonal (in which the attributes of the design are statistically independent of each other and no prior information on the parameters is used) or efficient designs (those that pursue the minimum predicted standard errors of the parameter estimates and increasing design efficiency by making assumptions about the sign or relative size of the parameters) (Mangham et al. 2009; Hoyos 2010; Greiner et al. 2014). Therefore, unlike the orthogonal design (the most well-known fractional factorial design), which aims to minimise the correlation between the attribute levels and choice situations, efficient designs aim to find statistically efficient designs, trying to maximise the information from each choice situation (Rose & Bliemer 2009). The appropriateness of orthogonal designs for CEs has been queried for some time, especially as they are generated primarily to satisfy the econometric properties of linear regression models, not discrete choice models which are non-linear. This means that larger sample sizes are often required with orthogonal designs in order to create statistically significant parameter estimates (Rose & Bliemer 2009). In addition, by ensuring attributes of the experiment are statistically independent, the design does not account for whether two or more attributes are cognitively correlated in the mind of a respondent (Rose & Bliemer 2009). Efficient designs lead to smaller standard errors in model estimation at smaller sample sizes and are increasingly being embraced by researchers as the best way of designing stated preference choice experiments (Greiner et al. 2014).

For my study, an unlabelled efficient design was used, whereby the three alternatives were given generic titles (‘A’, ‘B’, and ‘C’), so as not to convey any additional information to the decision-maker (Hensher et al. 2015). They merely reflect the relative order in which the alternatives are presented to the respondent during the choice task. The efficient design was generated using Ngene Version 1.1.2 (ChoiceMetrics 2014, Sydney, Australia).

To generate the efficient design, parameter priors of the attributes were estimated (Greiner et al. 2014). They were specified as Bayesian priors (as recommended by Sandor and Wedel (2001)) and assumed to be normally distributed around a given mean, with a standard deviation of 0.2. This accounted for possible misspecification and provided a degree of uncertainty around the parameter values, thereby leading to a more robust design than if fixed priors were used (Rose & Bliemer 2013; Greiner et al. 2014; Hensher et al. 2015). The priors were used by Ngene to generate the efficient design and the efficiency was optimised and expressed as a Bayesian D-error. There are several efficiency measures that can be used to measure the efficiency of a design, but the D-error is the most widely used because of its insensitivity to the magnitude of the scale of the parameters (Hoyos 2010; Hensher et al. 2015). I

opted for a D-efficient design for our study and no interaction effects between the attributes were included in our experimental design. In order to find the efficient design, a multinomial logit (MNL) model was used.

The Bayesian D-error for the efficient design in our study was 1.084. This large D-error reflects a loss in statistical efficiency, meaning that the true population parameters differ from those that were assumed during the design generation phase (Hensher et al. 2015). Efficient designs are fairly robust to misspecification of priors (Rose & Bliemer 2009). One way we could have reduced the D-error was by increasing the number of choice tasks (Hensher et al. 2015), but we opted to limit our choice tasks to six per person in order to limit the cognitive burden on the respondent. The ability of the experimental design to detect statistical relationships within the data is related to the sample size and, given a large enough sample, the statistical power of the experimental design may not matter (Rose & Bliemer 2009). Thus, the loss in design efficiency in our study is overcome by using a large sample size (1,215 individuals).

The efficient design was piloted in a seventh village in the study area, the choice data analysed (with the use of an RPL model), and the resulting parameter estimates used as priors to inform the improved (more efficient) Bayesian D-efficient design for the final survey (Greiner et al. 2014). The RPL model was conducted in Nlogit 5 (Econometric_Software_Inc 2010) using 500 Halton draws.

Appendix C-3: Choice experiment section from the individual questionnaire

Read out the introduction for choice experiment first and describe the process.

For this next section of the questionnaire, I want you to think about how to compensate for the impact that the Bujagali or Isimba Hydropower Project has on people and the environment. The compensator will create a new environmental project that will make up for the damage that the hydropower project has on the environment by improving the environment somewhere else (but in the same area). They have decided that they will do this by improving the state of the Central Forest Reserves in this area. They consider that the Central Forest Reserves are degraded because of too much fuelwood gathering and other pressures, and they would like to find ways to reduce this degradation.

At the same time, the compensator would like to make sure that local communities are not negatively affected by their environmental project, or that they might receive some benefits from it. The activities that the compensator wants to carry out as part of their project could affect you positively or negatively and we would like to see which activities you prefer.

