The Economic Value of Albertine Rift Forests;

Applications in Policy and Programming

A thesis presented by

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to

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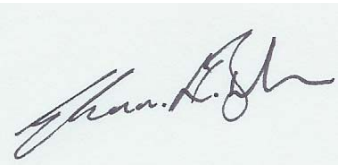
Declaration

In accordance with the regulations for Higher Degrees by Research, I hereby declare that this thesis submitted for the candidature of Doctor of Philosophy is a result of my own research and independent work except where reference is made to published literature. I hereby certify that the work embodied in this thesis has not already been submitted in candidature for any other institute of higher learning.

All errors remain my own.

Candidate:



Glenn K. Bush

12th August 2009

To Annabelle

"Whatever fortune brings, don't be afraid of doing things."

(AA Milne, 1882-1956)

Abstract

The **objective** of this thesis is to quantitatively understand the economic performance of protected area management strategies for forest and biodiversity conservation. Examples such as integrated conservation and development and eco tourism are assessed in terms of their ability to deliver on welfare benefits to local communities, and an assessment of the opportunity costs of forest conservation as a land use strategy. In addition the contribution of forest conservation in protected areas can make to poverty alleviation and economic development is also examined. The geographical focus of this study is the Albertine Rift region of East and Central Africa, stretching north from the southern end of Lake Tanganyika through the spine of Africa to the northern end of Lake Albert. The Albertine Rift is one of Africa's most important landscapes for the conservation of forests and biodiversity.

The overarching objective is addressed using a series of case studies empirically valuing the opportunity costs of conserving forests in a selection of sites in the central part of the Albertine Rift. The success of conservation is most often measured against progress in reducing habitat or species loss and not often in terms of the contribution of the protected area to poverty alleviation and local economic development. Achieving improvements of conservation strategies in the social dimension requires objective evidence on their effects. Economic valuation of protected area resources provides a quantitative means of assessing the promise and performance of conservation policies in achieving welfare benefits to local communities.

This thesis provides three case studies each addressing current valuation and social issues in conservation and sets them in a context of managing protected areas in the broad dynamic setting of poverty alleviation and economic growth from a developing economy perspective. In addition two of the empirical studies are as concerned with methodological enquiry and the

performance of novel environmental economic valuation techniques, such as the contingent valuation and choice modelling approaches, as the application of results to conservation questions.

The empirical studies show that the benefits to local households and communities from their local forests may be greater than at first perceived. Across all protected area categories, biomes and income groups, households derived significant amounts of their overall income from their local protected area with large proportions of the value of goods harvested from forests being consumed in the home. Amongst income groups high income households often appropriated a greater share of the value of forest goods. There was no significant difference found between the household consumption and the sale of protected area products between income groups. The findings indicate that imposing reductions in forest use may increase poverty amongst local people whilst increasing household income will not necessarily reduce forest exploitation. This indicates that community conservation and integrated conservation and development programmes must target the poor forest adjacent households more actively to ensure poverty alleviation, whilst providing improved protection and law enforcement for effective conservation.

It is also shown that biodiversity conservation can have an economic return through mountain gorilla eco-tourism. Findings show a disparity between what constitutes eco-tourism and the real values of tourists towards biodiversity conservation and local social benefits from protected areas. Despite showing a high marginal utility for biodiversity conservation, consumers are unwilling to pay for local community benefits from tourism as part of the permit price to view gorillas. Clearly the link between successful conservation and the welfare status of local communities is not sufficiently established in the minds of consumers to influence their spending decisions.

The challenges of effectively mobilising communities to protect biodiversity are discussed in the context of the variable impacts of integrated conservation and development programs over the last three decades. Direct payment payments for conservation services schemes are discussed as an innovative tool to add to the gamut of community approaches currently on offer. Payments for conservation schemes are viewed with cautious optimism in terms of their possibility for success. Despite their allure of being more economically and socially efficient at achieving welfare and conservation objectives, given the complex nature of any society, no less research in to social and economic dynamics of protected area use by local communities would be needed to ensure success of such schemes. However, the overwhelming majority of benefits form protected areas are tied up in ecosystem services values. Mechanisms to generate funding and distribute payments for these benefits in terms of offsetting the local opportunity costs are essential to change local behaviour and reduce forest degradation and destruction.

Table of contents

List of tables

List of figures

Acknowledgements

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The thesis is based on a considerable amount of data gathered from rural households in remote parts of the Albertine Rift and intrepid tourists visiting the national parks. These field studies would not have been possible to complete without a very diligent team of Ugandan and Rwandan enumerators and field research coordinators. I would particularly like to thank Simon Nampindo and Richard Mwesigwa for the part they played in assisting me to coordinate the collection of data and data entry for the surveys in Uganda. I would also like to thank Theogene Ngaboyamahina, Sylvie Mucyo and Ritah Gasana for their diligence in data collection and entry during the tourism field work in Rwanda. To all of you, your good humour, clear thinking and patience in the field made a difficult task delightfully straightforward. Thank you.

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Chapter 1.0:

Introduction, objectives and structure of the thesis

1.1 Introduction; the problem of forest and biodiversity loss

The unprecedented rate of forest and biodiversity loss due to human impacts on the biosphere is well documented (Common & Stagl 2005; MEA 2005). These ecosystems and their genetic material provide mankind with innumerable benefits from the sense of well-being and satisfaction. For example knowing that the mountain gorillas have a home in the wild, to the more tangible benefits that tropical forests play in stabilising global climate and mitigating the effects of extreme weather events. More locally, the immediacy of the direct benefits such as fuel wood or bushmeat to park adjacent subsistence farming households should also be appreciated. The impacts of forest cover change and associated biodiversity loss are beginning to be understood more widely by society in general as the real impacts of climate change are being felt globally (Stern 2006).

The causes of forest and biodiversity loss are well documented (Barbier 2001; Common & Stagl 2005; MEA 2005). Typically there are three principal issues occasioning the loss of forests and biodiversity 1) changes in land use causing habitat loss; 2) global trade and imperfect market related factors; 3) invasive species (moved by mankind) that out compete native species in their natural environment (Kontoleon et al. 2007). It should be noted that 1 is often a result of issue 2. Fundamentally the drivers of land use change are perhaps the most important factors in the context of conserving forests and biodiversity in developing countries. Outside of protected areas conversion of natural habitats (with its loss of related biodiversity) to agricultural and pastoral resources for use by people under uncertain land tenure and market access arrangements is a fundamental threat to forest and biodiversity conservation. This is especially problematic in the context of growing populations of poor, subsistence, natural resource dependant households. Within protected areas the ability of

under resourced managers to stave off the relentless pressure from local communities for timber and non-timber forest products is severely challenged.

1.2 Complex choices; resource scarcity and social preference

Society has to make difficult choice over the allocation of resources. Balancing the short-run and long-run costs and benefits at the local level and also at the national and international level is a complex and dynamic business. Economists continue to argue that resources are scarce. This means there is a distinct opportunity cost involved in society's choices over land use, to conserve or to farm? The indisputable argument that it is right to conserve forests and biodiversity is juxtaposed with poor people's inalienable right to development. The fact that nature conservation agencies are often under funded points towards society's choice over how to allocate funds towards activities considered in its best interest (Hanley & Shogren 2002). The current state of financing biodiversity conservation may mean that society does not really care enough despite the general rhetoric of biodiversity conservation (Pearce 2007).

Unless society, form a local to global level, is fully aware of the most pertinent facts regarding the costs and benefits of forest and biodiversity conservation it may continue to fail to make the optimal decisions over the amount of forest to conserve and the appropriate level of funding necessary to achieve this. It is for this reason that decisions over nature conservation using economic analysis will be better than those reached without (Hanley & Shogren 2002). Economics helps us to understand the allocative efficiency of resources and if any reallocation is actually desirable for society. As such it can pay a vital role for policy making and planning, to make objective and rational decisions about resource allocation for conservation at a national level and management decisions at the site level. Can the gainers compensate losers and still be better off (Kaldor-Hicks optimality)? In assessing such issues regarding biodiversity conservation, economists try to sum up the money equivalents of welfare changes across individuals. Welfare changes allow us to account for both the direction and intensity of preferences to allow some ranking of how to use scarce resources

through the comparison of the magnitude and distribution of costs and benefits both between and within different policy levels.

1.3 Thesis objectives

The **objective** of this thesis is to quantitatively understand the economic performance of protected area management strategies for forest and biodiversity conservation. Examples such as integrated conservation and development and eco tourism are assessed in terms of their ability to deliver on the welfare benefits to local communities. In addition this appreciates the contribution that forest conservation in protected areas can make to poverty alleviation and economic development. The geographical focus of this study is the Albertine Rift region of East and Central Africa. Stretching north from the southern end of Lake Tanganyika through the spine of Africa to the northern end of Lake Albert, the Albertine Rift (Figure 1.1), is one of Africa's most important landscapes for the conservation of forests and biodiversity. The overarching objective is addressed using a series of case studies empirically valuing the opportunity costs of conserving forests in a select of sites in the central part of the Albertine Rift.

In the two case studies assessing the opportunity costs of conservation to local communities (Chapters 3 and 4), a quantitative assessment of living standards using market price and contingent valuation methods is made. This analysis is augmented by the use of explanatory variables to understand the determinants of protected area use a unique undertaking in the geographical context of the studies. In addition these variables are also used to understand the divergence in welfare estimates between approaches (Chapter 4). International tourists' willingness to pay for local social benefits from park based tourism is measured to assess the potential for eco-tourism to offset the local costs of conservation (Chapter 5). Finally results from the empirical studies presented in this thesis as well as secondary data from other studies are used to assess the economic costs and benefits of managing land as a protected area versus conversion to subsistence agriculture (Chapter 6).

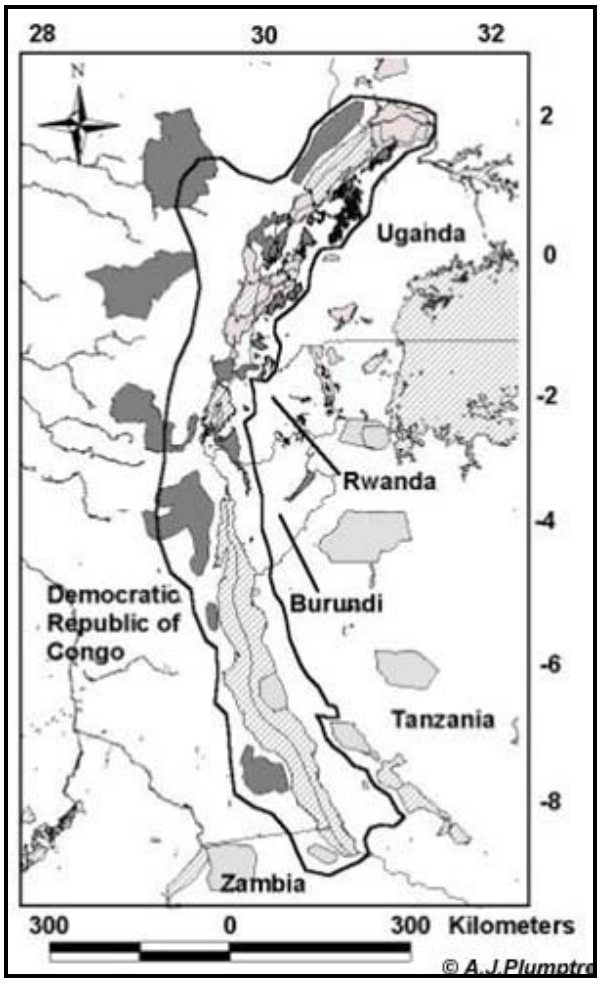


Figure 1.1 The geographical boundary of the Albertine Rift (©A. J. Plumptre)

Much debate still exists on the applicability of many novel valuation techniques such as contingent valuation and choice experiments to answer resource management questions, particularly in developing countries. There are a number of methodological issues related to their theoretical validity and contextual application. In addition to the applied nature of the work the empirical studies also cover discussions and tests of methodological issues. Specifically chapters 4 and 5 are as much about methodological enquiry in to the performance of the prescribed estimation techniques as their application to conservation management questions.

Importantly the lessons drawn from these studies are widely applicable throughout the Albertine Rift, both in terms of the issues tackled and the suitability of the valuation methods. Broadly these studies contribute novel quantitative information on how protected areas might actually contribute to poverty alleviation and economic growth. Specifically they contribute to the objective assessment of the economic performance of protected area management approaches in the context of protected areas management to conserve forests and biodiversity in the Albertine Rift region of central and Eastern Africa.

1.4 The significance of forest and biodiversity conservation the Albertine Rift

The Albertine Rift's wide variety of habitats incorporate lowland forests and savannah, hot springs and active volcanoes through to mountain and alpine vegetation and ice fields and glaciers of the Ruwenzori Mountains. It is an area over 1,200km long and up to 300 km wide (about 1.5 times the size of the United Kingdom). It covers and altitudinal range of 600m in Semuliki, Uganda to the summit of Mt Stanley in the Ruwenzori at 5,125m (Plumptre et al. 2003). As a result of its wide variety of habitats the Albertine Rift is reputed for its richness in species and its high level of endemism. It is identified as a World Wildlife Fund 'Eco Region', an 'Endemic Bird' area by Birdlife International and a 'Biodiversity Hotspot' by Conservation International.

Forests contain the greatest diversity of species of any terrestrial ecosystems (Stenger et al. 2009) and those in the Albertine Rift are no exception. Forest areas form a large proportion of the natural ecosystems of the rift which contain many endangered species such as the mountain gorilla (*Gorilla berengei berengei*), birds such as the Grauers' swamp warbler (*Bradipterus graueri*), as well as an incredible diversity of flora, much of which is not yet described by science. Plumptre et al (2003) identify 39% of all the species of mammals on the African continent occur in the Albertine Rift. In addition 52% of all African bird species are

also encountered there. Many of the resident species are also endemic to the Albertine Rift e.g. 34 species of mammal and 41 species of bird (Plumptre et al. 2003).

1.5 The social and economic challenges for conservation in the Albertine Rift

The Albertine Rift is bounded by six countries (Uganda, Rwanda, Burundi, Tanzania, Zambia and Democratic Republic of Congo). These are amongst the poorest nations on earth. Table 1.1 below gives an over view of some key socio-economic and geographical indicators to compare the six countries of the Albertine Rift. GDP per capita (in $PPP[1]) terms range from only $300 (DRC) to $1300 (Tanzania and Zambia) straddling the sub Saharan African average of $450, and are 15 to 67 times below the European average of $20,320.

The picture in general is of predominantly poor, rural societies, agriculturally dependant economies with approximately 35% to 86% of households living below the $1 per day income level. 60 to 90% of respective populations living rurally and up to 82% of GDP comes from agriculture. An exception is Zambia whose GDP is heavily reliant on the mining and minerals sector. These are country averages while the central regions within the Albertine Rift (south west Uganda, Rwanda and Burundi and the adjacent areas of DRC) contain some of the highest human population densities in Africa, with up to 600 to 700 people per km^2 (Plumptre et al. 2004).

The human dimension of conserving forests and biodiversity presents some particular challenges. Due to high levels of poverty and the intensity of farming in the region, the people living near protected areas in the central Albertine Rift make use of these forests to supplement their incomes from farming. They harvest fuel-wood, timber, non-timber forest products, water and bush-meat where they can, and often break the law in areas in which such

[1] PPP – purchasing power parity

harvesting is banned. As a result, there has been friction between the people living adjacent to protected areas and the protected area authorities (Plumptre et al, 2004).

Table 1.1 Social and economic indicators from the Albertine Rift nations

Country Indicator	Uganda	Rwanda	Burundi	Tanzania	Zambia	Democratic Republic of Congo
Population	31,367,972	10,186,063	8,691,005	40,213,160	11,669,534	66,514,504
Population density (people.km^2)	157	340	338	45	15	29
GDP ($PPP)	$29.04 billion	$8.44 billion	$2.89 billion	$48.94 billion	$15.92billion	$18.84billion
GDP per capita ($PPP)	$900	$900	$400	$1,300	$1,300	$300
%GDP form agriculture	82%	36.9%	33.7%	42.8%	17.3%	55%
Population below the poverty line (less than $1 per day)	35%	60%	68%	36%	86%	Not known
Life expectancy at birth (years)	52.34	49.76	51.71	51.45	38.59	53.98
Rural population	84.7	93.4	90	64.6	59.7	67
Population growth rate (% per annum)	3.603%	3.579%	3.443%	2.072%	1.654%	3.236%

Source: CIA world Fact Book, 2008 & IFAD Poverty Indicators

The case studies presented in this thesis quantify the contribution of protected areas to this supplemental income and its significance in maintaining local living standards. Many of the micro and macro economic conditions that protected areas operate in throughout the Albertine Rift are very similar, although the degree that these impact at the site level may vary considerably. Thus whilst some of the general conclusion form this work are broadly applicable to protected areas in the Albertine Rift, at the site level there is still a great need to conduct specific research in order to assess the local opportunities and constraints for protected area management.

1.6 Protected areas as a policy tool for forest and biodiversity conservation

The role of protected areas in conserving forests and biodiversity is well established as an instrument for forest and biodiversity conservation. For millennia societies have desired to protected areas of environmental resources and ecosystems to prevent the destructive impacts

of humans, based on those areas intrinsic values (Holdgate 1999). For example in India, almost 2000 years ago, forest were protected as the dwelling places of local deities (van Dyke 2008). The role of protected areas has continued to increase to date and by 2003 there were more than 100,000 protected areas globally, covering almost a twelfth of the global land surface (Mulongoy & Chape 2004). Protected areas as a tool for conservation thus seem to be indispensable. Indispensable as they may be, they still suffer from a lack of funding.

The distribution of forests and biodiversity is not equal in geographical terms; species richness is correlated with latitude on account of solar radiation levels. At the same time gross domestic product (GDP) per capita is inversely correlated with latitude if we exclude Australia (Common & Stagl 2005). Thus with the exception of Australia, wealthy northern countries are biodiversity poor and poor southern countries biodiversity rich. Considering the 12 most mega-diverse[2] countries in the world only one of them (Australia) is not a less developed country (LDC) economy. Clearly protected area management to conserve forests and prevent species loss is most important in the world's poorest countries at lower latitudes, yet in general these are the countries least able to afford the costs involved.

For example the African continent contains many tropical ecosystems and protected areas occupy slightly over 2 million km^2 or 7% of the continent's 30 million km^2. Figure 1.2 shows the proportion of different land cover types with the relative proportion under protection (UNEP 2008). Among the various eco-regions, biodiversity-rich tropical evergreen broadleaf forests comprise about 3 million km^2 barren and sparsely vegetated lands comprise about 9.6 million km^2. Of the barren and sparsely vegetated lands, about 4 percent are protected.

[2] Mega diverse countries are those with a very high national biodiversity index. The index is a composite of species richness and species endemism, so that if a country has many different species as well as many species that are not found anywhere else it will have a high index value. The index is then scaled so that the most mega-diverse (Indonesia) has a value of 1 and the lowest (Greenland) a value of 0.113.

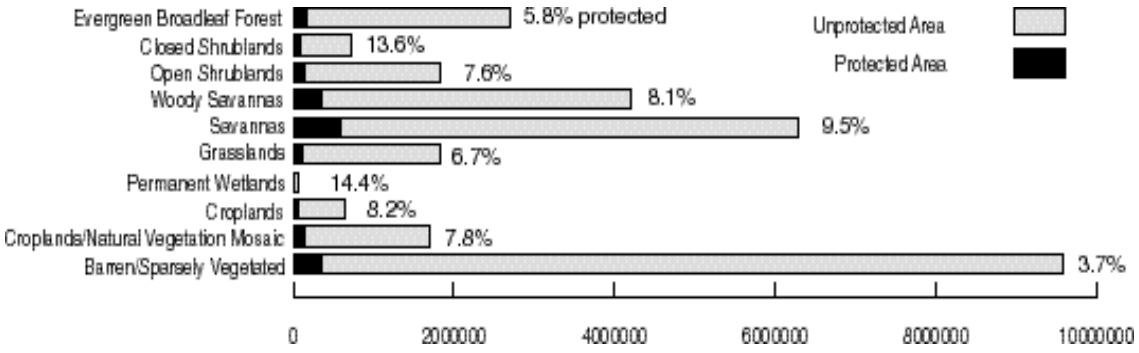


Figure 1.2 Proportion of land type with protected status in Africa. (Source; UNEP, 2008)

Closed shrublands (savannah woodland) which are estimated to be over 700,000 sq km in extent, have the largest proportion of protected area, approximately 14 per cent. About 2 million sq km, or about 8 per cent, of croplands and a mosaic of croplands mixed with natural vegetation are under protected status. Importantly, despite the existence of legal instruments to protect biodiversity those instruments are not uniformly applied or equally effective.

Globally all protected areas are classified according to the six numerical International Union for the Conservation of Nature categories developed in 1994 (Mulongoy & Chape 2004), each category differing by degrees regarding the restrictions placed on human activities with the protected areas territory (Holdgate 1999). Terms such as *national parks* and *nature* or *forest reserves* tend to be categories related to specific national institutional and organisational conditions for protected area management. For example in most of the Albertine Rift, *national parks* conform to the wilderness model, where there tends to be a strict non extractive use policy. By contrast in the United Kingdom there are few *national parks* that do not host permanent settlements and are a working rural landscape. In Uganda for example *national parks* are under the management of the Ugandan Wildlife Authority, but *nature reserves* are under the management of the National Forest Authority although both the Ugandan categories have similar strict non extractive use policies.

The back bone of conserving biodiversity in the Albertine Rift is an ecologically diverse network of state protected areas, such as national parks, wildlife reserves and forest reserves with varying degrees of use arrangements, ranging from strict protection with no extractive uses allowed, to a restricted set of community use arrangements or commercial activities (Figure 1.3). However governments may be ineffective at protecting land if they lack the knowledge of how to use a resource properly or the funding to enforce policy (Bromley 1997; Pagiola et al. 2004).

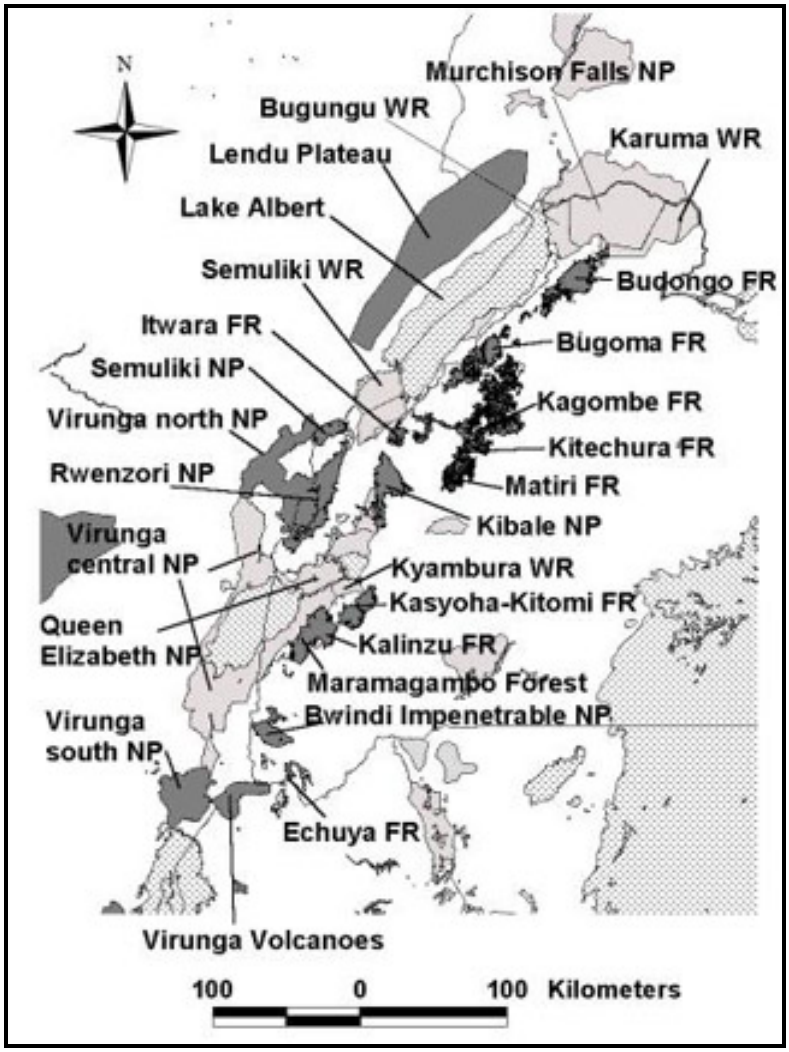


Figure 1.3 The protected areas of the central Albertine Rift (©A.J Plumptre)
NP=National Park, FR=Forest reserve; WR- Wildlife reserve

Conservation success depends on how effectively illegal or unsustainable use is controlled. Furthermore, such controls may cut off valuable sources of revenue for many communities, Pearce and Moran (1997) identify that exclusion strategies represent a "moral view", which

disinvests local value in biodiversity, taking away its economic value. There are countless examples of conflicts between protected areas and local development priorities, where bureaucratic land protection is not matched by enforcement in the relevant areas, particularly, but not exclusively in developing countries (Brown 2000; Smith et al. 1993; Stoll-Kleemann 2001).

Acknowledgement of such inequities in traditional conservation approaches has given rise to the community dimension in conservation where integrated conservation and development projects (ICDP) have become the accepted means of reconciling local development needs with biodiversity conservation objectives (Gihimire & Pimbert 1997; McShane & Wells 2004; Salafsky & Margoluis 1999). Such schemes have a mixed reputation in terms of success in achieving either or both of the twin objectives (Horwich & Lyon 2007; Hulme & Murphee 2001b; Jones & Horwich 2005; Upton et al. 2008). Despite the variable effectiveness in achieving biodiversity conservation or human welfare benefits both protected areas and ICDP continue to be the main stays of conservation strategies in the region (Plumptre et al. 2004). These attempts have included:

- supporting technical inputs and training to farmers adjacent to the national parks;
- income generating and alternative livelihood strategies and the provision of micro-credit;
- establishing a community conservation department within the protected area authorities which meets regularly with the communities;
- providing a trust-fund that supports the development of schools, clinics;
- community projects and social infrastructure such as water points, clinic and school rehabilitation in the vicinity of protected areas;
- allowing restricted access and use of certain forest products

The success of conservation is most often measured against progress in reducing habitat or species loss and not often in terms of the contribution of the protected area to poverty alleviation and local economic development. Improving the economic and social performance

of conservation approaches is essential in terms of reconciling local human development needs with international demands for biodiversity conservation. Achieving improvements of conservation strategies in the social dimension requires objective evidence on their effects. Economic valuation of protected area resources provides a quantitative means of assessing the promise and performance of conservation policies in achieving welfare benefits to local communities. In addition the collection of socio-economic data alongside the economic valuation data provides an important means to assess the social and economic drivers of protected area use so that conservation efforts can be more economically efficient in meeting welfare needs.

1.7 Thesis structure

Considering the above issues and thesis objectives Chapter 2 provides a detailed theoretical and contextual background for the study, providing an economic framework to illustrate the complex nature of decision making over biodiversity conservation decisions. The chapter also develops the framework for forest and biodiversity conservation in the context of a developing country functioning in a global economy. In addition the opportunities and constraints of global and national forest conservation and biodiversity policies as well as local management programs for protected areas are discussed.

Chapter 3 is the first of three empirical studies valuing opportunity costs from protected areas. This chapter utilises a household income study to estimate the non-timber and timber values of protected areas to local people, quantifying all ways in which local people derive economic benefits from forests (e.g. bushmeat, fuel wood). Physical quantities are valued using a market price method (MPM), and analysis focuses on both the mean and the variance of these flows. A socio economic picture of protected area adjacent households is developed and these factors are used to understand determinants of protected area use and the implications of these findings for ICDP approaches. This is a novel study in the context of protected area management in Uganda, providing rare and detailed insights in to forest use and evaluation

the opportunities and constraints for community conservation. This study draws on case studies from four different protected area sites of different bio types and represents not only a unique set of data in the context of protected area and forest management in Uganda, but an opportunity to draw generalised conclusions based on common factors or trends identified between sites of varied context, utilising data gathered in a systematic and directly comparable manner. The data used in this chapter were collected under an applied policy research program for the Ugandan National Forest Authority whilst the author worked for the Wildlife Conservation Society, Albertine Rift Program, Uganda.

Chapter 4 aims to test a contingent valuation (CV) study with a provision point mechanism (PPM) in a novel setting (willingness to accept compensation) to assess its affect in reducing strategic bias to provide a more reliable estimate of household economic values. In addition the data is used to assess the local direct benefits of households living around protected area under different resource access arrangements and draw some conclusions about the potential performance of community conservation. Selected methodological issues in CV are discussed with the objective of setting up the theoretical framework for the choice of valuation approach and the application of a provision point mechanism. Key literature on the application of contingent valuation methods (CVM) is reviewed with the objective of understanding practicalities in the design and implementation of CVM in a developing country context. Finally in this chapter a case study is described with the objective of conveying the context background, methods, results and conclusion of the empirical research, focusing on testing the effects of the PPM and the application of the values to conservation management policies. The methodological components of this study have been developed in to paper co authored with Prof. Daniel Rondeau and Prof. Nick Hanley, currently in submission to Environment and Development Economics. The data were collected whilst the author lead a research project for Care Denmark's, Protected Areas and Poverty Network financed by the Howard Buffet Foundation.

Chapter 5 examines international tourists demand for different attributes of mountain gorilla tourism in Rwanda using a choice experiment (CE). Integrated Conservation and Development Projects (ICDP) have been put forward as a means of reconciling wildlife conservation in developing countries with improvements in community incomes, and as a way of promoting community participation in conservation. Responsibly managed tourism with the mountain gorillas in the Rwandan Volcanoes National Park, is widely regarded to be a success story of tourisms contribution to conservation. Eco-tourism's twin goals of environmental and social responsibility fit well with ICDP philosophy; however, there is little evidence to suggest that tourists are interested in biodiversity conservation or community development *per se*. Tourists' variable motives for visiting primates in their natural habitat can make the reliance on eco-tourism for financing their conservation a risky venture if tourists are not particularly interested in either.

A "cut-offs" choice experiment approach is used to investigate two issues that have troubled economists making use of stated preference approaches for environmental valuation; and which also pose problems for the application for the rational economic model of cost-benefit analysis to project/policy appraisal. These issues are (i) non-compensatory preferences and (ii) inconsistent behaviour. Non-compensatory preferences imply that consumers can no longer be assumed to have smooth, continuous indifference curves, such that any change in environmental quality (say) can be compensated for by a finite change in some numeraire good. Elements of chapter 5 form the basis of a paper recently accepted for publication in Environment and Resource Economics, co authored by Dr Sergio Colombo and Prof. Nick Hanley. The data were collected as part of a research project designed and implemented by the author whilst under contract to the Dian Fossey Gorilla Fund International. The project was funded by the US Fish and Wildlife Department's, Great Ape Conservation Fund and the Dian Fossey Gorilla Fund International.

Chapter 6 presents a discussion about the use of the values derived in the empirical studies in chapters 3, 4 and 5 along with secondary data to develop a benefits transfer model to estimate the total economic value (TEV) of a protected area. Elements included in the model are the value of ecosystem services, the value of timber and non-timber outputs. Benefits are aggregated at different levels from local to global in order to assess the opportunity costs and the implications of the findings for policy analysis and management approaches. Using the TEV framework a cost benefit analysis of alternative land use options under different estimation procedures in presented. Finally conclusions form these findings are applied to policy and management issues.

Chapter 2:

The conservation of forests and biodiversity; reconciling local costs and benefits with the global public good

2.1 Introduction

Forest and biodiversity conservation is often considered as a global public good (Common & Stagl 2005; Sander 2004). As a public good its use can be considered non exclusive and non rivalrous, where the consumption by one individual does not detract from the consumption of another. In the global sense, demand for forest conservation and biodiversity may not be compatible with demands on a national or local scale, especially where rural households in developing countries rely on the depletion of biodiversity (forest conversion, unsustainable harvesting practices) as a means to maintain their basic livelihoods.

This highlights the complexity of the forest and biodiversity conservation problem in that benefits tend to accrue to those people far removed from the richest sources of forests, whilst poor forest adjacent households bear the brunt of costs from conservation i.e. opportunity cost from restrictive conservation policies or cost of crop raiding from animal conserved within protected areas. Thus externalities are created at different policy levels (local, national and global) arising from different consumption and demand priorities.

This chapter examines the poverty, economic development and conservation debate from a theoretical and practical perspective applied to forests conservation in protected areas. It defines what needs to be valued and why and also what specific tools mechanisms are currently employed to address conservation needs in focal countries of the Albertine Rift. Section 2.2 develops the theoretical contextual framework for the valuation studies in the following chapters. In section 2.3 current examples of Ugandan and Rwandan national, as well as global, conservation and development process currently ongoing are used to illustrate

the opportunities and constraints of national and international approaches to conserve biodiversity in the Albertine Rift. The discussion and evidence will focus on in situ conservation and protected area management as the backbone of forest and biodiversity conservation in the region the rationale for which is detailed in the introduction in Chapter 1.

As a reminder the **objective** of this thesis is to quantitatively understand the economic performance of protected area management strategies for forest and biodiversity conservation. Examples such as integrated conservation and development and eco tourism are assessed in terms of their ability to deliver on the welfare benefits to local communities. In addition this appreciates the contribution that forest conservation in protected areas can make to poverty alleviation and economic development. The objective is addressed using a series of case studies empirically valuing the opportunity costs of conserving forests in a select of sites in the central part of the Albertine Rift.

In the two case studies assessing the opportunity costs to local communities (Chapters 3 and 4), a quantitative assessment of living standards using market price and contingent valuation methods is made. In addition these variables are also used to understand the divergence in welfare estimates between approaches (Chapter 4). International tourists' willingness to pay for local social benefits form park based tourism is measured to assess the potential for eco-tourism to offset the local costs of conservation (Chapter 5). Finally results form the empirical studies presented in this thesis as well as secondary data form other studies are used to assess the economic costs and benefits of managing land as a protected area versus conversion to subsistence agriculture (Chapter 6).

This chapter thus provides a theoretical and practical framework to show where and how economic valuation including the work in this thesis can help to foster improved policies and practices in conservation and the implications for financing forest and biodiversity

conservation. Explicit reference is made to the empirical case studies in following chapters specifically linking the type of information generated in this research to the background issues detailed in this chapter.

2.2 The economic framework for forest and biodiversity conservation

This section sets out an economic framework for forest and biodiversity conservation. It examines from a theoretical perspective definitions and values of biodiversity, and the organisational opportunities and constraints to achieve the goals we set. It demonstrates theoretically how environmental change and thus biodiversity conservation can only be made if it is in the private interest of those individuals who exert the greatest physical influence over environmental resources are accounted for. It sets the theoretical scene for the practical role of environmental valuation in finding answers to complex management problems considering the needs for development and the needs to conserve ecosystems.

Environmental economics as a discipline draws heavily on the principles of welfare economics and idealized market economy leading to the optimum allocation of resources (Bateman & Turner 1993; Hanley et al. 2007). Understanding the human welfare implications of policy towards biodiversity conservation is central to understanding the actual or potential human consequences of policy and management approaches. In reality various forms of market failure require the intervention of national or global state apparatus to correct for the distributional impacts of imperfect market conditions considered to be socially unacceptable i.e. the inequitable distribution of income, wealth or other resources.

2.2.1 Market failure and the role of the state in protected area management

Market failure is the less than optimal functioning of a market to provide goods or services over a given period. Two such sources of market failure occur firstly in the provision of

public goods and secondly in externalities. Public goods have two attributes that discourage private markets because the supplier cannot appropriate profits and benefits:

- Public goods are non excludable, in that once produced, non-paying consumers cannot be prevented from benefiting from using the goods.
- Public goods are non rival in that the consumption of the public good by one individual does not diminish its supply to another

Externalities in essence are when one economic agents actions affect the ability of another economic agents benefits (Hanley et al. 2007), such that the affected party nether receives compensation for any loss or pays for any benefit. Externalities are a spill over effect on other individuals that are not fully reflected in the market price so that a good may be under or over provided on the market. This leads to the sub optimal allocation of resources and is the root of market failure.

The ecosystem services provided by forests are a classic example of a public good. If an individual or group has ownership or control of a forest to exploit it, they are not easily able to realise in financial terms a return from the public goods that are provided by it. Hence there is no financial incentive to conserve natural forests to ensure the provision of the public goods. Pearce (2007) indicates that externalities are a fundamental reason why society as a whole, chooses to discount inappropriately when choosing between conversion or conservation of forests. Unless a more precise understanding in terms of the value of these externalities and where they accrue to is developed it is difficult to direct policy and management tools to correct them.

Uganda for example has recently moved into a national fuel wood deficit and the geographical distribution of fuel wood scarcity is very uneven (Drichi 2003). In some districts

there is an acute shortage, and this has stimulated a market response in terms of increased prices. Deforestation causes increased fuel wood costs, both in terms of money and time spent in collection. When wood becomes scarce, prices typically increase and this can trigger more investments in tree growing. Wood supply can thus to a large extent be ensured by allowing markets to develop for wood from plantations and trees on-farm. Alternatively other unregulated or illegal natural timber harvesting may be a course of action to meet supply. The value to protected area adjacent households of forest resources such as timber may be much more than the current financial cost of a bundle of fuel wood access to protected areas also has a non marketed component in terms of the buffering that the resources give from imperfect markets.

However, markets typically fail to respond to loss of environmental values (Hanley et al. 2007; Pearce 2007). Deforestation also causes reduced supply of non-wood products, reduced environmental services such as watershed protection and soil protection, and reduced biodiversity. Market mechanisms alone are unlikely to save protected areas and the important social and environmental services they provide (Common & Stagl 2005). Clearance of land for agricultural development in the short term may be more profitable and locally socially desirable than conservation of protected areas or sustainable forest management. An underlying issue is the difference between financial and economic values attributed to protected areas and the need for individuals who use them to maximize short-term profit. Many economic values, which are public in nature, such as the ecosystem values of protected areas do not realise a tangible stream of financial benefits in the short term to individual users.

2.2.3 Environmental values and sustainable development

The debate about sustainable development has grown in recent years. There is firm consensus on sustainable development having to take account of three key factors, environment, society and economy. These are widely considered to be the ‘three legs’ of sustainability all of which

must be considered and developed in synchrony (Elliott 2006; Munasinghe & Cruz 1995). The theory and practice of environmental economics has developed dramatically in recent years to meet the challenge of putting the case forward for environmental management as a pillar of sustainability (Hanley & Shogren 2002). However narrow assumptions regarding technological substitution to correct environmental losses have continued to drive economic development practice, resulting in a corresponding decline in environmental resources. An economy also reflects the choices of society over the way in which it uses its resources. The choice in resource use is laden with social values that have no market dimension and are difficult to quantify economically. Attention must be drawn to the role of the environment and society in a sustainable economy and the non-use values associated with their existence. Only by finding a common language with which to argue for the benefits and importance of conservation areas can their longevity be maintained. Therefore, putting economic values to environmental benefits helps to mainstream environmental considerations in the economic decision making frameworks of policy makers (Hanley & Shogren 2002).

(Campbell & Luckert 2002) state that valuing non market goods and services from natural resources is of critical importance to Less Developed Countries' (LDC) economies due to the dependence of the rural livelihoods on natural resources in general, and trees and forests in particular. This means that a great deal of goods and services from natural resources are effectively 'un-priced'. Poor price information means that policy makers have little information available to make economic decisions about resource allocation which is critical in setting development priorities in an economic framework. Conservation areas are invariably major natural resources in LDC economies, enabling governments to make informed decisions about economically optimal strategies towards their conservation and management is a critical aspect of successful planning for their long-term preservation.

2.2.4 Total economic value

An entry point to understanding the values of a protected area is to recognize and define the broad range of goods and services that can be obtained from forests and protected areas. The benefits of forest resources have historically been valued in terms of their direct benefits. Timber, tourism and other non-timber forest products are the visible focus of the economic activities of people. However there is also a multitude of indirect, option and existence benefits as well (Table 5.1). It is the sum of all these values that accrue at local, national and international levels that generates the total economic value (TEV) of a protected area. The TEV concept has been widely espoused as an analytical framework e.g. (Emerton 2001; Turner 1993), the categories of benefit here are discussed in the context of forest and biodiversity conservation.

2.2.4 a) Direct benefits

The measurement of direct benefits is reasonably clear. Surveys of the use of forests by local people, estimates of the value of goods traded on markets, gate receipts and permits from tourists visiting forest parks can all be used to calculate financial values derived from the forests. Where goods are not marketed but consumed in the home, estimates of consumption can be made and appropriate market prices prescribed to value consumption (Mullan & Kontoleon 2008).

2.2.4 b) Indirect benefits

There is a hidden dimension to protected areas in that they have a wider role in the maintenance of environmental quality such as soil/ water conservation and carbon sequestration. It is the range of indirect benefits from environmental resources such as protected areas which points towards conservation being a rational land use option. Such hidden benefits are public goods that benefit many people at a local, national and international level. Forests loss in many areas may often result in terrible environmental consequences in

terms of soil erosion, flash floods and the depletion of a global carbon sink. The consequences of environmental degradation and the loss of forests are varied in magnitude and the economic and social cost. In Mali for example soil erosion though deforestation, causes losses in agricultural production of about 0.2% of GDP (Pearce & Moran 1994). Yaron and Moyini (2003) also report on the cost of soil erosion; the value of soil nutrient loss caused by soil erosion itself (although largely the result of poor farming practices, including deforestation) is calculated to be approximately US$625million each year (in 2001/2 prices) in Uganda. This is a truly enormous loss to the country – more than the entire value of manufacturing. It corresponds to an 11% share of GDP[3]. Not only are there direct losses to productivity to consider. Ameliorating the effects of natural resource degradation costs the public money that may otherwise have been better invested.

2.2.4 c) Option and Existence Values

The last two groups of value are the option and existence values (Turner 1993). Option values refer to any direct or indirect values that might be potentially used in the future. An example would be a national park where people who have no specific intention to visit it may still be willing to pay something in order to keep that option open in the future. In the context of ecosystems and their services, it is the value placed on maintaining ecosystems and their component species and habitats for possible future uses, some of which may not yet be known e.g. biomedical uses of plants not yet known. Option values can also be thought of as a form of insurance e.g. a natural forest may be regarded as a stock of resources to be used when times are difficult by local people.

The existence values are derived simply from the knowledge that the natural environment is maintained. The first of the three is the bequest value, where individuals attach value from the fact that the ecosystem resource will be passed on to future generations. Secondly the altruistic value: is where individuals attach values to the availability of the ecosystem resource

[3] Using a 2001/2 GDP figure of $5.7 Bn.

to others in the current generation and thirdly the existence value: derived from the existence of an ecosystem resource, even though an individual has no actual or planned use of it. For example, people are willing to pay for tropical forest conservation even if they never visit one. Non-use values are relatively challenging to capture since individuals find it difficult to price on such values as they are rarely required to do so. However, in some circumstances, nonuse value may be larger than use values.

Table 2.1 Direct and indirect benefits that together provide the total economic value of forests Adapted from (Turner 1993)

Total Economic Value			
Use Values		**Non Use values**	
Direct	**Indirect**	**Option**	**Existence**
Directly consumed goods	**Functional services**	**Future personal use and bequest to future generations**	**Welfare derived from knowing that things are there**
Timber: Fuel wood Construction materials Charcoal Non Timber Forest Products: Medicinal plants Wild honey Bark cloth Wild food (flora and fauna) Craft/Thatching materials Recreational use: Park entry fees Guiding fees Gorilla permits Earnings by tour companies/hospitality industry Grazing – Forage values	Soil protection: Erosion control Fertility Water conservation: Percolation into aquifer Stable release rather than flash flooding Climate control Carbon sequestration Health and hygiene Water related health issues (extra household expenditure on treatment, longer distance traveled to clean water source)	Environmental resources: Forests Wetlands Biodiversity Protected areas Livelihoods insurance: Risk reduction in peasant farming systems	Bequest-use by future generations Altruistic-importance to others today Non Use-Ecosystems existence

Since the publication of the Millennium Ecosystem Assessment (MEA 2005) much inertest has been raised in ecosystem services approaches to valuation which provides a broader temporal and spatial framework to understand the human welfare benefits generated from environmental or ecosystem goods (DEFRA 2007; Pagiola et al. 2004; Turner & Daly 2008). In addition the ecosystem services approach (Turner & Daly 2008) also identifies the property rights and institutional arrangements governing the system. The combined result is a biologically, socially and economically integrated framework to understand externalities in policy and management of natural capital.

Essentially the MEA aggregates the different economic benefits from the ecosystem under categories of different socio-ecological functional roles (provisioning, regulating, cultural and supporting) identified in Table 2.2 below (DEFRA 2007). The socio-ecological categories then correspond directly to the TEV frameworks different economic categories of benefits illustrated in Table 2.2.

Table 2.2 A comparison of the MEA and TEV frameworks

MEA Framework		**TEV framework**			
MEA Group	**Service**	**Direct Use**	**Indirect Use**	**Option value**	**Non-Use Value**
Provisioning	Provisioning Includes: food; fibre and fuel; biochemical, natural medicines, pharmaceuticals; fresh water supply	X		X	
Regulating	Regulating Includes: air-quality regulation; climate regulation; water regulation; natural hazard regulation etc.		X	X	
Cultural	Cultural Includes: cultural heritage; recreation and tourism; aesthetic values	X		X	X
Supporting	Supporting Includes: Primary production; nutrient cycling; soil formation	*Supporting services are valued through the other categories of ecosystem services*			

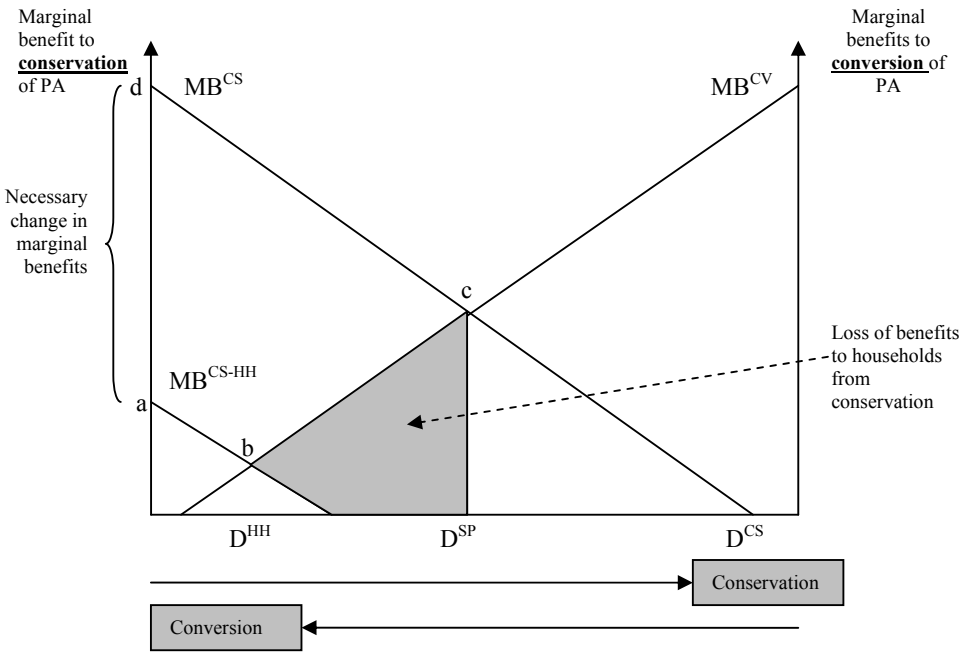
Source: (DEFRA 2007)

The TEV framework is a useful way of categorizing different types of value as they accrue to human beings. In the MEA context TEV is complementary as it presents categorizes ecosystem values at the critical end point in the broader ecological context. These are the final values which must be determined before other spatial and temporal scaling can be made upon which to assess the welfare impacts of ecosystem changes as a result of policy. Importantly the TEV framework also helps valuation practitioners to define and categorise the appropriate valuation techniques to estimate the costs and benefits of ecosystem services (DEFRA 2007; Pagiola et al. 2004; Turner 1993). Few TEV studies have been conducted to date despite the length of time that the framework has enjoyed mainstream acceptance (Pagiola et al. 2004). This is perhaps because despite the frameworks elegance and simplicity as a means to comprehensively understand the complex array of values, obtaining robust estimates for each of the components is often difficult, technically and logistically to do e.g. requiring quantitative data on the stocks and flows and changes therein of environmental goods and services. Chapter 6 of this thesis employs a TEV approach to understand present values of different land options (conservation vs conversion to local subsistence agriculture) of a protected area to understand the scope and nature of costs and benefits from local to global.

2.2.4 Household decisions to conserve or use protected areas?

The growing emphasis on communities and the role they play in the conservation of protected areas is driven not only by a concern for social justice, but a pragmatic assessment that it is these communities that have the greatest impact on the resources, either through direct unsustainable use from poorly enforced intuitional arrangement or through their collective voice to lobby governments to degazette land for development. It is these household level economic values that are of key importance (Hulme & Murphee 2001b). Lutz (1994) proposes that even when off farm effects are of primary concern considering the benefits and costs at the household level is appropriate because this is the level where conservation measure would in fact be implemented.

In a standard neo classical framework Larson (1994) depicts the trade off between the benefits to the conservation of forests and the marginal benefits to the conversion of forests. The argument developed can also be directly adapted to depict the marginal benefits of biodiversity conservation where the key threat is the loss of habitat. It yields an important insight in to the position that national governments should take when developing national polices on protected area management in an international framework. Assuming that governments do indeed act in the best interest of their people, governments should at a minimum consider the costs and benefits to local people at the prices they face (Lutz , 1994). This is an important entry point as it was an early attempt to focus attention on individual farmers as the principle agents of change in forest conversion.



Adapted from Larson (1994)

MB^{CS}= Marginal Benefit to Conservation; MB^{CV}= Marginal Benefit to Conversion, D^{HH}= Optimal level of land conversion for the household; D^{SP}= Socially optimal balance between conservation and conversion; D^{CS}= Optimal quantity of land to be conserved

Figure 2.2 Marginal costs and benefits between land conversion and forest/biodiversity conservation

In figure 2.2 the model depicts the marginal trade off in benefits between land under forest and land converted to other uses i.e. agriculture or grazing. On the X axis from left to right increasing quantity of land under conservation and from right to left and increase of land converted to other uses. The marginal benefits from conservation i.e. TEV from local to global scale, are denoted by MB^{CS} at the aggregate level and benefits accruing at the local household level by MB^{CS-HH}. Marginal benefits from forest conversion are denoted by the curve MB^{CV}. From the conservation perspective the optimal quantity of land to be conserved is D^{CS}.

The optimal level of land conversion at the household level is D^{HH}, and this is what local households will tend to without regulation and enforcement. The socially optimal balance between conservation and conversion is at D^{SP}. The challenge for conservation is therefore to estimate the loss of benefits (shaded area in figure) to households from attaining a given level of biodiversity conservation and redress the difference in marginal benefits from a to b.

Barbier (2005, 2007), develops further the economic model of forest clearance by individual farmers focusing on the farm profitability motive. The model defines two key determinants of the profitability of farming, market access and agricultural prices. Incentives to clear forest will be inversely related to market access e.g. reduced incentive to clear as the marginal benefits of the products from the land will be lower the further form the market it is. However incentives to clear will be positively related to increases in prices for agricultural commodities. Under open access conditions the model stipulates that the farmer will convert forest up to a point where the total revenues gained per unit of land will be equal to the per unit cost of land clearance. Thus the amount of land cleared will increase with the price of output and better market access.

These models' described above have explicit assumptions that do not take in to account any opportunity costs of clearance as in benefits foregone by the household from timber and non timber forest products. In addition they assume open access to forest resources and that

decisions to clear forest are based on perfectly functioning input and output markets and that on farm and off farm labour are perfect substitutes. Firstly these facets of a peasant or subsistence farming households do not hold in the case studies presented later. Thus the models are relatively naïve in their assumptions and will theoretically underestimate of the values of forest and the point at which forest clearance becomes profitable. Secondly in the context of protected areas, they are not open access resources even though de facto open access arrangements may exist because of poor or no enforcement of the regulations.

Estimating how much compensation is required to offset the costs of forgone forest access, or incentives to pursue other land use activities requires a thorough inventory of the costs and benefits from forests to adjacent households as well as alternative enterprises. Indeed Barbier (2007) emphasises the need for empirical studies to examine these issues. Chapters 3 and 4 of this thesis are just such empirical studies, developing a detailed understanding in financial and economic terms of the value of the benefits derived from protected area and apply this to answering questions about the efficacy of conservation management approaches to create incentives to mitigate the problems of illegal use.

2.2.5 Protected areas and poverty alleviation

Debate about the best approaches to conservation and the resulting social impact of *in situ* conservation is dynamic and polarised, with vigorous support for both the positive and negative impacts of protected areas on poverty at the local and national level (de Sherbinin 2008; Hulme & Murphee 2001a; Upton et al. 2008). The end product of much of this debate is the need to integrate local communities in to conservation as direct beneficiaries and active participants in the management of natural resources. The approach to conservation involving communities is commonly called community conservation, a term used to broadly define a diverse assortment of activities. These activities range from those with an indirect impact on conservation such as local development activities to improve incomes and divert livelihoods

activities way from conservation areas to education and awareness about the importance of environmental resources. Community conservation activities may also include local direct involvement in resource management such as protection and monitoring.

A particular prominent sub set of community conservation activities focuses on the development needs in communities adjacent to or within protected areas, which are dependent on the environmental resources there in. A broad assumption is that through addressing rural poverty and development needs, such communities may be less inclined to unsustainably or illegally use local environmental resources. Such activities are termed integrated conservation and development projects (ICDP) (Barrow & Murphee 2001; Hulme & Murphee 2001b; Newmark & Hough 2000).

The performance of community conservation has been considered by some to be disappointing in its achievement of conservation and rural development goals, in the last 3 decades and there is renewed energy towards strictly protected parks in achieving the forest and biodiversity conservation objective (Hutton et al. 2005). Approaches to evaluating the social impacts of protected areas and their management approaches tend to range from acceptance of the base assumption that because ICDP approaches are adopted, local people's needs are met, to the dismissal of the entire ICDP approach in achieving either conservation or local development goals. The general perception of failure is perhaps an example of received wisdom based on a narrow analysis of a restricted number of case studies (Emerton 2001; Gihimire & Pimbert 1997).

Upton et al (2008) make a landscape level analysis of poverty, to understand the dynamics between national wealth, the area, number and type of protected area, and found few significant relationships between indicators of poverty and the extent of protected area at a national level. They conclude that their findings have meaning for both positions in the debate on poverty and conservation. Critics of conservation generally, building upon local case studies of negative impacts to local communities, may be exaggerating the scope and

nature of the problem whilst conversely, conservation advocates need to temper their enthusiasm. Outcomes that achieve both poverty alleviation and conservation goals may be possible in certain circumstances, but generally choices or prioritisation between conservation and local livelihood goals must be made.

Emerton (2001) sets out clearly, from an economic perspective, why community conservation may have underachieved in Africa where household economic benefit based approaches had been the crux of community conservation. The problem lies not in a benefits based approach, but in understanding the scope and nature and distribution of benefits. Ultimately generating broad development benefits does not ensure that the presence of protected area generates a local benefit and that this is not the same as providing a direct economic incentive for conservation. Again this has implications for both perspectives in the poverty conservation debate.

Targeting community conservation efforts to those groups of people most negatively impacting the protected area is essential as well as developing a full economic and social understanding of the nature of the benefits they receive. Thus equity issues in conservation are as important at the local level as they are at the national or international level. Who wins and loses from biodiversity conservation must be a primary consideration in the design of effective conservation strategies involving communities. The question should then be by how much and in what way do different social and economic groups benefit in order to calculate their opportunity costs of different management approaches? Chapters 3and 4 value just such opportunity costs and chapter 6 of this thesis puts those local level opportunity costs in a broader cost benefit analysis framework.

2.2.6 Criteria for cost effective conservation

Once decisions about what to value and how to value it have been made some analysis of what might make practical financial sense for forest and biodiversity conservation must be

made. Organizations (public and private) have limited resources relative to what is necessary to accomplish the task. These groups must set priorities and make awkward choices(Hanley & Shogren 2002). Essentially conservation groups face the classic economic problem of allocating scarce resources. For this reason economic analysis can play a more active and important role in biodiversity conservation.

There are two basic challenges to prioritisation, firstly the challenge from a biological perspective is to decide on which biodiversity and ecosystems are the highest priority. Secondly facing the resource constraint to understand which biodiversity or ecosystem is most cost effective to conserve. Weitzman (1998) uses a neat analogy of a resource constrained Noah's Ark, that is not big enough to fit all example of biodiversity on to. The conservation problem is to choose species survival probabilities to maximize expected utility from species conservation subject to a budget constraint. Weitzman firstly assumes that the cost of increasing survival probabilities is a linear function and secondly assumes that utility consists of the direct value from the existence of the species, and the "distinctiveness" value, which measures the difference between a species and its closest genetic neighbour. Given these conditions, Weitzman proves that the optimal conservation policy is an "extreme policy" in which each species is either conserved to the maximum degree possible or not conserved at all (with the possible exception of a single fractionally conserved species).

Weitzman's conservation allocation rule, whilst providing an important entry point for considering criterion for cost effective conservation is in fact naïve in its assumptions froma biological perspective. Two key reasons why real conservation problems are not the same as the "Noah's Ark Problem" are firstly no single species can survive outside of a habitat that is usually comprised of a multitude of other species? Economically this gives rise to a joint production function, giving rise to multi species survival simultaneously. Secondly the assumption of a linear function for the costs of increasing survival probabilities is unreasonable as there are normally critical sizes of habitat for a given marginal change in

probability of species survival i.e. if the change in habitat is below a critical size it will not yield a change in the probability of species survival.

Polasky and Solow (1995), also describe a model to select a cost effective conservation strategy. They adopt a maximal utility function, constrained by factors such as budget, biodiversity (species richness) and probable impacts of a conservation solution. This was a significant development in bio-economic modelling as it allowed for more complex measures of biodiversity and conservation strategies to be included in the utility function. However as Polasky and Solow (1995) point out such models are unlikely to give neat analytic solutions. Even when a measure of species diversity is used, as in Weitzman (1998), the conservation strategy is rarely specific to a single species.

Conserving habitat, or protecting an ecosystem from invasion, typically provides protection for multiple species within an ecosystem (joint production). What lands should be set aside as nature reserves to conserve biodiversity given the other pressing demands on land use is a classic economic problem. It is also an is an outstanding example with which to explain basic economic concepts such as opportunity cost or the optimal allocating of scarce resources under a budget constraint to biologists and conservation managers who may be unaware of the relevance of economic tools. This thesis provides examples of some of the types of valuation techniques available, applied to pertinent conservation management questions and also an example of a cost benefit approach. The empirical data presented in this thesis is precisely the sort of basic data that is required to apply to bio-economic models, to assist in objective decision making about protected area management and cost effective solutions to forest and biodiversity conservation at different spatial and temporal scales.

2.3 Integrating forest and biodiversity conservation with human welfare objectives

This section furthers our understanding of contemporary approaches to conserving biodiversity from focusing on national policy and management practices, giving some background description and analysis of the key opportunities and constraints from an institutional and organisational perspective. Current and proposed mechanisms to address global externalities in the conservation of biodiversity are explored as well as local level issues in the poverty conservation paradigm; key operational entry points for the valuation of biodiversity are highlighted and their usefulness and limitations assessed.

Biodiversity conservation as a priority in the context of human development has promoted contentious debate in the last decade, from extreme technological views to eco-centric concerns regarding the substitutability of biodiversity for technological solutions in human development (Neumayer 2003). Rational policy debate has come to put biodiversity conservation as a central objective in acknowledgement of the dependence of many rural poor people on environmental resources and is thus essential in achieving the central development goal of poverty eradication (Adams et al. 2004; Balmford et al. 2002; Upton et al. 2008). As such, forest and biodiversity conservation objectives are often stated aims of many international, national and local level policies and approaches to human development (CBD 2008; MEA 2005). International examples include the United Nations millennium development Goals and The Convention on Biological Diversity. National and locally policies to conserve forests and biodiversity are reflected in national government Poverty Reduction Strategy Papers, through government agencies such as national wildlife authorities and forest authorities and local level district and regional government development plans incorporating environmental targets in to development plans. Importantly the economic assessment of

their values and stocks and flows of the resources have been identified as being essential in effective conservation and management of biodiversity.

However there remain large gaps in knowledge, for example, at a local and national scale, relatively limited information exists about the status of many ecosystem services and the economic value of non-marketed services. Moreover, the costs of the depletion of these services are rarely tracked in national economic accounts. Basic global data on the extent and trends in different types of ecosystems and land use are surprisingly scarce. Models used to project future environmental and economic conditions have limited capability for incorporating ecological "feedbacks," including nonlinear changes in ecosystems, or behavioural feedbacks such as learning that may take place through adaptive management of ecosystems (MEA 2005).

In the previous section economic theories on decision making over how much biodiversity to conserve and efficacy in achieving biodiversity conservation were discussed. In this section some of the most influential national policies and practices are discussed here with respect to how an economic understanding of the value of biodiversity helps to assess their implications in the management and protection of biodiversity in the Albertine Rift using case studies to illustrate the scope and nature of adoption and the strengths and weaknesses of the approaches.

2.3.1 National Approaches

2.3.1 a) Biodiversity conservation in a developing economy context

The 1st of the eight Millennium Development Goals is halving, between 1990 and 2015, the number of people whose income is less than $US one per day. The World Bank Group and International Monetary Fund launched the Heavily Indebted Poor Country (HIPC) Initiative in 1996 to provide debt relief to 41 heavily indebted poor countries, 32 of which are located in

sub-Saharan Africa, including Uganda and Rwanda. In September 1999 it was agreed that concessional lending and debt relief under the HIPC Initiative would be based on Poverty Reduction Strategy Papers (PRSP) (Swallow 2005). Since that time several multilateral and bilateral donors in addition to the World Bank and International Monetary Fund have indicated that they will only support activities that are clearly defined and given priority in the PRSP documents. PRSP have thus become among the most important documents for national planning and communicating priorities to development partners.

The focus of the approach is to help recipient countries build more effective poverty reduction strategies through a participatory and inclusive process. These strategies are then expected to form the basis for a joint PRSP, which brings together the country's own strategy and multilateral donor assistance to the country. The PRSP is an effort to help mainstream poverty reduction in the recipient country's public policy, thus PRSP should start from existing government strategies and build on them. Ultimately this feeds in to sectoral plans i.e. forestry, conservation, environment, education, agriculture etc. which are then costed and consolidated into a national plan and corresponding budget (medium term expenditure framework).

All of the countries of the Albertine Rift qualify for HIPIC relief and thus produce PRSP. In the case of Uganda such a strategy had existed for several years. Uganda was one of the first low-income countries to prepare a comprehensive and participatory national strategy for poverty reduction. The formulation of Poverty Eradication Action Plan (PEAP) in 1996-97 was an effort by the executive branch of the government to make this commitment and vision operational (Bush et al. 2004). The PEAP has guided the formulation of government policy since its inception in 1997, and is currently being revised. Under this plan, Uganda is being transformed into a modern economy in which people in all sectors can participate in economic growth. This implies a number of conditions:

Uganda's Poverty Eradication Action Plan (PEAP) is established on four major pillars:

- Creating a framework for economic growth and transformation
- Ensuring good governance and security
- Directly increasing the ability of the poor to raise their incomes
- Directly increasing the quality of the life of the poor.

The revision of the PEAP in 2000 drew on the progress made since 1997, including the development of sector-wide approaches, the participatory research carried out by the Uganda Participatory Poverty Assessment Project (UPPAP), the constraints identified in the Poverty Status Report, and the development of costing of public actions and indicators for monitoring in key, poverty-oriented sectors (GOU 2005).

Rwanda has also implemented policy and budgetary processes through the 2001 PRSP. In 2004 a review was conducted to monitor public expenditure management and implementation of national strategies for poverty alleviation. The new plan is called the Economic Development and Poverty Reduction Strategy (EDPRS) (GOR 2007), reflecting the view that poverty alleviation cannot be achieved without economic development.

Further to the medium term PRSP is the longer-term strategy Vision 2020 i.e. to be achieved by year 2020, which both countries have adopted. For example Rwanda sets out 6 main pillars and three cross cutting areas. Pillars are strategic objectives that the country wishes to attain as key to achieving sound economic development and poverty alleviation. Cross cutting areas are strategic issues of vital importance, without which it will be problematic or impossible to achieve the other strategic objectives, see example from Rwanda in Table 5.1 below. It is important to note that both Uganda and Rwanda have included environmental protection and sustainable natural resource management amongst their cross cutting areas.

Table 2.1 Rwanda's Vision 2020 – Pillars and cross cutting areas (GOR, 2007)

Pillars of the Vision 2020	**Cross Cutting Areas**
1. Good governance and a capable state 2. Human resource development and a knowledge based economy 3. A private sector-led economy 4. Infrastructure development 5. Productive and Market Oriented Agriculture 6. Regional and International Economic integration	1. Gender equality 2. Protection of environment and sustainable natural resource management 3. Science and technology, including ICT

The PRSP is both an important tools and an approach, through which environmental issues can be mainstreamed into national plans for development at the highest policy level. Recognition that a healthy environment underpins all efforts to alleviate poverty and develop the economy is included in the plans for Rwanda and Uganda. Critically the importance of the environment sector must be reflected in the national budget plans as multilateral and bilateral donors are increasingly coordinating their assistance with national government plans through 'basket'[4] funding approaches. Unless the environment sector and biodiversity conservation is illustrated as a priority issue in the national budget it will be difficult to secure national or international donor financing towards those sectors.

Vision 2020 and the PRSP are however strategic policy pieces and do not elaborate on the operational issues to achieve targets. At the next level down and where we start to focus more on forest and biodiversity conservation, are sectoral strategy and action plans. For example in Rwanda the ministry in charge of Lands, Resettlement and Environment and the Ugandan ministry of Lands Water and Environment have developed national Biodiversity strategy and action plans (BSAP), which form a more detailed outline of what is to be achieved by which organisations over a given time frame (GOU, 2002; GOR, 2003). Critically it was intended to give an indication of those costs which should feed into national budget planning, so that

[4] 'basket funding' also known as budget support, refers to giving international assistance directly to central government treasury to be administered through the recipient countries own structural financial systems and processes. Although given direct to treasury, funds are often restricted towards the donors preferred sectoral activities i.e. education, environment etc.

actions related to conservation of environment and biodiversity can be give proper scrutiny and prioritisation for funding.

Herein lies an anomaly, in both Rwanda and Uganda the mandate for the conservation of biodiversity lies with the ministry in charge of environment, yet national parks and in Rwanda's case forests come under the auspices of other ministries. In Rwanda national parks are part of the ministry for commerce (being the back bone of tourism) and forests are part of the ministry of agriculture. In Uganda national parks also come under the ministry of tourism, but forests lie with the environment ministry. There are obviously critical coordination issues in the development of BSAP and its implementation when in both countries the bulk of biodiversity lies in national parks, under the authority of different ministries. Such organisational complexity may give rise to tensions over lobbying and securing finance for biodiversity conservation in protected areas as well as questions regarding the ability of ministries charged with commerce and industry to be objective about the public goods aspects of forest and biodiversity conservation.

The weakness of any planning process is that the plan can only be as good as the knowledge and information available to the experts formulating it. Early rounds of the PRSP for both Uganda and Rwanda left out issues to do with the environment and biodiversity. Not until economically important sectors such as tourism and forestry were better understood in economic terms e.g. contribution to GDP, were conservation issues more fully incorporated into national plans. For example in Uganda it was not until the PRSP review in 2004 that forests were specifically identified as an important sub sector of environment and natural resources (Falkenberg & Sepp 1999). Similarly the importance the environment was not included as a separate cross cutting issue in the Rwanda PRSP until the most recent review in 2006. By that time a number of environmental disasters, with implications for the loss of

biodiversity with immediate economic impacts at a national level had occurred, that could have easily been averted (see text box below).

National Economic impacts of environmental degradation in Rwanda

Rwanda's has witnessed two major examples with immediate impacts on the economy from the disturbance of key environmental resources. The two cases in point are:

1. Forest Clearance at Gishwati Forest Reserve – 1996-1998
2. Wetland drainage in Rugezi Swamp – 2003

Both of these areas are or were home to rare and endangered species. For example the Golden Monkey (*Cercopithecus, mitis kandtii*) in Gishwati and the Grauers Swamp Warbler (*Bradypterus graueri*), both of which are Albertine Rift endemics.

Forest Clearance and economic impacts in NW Rwanda

Gishwati forest was a large area of tropical mountain forest in north west Rwanda providing almost the entire catchments for the Sebeya River flowing into Lake Kivu to it's west. A World Bank sponsored agricultural project saw approximately 180 km^2 converted to agriculture and livestock production in the 1980's and the remaining reserve was partially degazetted for resettlement post war during the mid 90's. However the resettlement was largely uncontrolled and although the nominal territory of the reserve is 40km^2 only 7km^2 of disturbed natural forest remains.

Impacts on the local economy range from reduced agricultural outputs due to soil erosion and loss of property and death of people and livestock due to a prevalence of flash flooding and landslides after the loss of forest. Siltation in the Sebeya River has also had dramatic effects on the volume and cost of power and potable water from Electrogaz and caused and increase in production costs at the Bralirwa brewery. Estimates from a GEF sponsored study (Bush 2004) indicate that annual financial losses to Eloctragz alone are in the region of $350, 000 per annum as a result of the marginal increases in the down time at plants for cleaning out sediment.

Wetland drainage and the national energy crisis

Rugezi Swamp is a tropical highland swamp, located in central northern Rwanda and runs north to south for approximately 40 km, between Ruhengeri and Byumba Provinces. It is a major part of the catchments for lake Bulera, into which Rugezi drains, and lake Ruhondo (into which lake Bulera drains) in northern Rwanda. The swamp acts a giant 'sponge' during the wet season and continues to release water slowly into Lake Bulera during the dry season, helping to maintain the dry season level of the lake.

A hydropower production plant is located in the channel between lakes Bulera and Ruhondo and was responsible for approximately 40% of national electricity production. In 2003 a local project was undertaken to drain Rugezi swamp to allow for agricultural production. The subsequent drainage system over a large part of Rugezi terminally disrupted the holding capacity of the swamp as a dry season reservoir for lake Bulera. As a result dry season flows into lake Bulera dramatically reduced, which saw the level of the lake drop by 3-4 meters the following dry season. The off take of water to the fixed infrastructure of the power plant was greatly reduced causing the largest part of a massive drop in output caused by only intermittent production when water levels allow. This has been the major factor in the power deficit in Rwanda. To cope with the power shortage, Rwanda has had to import diesel generators and the price of electricity has more than doubled. This undoubtedly has had huge impacts on economic development in the service and industrial sector as businesses were initially crippled by lack of power and are now facing higher production costs because of the price increase.
(Source: own research)

The direct link to biodiversity conservation is the obvious loss of habitat, but the benefits that these ecosystems provided to the local and national economy were not readily understood. Fortunately for Rwanda these issues will be treated more cautiously given the invigorated

national interest in the environment as result of these tragic experiences and the development of the Rwandan Environmental Management Authority.

2.3.1 b) Rural development policy and decentralization

ICDP are the main approach to mitigate the conflicts between human development and conservation (Hulme & Murphee 2001b; McShane & Wells 2004; Wells & Brandon 1992). Most ICDP represent some form of rural development project designed to have conservation impacts. Typically the money and resources available nationally and internationally for rural development are much greater than those for conservation. Therefore conservation may look towards this sector for partnerships that might have considerable beneficial outcomes towards the implementation of development projects that also meet conservation objectives.

Both Rwanda and Uganda have pursued policies of decentralization in the last decade. Decentralization involves two processes, de-concentration and devolution (Carney and Farrington, 1998). De-concentration is the transfer of administration and organization away from central government and into local government units. Devolution is the development of real decision-making and legal power to local government units i.e. to be able to pass by laws about local issues as well as raise and spend local taxes.

In Rwanda for example, the common development fund[5] was established to strengthen the poverty reduction strategy and empowerment of the population by providing them, through the decentralized local government structure, with financial support to implement development projects, a similar structure exists in Uganda. The specific principle challenges for the environment sector are how to ensure that conservation concerns and laws are addressed through the decentralized network and that sufficient finance and human resources are available to address key issues. Importantly there lies an institutional opportunity to mainstream conservation (ICDP approaches) through this structural financial mechanism.

[5] The CDF in Rwanda is a structural financial instrument through which to central government funds are channelled to the decentralized network of government

Already common development fund has a policy that 5% of finance must be spent on projects that directly address environmental issues. This, for instance, could be spent on labour-intensive public works to address public environmental concerns such as tree planting on public land or public tree nurseries to alleviate pressure on wood resources in protected area.

It is this policy on decentralization that also brings into focus the need for valuation information by protected area and environmental managers, in order to make rational decision at the level of the site about planning expenditure and which activities may result in the biggest welfare and conservation impacts. Disaggregated information from living standards studies such as those in chapters 3 and 4 may yield important information at a community level regarding which communities are highest forest users and can help better target the expenditure of scarce finances on community conservation activities.

2.3.1 c) National laws and policies in support of Community Conservation

The community development and poverty centred approach to national development has not been overlooked by ministries and agencies responsible for the management of biodiversity in Rwanda and Uganda. Both countries clearly acknowledge the central role that communities play in conserving biodiversity within protected areas with the development of several laws and statutes identifying the role that communities can play in conservation (see text box below).

Such laws and polices obviously demonstrate an active interest in ensuring equity at the lowest level in the management of environmental resources. However there are always institutional and organisational challenges that arise in the implementation of new policies and the development of novel instruments.

Uganda's policy and legal instuments for community conservation

The policy and legal framework for the management of environmental resources in Uganda places significant emphasis on sharing of the costs and benefits of conservation.

The **Uganda Wildlife Statute (1996)** recognises the importance of increasing benefits to local communities from protected areas as a means to improve relationships and thereby foster positive attitudes to conservation at community level. Specifically this Statute includes a provision for sharing of tourism revenues with communities adjacent to protected areas. More recently the Uganda Wildlife Authority has developed policies on community conservation and collaborative management that provide for other measures to share benefits, and reduce costs of crop damage by wildlife. However there is little information on the extent to which these measures are actually changing the balance of costs and benefits at local level, and thus the extent to which the benefit sharing provisions are adequate to achieve the desired result.

The **Environment Statute (1997)** established the National Environment Management Agency (NEMA). While the mandate for management of environment and natural resources still rests largely with the centre, collaboration between NEMA and the Local Government Development Programme supports increased transfer of resources, power and decision-making to locally elected councils at district and sub county levels, and the mainstreaming of environment into local government planning processes. This project will generate new information on the contribution of protected areas to poverty reduction that is key to efforts to mainstream conservation within broader planning processes.

The **Uganda Land Act (1998)** transforms land tenure policy in Uganda, giving full legal recognition to customary land tenure systems. Furthermore this act reinforces provisions of the constitution relating to protected areas such as forest reserves which states that such reserved lands are "trust lands" belonging to the people of Uganda, to be managed by government in a manner that serves the best interests of the people of Uganda. This key principle is receiving increasing attention as civil society groups raise concerns over equity in balancing local and national interests.

The **Forest Policy and Forest Act (2003)** provides for substantial devolution of authority to the local level. The Act promotes Collaborative Forest Management (CFM) which is defined as follows: "Communities are genuinely involved in the management of the forest resource through a negotiated process in which rights, roles, responsibilities and returns for sustainable management of such forest resources are shared". Guidelines have now been developed to guide the CFM process and attention is being focused on how the process can ensure equity in sharing of rights, responsibilities and returns so that CFM provides adequate incentives for effective and sustainable community participation.
(Source: Phil Franks, Care Inetrnatoinal Poverty, Environemnt and Climate Change Network)

For example the importance of Uganda's forests for biodiversity conservation should not be under looked. Almost 1/3 of the entire forest estate is under the network of reserves managed by the National Forest Authority (NFA), including many species rich tropical high forests and afromontane forests within Uganda's section of the Albertine Rift. In addition the NFA together with the District Forest Service (DFS) are responsible for the management of certain forest laws governing natural forest and plantation on private land.

In 1998 a National Forest Plan (Uganda) was produced which identified the need to reform the Forest Department, and to give the new NFA the autonomy and management freedoms

required to achieve clearly defined objectives. The new Forestry Policy passed by the Cabinet in March 2001 reflected this situation, stating that the institutional framework for the forest sector will be strengthened and that the Government is committed to the transformation of the present Forestry Department into an autonomous authority. The approval to prepare the legislation to create the NFA was given by Cabinet in October 2001. A National Forestry and Tree Planting Act gazetted in August 2003 provided the enabling clauses for the National Forest Authority.

The new NFA is organised as a parastatal[6], which will supervise the portfolio of central forest reserves and the District Forest Services will manage local forest reserves and provide support to private forest owners. It was assumed that the delivery of public goods, such as environmental services and community benefits, will be improved under the NFA management, which will operate with freedoms and planning horizons that the Forestry Department did not have. As a government-owned organisation, the NFA Performance Contract will specify the balance it must achieve between income generation and the delivery of public goods and services.

Despite the policy level acknowledgement of the importance of biodiversity and the role it can play in poverty alleviation and economic growth, it is a message that is still not clearly understood much less acted upon. The appropriate incentive for the government to maintain the focus on public goods may not be evident unless the full economic benefits from forests are properly quantified. By 2005 the newly formed NFA was in dire financial trouble as the scheduled central government finances were not disbursed (Bush et al, 2004). Clearly the focus of the Treasury in the creation of a parastatal agency was to divest itself of the financial burden

[6] A parasatal is term used widely in development for former government departments operating in a liberalised manner i.e. government executive agencies with a degree of autonomy over the raising and utilisation of own of finances through market based activities. Similar in institutional form to a quasi government organisation in the UK i.e. Environmental Protection Agency or Agricultural and Rural Development Agency PA

of managing Uganda's forest estate. This situation was finally resolved with a financial support package from the international donor community.

In additon in Uganda in 2007 President Museveni attempted to overule parliament to degazette Mabira Forest Reserve in Central Uganda to make way for sugar cane plantation. Assuming transparent governanace, this was clearly a decison made on the perceived economc importance of investment in economic development, and is also an example of putting short run benefits before long run costs. A clear illustration of the need for thorough economic valuation of the TEV, such as the exampel of chapter 6, of forests in protected areas and importantly the right sort of lobbying and exposure of the findings to the relavent authorities and the general public.

2.3.1 d) National coordination of policies on the environment and biodiversity conservation

Clearly there are many challenging coordination issues in the management and development of polices towards biodiversity conservation in the complex national institutional and organizational policy environment. The PRSP provides the principal inter-ministerial platform for policy coordination across all sectors. As such it is the fundamental tool to mainstream environmental issues in other sector policies. Currently the finance ministries in Rwanda and Uganda oversee the coordination of PRSP M&E system. This is done in conjunction with its stakeholders by issuing guidelines and preparing consolidated reports on macroeconomic and growth policies, annual budget execution and an annual PRSP implementation progress report.

A key challenge will be to address the interface between PRSP information needs, information needed for sector strategy formulation and implementation, and monitoring of district development plans. To supplement information produced through MINECOFIN[7]and the sector ministries' administrative systems, a wide range of studies are regularly conducted

[7] MINECOFIN – Rwandan Ministry of Finance and Economic Planning;

in the area of tracking public funds. These range from the central level to frontline service providers as well as the assessment of performances of those agencies in producing services accessible to the population. A citizen report card technique is being developed in Rwanda to measure the level of satisfaction and public services users' perceptions. This will feed into the policy design and implementation process. However in addition to such qualitative measures there is need for quantitative social, economic and environmental data on indicators of policy success. At present little elaboration of the indicators and mechanisms are available and the current focus for developing environmental indicators lies on issues to do with industrial and economic development and less on biodiversity (Bush et al 2005). This is clearly an opportunity of economic valuation studies to better inform policy processes at the national level e.g. the values of protected areas to adjacent communities in chapters 3 and 4.

Both Rwanda and Uganda rely heavily on international donor assistance in the financing of public sector activities. Both governments have in recent years stated a preference for predictable budget support as the primary mode of assistance. It is believed by both recipients and donors that clear budget support, when accompanied with accountable and transparent institutions, will deliver superior results compared to the traditional project approach. Budget support approaches offer some key opportunities for mainstreaming forest and biodiversity conservation in development planning and management. On one hand there is a common platform for lobbying both government and the donor communities about the economic importance of biodiversity conservation, assuming the empirical information on which to base the lobbying is available. On the other hand if conservation groups are unable to interface with these harmonized approaches to financing development it is likely that they will lose out on the option of wider development financing for biodiversity conservation, as it is unlikely to receive the prioritisation it deserves in strategic financial planning at the national level the TEV study in chapter 6 is an example where economic information can be used to promote rational argument for conservation of forests and biodiversity in this context.

Importantly economic indicators on biodiversity and forest conservation should be developed to provide quantifiable measures of success in policy implementation. Creating "green" national accounts to appreciate the value of natural capital has been discussed for some time now e.g. Pearce and Atkinson (1993), Solow (1986). The World Bank report "Where is the Wealth of Nations" (World Bank 2006), brings the natural capital accounting issue in to sharp focus indicating that natural capital accounts for almost a quarter of total wealth in low income countries, greater than the chare of produced wealth. To date few less developed economies globally have produced such green accounts despite the methods being theoretically uncomplicated (Hartwick & Olweiler 1998). The valuation studies on local uses of protected area resources are just the type of valuation exercise on which to build an aggregate estimate of the worth a nations forest stock. However the practical reality of developing estimates is practically more challenging and costly e.g. how to get reasonably accurate estimates of forest and biodiversity resources, in terms of survey work, on which to base estimates. To date none of the countries in the Albertine Rift have produced 'green' national accounts.

2.4 Conservation Management Approaches

2.4.1 Trans-boundary protected area management

Further to the model of protected area management as a foundation of conservation described in chapter 1 a slightly more complex situation exists whe ecosystems straddle international boundaries. The Albertine Rift is a region defined by ecological and physical geographical parameters and as such encompasses several different sovereign states. Several of the protected areas within the Albertine Rift have a border shared by a neighbouring protected area in another country, thus the protected area boundary is also an international boundary.

Perhaps the most iconic example of a trans-boundary park is the Masai Mara Reserve (Kenya) and Serengeti National Park (Tanzania), forming a contiguous ecosystem, where the annual migration of wildebeest and zebra transfer across an international boarder in search of seasonal grazing. Several trans-boundary conservation areas exist i.e. Nyungwe National Park (Rwanda) and Kabira Forest Reserve (Burundi), Queen Elizabeth National Park (Uganda) and Virunga National Park- northern sector (DRC). Conservation management practices in one park can have implications for the neighbouring park so some coordination of activities, laws and policies on wildlife management are essential for effective species conservation.

An example of particular interest with an active trans-boundary management process is the Virunga Volcanoes protected area, the home of the endangered mountain gorilla (*Gorilla berengei berengei*). This trans-boundary conservation area comprised of three national parks in neighbouring countries, Volcanoes National Park (Rwanda), Virunga National Park (DRC) and Mgahinga National Park, (Uganda). Since 1991 the International Gorilla Conservation Program[8] (IGCP) has been working on coordinating mountain gorilla park management practice and policies in the three range states. Its goal is to ensure the conservation of mountain gorillas and their regional afromontane forest habitats. One of IGCP's main objectives is to increase collaboration between the protected area authorities and their partners in the region. The programme provides a mechanism for the respective countries to develop a regional approach to the conservation of a shared habitat

IGCP worked with the authorities in all three of the range states to develop a plan for the creation of a Transfrontier Protected Area (TFPA). The three authorities subsequently presented a joint paper at a 1996 Peace Parks conference, outlining the potential for a collaboratively managed TFPA. This and subsequent work also involving the IUCN, led to all three protected area authorities signing a Tripartite Agreement in 2001. Further to this, in

[8] IGCP is a program of a coalition of international conservation NGO; African Wildlife Foundation, World Wildlife Fund and Flora and Fauna International

2006 IGCP began to facilitate the development of a trans-boundary secretariat which institutionalised an organisation to develop and oversee the implementation of a trans boundary ten year strategic plan between the three range states, which was launched in February 2008. Financing for the initiative was provided by the Netherlands Government development program in the region.

The objective of the secretariat provides the organisational structure to maintain regional collaboration and ensure a harmonious approach to protected area planning, management, financing and monitoring and evaluation. Technical advice is made available through committees for research, tourism, community conservation and law enforcement. Representatives of the key wildlife agencies and regional and international partner organisations sit on the committees, giving the opportunity to share regionally expertise in conservation. This is an important aspect as it is recognised within the strategic plan that capacities and the level of development of the protected area are different between states.

A trans-boundary approach to conservation also needs to be informed by economic and social research on the opportunities and impacts of conservation approaches discussed in more detail below. Importantly this trans-boundary approach provides an opportunity to harmonise economic research methods between range states so that competitive assessments of the performance of trans-boundary policies can be made. One of the roles that IGCP has played in recent years is lobbying for harmonization between countries of the gorilla permit price. From an economic perspective this sort of price fixing may not lead to the optimal benefits for each range state from tourism, due to the relative comparative and competitive advantages of the tourism sector in each country, even if it leads to maximised revenue at the park level.

For example Bush (2007) shows that price increases in 2006 led to a change in the consumption patterns of tourists coming to visit Rwanda with a clear shift away from Rwanda

as a focal destination to the gorilla park as a destination. Whilst this was good for the gorilla park in terms of increased revenue from permits, tourists were staying a shorter length of time and visiting fewer other locations within Rwanda; respondents tended to visit other countries in the region as well. This clearly has implications for the maximisation of benefits for the Rwandan private sector that had fewer opportunities to sell bed nights, car hire days, meals etc. per tourist visiting. In this respect such economic information could help sovereign states to make more informed decision about the policies that they wish to adopt and for international NGO to be clearer about the wider impacts of the advice they give. For example the work in chapter 5 on consumer values for mountain gorilla tourism could be repeated in the three different countries to get a detailed understanding of differences in consumption patterns and tourist's demographics and behaviour, to set regionally prices for gorilla treks. In addition studies on forest adjacent households living standards and forest dependence e.g. chapters 3 and 4, could provide essential information to differentiate strategies between countries to mitigate the impacts of illegal use of protected areas.

2.4.2 Integrated conservation and development approaches

Much attention has been given in the last few decades by the conservationists to what has become known as the "integrated conservation and development" approach to conservation (Leach et al. 1999). Earlier (section 2.3.5) a brief description of ICDP was given to outline their place in the gamut of community conservation approaches and the link with the theoretical valuation frameworks being discussed. In this section we elaborate further the opportunities and constraints of the approach and how economic values can help to improve on their performance as a conservation and development tool. The precise nature of the activities undertaken under the ICDP approaches are varied but can be basically categorised as activities that couple local economic welfare to the use of the protected area or those that try to decouple local economic welfare from use of the protected area (Barrow & Murphee 2001).

Many community-based protected area management programs try to meet at least two complex goals: conservation of nature, and economic empowerment of rural households. The underlying premise is that communities can profit from protected area if they are given sufficient authority and control over protected area resources. Thus, such programs invariably involve some devolution of state authority over wildlife management to either community or district government organizations, increased community involvement in protection of fauna and flora, new jobs created through increased tourism, protection, and benefits to rural households either directly or indirectly through community projects run by NGO (Kiss 2004; Newmark & Hough 2000; Romero & Andrade 2004)

Coupled activities such as timber and non timber forest product harvesting from defined areas of a protected area are tough to manage as sustainability is a key concern. Once local people have legitimate access to a protected area it can be problematic to police who is there legitimately or not, in addition to the problem of verifying if they are harvesting only authorised quantities. Decoupled activities such as the development of alternative livelihood options may be too indirect in targeting the conservation objective and the social, economic and technical conditions are often too challenging for them to be effective (Ferraro, 2001). However, the ability of such actions to effectively deal with the problems associated with, what are effectively, common property resources has resulted in limited success in achieving biodiversity conservation or sustainable resource use (Bowen–Jones & Pendry 1999; Ferraro & Kiss 2002; Hulme & Murphee 2001b).

Struhsaker (1996) points towards 'sustainable harvest' from forests as a commonly misunderstood concept. Several key conservation failures in sustainable resource use are identified. Firstly he points to the general failure of sustainable harvest projects. Secondly, and very importantly, is that sustainable harvest is used a blinkered manner, as only those

species of interest (the harvest) are considered and this only represents a small proportion of the living organisms within the ecological community being exploited. For example timber extraction is not usually compatible with sustainable conservation of other non-harvested species. Intensively managed forests more closely resemble tree plantations than natural forest. The flora and fauna that follow heavy logging are usually fast colonising (weed) species and not those typically associated with old forest growth. In the context of direct use of protected area, the harvesting of timber and non-timber forest products must take into account the complex food webs that are found in an ecological environment, otherwise damage may be done to other vulnerable species. Thirdly, it is important to establish a reference point in order to be able to monitor the consequences of a course of action. Lastly, there is the temptation to increase yields above the sustainable level, under demand pressure from markets, society and politicians.

Ferraro's (2001) narrative on the difficulty and complexity of implementing effective ICDP identifies three principal problems associated with using development interventions to protect ecosystems. First, given the complexity of development interventions and the temporal and spatial scales at which conservation objectives must be achieved, field practitioners must spread their resources over a multitude of tasks that often have no effect on conservation-related household behaviour. Second, when practitioners do manage to have a development effect, it is often an undesirable effect from a conservation perspective i.e. improved income means that poachers can afford guns instead of snares (Brown 2003). Third, even if practitioners generate a desirable effect, they often have difficulty sustaining it because the effect depends on market conditions that change frequently. This is one view and there are many other perspectives, but it does broadly illustrate the challenges faced in employing development approaches to conservation problems.

The general issues described above similarly affect many of the ICDP currently in operation in Uganda and Rwanda. For example an innovative strategy in the last decade has been tourism revenue sharing. The basic idea is to spread the benefits of tourism revenue from the national parks with local communities, so that the community values (obtains direct benefit from) the protected area and the wildlife within it. Developing a sense of community ownership of the resources and tangible economic benefits from their existence would hopefully mitigate any negative impacts of living next to the protected area (impacts of crop raiding or opportunity cost from loss of access to protected area resources) and assist in community protection of the resource.

The study by Plumptre et al (2004) on socio-economic costs and benefits from protected areas in the Albertine Rift showed that tourism ranked very low as a benefit from the protected area surveyed. Tourism was mainly perceived as being useful at a national level. It is clear that most tourism revenue does not accrue at the local level (Grosspietch 2007; Sabuhoro 2006). Developing the link in people's minds between tourism and other park benefits, especially revenue sharing, in all areas around the park should be part of the tourism development program. However the impact of tourism revenue sharing schemes in the community may be diluted due to the high population density relative to tourism revenue.

In Rwanda the revenue sharing scheme has recently been introduced on the basis of experiences in Uganda. An explicit policy to share 5% of total gate receipts of the national parks was developed by Office Rwandaise du Tourisme et des Parks Natoinaux (ORTPN) in 2002. By 2004 the system was operational with the first payments being disbursed in 2005. Typically the scheme disburses funds to communities through local government structures. Communities in this case are identified as those official administrative sectors adjacent to the national park. Money goes to provide social infrastructure such as paying for community

water points, clinic and school improvements. The projects are identified through district development plans, and are implemented through the local government structures.

Using the Volcanoes National Park (VNP), Rwanda as an example, an issue to be highlighted is access to water (Plumptre et al. 2004). The volcanic geology of the VNP area means that rain water either runs off rapidly or percolates quickly through fissures in the ground. During the drier months permanent water sources may only be found within the boundary of the national park as external ones dry up. Whilst the park authorities often grant permission for local people to access such water sources, this poses a conservation risk. As people access the park their activities may not be restricted to the collection of water. It is difficult for the park authorities to monitor and control such activities given their limited resources. Attention focused on methods of supplying water to local communities from the permanent water found in the forest. However appropriate environmental impact assessment must be made to evaluate the risks associated with the supply of water from the park, particularly in terms of the biological impacts to wetland flora and fauna.

Many revenue sharing water projects have been successfully completed, but to what human and conservation effect? Clearly many people benefit from such interventions and generally communities appreciate them (Sabuhoro 2006) however the impacts on conservation are unclear. Anti-poaching data from the national park show that in recent years there may have been little or no change in the incidence of illegal activities, including water illegal collection, in the park despite a corresponding increase in community conservation programs (Sabuhoro 2006). Many of the poorest households live close to the park boundary, whilst the wealthier households live close to or in the village centres. Usually community water infrastructure is commonly set up in village centres for logistical reasons i.e. the critical constraint being having a large enough roof of appropriate material as the rain water catchments, usually a public building. This means access to the infrastructure remains difficult for the poorest

people in the community, assuming they tend to live farthest from community centres. If access to developments in social infrastructure is no better for marginal groups who are high risk in terms of illegal use of protected area, then little impact on their behaviour towards protected area can be expected.

2.4.3 Direct Payments for conservation

(Ferraro & Kiss 2002) advocate more direct approaches to conservation. The failures to deliver either lasting local welfare benefits or conservation of the focal resources of traditional ICDPs have been well documented in the past decades (Gihimire & Pimbert 1997; Hulme & Murphee 2001b). ICDP approaches have been ignominiously termed 'conservation through distraction' (Ferraro & Simpson 2002) , this term captures the challenge of making rural people substitute one from of activity for another. The reality is that *ceteris paribus* new sources of income are more likely to be added to the suite of livelihoods options rather than substituted for old ones (Ferraro 2001). Ferraro and Kiss (2002) discuss the relative benefits of more direct approaches to conservation though direct payments for conservation, in a similar vein to payments for ecosystem services.

PES approaches incorporate both private property concepts and direct payments to households to encourage environmentally and socially desirable behaviour, e.g. forest conservation in upland areas to protect watersheds. PES approaches have been trialled in various countries, notably Costa Rica, where the government pays local residents $35 per ha annually to conserve natural forest on private land for water shed protection (Oritz & Kellenberg 2002). Generally PES approaches also generate biodiversity benefits as a side effect, yet few schemes have been applied directly as an instrument to explicitly conserve biodiversity (Ferraro & Kiss 2002)[9].

[9] Ferraro and Kiss (2002) do not classify biodiversity conservation as an ecosystem service in this paper, i.e. watershed management, carbon sequestration, but more of a separate benefit in its own right.

For clarity, PES approaches applied to biodiversity conservation we will call a payment for conservation scheme (PCS). PCS pass the first hurdle of at least observing a basic rule of economic policy; there must be at least as many instruments specifically designed to meet an objective as there are objectives (Coleman & Young 1990). Invariably ICDP are focused on directly improving human welfare on the assumption that improving living standards also translate in to improving sustainability in resource use and therefore puts less pressure on protected areas. ICDP require complex organisational and institutional infrastructure; Ferraro (2001) indicates that a PCS need not be as institutionally complex as an ICDP, but if the local institutional environment is able to support an ICDP then it can support a PCS.

(Conrad & Ferraro 2001) state that overhead costs in direct payment approaches are the same or less than ICDP overheads, and that in any case PCS could be much more efficient. A case study in Madagascar (Conrad & Ferraro 2001) demonstrated that of the then $4 million available for conservation annually were invested in PCS, about 80% of Madagascar's existing forests could have been protected compared to the actual 12% that was being conserved. Rural residents could have received financial payments two times higher than the benefits generated through traditional ICDP income generating projects. Again, this is a fundamental principle of economic policy - the most cost effective way of getting what you want is paying for what you want (Coleman & Young 1990).

The issue of the transaction costs of implementing PCS versus ICDP is an interesting one and presents several institutional and enforcement challenges. Most PES schemes have been focused towards forest stands on private land. Thus an area-based payment can be made to a person with a defined property right over an easily verifiable level of provision of an environmental resource (a stand of trees). The first challenge for delivering a PCS to individuals in a community is defining the community/beneficiaries for the scheme; secondly, the property right for the community over a defined sector of the protected area; thirdly, the

level and distribution of payments; fourthly, the establishment of monitoring indicators and the desired level of biodiversity in the protected area.

From a conservation perspective the fourth aspect is technically challenging to implement. A great deal of biological information will be needed to evaluate the targets to be achieved and the minimum tolerances/threshold levels of biodiversity against which payments are to be made. Floral diversity is relatively static and easily measured, however the faunal diversity and density is more difficult to measure and typical estimates of mammal density and distributions have high margins of error (Fawcett 2008). Monitoring fauna from year to year will inevitably require high levels of increase or decline before change will be detected in a statistically significant manner. Linking payments to target levels of illegal activity detected in the protected area is another method of monitoring conservation impacts, e.g. numbers of snares retrieved from the protected area or numbers of poachers arrested. Measuring anti-poaching and enforcement effectiveness is challenging due to fluctuations in level of effort and efficiency. Standardising measures and targets may prove to be difficult. Measuring flora as a proxy for faunal diversity is inadequate, as examples from central Africa have shown that large stands of seemingly pristine tropical forest are completely defaunated of mammals (Huijbregts et al. 2003). This means the financial cost of monitoring may be much greater than at first anticipated and certainly a good deal more technically challenging.

Payments from PES/PCS schemes can be made directly to rural households and are a means of delivering defined welfare benefits under the direct control of households, a critical bottleneck in ICDP approaches. It improves cash flows to peasant farmers which aids integration into the formal economy. It provides a fungible source of wealth, improving their ability to diversify their livelihoods options and to make their own decisions about best courses of action. It also helps to manage expectations and avoid local disappointment when either income generating projects or jobs in communities fail to materialise. Once again,

financial and economic analysis is essential in determining what level of payments should be made, to whom and on what basis. We cannot assume that all protected area adjacent households have similar social values or opportunity costs towards the protected area. Economic analysis has shown that higher income households showed a higher level of direct use and thus have thus have a higher opportunity costs than lower income households. Conversely higher income households also may be less dependant on protected area resources, and thus have lower social values attached to them (chapters 3 and 4). This leaves a difficult question of which amount to compensate, the social a value or the opportunity cost value.

Novel research by Groom and Palmer (2008) on the cost-effectiveness of direct payment approaches contests the findings of Ferraro and Simpson (2002) that they are in fact a superior alternative to indirect approaches e.g. ICDP. Groom and Palmer (2008) argue that the Ferraro and Simpson (2002) conditions of perfect elasticity in supply or demand enabling agents to purchase profit maximizing quantities of inputs at prevailing market prices is unrealistic. They propose instead that inputs and outputs may in fact subject to quantity constraints or rationing, concluding that direct payments are not necessarily more cost effective then indirect payments and that there are instances where parties involved prefer indirect payment mechanisms e.g. development project approaches. Thus we see that in the choice of the most cost effective approach understanding the context is essential. This seems like a realistic proposition in the context of forest dependant households, in imperfect markets with low substitutability of money for alternatives to forest products; direct payments in practice may not in fact result in the optimal conservation and welfare outcome.

2.5 Conclusion; lessons from the economic and social theory

2.5.1 Local to global interdependency

Changes in forest cover or biodiversity loss from the action of local households has an impact on the global climate. The span of impact between policy levels is a clear example of interdependency as was noted earlier and requires governance responses at all levels simultaneously. In addition environmental externalities such as forest and biodiversity conservation often have functional ties to other issues such as climate change at a local and international level. The governance solutions mooted in the Convention on Biological Diversity are justified in that although overlap exists as the achievement of both goals requires a range of direct interventions some of which will not achieve the goals of the other.

Understanding the economic flow of benefits between the different policy levels and between actors will also help us to understand the source and nature of externalities and may be instrumental in planning for their mitigation. Becker and Ostrom (1995) stipulate the existence of several conditions for joint management of resources between government and communities to result in the sustainable use of environmental resources.[10] Unless these conditions are present, externalities will still be manifest resulting in the unsustainable use of the resource. The failure of community management programmes can usually be attributed to the externalities caused by the failure of one or more of these conditions. Other reasons for the

[10]Conditions for sustainable resource use.

- Accurate information on the resource condition and expected flow of benefits are available and at low cost.
- Participants are relatively homogeneous in regard to asset structure, information and preferences.
- Participants share a common understanding of potential benefits and risks associated with the continuance of the status quo in contrast to the changes that they could feasibly adopt.
- Participants share generalised norms of reciprocity and trust that can be used as initial social capital.
- The group using the resource is relatively small and stable
- Participants do not discount the future at a high rate.
- Participants have the authority to make their own operational rules, which if made legitimately, will be supported and potentially enforced by external authorities.
- participants use collective choice rules that fall between the extremes of unanimity or control by a few (or bare minority), and thus they avoid high transaction or deprivation costs
- Participants can develop relatively accurate and low cost monitoring and sanctioning arrangements.

(Becker and Ostrom, 1995)

shortcomings of community conservation projects revolve around a tendency for projects to be too short term and over reliant on expatriate expertise (Becker & Ostrom 1995; Western et al. 1994) and a tendency for beneficiaries to be treated as passive recipients of project activities with no sense of ownership (Pimbert & Pretty 1995).

2.5.2 Direct and indirect conservation payment approaches

Problems with ICDP may arise from the lack of clear specification of aims and objectives and as a result they have a mixed history of success. If the aim of a project is to conserve a resource by community action what does this really imply, conservation of biodiversity or sustainable use of the resource? The activities that would be carried out under the two regimes would be very different. Community based tasks for biodiversity conservation may be protection/patrolling or tourism based, so as to be minimally invasive to the site. Under sustainable use this may imply agricultural development, forestry activities or hunting, which may do little to directly conserve biodiversity despite efforts to minimise their environmental impacts.

Despite the primacy of targeting biodiversity conservation action at the household level (Larson, 1994) the previously discussed theory broadens the perspective of community based management of environmental resources, establishing that it is not only at the local level that appropriate forms of external intervention may be targeted. It can be seen that both macro and micro level institutions can affect social actors. Thus the project focus of community based natural resource management though community conservation or ICDP programs cannot be generalised, more effective forms of intervention at the national policy level must also be looked in to (Reed, 2004).

Farrington and Boyd (1997) state that the implementation of improved natural resource management and its closer integration with agricultural improvement is not easy to implement

on any scale larger than a few villages. Thus to go beyond community level action will have to be based on multi-agency partnerships. Importantly at the international/global level, to correct for externalities, nations must adequately value their environmental resources. The challenge for conservationists is not just to rectify the past problems of protected area management and ICDP to achieve conservation goals, but to define the institutions and shape human behaviour towards biodiversity of which people are a part. Unless the stocks and flows of benefits at different policy levels are well understood the magnitude of externalities cannot be effectively factored into financing global initiatives and planning local level actions to mitigate them.

Chapter 3.0:

Measuring the financial value of protected areas to local people; a case study of four protected areas in Uganda

3.1 Introduction

It is being increasingly recognized that greater consideration must be given to community involvement in resource management. Traditional techniques of protected areas management, sometimes referred to as the "fences and fines" approach, are sometimes viewed as having failed in their goals of preserving biological diversity in the tropics by some proponents (Barrett & Arcese 1995; Johannesen 2005). The importance of involving communities in achieving positive results in wildlife conservation and management has also been widely acknowledged (Andrade 2003; Berkes 2004; Johannesen 2004; Leach et al. 1997; Leach et al. 1999; Naughton-Treves & Sanderson 1995; Noss 1997), although more recently the ways communities are being involved have come into question (Berkes 2004; McShane & Wells 2004).