We are working with the National Environment Management Authority (NEMA) to try and improve the projects used to compensate for the damage caused by the hydropower projects by taking your views and opinions into account. The results from this survey will be reported to NEMA and we will have discussions with them about how best to take these findings forward.

So for the environmental project that the compensator wants to implement, there are five different activities that will take place. We will show you a card which has three projects, each with different activities and I will ask you to select your preferred option. Even if you don't like any option, please choose the one you like better than the other ones. I will show you seven cards and would like you to choose your preferred option each time. I will take note of your choices as we go along.

Before we begin, I need to explain the five activities for the environmental project. Here is a card with a list of all the activities and different options to choose from. Please listen carefully as you will need this information when you make your choices. Please feel free to ask questions at any stage.

Description of the attributes and levels…(as per Appendix C-1).

Do you have any questions about what I have just described to you? Make sure that the respondent understands the different project activities (attributes) and levels that you have described.

Now we will begin. I will present you with one card at a time and you need to select which alternative you would prefer. Please ask if you have any questions as we go along.

(Shuffle the choice cards and then show them one at a time, informing the respondent about what options are in each alternative. The order in which the cards are shown will be changed from participant to participant. Show the participant one card again (it must be any randomly selected card) and note the answer)

1. Which alternative would you prefer?

a) Choice set 1

Card shown: _____

Alternative selected: _____

b) Choice set 2

Card shown: _____

Alternative selected: _____

c) Choice set 3

Card shown: _____

Alternative selected: _____

d) Choice set 4

Card shown: _____

Alternative selected: _____

e) Choice set 5

Card shown: _____

Alternative selected: _____

f) Choice set 6

Card shown: _____

Alternative selected: _____

2. How hard or easy did you find it to make the choices?

☐ Very hard ☐ Hard ☐ No feeling ☐ Easy ☐ Very easy

3. How sure are you about your answers?

☐ Very sure ☐ Sure ☐ No feeling ☐ Unsure ☐ Very unsure

4. Did you pay attention to each of the project activities when you were making your choices or did you ignore some?

☐ Paid strong attention to all of them ☐ Paid attention to all of them

☐ Not sure ☐ Didn't pay much attention to some ☐ Paid no attention to some

1. [Interviewer only]. How difficult did it seem to be for the respondent to make the decisions in the experiment (tick one)?

Very difficult	Difficult	Medium	Easy	Very easy

Appendix C-4: The random parameter logit model

Modelling of choice data relies on random utility theory to explain choices and to derive estimates of preferences (Czajkowski & Hanley 2012). The random parameter logit model (also referred to as a mixed logit model or mixed multinomial logit model (MMNL)) is often preferable for analysing choice data as: i) it does not depend on independence from irrelevant alternatives property (IIA); ii) it accounts for the repeated nature of the choices made by respondents, and thus the panel nature of the data generated; and iii) it is one means of accounting for preference heterogeneity (Rigby & Burton 2003).

As with any random utility model in the family of discrete choice models, it is assumed that a sampled individual (q = 1, …, Q) is faced with a choice amongst *I* alternatives in each of *T* choice situations (Hensher & Greene 2002). It is assumed that individual *q,* acting rationally, will evaluate the alternatives in the choice situation *t* and choose the alternative which gives them the greatest perceived benefit or utility (Mangham et al. 2009; Greiner et al. 2014). The (relative) utility associated with each alternative *i* as evaluated by each individual *q*, in choice situation *t* is represented in a discrete choice model by the following utility expression (Hensher & Greene 2002):

$$U_{itq} = \beta_q X_{itq} + \varepsilon_{itq} \quad \text{..... Eq. (E.1)}$$

Where X_{itq} is a vector of the (non-stochastic) explanatory variables observed by the analyst and includes the attributes of the alternative *i*, socio-economic characteristics of the respondent and descriptors of the decision context and choice task itself in choice situation *t* (Hensher & Greene 2002). The parameters (β_q) represent unknowns to be estimated and reflect the weights that respondents attach to each of the attributes of an alternative (Hensher et al. 2015). The error term (ε_{itq}) is typically assumed to be independently and identically distributed (IID) extreme value type 1 distribution (Gumbel) (Hensher & Greene 2002; Hensher et al. 2015).

Extreme value type 1 is a commonly used distribution in discrete choice analysis; the tails are thinner than those of the normal distribution (Jones & Hensher 2005; Hensher et al. 2015). There is no *t* subscript in the β_q term because tastes vary across individuals making the choices, but not across the choices made by the same person (Rigby & Burton 2003).