However, despite the recognition of this role that communities play in the use of forests, the practical implementation of community based conservation, integrated conservation and development projects or community based natural resource management initiatives have frequently fallen short of expectations (Barrett & Arcese 1995; Berkes 2004; Chapin 2004; Hackel 1999; Johannesen 2005; Leach et al. 1999; McShane & Wells 2004; Newmark & Hough 2000; Noss 1997; Salafsky & Margoluis 1999). One of the main reasons for this failure in project design has been the misidentification of the main social and economic parameters that drive local people to continue to 'illegally' use protected areas. There is thus a pressing need for quantitative information on the socio-economic value of protected areas to local communities, upon which to develop practical solutions to mitigate the conservation and development conflict that protected area managers are faced with.

This study applies a market price method to elicit quantitative economic data on the magnitude of forest income and understand the socio-economic determinants of household forest use. In addition the chapter gives insight into the distribution of forest income and consumption amongst different household income groups. Whilst several market price method studies have been carried out globally (Cavendish 1999a, 1999b; Godoy et al. 1995), the weight of evidence indicates that the issues determining use of forest resources in protected areas are often site specific (Vedeld et al. 2004), meaning it can be difficult to draw generalised conclusions about management practices from individual site case studies. This study draws on case studies from four different protected area sites of different bio types and represents not only a unique set of data in the context of protected area and forest management in Uganda, but an opportunity to draw generalised conclusions based on common factors or trends identified between sites of varied context, utilising data gathered in a systematic and directly comparable manner.

Key findings in this study were that protected areas contribute substantially to local living standards suggesting that if strict non use policies were enforced, local poverty would be significantly exacerbated. The value of benefits from the protected areas varied greatly with living standards. Worryingly, as living standards improved so did the value of harvested protected area products. This undermines the basic assumption of many community conservation and integrated conservation and development programs that improving living standards will also reduce the unsustainable or illegal use of protected areas by local households.

3.2 Methodological issues in household income and market price surveys

Arguably the market price method is the theoretically simplest of valuation methods, relying on market prices for a range of goods or services to be identified and valued. Many goods and services from tropical forests and other protected areas uses are traded, either in local markets or internationally, including wood products (timber, pulp and fuel), non-wood forest products (food, medicine and utensils), crops and livestock products, wildlife (meat and fish) and recreation. For those products that are commercially traded, market prices can be used to construct financial accounts to compare the costs and benefits of alternative protected area use options. Prices reflect the interaction of consumers and producers over the demand and supply of goods and services. In an "efficient" market, goods and services will be priced at their marginal value product and reflect the full opportunity costs of resource use.

3.2.1 Which price to choose?

For many NTFP, researchers are able to record prices in local or more distant markets. Despite questions regarding their efficiency, there is often little choice but to rely on actual market prices. When using market prices for the purpose of financial valuation it is important to determine the *appropriate* market price for the goods and services of interest. There may be a variety of ways to obtain the relevant market prices, including existing secondary data e.g. economic and social studies, published or privately held statistics, socio-economic surveys, or through consultation with key informants such as agricultural extension officers, forestry service personnel, government market specialists and statisticians. In many cases it will be necessary to carry out new market surveys to collect the prices of minor NTFP, which may be traded on a small scale or occasionally, and which are typically neglected by official economic statistics. It may also be necessary to take account of seasonal variations in demand or supply that lead to fluctuations in market prices. For those products that are not traded, traded infrequently, or bartered, respondents can be probed to understand what their exchange value would be. For example a unit of the non traded good (A) could be compared to a unit of

another good commonly traded of similar utility (B) and the respondent asked how many units of B they would be willing to accept for a unit of A. As the price of a unit of good B is known a quasi market price for good A can be established. Alternatively in a large sample information may be available from another respondent on prices received for good A to impute a price.

Using information derived from such sources it is possible to derive prices that reflect the prevailing market value of the goods and services of specific forest land uses. The farm gate price is the price without any transport, processing or marketing costs included. Domestic market prices will reflect any transport and marketing costs involved in getting the product to the local market and may also reflect the costs of processing the product before it reaches the market. Similarly, the border prices of traded goods will reflect additional transport, marketing and processing costs, and is given by the free-on-board price for exports and the (cost-insurance-freight) price for imports. The choice of which price to use in the analysis depends on whether the good is traded or non-traded, the level and type of analysis and the extent of activities included within the project (Bishop 2003; Crookes et al. 2005; Dixon et al. 1994; Gittinger 1984; Sander 2004)

As this study deals with rural, households in a subsistence mode of production, local market/farm gate prices were used. There was little record of cash crop production, mainly staple foods (maize, bananas, beans etc.), fruit and vegetables and occasionally livestock. Transport of goods to market for sale is mainly conducted by the individual using the foot or bicycle transport. This means that the cost of transport equates to the opportunity cost of own labour, which as discussed later in this chapter (section 3.3.4) is assumed to be very low or possibly zero. Thus local market prices closely approximate the farm gate prices.

3.2.2 The quality of survey data

Gathering detailed household accounting data is a challenging task which can be subject to many sources of error. Good data collection relies on well prepared survey tools and thorough training of enumerators. Typically the principal source of error is that of poor respondent recall. In contrast to agricultural products which are harvested at certain ties of the year, to which respondent might have a clear memory of the yield and prices; products from PA such as NTFP are often collected continuously throughout the year in variable quantities. Also, unusual climatic occurrences such as drought or too much rain can affect household production and consumption levels. Thus point estimates may be biased if they are extrapolated over an annual period. In general the shorter the recall period is, the more accurate and precise the reporting of income and consumption. Vedeld et al (2004) recommend that it is best practice to make visits once a quarter to a panel of households to build an accurate picture of income and consumption patterns. Whilst repeated visits are technically desirable, panel data collection is often prohibitively expensive and time consuming, constraints that are applicable to this study.

Another source of inaccuracy can come from inconsistent measurement units. Quantities of good harvested from PA are often assessed in units such as headloads, pieces, tins, buckets, and sacs which are obviously imprecise and not standardised. This creates problems for the enumerators in data collection and the analyst in estimation of values, especially where collected units are different from units of sale. One means of resolving this issue relies on enumerator's ingenuity in converting the volume or mass of a non standard unit in to a standardized one e.g. weighing the mass of product in a local tin or sac to estimate kg.

Unfortunately enumerator bias can also cause significant error in the data. A key source of enumerator bias can be by the use of questions that lead to a particular answer e.g. questions are phrased to elicit a certain type of response. To control for enumerator bias, the survey

questionnaire was rigorously screened for leading questions, in order to make the language as neutral as possible. In addition enumerators went through a training program to clearly explain and test how they went about administering the survey. Respondent bias is more difficult to control for. Either a respondent may wish to conceal information e.g. cautiousness about revealing illegal activities, or for income tax purposes, or to misinform in the expectation of being able to receive benefits from rural development projects.

To further control for bias a clear explanation of the purpose and objective of the survey must be delivered to each household before the interview. In addition discrete observations by enumerators of each household's situation on approaching the home can help to provide objectivity on the results of a household interview. If enumerators clearly see discrepancies between what was reported and what could be observed then polite but probing questions can be made to elicit a realistic response e.g. if hunting apparatus is evident in the home and the respondent did not acknowledge hunting in the forest, the enumerator can politely ask who the hunting equipment actually belongs to.

More difficult to control for is respondent strategic bias e.g. deliberately giving misleading answers in the hope of some beneficial outcome for the household or community. For example if a new development or poverty alleviation project is expected to come to the area, community members may underreport their income levels in order to create a picture far worse than reality to ensure that project activities come to their region and not a neighbouring one.

3.3 Estimating the local financial direct use values of protected areas in Uganda

The objectives of the household survey described below are to quantify the contribution of forest products to living standards and qualify the role of forest products in living standards security and in the reduction of household vulnerability and to assess the contribution of quantitative and qualitative social and economic factors as drivers of forest use. Drawing from the ICDP literature the key hypothesis to be tested is that increasing livings standards reduces use of protected areas. With a more detailed understanding of site specific issues over a range of sites it may be possible to draw some generalised conclusions about best practices to reduce unsustainable and illegal use of forest protected area resources.

The terminology used to describe the interactions between people and forests can sometimes be confusing, arising from the integration of sometimes overlapping theoretical and conceptual approaches from rural sociology and economics. It is important for a clear understanding what is meant by the four key terms often referred to in this chapter, namely livelihoods, living standards, forest use and dependency.

A livelihood comprises the capabilities, assets (physical and social resources) and activities required for a means of living (Chambers & Conway 1992). The term 'livelihood' in the context of rural development in less developed countries was further developed conceptually during the 1990's and is interwoven with concepts of sustainability in the development of the sustainable livelihood s framework (Ashley & Carney 1999). The framework describes not only the resource base for a household (stocks of capital assets and flows of benefits), but also the institutional, organisational and environmental context in which they are found and the inter linkages and feedback loops influencing the choices they make and strategies for survival.

Living standards is a technical terms focusing on the measurement of the level of household economic welfare, which is typically a measure of per capita household real income or consumption in a given time period e.g. per year (Deaton 1998). Income is clearly an important part of a household's livelihood and their measurement provides us with a means of estimating current living standards, tracking change over time and assessing the relative contribution of different resources to household income. This can also allow us to assess the impacts of changes in policy, institutional and organisational processes on different sections of society. Living standards then refer to the measurement of certain factors and functions, but are not a comprehensive measure, of a livelihood.

In this chapter we will also discuss forest use and dependency issues. Forest use is a measure of household income from forest goods as a component of living standards. Forest dependency is a relative assessment of how loss of the forest income might affect household living standards due to the lack of alternative income generating or livelihood strategies (Masozera & Alvalapati 2004). Whilst there is currently no universally accepted definition of 'dependence', in this context the notion of 'separability' from the development economics literature is useful in understanding what is meant (Ellis 1998; Kay et al. 2000). 'Separability' is when a households production and consumption decisions are discretely divisible (Singh et al. 1985; Vakis et al. 2004). This implies that production decisions are first seen through to their conclusion and the income is then independently committed to consumption decisions.

For peasant farming households only partially integrated into the market economy, consumption and production decisions are often non-separable e.g. when the production decision are driven by the immediate consumption needs in subsistence agricultural production. Non-separability also relates to the concept of 'bounded rationality' (Ellis 1993) that conspire to keep peasant households livelihoods strategies constrained within a known set

of actions or responses to maintain their living standards (information asymmetries). This occurs when the household faces contextual constraints such as institutional or market failure resulting in the perceived misallocation of resource. Such constraints create externalities such as unsustainable resource use which might also result in the creation of poverty traps. Thus dependence is characterised by the inability of rural households to adopt novel strategies to change their behaviour towards the national park without incurring a loss to their living standards.

3.3.1 Market price studies on the direct use of protected area goods

The market price method and the collection of household economic survey data is hardly a new phenomenon. For example Deaton (1997) illustrates that the National Sample Survey Organization of India has been collecting such data regularly since the 1940's, as indeed have many other countries. Household surveys provide a rich source of economic data on economic behaviour (Campbell & Luckert 2002; Deaton 1998) but it is only relatively recently that the methods have been applied to specifically examine the links between poverty and the use and management of environmental resources such as protected areas and natural forests (Campbell & Luckert 2002; Godoy et al. 1995; Sander 2004; Vedeld et al. 2004).

The market price method has been applied in many situations to value the direct use of forests by households living near them. Early studies such as Peters et al. (1989) analysed alternative forest uses in Mishana, Rio Nanay, Peru. They compared the financial benefits of maximum sustainable extraction of wild fruits and latex to the potential returns from forest conversion for timber. Similarly Godoy and Feaw (1989) presents a financial and economic CBA of smallholder rattan cultivation in Kalimantan, Indonesia, showing that economic returns to rattan production are less than financial (market) returns and also discuss per hectare returns to rattan compared with rubber, rice and seasonal tropical fruit. Campbell et al (1997) also value the local level benefits from savannah woodland in Zimbabwe.

Other studies have used the approach to evaluate the contribution of forests products in general to living standards through subsistence and commercial uses. Godoy et al (2002a) examined local financial benefits from the market price method to evaluate the contribution of NTFP to local living standards and poverty alleviation and Shackelton et al (1999; 2002) assessed the use patterns and values of savannah resources in rural South Africa. Other studies have taken a narrower perspective targeting a few specific forest products such as mushrooms (van Dijik et al. 2003) or medicinal plants (Balick & Mendelshon 1992; Brown 1992).

Moving on from these important descriptive studies of how much local people use these resources are studies that also examine relationships between the levels of forest use and other social and economic factors to understand dependency. Cavendish (1999a, 1999b) examines the importance of the way in which multifarious environmental goods interact with the household's other production and consumption decisions to characterize poverty-environment relationships in Zimbabwe. The study demonstrates that both environmental demands and environmental supplies are affected by a number of different factors, concluding that simplistic conceptions of the link between rural households and the environment will be quite wrong. Godoy et al (1995) investigated income effects on extraction of forest products as determinants of forest use as did (Masozera & Alvalapati 2004) in Rwanda. Sander (2004) conducted a thorough and comprehensive study of forest values and dependency in Madagascar. The key message from these studies is that understanding the dependency issue is critical in designing effective community conservation programs.

Vedeld at al (2004) also make a profound contribution to our knowledge in a meta analysis of several studies based on market price method data, highlighting the poverty environment relationship and determinants of use of environmental resources. Interestingly they illustrate the variability of environmental incomes between income groups, as well as demonstrating

great variability in use between sites. This highlights the site specific, uniqueness and complexity of such relationships. This is a significant indication that market price method studies, whilst very useful in understating local level issues related to forest use are, limited in terms of being able to make generalized conclusions regarding what management approaches might actually work in other contexts. In addition, few of these studies have gone further to understand how forest use compares to other land use options. A critical issue in consideration in the local or national conservation versus conversion might be an assessment of the opportunity cost of land use options, whilst not the principal focus of this chapter such an analysis is undertaken in chapter 6 of this thesis. Thus the key objectives of this chapter are to:

- Gather quantitative economic data on household consumption of timber and non-timber forest products
- Assess the contribution of protected area goods to general living standards.
- Qualify the role of forest products in livelihoods security and in the reduction of household vulnerability
- Apply the findings to protected area management strategies

3.3.2 Survey Sites

Four forest sites were surveyed, representing the four predominant forest types in Uganda described in the Table 3.1 below. Understanding the values associated with different forest types can assist in developing more accurate estimate about the value of Uganda's forests to the economy. From recent forest biomass studies conducted by the Forest Department (Drichi 2003), an accurate estimate of the area under each forest type was available.

Table 3.1. Sites and description of survey areas

Forest Site	Classification	Area (ha)	Status
Budongo	Medium Altitude THF	79,300[a]	Forest Reserve[11]
South of Bugoma	THF on private land	128,804[b]	Private Forest
Kasagala	Savannah Woodland	10,105	Forest Reserve
Rwenzori	Afromontane Forest	97,380	National Park[12]

[a] *Total area of Central Forest Reserve (CFR) but only 42,800ha is THF*

[b] *Area of THF in surrounding forest – not the area of Bugoma CFR itself*

THF=Tropical High Forest

The target population was all forest users in a focal area. We also assumed that beyond a certain distance from the forest in question households were unlikely to use it directly: for the purposes of this study we sampled within parishes (LCII) that bordered the forest. Normally the furthest most point of a parish boundary was not more than 5km from the edge of the forest, thus this made a convenient boundary for the sample frame.

3.3.3 Survey Design

A structured household interview was used for eliciting socio-economic data on local forest values in this study. The survey was administered according to a multi-stage stratified random sample over a range of forest and household types in Uganda. The sample was organized into lists of parishes that directly bordered the case study forests, subdivided into villages within the parish, households within the village and households by wealth group.

A structured survey questionnaire (Appendix 1) was developed to obtain quantitative and qualitative data on the above-mentioned issues. This relied on people's own perceptions and reported values about household wealth and net income in their local context. Data were collected from November 2003 to January 2004. Financial information was collected in

[11] A **forest reserve** is a protected area designation for the management forests, usually with strict use limitations such as controlled extraction of commercial trees. The land must be managed as a stand of forest e.g. cannot be converted to agricultural land, forest reserves are controlled by the Ugandan, National Forest Authority.

[12] A **national park** is a protected area designation primarily focused on wildlife and biodiversity conservation with strict normally non-extractive use policy, large expanses of forest and woodland are found within the network of Uganda's national parks. National parks are under the control of the Uganda Wildlife Authority.

Ugandan shillings, but is presented here in United States Dollar equivalents for ease of reference based on an exchange rate of 1800 Ugandan Shillings to the US Dollar.

Draft questionnaires were prepared in advance of an enumerator-training workshop. The method, background theory and questionnaires to be employed were reviewed with enumerators. Some role-playing exercises were used to familiarize the enumerators with the survey tools. A pre test was made on volunteers from the local rural community around the workshop site, to further test for problems with language and comprehension. This resulted in a questionnaire survey ready for further pre-testing. Further extensive pre-testing took place at Budongo Forest, Masindi District. This allowed enumerators to acquire additional familiarity with the survey tools as well as the chance to apply and review the method. As a result, additional changes were incorporated into the survey questionnaire. These addressed issues to do with enumerator ambiguity or poor comprehension of the questions and to address issues to do with respondent comprehension of questions.

The data collected included household demography, capital assets, qualitative data about seasonal household needs and coping strategies and detailed household income and expenditure information. Whilst a participatory wealth ranking approach was used to identify the community wealth strata for the sample survey, due to time and resource constraints it was not possible to utilize participatory methods to define other qualitative issues to do with forest use and socio-economic conditions. Such techniques could have enabled the study to provide richer data on access and resource use, but given the financial constraints and the focus on quantitative household income data we decided not to attempt such enquiries at the time. Respondents were asked to provide price information about goods in the survey, as in general all the goods reported were traded in the locality, market prices could be established.

Once communities were selected, usually a visit was made in advance to alert the relevant authorities to the survey team's arrival and to describe the process. Thus community members were alerted in advance to the possibility of being interviewed. On the day of the survey the team would arrive early in the morning or the evening before. After the wealth ranking exercise was conducted with the village elders, enumerators would then take a local guide to go in search of the randomly selected households. Household interviews were conducted with whoever was present or able to be interviewed in the home at the time (usually the household head or number two with other members present). If an interview was not possible an arrangement was made to return at a more suitable time, or failing that another household was selected at random from the list. Each household was given a gift of soap or tea (value not more than $1US) to thank them for their participation. Importantly respondents were ensured complete anonymity and no data that could identify the household was collected (names, exact locations etc.).

In order to minimize strategic bias a concise briefing of the survey objectives was delivered to each respondent. In our case it was clear that this was policy level research, not directly related to any local level intervention. In general therefore we feel that the data under estimates household income and consumption, because of recall problems, but it is difficult to know by how much. However we feel that any underestimation is probably evenly spread across all the household income data collected, therefore there will be little effect on the trends and patterns observed. Fortunately the seasons prior and during our data collection were not considered unusual. The data collection period corresponded with the end of the short rainy season and the beginning of the short dry season which continues until February/March. This corresponds to a period when food is relatively abundant, but the advent of Christmas and New Year holidays and festivities may put additional burdens on household's incomes. The relative abundance of food may put a downward bias on the use of PA resources, with an upward bias for a short period around the middle of December to mid

January. The two effects may have the effect of cancelling one another out therefore results should be fairly representative of the true picture.

3.3.4 Analyses

A useful approach to the analysis of how forests contribute to living standards is through the analysis of the relative importance of forests to different income groups. This focus is useful in understanding issues of managing forests requires us to understand whether access to forest resources is disproportionately important to living standards amongst poorer households.

Wealth groups were identified as a means of stratifying the community level sample. In each community in a participatory wealth ranking exercise[13] was conducted with community leaders. The wealth ranking exercise involved a discussion of wealth issues and the local indicators of wealth and the establishment of a set of indicators for three wealth categories (poor, average and wealthy). The elders were then asked to distribute households amongst the wealth categories. Within a village and within wealth groups we made selections by using a random number table, in order to select 12 parishes (Local Council II or LCII), then 1 village (LCI) from each parish and subsequently five households from the three categories of wealth group.

Wealth is a composite measure of a households physical resources, it encompasses income, savings, land, livestock, and other capital assets such as bicycles, radios, cars, farm equipment and other means of production. It is a relative concept as what constitutes a wealthy household in one community may be different in another. At the level of a village or perhaps even a parish it provides a useful assessment for stratifying a sample, but is limited in

[13] Wealth ranking is a tool to identify different wealth strata of a community f or the purposes of sampling. Key informants such as the village leaders and women's groups' representatives were convened to brainstorm about local perceptions of wealth. They were then asked to discuss a typical example of the spectrum of wealth groups found in their community to identify their assets and resources i.e type of dwelling, number so livestock of different types etc. size of land holding. Using the list of households available in each village from the local government representatives, key informant were then asked to allocate all of the households under one of the wealth categories. This formed the stratified sample list at the village level from which households were chosen at random.

terms of quantitative analysis were an absolute measure that can be used to compare between households is needed.

In this study in the final analysis households are disaggregated according to income quartiles. However it is difficult to identify income groups initially from within the villages, even with the use of key informants hence the need for the wealth ranking exercise described earlier. Once the household income data was obtained comparisons on the basis of income groups (income quartiles) was possible. The measure of income used in this study comprises goods sold, the prevailing market value of own-produced goods consumed in the home, monetary, non-monetary transfers into the household account, and income from wage labour in cash or the value of goods in kind. The measure of income used in this study is net of input costs, although little or no use of agricultural inputs (variable costs) or wage labour was evident. Where inputs in to the agricultural, livestock or other enterprises were recorded these were deducted from the total income for that activity or groups of activities. As a stratified random sample of households around each site was used, representative of all the probable users of the forest resource, no special treatment of one off or infrequent use of forest resources was required, on the assumption that the sample would be representative of the overall annual similar uses of forest goods by the population thus no particular bias would be introduced as a result.

In this study following (Ellis 1993) own labour in the peasant farming system is assumed to have a zero value, this is because the opportunity cost of labour in general is either zero or extremely low. The seasonal nature of farm work in a peasant farming system shows that there are work peaks and troughs. During planting, or harvesting periods the opportunity cost of labour can be very high as household labour resources are stretched to capacity to complete activities within a limited period of time (Upton 1987). At other times of year there may be a surplus of labour. With a finite amount of household labour resources the only option to

increase the labour requirements would be to hire workers. However given that on a regional scale every other peasant farming household will also be facing the same acute labour constraint, little labour is available even if the means to pay for it were obtainable. Thus there is little scope to vary farm labour requirements according to work needs. The result is that the marginal product of labour varies from season to season where an extra unit of labour in the seasonal work peaks would tiled a high return in terms of total yield and nothing in the seasonal troughs. Thus there is no single meaningful value for the marginal product or opportunity cost of household labour (Byerlee et al. 1976; Upton 1987).

A meta analysis of environmental incomes from forest resources, by Vedeld et al. (2004), show that 56% of studies in the analysis did not include labour costs whilst estimating forest environmental income. This implies an overestimation of the economic rent derived from it. However when they included labour costs and checked for any systematic differences between studies that included labour costs and those that did not, they found no significant differences in either absolute income or relative measures. This implies that the assumption that the opportunity cost of labour is low or zero as discussed previously is reasonable. However the Vedeld et al. (2004) did also indicate that the fact that labour costs were included in some studies might point toward a more rigorous effort in identifying and valuing all sources of income, thus estimates in such studies may have been higher, explaining the lack of significant difference between cases. At best then the marginal value of labour is very low, so the treatment of these costs as zero is rational in this case.

Income can also be a relative concept depending on unit of analysis. A household that earns a $1000 per annum and has 5 members has a higher income on a per capita basis than a household that earns a $1000 per annum and has 10 members. However, a larger household enjoys better economies of scale than smaller households with more labour available for different activities. In addition the composition of a household in terms of age and sex

structure affects levels of production and consumption of the household as a unit of analysis (Campbell & Luckert 2002; Deaton 1998) . In order to make valid comparisons in absolute terms across households an "adjusted net household income" was therefore used in this study, to reduce bias in inter-household comparisons of income. The weakness of this approach lies in a critique of the validity of the coefficients in different national settings as they are based on a study conducted in Sri Lanka (Campbell et al. 2002). However the biases created in the analysis by the use of such scaling will be considerably less than using either unadjusted figures or per capita income (Lanjouw & Ravallion 1995).

Adjusted net income was calculated by dividing the total net income by a factor comprised of two coefficients of adult equivalency and economy of scale (Table 3.2), to give an adjusted equivalent unit (AEU) derived from World Health Organization methodology reported in Campbell & Luckert, (2002). A household's AEU was calculated according to the following procedure. A coefficient of a standard adult equivalent unit is awarded to each household member. The sum of the coefficients gives a standardised measure of household size. Each household was scored on its number of occupants and given a coefficient of economy of scale. The absolute income (net value) is then divided by the AEU coefficients to give the income per AEU and the product then multiplied by the economy of scale coefficient (referred to as an *adjusted* value)[14]. This helps to account for biases otherwise introduced if comparisons are made on the basis of unadjusted income.

[14] Example AEU calculation: If a households had 3 members, an adult female age 19-59 and adult male aged 18-59 and an infant aged 3-4 years their combined value of their AEU would be 0.88+1.00+0.48=2.36 adult equivalents. If the household had $1000 total annual income then their income per AEU would be 1000/2.36=$423.73 per AEU. This value is then multiplied by the economy of scale co=efficient fro a houhold fo 3 people ($423.73*0.946) to give the AEU/ES value $400.

Table 3.2 Coefficients for adult equivalence and household economies for scale calculations (Adapted from Cambell and Luckert 2002)

Household economy scale	
Household Size	Economy of scale
1-2	1.000
3	0.946
4	0.897
5	0.851
6	0.807
7	0.778
8	0.757
9	0.741
10	0.729
10+	0.719

Adult equivalent scale		
Age	Male	Female
0-2		0.40
3-4		0.48
5-6		0.56
7-8		0.64
9-10		0.76
11-12	0.80	0.88
13-14	1.00	1.00
15-18	1.20	1.00
19-59	1.00	0.88
60+	0.88	0.72

Effectively the adjusted income value gives a figure that depicts household income on the basis of a standard adult unit. Therefore in the results section inter household comparisons of income and consumption are conducted using income quartiles based on the adjusted total income figures.

3.4 Results

A total of six hundred and ninety-six households were interviewed amongst the four survey sites in 70 LC1 (an LC1 is equivalent to a village and is an administrative unit used in Uganda). The number of LC1s sampled around each area varied slightly because of time constraints and access issues. It was especially problematic around the Rwenzori massif where communities were often extremely remote requiring a lengthy drive to a drop off point with the team continuing for several hours on foot to the LC1 centre. The number of households interviewed in each LC1 also varied slightly because of time and distance constraints, especially where households in an LC1 were diffuse over a wide area. Importantly the data set did not fit a normal distribution according to absolute and adjusted income measures, being skewed towards low income. Therefore, non-parametric tests are used in the results noted below.

3.4.1 What is the contribution of forests to household income?

As income data does not fit a normal distribution the *Kruskal-Wallace test* was used to analyze ranked sample means. Adjusted household income showed no significant differences between forests (Table 3). However mean total incomes were significantly different between Budongo and the Rwenzori, where the Rwenzori had the highest household income (X^2= 17.3, d.f. = 3, p = 0.001).

Table 3.3. Mean absolute and adjusted household income by forest site and mean % forest income as a share of total income.

Forest (n)	Absolute Mean Total Income (TI)	Absolute Mean Forest Income (FI)	Adjusted Mean Total Income (ATI)	Adjusted Mean Forest Income (AFI)	% Forest Income (Share of total income)
Budongo (154)	784	66	219	21	8.4
Bugoma (175)	1091	178	313	49	16.3
Kasagala (151)	953	101	294	39	17.0
Rwenzori (159)	1189	462	281	107	38.8
All (639)	1009	204	278	38	20.2

Households in the Rwenzori had significantly higher levels of absolute income from the forest as well as the proportion of income derived from the forest than all other sites (Chi Sq = 31.52 d.f.=3, p<0.01). Bearing in mind that comparisons of income between households should be made using the adjusted income figures, Households in Bugoma had significantly higher income than other sites (Chi Sq = 17.45, d.f. =3, p<0.01). Households around Budongo showed lowest forest incomes in absolute and proportional terms.

3.4.2 Do living standards affect who uses the forest?

A key assumption in ICDP is that it is the households with the lowest living standards are most likely to be highest users of forest resources and that improving living standards will in some way reduce use of forest resources in protected areas. An OLS regression was used to analyze the relationship between the dependant variable AFI (adjusted total annual forest income) and the independent variable ATI (adjusted total annual income). Locational

dummies were included to account for the influence of the 4 different sites on the results. AFI data were found to be heteroskedastic (White- χ^2=2701.98, d.f.=4, p<0.001) with the level of AFI varying markedly as ATI increased. Therefore a weighted least squares model was estimated using ATI (adjusted total income) as the weighting variable. The locational dummies showed no significant difference from the constant so were subsequently omitted from the model. That the data are heteroskedastic is probably a natural phenomenon. Importantly it is indicative of a level of choice between forest use at higher income levels and lack of choice or dependency at lower income levels.

From the weighted least squares estimate there was a significant relationship between ATI and AFI, showing that as ATI increases so AFI increases (R^2=0.180, t=11.821, p<0.01, β = 0.43) the slope of the relationship was close to unity, which means that for every unit change in ATI there is a corresponding unit change in AFI. The low R^2 value and high degree of scatter, shows that ATI may not be the clearest single determinant of which households use the forest. According to expectations in the literature it might be expected that AFI would decrease as ATI increased. This finding is an important result and shows that we cannot assume that the poorest (in income terms) households in a community are those most likely to be using forest resources. Thus by extension, improving living standards (ceteris paribus) will not reduce the level of consumption of forest products. This evidence also shows that without the current access that households have to forests, it is likely that many would become significantly poorer should there be no change in other aspects of their income.

3.4.3 How much is the forest used by local households?

It is also of interest to understand how the use of forest products is broken down between cash income and consumption (Table 3.4).

Table 3.4. Household income from forests separated into goods sold and goods consumed

Forest (n)	Mean value of goods sold US$ p.a.	Mean value goods consumed US$ p.a.	Mean income from the forest US$ p.a.	Value of goods consumed as % of mean forest income
Budongo (154)	21.74	44.19	65.93	67.0
Bugoma (175)	31.63	146.18	177.81	82.2
Kasagala (151)	45.71	55.69	101.40	54.9
Rwenzori (159)	85.19	318.76	403.95	78.9
All forests (639)	46.06	142.66	188.72	75.6

In absolute terms there was a significant difference (ANOVA – $F=4.2$, d.f. = 3, 634, $p<0.05$) between the mean values of forest goods sold between forests with Rwenzori and Kasagala showing the highest averages. In terms of the value of forest goods consumed in the household Rwenzori was significantly higher than all other forests surveyed (ANOVA – $F=18.9$, d.f. =3, 634, $p<0.05$).

When considering the value of forest goods consumed as a proportion of the total income from the forest, it can be seen that households in Kasagala consume proportionately less of the value of forest products in the home (ANOVA – $F=38.5$, d.f. = 3, 634, $p<0.05$). It may also illustrate that because Kasagala is savannah woodland, there is substantially less woody biomass generally, and less diversity of species, (wildlife, foods and craft materials) as compared with THF, which can be consumed in the household. Typically from savannah woodland, the most important product is charcoal and in the villages people sell it rather than use it, preferring to use firewood instead.

A break down of mean value of household income from non-timber forest products (NTFP) and timber products was also made (Table 3.5). NTFP in this study are any goods harvested

from the forest not comprised of woody biomass. Items such as wild fruits and vegetables, bushmeat and vegetation for artesian handicrafts are some examples of NTFP.

Table 3.5. Sources of forest revenue by type

Forest	Annual NTFP Income Value US$ p.a.	Annual Timber income Value US$ p.a.*	Timber value as a % of mean forest income
Budongo (154)	30.75	27.00	40.9
Bugoma (175)	65.12	109.45	61.6
Kasagala (151)	26.21	61.45	60.6
Rwenzori (159)	287.97	168.35	41.
All forests (639)	97.94	89.61	47.5

* Firewood and charcoal included under timber income

Analysis of the mean NTFP incomes showed that households in the Rwenzori had the highest income from the forest derived from NTFP compared with the other forests and this difference was significant (ANOVA – $F= 15.3$, d.f. = 3, 695, $p<0.05$ – Tukey HSD test). In terms of timber values, households around Rwenzori also derived the highest mean incomes, with Rwenzori being significantly different from other forests (ANOVA - $F= 8.741$, d.f. = 3, 695, $p<0.05$ – Tukey HSD test). It might have been expected that Budongo Forest, the main timber forest in Uganda, would have had high income values for local communities from timber, but the results show the lowest income values for this forest from timber. This may be due to a number of reasons such as good enforcement of regulations to halt illegal timber harvesting in the forest or reluctance to admit to illegal harvesting of timber given current law enforcement efforts. In addition, timber harvesting using hired labour (pit sawyers[15]) from outside the local area may bias reported timber values. Pit sawyers are often employed from outside the region because they work harder and then return to their home areas having completed the job. The local community is usually used as porters only. As such pit sawyers are transient members of local communities and income derived from this activity does not accrue locally and may not be accurately represented in the sample

[15] Pit sawyers are manual labourers cutting trees and sawing timbers by hand. The term comes from the method of hand sawing timbers from large sections of tree trunks. A wooden trestle is erected and a pit is dug below, whereupon the section of tree to be sawn into timbers is levered on to the trestle. Two men using a double handed long wood saw, one on top of the trunk and one below in the pit then manually saw lengths of timbers from a section of tree trunk.

Table 3.6 Value of forest product categories as a proportion of total income value of forest products consumed by survey site.

Forest	Non Wood Products [a] % of total value	Wood Products[b] % of total value	Bushmeat Total[c] % of total value	Large Wild Animals[d] % of total value	Small Wild Animals[e] % of total value
Budongo	12.07	69.81	18.12	8.81	9.30
Bugoma	33.19	60.28	6.53	0.98	5.55
Kasagala	10.75	82.08	7.17	1.46	5.71
Rwenzori	11.97	29.96	58.07	39.97	19.10

[a]NTFP not including wild animals and birds; [b]Timber, firewood, charcoal; [c]Wild animals and birds; [d]Duiker, small antelopes and smaller game such as rats, bush pigs ; [e]Elephant, buffalo and larger antelopes

Table 3.6 shows the share that the different categories of forest products have of the total value of forest products consumed. More of the total income value comes from NTFP than timber products. In the Rwenzori bushmeat contributes the largest proportion of the NTFP value and this may be because of the link to DRC where bush meat including primate meat is a popular food (Plumptre et al, 2004). Normally when wildlife is abundant, the large wild animals represent a higher gain per unit effort than smaller animals and are thus a preferred target for hunters. Interestingly in Budongo, Kasagala and Bugoma, the proportionate value of small wild animals consumed is higher than Rwwenzori. This could be an indicator that large wild animal densities in these sites may be low, resulting in lower catch rates or effort being switched to other prey that is easier to catch and is a supply side constraint rather than a demand constraint related to bushmeat consumption. I light of the earlier evidence presented that there was no significant difference between sites in the level of ATI determining AFI, supply constraint variations between sites of all other forest products this is probably not a general condition affecting AFI. Also anecdotal evidence from around the sites shows people have a preference for domestic (beef, goat and poultry) rather than game meat.

3.4.4 How is forest income distributed?

As noted above, the relationship between forest use and household wealth is important in understanding the links between forest conservation and rural development. The pooled

sample was divided into income quartiles based on the adjusted total income figures (Table 3.7). A Kruskal-Wallace test was used to define any significant difference between income groups.

Table 3.7 Income categories and proportionate shares by income group.

	Quartile (n=639) (S.E below in parenthasis)			
Income Variable	**1.Lowest 25%**	**2. 25 to 50%**	**3. 50 to 75 %**	**4. Top 25%**
Adjusted mean total income (ATI) (KW, Chi Sq=598.1, d.f. 3, p<0.01)	52 (18)	120 (23)	237 (45)	700 (500)
Adjusted mean forest income (AFI) (KW, Chi Sq=467.8, d.f. 3, p<0.01)	10 (12)	20 (22)	41 (53)	147 (257)
% Adjusted Forest Income (Share of total income) (KW, not significant)	18.8 (21.6)	16.1 (18.5)	17.1 (21.0)	22.0 (30.2)

ATI and AFI increased as we move from lowest to top quartile reiterating earlier findings from the weighted regression of AFI vs. ATI. In the case of proportion of total income from the forest the lowest and upper quartile are seen to derive 18.8 and 22 % of total income respectively from the forest; however there was no statistically significant difference between wealth groups.

In order to understand how wealth groups utilise their AFI an analysis of the mean and proportion of AFI consumed in the home was conducted (Table 3.8)

Table 3.8. AFI consumption by income group

Income Variable	**Quartile 1. Lowest 25%**	**2. 25 to 50%**	**3. 50 to 75 %**	**4. Top 25%**
Mean AFI consumed in the home($) (KW, Chi Sq=35.549, d.f. 3, p<0.01)	36 (51)	137 (301)	137 (249)	389 (301)
% of AFI consumed in the home (share of FI) (KW, Chi Sq=4.864, d.f. 3, not significant)	49.8 (47.9)	63.0 (44.7)	61.2 (44.7)	59.1 (44.1)

An ordinary linear regression of AFI against the proportion of AFI consumed in the home showed a positive but very weak relationship (R^2=0.008, d.f.=639, F=4.853, p<0.05). The forest income consumption results are surprising as it is often assumed that at low income levels forest income activities are for subsistence and at higher levels for cash; after all there are surely limits to how much firewood, NTFP etc can be consumed. These results clearly show in proportional terms that there is little difference regarding the importance of AFI

consumption between wealth groups, they are possibly symptomatic of the general level of poverty, in consumption terms, of the entire population living adjacent to the forest in all of the sites.

3.4.5 What determines forest income?

Following the earlier regression of AFI vs ATI to control for heteroskedacticity, a weighted least squares model was used to analyze the impacts of income and other social and economic and social variables on forest income (Deaton 1997; Woolridge 2002). The dependent variable AFI was tested against a number of other variables shown in Table 3.9 below. Variables were chosen that reflect what we considered to be the main socio-economic and spatial factors that might determine households use of the forest. The significant factors were ATI, value of capital assets (motorcycles, bicycles, radios etc) and value of livestock assets (cows, goats, poultry) (Table 3.9). The fit of the model was low, but significant.

Table 3.9 WLS analyses – determinants of net annual total forest income

Variable	β	t value	Significance
Constant	60.92	4.11	<0.001
Adjusted total income	$0.6 * 10^{-5}$	7.519	<0.001
Value of capital assets	$-0.19*10^{-4}$	-3.163	<0.01
Value of livestock assets	$-0.24*10^{-4}$	-3.119	<0.01
Distance from the forest	$-0.13*10^{-3}$	-0.001	Not significant

Model Summary, R^2=0.371, n=639, Likelihood ratio test –χ^2=64.94, d.f.=4, p<0.001

Distance from the Forest

Proximity to the forest was not a significant determinant of forest use. This result is perhaps not unusual as the sample population for the study was taken to be all probable forest users so it might be unlikely to expect high variance in forest use between households in the sample. However additional exploration of the data did show that ATI was significantly and positively related to distance from the forest[16], although the very low r^2 value showed a high degree of scatter. For some households at least being further from the forest improved the likelihood of having improved living standards.

[16] Weighted least squares - *β=0.42, t-value=1.98, p<0.05, R^2=0.006, Likelihood Ratio- χ^2=3.92, d.f.=1, p<0.001)*

Adjusted total income

As demonstrated earlier a significant positive relationship was shown between AFI and ATI. An interesting observation was that mean household occupants between income quartiles showed that high income quartiles had significantly higher numbers of total household occupants than low income households (ANOVA – $F=28.4$, d.f. = 2, 634, $p<0.05$ – Tukey HSD). Since the adjusted measures which effectively control for differences in household size it was not appropriate to include a variable for number of household occupants as this might cause unnecessary bias in the model e.g. auto correlation). This factor indicates that there is this additional labour in higher income households to exploit forest resources.

Value of livestock assets

Values of livestock assets were calculated using prevailing market prices. There was a significant negative relationship between the value of capital assets and AFI. A high livestock asset value is indicative of households being engaged in an alternative to forest based income generating activities. As such it is a useful indicator of dependence on forest resources. Higher household livestock asset values are also an indicator of wealth.

Value of capital assets

A measure of the value of capital assets such as fixed (bicycles, radios etc.) and livestock was made for each household. This was calculated by using the prevailing market price for the assets listed by each household and summing the values. There was a clear negative relationship between the value of capital assets and AFI. A high capital asset value is indicative of households being engaged in alternative income generating activities, such as agriculture and animal husbandry. As such it is a useful indicator of dependence on forest resources. Higher household capital asset values are also an indicator of wealth.

3.4.6 What is the seasonal importance of forest use?

The survey also investigated seasonal aspects regarding forest use. Respondents were asked questions about which months they used the forest most, which months they needed to purchase food, and which months they needed cash most. A positive correlation was found between the months when the forests were used most and the months in which food was most scarce (*Spearmann* $r=0.1$, $p<0.05$). In addition a positive correlation was found between the months when forests were used most and the months in which cash was most required (Spearmann $r=0.2$, $p<0.05$).

The months of most frequent forest use overall were December through to March, which not surprisingly correspond with the long dry season over much of Uganda and a period often termed in socio economic literature as the 'hungry gap', where harvests or food stocks have run out and it will be some time before the next harvest (Upton, 1987). The above correlations provide some evidence in aggregate that forests do play a role in reducing vulnerability and providing a buffer against seasonal shocks.

3.5 Discussion: Forests and Their Role in Living Standards

3.5.1 Income, wealth and forest use

Many households that live near forests benefit from their direct use. If rules governing access or use of the protected forests were effectively enforced, it is clear that an ‘income gap' would created, in terms of income and consumption, to maintain a households current level of welfare. As ATI increases so does AFI but interestingly there was no significant difference in the proportion of AFI consumed in the home between income groups. This means that meant that as AFI increases amongst income groups so the adjusted value of forest goods consumed per AEU also rises.

3.5.2 Household Labour and Forest Use

The survey showed that higher income households, as measured by the AEU, tended to have higher numbers of total occupants. Assuming no differences in fertility or investment costs of having children, we can extend this observation to conclude that higher income households will have a relatively higher level of household labour available than poorer households and are thus able to generate more income. It is possible to conclude this as differences of composition between households was taken into account by the use of an adjusted income measure to make inter-household comparisons.

This is an important consideration in the ability to exploit protected areas. There was a clear link between increased protected area use and higher numbers of household occupants. For relatively higher income, or larger, households it concludes that forests represent an opportunity for income generation, a stock of goods that allows the optimization of other resources. As such protected areas and unprotected environmental resources (such as forests) can be considered as key resource to help drive rural economic development as they assist rural households to generate cash and produce surpluses that improve household income. In the short term, assuming that such a socio-economic trend continues, richer and typically larger households may in fact be able to exploit the forests more. Indeed studies from other countries have shown that as wealth increases so does forest use (Vedeld et al 2004).

3.5.3 Role of Natural Forests in filling the "Hungry Gap"

A predominant feature of the effects of seasonal change on peasant households is the "hungry gap" which relates to a pre-harvest shortage of food. Upton (1987) identifies the hungry gap, as the period when food is scarce and energy requirements are high, there also tends to be a high incidence of disease, exacerbating the problems many families' face at this time. Cash stocks will also be lower and food prices higher. All of these factors occurring simultaneously reinforce the problem of the "hungry gap" for the peasant household. The survey results show

a clear link between seasonal stress on the household and forest use. Across all forests, households were more likely to use the forest at times of year when both cash and food stocks were low.

3.5.4 Forest benefits and the threat to forest conservation

What we have described is the '**benefit**' (albeit mainly illegal) of forest access, but similarly it also represents an '**opportunity cost'** to local living standards should there be effective enforcement of the regulations excluding or regulating use. Budongo, Kasagala and Rwenzori are all protected forests, whilst the area south of Bugoma was forest on private land. The protected forests currently have regulations excluding their use for extractive purposes. In addition the national laws of Uganda prohibit the hunting of any wildlife. Obviously such regulations are no impediment to local people's use of the forest. There exists a question of property rights regimes and enforcement, where the property right of the state is not enforced. Clearly local people use forests because they can (illegal or not) and that the opportunity cost and risk of detection is probably lower from using forests illegally over other forms of economic activity.

3.6 Implications for policy and practice

What does this mean in terms of forest policy and management? The enforcement of policies that exclude local people from using the forest therefore run the risk of contributing to rural poverty from reduced living standards and livelihoods insecurity. We saw in table 3.3 that overall the mean absolute forest income was $204 per household annually, ranging form $66 to $462 per household per annum between sites. This is the financial opportunity cost of conservation. Therefore exclusionary policies should account for the need to assist in generating alternative income or food security options.

The integrated conservation and development approach, which promotes local people into the sustainable management or promote diversionary activities of forests, have the potential to

contribute significantly to local communities' living standards and welfare, as well as conserving the forest resource (Andrade, 2003; Berkes, 2004). The design of such policies are context specific, their success being dependent on a number of factors such as the integrity and viability of the resource, the size and homogeneity of the population relative to the sustainable stream of benefits coming from it, well defined property or user rights and adequate protection and monitoring of the resource.

However from the survey data it was observed that that AFI increase with ATI. A large proportion of household AFI is also consumed within the home and this was also across income groups. Therefore we conclude that the planned for effects of integrated conservation and development activities in increasing household incomes or making households wealthier may only serve to increase forest exploitation under current access conditions. In terms of practice this study presents a challenge to the classic integrated conservation and development program assumption that welfare gains should reduce forest use through alternative income generation and substitution.

The impacts of broader economic growth at a local level, in the short term, could have serious negative effects on the integrity of forests and the environment generally. Clearly integrated conservation and development approaches must work closely with enforcement and protection activities to ensure the desired effect. Many factors affect how people might change their pattern of use on environmental resources and the uptake of alternative activities. For example in a study from Eastern DRC, bushmeat hunting increased as households became wealthier because the resources (rifles and cartridges) with which to hunt became affordable (Brown, 2003). Interventions to improve the welfare of local communities must take into account the environmental impacts of their actions and plan to mitigate them from the outset

An important question that arises from the discussion is, to what extent should the protected area authority be willing to go to, or is able to go to, in order to promote alternative livelihoods amongst current forest users? It is clear that the principal focus for the Uganda National Forest Authority and Wildlife Authority is to manage the protected areas and forests directly. The capacity in terms of finance and expertise to become involved in broader rural development activities is clearly limited. Instead it calls for more integration of conservation and rural development policy and practice.

Chapter 4.0:

Valuing local direct benefits from protected areas in Uganda; testing a provision point mechanism to reduce hypothetical bias in a compensatory framework

4.1 Introduction

Communities adjacent to protected areas in Uganda normally consume or sell timber and non timber forest products (NTFP) sourced locally as part of their livelihood strategies. As was illustrated in Chapter 3, these uses often are illegal and there are many indirect social values from protected area such as the role that they play in maintaining living standards and reducing risk in the livelihoods of local users. Market price surveys are useful in eliciting financial values but cannot capture the full economic (financial and social) values of such resources. Contingent valuation methods are useful in capturing the economic value. This chapter uses a novel device in a contingent valuation exercise to value local direct benefits form protected areas under different management and access arrangements.

Typically rural households around the study sites exist in a peasant/subsistence farming economy, with only partial integration into the market economy and consuming most of what they produce. Despite national legislation that precludes hunting of wild animals and, in the case of national parks, use of other NTFP, poor enforcement by under resourced management authorities means there is *de facto* open access, which local communities exploit. In the Albertine Rift region of Uganda, much of the natural forest on private lands (areas outside of the protected areas) has already disappeared due to conversion of forest to agricultural and pasture land (Dirichi et al, 2002). Protected areas provide the last remnants of the forest biomes that once covered this area. Without access to forest resources in protected areas many rural households may face high levels of impoverishment, thus the protected areas play

an important role in poverty alleviation even though much of the direct use may be illegal (Bush et al. 2004; Ministry of Lands Water and Environment (MLWE) 2002).

There is growing recognition that conferring some form of property/use right and management responsibility on local communities might provide a cost effective solution for protected area conservation and sustainable management. Contemporary approaches to conservation attempt to address these issues by placing communities at the centre of conservation through integrated conservation and development approaches (Hulme & Murphee 2001a). A key aim of such approaches is to increase local human welfare (income) in some way, to mitigate the local need to exploit PA resources. In order to be successful with integrated conservation and development projects (ICDP) it is essential to quantify welfare levels associated with direct use of products from protected areas in order to, at a minimum, provide a similar level of welfare through alternative livelihoods options. Measurement of the actual impacts from different scenarios is possible once ICDP schemes are in place; however implementing such projects without knowing the minimum level of impact necessary for success is a risky gambit.

In order to understand how communities and different socio-economic groups of households might respond to different forms of management arrangements a better understanding of the economic importance of protected area within local communities is needed. This will enable protected area managers to understand how communities might respond to proposed collaborative management schemes and to evaluate the cost effectiveness of such schemes against more traditional forms of protected area management. In addition outcomes from international conventions on protected area management (e.g. Convention on Biological Diversity and World Parks Conference 2003) indicate that on no account should protected area management contribute to or exacerbate poverty. Understanding the variable effects of

protected area management strategies on communities as whole as well as different socio-economic groups should therefore be of great interest to protected area managers and conservation policy makers.

Through conducting targeted economic valuation, a protected area manager might find that park adjacent people are not deriving any benefits from the protected area or may have been forced to forego opportunities of using the land for agriculture, forestry or other uses due to the establishment of the protected area. The protected area manager needs to look for alternative management practices that enable the protected area's neighbours to derive some benefit from the presence of the area without compromising its overall conservation objectives, thereby reducing the pressure to convert the protected area land to other uses. Alternatives may be to open the protected area to sustainable harvesting of forest products or to develop local capacity to service tourists visiting the protected area. Where different management approaches already exist it is useful to economically understand the variable economic impacts on local communities or distributional impacts within communities to be able to fine tune or focus community conservation activities. However financing the establishment of collaborative management programs is challenging, and many protected areas authorities do not have the finances to establish programs themselves.

Use of protected area resources such as fuel wood in Uganda has increased dramatically in recent years (Bush et al. 2004; NEMA 2001) partly the cause is due to increasing populations around protected area and poor enforcement of regulations. It appears that current levels of use will mean that in the future such resources will become increasingly scarce and may even become exhausted. In fact in the late 1990's Uganda declared a national fuel wood deficit (NEMA 2001). Also much current use is illegal and assuming effective governance, users run the risk of being caught and punished (prison or fines) by parks and forest authorities for illegal use (Bush et al, 2004). Exclusive management practices tend to create tension between

local people and protected area authorities as local people see the regulations as unfair (Hulme & Murphee 2001a; Plumptre et al. 2004). If the local community wishes to be able to receive direct benefits from the protected area in the future more effort must be made to effectively manage, regulate, or provide incentives to change local behaviour over the use of the protected area.

The household income approach to measuring welfare from protected areas is a difficult and arduous endeavour in a developing country context. The basic lack of infrastructure and seasonal stresses and strains that rural communities face are similar for the field team. Poor communications along badly maintained dirt-roads which require the use of four wheel drive vehicles or lengthy walks from a drop off point are some of the access considerations. Conditions can be physically demanding due to extremes of weather such as tropical rainstorms and high heat. Accommodation for field teams is often rudimentary or completely lacking requiring a high level of self-sufficiency on the part of the team. At times the work can be dangerous due to the presence of large wild animals, especially when camping. Generally, a survey in such conditions requires much careful planning and forethought regarding the basic housing and accommodation of the survey team, in addition to the technical details of administering the survey itself.

Whilst the level of qualitative and quantitative detail obtained in a household survey is extremely useful, there are weaknesses in that it is difficult to capture in financial terms the social value of the direct benefits from protected area exploitation (Vedeld et al. 2004). Social values such as the 'insurance' value environmental resources play in mitigating risk to livelihoods or the cultural importance of local natural heritage have no market based value, yet make up a key part of the social value that resource plays in local peoples livelihoods.

The **contingent valuation method** (CVM) uses a direct approach to valuing an environmental good or service in that it asks people through surveys or experiments what they are willing to pay for the good or willing to accept for the loss of the good. Contingent valuation is particularly attractive because it can estimate values where markets do not exist or where market substitutes cannot be found, often a limitation in market price valuation approaches. In addition market price methods as a financial approach may not capture social values attributed to the resource, undervaluing the true economic value of the resource. For these reasons, CVM is widely used to measure existence values, option values, indirect use values and non-use values. CVM is part of a broad group of survey based valuation methods known as 'stated preference' techniques, where respondents to valuation questions are asked to directly state their value or preference. This is in contrast to 'revealed preference' techniques where values are inferred from actual choices respondents make. Valuations are 'contingent' on a hypothetical market scenario presented to respondents in a survey.

Portony (1994) reports that the early underpinnings of the approach are discussed by (Ciriacy-Wantrup 1947) where it was observed some of the benefits of soil conservation were not market commodities in a conventional sense. He proposed that the way to obtain information on the demand for these public goods would be to simply directly ask individuals about their willingness to pay for successive additional quantities of the good. Early CVM studies were often considered unreliable and results were often held sceptically. This is perhaps not unreasonable for an emerging technique; however the knowledge and experience of CVM has developed considerably to date. A notable breakthrough in the confidence assigned to CVM to inform policy was seen in the work of Arrow et al (1993b) and their report to the United States National Oceanographic and Atmospheric Administration. Carson et al (1996b) made a test of the methodological assertions by Arrow et al (1993) and broadly found them to hold true. Despite the last decade's methodological advances, the critique of CVM now focuses on issues to do with controlling, detecting and understanding the

generation of bias in responses especially with reference to non-use values (Diamond & Hausman 1994; Guzman & Kolstad 2007; Harrison et al. 2004). However empirical studies have shown that many sources of bias are both detectable and can be controlled for (Bateman et al. 1998; Harrison & Rustrom 2005)

4.2 Study aim and objectives

This study aims to test a provision point mechanism (PPM) in a novel setting (willingness to accept compensation) to assess its affect in reducing strategic bias to provide a more reliable estimate of household economic values. In addition the data is used to assess the local direct benefits of households living around protected area under different resource access arrangements and draw some conclusions about the potential performance of community conservation. The case study presented in this chapter represents a different set of respondents in different sites from the data presented in Chapter 3. The questionnaire survey used is presented in Appendix 2.

In section 4.3 selected methodological issues in CVM are discussed with the objective of setting up the theoretical framework for the choice of valuation approach. To this end the literature review will concentrating on the WTP/WTA disparity debate key sources of strategic and hypothetical market bias in responses. Section 4.4, deals with the application of a provision point mechanism (PPM) in the context of this study. and the application of a PPM in mitigating strategic and hypothetical market bias. In section 4.5 key literature on the application of CVM is reviewed with the objective of understanding practicalities in the design and implementation of CV in a developing country context. Finally sections 4.6 and 4.7, present the case study with the objective of conveying the context background, methods, results and conclusion of the empirical research, focusing on testing the effects of the PPM and the application of the values to conservation management policies. The CV approach used a one shot open ended format to elicit local peoples direct use values of protected areas

under different management arrangements with particular reference to the impact of total household income on the stated preference.

4.3 Selected methodological issues in CVM

4.3.1 Measuring individual preference – utility and consumer surplus

The objective of this section is to review a selection of theoretical issues to motivate the choice of valuation method in the case study in part 3. CVM requires that individuals state a preference for a hypothetical level or change in provision of environmental goods and services. The hypothetical scenario typically involves explanation of a change in the provision of environmental goods and services under specific conditions. The survey then elicits a response in monetary terms for an individual's willingness to pay (WTP) for a welfare gain or willingness to accept compensation (WTA) for a welfare loss as a result of the specified change; thus valuation is based on individual preferences.

Peoples' choices over environmental goods and services are worth studying for several reasons; a key reason is to understand people's behaviour, i.e. explaining past or predicting future behaviour. Importantly understanding peoples' preferences for environmental goods is useful in order to assess how actual or hypothetical changes in their provision may impact on an individual's welfare. CVM data can be used to estimate the utility and thus the consumer surplus, in the absence of market prices, for different levels of environmental goods and help policy analysis through giving insights into optimal resource allocation by predicting and assessing welfare impacts.

The basic theory of welfare economics, utility and consumer surplus is well developed and documented (Bateman & Turner 1993; Hanley et al. 2007). This section will focus attention to relevant key issues related to the choice of the valuation approach (WTA vs WTP) and

sources of strategic and hypothetical market bias in responses and the application of a PPM in mitigating them.

4.3.2 Willingness to pay and willingness to accept; the divergence in value measures

The theoretical divergence between willingness to pay (WTP) and willingness to accept compensation (WTA) measures for identical goods is well documented (Hanley et al. 2007). WTA is larger than WTP is also found when either a gain or a loss of welfare is being considered (Willig, 1976; Randall and Stoll 1980). This has prompted considerable debate over the correct elicitation format to estimate consumer surplus and it is a question that concerns us here in terms of the selection of the elicitation format for this study.

Using utility curve analysis of welfare gain and loss measurements we can identify some theoretical problems. The upper part of Figure 4.1 (adapted from Hanley et al. 2007) depicts an unpriced environmental good in a discrete choice setting (X_1), shown on the horizontal axis while the vertical axis shows income as a composite of all other consumption. (X_0). The budget line ($\overline{X}$) is horizontal as the good is unpriced with the initial consumption of X_1 being quantity constrained (not price constrained) at Q_0 (point A on U_0).

In the last two decades, empirical evidence has clearly demonstrated the divergence between WTP and WTA measures (Boyle 2003; Hanemann 1991; Hanley & Shogren 2005), which has raised questions over which measure to choose and, in fact, the validity of CVM to accurately measure welfare at all. Evidence from the experimental economic literature has showed considerable divergences (Kahneman et al. 1991; Knetsch 1989; Knetsch & Sinden 1984), but this divergence seemed to exist irrespective of income effects, transaction costs or how often the good was traded. Experimental evidence (Loomes et al. 2003; Shogren et al. 2001) has shown that detailed explanations of the mechanism and how to derive valuations,

practice in using the mechanism, binding outcome experiences and anonymity can result in no significant differences being found in WTP-WTA value measure. One explanation for why familiarity with the good reduces the divergence is preference construction, where individuals develop preferences as choices present themselves, based on underlying beliefs and attitudes, dependant on the valuation context. Hanley et al (2007) suggests that where non-market goods are unfamiliar, values are likely to depend on how the exercise is undertaken and will vary over context. This indicates that the WTA-WTP divergence is largely based on technique or approach and that the divergence problem can be void if the appropriate choice of valuation approach or technique is employed.

Kahneman and Tversky (1979) proposed a loss aversion theory that states individuals judge all gains and losses from a reference point, which is their existing entitlement to a given level of resources i.e. air quality. The loss aversion theory has been further extended and explained as 'endowment effect', (Knetsch et al. 2001). Any decrease below the reference level will have a higher impact on their welfare than the impact of an increase in the provision of the good will have on welfare gains. This implies that where a loss in welfare below the reference point occurs, WTA is the correct measure as WTP will understate the loss. Thus WTP should be used for environmental gains and WTA for environmental losses.

Detailed analysis of the WTP-WTA divergence literature by Plott and Zeiler (2005) revealed that despite claims in the literature about the growing evidence to support the 'endowment effect' theory, this mainstream argument was in fact mainly based on incorrect interpretations of experimental results; whilst many experiments have observed the gap, many have also not.

A common finding by Plott and Zeiler (2005) was that whatever experimental procedure was adopted , a common and extremely important issue detailed in much of the literature, was the need to avoid subject misconceptions and it was in this issue that Plott and Zeiler (2005)

focused. They identified that lack of an operational definition of subject misconception meant that different experiments that had attempting to control for subject misconceptions in different ways. This depended on how the researchers anticipated which form that subject misconceptions might take. In their experiment, Plott and Zeiler (2005) control for subject misconception by adopting the gamut of approaches detailed in the literature.

In broad terms, Plott and Zeiler (2005) found no significant differences in WTP and WTA values as a fundamental feature of human preferences, but differences were found between different procedures altering the level of control for subject misconception, thus refuting the endowment theory. A further point is that issues of ownership can confound the result in that in their experiment subjects were meant to strip from their responses any special value related to ownership, but their results cannot confirm if this transformation actually took place. It is an important observation that ownership can have profound effects on measuring an individual's judgement of value.

A relatively recent empirical test of the difference between hypothetical and real WTA has yielded some critical insights. List and Shogren (2002) in an experimental study to calibrate the divergence, show that subjects significantly understated their real WTA in the hypothetical scenarios, however after controlling for subject specific effects marginal effects were minimal and there was no significant difference between hypothetical and real values.

Therefore there remains some uncertainty over when to use the WTP or the WTA approach related to ownership of a good. Mitchell and Carson (1989) propose a property rights approach to understanding welfare measures. They focus discussion on collective property rights and public goods and the annual payments necessary to maintain a given level of the good i.e. air quality or water quality. It is the non-excludable nature of a public good that ensures such goods are available to everyone, to which Mitchell and Carson (1989) argue that

WTA formats are inappropriate. This leads to an approach to identify the correct welfare measure to be used where we must examine the level of goods provision and property right status.

For pure public goods, WTP should be used to assess consumer surplus (CS) to ensure a gain, or equivalent surplus (ES) to avoid a loss occurring. However there remains a problem in terms of valuing public goods with a low substitutability i.e. water and air. Where private property rights are assignable to individuals or groups in some sense over the environmental good, the range of CS and ES measures in WTP and WTA forms are appropriate. In fact where the environmental goods have a low substitutability then WTA is actually the correct approach, as WTP would underestimate the individual's true economic value. Table 4.1 depicts the appropriate measures under the property rights and substitutability framework described above.

Table 4.1 Welfare measures in a property rights framework

Property right	**Welfare change**	**Substitutability**	**Level of Provision**	**Welfare measure**
Public	Gain	High/Low	WTP ensure gain	CS_{WTP}
	Loss	High/Low	WTP avoid loss	ES_{WTP}
Private	Gain	High	WTP ensure gain	CS_{WTP}
	Gain	Low	WTA if gain does not occur	ES_{WTA}
	Loss	High	WTA if loss occurs	CS_{WTA}
	Loss	Low	WTA if loss occurs	CS_{WTA}

Whilst initial theoretical examination suggested that the divergence should actually be low, (Willig 1976) it is most likely that the magnitude of the difference is dictated by the slope of the utility curve and the marginal rate of substitution for the good in question with money (Bateman & Turner 1993; Brown & Peterson 2003; Hanley et al. 2007). (Hanemann 1991) supports this view arguing that if the level of substitution between goods is high then the divergence between WTA and WTP tends to disappear. Shogren et al. (1994) also support the substitutability hypothesis, finding in laboratory experiments that the WTP/WTA divergence for goods with relatively close substitutes disappeared with repeated exposure to market

experience and feedback. For environmental goods, which often display a high degree of inelasticity over demand, the marginal rate of substitution of the environmental good for money/income could be very low. This means that the magnitude of the difference between WTP and WTA will be high and sometimes very high.

Moral and ethical issues are also an important dimension regarding the choice approach to valuation. What rights do people have to consume environmental goods and services versus what responsibilities do they have to maintain them and what are the right approaches to enforcing any standards? From a 'rights based' perspective although the value of a loss is appropriately measured by WTA, what is in fact experienced as a loss may not be treated as a loss within legal systems (Knetsch & Sinden 1984). This distinction between *de facto* and *de jure* loss occurs often with environmental goods. If the laws governing resource management preclude rights to existing uses, then the relevant measure of the recreation value is what users would pay to prevent the harvest. To reiterate, the welfare loss to the person losing access is measured by WTA, but the assignment of rights may not be equitably undertaken depending on the institutional arrangements and who sets the agenda. In the case of some of the protected areas in this study, access rights by local communities were expropriated from them by the state upon the creation of the protected areas. For example the state may not recognize any local community use right under constitutional law and thus would not agree with the WTA approach. This and the fact that alternative livelihoods options are few and far between means that enforcement of *de jure* regulations may contribute significantly to making poor people even poorer. In such cases, the WTA measure is still the most morally appropriate.

Several authors have examined the impact of moral and ethical responsibility towards the environment on welfare measures (Boyce et al. 1992; Brown & Gregory 1999; Gregory 1986; Irwin 1994; Ritov & Baron 1992). Results from such studies show that a sense of moral responsibility e.g. for things placed in one's care or to the environment, can also lead to a

WTA–WTP disparity (Gregory 1986). When responsibility is felt and a potentially damaging or harmful outcome is possible, inaction could be favoured over action, because people feel better if the harm just occurs than if they acted in a way that caused it i.e. benign neglect (Ritov & Baron 1992). The premium required to offset this potential therefore contributes to the disparity by lowering WTP and raising WTA (Brown & Gregory 1999)

Evidence that moral responsibility may enhance a WTA–WTP disparity was presented in an unusual scenario by Boyce et al. (1992). In a real-money experiment involving a house plant, participants were placed in the position of potentially allowing the destruction of the plant though a decision to either sell it or not purchase it. The authors argued that the loss aversion experienced by the respondents was altered by the differential assignment of property rights under WTA and WTP measures. This was in their opinion due to a shift in the respondent's allocation of moral responsibility for the preservation of the commodity.

Other recent studies principally investigating hypothetical bias have also provided insights in to causes of the WTP-WTA disparity where studies of induced values point towards 'home grown' values as a cause of the disparity in valuation measures, where the value of a good or service is dependant on a respondent's own innate values rather than an appreciation of a real market price value based on their own experiences (Collins & Vossler 2008; Polome 2003; Taylor et al. 2001; Vossler & McKee 2006). These studies focus on eliciting values for a real commodity or policies and use induced values to test if observed choices are consistent with induced preferences and to establish if welfare estimates are equal to induced values. Liu et al. (2006) also found that WTP distributions were systematically different between those who viewed their survey as inconsequential and those who did not, therefore disparity between WTP and WTA may occur when respondents do not believe that their decisions are consequential or when goods are unfamiliar (Carson & Groves 2007; Vossler & Evans 2008). These recent findings may help to explain the results of Irwin's (1994) study on WTA and

WTP differences for both market and environmental goods. In addition to the standard WTA–WTP disparity, WTA of the environmental goods exceeded WTA of the market goods, although WTP did not differ between the two sets of goods. Perhaps the compensation scenario in the case of the environmental good was not really believable to the respondents.

From the theoretical and empirical evidence it seems that far from being unreliable, the theory behind CVM is sound. Importantly the WTP/WTA divergence is not a methodological glitch, as it has a strong theoretical basis, but problems arise in understanding or controlling for the degree of divergence. Empirical evidence has shown that the level of divergence can be insignificant and differences between value measures may be due to procedural issues related to controlling for subject misrepresentation. This means that in order to choose the right valuation approach (WTA or WTP) careful consideration must be given to controlling for subject misconception over the valuation task, property rights or if welfare gains or losses are proposed. Two factors are also critical to reducing the WTP-WTA disparity, firstly the familiarity and substitutability of the good in question. Secondly, the reality of the hypothetical scenario relative to perceived consequences for the respondent. Both are forms of inaccuracy and bias introduced in the hypothetical scenario. In the case study presented later on a WTA approach is adopted in light of the evidence examined above where the forest goods familiarity is high, substitutability is low and a *de facto* use right is inexistence irrespective of the legality.

4.3.3 Inaccuracy and Bias

Much concern in recent years about CVM has focused on the sources of bias affecting the accuracy of the tool. The researcher may unwittingly introduce sources of bias, or the respondent may for some reason wish to strategically influence the outcome of the survey (Bateman & Turner 1993; Hanley et al. 2007; Harrison & Rustrom 2005; Shogren 2004). Following Hanley et al (2007), problem areas may be classified as follows; biases,

embedding, WTP/WTA differences, information effects and the transferability of benefit estimates. The discussion in this section will focus on two key areas of bias, strategic and hypothetical bias, as being most relevant to the successful implementation (issues to do with WTP and WTA variance having been discussed in the previous section) of this survey and the field testing of the PPM in this context.

4.3.3 a) Strategic Bias

The holy grail of stated preference methods is the incentive compatible survey. An incentive compatible survey is one that results in respondents providing truthful and accurate responses to the valuation question. The process of getting to an incentive compatible result is that of demand revelation, implying the strict incentives necessary to motivate people to report their true valuation of a good or service.

A useful entry point in understanding the problems faced in accurate demand revelation and incentive compatibility is through understanding strategic bias. 'Free riding' is an example of respondent strategic bias, in the case of a public good (i.e. non excludable), if an individual believes that the bid will actually be collected on he could believe that a benefit will be received without their need to pay for it (Bateman & Turner 1993; Hanley et al. 2007). Thus there is a strong likelihood that they will understate their bid. Alternatively if a respondent would really like to ensure that an environmental change occurs and that the bidding is truly hypothetical, then they are likely to inflate their bid to ensure that the change occurs. Both of these situations rely on the believability of the scenario in the first instance and the risk of their strategic behaviour will not be detected. In a WTP context regarding a private good, individuals are likely to understate their bids or make zero or protest bids in an attempt to drive down the price for the good if they believe that the survey may have some real outcome.

Intuitively in the WTA scenario, applied to private goods, a strategic over inflated compensation bid may be induced in order to influence a perceived real outcome. However if

we look at this scenario objectively in a broader context where the goods are of very low substitutability bids may be inflated, as an individual could feel strongly that their livelihood may not be tenable without the good. Such bidding may in reality reflect the respondents real risks associated with loss rather than the cognitive burden of calculating how much money it may take to adequately compensate for the loss.

4.3.3 b) Hypothetical bias

From the above discussion it is clear that the hypothetical scenario being described is essential to the revelation of an accurate bid. The hypothetical scenario established as the basis of a response must enable the respondent to fully understand the good being valued as well as the market and its institutions. This is perhaps the most technique specific problem facing CVM (Bateman & Turner 1993; Harrison & Rustrom 2005). Essentially it is argued that the lack of a binding commitment might cause rational people to overestimate their true value (Cummings et al. 1986). The criteria in the table 4.2 set out guidelines which if not met in the questionnaire design will result in biased and inaccurate data.

Table 4.2. Scenario Design Criteria for CVM (adapted from Campbell and Luckert, 2002)

If the scenario is not…	**The respondent will…**	**Effect on measurement**
Theoretically accurate?	Value the wrong thing (theoretical misspecification)	Measure wrong thing
Policy relevant?	Value the wrong thing (policy misspecification)	Measure wrong thing
Understandable to the respondent?	Value wrong thing (conceptual misspecification)	Measure wrong thing
Plausible to the respondent?	Substitute a condition or not take the exercise seriously	Measure wrong thing or give unreliable, biased or protest response
Meaningful to the respondent?	Not take the exercise seriously	Give unreliable, biased or protest response

Schulze et al. (1996) define bias in CVM studies as the difference between the distribution of hypothetical bids obtained from a survey and the distribution of bids that would be obtained in an actual demand revealing market setting. Hypothetical bias refers to the question whether hypothetical bids vary in some systematic manner from actual bids (Carlson 2000;

Willis & Powe 1998). Most often this question has been approached in laboratory experiments, which typically compare an initial hypothetical response valuing a commodity to actual laboratory market responses where the commodity can actually be purchased (Harrison & Rustrom 2005).

Such experiments offer much greater precision than comparisons made between contingent values and values obtained from other studies, e.g., travel cost method or replacement cost method. (Schulze et al. 1996) conclude that some upward bias is likely to be present in many studies and that hypothetical bias may be a function of income and richer people may use substitutes to a much larger extent than poor people do (Kriström and Riera (1996). It was also speculated that the pure ecological motive for stating a WTP might be concealed by arguments about donating in order to achieve social status and contributing to a good cause. Social norms (perceived or otherwise) exert a profound influence on individual's preferences and reflect the dynamic nature of society. In such a case, respondents are more likely to describe what is good for a country or region, expressing support for a perceived socially desirable outcome rather than their own innate value (Diamond & Hausman 1994) who confirm the existence of a strong bias for people when they overestimate the likelihood that they will engage in a socially desirable behaviour.

Hypothetical bias is an issue that must be dealt with systematically to improve the reliability of CVM estimates. The literature defines many approaches to mitigating such bias yet gaps remain in our approaches to utilising CVM. An important gap is the WTP versus WTA argument. (Harrison & Rustrom 2005) eloquently discuss the historical side stepping of WTA measures due to problems with controlling hypothetical bias in responses. The forms of bias and strategic bidding described before affect WTP measures and WTA similarly. However there is still a general avoidance of WTA, even when it is theoretically more appropriate to use. In part at least this may be due to the standards set early on by organisations such as

NOAA[17] in the application of CVM in legal cases. (Harrison & Rustrom 2005) further point out that WTA may be the most logical counter part to the issue in question, after all why should anyone pay to avoid another environmental catastrophe where in fact we should be compensated for the last one?

4.3.3 c) Payment Vehicle Bias

This is an area of survey design where there is a trade off between credibility with the respondent and the potential of the researcher introducing unintended side effects (Cummings et al. 1986). Typical payment vehicles include levies on income taxes, water or land rates, increased park entrance fees and increased sales taxes. The use of levies or taxes, and referenda in which the community votes on whether a specific project should go ahead, are less common in countries other than the USA and Switzerland, although there is increasing experience in Europe and elsewhere (Navrud & Pruckner 1997). A relative unfamiliarity with such institutional procedures can lead to problems regarding the plausibility of payment vehicles and the appropriateness of political market models included within CVM questionnaires. Blamey (1995) suggests, for this reason, that selecting plausible and non-objectionable payment vehicles presents a major challenge to CVM researchers.

The payment vehicle is a crucial element in any CVM survey because it provides the context for payment. Similar to other aspects of a CVM scenario, the payment vehicle can affect the way respondents answer the elicitation question. Respondents' choices may depend on when payment is due and the way in which it is collected. For example, Stevens et al (1997) found that WTP varied across alternative temporal payment schedules. These effects do not signal the existence of bias, so long as the effects of a payment vehicle are appropriate for the context of the study. Bias only arises if there is a spurious effect resulting from the selection of a particular payment vehicle. Payment vehicle bias occurs, according to Mitchell and Carson (1989), 'where the payment vehicle is either misperceived or is itself valued in a way

[17] NOAA – National Oceanographic and Atmospheric Administration, United States Government.

not intended by the researcher'. Unless payment vehicles and payment scenarios are selected and designed with reference to the institutional and cultural context, it is possible that payment vehicle bias will arise. Morrison et al (2000) propose that the payment vehicle issue can result in protest responses to the valuation exercises, not because the respondent doe not value the good in question but because of doubts about the plausibility of the payment vehicle.

In this study rural people in Uganda pay few taxes, partly because they are so poor and not fully integrated in to the market economy (subsistence producers still using a lot of barter to trade). The Ugandan government tried to implement a form of income tax called graduated tax a decade ago. This was with intention of getting a large majority in the population who are not fully integrated in to the market economy and do not earn taxable wages contributing to public service provision. The scheme was so widely unpopular it was scrapped after two years of unsuccessful implementation, which aroused strong civil unrest such as nation-wide protests. As a result, rural Ugandan people are highly sensitive towards taxes on their livelihoods. Use of taxes as a payment vehicle in a CV scenario may result in inaccurate demand revelation, due to protest responses. Payment vehicles such as voluntary contributions or WTA scenarios may work better or have a less distortive effect in this situation.

4.3.4 Risk preference and sample heterogeneity

The issue of risk in poor rural peoples' livelihoods merits some examination in relation to WTA compensation. Household access of direct benefits from protected areas is uncertain where seasonality and periodic shocks such as drought or flooding can also impact the productivity of the protected area therefore harvests are often an unknown quantity.

Imagine a low and high-income rural household, where the low-income household extracts in financial terms a lower value of goods form a protected area than the high-income household. The role that the protected area goods play in securing the basic livelihood may be more important (due to high dependency) for the low-income household than the high. Thus the low-income household rather than the high-income household might perceive more livelihoods risk in terms of vulnerability from losing access. Level of compensation payment will be a known quantity and assuming effective implementation mechanisms, more of a 'sure thing'. Therefore accepting compensation will be a lower risk proposition than accessing a protected area under any given set of institutional arrangements. Therefore risk preference will also matter in terms of stating a WTP/A.

Risk preferences will also be heterogeneous in that each respondent or household will be different from one another in some fundamental way i.e. income, assets, composition, age, education, livelihoods options etc. which will mean different attitudes towards risk. Risk aversion is a classic feature of a peasant-farming household (Ellis 1993) and could therefore have a profound impact on the measurement of WTA. Thought must be given to how a scenario design might be more or less acceptable in terms of risk to different social and economic groups, or how it might influence the outcome of the results between groups.

Whilst it is it is not necessary to control for risk preference, as it is a feature of choice and utility towards a good or service, it is important to account for it in the interpretation of results (Hanley & Shogren 2005). Where respondents have high dependency on an environmental resource, they will more likely be risk averse to a reduction or exclusion in its use. This will contribute to higher social values as well as the direct use values of the resources. For instance mean market price values of goods harvested annually form a protected area may be higher in high income groups than in lower, but the mean annual WTA for loss of access in relation to income group may be the opposite. A seemingly incongruous finding, but viewed in the light

of high dependency for the low-income group quite logical. The significance of the variability between individuals is supported by Burton et al (2007), who found that that individual hypothetical bias was driven by the differing influence of pure self-interest and other-regarding preferences in real and hypothetical situations, not by a single behavioural theory such as free riding. In a hypothetical situation these preferences cause 'yea' saying and non-demand revealing voting in some but not others.

Sample heterogeneity is also relates to respondent income and the potential impacts of income on values of environmental goods. In the case of environmental goods, the individual is often faced with a quantity rather than a price constraint and such goods may have high-income elasticity's of WTP. Consequently a large income effect could compromise the consumer surplus measure of welfare change (Bateman & Turner 1993). Hokby and Soderqvist (2003) show environmental services characterised by their respondents as an ordinary good and price elastic. They developed a model of income elasticity of demand (based on aggregated data of 5 different CVM studies conducted in Sweden) for eutrpohication of the Baltic Sea.

Respondents faced with no alternative sources of environmental goods and services may well have very low income elasticity of demand. Indeed both this position and that of high income elasticity's of demand are implicitly supported by Hokby and Soderqvist (2003) who conclude that their findings should not be regarded as a general finding for all environmental goods and services; they are all essentially all different in character where some people may regard them as necessities and others as luxuries (preference heterogeneity). In the first case the income elasticity issue does not present a particular bias in estimation of WTP or WTA. Thus a thorough examination of the valuation context must be made in order to understand bias in estimation potentially introduced by income elasticity.

4.4 The PPM and its application to mitigating bias

A novel approach to improving on incentive compatibility and demand revelation in reducing strategic bias and free riding in CVM is the provision point mechanism (PPM). With this mechanism a good of a predetermined magnitude and institutional form is provided only if the sum of contributions from a defined group equals or exceeds its cost (Rondeau et al. 1999; Rose et al. 2002). Experimental research has shown that although individuals make voluntary contributions for the provision of public goods, it is often done sub optimally and supporting predictions of under contribution (Ledyard 1995). Early mechanisms to reduce under contribution in such lab settings found that better contributions could be induced through repeated rounds of bidding, an approach not practical in the field setting. Later developments saw the introduction of the voluntary contribution mechanism (VCM), a one shot approach in reducing strategic bias and under contribution, however it consistently produced contribution levels 40 to 60% below optimal (Ledyard 1995).

The PPM can be regarded as an alternative to VCM as experiments have shown that free riding is substantially reduced in comparison to VCM. Additional innovations such as rebate rules and money back guarantees have also been found to increase contributions (Rondeau et al. 1999; Rose et al. 2002).

An interesting development in the application of the PPM is that of including a money back guarantee (MBG). The MBG is a rebate rule, which states that should either the PP be exceeded or not enough funds be elicited, and then the individual will either get a rebate of the excess proportionate to their contributions or, in the latter case, their money back. (Isaac et al. 1989; Rondeau et al. 1999) The MBG then acts as an insurance against risk of unnecessary loss. Although Dawes et al (1986) found no improvement in contribution rates when testing the effect of a MBG, significant increases in contributions were found by other researchers

from the use of an MBG (Isaac et al. 1989; Marks & Croson 1998; Rapoport & Eshed-Levy 1989). So at best it is effective having a positive impact on demand revelation and at worst no particular effect.

Following Rondeau et al (1999), in the WTP situation, a typical provision point situation will comprise of participants that are part of a group of a number of individuals (N) taking part in the bidding round. Each individual has a budget (I) such as the total household income, and must decide on their individual contribution (B_i) to a group fund (B_j) to ensure a given welfare gain (U_i). With a money back guarantee (MBG), if the sum of group contributions is below the provision point (PP) then contributions are fully refunded, thus individual earnings are equal to their initial bid hence no net change in utility. However if the group WTA bids exceed the PP then individual earnings are equal to the sum of the return on their bid (V_i) plus any proportional rebate according to defined rules as follows:

- $if \sum_{j=1}^{N} B_j < PP$ PP is not met from group contributions, program does not go ahead
- $if \sum_{j=1}^{N} B_j = PP$ PP is met, program goes ahead, and people pay individual WTP
- $if \sum_{j=1}^{N} B_j > PP$ PP is exceeded; program goes ahead people pay individual WTP minus a rebate of their proportional share of any surplus above the PP

Hence following Rondeau et al (1999) the individual's utility can be given algebraically by:

$$U_i = \begin{cases} I & if \sum_{j=1}^{N} B_j < PP \\ I - B_i + V_i & if \sum_{j=1}^{N} B_j = PP \\ I - B_i + V_i + \dfrac{B_i}{\sum_{j=1}^{N} B_j}\left(-PP + \sum_{j=1}^{N} B_j\right) & if \sum_{j=1}^{N} B_j > PP \end{cases} \quad (4.1)$$

Rapoport and Suleman (1993), Asch et al (1(1993) and Croson and Marks (1996) have also conducted PP experiments in lab settings in the WTP context. Bagnoli and Mckee (1991) conducted PP experiments with an MBG and Cadsby and Maynes (1998a, 1998b, 1999) utilised a similar approach without an MBG using small groups. Of all of these experiments only Bagnoli and Mckee (1991) managed to reveal true demand for the public good. Problems related to true demand revelation are linked to the small group sizes (5-12 subjects) and the homogeneous nature of the groups i.e. students, nurses, all male, all female. Rondeau et al (1999) recognised this problem and conducted lab based experiments more closely emulating field conditions (with group sizes of 50 participants drawn from a more heterogeneous background). They found that under these conditions the PPM was demand revealing in aggregate and conclude that the PPM is simple enough to be used in field conditions and capable of efficiently estimating the value of public goods through a voluntary contributions scheme. In the WTA context the MBG is not applicable, as no contribution is being solicited therefore there is no risk associated with an individual contributing too much.

Few CVM applications with PPM have been designed to empirically test the PPM in a field setting. The most notable example is Rose et al (2002) who utilise PPM in both lab and field experiment to test WTP to finance renewable energy programs, finding that in both settings their PPM with money back guarantees substantially increased contributions and corroborate

the findings of Rondeau et al (1999). Currently we are aware of no other application of the PPM applied to a WTA scenario in a laboratory or a field setting.

In a WTA setting the PP is a sum of money that constitutes the entire fund available for compensating all affected individuals in a group. Respondents are faced with the prospect that should the sum of group bids exceed the sum of money available then the entire compensation scheme would not go ahead and some other course of action would be taken or the status quo would be maintained. Should the sum of the bids be less than or equal to the PP then the individual can expect their additional income to be the value of their bid plus a proportional increment of the difference between the sum of the group bids and the PP. The rebate rules will thus be as follows:

- $if \sum_{j=1}^{N} B_j > PP$ PP is exceeded and the compensation scheme does not go ahead, no compensation is paid

- $if \sum_{j=1}^{N} B_j = PP$ PP is met, the compensation scheme goes ahead, and people receive individual WTA in compensation

- $if \sum_{j=1}^{N} B_j < PP$ PP is not met; the compensation scheme goes ahead and people receive individual WTA in compensation plus a proportional share of the surplus compensation fund.

Here the individual's task is one of constrained optimisation i.e. to maintain a given level of utility through maximising the income stream from the park related services (V_i) subject to the constraints of the provision point. B_i is the individual WTA bid and $\sum B_j$ is the sum of the group bids.

$$U_i = u\begin{cases} I_i + V_i & if \sum_{j=1}^{N} B_j > PP \\ I_i + B_i - V_i & if \sum_{j=1}^{N} B_j = PP \\ I_i + B_i - V_i + \dfrac{B_i}{\sum_{j=1}^{N} B_j}\left(PP - \sum_{j=1}^{N} B_j\right) & if \sum_{j=1}^{N} B_j < PP \end{cases} \qquad (4.2)$$

In this case the individual gets no services from the protected area in the "with project" case. However in reality V_i in the project scenario is unlikely to be zero community wide as some individuals may continue to violate rules and illegally extract resources from the protected area as well as receive compensation.

The game theory prediction for the PPM in the WTP context is described in Bagnoli and Lipman (1989) and developed by (Marks & Croson 1998) where a rebate rule is added to the mechanism. Assuming that participants are only motivated by their own gains, a bid is rational if it does not exceed the individual's value for the public good. If the sum of the bids does not exceed the provision point then the Nash equilibrium is achieved as shown in by

$$\sum_{j=1}^{N} B_j < PP; and\left(PP - \sum_{j=1}^{N} B_j\right) > (V_i - B_i) \forall i \qquad (4.3)$$

Thus, the sum of WTP bids is below the PP and no individual can unilaterally increase their own contribution in a rational manner to reach the provision point. (Rondeau et al (1999). A

profit maximising solution will be reached when the sum of the bids is equal to or greater than the provision point. This could mean that an individual may be motivated to overstate their true value to ensure the scheme went ahead for some other reason. Importantly it is clear to see that the PPM is not incentive compatible as long as there is incentive for strategic bidding confounding true demand revelation.

Therefore in the WTA context the converse is true (4.4) where

$$\sum_{j=1}^{N} B_j > PP; and \left(PP - \sum_{j=1}^{N} B_j \right) < (V_i - B_i) \forall i \qquad (4.4)$$

Thus, the sum of the bids is greater than the PP and no individual can decrease their bid in a rational manner to reach the provision point. However, if the sum of bids exceeds the PP any individual who made a contribution may choose to decrease their bid if given the chance, so the mechanism may not in fact be strictly incentive compatible. However the issue of its demand revelation properties is not so clear, in that a change of bid value may not necessarily reflect a change in the value of the good, but a trade off in terms of willingness to accept less than the true value of the good for some other reason.

However this problem only arises if an individual knows the PP amount and the size of the target group in a scheme. In the WTP context a respondent might make a decision based on an equal cost share strategy in order to reduce their level of contribution. Conversely in the WTA context they may inflate their bid level above their real utility on a similar basis to capture a higher equal share of the compensation fund. This would of course require a high degree of conference between the individuals in a community in order to establish what level of bid would be made, but would still not eliminate focal point bias as individuals could still bid freely (and anonymously). It would in effect be an inverted example of the prisoner's

dilemma whereby the theoretical end state would be decided upon, but could still be influenced because of anonymous bidding. In addition it would encourage the participation of individuals who might otherwise have received no compensation. This seems like an unlikely and high-risk scenario due to the information and coordination requirements as well as level of trust required in a community to ensure success and another indication of the PPM's not being incentive compatible.

A further threat to the mechanism is the power an individual may also have to veto the entire scheme by bidding an amount greater than the PP in the WTA. This is an altogether more complex problem, as the reasons behind such a veto may be difficult to ascertain. It may be due to cultural factors i.e. opposition to any form of control over local access due to people having a grudge about being displaced from former traditional lands. However it is possible to screen for such bids by simple examination of the distribution of bids and the removal of obvious outliers, or where enumerators noted that a respondent may have had such strong opinions against the scheme. This underscores the importance of gathering other social data alongside CV studies especially regarding attitudes towards the protected area.

One way around these forms of bias is to withhold the level of the provision point to prevent participants from using an equal or higher benefit share strategy or easily establishing a veto. In order to remove this source of bias the rebate rule can also be modified to specifically provide an equal share of any difference between the PP and the group bids removing the need for strategic bidding to maximise the return on investment. Whilst this will not make the PPM incentive compatible it may in practice improve the demand revealing properties, however evidence on this issue is weak (Rondeau et al. 2005).

This effectively mimics real life situations where a program's costing may not have been established in detail before such a CV exercise could be carried out. The example from Rose

et al (2002) of the Niagara Mohawk Power Company, 'Green Choice Program', offered to its 1.2 million residential customers, stated that the final cost of the project was to be established through competitive bidding. In the context of our case study such a CV exercise may in fact be the basis of assessing the financial viability of a compensation scheme prior to looking for funds from national park revenues or the international donor community. Logically the establishment of the provision point in the WTA context should decrease the likelihood of an individual's overstatement of a bid, reducing 'free riding' and give a more accurate measure of CS_{WTA} , thus giving policy researchers a useful tool for assessing the full economic costs of changes in access arrangements to protected areas.

In summary, in the WTP setting the PPM can help to improve demand revelation through reducing the incentive for strategic bidding, consistent with the 'free riding' finding of the Rose et al (2002) study. Where a rebate rule is applied then the incentive to free ride may be further reduced as there is a risk of sub optimal returns to the individual from overstating their true WTP. In addition withholding the intended provision point introduces an informational constraint to making a strategic bid to maximise individual return. However strategic bidding cannot be eliminated in that an individual may grossly inflate their WTP value in order to ensure a scheme went ahead. However such bids might be picked up as an outlier when screening data so may be controlled for in analysis.

In the WTA setting similar but converse issues apply, thus a surplus benefit share rule can eliminate or reduce the individual incentive to free ride, but not to bid strategically. A veto of the scheme could be possible through grossly inflated bids but as with the WTP setting, such bids may be identified as outliers when screening the data. Again withholding the actual amount of the PP also removes a critical piece of information upon which to make strategic bids. Thus, the theoretical demand revealing properties of a PPM in the WTP and WTA

setting means they are not incentive compatible, but the mechanism may possibly have practical effects on more accurate demand revelation .

4.5 The application of CVM in developing countries

The application of CVM in developing countries has focused mainly on the valuation of water supply, improved sanitation and health services and the valuation of environmental amenities arising from national parks (International Institute for Environment and Development 2003; Kramer et al. 1992; Kramer et al. 1995; Whittington 1998; Willis & Garrod 1996). Mekonnen (1997) applied WTP elicitation formats to obtain the economic value of community forestry in Ethiopia and similarly Lynam et al. (1994) valued trees on communal lands in Zimbabwe. Ruitenbeek (1992) valued rainforests in Cameroon using a WTP-CVM scenario. In contrast to applying WTP elicitation format, Smith et al (1998) use a WTA CVM approach to analyse potential compensations payments required to induce land use changes among farmers in Peru with the objective of CO_2 sequestration. Other studies address the problem of compensation payments that are required in order to induce land use change of local frames for watershed protection (Kramer et al 1992; 1995).

Despite the fact that CVM surveys are frequently applied in developing countries, the results must be critically evaluated, to provide a better understanding of the contextual strengths and weaknesses in apply CVM in a developed versus a developing economy. Whittington (1998) states that many studies have been conducted without better prior knowledge of their correct application in developing countries most have followed the NOAA guidelines (Arrow et al. 1993a) devised in the context of litigation in an industrial marine setting in a developed economy. After numerous applications of CVM in the developing world, it must be concluded that those guidelines often do not fit the specific circumstance confronted with in developing countries and, hence, the result of CVM surveys may be biased or simply wrong.

In support of this view Mekonnen (1997) regards posing hypothetical questions to low-income, perhaps illiterate respondents as potentially too overwhelming. This is perhaps an extreme conclusion as illiteracy does not necessarily infer low intelligence, but the institutional context is of great importance. People operating in peasant economies are often mainly subsistence producers, only partially integrated in to market economies and have varying needs for money (Ellis 1993). In addition they are often operating in highly risk prone environments with high levels of vulnerability to environmental change and will have developed their own conventional wisdom, and institutions to cope with life in such conditions. Perhaps the NOAA guidelines in this context are not appropriate.

Significantly Whittington (Whittington 1998) concludes that although there are numerous issues that arise in contingent valuation work in developing countries in many respects it is easier to do high-quality contingent valuation surveys in developing countries than in industrialized countries. Typically response rates are very high and respondents are often quite receptive to listening and considering the questions posed. Costs of administering surveys are typically lower than in developed nations, allowing researchers to use larger sample sizes and conduct more elaborate experimental designs. Often the available data on the benefits of different kinds of projects are typically quite limited. This means that the marginal value of additional information obtained from CV surveys is likely to be large. As long as the CV design criteria are well applied to appropriate valuation questions it is not only feasible but and advantageous to use CVM in developing countries to help evaluate a wide range of projects.

Two additional narratives on CVM in developing countries by Whittington (2002; 2004) address important ethical issues and highlighting shortcomings of CVM surveys conducted in developing countries. Whittington (2002) concludes that such surveys are often poorly administered and executed, that hypothetical scenarios are often poorly designed. Key

problems identified were that few studies are designed to verify whether some of the key assumptions that the researcher made were the right ones or whether the results were robust in respect to simple variations in research design and survey method. In addition he highlights that there is a significant risk that the push for simpler, cheaper survey methods could discredit the CVM method in itself. However one might add this is not a shortcoming just because a CVM study was conducted in a developing country (there are perhaps also plenty of poorly executed studies for similar reasons in the developed country context as well) but is more an issues to do with the competencies of the researcher.

Whittington (2004) discusses the impacts of cross-cultural communication in implementing CV studies in developing countries and further identifies three cross cultural problems, 1) promises of anonymity and the right of respondents not to participate, 2) power asymmetries between international and local members of the CVM research team, and 3) compensation of respondents. Firstly developing countries with the best sampling frames are generally the least democratic and even though respondents may be promised anonymity the reality is different, as individuals living in undemocratic governance regimes may be easily located. Additionally it may be difficult to convince government officials why anonymity and no access to the original data is an essential need of the survey approach. To some extent anonymity may be guaranteed where no details that can identify the household are collected and convincing government officials of the need for anonymity may not be so difficult is the researcher spends some time and effort explain the bias that may be introduced in to the survey results without anonymity. In reality few government officials have the time and energy to go sifting through piles of survey questionnaires.

On the second issue researchers may find that in certain cultural circumstances respondents are trying very hard to please by giving responses based not on the preferences, but what they think the researchers preferences may be. This is a common problem in societies where trying

to please esteemed visitors is a cultural nicety. However the skill of the researcher in designing the questionnaire comes in to play and the design of the scenario needs to be carefully considered so as to be neutral and not leading in any way. This is clearly a design issue related to reducing hypothetical bias.

Thirdly researchers may offer compensation to respondents for their time and effort in taking part in the survey and this might be perceived as coercive. Context is everything in terms of prices and it is important for the researcher not to unwittingly set compensation levels so high that respondents feel coerced (given an offer they can't refuse) into accepting. Whittington (2004) stresses that even the smallest amount of compensation may be considered coercive for the poorest people in developing countries. Here timing may be everything and the impact of compensation may be related to how it is offered. If nothing is offered up front then the researcher's solicitation to a respondent may be accepted or declined on its own merit. The researcher is then free to offer an appropriate contribution for the person's time at the end of the interview. The compensation does not have to be monetary, but could be a good in kind such as soap, tea or salt. The application of CVM in developing countries to measure preferences for environmental goods and services has an established pedigree. Early applications may have been wildly inaccurate due to hypothetical bias induced by poor instrument design. However there is now enough contemporary experience and wisdom about the need for contextual adaptations to make CVM a very useful and applicable tool. Importantly the issues discussed in this section fed in tot the design and implementation of the case study in section 4.6.

4.6 Valuing local direst use benefits from protected areas in Uganda using a CV with PPM

4.6.1 Case Study Objectives

As indicated earlier the PPM has been shown in the WTP context to increase contributions, however few field tests have been conducted to demonstrate its performance under conditions where a single shot is required to estimate the economic value of an environmental good affecting a large population with heterogeneous values (see discussion on the PPM and its role in mitigating bias and respondent incentives in Part 1). Extensive field based sample surveys are expensive exercises to undertake, invariably there are time and financial constraints. In a field setting a researcher may have only one attempt to ascertain a respondent's true value hence the 'single shot' term. Typically extensive surveys of population's mean that the research will encounter a wide spectrum of social and economic groups as potential consumers of the good being valued and will not typically be focusing on a particular homogeneous group. Surveys need to be designed to cope with respondent heterogeneity therefore larger sample sizes will be necessary, reinforcing the need (under resource constraints) for an effective single shot approach.

In the WTA context the PPM is a novel tool, the central of objective is to empirically test its performance in mitigating bias in that the establishment of a provision point in the WTA context should decrease the likelihood of an individual's overstatement of a bid, giving a more accurate measure of true WTA. In our policy context, this would provide a useful tool for assessing the full economic costs of changes in local access arrangements to Protected Areas.

4.6.2 Method

The CVM survey was administered alongside a market price method household survey of social and economic costs, benefits as well as social impacts (key results are reported later) to

park adjacent households. Respondents were asked to state their maximum level of compensation required to forgo access to timber and non-timber forest products from their local protected area for a period of one year. The questionnaire survey is found in Appendix 2. Two separate payment mechanisms were employed in split samples (Table 4.3). In the control treatment, an open-ended CV format was used in which respondents were simply asked to state their WTA compensation to forgo the benefits from the protected area for one year.

The scenario sets up a framework for the implementation of a hypothetical novel community based park management scheme in collaboration with park management authorities. It stipulates direct payments for conservation as an incentive to provide benefits to the local community and to enforce non-use regulations and reinforce the link between the benefits and conservation of the resource. The bidding is open-ended, based on the respondents perceived level of compensation to lose direct benefits form the protected area on an annual basis. The provision point, rebate rules and money back guarantee are detailed in the text box below.

Provision point and money back guarantee description in the CV scenario

The community is being asked to make monetary bids to assess the demand for such a scheme and estimate the level of compensation. Only a limited amount of funds are available for such a scheme. If the sum of all the communities compensation bids is **less than** or **equal to** the money available then the scheme would **go ahead** as described and a proportional share of any surplus funds between the community bid and the compensation fund will be made.

If the sum is **more** than the money available then such a scheme **would not** go ahead and it is likely that the current management practices would continue with increased enforcement efforts.

The survey tool administered by a group of trained enumerators and was pre-tested in the field. Surveying was rigorously supervised to ensure that enumerators complied with established procedures. Pre-testing was conducted to identify weaknesses in the presentation and comprehension of the tool by both the enumerators and respondents. In general there was

consensus from enumerators that the scenario was believable by respondents. Importantly the scenario addressed both a real conservation issue (illegal use) and an appropriate response to resolving it (direct payment for conservation) with an enforceable set of rules, as such it was plausible and policy relevant.

The survey was administered using a team of field assistants (enumerators) to conduct interviews in the local languages of the region. The questionnaires were in English, questions were verbally translated into the local language and then responses translated into English and recorded directly on to the data sheet.

Whilst in the English language version of the survey presented in Appendix 2 used technical terms like "biodiversity", "demand" and "bid", these terms had no direct translation in to the diversity of local tribal languages encountered in the survey, into which the questions were translated. Much time was spent in discussion with the survey team to ensure their full comprehension of the underlying concepts so that more appropriate and detailed translation could be made when administering the survey locally. Local comprehension of the survey issues was significantly aided by conservation education and awareness programs that have been operation around the protected area sites in recent years.

Usually it took the team of 5 enumerators about 3 days in each community to complete the interviews. During this period the research team either found local lodgings, or camped within the community. The extended period of contact with local people allowed the team to develop a high degree of familiarity with the social and natural environment of each community. This often gave opportunities to discuss responses and triangulate on any issues to highlight discrepancies. For example, amongst some of the diverse local cultures in which the survey was administered, it was culturally taboo to tell strangers how many children or livestock the household has for fear of bringing bad luck and the possible loss. However it is not a social

taboo for neighbours or other local key informants to divulge information about one another's situation, so a point of triangulation of the accuracy of information was available.

Execution of the CV exercise was significantly aided by the lengthy household social and economic study, being in a sense a warm up exercise, with the respondent to explore local cost benefit issues in depth. This may have helped to produce a more considered response to the CV question and avoid confusion in responses. In the results section we show that there were few 0 or no bids recorded. Sampling of households was on a random stratified basis of wealth categories within a community (identified through a participatory wealth ranking exercise). Data were collected on 690 households in communities around each of three different protected area (Table 4.3), and included not only the CV bids, but also various social, economic household data. The protected areas are ecologically different (tropical closed canopy rainforest, afromontane forest and savannah woodland) which means different ranges of goods and services and therefore utility derived by local households.

Local impressions of wealth are site specific making inter-community comparisons of households difficult i.e. a wealthy household in one community might be poor in another. In each case a monetary estimate of total household income (adjusted per adult equivalent unit – see method described in chapter 2) was made so that households can be allocated to income quartiles as a basis for comparison. An assessment was made of the demographic composition of each household, level of education, employment etc. Income data was collected on total household income in terms of sale and consumption of protected area and non-protected area goods. The stated preferences from the CVM study may therefore be compared on the basis of a number of social economic factors.

Table 4.3 Data collection sample frame

Protected Area	**Bio Type**	**Governance Type**	***No of Households in survey***	***Treatment applications***	
				With PPM	***Without PPM***
Queen Elizabeth National Park	Savannah Woodland & Grassland	Strict National Park (no community co-management)	*330 (10 communities)*	*165*	*165*
Bwindi Impenetrable Forest National Park	Afromontane Forest	National Park with some community co-management	*240 (8 communities*	*120*	*120*
Community Forest Reserve (Masindi District)	Tropical High (Closed Canopy) Forest	Forest on private (community) land, community owned and managed	*60 (2 communities)*	*30*	*30*
Collaborative Forest Management	Tropical High (Closed Canopy) Forest	Forest Reserve (public land), with community co-management	*60 (2 communities)*	*30*	*30*
		Total HH	***660***	***330***	***330***

The CVM study is based on the stated preference of local households stratified by different management approaches and income, using a provision point to reduce strategic bias from respondents and free riding.

4.6.3 Results

Results are presented in two parts firstly to give some socio-economic context to the study some basic descriptive data are reviewed on household income, wealth and demographic characteristics. Secondly the CV results are reviewed to empirically test the PPM performance in mitigating bias specifically does it decrease the likelihood of an individual's overstatement of a bid and give a more accurate measure of true WTA. In addition socio-economic determinants of WTA bid value are also presented. A total of 10 interviews were discarded as incomplete due to poor completion or respondent unwillingness to complete the interview leaving 680 completed surveys to be included in the analysis.

4.6.3 a) Local socio-economic context

Typically all households surveyed were involved in subsistence agriculture. As such they fit the model of a peasant-farming household. There are two main distinguishing features of peasant economies, partial integration into markets and the incomplete natures of the markets

in which they operate(Ellis 1993). Incomplete integration refers to their ability to engage in or withdraw from markets as they choose. This in part is due to their variable capacity to provide much of their own food requirements as well as from the imperfect market in which they operate. Market incompleteness refers to the sporadic operation of certain markets. For example Ellis (1993) cites seasonal demand for labour for harvesting at differential wage rates, the difficulty in obtaining imported inputs and the restricted availability of consumer goods in rural areas. Peasant societies often exhibit a form of barter or other non-market transactions between farm households that of course have an economic basis but their reciprocal nature makes it difficult to value such transactions in a market context. In order to give some broad contextual background to the survey respondents some basic socio-economic characteristics aggregated at the survey site level are presented below.