The RPL model corrects for possible violations of the IID condition by partitioning the stochastic component of the utility into two additive uncorrelated parts (Hensher & Greene 2002). One part is correlated over alternative outcomes and heteroskedastic, while the other part is IID over alternative outcomes and individuals (Hensher & Greene 2002; Jones & Hensher 2005):

$$U_{iq} = \beta' X_{iq} + [\eta_{iq} + \varepsilon_{iq}] \quad \text{..... Eq. (E.2)}$$

Where η_{iq} is a random term with zero mean, whose distribution over individuals and alternatives depends in general on underlying parameters and observed data relating to alternative *i* and individual *q* (Hensher & Greene 2002). ε_{iq} is a random term with zero mean that is IID over alternatives and does not depend on underlying parameters or data (Hensher & Greene 2002).

In contrast to the standard logit model, (e.g. MNL model), the random parameter specification in the RPL model involves specifying each β parameter associated with an attribute of an alternative as having both a mean and a standard deviation (Hensher & Greene 2002; Jones & Hensher 2005). The standard deviation accounts for the presence of preference heterogeneity in the sampled population (Hensher & Greene 2002).

The mixed logit class of models assumes a general distribution for η and an IID extreme value type 1 distribution for ε (Hensher & Greene 2003). This means that η can take on a number of distributional forms such as normal, lognormal and triangular (Hensher & Greene 2003). For any given value of η, the conditional probability for choice *i* is logit. Therefore, the probability that individual *q* chooses alternative *i*, where L_i is the logit probability, is:

$$L_i(\eta) = \exp(\beta'X_i + \eta_i) / \sum_j \exp(\beta'X_j + \eta_j) \quad \text{..... Eq. (E.3)}$$

Mixed logit probabilities are the integrals of logit probabilities over a density of parameters:

$$P_i(\eta) = \int L_i(\eta) f(\eta)|\ \Omega) d\eta \quad \text{..... Eq. (E.4)}$$

These models are called mixed logit (or random parameter logit) because the choice probability $L_i(\eta)$ is a mixture of logits with *f* as the mixing distribution and does not exhibit IIA (Hensher & Greene 2003).

Table C-5: RPL model parameter estimates for the pooled and individual village choice data, with no interactions with socio-economic variables, and standard deviations of the parameters. The mean RPL model parameter estimates reflect the sample's values for marginal utility (or disutility) that would be derived from the attributes and levels, compared to the baselines for each attribute. Standard errors are in parentheses. Significance thresholds are 1% (***), 5% (**) and 10% (*). The Pseudo R-squared and Akaike Information Criterion (AIC) values report adequate fits for all models

Attribute / level	Pooled village data	Bujagali-West Kikubamutwe	Bujagali-East Kyabirwa	Kalagala-West Kalagala	Kalagala-East Bubugo Bugobi	Isimba-West Nampaanyi	Isimba-East Bwase Buseta
Location	-	Bujagali (Construction complete)	Bujagali (Construction complete)	Kalagala (no development)	Kalagala (no development)	Isimba (Construction underway)	Isimba (Construction underway)
Sustainable livelihood schemes	0.025 *** [0.002]	0.017 *** [0.005]	0.042 *** [0.013]	0.025 *** [0.005]	0.024 *** [0.004]	0.027 *** [0.007]	0.027 *** [0.006]
Employment	0.022 *** [0.001]	0.036 *** [0.004]	0.021 *** [0.004]	0.023 *** [0.003]	0.018 *** [0.003]	0.020 *** [0.004]	0.020 *** [0.004]
Revenue-sharing – investing in Central Forest Reserve[a]	2.195 *** [0.132]	2.953 *** [0.357]	2.180 *** [0.541]	2.702 *** [0.306]	2.073 *** [0.265]	2.021 *** [0.454]	1.890 *** [0.422]
Revenue-sharing – investing in community development[a]	4.129 *** [0.248]	6.668 *** [0.738]	3.687 *** [0.856]	3.925 *** [0.555]	2.342 *** [0.457]	5.507 *** [0.921]	6.253 *** [1.029]
Tree planting programme – Planting of native trees[b]	1.145 *** [0.219]	0.308 [0.564]	2.909 ** [1.233]	1.244 ** [0.491]	1.618 *** [0.464]	0.987 [0.676]	0.217 [0.572]
Tree planting programme – Clearing alien trees[b]	-0.628 ** [0.252]	-2.233 *** [0.670]	0.930 [1.320]	-0.228 [0.569]	0.302 [0.531]	-1.062 [0.727]	-1.416 ** [0.653]
Tree planting programme – Planting native trees and clearing alien trees[b]	0.967 *** [0.282]	0.328 [0.728]	3.639 ** [1.767]	0.846 [0.577]	1.235 ** [0.555]	0.948 [0.880]	0.228 [0.799]

Attribute / level	Pooled village data	Bujagali-West Kikubamutwe	Bujagali-East Kyabirwa	Kalagala-West Kalagala	Kalagala-East Bubugo Bugobi	Isimba-West Nampaanyi	Isimba-East Bwase Buseta
Visitors and residents pay to access the spiritual sites[c]	0.512 *** [0.161]	1.211 *** [0.416]	-0.144 [0.729]	0.564 [0.347]	0.351 [0.323]	0.219 [0.495]	0.204 [0.498]
Visitors and residents do not pay to access the spiritual sites[c]	-0.232 ** [0.091]	-0.223 [0.233]	-0.727 ** [0.327]	-0.127 [0.205]	0.138 [0.177]	-0.425 [0.271]	-0.316 [0.276]
Standard deviations of parameters							
Sustainable livelihood schemes	0.027 *** [0.002]	0.025 *** [0.004]	0.024 *** [0.005]	0.033 *** [0.004]	0.029 *** [0.004]	0.030 *** [0.006]	0.023 *** [0.005]
Employment	0.007 *** [0.001]	0.013 *** [0.002]	0.014 *** [0.004]	0.008 *** [0.002]	0.005 * [0.003]	0.004 [0.004]	0.002 [0.004]
Revenue-sharing – investing in Central Forest Reserve[a]	2.148 *** [0.129]	2.363 *** [0.345]	1.893 *** [0.562]	1.849 *** [0.289]	1.772 *** [0.245]	2.784 *** [0.452]	3.254 *** [0.476]
Revenue-sharing – investing in community development[a]	3.501 *** [0.236]	4.505 *** [0.624]	3.083 *** [1.077]	3.420 *** [0.508]	2.683 *** [0.472]	4.218 *** [0.876]	5.541 *** [0.988]
Tree planting programme – Planting of native trees[b]	0.012 [0.263]	1.031 *** [0.376]	0.423 [0.835]	0.220 [0.442]	0.031 [0.446]	0.999 * [0.571]	0.846 [0.538]
Tree planting programme – Clearing alien trees[b]	1.214 *** [0.124]	1.304 *** [0.376]	2.068 *** [0.396]	0.999 *** [0.278]	0.937 *** [0.293]	0.697 [0.540]	0.578 [0.601]
Tree planting programme – Planting native trees and clearing alien trees[b]	1.115 *** [0.207]	0.613 [0.554]	1.011 [1.099]	0.537 [0.491]	1.246 *** [0.362]	1.050 [0.730]	2.301 *** [0.772]
Visitors and residents pay to access the spiritual sites[c]	0.556 *** [0.182]	0.519 [0.367]	1.321 *** [0.342]	0.347 [0.569]	0.657 ** [0.302]	0.915 ** [0.375]	1.262 *** [0.335]

Attribute / level	Pooled village data	Bujagali-West Kikubamutwe	Bujagali-East Kyabirwa	Kalagala-West Kalagala	Kalagala-East Bubugo Bugobi	Isimba-West Nampaanyi	Isimba-East Bwase Buseta
Visitors and residents do not pay to access the spiritual sites[c]	0.935 *** [0.119]	0.730 *** [0.311]	1.047 ** [0.446]	1.100 *** [0.219]	0.605 * [0.317]	0.849 ** [0.369]	0.768 * [0.452]
Model fit							
Log likelihood function	-5794.907	-1021.386	-830.287	-1133.579	-1176.717	-718.261	-761.259
Pseudo R-squared	0.276	0.354	0.315	0.268	0.247	0.302	0.292
AIC/N	1.595	1.444	1.537	1.633	1.680	1.573	1.594

a Dummy coding used for the two attribute levels with the ‘no tourism revenue-sharing’ option as a baseline

b Dummy coding used for the three attribute levels with the ‘no planting of native trees and no clearing of alien trees’ option as a baseline

c Dummy coding used for the two attribute levels with the ‘visitors pay to access sacred sites but residents do not pay’ option as a baseline