Table 4.4 Household composition

Site	n	Mean number of hh occupants	Mean number of males per hh	Mean number of females per hh	% males per hh
Budongo	60	6.37	3.02	3.35	47.38
Tengele	59	5.78	3.02	2.85	51.45
QEPA	319	6.14	3.14	3.18	49.75
Bwindi	232	6.24	3.35	3.07	52.18
All	670	6.16	3.19	3.13	50.53

hh= household

Table 4.4 shows the composition by gender. The average household size across the sample was 6.16 individuals approximately evenly split between men and women. There was no significant difference between sites. Average household size (mean number of occupants) was slightly higher than the national average of 5.1 persons (UBOS 2003).

Table 4.5 Age structure

Site	n	Mean age	Mean age males	Mean age females
Budongo	60	21.55	23.45	22.10
Tengele	59	20.68	19.89	22.01
QEPA	319	22.40	22.74	23.17
Bwindi	232	21.58	22.70	22.44
All	670	21.89	22.55	22.72

hh = household

Household average ages are quite low (Table 4.5) reflecting high proportions of young people. These findings are consistent with the Uganda National Household Survey (UBOS 2003) showing that slightly more than half the population of Uganda is below 15 years of age.

Table 4.6 Household education levels (% of hh members aged 15 and above)

Site	n	no formal	primary school	secondary school	higher education
Budongo	60	26.32	60.00	13.16	0.53
Tengele	59	22.45	58.16	17.35	2.04
QEPA	319	24.88	58.91	12.74	3.48
Bwindi	232	26.90	60.41	10.48	2.21
All	670	25.47	59.45	12.43	2.65

In the proportion of household members, above the age of 15 years old, having no formal and secondary education there was no significant difference between sites (Table 4.6). Significant differences were seen between sites in terms of the proportion of households receiving secondary (χ^2= 140.462 d.f. = 21, Φ = 0.658, $p<0.001$) and higher education (χ^2=76.539 d.f. = 36, Φ = 0.933, $p<0.001$). Primary school education is provided freely by the state, but not secondary and tertiary education. Whilst the state has endeavoured to make primary schooling accessible to all through constructing and staffing rural primary schools, the program with secondary schools is not so advanced. Achieving secondary schooling and higher education will be influenced by both access and affordability. The overall proportions are in line with national averages

Table 4.7 Household land ownership

Site		Mean area of agricultural land owned (Ha)	Mean area of land rented in (Ha)	Mean land holding (Ha)
Budongo	60	7.38	1.50	8.88
Tengele	59	5.89	0.63	6.51
QEPA	319	4.08	1.43	5.52
Bwindi	232	3.95	0.88	4.83
All	670	4.49	1.18	5.67

hh= household

Significant differences between sites the amount of land owned ($F=4.044$, d.f. =3, $p<0.01$) and rented in ($F=7.957$, d.f. =3, $p<0.001$) were significantly different (Table 4.7). This is a reflection of the relative land scarcity and population densities of the different areas rather

than agro ecological potential. Bwindi has perhaps the highest population density and Budongo the lowest. Both along with Tengele are characterised agro ecologically as highly productive crop growing areas, being most tropical forest zones (Bwindi is also at a high altitude). QEPA is largely a savannah and acacia woodland ecosystem (although there are areas of tropical high forest), with much more marginal arable production systems (dryland agriculture) and more pastoralisim. The areas around Budongo and Tenegele have also been more recently settled with natural forests on private lands being converted to agricultural land. A significant part of this conversion is due to recent population growth in the last 10 years, due to translocation of people from around the western parts of QEPA and Bwindi areas.

Table 4.8 shows the mean hh income across all sites was just over $1010 per annum. There were however significant differences in annual hh income between sites. The overall annual value is consistent with the studies conducted by this author of $1009 per household per annum (Bush et al. 2004) and the values presented in Chapter 3 of this thesis.

Table 4.8 Household Income ($US per annum)

Site	n	Mean net total hh income	Mean net total protected area income	Mean net total protected area income consumed	Mean net total protected area income sold	% protected area income consumed	protected area income as a % of total hh income
Budongo	60	373.30	4.40	1.05	3.35	23.93	1.18
Tengele	59	894.00	44.16	29.79	14.37	67.47	4.94
QEPA	319	1393.05	36.24	1.44	11.18	3.98	2.60
Bwindi	232	681.37	0.05	0.05	0.00	100.00	0.01
All	670	1011.35	21.56	3.42	10.54	15.88	2.13

hh= household

From this basic social and economic data we see that the respondents in this survey are overwhelmingly poor by international standards e.g. per capita income less than the $2[18] per day per capita global poverty measure. In addition survey households were highly and reliant on natural resources as the foundation of their livelihood. Less than 2% of the sample

[18] The $2 value is in purcahsing power parity terms
Source:http://unstats.un.org/unsd/mdg/Metadata.aspx?IndicatorId=0&SeriesId=580

recorded sources of income other than agriculture, livestock or protected area related income e.g. casual labour, remittances from extended family or small business activities. Locally acute fuel wood shortages may mean that the substitutability of protected area products for money may in general be low, as locally it may be difficult to source fuel wood should none be forthcoming from the protected area.

4.6.3 b) Impact of the PPM on mean bid value and distribution

As a reminder this contingent valuation study utilised a provision point mechanism (PPM) where the implementation of a community protected area management scheme is dependant on the sum of respondent bids not exceeding a maximum threshold. Bids were solicited in the local currency (Ugandan Shillings, UGS), but results are presented in $US terms (exchange rate, 1900UGS/$US). A total of 4 zero bids and 5 no responses were recorded to the WTA bidding out of the 680 completed surveys. Where 0 or no response was forthcoming clarification was sought from the respondent. The 0 bids may have genuinely been because those households did not use the protected area however cases of 'no response' can be variously attributed to respondents not understanding the valuation exercise, as well as the valuation task not being relevant because there was genuinely no use of the protected area.

Protest bids are a common problem in all WTA valuation exercises, and the PPM cannot be expected to eliminate true protests. The reasons behind such a protest response may be difficult to ascertain. It may be due to cultural factors i.e. opposition to any form of control over local access, or due to people having a grudge about being displaced from former traditional lands. However, a credible PPM scenario should curtail the number of very high claims that are not simply true protest bids. At a minimum, the limit on the total amount that can be paid out in compensation provides a strategic incentive to bring one's claim closer to

the true value of losses. If anything, PPM results might also make it easier to screen for true protest bids by comparing the distributions of bids across payment scenarios[19].

The main effect of the PPM should be to reduce mean bid value, upper extreme value and variance, when compared to bids solicited without the use of a PPM device. We would expect the variance to reduce with the device as bids will range from 0 to some upper value. If the upper extreme value is reduced then consequently the spread of bids is reduced which means that degree of standard deviation will also be reduced. Table 4.9 sets out the descriptive statistics for the sample.

Table 4.9 CVM - PPM study descriptive statistics

Treatment	n	Mean ($US)	Std. Deviation ($US)	Std. Error ($US)	Coefficient of Variation	95% Confidence Interval for Mean ($US)		Minimum Value ($US)	Maximum Value ($US)
						Lower Bound	Upper Bound		
NO PPM	337	482	541	29	1.12	424	540	0	3,158
WIITH PPM	338	354	320	17	0.90	319	388	0	1,579
ALL	675	418	448	17	1.07	384	452	0	3,158

(Mann Whitney U test mean WTP; Z = -2.605, p<0.01)

When considering the entire data set between the two cases the mean WTP with the PPM device[20] was $354 compared to $482 without the PPM device, this difference was found to be significant (Z= -2.605, p<0.01). With the PPM device a lower standard error was recorded ($17 compared to $29) and a lower maximum bid value ($1,579 compared to $3,158) than when the PPM device was not used. Given the degree of difference in the mean values S.E. may not be directly comparable therefore the coefficient of variation is used, which also shows a lower coefficient with the PPM than without the device. Data conform to all of the hypothesised effects as mean bid value, upper extreme value and sample variance are all reduced with the use of a PPM device.

[19] Another possibility, not explored here, is that if respondents think that the size of the compensation fund is partly endogenous, they might increase their bids to raise the provision point.

[20] the term PPM device is used to mean the PPM with the money back guarantee

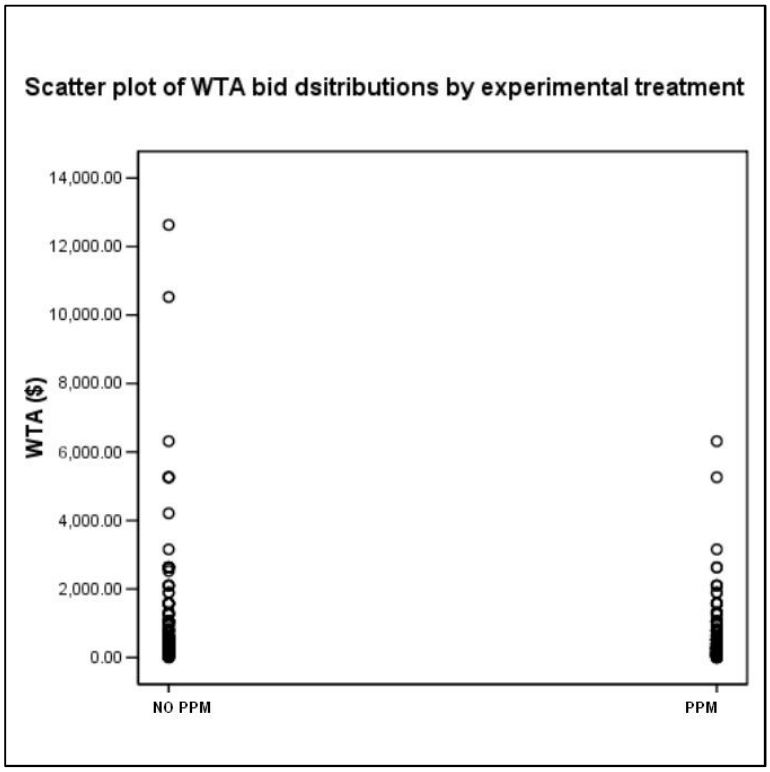


Figure 4.2 Distribution of WTA bids under different experimental treatments

The distributions of bids under the different experimental treatments are shown in Figure 4.2; it seems that broadly speaking without the PPM respondents made fewer high bids. In comparison of quartiles of the two treatments distributions (Table 4.10) we can see more clearly where the effects of the PPM lie. From the table it can be observed that the differences in quartile means standard deviations are quite small and not significant except for the highest quartiles, where the mean bid value with the PPM treatment was difference was significantly lower than without the treatment ($Z= -3.852$, $p<0.001$). This shows that the PPM in this case has had the effect of lowering the upper bid values only, indicative that little free riding going on amongst respondents at lower bid levels.

Table 4.10 Comparison of treatment quartiles

Treatment	Treatment* Bid Quartile	Quartile Mean bid ($)	N	Std. Deviation	Std. Error of Mean	Coefficient of Variation
NO PPM	Lowest 25%	65.47	79	32.18	3.62	0.49
	Lower middle 25%	212.19	79	53.67	6.04	0.25
	Upper middle 25%	435.64	79	105.87	11.91	0.24
	Highest 25%	1835.95	77	2007.60	228.79	1.09
WITH PPM	Lowest 25%	58.60	79	31.93	3.59	0.54
	Lower middle 25%	206.76	79	53.92	6.07	0.26
	Upper middle 25%	405.46	79	112.12	12.61	0.28
	Highest 25%	1102.70	78	953.51	107.96	0.86

* Quartiles assigned from within each treatment distribution not entire sample

The impacts on hypothetical bias are less clear, but the similarity of the mean bid values in the lower quartiles shows that the PPM either had no effect, or perhaps that there was little hypothetical bias in the responses in the first instance. An interesting experiment by Murphy et al (2005) evaluated the impact of 'cheap talk'[21] on hypothetical bias in a PPM valuation, finding that it did indeed help to reduce hypothetical bias. However the design of this experiment does not allow us to conclusively test for this.

4.6.3 c) Effects of the PPM and social and economic influences on bid value

It might be expected that peoples' WTA statements would depend on a number of social, economic and institutional factors (livelihoods context) that might influence bid value e.g. current level of use of the protected area and the role that these resources play in reducing vulnerability, or the demand in the household for food and income. Livelihood strategies are also dictated by options therefore access to or ownership of other resources and communications to market as well as proximity to the park may also be determining factors of protected area use. The institutional structure governing people's use of the protected area resource may also pay an important factor in people WTA responses, and these might be

[21] Cheap Talk is where an explanation of the bias problem is delivered in the hypothetical scenario to respondents prior to the valuation task

given proxy measure where these were surveyed. The variables that most closely correspond to such social, economic and institutional factors are described in table 4.11 below.

In the case of the governance structure, dummy variables were used to account for the 4 different governance types of protected area or the level of effective enforcement of current access restrictions. As such 3 dummies were constructed with the omitted variable being the strict national park (Queen Elizabeth Protected Area), where legally there is no direct use of the protected area allowed other than tourism. The other dummies are arranged in order of increasing community use rights. It is could also be expected that there we should see an increasing WTA with increasing community use rights therefore an increase in the magnitude of the coefficient between GTDUMMY1 to GTDUMMY3, demonstrating higher levels of utility towards the protected area under more participative governance arrangements.

Table 4.11 Variable descriptions for determinants of bid value

Variable	Description	Expected sign
HHTOTALO	Household total occupants; total number of individuals in the household irrespective of age/sex class	Positive - the greater the number of household occupants the more labour there is to exploit resources therefore the higher the value of protected area income and WTA value
AGRILAND	Agricultural land (Ha.); area of agricultural land cultivated by the household	Negative - the more agricultural land a household farms the more resources required for farm operations and the less resources available to exploit the local protected area and lower use value therefore a lower WTA
ATHI	Adjusted Net total household income; net total annual household income	Negative - the higher the level of adjusted household income the lower the utility of protected area direct benefits and WTA as households are engaging in other income generating activities
APAI	Adjusted Net Protected Area Income; net total annual protected area income	Positive - the higher the level of APAI the lower the higher the utility of protected area direct benefits and therefore WTA as households get increasing level of direct financial benefits from the protected area
DISTMARK	Distance to market (Km); distance from households dwelling to travel to nearest market	Positive - the further away from markets the higher the value a household might hold for protected area goods thus a lower WTA
DISTPA	Distance to protected area (Km); distance from household's dwelling to the protected area boundary	Negative - access is an important factor of protected area use, the further away a household is from the protected area the less attractive it may be as a livelihood resource and lower utility and WTA
EXPTREA	Experimental Treatment; bid with or without PPM device (dummy with 0 with the PPM device)	Positive - higher bids are expected without the PPM device than with it
GTDUMMY1	Governance type, dummy variable 1; national park with some community co-management (Bwindi Impenetrable Forest National Park)	Positive aggregate of individual household welfare value of direct use of protected area should be higher than the omitted variable
GTDUMMY2	Governance type, dummy variable 2; forest reserve with collaborative management (Budongo Central Forest Reserve)	Positive aggregate of individual household welfare value of direct use of protected area should be higher than the omitted variable
GTDUMMY3	Governance type, dummy variable 3; community owned and managed reserve (Tengele Community Forest Reserve)	Positive aggregate of individual household welfare value of direct use of protected area should be higher than the omitted variable

Multicollinearity is a common problem in analysis of cross-sectional data (Green, 2003). The severity of multicollinearity among explanatory variables was checked using the Variance Inflation Factor (VIF) comparison. VIF is $(1-R_i^2)^{-1}$, which is the diagonal element of the inverse correlation matrix; where R^2_i is the coefficient of determination obtained from auxiliary regression. According to Gujarati (1995) as a rule of thumb, if VIF exceeds 10, this is considered as an indicator for the existence of serious multicollinearity problems between

regressors. VIF estimates for the regressors are found in Table 3.12 and show that there were no serious multicollinearity problems.

Table 3.12 Variance inflation factor collinearity statistics for regressors

Regressor	Variance Inflation Factor
HHTOTALOCCUPANTS	1.634
AGRILAND	1.492
NTHI	1.732
NPAI	1.467
DISTMARKET	1.247
DISTPA	1.647
EXPTREA	1.360
GTDUMMY1	1.290
GTDUMMY2	2.097
GTDUMMY3	1.940

A Tobit model was applied to the selected variables that could have had an influence on bid value. A Tobit model was utilised, as the bid value could be any value from 0 to infinity, thus the data are effectively censored for any values below e.g. there could be in theory negative WTP values (however unlikely). Such a case cold be where a respondent may in fact be willing to pay to conserve the park, such observations would be recorded as a 0. However given that only 4 zero bids were actually recorded the effects on the model are likely to be limited. An OLS regression is also reported alongside the TOBIT estimate to assess any kind of bias that may be introduced as a result of the different estimation procedures.

Only 472 observations were included in the model compared to 675 in the descriptive statistics as a full set of data on all of the parameters was not available. Both the variables DISTMARK and DISTPA had a high number of missing entries. This was due to distance measurements in km being poorly understood by respondents as distance is more commonly measured as units of time by different modes of transport i.e. foot, bicycle, car etc.

Table 4.13 Results for determinants of bid value

Variable (X)	Tobit Coefficient (β)	Tobit β/S.E.	OLS Coefficient (β)	OLS t-value	Standard Error	Mean of X
HHTOTALO	9.00	1.23	8.631	1.169	7.31	6.22
AGRILAND	-0.89*	-2.11	-0.922*	-2.155	0.42	2.48
ATHI	$2.90e^{-7}$	0.681	$2.86e^{-6}$	0.653	$4.29e^{-6}$	642.1
APAI	$1.197e^{-4}$**	2.786	$1.19e^{-4}$**	2.836	$4.33e^{-5}$	24.9
DISTMARK	3.52	0.53	3.67	0.492	6.61	3.24
DISTPA	10.02	0.87	10.62	0.908	11.59	1.43
EXPTREA	114.56**	3.02	75.54**	2.475	37.98	-
GTDUMMY1	-11.01	-0.18	-9.09	-0.150	60.03	-
GTDUMMY2	-25.24	-0.39	-25.17	-0.385	64.97	-
GTDUMMY3	-199.75**	-2.82	-192.11*	-2.689	70.86	-
CONSTANT	343.44***	54.30	323.44***	5.858	55.2	-
Disturbance standard deviation (σ)	429.18***	30.657	-	-	14.00	-

p<0.05, **p<0.01, ***p<0.001; Tobit - n=472, R^2 (Decomposition) = 0.061; OLS - R^2 = 0.064, F= 3.94, d.f. = 9, 463 p<0.001

Results, in Table 4.13, show only three significant explanatory variables of bid value in the model, AGRILAND, EPTREA, GTDUMMY3. No bias was detected as a result of the estimation procedures, although the significance of the GTDUMMY3 variable declined slightly under the OLS procedure.

The significance of AGRILAND was of interest. The relationship was negative, indicating that those households with more agricultural land hold a lower value for protected area access than those with less agricultural land. This infers that rather than exploiting the protected area, such households prefer to employ their household labour in the transformation of their own natural capital. It comes as no surprise that EXPTREA was significant as previously demonstrated; the PPM mechanism has an effect on reducing the mean bid value. NPAI had a significant positive effect, which is consistent as higher levels of income from the protected area would also imply higher welfare values.

GTDUMMY3 also showed a significant and negative relationship compared to the constant. The dummies for governance type are arranged in order of increasing community involvement in control and ownership of the resource. Although GTDUMMY1 and GTDUMMY2 were not significant, they also showed a negative value, but much less than that of GTDUMMY3.

Initially one might expect that with increasing community ownership and control we should see increasing bid values for WTA, and that the coefficient for GTDUMMY3 could be positive, or at least less negative than GTDUMMY 1 or 2. A number of factors may have affected this result Dependence on a local protected area is not only intra site specific issue, but inter site as well. If we look at the mean land holdings between sites (Table 4.14), we see that there are some distinct differences. Tengele (GTDUMMY3) households have a high mean land holding with a low standard deviation form the mean compared to the other sites.

Table 4.14 Descriptive statistics for land ownership by study site

Site	n	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Budongo	55	7.377273	13.8232	1.863919	3.64034	11.11421	0.25	80
Tengele	58	5.887931	4.813216	0.632006	4.62236	7.153502	1	30
QEPA	291	4.082646	7.3838	0.432846	3.230728	4.934564	0	80
Bwindi	225	3.948978	5.93471	0.395647	3.169311	4.728645	0.01	50
Total	629	4.48938	7.573974	0.301994	3.896339	5.08242	0	80

According to the regression model AGRILAND was an important factor in lowering respondents WTA value, thus respondents in Tengele may have had a lower WTA value than the strict national park for this reason.

If we consider the broader institutional context *de facto* access might be another key factor in explaining this apparent anomaly. In the case of a strict national park, although there the regulations do not allow any use by local communities, poor local enforcement of the regulations by under resourced staff means that a *de facto* open access arrangement exists. In

this case use is unregulated and also likely to be unsustainable. With increasing levels of community involvement in the management of the protected area more effective enforcement of lower but more sustainable levels of use may be apparent. This means that overall less goods are available to the community form the protected area and therefore less on an individual basis to households in the community.

Another contextual factor that may affect the result is that in the site represented by GTDUMMY 3 (Tengele) is under a collaborative forest management scheme and was gazetted within the last 5 years. Prior to that Tengele was open access forest on private land. The other sites have been under some form of protection by the state since the 1950s. Recent developments in the region have seen large investments in tobacco and tea. Therefore the local people may be experiencing some sense of loss in terms of the opportunity cost of the land upon which the forest lies. Financial returns may be higher in terms of alternative land uses than the forest products that can be extracted under the CFM arrangement.

Another consideration may be that given a functioning management regime was only recently enforced, this relatively small forest could have already been depleted of most of its valuable timber and NTFP, thus the low value may be less to do with the governance arrangement than the relative scarcity of resources available. Although the mean adjusted value of protected area goods was highest in Tengele, there was also a higher degree of variance in the individual values than other sites. Therefore the mean value was biased upwards by a few households expropriating a greater share of the available benefits.

No significant value was found for DISTPA. It was hypothesised that proximity to the protected area might be an important factor in that household further away from the protected area might value their benefits less. However this result is not conclusive in that a sampling bias might be present as the sample population were households in communities adjacent to

the protected area. The mean distance from the protected area was calculated as 1.43km. This might change in a broader sampling frame in which more variance to the proximity of the protected area occurred. No significant relationship was noted for DISTMARK as access to markets may have been similar across the sample frame. This result is not conclusive as proximity to markets was not a specific sampling criterion.

In addition ATHI also showed no significant impact on the bid value, indicating that there was no specific income effects observable in this data on the economic value of protected area to households. This is an inserting finding, as a key assumption in ICDP approaches is that making protected area adjacent households wealthier may in some way reduce their use or dependence on protected area resources. This result indicates that at best increasing local household incomes (*ceteris paribus*) it will have no significant change on local use of the protected area.

4.6.3 d) Evaluating the difference between the MPM value and the CV estimates

From the market price estimate of total annual mean net protected area income ($22) and the CV estimate with the PPM device ($320) we can see that there is a large difference ($298, just over 10 times) in mean value estimates. This is not surprising as the two approaches essentially measure different things; the MPM measures financial values and the CV economic values (financial plus non-market). Whilst it is difficult to ascertain by how much the magnitude in the difference is affected by hypothetical market bias, we can be sure that the PPM device has acted to reduce its impact. Essentially the difference between the two values is a measure of the non-market benefit of protected area access.

It would be interesting to understand which type of households i.e. what social and economic factors, might determine the level of difference between the financial value and the economic values in the different estimates. In terms of dependence on forest resources, irrespective of the absolute financial value of protected area goods harvested by a household, there will be

variation in the perception of the role that protected area goods play in maintaining living standards through reducing the impact of seasonal and cyclical shocks and thus mitigating risk. The main hypothesis in this case is that that the more protected area dependant a household, the higher the difference between the financial and economic estimate will be, where dependency is a function of the lack of other alternatives to maintain a household living standards.

A Tobit model was applied to the same set of selected social and economic variables as in the previous analysis against the MPM-CV difference (GAP). The Tobit is applicable in this case as any negative values would be assigned as zero. In this analysis a subset of cases was used representing WTA values where the PPM was applied, as testing the effect of experimental treatment was not an objective. The model fit is not very good with a low R^2 values, indicating a lot of sample variance, but a few key variables do stand out as being strongly significant.

The analysis reveals some interesting results (Table 4.14), household total occupants (HHTOTALO) was positive and significant, the larger the household size the more likely a bigger GAP value. This might be because larger families feel more dependant on forest resources for livelihoods security i.e. a larger household may have higher vulnerability to seasonal shocks such as when crops fail, thus they may have a higher social value attributed to being able to access the protected area. AGRILAND was significant and negatively associated with higher values of GAP. Thus the more agricultural land a household has the less likely that there is a big GAP, showing clearly that household perception of dependency on the protected area is related to having other livelihoods options.

Table 4.14 Tobit regression determinants of GAP (difference between CV – WTA and MPM valuation results)

Variable (X)	Coefficient (β)	Standard Error	b/St.Er.	Mean of X
HHTOTALO*	18.63	6.44	2.89	6.32
AGRILAND **	-0.05	0.07	-0.66	2.48
ATHI	0.00	0.00	2.183	162.54
DISTMARK	0.08	0.07	1.12	3.24
DISTPA	-0.20	0.16	-1.24	1.43
GTDUMMY1	-55.18	38.92	-1.42	
GTDUMMY2	-25.94	62.34	-0.42	
GTDUMMY3 **	-250.08	72.44	-3.45	
CONSTANT ***	326.70	85.74	3.81	
Disturbance standard deviation (σ) ***	310.48	12.03	25.8	

n=337; R^2 (Decomposition) = 0.051; * p<0.05, **p<0.01, ***p<0.001

The other significant variable was GTDUMMY3, the community forest management scenario, which showed a negative relationship. The community management scheme is a recent innovation, having only begun two years ago, when the protected area was more or less an open access resource. Owing to more effective enforcement of use regulations, local households may have reduced access to the resources, increasing vulnerability and the feeling of risk. Despite local households currently extracting a low mean value this does not represent the real social value of access to the protected area. Market valuations are in this sense inadequate as they do not take account of transaction costs and risks as well as transformation costs involved in asset use or production.

4.7 Discussion and Conclusion

4.7.1 Methodological

As previously discussed there has been a general reluctance to implement WTA-CV studies because of perceived theoretical and practical problems in eliciting useable data. However on balance it was noted that the same set of theoretical problems in fact rationally affect WTP-CV studies as well so there is no reason not to use WTA as a measure form a theoretical perspective. In addition choice of valuation approach must be carefully considered in a

property rights context and that WTA was the most valid measure when trying to reflect a private welfare loss. Otherwise this could lead to misspecification of the valuation task resulting in the valuation task being irrelevant and introducing hypothetical bias, which may also be a cause of WTP-WTA disparity.

This study represents one of few PPM assessments in a field setting and perhaps the first applied to assessing the effectiveness of the mechanism in a WTA context. The results clearly show that the PPM has the desired effect in mitigating bias in responses to the valuation task, which gives a more reliable estimate of consumer surplus. However there still exists an incentive to strategically overstate true losses or making an extraordinarily high bid to veto the project by stating a WTA greater than the provision point thus the mechanism is not incentive compatible. Whilst the overstatement problem is difficult to eliminate in its entirety, as was discussed earlier the veto problem can be eliminated by simply not defining the PP amount. In this way the provision point is used in a conceptual manner to reduce free riding and bias.

The PPM in this case has had the effect of lowering the upper bid values only, indicative that little free riding going on amongst respondents at lower bid levels. The impacts on hypothetical bias are less clear, but the similarity of the mean bid values in the lower quartiles shows that the PPM either had no effect, or perhaps that there was little hypothetical bias in the responses in the first instance. This may be related to issues to do with different preference structures amongst segments of the population and echoes the concerns of Burton et al (2007) regarding the importance of an individual level of analysis and the impacts of risk preference on responses in subsets of the sample.

An interesting experiment by Murphy et al (2005) evaluated the impact of 'cheap talk'[22] on hypothetical bias in a PPM valuation, finding that it did indeed help to reduce hypothetical bias. However the design of this experiment does not allow us to conclusively test for this. Although in theory the PPM is not demand revealing empirically it could be although experimental evidence on this is mixed. Bagnoli and Mckee (1991) found that their respondents implemented on of the Nash equilibrium surprisingly frequently, but they did not reveal value. Rondeau (1999) found that respondents did reveal demand, but it was not a Nash equilibrium and in Rondeau (2005) found that respondents over contributed at low induced values and under contributed at high induced values and although they did approximate demand revelation in aggregate.

There is a potential bias issue related to the hypothetical scenario and micro behavioural decision making at the household level. Given the labour resource constraint in terms of protected area exploitation discussed earlier, if respondents are asked to contribute labour to monitoring and enforcement efforts there exists a trade off related to the amount of effort required to be put in to the scheme in return for a payment versus the current level of effort to maintain the status quo. No clear specification of the amount of effort required was made. Although the PPM estimate does give a smaller figure we should not assume that this is equal to the actual welfare measure. It is however the best estimate. Clearer specification of the level of effort required in implementing the proposed scheme would then mean respondent could make a decision regarding the returns to labour which would be implicit in their bid, making the estimate more robust.

In terms of the application of the valuation approach in a developing country context a variety of contextual considerations were discussed in relation to the application of CV studies. These considerations were adopted in the design and implementation of this survey where the

[22] Cheap Talk is where an explanation of the bias problem is delivered in the hypothetical scenario to respondents prior to the valuation task

applicability of an individual payment to households that are by and large operating in a functioning market economy all be it in a subsistence mode of production.

The control for the study was a corresponding CV study where the hypothetical scenario left out the PPM description. This means that we are unable to make direct comparisons between WTP-WTA measures. However the results look favourable in light of the reduced mean bid value of the WTA measure and theoretical prediction of improved WTP values, further empirical testing of the PPM effects is imperative. In addition it would also be interesting to test the impact of bid elicitation format between the open ended and double bounded formats according to the different PPM treatments in order to understand the implications for more accurate demand revelation.

4.7.2 Conservation management

Determining what social and economic parameters affected bid value revealed three interesting results. Access to agricultural land (AGRILAND) had a marked impact on the bid value. This indicates that households with more agricultural land for cultivation value protected area resources less than those with less land. This is an indication that protected area dependency is linked to the lack of access to other livelihoods means. This is especially interesting when compared to the result that levels of adjusted household income (ATHI) were not seen to have an impact on bid value indicating that the value of the protected area goods available to households may be similar. This may be an indication that wealthier households are using the protected area because they can, whilst poorer households are using the resources because they have fewer other choices.

Access arrangements are also an important determinant of bid value. Whilst community involvement in managing and protecting biodiversity and environmental resources can be effective in terms of enforcement of regulations, the significance of the parameter for

community owned and managed protected area (GTDUMMY3) showed that attempts to formalise the management of natural resources in communities can also have negative impacts on household perceptions of welfare. In light of the forest dependency issue this raises a concern of equity related to poverty alleviation, in that where poorer households are more dependant on protected area resources, they will be hit hardest if reductions on the availability of those resources are imposed upon them. However we must treat this result cautiously as the case of community forest management in Tengele CFR is subject to number of external institutional and economic factors that may not be generally representative of other protected area in the study i.e. opportunity cost of land, recent gazettment of the community forest reserve and extent of degradation of the forest prior to gazettment.

It does however highlight the complexities of setting up such schemes, especially with the objective of establishing equity in the management of natural resources. Whilst the objective of conserving the forest seems to be a clear outcome of the scheme, the benefits to the community may be perceived to be less in the short term due to the opportunity cost of land being high through converting the forest to agricultural land for cash crop production. Such dynamics may be decreasing willingness for the community to take part in collaborative management efforts.

Such dynamics are critical issues when thinking about ICDP approaches and efforts to pursue community based approaches to conservation. Any alternative activities to protected area use must be designed to offset the local welfare loss (economic loss) rather than simply the financial loss to maintain household participation. In addition the social perspective on the value of the protected area is not static and may change over time. This is a minimum requirement, in that imposition of welfare losses must to be met with similar welfare gains from other sources in order to change local behaviour and perceptions towards protected area.

A quantitative understanding the scope and nature of costs and benefits helps realistic planning in terms of understanding the investments required to implement successful ICDP.

Chapter 5:

Valuing the demand for mountain gorilla eco-tourism in Rwanda; testing for non-compensatory preference inconsistencies and hypothetical market bias using a cut offs based choice experiment

5.1 Introduction

In many developing countries, tourism is providing an increasingly important source of foreign revenues and direct investment (Kontoleon & Swanson 2003; Wunder 2000). In Rwanda, tourism is a particularly dynamic sub-sector, thanks to the charismatic mountain gorilla *Gorilla beringei beringei* found in the Volcanoes National Park (VNP) in the north-west of the country. VNP consists of about 160km^2 of montane forest and until Rwanda's independence in 1962 was part of Africa's first national park, the *Parc National Albert*, created in 1925 with an intention of protecting the great apes (ORTPN 2004). Both the mountain gorillas and the VNP as a tourist destination became internationally renowned through the work of the conservationist Dian Fossey who died in 1986 and whose biography was later turned into the popular movie "*Gorillas in the Mist"*. By the early 1980's Rwanda was receiving up to 22,000 visits to the national parks annually. However, visits collapsed during the genocide, civil war and subsequent period of insecurity from 1994 to 1998 (ORTPN, 2004). Despite recent serious threats to the gorillas from illegal hunting, today the park is well protected, and numbers of the great apes are increasing (Gray et al. 2003).

Since the park was re-opened in 1999 its tourism industry has seen an incredible rebound from 417 park visits in that year to around 30,000 park visits in 2006. Tourism is currently ranked as the third highest foreign revenue earner for Rwanda, generating around $35.7 million of income in 2006 (Republic of Rwanda 2007). To understand the national significance of the sector, tea, coffee and minerals accounted for more than 80% of all export receipts in 2005 (UNCTD 2006). This equates to annual non-tourism exports per capita of just

$18 – far below the sub-Saharan African average of $145 (Republic of Rwanda 2005). Likewise, the share of exports in GDP is one of the lowest in the world at 5.3% (Republic of Rwanda 2005). Coupled with this Rwanda relies heavily on imports for consumer, intermediate and capital goods. Tourism is thus one of Rwanda's priority sectors for economic development, so that understanding international demand for tourism is an important task. Eco tourism is a pivotal concept in the model of tourism development that Rwanda is currently following. In the context of this study we consider eco-tourism to be nature based tourism that actively benefits local communities e.g. socially responsible (Wunder 2000). Economic valuation methods can help us identify how much tourists are willing to pay for the opportunity to visit national parks (Schultz et al. 1998), and importantly in the context of eco-tourism understand their preferences for both biodiversity conservation and local social benefits from nature tourism activities (Naidoo & Adamowicz 2005).

Valuation practitioners are increasingly developing an interest in alternative stated preference formats such as choice experiments. CE is a family of survey-based methodologies for modelling preferences for goods, where goods are described in terms of their attributes and of the levels that these take. Respondents are presented with various alternative descriptions of a good, differentiated by their attributes and levels, and are asked to rank the various alternatives, to rate them or to choose their most preferred. By including price/cost as one of the attributes of the good, willingness to pay can be indirectly recovered from people's rankings, ratings or choices. As with contingent valuation, CE can also measure all forms of value including non-use values. The conceptual microeconomic framework for CE lies in Lancaster's (1966) characteristics theory of value which assumes that consumer' utilities for goods can be disaggregated into utilities for composing characteristics. Empirically, CE has been widely used in the market research and transport literatures (Green & Srinivasan 1978; Hensher 1994; Swait 2001), but has only relatively recently been applied to other areas such

as the environment. (Glenk et al. 2006; Hanley et al. 1998; Hanley et al. 2000; Naidoo & Adamowicz 2005).

The application of CE to the environment has stimulated some debate over its applicability regarding valuing ecosystem services such as flood or erosion control (Gatto & de Leo 2000; Glenk et al. 2006; Morrison et al. 1998; Nunes & van den Bergh 2001). Problems arise when respondents are unfamiliar with the scientific aspects of such services in order to make meaningful choices between sets of attributes. The complexity of the ecological subject matter usually does not allow improvement of respondent comprehension through more detailed explanation in the scenario presented. Clearly the problem of scenario uncertainty not just limited to environmental goods and can clearly be extended to any context such as social benefits. Therefore one of the key challenges in scenario design is to be sufficiently explicit about the goods or services to be valued or to value less complex proxy attributes.

Recent developments in CE in the transport economics literature (Swait 2001) have seen the incorporation of attribute cut-offs[23] as a direct response to the issue of measuring the limits within which decisions are made by individuals over their preferences for different attributes within a specific choice framework. These cut-offs represent a kink in the individual utility curve with respect to the tradeoffs that consumers make. Knowledge of the cut-off limits can help to explain in more detail consumer behaviour and may substantially improve our ability to predict behavioural changes arising from policies that may affect attribute levels. Importantly cut-offs may be used to screen for irrational choices and could be a way of moderating hypothetical market bias in stated choice data that has yet to be explored in the literature.

[23] Cut-offs are minimum or maximum tolerances or thresholds of demand for a products features influencing consumer choices.

In this chapter, we use the "cut-offs" model proposed by Swait (2001) to represent choices and preferences for ecotourism related to mountain gorillas in Rwanda. The cutoffs model was initially suggested as a way of handling the non-compensatory nature of choices. Here, we extend it to allow consideration of inconsistencies in choice, and as a way of controlling for hypothetical market bias in stated preference choice data. We find that this allows a better fitting model to be estimated, and that it produces considerable effects on the implied willingness to pay for changes in ecotourism experience attributes. In addition we present a unique case study that values both consumer willingness to pay for biodiversity conservation and community benefits from mountain gorilla tourism.

5.2 Background theory of choice experiments with cut-offs

5..2.1 Choice experiments

Random utility theory, in which consumers make discrete choices from a set of alternatives, underpins the choice experiment approach (McFadden 1974; Train 2003). In random utility theory, the consumer is said to obtain utility U (conditional on their choice) from an alternative *i.* This conditional indirect utility function is composed of the deterministic component (V), and a stochastic component (ε). The utility of an option (i) for an individual n (U_{in}) is assumed to depend on environmental attributes of the option (Z_i) and the socio-economic characteristics of the individual (S_n).

$$U_{in} = \mathrm{V}(Z_i, S_n) + \varepsilon(Z_i, S_n) \tag{5.1}$$

An alternative i will be chosen if it has a greater utility than alternative j. The probability of choosing i over j is thus

$$p(i|\mathrm{C}) = p\{\mathrm{V}_{in} + \varepsilon_{in} > V_{jn} + \varepsilon_{jn}; \mathrm{j} \in \mathrm{C}\} \tag{5.2}$$

where C is the complete choice set. It is assumed that the error terms of the utility function are independently and identically distributed. Consequently the property of independence of irrelevant alternatives (IIA) requires that the probability of choosing one alternative over another is completely independent of the utility of the respective alternatives e.g. all pairs of alternatives are equally similar or dissimilar (Hensher et al. 2005). The probability of choosing *i* is given by,

$$p(i)=\frac{\exp^{\mu V_i}}{\sum_{j\in C}\exp^{\mu V_j}} \tag{5.3}$$

where $V_i = V(Z_i, S)$ is the indirect utility function, Z_i is a vector of environmental attributes, S is a vector of socio-economic characteristics.

The standard conditional logit model applies to choice experiments when V_{in} is defined as

$$V_{in} = \sum_{jn}\beta_k X_{in}^k \tag{5.4}$$

where β_k is the coefficient on attribute X_k . This model can be estimated by maximum likelihood techniques, and is a useful first cut at modelling choice behaviour. However, the independence of irrelevant alternatives property, which states that a change in the attributes of one alternative changes the probabilities of the other alternatives in proportion, may not be realistic in all settings.

Secondly, the coefficients of all attributes are assumed to be the same for all respondents in a choice experiment, whereas in reality there may be substantial variability in how people respond to attributes. Thirdly the standard conditional choice model assumes IIA, whereas one might actually expect such factors to be correlated within decision-makers (Train, 2003). In addition to the conditional logit model, several alternatives are also offered as methodological advancements, such as mixed logit, multinomial logit, nested logit and

random parameters logit each with different sets of assumptions and applications depending on the constraints of the data. A comprehensive review is available in Train (2003).

5.2.3 The cut-offs approach to choice modelling

Swait (2001) indicates that in the extant literature dealing with consumer behaviour (drawing from economics, psychology and marketing) a practical anomaly exists. Generally it is concluded that humans are cognitive misers in that they adapt the amount of effort they invest in making optimal decision depending on the context and resources available (Bettman et al. 1991; Ford et al. 1989; Payne et al. 1993). However this fact is not generally incorporated in to models of consumer decision making where it is normally assumed consumers actually use all the available information to make decisions. This assumption is more often an expedient of the difficulties sin modelling the relaxed assumptions associated with humans as cognitive misers. The cut off approach is a practical approach to relax the complete information assumption that is both straight forward to administer and also to model. This will result in a clearer understating of consumer behaviour and substantially improve predictions of consumer behaviour under different attribute conditions.

In this chapter, we make use of the "cut-off" choice experiment approach proposed by Swait (2001) to investigate i) non-compensatory preferences and (ii) inconsistent behaviour. These are two issues of concern to economists making use of stated preference approaches for environmental valuation; and which also pose problems for the application for the rational economic model of cost-benefit analysis to project/policy appraisal.

Non-compensatory preferences imply that models of consumer behaviour should not assume smooth, continuous indifference curves, such that any marginal change in environmental quality can be compensated for by a finite marginal change in some other good, this would imply WTA amounts are bounded. In the 'soft cut-offs' approach presented in this chapter a

model of behaviour which is compensatory, demonstrated by the existence of a respondents stated minimum or maximum levels (cut-off) of an attribute which must be satisfied before an alternative will be chosen. The cut-offs are 'soft' because the limits are not viewed as discrete where the individual can trade off the penalty loss against some other attribute.

Choice inconsistencies represent a second major challenge to the use of stated preference methods of valuation. Such inconsistencies violate the neo-classical assumptions of preference, specifically that of the rational economic decision-maker e.g. where there are violations of the transitivity axiom (circular triads, where $A \succ B$, $B \succ C$, but $C \succ A$). Choice modellers have also sought to screen data for evidence of irrational choices for confirmation of irrational behaviour (Hanley et al. 2002); finding such behaviour then casts doubt on the reliability of choice data. In this chapter, the cut-off idea is developed as an additional test for preference inconsistencies.

An additional idea explored here, is that it is also possible to identify respondents who violate their stated cut-offs by large enough amounts to suggest the presence of *hypothetical market bias*. For instance, a respondent may say that they would never pay more than $200 for a trip, but subsequently select a choice option with a cost of $300. An interesting exercise is then to compare choice model estimates under different assumptions about what constitutes a "large" violation of this stated cut-off. This could be a way of moderating hypothetical market bias in stated choice data that has yet to be explored in the literature.

Choice modelling assumes that respondents make rational choices that maximise their utility (equation 5.5 below). Following the theoretical framework used by Swait (2001), a typical formulation of the choice problem is:

$$\begin{aligned} &[Max] \quad U = \sum_{i \in C} \delta_i U(X_i) \\ &s.t. \quad \sum_{i \in C} \delta_i = 1; \quad \sum_{i \in C} \delta_i p_i \le Y; \quad \delta \in \{0,1\} \quad \forall i \in C. \end{aligned} \tag{5.5}$$

where U is the utility, C is the set of substitute alternatives, δ_i is a choice indicator equal to 1 if respondents choose alternative *i* and 0 otherwise, p_i is the price of alternative *i,* X_i is the *k* dimensional vector that describes the good, and Y is respondents' income.

Under the above conditions, a respondent *n* is assumed to consistently evaluate all the attribute tradeoffs between alternatives and choose only one alternative in each choice set. According to (Ford et al. 1989) , respondents may use "non-compensatory" decision rules to simplify these choices. Thus in reality, other decisions rules may be used by respondents in the choice exercise depending on factors such as the difficulty of the choice task, their knowledge about the goods under study, and the environmental and social conditions in which the choice is carried out.

A cut-off is a non-compensatory choice heuristic intended to simplify choices in a world of costly decision-making. This suggests that even with perfect information, an individual has a problem in processing the costs and benefits of all of the alternatives e.g. individuals are unwilling or unable to maximise utility by considering all possible choices and their pay-offs, relative to their budget constraint. Thus, simplifying strategies are adopted due to the costs of information processing (Svenson 1996).

Swait notes that cut-off's may be thought of as "hard" or "soft". Hard cut-offs are attribute levels that must be reached before a choice is allowed; an example of strategy involving an alternative that must meet the cut-off for all attributes is known as conjunctive satisficing), as well as elimination-by-aspects (Manari & Sinha 1989; Tversky 1972). However, cut-offs need not be hard: consumers can choose to violate them if the benefits are great enough (that is, once the opportunity costs of self-imposed cut-offs are recognised).

The inclusion of hard cut-offs into the choice modelling framework requires adding additional constraints that impede respondents from choosing an alternative that violates any of their stated cut-offs. For example, if respondent *n* stated that he would not pay more than *x* (the hard cut-off value), the utility maximization process only considers all the alternatives with a monetary value less than x[24]. Equation (5.5) is then rewritten as:

$$\begin{aligned} &[Max] \quad U = \sum_{i \in C} \delta_i U(X_i) \\ &s.t. \quad \sum_{i \in C} \delta_i = 1; \ \sum_{i \in C} \delta_i p_i \le Y; \ \ \delta \in \{0,1\} \ \ \forall i \in C; \\ &\delta_i \theta^L \le \delta_i Z_i \ ; \ \delta_i \theta^U \ge \delta_i Z_i \ ; \quad \delta \in \{0,1\} \ \ \forall i \in C. \end{aligned} \tag{5.6}$$

where $\theta^L = [l_1\ l_2\ \ldots\ l_k\ l_p]'$ is the vector of lower limits and price (l_p) cut-offs; and $\theta^U = [u_1\ u_2\ \ldots\ u_k\ u_p]'$ is the vector of upper limits and price (u_p) cut-offs; $Z_i = [X_i\ p_i]'$.

Soft cut-offs, proposed by Huber and Klein (1991) and Sethuraman (1994) are incorporated into a discrete choice setting by Swait (2001) and is also the method employed here. Since soft cut-offs allow for a linear piece-wise utility function to be estimated, they can represent non-linearity[25] and discontinuities in the deterministic portion of the utility function. Swait

[24] The same would apply in case of a lower limit cut-offs, for instance if respondent declares he/she would not select any alternative cheaper than *x*.

[25] Non-linearity refers to a kink in the consumer's utility curve for a good as a result of the cut-off being violated. Under such a soft cut-off scenario, a good still might be chosen over competing goods if the benefits of all of the other attributes provide sufficient compensation to overcome the disbenefit of cut-off violation a given attribute.

(2001) demonstrated for his data on rental car choices, that use of a soft cut-offs model would provide a better fit to stated choice data; this was also found by Amaya-Amaya and Ryan (2006) for two stated choice data sets for health care options. Swait (2001) also notes that ignoring the presence of soft cut-offs, when these are in fact present in peoples' decision making, will lead to biased estimates of marginal utilities.

Cut-offs are made soft by the addition of a penalty, associated with the violation, to the utility function, where the marginal disutility of violating the lower cut-off for attribute k (k=1...K+1) is denoted by w_k; v_k is the marginal disutility of violating the upper cut-off for attribute k (k=1...K+1); λ_{ik} is a cut-off constraint variable for the lower limit cut-offs and κ_{ik} is a cut-off constraint variable for the upper limit cut-offs (5.7):

$$
\begin{aligned}
&[Max] \quad U = \sum_{i \in C} \delta_i U(X_i) + \sum_{i \in C} \sum_k \delta_i (w_k \lambda_{ik} + v_k \kappa_{ik}) \\
&s.t. \quad \sum_{i \in C} \delta_i = 1; \quad \sum_{i \in C} \delta_i p_i \le Y; \quad \delta \in \{0,1\} \quad \forall i \in C; \\
&\delta_i (\theta^L - Z_i) - \lambda_i \le 0 \qquad \delta \in \{0,1\} \quad \forall i \in C; \\
&\delta_i (Z_i - \theta^U) - \kappa_i \le 0 \qquad \delta \in \{0,1\} \quad \forall i \in C; \\
&\lambda_i \ge 0; \kappa_i \ge 0; \quad \forall i \in C.
\end{aligned}
\tag{5.7}
$$

Where a choice alternative satisfies all cut-offs, the optimal solution has all λ_{ik} and κ_{ik} equal to zero, thus the utility maximization problems reduces to equation (5). Coding of the cut-offs constraint variables is a straight forward exercise. For quantitative attributes $\lambda_{ik} = \max(0, \theta^L_k - Z_{ik})$, $\kappa_{ik} = \max(0, Z_{ik} - \theta^U_k)$ where (k=1...K+1); for qualitative attributes λ_{ik} and κ_{ik} are equal to 1 or 0 depending if the stated cut-offs have been violated or not.

In this model specification the marginal effect of each attribute will be affected by the disutility of cut-offs violation (under linear utility function) so that:

$$\frac{\partial U_i}{\partial Z_{ik}} = \begin{cases} \beta_k - w_k \ \ if \ \ Z_{ik} < \theta_k^L \\ \beta_k \qquad if \ \theta_k^L \le Z_{ik} \le \theta_k^U \\ \beta_k + v_k \ \ if \ \ Z_{ik} > \theta_k^U \end{cases} \tag{5.8}$$

This modelling framework is able to represent combinations of compensatory, conjunctive and disjunctive choice strategies (Swait, 2001). For example if a respondent holds pure disjunctive behaviour, an alternative will never be chosen where the **price** level is above his stated upper cut-offs, so v_k penalty for that attribute will tend to ∞ and all other taste and penalty weights will be zero. Similarly, pure conjunctive behaviour, where **all** the chosen alternative must meet the requirement for all attribute cut-offs, can be captured by simply having the w_k and v_k go to $\pm \infty$.

Attribute cut-offs can also be used as a way to reduce hypothetical market bias. Since choice experiment data may over-state absolute WTP values (Harrison 2006), this is an important issue in stated preference surveys. Hypothetical market bias can happen because respondents do not fully understand the choice task or because they do not act as if they had to pay the amount attached to each alternative[26]. In both cases estimated parameters are potentially biased as the model specification of equation (5.7) assumes, i) that the penalty component of the objective function is valid everywhere outside the "feasible" region of an attribute and ii) the "feasible" region of an attribute is not defined. Using cut-offs to test for hypothetical market bias may be done by specifying "hard" cut-offs constraints e.g. when respondents violate their upper price stated cut-offs by more than a specified value (the "feasible" region

[26] This could be particularly true for "tourist preferences" where respondents know that they would not return to the same area again, but think that "higher fees" would contribute to improve the quality of the good (natural parks, conservation of historical buildings, biodiversity, etc.). However in this model application it is unlikely as only 5.8% of respondents had previously visited Rwanda, implying a low likelihood of repeat visits in the future.

of the attribute). In this case how the value was determined post exercise by the analyst is discussed later.

In practice this "hard" constraint is usually satisfied in stated choice studies, where the cost attached to the alternative often represents only a small part of respondents' income. The approach is beneficial due to survey time and budget constraints where the analyst is often unable to collect all the data needed to calculate the respondent' disposable income. An additional survey constraint is that the analyst cannot read the respondents mind to evaluate the maximum proportion of income he/she will dedicate for the good under study. However, this information *is* revealed by the upper price cut-off, as a respondent knows their own personal disposable income and how much they are willing to pay for any good.