Table C-6: Krinsky – Robb test for significance of differences between attribute levels in the pooled village sample

Attribute levels	Parameter difference and standard error
Revenue-sharing: Investing in Central Forest Reserve vs Investing in community development	-1.933 *** [0.230]
Tree planting programme – Planting of native trees vs Clearing alien trees	1.773 *** [0.110]
Tree planting programme – Clearing alien trees vs Planting native trees and clearing alien trees	-1.595 *** [0.175]
Tree planting programme – Planting of native trees vs Planting native trees and clearing alien trees	0.178 [0.203]
Visitors and residents pay to access the spiritual sites vs Visitors and residents do not pay to access the spiritual sites	0.744 *** [0.129]

Significance thresholds are 1% (***), 5% (**) and 10% (*), standard error in parentheses

Table C-7: Probability values for tests of differences between MRS estimates between villages and the pooled data, for those variables significant in both data sets. Values represent the probability of accepting the null hypothesis that the differences between the MRS estimates (significant in both villages) are equal to zero. Significant results are shown in bold and instances where variables were not significant in both villages, with a dash

Attribute / level	Pooled vs K-E	Pooled vs I-E	Pooled vs K-W	Pooled vs B-W	Pooled vs B-E	Pooled vs I-W	K-E vs I-E	K-E vs K-W	K-E vs B-W	K-E vs B-E	K-E vs I-W	I-E vs K-W	I-E vs B-W	I-E vs B-E	I-E vs I-W	K-W vs B-W	K-W vs B-E	K-W vs I-W	B-W vs B-E	B-W vs I-W	B-E vs I-W
Employment	0.260	0.287	0.490	**0.003** [a]	0.088	0.267	0.512	0.286	**0.004** [a]	0.186	0.519	0.296	**0.009** [a]	0.210	0.505	**0.018** [a]	0.106	0.302	**0.012** [a]	**0.015** [a]	0.220
Revenue-sharing – investing in Central Forest Reserve	0.438	0.234	0.178	**0.006** [a]	**0.030** [a]	0.273	0.288	0.187	**0.015** [a]	0.055	0.355	0.102	**0.011** [a]	0.198	0.431	0.079	**0.017** [a]	0.141	**0.006** [a]	**0.019** [a]	0.144
Revenue-sharing – investing in community development	**0.042** [a]	0.094	0.394	**0.002** [a]	**0.043** [a]	0.231	**0.010** [a]	0.105	**0.001** [a]	0.419	**0.025** [a]	0.132	0.096	**0.018** [a]	0.362	**0.012** [a]	0.085	0.229	**0.006** [a]	0.063	**0.029** [a]
Tree planting programme – Planting of native trees	0.102	-	0.423	-	0.083	-	-	0.214	-	0.450	-	-	-	-	-	-	0.180	-	-	-	
Tree planting programme – Clearing alien trees	-	0.166	-	**0.013** [a]	-	-	-	-	-	-	-	-	0.123	-	-	-	-	-	-	-	
Tree planting programme – Planting native trees and clearing alien trees	0.307	-	-	-	0.063	-	-	-	-	0.153	-	-	-	-	-	-	-	-	-	-	

Visitors and residents pay to access the spiritual sites	-	-	-	**0.032** [a]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Visitors and residents do not pay to access the spiritual sites	-	-	-	-	0.167	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

a Statistically significant, $p < 0.05$

References

Greiner, R., M. Bliemer, and J. Ballweg. 2014. Design considerations of a choice experiment to estimate likely participation by north Australian pastoralists in contractual biodiversity conservation. Journal of Choice Modelling **10**:34-45.

Hensher, D. A., J. M. Rose, W. H. Greene, D. A. Hensher, W. H. Greene, and J. M. Rose 2015. Applied choice analysis. Cambridge University Press, UK.

Hoyos, D. 2010. The state of the art of environmental valuation with discrete choice experiments.

Mangham, L. J., K. Hanson, and B. McPake. 2009. How to do (or not to do)… Designing a discrete choice experiment for application in a low-income country. Health policy and planning **24**:151.

Rose, J. M., and M. C. J. Bliemer. 2009. Constructing efficient stated choice experimental designs. Transport Reviews **29**:587-617.

Rose, J. M., and M. C. J. Bliemer. 2013. Sample size requirements for stated choice experiments. Transportation **40**:1021-1041.

Sandor, Z., and M. Wedel. 2001. Designing conjoint choice experiments using managers' prior beliefs. Journal of Marketing Research **38**:430-444.