For example if we focus on a price attribute, if respondents *n* declared that they are unwilling to pay more than $100 for an alternative, the "soft" cut-offs approach would actually allow a choice as rational even if it were higher than the stated cut-off for the price attribute e.g. a choice of $120 was made. This is allowable as the model assumes the alternative offers the respondent some compensating features conferring greater benefits than the marginal cost above the cut-off. However, as indicated previously this can only be true up to a specific level of cut- off violation. In this study, under the specification used in equations (5.5) to (5.7) it is achieved by stipulating that the price attribute of the chosen alternative is not greater than a given proportion of the respondents stated cut-off. This constraint can then be added to the maximization problem where γ is an exogenous value set by the analyst. This value represents the amount of the violation (as percentage relative to upper price cut-off) that the *analyst* is willing to accept (5.9);

$$
\begin{aligned}
&[Max]\ \ U = \sum_{i \in C} \delta_i U(X_i) + \sum_{i \in C} \sum_{k} \delta_i (w_k \lambda_{ik} + v_k \kappa_{ik}) \\
&s.t.\quad \sum_{i \in C} \delta_i = 1;\ \ \sum_{i \in C} \delta_i p_i \le Y;\quad \delta \in \{0,1\}\quad \forall i \in C; \\
&\delta_i (\theta^L - Z_i) - \lambda_i \le 0 \qquad \delta \in \{0,1\}\quad \forall i \in C; \\
&\delta_i (Z_i - \theta^U) - \kappa_i \le 0 \qquad \delta \in \{0,1\}\quad \forall i \in C; \\
&\delta_i \kappa_{ip} \le \gamma\, \theta_p^U \quad \forall i \in C \qquad \gamma \in R^+ \\
&\lambda_i \ge 0;\ \ \kappa_i \ge 0 \quad \forall i \in C;
\end{aligned}
\tag{5.9}
$$

Thus under the soft cut-off approach responses can be coded as having violated the constraints when the ratio κ_{ip} / θ^U_p is greater than the γ value e.g., the price violation is too large with respect to what can be considered "acceptable". They can then can be either excluded by the analysis or recoded as having chosen the opt-out option[27].

For the case study of gorilla tourism used in this chapter, if a respondent declared that he is willing to pay as maximum excess, $100 above the current permit price and then chooses an alternative that costs $200, we have a case of cut-off violation. If the analyst is willing to accept a violation of the upper price cut-offs of 50% as maximum e.g. $150 this respondent would be treated as they had chosen the no trip choice. As was mentioned earlier what value to use as an acceptable limit is an empirical question that the analyst can address by undertaking a sensitivity analysis using different "γ values". However the issue of consumer sovereignty arises e.g. what right does the analyst have to make choices on behalf of the respondent? At one extreme this might be considered as simply trimming out undesirable data that might confound the model and making use of otherwise senseless data. On the other hand this does present a useful tool to edit choices if a rational theoretical approach is taken, the issue then is how to proceed without jeopardizing the integrity of the choices that the respondent made? In this study several "γ values" extending over the interval [0.04-1.5] were

[27] As Swait (2001) pointed out, the set C must have a null alternative (e.g. the possibility of not choosing), otherwise the utility maximization problem might not have a feasible solution for particular configuration of attributes and cut-offs.

applied. For conciseness, only models estimated using 50% and 100% of the maximum permitted upper cut-off price violations are described.

5.3 Valuing the demand for mountain gorilla eco-tourism in Rwanda

5.3.1 The application of choice experiments in developing countries

Applications of CM approaches are widespread in the developed country context, but examples of their application to value goods and services in a developing country are comparably rare and tend to be in the context of urban areas focusing on transport and sanitation (Glenk, 2006). Fewer still are applications of CM to biodiversity and environmental valuation (Christie, 2006), especially in developing countries. Recent applications have examined non-use values of coastal ecosystems (Othman et al. 2004; Seenprachawong 2003) or specific ecosystem goods and services from Tropical forests (Glenk et al. 2006; Naidoo & Adamowicz 2005; Rolfe et al. 2000).

(Naidoo & Adamowicz 2005) surveyed tourists and foreign residents in Uganda to determine how preferences for particular protected areas are formed. Tourists demand for elevated biodiversity levels (increased numbers of bird species seen) were evaluated relative to other protected areas attributes. Results showed that as the number of bird species increased, tourist's willingness to pay also increased, independent of all other factors. This is an important study as it is to our knowledge the first to explicitly value tourists' preferences for biodiversity conservation and is also in a developing country context.

A study in Indonesia by Glenk (2006) estimated local peoples values for rattan availability, water supply for irrigation, population size of game mammals as well as different methods of coco cultivation along a shade tree gradient. While on average willingness to pay for the maintenance of the resource base was found for the first three attributes, respondents had preferences for more intensive ways of coco cultivation. The finding by Glenk (2006)

indicates an interesting conflict in the choices that an individual has to make. Utility, as it is comprised of different attribute benefits, may contain attributes that fundamentally conflict to some extent e.g. that while preferences for biodiversity conservation and environmental attributes are important to people so is coco cultivation which has a negative impact on biodiversity and that to some extent individuals must make trade offs between the levels of utility derived from different attributes.

Further to the findings by Glenk (2006) Rolfe et al 2000 conducetd a study of Australinas values towards tropical forest conservation in Vanuatu.

5.3.2 Conservation, tourism and economic development

The Virunga mountain gorilla (*Gorilla beringei beringei*) is a highly endangered African ape subspecies, with a total estimated population of 380 existing only in the Virunga Conservation Area encompassing Rwanda, Democratic Republic of Congo and Uganda (Fawcett et al. 2004; Homsy 1999). The distribution of the Virunga mountain gorillas is limited to an approximate area of 447 km^2, which encompasses the *Mgahinga Gorilla National Park* of Uganda, the *Parc National des Volcans* of Rwanda and the *Mikeno* sector of the *Parc National des Virunga* of the Democratic Republic of Congo. The current population size of 380 individuals represents a 17% increase since in 1989, when a complete census estimated 324 individuals (Gray et al. 2003).

The Virunga mountain gorilla population represents an isolated island population in an upland area surrounded by populations some of the highest human densities found on the African continent (some areas reach 820 people per km^2) with extremely poor, agricultural-based local economies (Plumptre et al. 2004). As such, these gorillas are and will continue to be severely threatened by anthropogenic disturbance, such as agricultural conversion and illegal extraction of resources, for example, snare setting for smaller mammals that entrap gorillas.

While these gorillas are no longer hunted for their trophies in this region, they are however, the focus of illegal animal trafficking. A current threat in the Virunga occurs when members of a group are killed and wounded (with the group sometimes disintegrating as a result) in an effort to trap infants for the black market. In 2002, three separate incidents accounted for the death of at least six adults and three infants. In 2004, yet another infant mountain gorilla was confiscated, suggesting that a Virunga gorilla group suffered at the hands of poachers.

Despite the anthropological threats, the direct poaching, and insecurity in both areas related to the 1994 Rwandan genocide and the subsequent Congolese civil wars that began in 1996 and are now just coming to an end, the documented increase in the Virunga population since 1989 can be attributed to one important factor. These populations are located in National Parks with well-developed protection and enforcement programs supported by a plethora of international conservation organizations, first initiated by Dian Fossey and her efforts to focus world attention on the plight of mountain gorillas.

Early conservationist's precautionary approach to tourism with the mountain gorillas, tourist visits have been shown to provide much needed finance for the protection and management of the gorillas and their habitat. Tourism is now an established part of the conservation strategy for the mountain gorillas alongside law enforcement and protection programs. Importantly the economic benefits realized from gorilla tourism and its central focus of all tourism activities in the Virunga has also brought much needed political will to support conservation activities in the national park.

Given the current economic impact of gorilla tourism in Rwanda and its potential in DRC, it is critical to consider the economic parameters underlying these activities, both from the point of view of local stakeholders (communities, businesses and the parks) as well as the market forces that sustain these income streams. With respect to stakeholders, the approach of

integrating conservation with local community development projects through integrated conservation and development projects (ICDP) is now a standard sustainable development methodology. It is often assumed that ICDP will result in the conservation of natural resources, while at the same time leading to benefits for local communities who may forgo less environmentally friendly activities (Barrett & Arcese 1995). If ecotourism as an ICDP initiative is to be an effective means of conserving biodiversity, tourists' behavior must lead firstly to elevated revenues for areas rich in biodiversity and secondly an economic incentive to those who control the fate of the protected area

This is a critical period for mountain gorilla tourism. Because security has returned to Rwanda and this is now clearly perceived by the global market, the current level of permits and visits is often full and there are distinct pressures to increase revenue. This is often viewed as a simple exercise in expanding tourism to other gorilla groups. Similarly, in DRC, now emerging from civil war, there is an intense effort to resurrect the gorilla tourism industry, but little data is available to design a sustainable planning approach. There is little doubt that tourism provides a useful tool to finance the management of protected areas, but financial considerations may tempt conservation managers to put short-term profit before long term sustainable gain. Fortunately current limits to exploitation are set with due regard for underlying ecological constraints (Fawcett et al. 2004; Homsy 1999). Currently these limits are defined as 8 tourists per tourism group, for one hour, once per day. This gives a maximum quota of permits for Rwanda of 20,440 based on full visitation for the current 7 tourism groups 365 days per year. However, without economic data it is difficult for managers to set price structures to optimise returns, within the ecological constraints. One of the few direct means for the park authority to increase revenue is to increase permit prices for gorilla visit.

With respect to the tourism market, there is little evidence to suggest that tourists are interested in biodiversity and community development *per se*, rather than seeing charismatic flagship species such as the mountain gorilla (Kontoleon & Swanson 2003; Loomis & White 1996; Naidoo & Adamowicz 2005) and experiencing an adventure with attractive accommodation and spectacular landscapes. Tourists' variable motives for visiting tropical forests can make the reliance on nature-based tourism for financing conservation a risky venture, if they are not particularly interested in the conservation of biodiversity and especially in the light or regional insecurity.

Quantitative assessments of the impacts of ICDP to either conservation or local human welfare are few (Balmford et al. 2002; Johannesesn 2005; Salafsky et al. 2001; Wunder 2000) fewer still are quantitative assessment of specific ecotourism programs within the ICDP context (Barnes et al. 2002; Naidoo & Adamowicz 2005; Wunder 2000). Whilst there have been several endeavours to assess values for biodiversity (Christie et al. 2006)) few have tried to assess how such values for biodiversity are a function of demand for ecotourism (Naidoo & Adamowicz 2005). To our knowledge none have specifically tried to quantitatively assess the value of community benefits from tourism as a function of demand for ecotourism. This study presents a unique insight in to tourist's values for both biodiversity conservation and community benefits from and ecotourism program as functions of demand for an eco-tourism experience.

5.3.3 Structure of the Rwanda tourism industry

Tourism in Rwanda has been recently liberalised under government reforms of the past decade. The GOR embarked upon an ambitious program of restructuring including the divestment of hotels from government ownership and operation, the decentralisation of the state tourism and wildlife agency (ORTPN)[28] from a government department to a semi autonomous agency. Other liberalised policies include tax holidays fro the tourism sector, a

[28] ORTPN – Office Rwandaise du Tourism et des Parks Natoinaux

framework to encourage international private sector investment MINICOM (Ministry of Commerce) is responsible for industry and commerce under which tourism and national parks fall. MINICOM is responsible for developing the broad policy guidelines under which tourism and the national parks are managed. ORTPN is the parastatal[29] agency responsible for the management and implementation of tourism and park management policy as well as the management and development of policies to promote tourism within the national parks. Importantly they manage the framework within which the private sector operates.

Many private tour operators both international and local exist in Rwanda. These range from operators with both vehicles and guides and a larger staff offering a complete package to individual operators with just themselves as a driver guide with one vehicle offering to organize a more home grown package for independent travellers. I addition there are businesses offering self drive vehicles. There are many privately owned and operated hotels ranging from international operations such as the Serena Hotels chain to small family run guest houses.

5.3.4 Price policy issues

Under the newly liberalized arrangements ORTPN is faced with the challenge of maximizing the revenue obtained from park entry permits to finance management and conservation activities. The private sector also wishes to maximize revenues from the provision of tour services and accommodation. In the context of eco-tourism the public (local communities also wish to maximise their benefits from tourism, indeed ORTPN has a responsibility to ensure the framework conditions are in place to allow this to happen as sharing the benefits from tourism with local communities is an explicit policy objective). Tourism growth in Rwanda has been strong in the last two years. In the main season (July to September) almost all

[29] A parastatal organisation is one that is government owned but is given a more liberal management mandate than the civil service. Often this means the opportunity to be self-financing through private sector business activities or to be able to receive finances from other non-government sources. These are often used to promote more responsive and demand orientated public services than the civil service might be able to deliver.

available permits for gorillas were purchased. Despite a massive gorilla permit price increase in 2004 from $250 to $375 no discernable impact on permit sales was experienced, in fact tourism numbers rose (ORTPN, 2007).

An important dynamic in the tourism market is that tourists may have little incentive to stay in Rwanda beyond their gorilla visit. Currently consumption of alternative park activities is low (ORTPN, 2007). Relatively few visitors choose to climb the volcanoes or go on nature walks. Anecdotal evidence from the focus group discussions points toward tourists view the current price of these alternative activities as too high. Without appealing alternative activities the incentive for visitors to stay additional nights around the PNV or indeed in Rwanda is low. This affects the private sector to maximize their income, as they are able to sell fewer bed nights and corresponding services the shorter the visitors' stay in country.

Another component of price structure is that revenue from the parks is shared with local communities. Currently 5 % of revenue from tourism sales goes into a community revenue sharing fund to provide development assistance to communities who live adjacent to the national park. This is to provide an incentive for local communities to not illegally use the park and endanger wildlife. However communities could also benefit from providing their own tourism products outside of the NP such as cultural events. However the willingness of consumers to pay increased permit prices to provide more benefits to local communities is not known.

5.3.5 Park Based Tourism

Understanding some of the details and context for the gorilla tourism experience and tourism activities in general are important in proving background to how the initial identification and final selection of attributes for the CE presented later were finally made.

Prices for activities vary according to residency status and are structured according to a park entry fee plus a permit fee for an individual activity (Table 5.1). The park entry fee does not actually give access to the park as every possible activity requires a permit and no visitor may enter the park without a guide and an escort of at least one park ranger. A break down of prices for different activities is given below.

Table 5.1 Schedule of park entry fees at time of study (still current as of Aug 2008)

Activity	**Price**		
	Non Resident Foreigner (US$)	**Resident Foreigner (US$)**	**Rwandan National (Rwandan Francs)**
Park Entry Fee	25	25	2000
Gorilla Trekking	350	175	8000
Golden Monkey	75	40	2500
Nature Walk	30	20	1500
Karisoke Trek	50	40	2000
Climb Karisimbi	150	100	5000
Climb Muhabura	-	-	-
Climb Visoke	50	40	2000

5.3.5 a) Gorilla Trekking

The visit to see the mountain gorillas (*Gorilla berengi berengi*) in Rwanda ranks amongst the worlds top wildlife experiences. Tourists have a chance to get within close proximity of habituated wild gorillas for a period of one hour. The group size of tourists is currently restricted to eight to minimize the disturbance to the gorilla group e.g. so the gorilla group does not feel threatened by a large group of humans.

During the allotted hour, tourists have the opportunity to witness the complex social dynamics and behaviour of the mountain gorilla in its natural environment. Beyond a minimum distance requirement of 7m[30] and some basic guidelines about personal behaviour around the gorillas

[30] There are close physiological similarities between mountain gorillas (as well as other great apes) and humans. This means that the same communicable diseases that can transfer between humans can also be transmitted between humans and gorillas. Of special significance from a conservation perspective are respiratory infections and their transfer from humans to gorillas. Periodically there are outbreaks of respiratory disease in the gorilla groups and occasionally fatalities as a result. There is a risk that visitors may transfer such infections to gorillas. Whilst there is a policy that visitors expressing symptoms of respiratory infection must not visit the gorillas (they receive a refund of the full permit price), there is the risk that people with no obvious signs of infection but with

(no loud talking or sudden movements etc.), visitors enjoy unrestrained access with no man made barriers between them and the animals. The visit usually comprises of an initial contact with the group upon which the visitors will take up a strategically located position from which to watch the gorillas. If the gorillas move then the visitors are also able to move, in a respectful manner, amongst the vegetation to maintain a reasonable view. Visitors are allowed to take as many photographs or as much film footage as they please, without the use of flashguns or other lighting aids.

The trekking day starts at 0700HRS at the park HQ in Kinigi. Visitors are organized into groups of eight and allocated a tourist group to visit (there were five tourism groups during the study period). Park Guides then give a debriefing about organization and the trekking experience. Visitors then have to depart by car to a drop off point to start the trek. The time taken from the drop off point to find the gorilla group varies considerably from 15 minutes to 4 or 5 hours. Normally trekking starts at around 0800HRS and tour groups are back at the park HQ by 1400HRS to receive their certificate of viewing the mountain gorillas as a souvenir. Visitors must be out of the park before dark therefore there is a cut off time of 1500HRS after which if the tour group has not made it to the gorilla group they must return to the park boundary. In such cases no refund is made, however availability and time permitting, visitors may be given another chance to view in the following days.

5.3.5 b) Accommodation and services

Visitors to the gorillas have four main centres from which to base themselves for gorilla trekking. Until recently there was only average quality accommodation near the park and tourists would often stay in hotels in Kigali, nearly 3 hours drive from the park HQ. Local developments have seen new hotels being constructed or the refurbishment of existing ones at two localities of Kinigi and Ruhenegri. Kinigi is where the park HQ is located and Ruhenegri is the large provincial town only 10km away. At the time of this survey The road from

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communicable diseases may slip through any screening. It has been deemed by veterinary experts that maintaining a distance of 7m from gorillas significantly reduces the risk of cross-infection.

Ruhenegri to Kinigi was extremely rutted and pot holed so the journey took a bone shaking 30 to 40 minutes to complete, and necessitates an early start to make the 0700HRS rendezvous at the park HQ. Recently the road was tarmaced and the same journey now only takes twenty minutes.

5.3.6 Developing the Choice Experiment Attribute list

5.3.6 a) Focus Group Interviews

During August 2005 Focus group interviews were held to identify the most important attributes and other aspects of their trip to Rwanda and the PNV. The sample was purposive to include focus groups from different market niches. The niches identified are characterized as high middle and low and are outlined in the Table 5.2 below.

Table 5.2 Market niche characteristics

Market Niche	**Characteristics**
High	Clients staying in more expensive accommodation (us$65 per night per person or more) on organized tours or travelling independently
Middle	Clients staying in mid range accommodation (USD20 to 65 per person per night) on organized tours or travelling independently
Low	Clients staying in inexpensive accommodation or camping (less than US$20 per person per night, on organized tours (overlanders) or travelling independently.

Focus group sizes varied from 2 to 8 individuals. Respondents were from different European and North American countries as well as one respondent from Zimbabwe. A self-administered questionnaire was delivered to individuals in the focus group after which a semi-structured interview with the group was conducted. Questions were asked about the attributes and their importance as well as other issues about preferences and interests in tourism. The attributes presented in the questionnaire are listed in Table 5.3 below. Attributes that influence consumer welfare regarding their trip to visit the gorillas fall into two main areas those related to the gorilla trek and those more generally associated with the trip to Rwanda itself.

Table 5.3 List of attributes generated from focus group discussions

Attribute	Description
Gorilla Visit	
Tour Group Size	The number of tourists in a group. Limited to a maximum of 8 for conservation reasons
Length of trek	The amount of time taken to reach the gorillas. Some visitor feel a bit cheated if they reach the gorilla group quickly as experiencing the forest is an important part of the experience.
Proximity to gorilla group	The closeness to which the individual can get to the gorillas, up to the 7m boundary
Conservation impact	The impact of tourism on the integrity (behaviour and ecology) of the gorillas and other biodiversity
General	
Community Benefit	Currently 20% of gate gross park revenues is restricted towards financing development activities in communities adjacent to the national park. To some visitors it is important that local communities receive some benefits from the tourism activities.
Standard of accommodation	Accommodation standard for tourists varies greatly between low standard accommodation in local lodges and guesthouses to the high-end safari camps; price is the main factor in consumer choice.
Accommodation Proximity to Park	This relates to the time travelled in the morning to get to the park for the 0700HRS meeting to be allocated gorilla groups. The further away the earlier in the morning you have to start. Also the road between Ruhengeri and Kinigi is very bumpy and not pleasant to travel along.
Alternative Activities	It is not only important that there are alternative activities, but that they are priced appropriately. Many visitors feel that the current prices are too high.
Marginal Price Increase on permit costs	$25, $50, $100, $150

Tourist Attitudes toward attributes

Table 5.4 below presents the attitudes of the different niches towards the different attributes previously identified. The table presents the attitudes according to a relative scale of importance (1=Low; 2=Medium; 3=High)

Table 5.4 Importance of trip attributes by niche group

Attribute	**Market Niche**		
	High	**Middle**	**Low**
Tour Group Size	3	3	3
Length of trek	2	2	2
Proximity to gorilla group	3	3	3
Conservation Impact	3	3	3
Community Benefit	2	2	2
Standard of accommodation	3	3	2
Accommodation Proximity to Park	1	1	1
Alternative Activities	2	2	1
Marginal Price Increase on permit costs	2	2	2

Tour group size: The policy is that 8 is a maximum number of visitors. It seemed preferable that the group size was kept small, or perhaps reduced.

Price of Gorilla trek: In general the current price of 375 was thought acceptable. In most cases tourists were willing to pay more, especially if this meant more benefits towards conservation and community development.

Length of gorilla trek: Whilst the hour with the gorillas is fixed, the time/distance to get to them varies greatly. There was a variable response in that some preferred the short trek and others felt a bit cheated that they didn't get to see more of the park. This was mainly dependent on physical fitness.

Conservation impact: Whilst people are keen to see the gorillas they also seemed sensitive to the potential impact on their well being, and were disinclined to visit the gorillas should the

visit actually cause unwarranted disturbance to their well being. This also relates to trek group size as the smaller the group the lower the disturbance on gorilla behaviour.

Community benefit: All were concerned that communities were able to benefit economically from tourism. Of concern were the social impacts from tourism and the need to control them

Price of alternative activities: General consensus was that treks up the volcanoes, visits to the golden monkeys and Dian Fossey's Tomb were over priced. $50 (US) seemed to be the ball park figure. It seems that regardless of niche tourists want to feel like they are getting "value for money". Distance of accommodation from the park seemed to be of little concern.

Marginal price increase: Tourists seemed willing to pay more for the price of a gorilla permit provided that this meant there were additional benefits to conservation and communities.

With respect to benefits transfer between stakeholders, current consumption patterns (visitors staying for 1 or 2 nights) means that ORTPN benefits the most followed by the private sector then communities. The strategy would be to try to keep tourists around the PNV for 3 to 4 nights in this way the private sector and communities have a greater chance of benefiting from tourism spending. Currently there are two main bottlenecks to achieve this. Firstly from the focus groups tourists were not generally aware of the possibility of doing other activities. Secondly once they heard about the current prices $75 or more they were put off. In fact those that had heard about them and booked in advance had been given wrong information about prices e.g. that treks cost $50, and were a bit disgruntled at the $75 price tag. They indicated if they had known the price before hand they might not have opted to do the activities.

In terms of identifying which attributes to include in the choice experiment, we are presented with a range of attributes identified by the tourists themselves, both general in nature and specific to the gorilla trekking experience.

5.3.6 b) Attribute selection

The final choice of attributes (Table 5.5) was limited to those that most closely fit with the gorilla trekking experience and with the general tenants of eco tourism. Selected attributes were trek group size, length of trek, possibility of seeing other wildlife (a proxy for biodiversity value) and benefits to local community (a measure of their value for positive social impacts from tourism). The design also included an additional price parameter.

Table 5.5 Attributes and their levels

Attribute	Description	Level
Tour Group Size	The number of tourists in a group. Limited to a maximum of 8 for conservation reasons	Small-4 Medium-6 Large-8
Length of trek	The amount of time taken to reach the gorillas. Some visitor feel a bit cheated if they reach the gorilla group quickly as experiencing the forest is an important part of the experience.	Short, <1hour Medium, >1 but <3 hours Long, > 3hours
Community Benefit	Currently 20% of gate gross park revenues is restricted towards financing development activities in communities adjacent to the national park. To some visitors it is important that local communities receive some benefits from the tourism activities.	No change 10% more 20% more 30% more
Other wildlife	The ability of tourists to see other flora and fauna in the park can contribute to the richness of the experience. For some tourist this is not so important for others it can be almost as important as seeing the gorillas themselves.	High Medium Low
Permit price increase	Marginal Price Increase on gorilla trek permit and implied new total (including park entry fee)	$25 (400) $50 (425) $100 (475) $150 (525)

5.3.6 c) Designing the choice experiment and survey tool

Having identified the attributes it remains to make some decision about the design of the experiment. The number of attributes and levels were too large to accommodate in a full factorial experiment, thus an orthogonal main effects only design was opted for to reduce the number of treatment combinations required (see Appendix 3 for treatment combinations and NLOGIT code). A total of 36 treatment combinations were produced paired together to from 18 different choice sets, in two blocks of 9. Equal numbers of the blocked designs were delivered to respondents to maintain orthogonal properties of the experimental design. The

experimental design was generated by SPSS using the 'generate orthogonal design 'tool. This approach followed the procedures specified in Hensher et al (2005). In the survey a description of the choice context and the attributes were presented immediately before the choice exercise (See Appendix 4). Cut-off questions were presented both before and after the choice experiment (two different treatments) for both blocks. Thus 4 different version of the CE survey tool were generated under the 2 different treatments and 2 block design. The final survey also included a series of questions on demography and tourism inertest as a warm up prior to the choice exercise.

5.3.7 Organising and coding the data for analysis.

Effects coding was chosen as a pose to dummy coding as not only did we wish to test for non linear effects in the in the levels of the attributes but we wished to do so without confounding measurement of the base level of the attribute with the grand mean. Effects coding allows for a more flexible approach to analysis of the true utility function of each attribute (slope coefficients) as a pose to the function relative to the grand mean of the overall utility function (Hensher et al, 2005)

For a variable with a given number attribute levels *effects variables* were created equal to the number of attribute levels minus one. Thus for a variable with three levels we should create two effects variables. The variables should be coded with a -1 at the base level and with a 1 for the level relevant to the effects variable. Other levels should then be coded with a 0. The *effects variables* and their codes are shown in Table 5.6

Table 5.6 Effects variables and codes

	Variable							
Attribute Level	TGS1	TGS2	LOT1	LOT2	CB1	CB2	OW1	OW2
high	1	0	1	0	1	0	1	0
med	0	1	0	1	0	1	0	1
low	-1	-1	-1	-1	-1	-1	-1	-1

TGS – Tour Group Size; LOT – Length of Trip; CB – Community Benefit; OW – Other Wildlife

Each respondent is presented with 9 choice sets, each with 3 alternatives (including the opt out). Each alternative has 4 attributes with 3 levels per attribute. Thus every respondent will have 27 rows of data. There are 4 attributes with 3 levels and a price attribute. The 4 with three levels will result in 8 columns of variables plus an additional column for price (absolute value). Columns were included for respondent identification, profile, choice selection, alternative selected, and number of choices in set and a selection of socio economic variables.

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5.3.8 Survey results

Focus group interviews were conducted in June and July 2005, with groups of visiting tourists to identify the key attributes that visitors to the gorillas were concerned about. Collection of the survey data ran from August 2005 until January 2006. In total 426 individual respondent surveys were administered (Appendix 4), of which 419 were returned complete and useable. This represented a 98% success rate in completion. Questionnaires were developed to be self-administered. Respondents were identified at random each morning when they arrived for gorilla trekking at the national park and asked if they would participate in the survey. They were later approached in their accommodation, in and around Ruhengeri Town and Kinigi Village, post trek to fill out the questionnaires on 1) personal socio-economic and demographic characteristics, related tourism activities and interests, 2) the choice task (with nine sets/cards per respondent) and 3) the cut offs.

5.3.8.1 Demographic and tourism interest data

Nationality and residency

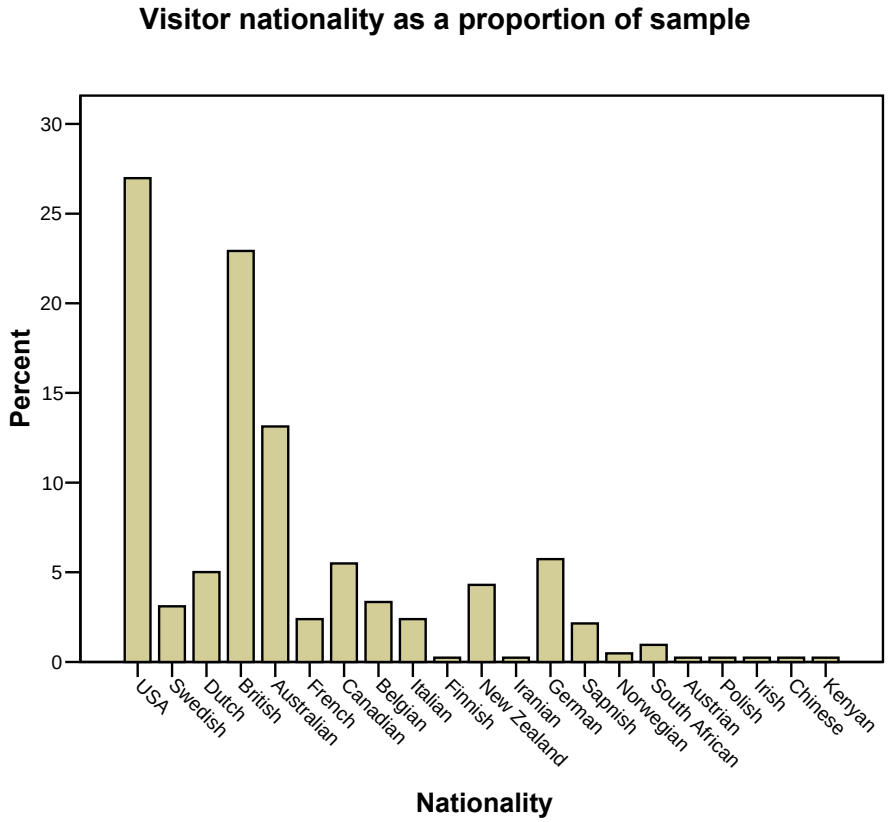

Figure 5.1 Visitor nationalities

The highest proportion of respondents were from the USA (27%), followed by the UK (22.9%), Australia (13.1), Germany (5.7%) and Canada (5.5%) (Figure 5.1)

Countries of origin were grouped into 4 global regions (North America, Europe, Australasia and Other). (Figure 5.2)

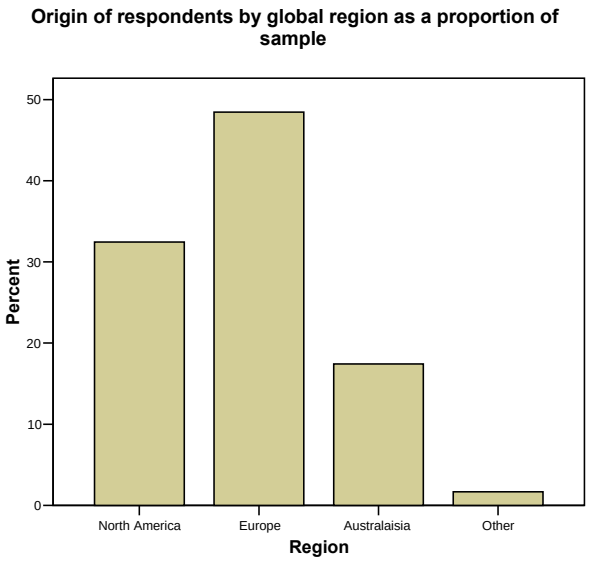

Figure 5.2 Respondent origin by global region

It was observed that in terms of regional visitors Europeans (48.4%) represented the highest proportion of respondents, followed by North America (32.5%), Australasia (17.4%) and people from other nations (1.7%). These data compare well to visitor demographic data systematically collected by ORTPN, showing that our sample is broadly representative of the tourists that visit Rwanda year round.

Demographics, income and interests

The sample of respondents was split quite evenly between men (46.1%) and women (53.9%).

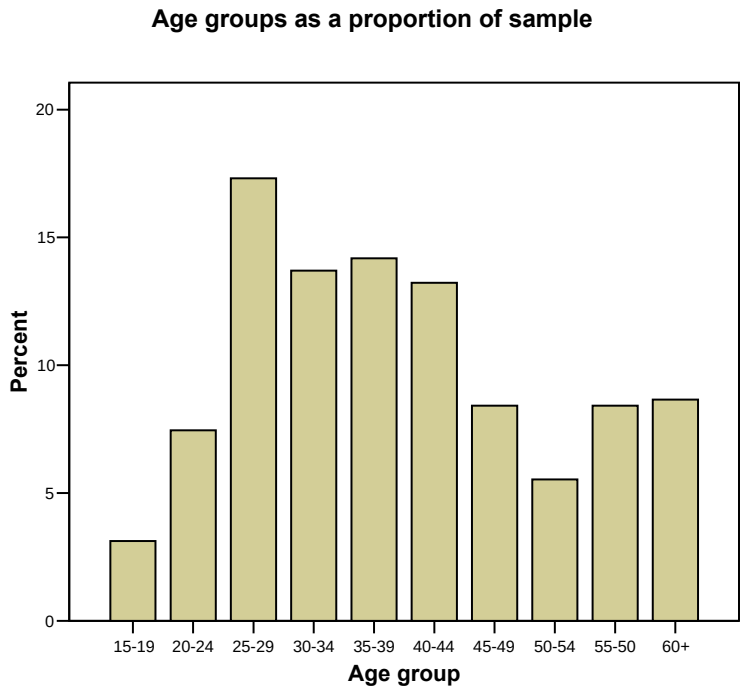

Figure 5.3 Respondent age groupings

No significant difference in the proportion of respondents belonging to different age groups was found overall or between regional groupings (Figure 5.3). However, the majority of respondents were grouped between the ages of 25 and 49 (66.8%). Whilst visitors from North America showed no significant difference in the age groups visiting, results from Europe and Australasia were slightly skewed towards younger groups.

There was also a peak in the consumers from 55-60 (8.4%) and in the 60+ (8.7%) age groups. The split between respondents gender was 46.1% male and 53.9% female the difference was not significant between income groups. Only 25.6% of respondents had children (a family)

In terms of education levels, respondents showed a high level of education with 46.9% having a university degree and additional 34.2% having a postgraduate qualification as well. This means that 81.1% of respondents had a tertiary education.

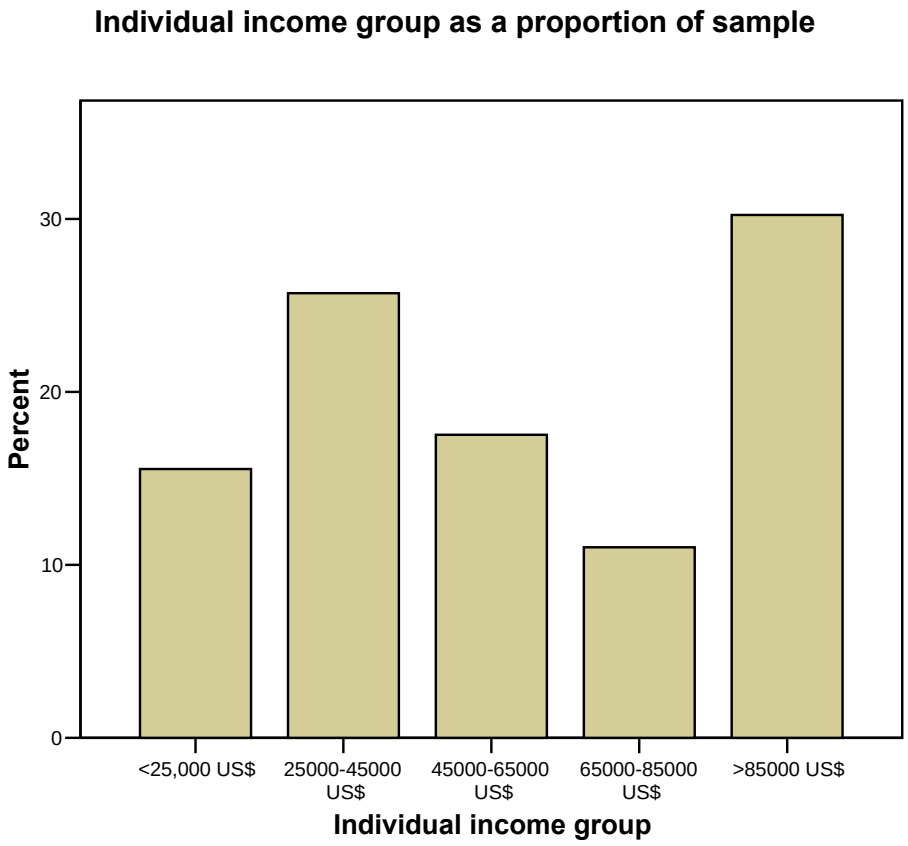

Figure 5.4 Respondent income group classifications

Respondents were asked about their individual income, interestingly there were two peaks at US$25-45,000 (46.9%) and above $85,000 (30.2%) (Figure 5.5). An OLS Regression was conducted on the relationship between income and age and level of education. Age and education level were positively related to income group (R^2=0.214, p<0.001) e.g. older and more educated people were more likely to be in a high income group.

Regional income data showed some interesting differences. Across the entire sample proportionately more visitors were in the $85,000+ p.a. group (30.4%) and the $25-45,000 p.a. group (25.9%) than other income groups, the difference was significant (χ^2= 36.438, d.f.=

12, Φ = 0.322, $p<0.001$). In the highest income group ($85,000+p.a.) visitors from North America had the highest proportion of the sample (16.5% of entire sample), followed by Europe (10.5% of entire sample). In the $25-45,000 p.a. group, Europe had the highest proportion (14.8% of entire sample)

Respondents were asked about how their interest in visiting the mountain gorillas in Rwanda had developed. The top three reasons for stimulating interest in Rwanda and the mountain gorillas were a knowledge of Dian Fossey and her work (31%), travel marketing material (21%) and natural history television programs (12.3%). Interestingly 50.6% or respondents also indicated that they took an active interest in conservation or were members of a conservation organisation.

5.3.8.2 Trip characteristics

Respondents were asked to select a category that described the mode of their travel. Overlanders are those on the large overland trucks run by international package tour companies. Back packers are those travelling independently on a low budget either individually, in pairs or small groups. Independent travellers are those travelling independently on a mid to high budget, possibly in their own vehicle. Organized tours are those organised tours characterised by mid to high end, low volume specialist tour operators.

Of the different categories of tour 41.6% of respondents were on an organized tour (the highest proportion), followed by independent travellers (28.05%) and overlanders (24.65%) (Table 5.7). In the organized tour category the proportion of the total sample in the highest income category was 16.43% of the entire sample. Respectively the second and third highest proportions of the sample were overlanders in the $ 25-45,000 p.a. group (9.07%) and Independent travellers in the $85,000 plus group (8.78%). These results were significantly different (χ^2= 32.417, d.f. = 12, Φ = 0.303, $p<0.001$).

Table 5.7 Respondent income classifications by travel class

Individual income group		Trip description			
		Overlanding	Backpacking	Independent travel	Organized tour
<25,000 US$	Count	15	7	17	16
	% of Total	4.25	1.98	4.82	4.53
25000-45000 US$	Count	32	4	22	33
	% of Total	9.07	1.13	6.23	9.35
45000-65000 US$	Count	19	6	18	19
	% of Total	5.38	1.70	5.10	5.38
65000-85000 US$	Count	6	1	11	21
	% of Total	1.70	0.28	3.12	5.95
>85000 US$	Count	15	2	31	58
	% of Total	4.25	0.57	8.78	16.43
All groups	Count	87	20	99	147
	% of Total	24.65	5.67	28.05	41.64

The mean trip length was 4.03 nights and the mode 6 nights stay (35% of respondents), there was also a peak at three nights (Figure 5.5).

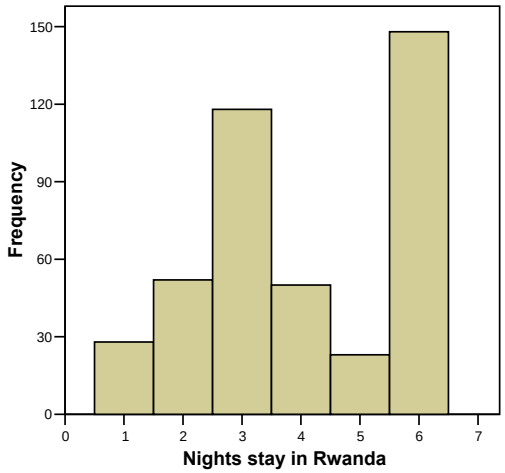

Figure 5.5 Respondent number of nights stay in Rwanda

No significant difference in trip length was observed between income groups however visitors from Europe and Australasia spent a significantly longer stay in Rwanda than visitors from North America ($F=16.477$, d.f.$= 3$, $p<0.001$).

The main purpose of respondent's trip to Rwanda was gorilla tourism (70.5%), followed by visits to family and friends then commerce (7.4%) or conferences/work shops (7.4%) 9 Table 5.2). There was no significant difference between income groups. Resident expatriates made up 2.5% of the sample. Only 5.8% of respondents had visited Rwanda before.

Respondents were asked about which other activities were undertaken and places visited in Rwanda during their trip Table 5.9.

Table 5.9 Respondent activities in Rwanda by income classification

	Income Group (% of total sample) n=406					
Activity/Place	**<25,000$ p.a.**	**25-45,000$ p.a.**	**45-65,000$ p.a.**	**65-85,000$ p.a.**	**>85,000$ p.a.**	**All income groups**
Nyungwe National Park	3.1	4.2	3.7	2	7.1	20.1
Akagera National Park	3.1	4	3.1	2	5.4	17.6
Kigali City Tour	5.4	7.1	6.5	6.2	13.8	39
Kigali Genocide Memorial	11.3	18.1	10.5	7.6	17.8	65.3
Mountain Climbing - PNV	1.1	2.5	1.4	0.6	3.1	8.7
Karisoke and Dian Fossey Tomb	0.3	3.7	1.7	1.1	2.3	9.1
Golden Monkeys	0.6	3.7	3.1	0.8	6.5	14.7
Nature Walk	1.4	1.4	1.4	0	3.4	7.6

All respondents had completed at least one trip to visit gorillas. 20.1 % of visitors indicated they had or would visit Nyungwe National Park and only 17.6% of respondents responded positively for Akagera National Park. Only 46 (10%) of respondents indicate that they would or had visited both parks. There was no significant difference between income groups or regional groups in this respect. Kigali based activities saw 65.3% of respondents visiting the Genocide Memorial and 39% taking a City Tour. In terms of PNV based alternative activities, the most popular was the Golden Monkey Trek (14.7%), followed by visiting the old

Karisoke Research Centre and the tomb of Dian Fossey (9.1%) and trekking the volcanoes (Karisimbi and Visoke; 8.7%). Only 7.6% of respondent's went on the nature trail walk.

Most activities showed no significant difference in consumption between income groups, except the Kigali city tour and visits to the golden monkeys. In both cases respondents in the highest income category ($85,000+) showed the highest proportion of consumers for the City Tour (13.8%, χ^2= 12.683, d.f. = 4, Φ = 0.189, $p<0.05$) and Golden Monkey trek (6.5%, χ^2= 11.314, d.f. = 4, Φ = 0.179, $p<0.05$).

International travel and activities

Respondents were asked about how their trip to Rwanda fitted in with travel to other countries in the region, namely Uganda, Kenya and Tanzania (Table 5.10).

Table 5.10 Respondent regional travel by income class

	Income Group (% of total sample) n=406					
Country visited	**<25,000$ p.a.**	**25-45,000$ p.a.**	**45-65,000$ p.a.**	**65-85,000$ p.a.**	**>85,000$ p.a.**	**All income groups**
Uganda	8.5	16.7	11.6	4.8	12.1	53.7
Kenya	7.3	16.4	8.8	6.8	15	54,2
Tanzania	5.9	10.5	7.6	4.5	11.0	39.5

Of those who had already or would visit a second East African country, 53.7% said Uganda, 54.2 % said Kenya and 39.5% said Tanzania. In the $25-45,000 p.a. group 16.7% would also visit Uganda and 16.4% would also visit Kenya. In the highest income group 12.1% would also visit Uganda and 15% would also visit Kenya. Only 12% of respondents visit two additional countries. In terms of other nature based activities either in Rwanda or another country on their tour, 60.1% said they were planning to or had taken part in a savannah based safari, 16.7% would visit gorilla sin Uganda, 26% would do some other type of nature trek, 17.7% were interested in bird watching and 17.2% would trek one of the major peaks in the Region e.g. Mt Kenya, Mt Kilimanjaro or the Ruwenzori). 50.7% of the respondents indicated that they had an active interest in conservation through being a member of or subscribing of a conservation or environmental group.

5.3.9 Choice Experiment and cut-off data

A total of 18 different choice sets were developed which were separated into two different randomised blocks of 9 choice sets. Cut-offs were presented both before and after the choice experiment, between formats in order to assess the impact of cut-off questions on the completion of the choice task, however no significant impacts of this were found on cut off violation or model estimation.. The combination of choice set blocks and cut off presentation lead to the development of 4 different versions of the questionnaire (Table 5.11).

Table 5.11 Number of complete surveys for choice set and cut off presentation combinations

Version	Cut-off Presentation	Choice block	Number of completed surveys
1	After choice exercise	1	106
2	Before choice exercise	1	98
3	After choice exercise	2	110
4	Before choice exercise	2	105

Cut-offs were identified as the maximum trek group size, the minimum length of trek, the maximum length of trek and the level of community benefit from tourisms receipts, maximum willingness to pay over current permit price (Table 5.12) a total of 6 cut-off parameters to be estimated.

Table 5.12 Cut-off frequencies for the sample

Cut off	Version 1	Version 2	Version 3	Version 4	All
	Count (% of total sample)	Count (% of total sample)	Count (% of total sample)	Count (% of total sample)	Count (% of total sample)
Max. people on tour/trekking group to gorilla					
1	4(0)	0(0)	0(0)	2(0.48)	2(0.48)
2	0(0)	2(0.48)	2(0.48)	1(0.24)	5(1.19)
3	3(0.72)	1(0.24)	3(0.72)	0(0)	7(1.67)
4	6(1.43)	4(0.95)	8(1.91)	8(1.91)	26(6.21)
5	7(1.67)	7(1.67)	8(1.91)	5(1.19)	27(6.44)
6	30(7.16)	40(9.55)	35(8.35)	28(6.68)	133(31.74)
7	7(1.67)	1(0.24)	4(0.95)	6(1.43)	18(4.3)
8	53(12.65)	43(10.26)	50(11.93)	55(13.13)	200(47.73)
Grand Total	106(25.3)	98(23.39)	110(26.25)	105(25.06)	419(100)
Min. hours (round trip) to trek gorillas					
SHORT	58(13.84)	44(10.5)	56(13.37)	57(13.6)	215(51.31)
MEDIUM	24(5.73)	25(5.97)	19(4.53)	21(5.01)	89(21.24)
LONG	24(5.73)	29(6.92)	35(8.35)	27(6.44)	115(27.45)
Grand Total	106(25.3)	98(23.39)	110(26.25)	105(25.06)	419(100)
Max. hours to trek gorillas					
SHORT	26(6.21)	19(4.53)	21(5.01)	18(4.3)	84(20.05)
MEDIUM	26(6.21)	27(6.44)	36(8.59)	25(5.97)	114(27.21)
LONG	(2.89)	52(12.41)	53(12.65)	62(14.8)	221(52.74)
Grand Total	106(25.3)	98(23.39)	110(26.25)	105(25.06)	419(100)
Lowest % of T.P.R to local communities					
2	1(0.24)	1(0.24)	0(0)	0(0)	2(0.48)
5	6(1.43)	10(2.39)	4(0.95)	8(1.91)	28(6.68)
10	40(9.55)	36(8.59)	44(10.5)	43(10.26)	163(38.9)
20	35(8.35)	30(7.16)	43(10.26)	28(6.68)	136(32.46)
30	20(4.77)	17(4.06)	15(3.58)	23(5.49)	75(17.9)
35	0(0)	1(0.24)	0(0)	0(0)	1(0.24)
40	0(0)	0(0)	1(0.24)	1(0.24)	2(0.48)
48	1(0.24)	0(0)	0(0)	0(0)	1(0.24)
50	2(0.48)	3(0.72)	3(0.72)	2(0.48)	10(2.39)
100	1(0.24)	0(0)	0(0)	0(0)	1(0.24)
Grand Total	106(25.3)	98(23.39)	110(26.25)	105(25.06)	419(100)
Max. additional amount above current permit price					
Mean	$95.55	Minimum	$0.00		
Standard Error	6.63	Maximum	$500.00		
Median	50				
Mode	0				

Table 5.13 shows detail on cut-off violations in terms of actual choices made. It had been hypothesised that presentation before the choice exercise may act as a 'warm up' and might

lead to lower level of violation than when presented after. No significant difference was found in the level of cut-off violation between there presentation before or after the choice exercise.

Table 5.13 Frequency of cut off violations

Version	**1 n=106**	**2 n=98**	**3 n=110**	**4 n=105**	**All n=419**
Cut off position	**After**	**Before**	**After**	**Before**	
Maximum length of trek	25	18	22	17	82
Minimum length of trek	16	13	24	26	79
Permit price	42	50	45	57	194
Community benefit	45	40	53	52	190
Tour group size	24	21	17	14	76

Numbers of violations were similar between the tour group size and maximum and minimum length of trek cut –offs e.g. around 20%. However both permit price and community benefit cut offs showed a much higher level of violation almost 50% of the sample. This may be an indication that either respondents were not understanding the choice exercise and the role of the cut offs, or that some other compensatory decision process is going on between the attributes.

5.3.9 a) Model estimations

Results are organised as follows. First, we present results from models estimated on all data without and with soft cut-offs, secondly, we consider the impacts of stipulating different values for γ (50% and 100% excess of stated price cut off), to represent alternative views as to what constitutes unacceptable hypothetical market bias. A focus on model fitting is demonstrated through analysing the impacts of applying the price cut-off parameter is adopted. The price parameter was selected to demonstrate the effects of cut off reclassification. The classical assumption being that price is the principle motivating factor in most consumption decisions; similarly we are interested in the potential changes in consumer behaviour from changes in price for a gorilla trek based on the selected attributes.

In addition price is also the most important factor from an applied policy perspective. Changes to trek price are most likely to be considered or implemented than say changes to

tour group size, level of benefits to local communities. Whilst increase of the trek group size are not allowed under the strict conservation limitations of the gorilla tourism program, reductions in the trek group size are also unlikely from the perspective of maintaining general levels of tourism in Rwanda. Given the dependence of total number of visitors to Rwanda on gorilla tourism reduction in the trek group size would affects the quota of permits available. This in turn would likely reduce the total vitiation level of tourists to Rwanda.

Increasing levels of benefits to local communities as restricted fund derived from permit sales also means that there would be less money available to the park authorities to fund other management activities. On this particular fact we wish to assess the impact of the community benefit attribute on consumer willingness to pay to understand if it would make sense to increase permit price to cover increased benefits to local communities. Other cut-off variables such as length of trek and possibilities to see other wildlife are dependant on the behaviour of the wildlife itself and thus are not directly controllable by the park authorities. Importantly the price parameter was highly likely to be violated (in almost 50% of cases, see Table 5.13) indicating that some other compensatory decision making was going on between attributes contrary to classical assumptions. Thus given the significance of price policy and the level of seemingly anomalous behaviour investigating the effects of reclassifying violations according to the price attribute cut-off seemed expedient.

As the data to not pass the Hausman Test (χ^2=9.24, d.f.=12, p>0.05, not significant) of the IIA assumption (Hausman & McFadden 1984) and to allow for preference heterogeneity, random parameter logit (RPL) models were estimated. In this form of estimation it is assumed that all the parameters are random and the individual parameters undergo a zero based t-test to establish their overall contribution to the model.

5.3.9 b) Using all data: no cut-offs versus soft cut-offs

This comparison follows the analytical approach taken by Swait (2001). Table 5.14 shows the no cut-offs results compared to the results with soft cut-offs. Model fitting improves with the application of cut-offs (r^2) and are significant at 99% but not by much. As an aside, model fit improved enormously with the application of RPL over the conditional logit. The price attribute has a positive and significant parameter in both cases, however the parameter on the upper price cut-off is not significant. This is an odd result in that apparently respondents are more likely to choose trekking options that are more expensive. It is conceivable that the price attribute was being considered as a proxy for trek quality, which could explain the wrong sign. However this is unlikely given the lengthy description of the attribute as well as the familiarity of the respondents with the trekking experience having just recently returned from their trip. This was interpreted as a good indication that choice inconsistencies lie behind the result.

Table 5.14 RPL estimates with and without cut-offs[31]

	No cut-offs		**With soft cut-offs**	
	Parameter	t-stat	Parameter	t-stat
Random parameters in utility function				
TGS	-0.129	-5.66	-0.133	-5.51
LOT1	0.200	6.21	0.157	3.55
LOT2	-0.13	-0.41	-0.139	-3.10
CB	-0.007	-2.62	-0.004	-0.84
OW1	0.197	6.12	0.192	5.92
OW2	-0.31	-0.99	-0.023	-0.74
Non-random parameters in utility function				
Constant	1.237	10.56	1.139	6.87
Price	0.003	7.87	0.003	4.71
TG cut-off			0.21	0.56
CB cut-off			-0.002	-0.42
Price cut-off			0.001	1.55
LOT cut-off 1			-0.158	-1.41
LOT cut-off 2			0.437	5.23
Standard deviations for parameter distributions				
σTGS	0.34	19.30	0.341	19.24
σLOT1	0.022	0.08	0.116	1.01
σLOT2	0.172	2.17	0.091	0.62
σCB	0.000	0.03	0.002	0.11
σOW1	0.001	0.01	0.000	0.00
σOW2	0.012	0.15	0.006	0.07
Log Lik	-3524		-3506	
Pseudo r2	0.14		0.15	
N (people, choices)	419, 3771		419, 3771	

5.3.9 c) Reclassifying inconsistent responses for different values of γ

To test for the impacts of choice inconsistencies choices that violate different values of γ were recoded in the analysis as a violation. Thus different estimates shown below retain the original number of observations as no observations were dropped, simply reclassified as stay at home. Thus model fitting improves (shown by the pseudo r^2) due to the reclassification procedure and not as a result of biases created by dropping observations from the analysis. The objective of the following analysis (results depicted in tables 5.14 to 5.16) is to assess how reclassifying γ influences not just the model fit overall, but also how the influence of cut-offs might also improve the model fit from a basic model. Thus the base model changes in each pair of comparisons as the values of γ are changed. Assessing the γ such that any choice that

[31] We used 100 replications and Halton draws.

TGS = total group size; LOT1 = length of trek between 1 and 3 hours (the reference is less than 1 hour); LOT2 = length of trek more than 3 hours; CB = community benefits OW1 = prob. of seeing other wildlife = medium (the reference is low); OW2 = prob. of seeing other wildlife : high.

The attributes TGS and price have upper cut-offs; CB has a lower cut-offs; LOT has both lower (LOT1) and Upper (LOT2) cut-offs.

violates a person's stated maximum WTP in terms of its price level by more than 50% is reclassified as a stay-at-home choice produced a considerable effect. Model fitting improved substantially both with and without cut-offs (Table 5.15).

Table 5.15 Choices violating upper price cut-off by 50% are re-classified as "stay at home" using RPL model

	No cut-offs		**With soft cut-offs**	
	Parameter	T stat	Parameter	t-stat
Random parameters in utility function				
TGS	-0.611	-13.17	-0.400	-9.20
LOT1	0.069	1.37	0.172	2.65
LOT2	0.039	0.80	-0.106	-1.67
CB	0.005	1.24	0.010	1.23
OW1	0.088	1.72	0.126	2.42
OW2	0.087	1.77	0.105	2.04
Non-random parameters in utility function				
Constant	1.46	8.68	0.856	3.58
Price	-0.009	-12.34	-0.002	-2.86
TG cut-off			-0.016	-0.31
CB cut-off			-0.006	-0.79
Price cut-off			-0.023	-12.98
LOT cut-off 1			0.019	0.12
LOT cut-off 2			0.386	3.34
Standard deviations for parameter distributions				
σTGS	0.63	16.61	0.417	13.29
σLOT1	0.228	2.72	0.163	1.56
σLOT2	0.129	0.77	0.095	0.66
σCB	0.022	2.70	0.021	2.42
σOW1	0.281	3.70	0.291	3.83
σOW2	0.093	1.03	0.113	1.16
Log Lik	-2380		-2266	
Pseudo r2	0.42		0.45	
N (people, choices)	419, 3771		419, 3771	

With no cut –offs the parameter on price becomes negative which is concurrent with what was expected e.g. marginal disutility for increasing price of a trek. In the cut-offs model both price and the price cut-off parameters are significant. Importantly the price cut-off parameter is 10 times bigger than the price coefficient. This implies a kink in the marginal disutility of higher prices above the upper soft cut-off e.g. the utility curve is not smooth. Adding soft cut-offs to this edited data set of choices produces, in itself, a significant improvement in the model's explanatory power. For example most of the cut-off t-stat values for the random parameters in the utility function have increased in level of significance on the model without cut-offs.

When a less strict rule is used for identifying hypothetical market bias (γ = 100%), so that only those choices which violate the stated price cut-off by more than 100% are re-classified as stay at home, the model fit relative to the "all data" versions does not improve so much as with γ = 50%. However, the parameter on the price attribute still becomes negative rather than positive in the no cut-offs version of the model, whilst model fit again improves when soft cut-offs are included (Table 5.16).

Table 5.16 Choices violating upper price cut-off by 100% are re-classified as "stay at home"unsing RPL model

	No cut offs		**With soft cut offs**	
	Parameter	T stat	Parameter	t-stat
Random parameters in utility function				
TGS	-0.606	-12..48	-0.458	-10.31
LOT1	0.113	2.51	0.161	2.765
LOT2	0.064	1.42	-0.115	-1.96
CB	0.001	0.27	0.005	0.647
OW1	0.107	2.33	0.131	2.82
OW2	0.073	1.66	0.079	1.74
Non-random parameters in utility function				
Constant	1.38	8.88	0.909	4.01
Price	-0.004	-6.28	0.001	1.29
TG cut-off			0.062	1.29
CB cut-off			-0.007	-0.87
Price cut-off			-0.013	-10.47
LOT cut-off 1			-0.082	-0.57
LOT cut-off 2			0.451	4.19
Standard deviations for parameter distributions				
σTGS	0.65	17.27	0.512	14.82
σLOT1	0.178	1.79	0.123	0.81
σLOT2	0.177	1.61	0.060	0.31
σCB	0.015	1.88	0.018	2.07
σOW1	0.194	2.20	0.201	2.30
σOW2	0.017	0.17	0.027	0.23
Log Lik	-2541		-2469	
Pseudo r2	0.38		0.40	
N (people, choices)	419, 3771		419, 3771	

Again, a sharp kink was observed in the marginal disutility of higher prices once the cut-off is passed. This seems logical as one might expect there to be a threshold level of tolerance, past which the selection rule will become void e.g. it exceeds the boundary of what is an

acceptable trade-off, and the fit of the model and significance of the parameters start to deteriorate.

5.3.9 d) Attribute value and preference heterogeneity in the preferred model

The best model was observed to be one with soft cut-offs where violations of the price cut-off were reclassified as "stay at home" in any case where the choice exceeded the respondents, stated price cut off by 50% (Table 5.15). Looking at this models results, it can be seen that that visitors prefer smaller tour groups in terms of the number of people in the group; prefer a length of trek between 1 and 3 hours to either shorter or longer treks; and prefer to see greater numbers of other wildlife as well as gorillas. However, there is no evidence of a significant effect for what percentage of park revenues is recycled to development activities in communities around the national park, which is surprising. In terms of preference heterogeneity, we find significant evidence of this for tour group size, seeing other wildlife, and community benefits. Interestingly this is converse to people's stated cut-offs where respondents indicated that they would on average like to see more of the park revenues going to communities.

5.3.9 e) Implicit prices

Focussing on results in Table 5.15, it is possible to examine the effects on implicit prices (marginal willingness to pay amounts) of including cut-offs in the choice model. There are four possible conditions for defining implicit prices with cut-offs:

(1) No cut-offs are violated. The implicit price for an attribute such as *tour group size (Tgs)* is equal to (- β tgs/ β price).

(2) The cut-off for any attribute is violated, but not the cut-off for price. In this case, the implicit price for *tgs* = - (β tgs + β cut-off tgs) / β price

(3) The cut-off for price is violated but not the cut-offs for the other attributes. In this case, the implicit price for *tgs* = - (β tgs)/ (β price + β cut-off price)

(4) Both sets of cut-offs are violated: Implicit price = - (β tgs + β cut-off tgs) / (β price + β cut-offs price)

Implicit prices were calculated for each of the attributes evaluated using condition 3 above, since the effect of violating the price cut-off turns is perhaps the most important for these data, and compare these to implicit prices evaluated assuming that no cut-offs are violated as in condition 1 above (Table 5.17).

Table 5.17 Implicit prices and 95% confidence intervals (US $ per person per trip)[32]

Attributes	Implicit Price Model 1	Implicit Price Model 3
TGS	-63.5	-15.3
	(-78.4; -51.3)	(- 19.6; -11.5)
LOT1	7.2	6.6
	(-2.5; 16.8)	(2.15; 11.5)
LOT2	4.1	-4.1
	(-5.3; 13.8)	(- 8.7; 0.4)
CB	0.6	0.4
	(-0.4; 1.5)	(-0.2; 1.0)
OW1	9.2	4.8
	(-1.5;19.3)	(0.9; 8.7)
OW2	9.1	4.0
	(-0.8; 18.8)	(0.1; 8.1)

The effects on the implicit prices are significant. For example, looking at tour group size, willingness to pay for a one person reduction in the number of people in the tour group falls from $63 in the no cut-offs version to $15 in the price cut-offs version. Thus mean WTP falls significantly once we take into account the soft cut-off penalty on the price of a trip. Importantly the implicit price on the community benefit attribute is never significantly different from zero. Surprisingly gorilla visitors in Rwanda do not have a high value for the community benefits of nature tourism.

5.3.9 e) Determinants of cut off violation

A question also arises regarding if social or economic characteristic might have an effect on an individuals choice regarding when cut offs are violated. A Probit model was used to determine the effects of several parameters on cut off violation at the 50% level. Only income yielded a significant relationship (Table 5.18).

[32] Model 1 corresponds to the model of table 5.15, without cut-offs; Model 3 corresponds to the model of table 5.15 with soft cut-offs, where the implicit prices are estimated considering cut-offs violations on the trip price attribute alone.

Table 5.18 Income as a detriment of cut off violation

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]
Constant (<25,000 US$)	0.448	0.180	2.487	0.013
Income Dummy 1 (25000-45000 US$)	0.702	0.249	2.823	0.005
Income Dummy 2 (45000-65000 US$)	0.577	0.268	2.152	0.031
Income Dummy 3 (65000-85000 US$)	0.500	0.309	1.621	0.105
Income Dummy 4 (>85000 US$)	0.257	0.225	1.140	0.254

n= 338, $\chi^2 = 10.157$, d.f. = 4, $p<0.05$

Dummy variables are organised in order of increasing income group. A significant relationship between cut off violation and the constant were found. In addition Income Dummy's 1 to 3 also showed a significant positive relationship with cut off violation. The highest income group however showed no significant relationship with cut off violation. Noticeably there is also a decrease in the marginal effect (coefficient value) of income on cut off violation with increasing income. From this it is apparent that higher income group individuals are less likely to violate their stated price cut off than lower income group individuals. This might be explained by visitors in lower income categories not wishing to pay any excess for the trip and having a low cut off value for price, but in reality not wanting to stay at home either thus a higher likelihood of violating their price cut off.

Surprisingly no significant difference was observed (F= 1.66, d.f.=5, p=0.142, not significant) in mean price cut off between income groups (Table 5.19).

Table 5.19 Mean price cut off by income class

Income group	N	Mean	Std. Error	Minimum	Maximum
<25,000 US$	54	115.41	23.127	0	500
25000-45000 US$	91	77.95	11.560	0	500
45000-65000 US$	62	71.71	14.045	0	450
65000-85000 US$	37	82.19	18.383	0	400
>85000 US$	105	107.42	13.188	0	500
All	419	87.89	6.270	0	500

5.4 Conclusion

5.4.1 Analytical implications

In this chapter, we have used the cut-offs approach to choice modelling to address two issues. Firstly, that respondent choice may not fit a strict compensatory model presumed by most economists. In this matter our finding somewhat similar to those of Glenk (2005) regarding trade offs between attributes. Whilst individuals indicated in their cut offs their willingness to pay for social benefits, when it came to making choices and prioritising attributes, they were unwilling to make a trade off in favour of local community benefits.

Secondly, that of hypothetical market bias, where violations of the stated price cut-off were used as a means of detecting this bias. Swait (2001) indicated that breaks in the utility function are person-specific and since the cut-offs approach is one way of dealing with heterogeneity in preferences, that *"..fit improvements over models without (cut-offs) should be, and are, striking"* (p914). Echoing Swait's findings this study also found an improvement in model fitting by incorporating cut-offs; although not to the extent found by Swait. Amaya-Amaya and Ryan (2006) also found, like Swait, that most penalty function parameters were significant, and that the size of parameter on the cut-off exceeded that on the associated attribute itself. In contrast to the former, we find that only a minority of penalty function parameters are significant (Table 5.15); but found for price that the penalty function parameter was indeed much bigger than that on the price attribute itself, and that the same relationship held for length of trek.

Overall, it would seem that the cut-offs approach is a useful way of modelling choices in a world of partially non-compensatory decision-making. We have also suggested that the approach could be useful in investigating hypothetical market bias in stated preference data. However, there is clearly an issue here of what value of γ to use in doing this, since the values we take are arbitrary. Perhaps this could be investigated by using a laboratory experiment to

estimate this parameter, by comparing real and hypothetical choices. There is also the issue of what to do with these screened choices: we recode them as representing the opt-out option, but another idea would be to delete them entirely, or perhaps even calibrate them. The consumer sovereignty issues highlighted earlier is also of concern and an obvious approach might be to have the respondent reappraise their response in light of the cut-off violation, which would be possible in face to face interviews. However a compelling advantage of the analyst enforced decision rule is that it represents, in postal or remote surveys, a method of screening for irrational responses post exercise. Finally, we note that other approaches to modelling the screening of choices (of which cut offs are but one example) include the use of fuzzy set theory (Koutsopoulos & Vythoulkas 2003) and Bayesian approaches (Gilbride & Allenby 2004).

A caveat to this study is that retrospectively gorilla tourism may not have been the ideal good for such a methodological test as it represents a unique good that is far from frequently traded. Indeed the option to opt out was not a choice that was frequently made. Fundamentally the principal reason for many in visiting Rwanda was the trek to see mountain gorillas. So contextually this may mean that the 'opt out' option was not a rational one for them to make. In effect respondents may have felt forced in to making a decision between the option A or B and having to choose the 'lesser of two evils' thus violating their cut-offs. However we must considering that the cost of the actual gorilla permit at $375 per trip does represents a good proportion of the total spend to visit Rwanda e.g. it may be as much as 20 to 30%. Generally respondents in this survey were committed nature or eco-tourists and have the options to consider other unique and charismatic species to visit such as the giant panda in China, tigers in India, or simply going on safari in other parts of Africa. In this broader context they are not making a forced choice in the sense that if they don't visit gorillas they don't have choices to do other things.

5.4.2 Conservation implications

This chapter has employed the choice experiment method to investigate the determinants of demand for nature tourism in Rwanda based on mountain gorillas. One of the most cited yet poorly quantified benefits of ecotourism is that biodiversity is a main reason why tourists visit protected areas, and hence the maintenance of critical biodiversity habitat can provide economic returns and corroborates findings by Naidoo et al (2004). As such these results are also contrary to a number of recent studies which describe the relationship between ecotourism and conservation of biodiversity as uncertain (Bookbinder *et al*., 1998; Isaacs, 2000). The results show that tourists are willing to pay for biodiversity conservation, both in terms of gorillas and for other wildlife seen during a trip. Tourists prefer to be in smaller tour groups in terms of the number of people in the group, and prefer a length of trek between 1 and 3 hours to either shorter or longer treks. These two findings also show that tourists support the eco tourism principles of minimising ecological impact, since more people taking longer trips will increase adverse ecological impacts.

In the broader context of tourism and conservation in Rwanda, international tourists that visit the mountain gorillas comprise the majority of tourists that visit the two other national parks in Rwanda. Tourists' support for biodiversity conservation provides evidence that management practices that promote species density and diversity can have an economic return. This is of particular importance in Rwanda where there are acute constraints on land due to the unusually high population density. In other sub Saharan African countries with lower population densities than Rwanda, much of the nation's biodiversity assets are found out-with of the protected area system, for example Kenya where an estimated 90% of the nation's biodiversity found on land out-with of the national parks system (Mwanjala 2005). In contrast, Rwanda shows a concentration of natural flora and fauna within the three national parks due to extensive conversion to arable or livestock agricultural systems outside these

areas. Protected areas must continue to be at the forefront of conservation efforts and nature-based tourism is the key means of paying for them.

However, we found no significant effect on tourism demand for what percentage of park revenues are recycled to enhance local community developments within the national park. Whilst respondents feel that it is right that local communities should benefit more from tourism (as shown by their stated cut off- values), they are not willing to pay for it. This is in itself no reason to abandon ICDP policies that contribute to improving local social welfare, but suggests that promoting 'revenue sharing' as a marketing device is unlikely to be effective in boosting demand. However nature-based tourism and the revenue sharing policy, remains an important tool as part of an ICDP strategy, since in principle it provides a means for local people to benefit from the public good of wildlife and habitat conservation. However, we have not here investigated how in this specific context local communities can gain the most from nature-based tourism, nor what the costs are to people living locally of a conservation policy based on protected areas.

Chapter 6:

Application of economic values to protected areas policy and management issues; a case study of Queen Elizabeth Protected Area Uganda

6.1 Introduction

This thesis has focused on developing a quantitative understanding of the values from selected protected areas in the central regions of the Albertine Rift. In chapter 3 a market price method (MPM) was used to value financial benefits to local households from protected areas in south western and western Uganda. Analysis was carried out at different levels of aggregation and according to location, income and other socio-economic factors. In chapter 4 a contingent valuation (CV) study with a provision point mechanism was used to value local peoples economic benefits from protected areas, along side a market price method MPM study and a comparison of the valuation methods was made. Chapter 5 examined the use values of international tourists for mountain gorilla eco-tourism using a choice experiment.

This chapter seeks to place some of the values derived from the empirical case studies in this thesis in a broader context to demonstrate how a better understanding of the values of protected areas as the back bone of forest and biodiversity conservation can contribute to the optimal design of protected area policies and management. The key objectives of this chapter are; 1) estimate the total economic value of a protected area under a social and financial accounting framework; 2) evaluate the costs and benefits of maintaining a protected area vs alternative land use options; and 3) draw some final conclusions based on the findings from this chapter and previous chapters to answer policy and management questions regarding socially optimal strategies to conserve biodiversity.

The analysis in this chapter is based on developing a case study using findings from this research, and other secondary data, to estimate the total economic value (TEV) of a protected

area using benefits transfer techniques. Despite the TEV conceptual model being well established few studies to date have really used it as a comprehensive approach to valuation of an environmental resource (Pagiola et al. 2004).

Apart from the valuation exercise to estimate direct values presented in chapters 3 and 4 little other data exists on which to make estimates of the broader values described in the TEV framework for Queen Elizabeth Protected Area (QEPA). In order to do this benefits transfer techniques will be used. Benefits transfer is a term adopted in economics to describe the use of secondary data on valuation estimates obtained in a particular context to estimate values in a different context (Pagiola et al. 2004). Broadly there are two different types of benefit transfer approaches value transfers and function transfers (Rosenberger & Loomis 2003). Value transfer is the direct application of original research summary findings to a different policy or site context. Function transfer entails the application of a statistical function or model from one policy context to another. This study uses a variety of value transfer techniques to estimate TEV.

Whilst there are pros and cons to both approaches (Rosenberger & Loomis 2003) it is generally accepted that benefits transfer overall can be a useful approach under certain conditions. Such conditions include that the commodity or service being valued is very similar in nature between sites, and that the populations affected should be similar in characteristics. In addition the original estimates being used must be trustworthy in order for the transfer to be significant (Barton & Mourato 2003).

Globally there are several notable cases where the TEV framework has been used to draw together a range of ecosystem service values (Adger et al. 1995; Bush et al. 2004; Falkenberg & Sepp 1999; Hatfield & Mallaret-King 2003; Howard 1995; Kramer et al. 1995; Ruitenbeek 1992; Ruitenbeek 1989). Several of these studies also include cost benefit analysis of

alternative land uses in the analysis. However the challenge for all these studies is that the different forest benefits estimated often rely on crude assumptions or secondary data to conduct the benefit transfer for some if not all of the estimates. Typically where empirical data was collected to make the estimates this was mainly limited to estimates of direct use values e.g. (Bush et al. 2004; Hatfield & Mallaret-King 2003; Howard 1995; Kramer et al. 1995; Ruitenbeek 1992; Ruitenbeek 1989). Whilst secondary data sources on tourism receipts from particular national parks or timber off-takes and revenues can be reasonably accurate and adapted to site specific conditions, other ecosystem service values can be much more prone to error and bias. For example ecological functions such as watershed, in terms of the flow of benefits to different stakeholders are not the same between sites often due to topography and also the socio-demographic and spatial distribution of people throughout the watershed. Thus making realistic adjustments of a benefit transfer a difficult task if little is known about the precise site (Bruijnzeel 2004). This aggregating up benefits from a country site to the national level is also fraught with the same problems, making national level aggregates about the contribution of a forest type to the national economy imprecise in the order of magnitudes. Many of the above limitations also apply to this study, however leaning form these earlier experiences is it possible to do more rigorous screening for relevance of value transfers and omit double counting. Thus the impact of the limitations can be reduced limitations to develop a more accurate estimate of TEV.

The valuation exercise is set in the context of international and national polices towards biodiversity conservation and contemporary management approaches widely used in Uganda and other countries in the Albertine Rift. In this case study every effort has been made to screen the values being transferred for relevance, with most coming from cases within Uganda. The purpose of the benefits transfer approach in estimating TEV is not the precision of the values estimated, but firstly to contextualise the assessment of the relative scope and magnitude of benefits which occur at different levels in the value chain. Secondly it is to

apply this information in making rational decisions for managing biodiversity in protected areas.

6.2 Assessing the implications of costs and benefits of biodiversity conservation in the Queen Elizabeth Protected Area

A case study of the Queen Elizabeth Protected Area (QEPA) in Uganda is undertaken here to better understand the scope of economic values from protected areas on the design of protected area policies in Uganda. QEPA is one of the sites surveyed in chapter 4 of this thesis. The nature and scope of local direct economic values are of key interest (Campbell & Luckert 2002) in assessing the broader framework of policies aimed at biodiversity conservation. As discussed in chapter 2, ICDP and the community conservation approaches are amongst the most prominent tools currently used to redress the inequities faced by local communities that live in close proximity to protected areas. In addition there is a well developed critique of ICDP's relative failure to achieve the twin goals of biodiversity conservation and human development. Chapter 2 reviews some of this literature and points towards the need to fully quantifying the opportunity costs at the local level, which chapters 3 and 4 subsequently do. The use of QEPA as a case study is a useful example as it is neither a particularly high nor low earning protected area in terms of park revenue unlike Bwindi in Uganda or Volcanoes National Park in Rwanda, both of which contains the world famous mountain gorillas and have high revenues. In addition the problems of managing the QEPA as a geographically expansive area that is surrounded by human habitations and bisected by a road are features common to many other parks in the Albertine Rift region. How much revenue does a protected area such as this need to collect in order to fund its management, as well as offset the losses to local communities? Where can it possibly raise the revenue? These are key questions for this and perhaps every protected area globally.

6.2.1 Location and biological significance

QEPA is found in the south-western region of Uganda, bordering the Democratic Republic of Congo (DRC) on its south-western perimeter. It includes Queen Elizabeth National Park (at 2080 km^2, it is Uganda's largest national park), buffered by the Kyambura (154 km^2) and Kigezi (265 km^2) wildlife reserves on its southern boundary. It boarders Lakes George and Edward, and includes the Kazinga channel, a number of crater lakes and a large wetland (the 250 km^2 Ramsar wetland is of international importance).

QEPA is part of a wider trans-boundary ecosystem within the Albertine Rift region of central and east Africa. The Albertine Rift includes some of the most important protected areas in the world that act to conserve Acacia woodlands, lakeshore, wetlands, grasslands, thickets, medium and high altitude afromontane forest as well as afroalpine heath and moor land. It is not only an area of high species density, but also an area of high species endemism. Within Uganda the ecosystem includes Kibale National Park, Rwenzori Mountains National Park, and in the DRC the Park National des Virunga. QEPA was designated a Biosphere reserve in 1979 and in 1961 the Uganda Institute of Ecology was founded at Mweya; the ecosystem has been intensively studied.

QEPA and the contiguous Parc National du Virunga in the DRC constitute the only fully protected parts of an ecosystem mosaic that has the world's highest known carrying capacity of large herbivorous mammals. The area has several species of special interest and concern including the threatened shoebill stork, chimpanzee and tree-climbing lions. QEPA supports a wide range of Uganda's natural habitats and landforms including grassy plains, distinctive savannah woodlands, tropical forest, wetlands, rivers, swamps, lakes and volcanic craters. The area has a greater biodiversity than any other protected area in Uganda.

6.2.3 Social change and threats to QEPA

Opened by Her Majesty Queen Elizabeth II in 1953, from whom the park takes its name, it was established by the then colonial administration. Since its establishment there have been questions over rights to access by local people who were trans-located out of the area and more recently questions by the expanding local population who have a desperate need for agricultural land, timber and NTFP products that are in the protected area.

The large mammal populations have suffered severe losses in the turbulent times since Uganda's independence in 1963. Poaching caused a sharp decline in numbers of elephant, buffalo and hippo during the mid-to-late 1970's, much of which was conducted by militia groups and the Ugandan Army of the Amin presidency (Douglas-Hamilton et al. 1980; Lamprey et al. 2003). In the early 80's, local communities increasingly encroached the Kyambura and Kigezi areas (Eltringham & Malpas 1983). By the late 80's, new found political stability in Uganda saw renewed emphasis on wildlife conservation and tourism with extensive efforts being made to rehabilitate QENP through law enforcement to control poaching and illegal uses. In addition fishing communities that were established during the periods of poor control were contained and regulated.

Despite these efforts in the late 1990's wildlife numbers had declined further still (Lamprey et al. 2003) and certain species such as elephant, buffalo and topi were particularly threatened. Human populations around the park were increasing rapidly and there was an increased demand for meat and fuel wood in rural villages as well as Kasese town. In the late 1990's a rebel insurgency in the south west (Allied Democratic Forces) meant that there was a high presence of Ugandan Army troops within and around the QEPA, further increasing the local demand for meat and fuel wood. There is little doubt that the proliferation of small arms in the area had a detrimental effect on wildlife numbers.

QEPA is a long narrow protected area with roads both bisecting it and running along the outer edges of it. The poaching problem is exacerbated by the high level of illegal access from local households to core areas of the protected area, from these public roads. In the new millennium the downward trends in wildlife population numbers seem to have reversed. The numbers of large mammals such as elephant, buffalo, hippopotamus and Uganda cob are all on the rise, although the populations still remain fragile (Lamprey, 2003). This rise in animal numbers can be principally attributed to increase security, protection and monitoring efforts in the park over the past two decades. Tourism has become one of the leading sectors of Ugandan Economy. It is the third most important source of foreign exchange earning after coffee and tea. The tourism industry is almost exclusively based on wildlife tourism and the national parks, therefore healthy populations of wildlife are essential to maintain and fulfil consumer interest.

Local communities adjacent to the QEPA are predominantly rural with subsistence peasant economies reliant on agriculture and pastoralisim as their main source of income (see chapter 4). Few jobs in market-based activities are available, although there is some commercial fishing based in communities located within QEPA and a salt works. The major town in the area is Kasesse, which is the focus for regional markets and government administration.

The QEPA headquarters is strategically located within the national park at Mweya, over looking the Kazinga channel and Lake Edward. Sub stations are located at Kyambura on the eastern side of the Kazinga channel and Ishasha in the southeast of the park, close to the boarder with the DRC. All of these stations serve as a base for tourism and for the protection and monitoring of activities with-in the park. QEPA is the most visited park in Uganda but is only the second highest earning park after Bwindi Impenetrable Forest National Park (home of the mountain gorillas).

Figure 6.1 The Queen Elizabeth Protected Area. Source: UWA QEPA Tourism Brochure

6.3 Estimating the opportunity costs to local households

Using the results from Chapter 4 on household values, it is possible to make an estimate of the total financial value of the protected area to local livelihoods. The calculation was based on the mean value per household from the protected area and the total number of households that are probable protected area users. Probable protected area users were, for the purpose of this study, identified as those households resident within parishes that share the boundary of the protected area in question. A weighted least squares regression in chapter 3 examining determinists of forest use showed distance to be an insignificant factor in determining use compared to other factors such as household size, income, and other assets in our sample population (all probable protected area users). Although QEPA was not amongst the sites

used in the analysis in Chapter 3 the general principal should apply. The aggregation presented here is just to the level of the sample population so a distance decay approach was no it adopted as the mean value of household forest income is sufficiently representative of the entire sample population under consideration. All of the households in the sample population were considered to be forest users. Therefore they are in close proximity to the protected area in terms of access. The random stratified nature of the sample of households within parishes allows us to apply the average values obtained across all households within the population of probable protected area users in order to scale up the financial values to a protected area level.

Using the 2002 census data (the most recent available), the total number of households in the LCII immediately bordering the QEPA was 40,063. This equates to the total population as per the sample frame for the market price values derived as part of the survey presented in chapter 4. The mean annual household's income from the protected area was calculated as $36.2. Therefore the total annual financial value of the entire protected area to local household's income and livelihoods is approximately $1,530,000 (40,064housholds*$36.2). It is important to note that this value is a result of illegal harvesting of resources from the park.

As was discussed in chapter 4 there is a large discrepancy between financial values estimated using household income approaches and the economic values estimated using contingent valuation approaches. The mean WTA value estimated for QEPA was $468 per households per annum. Using the same calculation as above the annual economic welfare is $18,749, 484 a figure more than 10 times the financial estimate. The classic opportunity cost approach provides an estimate of the value of a protected area based on the foregone income of the best alternative use of the area. Measuring the opportunity cost of the protected area can give the protected area manager an idea of the competitive threats to the area. In the case of potential threats from people living adjacent to a protected area, the relevant opportunity costs will be

the value of alternative land uses they may prefer, such as farming or ranching. Other interests in the area may come from pressures for industrial or urban development, mining or intensely modified recreation uses.

6.3.1 Arable agricultural income foregone from protected area land

A key opportunity cost is the benefits forgone from utilising the land in the protected area for agriculture as a comparative land use. The total area of land available for arable agriculture is comprised of the tropical high forest and woodland areas. This equates to an area of 72,026Ha. Assuming that only 50% of this land area is actually cultivable leaves 36,013Ha of useful land. 50% is a conservative assumption as there will be areas where soil conditions or rainfall is too poor to make cultivation viable. In addition those areas that would be cultivable are in a semi arid area, which probably means that output may be well below the current averages by up to 50 %.

The mean net total household income from agricultural sources (value of own produced agricultural goods consumed and sold) was $US1,384 per annum on a mean land holding of 4.01Ha. Thus the mean net total household income is $US345 per Ha multiplied by 0.5 to account for lower productivity. Over the available area, this amounts to approximately 5.8 million USD.

6.3.2 Livestock income foregone from protected area land

Data from the UBOS (2003), cited in Bush and Mwesigwa (2007) on livestock profitability in semi-arid grasslands is about $15 per Ha. The traditional livestock farming practices is extensive grazing in the grassland and bushland areas. Generally the bushland and grassland areas are semi-arid and are unsuitable for arable agriculture, unless irrigation is available. The area of bushland and grassland available in the QEPA is 114,496Ha. Thus the total net benefits foregone from livestock production are $1,717,440 per annum.

The opportunity costs calculated in this way considerably exceeds both gross revenues and community use values. Clearly this indicates that conversion to agro-pastoral use would financially be preferable than maintaining the status quo. However the calculation relies on certain assumptions that are only partially valid. It assumes that much of the land actually has a uniform development potential. Many of the high potential areas were occupied before the protected area was established so inevitably the protected area occupies land that is in some ways marginal. Second, it assumes that land is a limiting factor in the local and national economy and that if it were made available for conversion that it could be converted immediately to the same levels of productivity as other local areas.

Currently only about 30% of the potentially viable agricultural land out with the protected areas in Uganda is cultivated (Drichi 2003). Lack of exploitation of available land may be due to low levels of mechanisation e.g. peasant farming systems, climatic variables, livestock disease and in recent history the effects of war and insecurity. Current levels of agricultural production are perhaps lower than could otherwise be achieved using improved techniques (intensification through the use of fertilizers and improved soil management). In addition it assumes that conversion could happen without any other associated costs or benefits being incurred. There are potential negative impacts from changing the ecosystem functions of the protected area and their resulting downstream positive impacts on soil and water relations

6.3.3 National Level Values

6.3.3.1 Domestic Water Conservation

QEPA is an important source of water for local communities and its integrity directly affects the quality and quantity of the water available. Almost 60% of all respondents indicated that their principal source of water came from surface water sources within or emanating from QEPA.

It is possible to estimate the value of the provision of clean water by natural ecosystems to local communities by considering the cost of providing an alternative source of water should current supplies be made unavailable through the loss or degradation of the forests that sustains them. One option is to provide clean water by sinking a borehole, which obviously has a market cost. Whilst a borehole may not be appropriate in all cases, boreholes are perhaps one of the most common methods seen in Uganda for rural people to obtain a regular supply of clean domestic water.

Using figures from the IUCN (2002) study on Sango Bay, a borehole should sustain 300 people and 276 head of livestock (cow equivalents). Based on the cost of installing a borehole depreciating it over 5 years and including the costs of maintenance the average annual cost of providing a borehole was calculated to be $US293 per annum (IUCN 2002). The stages in the calculation to scale up the economic value of water services to the park adjacent communities are set out below.

Stage 1 Borehole costs for human population

Total number of individuals living adjacent to the QEPA=198,232

Number of bore holes required=661

Total cost of bore hole provision= 661*293= $193,673

Stage 2 Borehole costs for livestock

Mean number of livestock per household= 0.24

Total number of households adjacent to the QEPA= 40,063

Total livestock equivalent units= 9,615

Number of boreholes required= 9615/276 = 35

Total cost of borehole provision= 35*293= $US1025

Stage 3 Total annual value of replacement cost

Total=$203,928*60% = $US122,355 per annum

Mean per person = $US 0.62 per person per annum

Mean per household = $US 3.05 per household per annum

The total value of local level water services was calculated as $US122,355 per annum. The mean value of water provision per household in this scenario is $US0.62. This is based on 60% of the population needs. It is likely that ground water levels in the local area of the protected area would also drop for two reasons; first, the forest cover plays a role in maintaining the height of the water table and secondly, additional users of local aquifers will result in the level of the aquifer dropping to a new equilibrium level, assuming that consumption does not outweigh replenishment. Therefore existing boreholes may have to be re-sunk meaning the cost of water provision may increase. An additional assumption is that water demand will remain the same on a per household basis. The values derived in the above calculation only take in to account households in the sample frame immediately around the QEPA.

6.3.3.2 Soil fertility

The economic effects from forest loss on agriculture through soil erosion and loss of fertility are difficult to quantify as the magnitude of effects are highly variable and situation specific. This is due to a variety of environmental factors such as soil type, topography, rainfall, and human agro-ecological and demographic factors such as the type and extent of crops grown, farming practice (extensive or intensive) and population density. Calculating the economic effects is complicated by factors such as the impacts of soil loss being spread over time. None the less the impacts of declining soil fertility are real and should be factored into an estimation of the total economic value or the protected area will be undervalued.

As was established in the livelihoods survey (Chapter 3), households rely heavily on the natural forests for fuel wood. All households interviewed obtained some or all of their fuel wood from the forest. Uncontrolled over exploitation of the natural forest will result in the resource being mined, in that consumption exceeds regeneration, resulting in a decrease in the capital stock of wood. As fuel wood becomes scarce households will turn to crop residues or grass for fuel (as has already happened in Rakai District, Northern Uganda and some other parts of Uganda). The result will be a loss of crop residues and nutrients to the agricultural system. Further degradation of the soil and declining crop residues will result in the use of animal manure as fuel, should there be no other options for extensification of agriculture, the result being further decline in soil fertility.

The damage cost of the diversionary use of farm yard manure (FYM), from organic fertiliser to fuel, can be calculated by the replacement cost approach, e.g. the cost of replacing the nutrients in farm yard manure with chemical fertiliser which is available in local markets. Bush, et al (2004) calculated the replacement cost of FYM in the agricultural system at just over $157 per household per year. The average value of woodland to soil nutrient conservation is just over $160 per household per annum. This figure is comparable to other estimates for Uganda by (Nkonya et al. 2003) who calculated that 95% of farmers in their survey were taking out more nutrients from the soil than they (and nature) were putting back. By measuring how much nitrogen (N), potassium (P) and phosphorus (K) was being mined, the study team calculated that if the loss in soil fertility was to be fixed by adding chemical fertilizer it would cost an average of 21% of the total current value of maize production (US$153 per household per annum). Taking the Bush et al (2004) price, the total economic contribution of the protected area to soil fertility is estimated as approximately $6,410,000US.

6.3.3.4 Tourism

Reported tourism revenues for QEPA were $769,420, yielding a profit of $75,899 for the financial year 2005-06. However in addition to the direct revenues generated by the national park, significant external impacts may also be felt in the wider economy (multiplier effects). Expenditures of US$$769,420 by international visitors (specifically park entry fees) is the direct contribution of the protected area to the national economy. Other factors, however, will modify the actual net contribution. Firstly, a portion of revenue spent and received in-country will be expatriated to other countries. Secondly, the contribution of any economic activity to the national economy should be assessed by considering direct effects vs. secondary effects. Direct effects refer to the effects of the 'first round' of spending e.g. immediate revenue, whilst 'secondary effects' refer to revenue generated by the re-spending of those dollars e.g. second and third round spending. These are also referred to as 'indirect' or 'induced' effects. These are important figures to consider in the valuation of tourism benefits as gate receipts alone only account for part of the economic effect at the national level. Secondary effects impact on the following components of the economy:

(i) income derived from indirect and induced sales

(ii) government revenue through sales and income tax

(iii) number of jobs created by indirect and induced effect

Assessment of secondary effects is done through estimation of a multiplier for each component, which indicates the "knock on" effect of the original revenue on that component. For example, a sales multiplier of '2.0' indicates indirect and induced sales will be 200% of the original revenue. An estimate of an appropriate multiplier (2.91) was made by (Hatfield & Mallaret-King 2003). A comparison of foreign exchange earnings ($3.72 million) indicates that benefits from gorilla tourism to the Ugandan economy in terms of income and government revenue gains and income effects are US$ 10.86 million. Using the same factor

of 2.91 to multiply the gate receipts for QEPA ($769,413) gives a total of $2,238,991. This can be allocated as $1,544,904 to government taxes and $694,087 to income effects.

6.3.3.5 Biodiversity Option Values

Option values are perhaps the least tangible benefits from Uganda's forests. However an aspect that promises real returns is the development of plant based pharmaceuticals. (Ruitenbeek 1989) was one of the first to use the valuation methodology of patent rights to estimate the potential value of undiscovered plant-based drugs for the pharmaceutical industry. He estimated values for the Korup Park, Cameroon and surrounding management area as $0.10/ha per annum. Pearce and Moran (1994) estimate a range of values for tropical forest, which are generally larger than that produced by Ruitenbeek, ranging from US$0.10/ha to US$21/ha. Work on this issue, by Mendlesohn and Balik (1997), produced a value for undiscovered plant-based drugs in tropical forest with average plant endemism of US$3/ha.

The number of endemic plant species per hectare is very important as a predictor of potential drugs according to Mendlesohn and Balik (1997). If an area of tropical forest had ten times more endemic species per hectare than average, their model predicts a per hectare future drug value of US$30/hectare. Howard (1995) indicated that Uganda's forests are not as species rich as the Korup Park and that many species present are widespread over many parts of Africa, so that developing plant based pharmaceuticals markets for such species would be competitive, in which Uganda' would have little competitive advantage. An example of such a plant is *Prunus africana*, which grows naturally in Uganda in Afromontane areas. However commercial exploitation of *Prunus africana* is usually based on the establishment of plantations, which are originally sourced from wild genetic material. Using the Mendlesohn and Balik (1997) estimate, but reducing the lower figure by 50% as a conservative estimate, gives an average of US$1.5 per ha. Over an area of 198,969 hectares this equates to US$298,453.

6.3.4 International/Global Level Values

6.3.4.1 Carbon Storage

At the global level, the forestry sub-sector is an important carbon sink, helping to reduce accumulation of greenhouse gases and hence global warming which will lead to adverse changes in climate. According to Howard (1995), the service rendered by Uganda's forestry sub-sector to the economy through its impact on carbon sequestration is estimated at US$ 17.4 million/year based on current levels of carbon stocks depreciated over 25 years. Table 6.1 depicts the size of different protected area zones and their different vegetative zones.

Table 6.1 Vegetation cover in the QEPA

QEPA Zone	Tropical high forest Area (ha)	Woodland	Bushland	Grassland	Wetland
QENP	4,524	62,048	25,593	69,598	10,913
Kigezi Game Reserve	223	1,626	6,611	4,718	540
Kyambura Game Resreve	1,861	2,738	511	7,465	0
TOTAL	6,608	66,412	32,715	81,781	11,453

(National Forest Authority Biomass Study, 2003)

Table 6.2 Carbon sequestration by vegetation type QEPA

Vegetation type	Area (ha)	Carbon sequestered (Tonnes/ha)	Carbon sequestered (Tonnes)	Stock Value (US$)	Rotation period	Annual Value (US$)
Tropical high forest	6,608	210	1,387,680	13,321,728	50	266,435
Woodland,	66,412	10	664,120	6,375,552	25	255,022
Bushland,	32,715	10	327,150	3,140,640	25	125,626
Grassland	81,781	10	817,810	7,850,976	5	1,570,195
Wetland	11,453	100	1,145,300	10,994,880	10	1,099,488
TOTAL	198,969	340	4,342,060	41,683,776		3,316,765

Table 6.2 shows the areas of different vegetative types and the amounts of carbon sequestered, stock value and rotation periods. The annual carbon value of QEPA is estimated as the value of the stock of sequestered carbon divided by the rotation period of each vegetation type. The annual carbon quantity is then multiplied by the average market price for a tonne of carbon. The world market price for a tonne of carbon (2005-2006) is taken as $10.50 (World Bank 2008). Estimates of carbon sequestration ranges between 10 tonnes of

carbon per hectare of bushland or grassland to 210 tonnes of carbon per hectare of closed canopy primary forest. Uganda's natural vegetation is estimated to cover a surface area of almost 11.5 million ha (Emerton & Muramira 1999). QEPA may provide economic benefits through mitigating the effects of global warming at a carbon market value of $3,316,765 per annum.

6.3.4.2 International social value (consumer surplus)

In the case of QEPA original data was not collected to calculate tourist's consumer surplus. The approach to estimating consumer surplus will be through utilizing secondary data of international tourists consumer surplus values from a similar type of protected area in Africa, Lake Nakuru National Park in Kenya (Navrud & Mungatana 1994). A travel cost model was developed and estimated that the consumer surplus for each foreign national visiting the park ranged from $114 to $120 per person. Taking the mid point ($117) and applying this to the number of international tourists coming to QEPA (average of 3500 per annum) the total international consumer surplus for wildlife viewing in QEPA is approximately $409,500.

6.3.5 Distribution of benefits in conserving the QEPA

Developing a picture of the distribution of benefits between different aggregations of society, allow the quantitative examination of externalities. An additional issue is the choice of valuation method used to estimate values and how divergences in valuation approaches can create significantly different results (see also Chapter 4). Table 6.3 sets out the benefits valued in this case study and where they accrue in the value chain (local to global). Focusing on the divergence in value measures and the aggregation of values the table presents two different pictures of benefits, in the first setting the local financial value (MPM value) of benefits form the protected area are used and in the second setting the economic value (CVM value).

Table 6.3 QEPA Economic benefits local to global

Economic Benefit		Value $ per annum	
Local		**Local Financial**	**Local Economic**
Local Direct Use		1,530,000	18,749,484
	Sub total	**1,530,000**	**18,749,484**
National			
Domestic water services		128,000	
Soil fertility		6,410,000	6,410,000
Park Tourism Revenue		769,420	769,420
Biodiversity option		298,453	298,453
	Sub total	**7,605,873**	**7,477,873**
Global			
Carbon		3,316,765	3,316,765
International tourists consumer surplus		409, 500	409, 500
	Sub total	**3,316,765**	**3,316,765**
	Total	**12,452,638**	**29,544,122**

The scope of values estimated in table 6.3 above do not take in to account existence values by the international community. Estimating existence values for any protected area is a challenging endeavour, indeed few exercises have been undertaken globally (Pagiola et al. 2004). Furthermore it is difficult to separate these values from other non use values such as bequest values or isolate a particular forest or ecosystem at a site level from all of the other similar sites globally. For example two studies (Kramer et al. 1995; Walsh et al. 1990) estimate that the non use values for tropical forest range from $24 to $47 per capita per annum, but the problem is what proportion of that value can really attributed to QEPA? Existence values are there fore not included in this estimate as their computation are fraught with too much bias with currently available information. As such the estimate in Table 6.3 does represent an underestimate of the social values towards QEPA. However this does not completely undermine the purpose of the exercise, it merely narrows the scope of analysis to the evaluation of a relative set of benefits for which reasonable estimates can be made.

Additionally there is the issue of double counting benefits between different value estimates. For example in Table 6.3 under the financial estimates there are entries for domestic water services calculated for the sample population around the national park entered at the national level. In the household finical valuation no appreciation of this value was made, thus it is

justified to include a value at the national level. However in the economic estimate, the value of such direct benefits from the protected area is implicit in the valuation so the financial estimate for water services is omitted. This would cause double counting and an over estimate of the total economic value. The double counting issue has been controlled for in the estimation process so is not a serious issue affecting the principal findings from these results.

When comparing the benefits at different policy levels we immediately confront the problem of which local values to consider - the financial or the economic? Which values are adopted has a profound impact on the balance of benefits at the different levels. To take the financial values alone would be remiss, as we have developed during the course of this study a picture of the complex nature of interactions of local people with protected area resources and the role that these resources play in mitigating risk in livelihoods and thus social values. Evidence from chapter 3 showed that distribution of those costs at a local level is mainly amongst the higher income households in absolute terms. However which value to consider depends largely on the questions to be answered. If we consider losses to individual parties then financial values may be more appropriate. Alternatively when considering overall economic efficiency then economic values would be appropriate.

In addition low income households used more of their protected area income for subsistence purposes than high income households, which presents a picture of dependence on the protected area by poorer households, despite it being an illegal source of revenue. If the protected area regulations were to be enforced to the letter of the law then many poor households would be adversely affected. In both scenarios local communities face significant losses should the regulations of complete exclusion be effectively enforced. This would then mean a cost at the local level, but a benefit at the national and international level.

Reported revenues for QEPA were $769,420, yielding a profit of $75,899 for the financial year 2005-06. The profit from the park falls considerably short of the estimated $1.5 million

financial value, the $8.2 million in benefits foregone from agricultural and livestock production, the $18.7 million in welfare values currently enjoyed by the local population. All are different estimates of various types of opportunity cost borne by the local population. Clearly tourism revenues alone are not able to adequately finance compensations schemes for the reduction in local household's welfare that would result from loss of access to the protected area. Findings from the study in chapter 5 on eco-tourists values shows that whilst the visitors were willing to pay for biodiversity conservation in itself they were less willing to pay for benefits to local communities as an outcome of the fees that they pay for experiencing biodiversity. However if we consider the multiplier estimate (section 6.3.3.4) and look at the component that is tax revenue, an additional $1,544,904 was available. This amount is at least enough to cover compensatory schemes up to the value of the financial losses incurred by local communities. However in a poor country like Uganda, the government has few sources of endogenously earned revenue, almost 55% of the national budget comes from the international donor community (GOU 2004). Thus there are many competing national priorities for such financial resources and the government is unlikely to directly allocate all of it back to local communities.

Looking more broadly at the benefits from protected area, it is the national and international communities that benefit more than the local communities. Thus there is strong argument to support public financing of the park from the national and international communities. The distribution of benefits between the local and national level leaves some room for debate because some factors such as the national social values related to biodiversity conservation have not been incorporated, which is likely to skew the distribution further towards the national and international community. It may also change the balance of distributions between the national and international levels. Importantly the analyses conducted here helps to make the economic case in national and international political processes of the importance of protected areas as a policy approach for biodiversity conservation.

6.3.6 Comparison of land use options

It is worth considering these values in the context of conversions of the national park to agriculture under different scenarios. The most pressing issues regarding protected areas is justification for their retention under increasing population pressure or the drive for investment and production of cash crops, involving their conversion to alternative land uses, particularly for the extensification of local agricultural systems; local population expansion is one of the key pressures facing QEPA. Recent influx of repatriated Basongora nomadic cattle herders from DRC in 2006 saw nearly 10,000 people and more than 30,000 cattle put a very real political pressure on the park, through calls for degazettement[33] for resettlement (Among 2008).

Table 6.4 makes a comparison of the benefits from QEPA as they accrue at different policy levels from local to global. The comparisons are made on the basis of maintaining QEPA in its current status versus conversion of suitable areas of the protected area into the local agricultural production systems. In terms of maintaining QEPA as it currently exists there are two accounting frame works used, a financial one and an economic one which take into account the current direct local social as well as financial values. Values used in table 6.3 are those derived from the calculations earlier in this chapter. They are presented to show the economic impacts of conversion of QEPA form the base line scenario of conservation.

Under the conversion scenario the ecological and social values would be lost, all of the national level benefits would become negative reflecting their opportunity cost and the carbon storage value would be also be entered as a negative (such land would not qualify for offset schemes). In terms of converting QEPA, the economic NPV cost per ha is just over double that of the financial accounting framework.

[33] Degazettment – the change in legal classification of land form a national park to some other legal category

Table 6.4 Conservation vs conversion a comparison of values

Economic Cost/Benefit	**Financial Values under different land management options ($US per annum)**	
(Costs entered as negative values)	**Conversion to local subsistence agriculture**	
	A **Local financial value**	**B** **Local economic value**
Local		
Local Direct Use	-1,530,000	-18,749,484
Arable production	5,800,000	5,800,000
Livestock production	1,717,440	1,717,440
Sub total	**5,987,440**	**-11,232,044**
National		
Park management costs	693,243	693,243
Domestic water services	-128,000	-128,000
Soil fertility	-6,410,000	-6,410,000
Park Tourism Revenue	-769,420	-769,420
Tourism multiplier effect	-2,238,991	-2,238,991
Biodiversity option	-298,453	-298,453
Sub total	**-9,151,621**	**-9,151,621**
Global		
Carbon	-3,316,765	-3,316,765
International tourists consumer surplus	-409,500	-409,500
Sub total	**-3,726,265**	**-3,726,265**
Total	**-6,890,446**	**-24,109,930**
NPV per Ha.[34]	**-32**	**-118**

The international consumer surplus would also be lost as the dynamics of the interlinked ecosystem would be disrupted and biodiversity and ecological potential of the park would be lost. Under conversion financial accounting framework the per. hectare value of the park is approximately 50% of the per hectare value under the economic framework, with the values becoming correspondingly negative under the conversion scenario. An assumption in this model is that prices remain static; however food prices may go up, tourism may increase or the international value of carbon sequestered may change. Such factors can have a profound impact on the level of benefits, and where they accrue, as well as impacting the relative levels

[34] NPV was calculated as the sum of the present benefits detailed in the table divided by the land area of QEPA

of performance of the different land use options. It is important to assess how sensitive these results are to changes in key variables. The impacts of changes in the tourism and food sectors are examined below.

The tourism sector is one of Uganda leading foreign exchange earners and is a high priority for development financing. Uganda is working hard to develop its tourism industry and QEPA is one of the central foci of any international tourists visit to the country. For example if tourism visits increased by 10% an additional $77,000 in direct revenues and $220,000 in spending from the multiplier effect would be generated.

Seasonal shocks such as flooding and drought have a profound impact on the availability and price of food. Recently Uganda has suffered from the impacts of extreme weather events. In 2007 the eastern parts of Uganda (the main cereal production region) suffered sever flooding destroying crops while the south-western parts (a principal cavendish banana producing region) suffered severe hail storms thus destroying many banana plantations. These are contributing factors to the sharp rises in food prices in many urban centres of Uganda in early 2008 (Biryabarema & Bagala 2008), in some instances retail values for basic food items doubled. If there were a 100% increase in wholesale food prices and this translated in to the same increase at the farm gate then potentially the financial value of arable and livestock production would also double, giving an NPV per ha under conversion of $74, or only $1 per ha more than the status quo scenario. Such exogenous shocks are often short term in nature and in Uganda by mid-2008 food prices had returned to normal levels. As such the model is fairly robust to agricultural price rises. In purely financial terms the maintaining of QEPA is a financially competitive option compared to conversion.

The question remains how to capture the benefits illustrated to pay for the desired conservation and development outcomes e.g. how to generate real funds to cover management costs (this is as a pose to how best to ensure beneficiaries receive the payment)? Essentially conservation financing has to firstly secure adequate resources at any given time to cover the costs of conservation and sustain this in the future. Whilst many of the benefits detailed are public in nature, most governments especially those of less developed nations with acute budget constraint are reluctant or unable to finance conservation activities to the level necessary, even if the benefits are clear.

An useful approach is to understand which services are providing what benefits to which beneficiary (Pagiola et al. 2004). The challenge then is to motivate the beneficiaries of the services to pay for them through taxes or logging concession fees or tourism gate receipts. Of course there may well be a gap between what consumers are willing and able to pay versus the real cost of management of the resource e.g. high logging fees that make the unit cost of products cost more than the current world market price would result in no revenue being produced to cover management costs, similarly overpricing of entry fees for tourists. This is another area where economic valuation can also provide valuable information e.g. optimal pricing, see chapter 5. More challenging is to get service users to pay for services that they might have been obtaining freely e.g. watershed protection or climate change mitigation through carbon sequestration. For local watershed services it might be possible to include a small incremental fee on water consumers that is restricted towards paying for watershed management.

In the case of global public goods issues such as climate change the role that forests play in carbon sequestration major initiatives are under discussion to look at a global mechanism to pay for this service such as the reduction of emissions from deforestation and forest degradation program being developed by the United Nations Framework Convention on

Climate Change. Such programs also have obvious positive externalities such as carbon financed forest conservation having a benefit for both watershed management and biodiversity conservation.

6.4 Conclusion: forest valuation and the implications for policy and management

6.4.2 Compensation of local costs

What are the implications for local level compensation of costs through ICDP and other initiatives? Clearly there is a major challenge in assessing which opportunity costs need to be considered, the purely financial or the economic (social plus financial), as illustrated by the different values obtained between the MPM and CV estimates in chapter 4. In terms of the financial opportunity costs, what are we trying to achieve with ICDP or direct payments approaches; compensation of like for like? In chapter 4 we discussed issues to do with substitutability of goods; trying to achieve a comparable level of income through ICDP activities or direct payments assumes that alternative goods are available. If we consider fuel wood for example (a significant component of the financial off take for these households) in the QEPA, and perhaps most of the other protected area in the Albertine Rift, alternative sources of wood are simply not available. Therefore the investment costs in compensation need to reflect the cost of sourcing wood from elsewhere. This social cost is reflected, at least in part of the CV-WTA value and may also contribute to the large difference in value measures.

Communities are not homogeneous in socio-economic composition and there are often discrepancies in the way that different socio-economic sub-groups are distributed throughout a community landscape. For example, poor households may be on the periphery of the community located on marginal lands, often in areas closer to the national park boundary. Centralised community water points may be further from their dwellings thus any benefit to the community will have lower marginal benefits for poorer households further away. Poor

households are also those who are less able to afford medical treatment and less likely to send their children to school due to labour constraints in the home. Assessing the household dependency issues on forest resources is critical to identify entry points to change behaviour with the highest probability of success. Another concern from conservation perspective is the need to target ICDP projects towards those households most likely to use the protected area resources and those with the highest level of use. It seems that in many cases higher income households in fact expropriated more (in terms of adjusted financial value) from protected area (see results from Chapter 3). Clearly, improving protected area adjacent households living standards may in fact (ceteris paribus) mean that the protected area will be under greater threat.

Other social and economic factors also influence the ability of an ICDP to change behaviour and investment in community infrastructure is a very imprecise way of delivering welfare benefits to local households. People living in isolated areas with limited access to external markets and infrastructure facilities are likely to remain poor and will continue to depend on nearby forest resources. On the other hand, communities closer to town may have a wide range of opportunities such as employment in tea plantations and small businesses. Plumptre et al (2004) also shows that younger households are more dependent on forest resources. This may be due to the fact that forest dependent activities in the NFR are illegal and it is risky to undertake them. Youth generally take greater risks relative to older people in the community. Furthermore, with limited off farm economic opportunities, younger households rely more on forest resources to meet their basic needs. Thus ICDP and community conservation approaches need to focus on addressing equity issues amongst those households most negatively impacted.

The Bush et al (2004) study on protected and private forests in Uganda points towards their significant role in livelihoods security. Here the concept of the 'hungry gap' (Ellis 1993) is

important. The hungry gap is the period when reserves of home produce and cash are low or exhausted prior to the collection of the next harvest. It is a time when households may have to sell capital assets such as livestock to make ends meet. Thus having a forest on hand to provide alternative options such as wild foods to cover the hungry gap is very important. In addition there was a significant positive correlation between the time of year when household used the forest most and when cash and food is needed most.

Evidence from Bwindi Impenetrable Forest and Mgahinga National Park, Uganda (Plumptre et al, 2004) reveals that despite the numerous ICDP interventions being implemented among local communities, law enforcement, perhaps combined with education, remains the major reason for reducing illegal access to park resources. Several million dollars have been put into ICDP efforts in Bwindi, a trust fund and other activities to improve community relations around Bwindi and Mgahinga forests and yet the percentage of people admitting to accessing the forest illegally (13-19%) in these two areas was not very different (14-22%) to other areas (Nyungwe, PNV and Virunga) where mainly law enforcement has been used (Plumptre et al, 2004). Since many people would not admit to collecting resources illegally from parks, this may be an underestimation of the real numbers that do collect these resources. Illegal access to forest wood resources for fuel, poles, stakes and timber remain among the major illegal activities in the two Ugandan parks. Some households cite lack of land and the fact that they would have to reduce the amount of food crops they plant as a reason not to practice on-farm substitution of tree products (Plumptre et al. 2004).

Working with communities bordering the forest may not completely reduce the levels of illegal activities but is expected to lead to better relationships with the protected area authorities, which allows less aggressive tactics in dealing with illegal activities. Drawing again on regional experience, it could be expected that Mgahinga and Bwindi NP (Uganda) would have more respondents claiming that relations between themselves and the protected

area authorities have improved. This is found to be the case. However, there were also more people around these two protected areas who believed that relationships had deteriorated than around the other protected areas where they believed the relationships to be stable.

Despite the rather disappointing evidence on the performance of ICDP (discussed in chapter 2) the importance of actually buying good will in the community from ICDP efforts should not be undervalued. Anecdotal evidence from park staff at Bwindi NP shows that the years of ICDP have significantly changed the formerly adversarial relationship with park rangers; only a little over a decade a go they were often subject to aggressive altercations with local communities, including physical assaults when purchasing provisions in local villages. At least there is now a constructive environment from which to develop better and more effective ways of collaborating with communities in biodiversity conservation.

The evidence from national cases of ICDP clearly illustrates the concerns of Ferraro (2001). Understanding the financial, economic and institutional opportunities and constraints that dictate local use of protected area are critical in identifying how ICDP actions can address them. The bottom line consideration is that if a proposed scheme does not compensate a household's opportunity cost (in welfare terms) from loss of access to protected area resources, it cannot hope to change behaviour. Importantly these issues are felt at the household level not at the community level. So if ICDP are to be effective at changing household or individual behaviour then they must deal where ever possible with households and individuals directly.

6.4.3 Direct approaches to community conservation

Paying people not to do something that society thinks is bad does require us to make some moral and ethical leaps of faith in the conservation community; after all we don't usually protect banks by paying bank robbers to give up their criminal activities. It is however a question of proving the right incentives for socially desirable behaviour and disincentives for

socially aberrant behaviour. For example, the European Union has from 1988 to 2007 paid farmers in Europe to produce less food through the Common Agricultural Policy's 'set aside scheme'[35], effectively paying farmers not to farm (USDA 2008). Similar agricultural policies have also periodically been in force in the USA since the 1960's (Green 1990). To conservationists, and much of conservation concerned society, biodiversity loss is a socially undesirable externality; in rectification of this externality there are many laws and regulations with associated fines and other penalties. However to encourage socially desirable behaviour why not give an incentive, more 'carrot' and less 'stick'? This is also appealing in terms of addressing the distributional issues regarding the benefits and costs of conservation.

A concern that arises is that once payments are in place what checks and balances will be needed to avoid local households holding biodiversity or protected area 'hostage', e.g. "pay us more money or else we will chop the forests down". Ultimately such a demand will only be driven by property rights that are not fully established and where such a high risk strategy might be the only sort of pay off an individual might expect to receive. Intuitively, if a resource right is properly established and an individual or household can realise a guaranteed future stream of benefits, in all likelihood they will pursue a rational course of action. As long as the payment meets or exceeds the opportunity cost of using resources in some alternative manner then an individual will probably pursue the highest return for the least effort. Cutting down forests or cultivating land still requires up front investment in terms of labour and capital. Few subsistence-farming households probably have the time and energy to pursue additional labour intensive schemes, or else more land would have been cleared already. However a thorough examination of the institutional framework, contractual obligations and arbitration procedures will need to be made in any given situation to address the credibility of such concerns.

[35] Set aside – where the EU makes payments to farmers to keep 10% of their arable land out of production in an attempt to reduce the oversupply of food that was in no small part caused by EU production subsidy in other areas.

There is also the question of sustainability to contend with; who will provide the finances for a payment scheme? An intention of many ICDP and development projects generally is 'sustainability'. This much misunderstood term has proved elusive to achieve and many indirect approaches need continued finance from some source to make them work, a term for this approach is 'sustainable financing'. Ultimately the concept of sustainability needs to be examined in terms of scale. Although many ICDP schemes may not be locally sustainable, however in a global sense and with global financing they can be, if not sustainable, at lest financed in the longer term. The same goes for the PES or PCS approach, for example, global carbon financing could pay for the conservation of biodiversity through the preservation of habitats. This is appropriate as was highlighted earlier; biodiversity is global public good therefore global sources of finance should be sourced to address the global externality.

Direct payments have the capacity to address more efficiently and effectively conservation targets with local welfare benefits. This is no guarantee that they will work, at least not any better than ICDP traditional approaches such as developing social infrastructure or income generating projects. Unlike ICDP, direct payment schemes do address fundamental constraints in community conservation approaches and conform to the theories regarding property rights, political economy and the basic rules of economic policy formulation. All lessons which need to be thoroughly learned for ICDP development in the future.

6.4.4 Integrating protected area values into policy

From the evidence presented in the preceding chapters it is clear that the broader development context in which biodiversity conservation operates is a complex and dynamic environment. Developing an economic and political economic understanding of the context of biodiversity conservation is a key step in being able to manage these resources more sustainably. A number of critical issues and challenges need to be addressed in order to give biodiversity in protected areas the prioritisation needed in national budget and planning processes. Similarly,

much improvement in the efficiency and effectiveness of approaches to reconcile human development needs and conservation at the local level needs to be made and a thorough economic understanding of the local social dynamics and political situation is essential.

The integration of protected area values into policy at the national level is a crucial step. protected area managers are often reluctant to modify their management/use practices even when the importance of environmental factors is acknowledged. This may be in part due to a relentless pressure to reduce costs and increase revenue. Careful design of protected area regulations to create the right regulatory framework can encourage protected area users and managers to account for non-market benefits in their own interests. This can in turn reduce the need for costly supervision by regulatory agencies, whilst achieving a more efficient mix of market and non-market benefits.

Values can be applied at different geographical and policy levels, for example in deciding about land use planning policy, or about how individual protected area should be managed. In both cases the scope for improving policies runs from zoning and property rights to national regulation and incentive schemes for protected area protection. However bringing the type of values presented in this thesis to bear on policy at the national level still presents some significant challenges that must be addressed as a priority. The Ministry of Finance (MoF) for example does not listen directly to sub-sector issues. The MoF requires the presentation of sub-sector issues as part of a coordinated and unified sector plan. In order to take the evidence and recommendations of parks and forest sub-sector values forward the responsible line ministry must compile a Sector Investment Plan as the basis of further discussion with the MoF. This requires strong lobbying and representation from the parks departments and other agencies responsible for biodiversity conservation to provide such evidence with in the national policy and budget processes.

Developing an integrated approach to land use planning has interesting implications in terms of coordination between ministries. Agriculture has it own line ministry and this represents its economic and political importance over other environment and natural resource (ENR) sectors. Agricultural policy will therefore have a profound impact on the viability of other ENR sectors, but ultimately it is the integrity of the environment and the important role of protected area in maintaining healthy agro-ecosystems that will underpin the success or failure of agriculture in locales around protected area in the future, particularly in mountainous regions that typify most of the Albertine Rift.

Although this chapter has focused mainly on protected areas as the back bone of biodiversity conservation, the front line for defence continues to be land use practices on private land, especially that land adjacent to protected area. Particularly we need to consider policies in the agriculture and forest sectors that halt the clearance of natural forest and also promote the establishment of plantations. Better still for biodiversity conservation will be policies that promote the re-establishment of natural forest. A key area of research and analysis must be household decision making related to environmental resource use. Valuation approaches must go further to examine both input and investment aspects of land use practices are essential in understanding the drivers of resource use and identifying efforts to mitigate the problem (Takasaki 2007). Fundamentally land reform is also needed to allow individual basic private owner ship and control of land resources to raise capital to make investments in livelihoods (Barbier 2004). In addition policies that promote non-land based activities among rural protected area communities are needed (Bush 2004; Plumptre et al. 2004; Takasaki 2007).

Earlier the concept of externalities was introduced. In addressing the above questions we are attempting to mitigate or 'internalise' the market externalities. Virtually all protected area have some sort of positive non-market value (e.g. soil conservation, biodiversity). This implies that the ***economic*** value of keeping land in a natural state (especially natural forest) is greater than

the ***financial*** values that can be derived by a private actor producing for the market. Therefore knowing the values of the externalities produced and where they accrue is essential in identifying who pays and how much to achieve the optimal outcome. For example the valuation study in chapter 5 on gorilla tourism shows that tourists value protected area where they have a higher chance of seeing a variety of biodiversity, showing that conservation can have an economic return. Also these people are willing to pay for not only gorilla, but also biodiversity conservation. A key assessment that still needs to be made is of the ability of international tourists to pay for the local social cost of loss of protected area access. Even if tourists are able to pay, the evidence in chapter 5 showed that they were not willing to pay for the local social costs as part of the permit price for gorilla trekking. By extension this means that other protected areas might face similar constraints, this leaves some perplexing challenges in finding ways to resolve the externality.

In order to understand how to mitigate externalities, property rights were discussed as a conceptual framework. Economists often argue that a fundamental undersupply of non-market benefits is the result of lack of exclusive property or user rights. The notion is that private property where it is enforceable creates an opportunity for profitable exchange and is thus an incentive for sustainable management. Generally economists tend to advocate for the provision of property rights over regulation or price policy. An advantage of such an approach is that government agencies need not concern themselves with the difficulties of setting prices or taxes but can devote its efforts to enforcing property rights and contracts. This is clearly one of the challenges currently facing conservation in that the proerty right of the state over the protected areas are not adequately enforced leading to the high levels of illegal use or unregulated exploitation (quite apart from the moral and ethical issues regarding)

However as a sole approach to managing protected area this is difficult to envisage that either market based approaches, e.g. PES/PCS, or establishing property rights alone can really

deliver on effective protected area conservation with their multitude of public goods and local to global externalities. To this end ICDP are an appropriate (if somewhat economically inefficient) vehicle to deliver public and private goods at the level of the protected area where they concentrate on utilising a combination of market based and public service approaches. Understanding precisely, not only the relative costs and benefits of different project approaches, but also the transaction costs of implementation is essential in deciding upon the most effective mix of activities with the available resources. Economic research on community based conservation approaches and economic values of forest biomes and may provide the wisdom and confidence for conservationists to try new approaches and refine old ones, as well as reconciling the concerns of the development community about the worth and true value of environmental resources in poverty alleviation and economic growth.

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Appendix 1 Market price household survey

Interviewer:	**Date: Time:**
Checked by:	**Check Date:**
Village (LC1):	
Parish (LC2):	**Respondent Age:**
Sub-county	**Respondent Sex:**
Forest:	**Wealth Group:**

Introduction and explanation of survey

1.Household Composition
How many people are in the household?

Status	Description	Age	Sex	Education level	Occupation
Head of Household					
Spouse					
Member 1					
Member 2					
Member 3					
Member 4					
Member 5					
Member 6					
Member 7					
Member 8					
Member 9					
Member 10					

Description – *1)husband, 2)Wife, 3)Child 4)Relative 5)Orphan 6) Visiting worker 7)Dependent 8) Female head*
Education Level *– 0) no formal education, 2)Primary, 3) , secondary)4) College/University education*
Occupation *– 0) no work 1)Farming-including subsistence 2)student 3)Own business 4) wage labour 6)Salaried employee 7)Infant 8) Other – specify*

How many years has your family been in this village/location?……
1)Less than 1 year 2) 1-5 years 3)5-10years 4)10years or more

2. Assets
House Materials for Main Dwelling (try to make discreet observations on approach)
Walls
1)Timber/poles 2)Brick 3)Mud 4)Iron 5)Plastic Sheeting
Door/Window Frame
1)Timber/poles 2)Brick 3)Other-specify
Floor
1)Timber/poles 2)Mud 3)Cement4)Tiles/bricks
Roof
1)Thatch 2)Tiles 3)Iron Sheets 4)Plastic Sheeting

Do you own a Bicycle? How many? How about any of the other things below?
1)Radio 2)Television
3)Bicycle 4Motorcycle 5)Pickup truck or car 6)None

Livestock Assets
Do you have any animals amongst your household assets?

Livestock Item	Number
Goats/	
Sheep	
Pigs	
Chickens /ducks/ pigeons	
Rabbits	
Cows	
Dogs	

3. Land Resources - How much land do you have? What do you use it for?

Land Type	Area (Local Unit)	What % is this of your total land holding?

Land Type *– 1)Natural forest/woodland, 2)Woodlot, 3)Arable, 4)Wetland, 5) Grassland Pasture 6)Woodland/forest pasture 7)Cash crop plantation*

4. Do you own a woodlot? If woodlot is owned:

Species of tree	Area (Ha)	Purpose

6.In Which months do you experience high cash expenses and what are they?	
Expense	**Month**

7. Do people use the forest?

8. How far is it to the forest in Km

9.How long does it take to walk there?

10. Which months of the year do you use the forest most?

Month	Reason

11. Which months is food scarce or expensive?

Month	Reason

1. **Which fuels do you use each week and how much?**

Source	Use	Volume (unit)
Wood		
Charcoal		
Paraffin		
Gas		
Electricity		
Other?		

Use- 1)Cooking 2)Lighting 3)Heating

13.What trends have you noticed regarding the following resources from your local forests or market in the last year?

Charcoal		Fuel wood		Timber	
Supply		Supply		Supply	
Quality		Quality		Quality	
Price		Price		Price	

0) Decrease, 1)Increase 2) No change 3) Don't know

12. How far on average do you travel each day to collect firewood? Is it from the forest reserve?

14. How has this changed in the last 5 years? 1) No change (go to 15) 2) travel further 3)travel shorter

15. What is the reason for the change (if any)?

16. Where do you get your water?

Bore hole/well	
Stream/river	
Spring Protected	
Spring Unprotected	
Pond/Dam	
Lake	
Other Specify	

16 b Does your water come from the forest? Yes/No

17. How far is it from your home (one way) to the water source?

18. Who collects water in the household? (If hired labour skip to 19)

19. How many 20l jerry cans do you use each day?

20. What type of treatment do you use to purify water for drinking?

Nothing	
Boiling	
Boiling and Filtering	
Chemicals	

21Does the quantity of drinking water change during the year? Why?

22. What is the quality of your drinking water?

1.Excellent 2.Good 3.Fair 4.Poor

23. How has the quality of water from your domestic source changed over time? I f (no change go to 24)

Time	Quality
5 years ago	
1 year ago	

Score - 1.Excellent 2.Good 3.Fair 4.Poor

24. How do you expect water quality to change in the future?

1.Improve 2.Deteriorate 3.No Change 4. Don't know (go to 25)

25.Why would you expect the above?

26. Do you collect medicinal plants from the forest? 1) Yes 2)No (go to 31)

27. What is the main reason you collect medicinal plants?

1) Own Consumption 2) Sale

28. Can you tell me about some of the most important medicinal plants you collect from the forest?

Local Name of Plant	Part Used (bark, root etc.)	To treat which illness?	Where is it sold?	Price per Unit
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

29. Which would be the most important medicinal plants from the forest to you?

Plant Name	1	2	3	4	5	6	7	8	9	10
10										X
9									X	X
8								X	X	X
7							X	X	X	X

6						X	X	X	X	X
5					X	X	X	X	X	X
4				X	X	X	X	X	X	X
3			X	X	X	X	X	X	X	X
2		X	X	X	X	X	X	X	X	X
1	X	X	X	X	X	X	X	X	X	X

Rank: 1. 2. 3. 4. 5.

30. What is the most significant factor for you about the top 5 plants (you can tick more than one?

Factor Plant Number=>	1	2	3	4	5
Income generating potential					
Use in the household					
Cultural belief					
Other					
Other					

31. Do you cultivate any medicinal plants (specify)?

32. Why do you cultivate these plants?

	Reason	
1	Income generation	
2	Home use	
3	Other	

The following questions on household income and consumption should concentrate on recalling events from the past 12 months.

33a. Household Income/Consumption (Non forest based)

Item			**Annual income from own produce/labour**	**Weekly consumption of own produce**	
	Local Unit	**Total annual harvest**	**Units Sold/received**	**Units Consumed**	**Average Price per unit**
Crop Income					
Coffee	Tin				
Tea	Kg				
Cocoa	kg				
Tobacco					
Processing Cane	tonne				
Beans (dry)	kg				
Staple Food (starches, maize matooke etc):					
1					
2					
Vegetables:					
1					
2					
Fruits:					
1					
2					
Tree Crop Income					
Woodlot Timber:					
1					
2					
Woodlot poles:					
1					
Charcoal	Sac				
Moringa	Kg				
Neem	Kg				
Seedlings	Piece				
Livestock					
Large animal					
Small animal					
Animal products					
Renting out of livestock					
Wage Labour					
Unskilled Agricultural/seasonal labour					
Other employment					
Skilled/regular employment					
Crafts and small scale enterprise					
Beer	Jerry can				
Waragi	litre				
Sale of crafts	item				
Trading goods					
Renting out goods					
Miscellaneous cash income					
Total Cash Income (excluding environmental cash income)					
Private Cash gifts/donations received					
Private non cash gifts received					
Total gifts received					

33.b *Please indicate the quantities and values of inputs used in crop production over the last 12 months (this refers to agricultural cash expenditures).*

Inputs	**Unit**	**Amounts**	**Total costs**
Seeds			
Fertilizers			
Pesticides			
Manure/crop residues			
Hired labour			

Extension services			
Other			

Note: The key is to get total costs.

34. Household Income/Consumption (Natural Forest based goods)

Do you have any problems with crop raiding animals from the forest? 1)Yes 2)No

Which Species?
1)Buffalo 2)Antelopes 3) Chimpanzee 4)Monkeys 5)Baboons 6)Porcupines 7)Wild pigs

8)Other (Specify)……

Which species is most problematic?

Do you ever trap some of these problem animals?

Do you eat them? 1)Yes 2)No

Do you harvest or sell anything from the forest?

Item	**Local Unit**	**Own harvested units Sold Annually**	**Own Harvested Units Consumed Weekly**	**Price Per unit**
Sale of forest goods				
Yams	Heap			
Bamboo shoot	Bundle			
Mushrooms	Basket			
Wild honey	Litre			
Afromamum	Heap			
Passion fruit	Heap	".		
Guava	Heap			
Mango	Heap			
Jackfruit	Head			
Pawpaw	Head			
Palm nut (oil)	Basket			
Wild Coffee	Kg			
Tamarind	Bundle			
Small wild animals:				
Rats	Piece			
Rabbits	Piece			
Duiker	Piece			
Primates	Piece			
Snakes	Piece			
Porcupine	Piece			
Guinea fowl	Piece			
Francolin	Piece			
other				
Large wild animals:				
Big Antelope	Piece			
Hippo	Piece			
Buffalo	Piece			
Other products:				
Building Poles from forest	Piece			
Timber from forest				
Grass for thatching	Bundle			
Rattan	Bundle			
Bamboo	Bundle			
Sand	Heap			
Clay	Heap			
Stones	Heap			
Other				
Large carpentry items	Item			
Small carpentry items	item			
Medicinal plants	Kg			
Mats/woven goods	Item			
Handicrafts	Item			
Firewood	Bundle			
Charcoal	Sac			

Appendix 2Household questionnaire survey with the CVM-PPM

A. Rapid Social Impact Assessment

Name of enumerator…… Date……... Time start:…… Time end:……

1 INFORMATION ON INTERVIEWEE/S

1.1	**Name of Village**		
1.2	**Distance of house to the PA boundary[36] or GPS reading**		
1.3	**Does Household have an arrangement to access resources from the PA**	1.3.1 Yes	1.3.2 No
1.4	**Wealth Group** *(circle one)*	1)P 2)M 3) W	

Interviewed? Tick as appropriate	
1.5 Female headed household (unmarried, separated, divorced or widowed)	1.5 Child headed household[37]

Marginalized minority?	1.6 State name of group

1.7 Household composition

Can you tell us about the composition of your household (see guidelines on definitions), the members, their age, gender and educational level?

Household member	Relation to hh head (See codes below)	Age (years)	Sex (M=male F= female)	Formal Education Level (N=none; P=Primary; S= Secondary, H=Higher)
1	Household head			
2				
3				
4				
5				
6				
7				
8				
9				
10				

Relation to hh head codes: 1: Spouse; 2: Son/daughter; 3: Son/daughter in law; 4: Grandchild; 5: Mother/father; 6: Mother/father in law; 7: Brother or sister; 8: Brother/sister in law; 9: Uncle/aunt; 10: Nephew/niece; 11: Step/foster child; 12:Other/Not related.

[36] If within the PA then "0", otherwise estimate distance in kilometers to the nearest 0.1km

[37] Under 18 years.

B. Economic Survey

1. Assets

1.1 Land ownership/transactions

Please indicate the amount of arable land (in hectares - ha) that you own or had access to during the last year.

1.	How much agricultural land do you own?	*Ha*
2.	Of the land that you own, how much is under: a. cropping by the household	*Ha*
3.	b. fallow/idle	*Ha*
4.	c. pasture	*Ha*
5.	d. rented out	*Ha*
6.	If rented out land, what was the contract? Code: 1: fixed rent; 2: share cropping;	
7.	What was the payment (for fixed contracts, and as % of crop to you (the owner) when share cropping)	
8.	How much land did you rent-in to cultivate?	*Ha*
9.	If rented in land, what was the contract? Code: 1: fixed rent; 2: share cropping;	
10.	What was the payment (in UShs for fixed contracts, and as % of crop to the owner when share cropping)	
11.	Are any of the mentioned holdings outside of the village?	
12.	If yes what proportion?	
13.	Where are these located? (Distance from home km)	

Note that 1 = 2+3+4+5

1.2 Savings

1.	Does the household have any savings in banks, credit associations or savings clubs? *(0-1)*	
2.	If Yes, what is the total amount of your savings?	

1.3 Implements and other large household items

Please indicate the number and value of implements and other large household items that are owned by the household.

	No. of units owned	**Total value (current market value, not purchasing price)**
1. Car		
2. Tractor		
3. Motorcycle		
4. Bicycle		
5. Handphone/phone		
6. TV		
7. Radio/cassette		
8. Stove for cooking		
9. Fishing boat and boat engine		
10. Chainsaw		
11. Plough		
12. Hand cart		
13. Shotgun		
14. Others (worth more than approx. 50 USD)		
15.		

1.4 PA resource base

5. How has the household responded to forest resource decline (rank max 3):		Rank
	Increased planting of (fuel wood and fodder) trees on private land	
	Increased purchase of commercial fuels	
	Increased use of agricultural residues (as fuel and fodder)	
	Decreased need for use of fuels, such as using improved stove	
	Changed animal feeding system, such as zero-grazing or stall-feeding	
	Increased sale of crops and livestock products	
	No responses required as still sufficient forest resources available	
	Other, specify	
6. Does your household have any planted woodlots? (0-1)		

7. If YES	i) How many hectares of planted woodlots does the household have?		Ha
	ii) What is the main purpose of the trees planted? *Please rank the 3 most important purposes*	*Purpose*	*Rank*
		1. firewood for domestic use	
		2. firewood for sale	
		3. fodder for own use	
		4. fodder for sale	
		5. timber/poles for own use	
		6. timber/poles for sale	
		7. other domestic uses	
		8. other products for sale	
8. Does the household have any agroforestry fields? (0-1)			
9. If yes, approximately how many ha of planted agroforestry?			ha
10. What are the main agroforestry products? (Rank 3 most important)		Product	Code-product
- Rank 1			
- Rank 2			
- Rank 3			

2. PA Product Markets

a) What is the forest product that gives the household the highest cash income (including income from barter trade)? *Use products codes*		
b) Where does your household sell this product? *Please rank the top 3 markets*	*Rank*	*Type of market (code market)*
	1.	
	2.	
	3.	
c) For how long have you been selling to the main market/agent (rank 1)?		years
d) What is the distance you have to transport the forest product from your house to where you sell it?		km
e) What is the mode of transportation to the market? *Codes: 1=walk; 2=bicycle/wheelbarrow; 3=animal transportation; 4=vehicle (car, bus); 5=boat; 6=other*		
f) If you sell to a trader/organization/agency, do you get any credit/loan from them? *Codes: 0=No; 1=occasionally; 2=often/usually*		

3. PA income

1. Your household is involved in different activities to generate subsistence and cash income: How would you compare forest activities to the other activities when it comes to …….. *Codes: 1=forest activities (FA) score better; 2=FA about the same; 3=FA score lower; 4=don't know*		**Code**
	i) Food security	
	ii) Profitability (cash/day of work)	
	iii) Level of risk	
	iv) Enjoyment of the work	
2. What changes do you think would be most important to increase the income from forests? *Please rank the 3 most important*		**Rank**
	i) better access to the forest	
	ii)better protection of forest (avoid overuse)	
	iii) better skills	
	iv) better access to credit/capital	
	v) better access to markets	
	vi) reduced risk	
	vii) Other, specify	
3. Have your household over the past 5 years used forest income to invest in any of the following	**0-1**	**Approx. amount**
a. Education for the children		
b. New/Improved house		
c. Investment in forest business		
d. Investments in agriculture		
e. Investments in other business		
f. Buying other major assets (e.g. boat, engine, motorcycle, etc.)		

4. Risk

1. Has the household faced any major income shortfalls or large expenditures during the last year?

Event		Code [1)]	Estimated income loss or costs
i.	Harvest/crop failure (including wild animal damage)		
ii.	Serious illness in family (unable to work for more than one week)		
iii.	Death of adult member		
iv.	Weeding		
v.	Land loss (expropriation, etc.)		
vi.	Livestock loss (theft, drought, etc.)		
vii.	Other asset loss (fire, theft, etc.)		
viii.	Lost job		
ix.	Other: _____		

1) For each, use the following codes: 0 = no; 1 = yes, mild crisis; 2 = yes, severe crisis. See guidelines for definitions

2. If at least one adult member of the household has been unable to work due to illness over the last 12 months please indicate the number of ***man-days*** *lost due to illness and the* ***medical costs incurred by household***

Relationship with household head *See codes*	**Man-days lost**	**Total medical costs**

3. How did you cope with the crisis mentioned in the first question (not just health related)? (Rank maximum 3)

		Rank
i.	Harvest more forest products	
ii.	Cash savings	
iii.	Sell assets (land, livestock, etc.)	
iv.	Casual labour work	
v.	Assistance from friends and relatives	
vi.	Assistance from NGO, community org., religious org. or similar	
vii.	Get loan from money lender, credit association, bank etc.	
viii.	Tried to reduce consumption	
ix.	We did nothing in particular	
x.	Others, specify:	

5 PA services

5.1 Has the household over the past 12 months received any cash payments related to the following forest services?

		Code: 0-1	**If yes, indicate amounts received**
i.	Tourism		
ii.	Carbon projects		
iii.	Water catchments projects		
iv.	Biodiversity conservation		
v.	Others, specify:		

6. Forest/land clearing

a) Did the household clear any forest for agricultural purposes the last year? *0-1*		
b) **If YES**,	i) how much land was cleared?	Hectares
	ii) what was the cleared land used for? *Codes: 1=cropping; 2=pasture*	
	iii) If used for crops, which crops were grown? *Code-product (can have more than one)*	
	iv) That type of forest did you clear? *Code-forest.1-natural primary, 2-secondary 3-forest fallow land p-private land, s-state land c-community land, t-customary tenure land*	
	v) If secondary forest, what was the age of the forest (rotation period)?	years
	vi) How far from the house is the new plot located?	km
c) Has the household over the last *five* years cleared forest for agricultural purposes? *0-1*		

7. Income from agriculture – crops

Note: This includes both annual and perennial crops, i.e., it should include agro-forestry, woodlots etc. See also guidelines.

7.1 Please indicate the quantity and values of crops you harvested during the last 12 months.

Crops	Code-product	Production (No. of units)	Unit measure	Family consumption	Sale	Price/unit

Note: Production = Family consumption + sale.
See technical guidelines for code list.

7.2 Please indicate the quantities and values of inputs used in crop production over the last 12 months (this refers to agricultural cash expenditures).

Inputs	Unit	Amounts	Total costs
Seeds			
Fertilizers			
Pesticides			
Manure/crop residues			
Hired labour			
Extension services			
Other			

Note: The key is to get total costs.

8 Income from livestock

8.1 Please indicate the number of animals you have, and how many you have sold, bought, slaughtered or lost over the 12 months.

	Beginning number	Sold (live or slaughtered)	Slaughtered for own use of gift	Lost (theft, died,..)	Bought	Units sired (births)	Gifts received	End number	Price unit
Cattle									
Goats									
Sheep									
Pigs									
Ducks									
Chicken									
Others									

8.2 Please indicate the quantity and value of animal products that you have produced over the last 12 months.

Product	Production (No. of units)	Unit measure	Family consumption	Sale	Price/unit
Meat					
Milk					
Cheese					
Ghee					
Eggs					
Skin					
Manure					

8.3 Please indicate the quantities and values of inputs used in livestock production over the last 12 months (cash expenditures).

Inputs	Amounts	Unit	Price per unit	Total costs
Feed and fodder				
Fodder				
Medicines, vaccination and other veterinary services				

Costs of maintaining barns, kraals etc.				
Hired labour				

Note: the key is to get total costs.

9. Income from own business

Type of business: Code: 1: shop/trade; 2: agric. processing; 3: forest based; 4: handicraft; 5: carpentry; 6: other skilled labour; 7: transport (car, boat,…), 9=other			
	Per month	**Last year**	**Comments**
Gross income (net sales)			
Costs:			
a) Purchased inputs			
b) Own inputs from farm or forest (equivalent market value)			
c) Hired labour			
d) Transport and marketing cost			
e) Capital costs (repair, maintenance, etc.)			
f) Current value of capital stock			

Remittance	
Support from government, NGO, organization or similar	
Pension	

10. Income from PA

Forest Product	**Code-product**	**Production (No. of units)**	**Unit measure**	**Family consumption**	**Sale**	**Price/unit**
Fuelwood						
Timber						
Wild animals						

11. In which months do you experience high cash expenses and what are they?	
Expense	Month

12. Which months of the year do you use the forest most?	
Month	Reason

13. Which months is food scarce or expensive?	
Month	Reason

WTAC Scenario (using direct community enforcement with government enforcement):

1. In the previous part of the survey we have discussed some of the benefits as well as costs from the protected area. Currently the level of harvesting of many of the PA resources people access is beyond the ability of those natural resources to be replenished. For example the demand for fuel wood is very high and the local community may have already noticed that stocks within the PA are become increasingly low and of poorer quality, which means that household members have to spend more time searching for fuel wood.

2. Clearly if the current level of use continues then eventually the stock of fuel wood and other goods from the protected area may run out entirely. This means that life will be much more difficult for your families or your children's families in the future.

3. As the PA authorities become more aware of the impact that the local community has on the loss of biodiversity they are looking for more effective or new ways of enforcing the necessary management rules. However current management relies heavily on exclusion of people from the PA and tends to create tension between local people and the PA as local people see the regulations as unfair.

4. If the local community wishes to be able to receive direct benefits from the PA in the future something has to be done to effectively manage or regulate the use of the PA by the local population and reduce tension between the park and local people. One option would be to implement a collaborative management scheme in partnership with in the PA authority focusing on regulated community use of the PA.

5. Responsibilities/Benefits- Under such a scheme members of your community would be asked to protect a specific area of the park e.g. a zone extending 2km within the boundary of the protected area adjacent to your community boundary. Within that zone community members would be expected to look for snares and signs of illegal activity and report illegal activities to the PA authority whilst they access the forest. Protection activities would be carried out by a community protection association (CPA). Membership of the CPA would be free and open to one member from each household in the community, provided that they are able to be actively involved in protection activities. Each **household** in the community would then receive a direct payment to compensate them for their loss of access to the PA, and the time the household puts in to the protection and monitoring activities.

6. Management- Access would be regulated by a committee of the CPA made up of elected CPA members and a representative of the national park and local government. The committee would be responsible for managing and monitoring the activities of the CPA rangers in collaboration with the PA authority. The committee would also conduct impact monitoring on the state of the community managed zone in order to verify indicators.

7. Penalties- Failure to effectively protect the identified zone may result in the reduction or loss of the amount paid by the PA authority to the community fund or in extreme cases the closure of the collaborative management scheme in favour of exclusion with no compensation.

8. The community is being asked to make monetary bids to assess the demand for such a scheme and estimate the level of compensation. Only a limited amount of funds are available for such a scheme. If the sum of all the compensation amounts is **less than** or **equal to** the money available then the scheme would go ahead as described, and a share of any surplus funds between the community bid and the compensation fund will be made. The amount received being equal to the proportion of your bid relative to total community contribution raised.

If the sum is **more** than the money available then such a scheme **would not** go ahead, all community bids would be returned and it is likely that the current management practices would continue with increased enforcement efforts.

Bidding:

Have a think about how much the protected area contributes to ***your*** current livelihood. What is the ***minimum*** amount of money ***you*** would be willing to receive ***annually***, for the foreseeable future, in compensation for reduced access to the forest?

Amount:_____USh

Appendix 3 Treatment sets, choice cards and example NLOGIT RPL code

Treatment sets and choice cards.

Treatments used in the experiment

Profile	Group Size	Length of Trek	Community Benefits	Other Wildlife	Price
1	6	More than 3 hours	10% Increase	High	$75
2	8	Less than 1 hour	No change	Low	$75
3	4	Between 1-3 hours	20% Increase	Medium	$75
4	6	Less than 1 hour	20% Increase	Low	$100
5	8	Between 1-3 hours	10% Increase	Medium	$100
6	4	More than 3 hours	No change	High	$100
7	6	Between 1-3 hours	No change	Low	$150
8	8	More than 3 hours	20% Increase	Medium	$150
9	4	Less than 1 hour	10% Increase	High	$150
10	6	Between 1-3 hours	20% Increase	High	$200
11	8	More than 3 hours	10% Increase	Low	$200
12	4	Less than 1 hour	No change	Medium	$200
13	6	More than 3 hours	No change	Medium	$25
14	8	Less than 1 hour	20% Increase	High	$25
15	4	Between 1-3 hours	10% Increase	Low	$25
16	6	Less than 1 hour	10% Increase	Medium	$50
17	8	Between 1-3 hours	No change	High	$50
18	4	More than 3 hours	20% Increase	Low	$50
19	8	Less than 1 hour	20% Increase	Low	$50
20	4	Between 1-3 hours	10% Increase	Medium	$50
21	6	More than 3 hours	No change	High	$50
22	8	Between 1-3 hours	No change	Medium	$200
23	4	More than 3 hours	20% Increase	High	$200
24	6	Less than 1 hour	10% Increase	Low	$200
25	8	More than 3 hours	10% Increase	Medium	$75
26	4	Less than 1 hour	No change	High	$75
27	6	Between 1-3 hours	20% Increase	Low	$75
28	8	More than 3 hours	No change	Low	$150
29	4	Less than 1 hour	20% Increase	Medium	$150
30	6	Between 1-3 hours	10% Increase	High	$150
31	8	Less than 1 hour	10% Increase	High	$100
32	4	Between 1-3 hours	No change	Low	$100
33	6	More than 3 hours	20% Increase	Medium	$100
34	8	Between 1-3 hours	20% Increase	High	$25
35	4	More than 3 hours	10% Increase	Low	$25
36	6	Less than 1 hour	No change	Medium	$25

This resulted in 18 different choice cards grouped in to blocks of 9.

NLOGIT code for model estimation

To evaluate the differences between proportional levels of cut-off violation, the proportion of cut-off violation for each response was estimated in a column in EXCEL. The level of violation i.e. >1%, >10% etc was then selected using a separate column (x%) coded as a 1 or a 0 to accept or reject the response to be used in the model.

```
Nlogit      ; reject, x %= 0$
            lhs=y
            ;choices =A,B,QUO;
            ;rhs=k,tgs,lot1,lot2,cb,ow1,ow2,price,tgsco2,cbco2,ppco2,lotc1,lotco2$
            ;Rpl
            ;Halton
```

Appendix 4 Choice modelling survey

Tourism Demand Survey Questionnaire-Introduction

Tourism is an essential source of revenue to conserve the mountain gorilla and their habitat. However tourist visits to the gorilla groups is not without impacts to the environment and local society. ORTPN is working to manage tourism in the most environmental and socially responsible way. The money generated through park fees goes directly towards the costs of running and managing the three national parks in Rwanda as well as providing finance to neighboring communities for conservation and development projects.

This survey is a piece of **independent** research by the ***University of Stirling***, United Kingdom, on **your** attitudes and values towards wildlife and their conservation in the Volcanoes National Park, Rwanda. In addition we would like to find out about your visit to the Parc National des Volcans today. The information that you provide us with will help to guide policies and practices to help ORTPN deliver better tourism services and protect the natural environment.

Tourism Interests

1. What first interested you in visiting the mountain gorillas? **Please** ✓ *one* **only**

	Magazine Article	❑		Tourism/travel marketing	❑
	Natural history program	❑		Knowledge of Dian Fossey's life and work	❑
	Internet based article	❑		Other *Please specify*	❑
	Radio program	❑			

2. What is the main purpose of your trip to Rwanda? Please ✓ ***one*** only

	Gorillas	❑		Business – workshop/conference	❑
	Cultural	❑		Study/Research	❑
	Tourism Other	❑		Resident expatriate	❑
	Visiting friends or relatives	❑		Other *please specify*	❑
	Business – commercial	❑			

3. What other tourism activities will you do/have you done in Rwanda? **Please** ✓ *all* **that apply**

	Visit Nyungwe Forest National Park	❑		Visit Karisoke and Dian Fossey's Tomb- PNV	❑
	Visit Akagera National Park	❑		Visit to Golden Monkeys – PNV	❑
	Kigali City Tour	❑		Nature Walk – PNV	❑
	Rwandan Genocide Memorial, Kigali	❑		Other *please specify*	❑
	Mountain Climbing – PNV	❑			

4. Which countries have you visited/will you visit on this trip?

	Kenya	❑		Tanzania	❑
	Uganda	❑		Other please list	❑

5. What are the main activities you will do/intend to do in the other countries on your trip? **Please** ✓ *all* **that apply**

	Safari – Savannah Parks	❑		Diving/snorkeling – in the ocean	❑
	Gorilla trekking in Uganda	❑		Water sports – ocean or fresh water	❑
	Other nature treks	❑		Fishing – sea and freshwater	❑
	Bird watching	❑		Other *specify*	❑
	Trekking/climbing mountains	❑			

6. How would you describe your trip?

	Overlanding	❑		Independent Travel	❑
	Backpacking	❑		Organized Tour	❑

7. How many nights will your stay in Rwanda be?

	1 night only	❑		3 nights	❑		5 nights	❑
	2 nights	❑		4 nights	❑		6 nights or more	❑

8. If on an organized tour or overlanding which tour operator did you use?
*Name of operator*_____

9 How would you rate the quality of information given by park staff on the following issues?
(1, Poor; 2, Satisfactory; 3, Excellent; 4, None given)

		1	**2**	**3**	**4**
	Park in general	❑	❑	❑	❑
	Gorilla behavior and conservation	❑	❑	❑	❑
	Birds in the park	❑	❑	❑	❑
	Conservation issues	❑	❑	❑	❑
	Plants in the park	❑	❑	❑	❑

10. Would you like more detailed information on any of the following topics?

Park in general	❑	Conservation issues	❑	
Gorilla behavior and conservation	❑	Plants in the park	❑	
Birds in the park	❑			

		YES	NO	NOT SURE
11.	**Did anyone in your group use a camera flash when taking pictures of the gorillas?**	❑	❑	❑
12.	**Did you think any one in your group got within 7m of the gorillas during the trek?**	❑	❑	❑
13.	**Were any of your tour group physically touched by gorillas?**	❑	❑	❑
14.	**Did you see any park staff cut vegetation with a machete near the gorillas?**	❑	❑	❑

15. Is this your first trip to the Parc National des Volcans?

YES ❑ **NO ❑** ***Please specify number of previous visits_____***

Demographic Information

To help us understand our visitors more, we would like to ask a few questions about you:

16. Nationality:_____17. Country of residence: _____

18. Age Group *Please circle one*

	15-19	❑		35-39	❑		55-59	❑
	20-24	❑		40-44	❑		60 or over	❑
	25-29	❑		45-49	❑			
	30-34	❑		50-54	❑			

19. Are you Male❑ or Female ❑

20. Household Income group: *Please ✓one category*

USD $ per year	Less than 25, 000 ❑	25,000 to 45,000 ❑	45,000 to 65,000 ❑	65,000 to 85,000 ❑	More than 85,000 ❑
GBP £ per year	Less than15,000❑	15,000 to 35, 000 ❑	35,000 to 55,000 ❑	55,000 to 75,000 ❑	More than 75,000 ❑
Euro € per year	Less than 25, 000 ❑	25,000 to 45,000 ❑	45,000 to 65,000 ❑	65,000 to 85,000 ❑	More than 85,000 ❑

21. Which category best describes your education level: ***please ✓ one box***

	Secondary School	❑		University	❑	Postgraduate	❑

22. Do you have children? (*Please ✓ one)* No❑ Yes ❑*(If yes how many____)*

23. Are you a member of a conservation group or do you take an active interest in conservation? ***Please ✓ one***

1.	YES	❑	2.	NO	❑

Choice exercise

This part of the survey attempts to explore your preferences for nature conservation and some hypothetical impacts or outcomes from gorilla tourism. Below you will find 9 choice cards from which you will select one response regarding your preference for different combinations of features of a trek to the gorillas. These features are:

Size of tour group: This attribute relates to the number of tourists in a trekking group to visit the gorillas. This is limited to a maximum of 8 for conservation reasons, however smaller groups are sometimes preferred by some visitors.

Length of trek: The amount of time taken to reach the gorillas. Some visitors feel a bit dissatisfied if they reach the gorilla group quickly as experiencing the forest is an important part of the experience. For others the trek is not a very important part of the experience and they are keen to get to the gorillas as quickly as possible to enjoy their allocated hour with them.

Community Benefit: Currently 5% of gross park tourism revenues (permit prices) are targeted towards financing development activities in communities adjacent to the national park. To some visitors it is important that local communities receive some benefits from the tourism activities, to others this is not an important aspect of their gorilla trekking experience

Possibility of seeing other wildlife: The ability to see other flora and fauna in the park can contribute to the richness of the experience. For some visitors this is not so important but for others it can be almost as important as seeing the gorillas themselves.

Increase in permit price: Whilst the price of the trekking permit is US $375 the management of the park and conserving the gorillas is a costly business. Many visitors are willing to pay an additional premium to ensure the conservation of the mountain gorilla and their habitat, others are less inclined.

We now wish you to review the choice cards below, there is no right or wrong answer we are simply interested in your opinion. For each of the 9 select which option would be most preferable to **you**:

1.

Gorilla Trip Features	Option A	Option B	Neither
Tour group size	4	6	I would not choose either option to visit the gorillas and would conduct some other activity instead
Length of trek	Between 1-3 hours	More than 3 hours	
Community benefit	20% of permit price	No change	
Possibility of seeing other wildlife	Medium	High	
Increase in permit price	$75	$50	
Which option do you choose *(✔one only)*	❑	❑	❑

2.

Gorilla Trip Features	Option A	Option B	Neither
Tour group size	4	6	I would not choose either option to visit the gorillas and would conduct some other activity instead
Length of trek	More than 3 hours	Less than 1 hour	
Community benefit	No change	10% of permit price	
Possibility of seeing other wildlife	High	Low	
Increase in permit price	$100	$200	
Which option do you choose *(✔one only)*	❑	❑	❑

3.

Gorilla Trip Features	Option A	Option B	Neither
Tour group size	6	8	I would not choose either option to visit the gorillas and would conduct some other activity instead
Length of trek	More than 3 hours	Less than 1 hour	
Community benefit	No change	10% of permit price	
Possibility of seeing other wildlife	Medium	High	
Increase in permit price	$25	$100	
Which option do you choose *(✔one only)*	❑	❑	❑

4.

Gorilla Trip Features	Option A	Option B	Neither
Tour group size	8	4	I would not choose either option to visit the gorillas and would conduct some other activity instead
Length of trek	More than 3 hours	Less than 1 hour	
Community benefit	20% of permit price	No change	
Possibility of seeing other wildlife	Medium	High	
Increase in permit price	$150	$75	
Which option do you choose *(✔one only)*	❑	❑	❑

5.

Gorilla Trip Features	Option A	Option B	Neither
Tour group size	4	6	I would not choose either option to visit the gorillas and would conduct some other activity instead
Length of trek	More than 3 hours	Less than 1 hour	
Community benefit	20% of permit price	No change	
Possibility of seeing other wildlife	Low	Medium	
Increase in permit price	$50	$25	
Which option do you choose *(✔one only)*	❑	❑	❑

6.

Gorilla Trip Features	Option A	Option B	Neither
Tour group size	6	8	I would not choose either option to visit the gorillas and would conduct some other activity instead
Length of trek	Less than 1 hour	Between 1-3 hours	
Community benefit	20% of permit price	No change	
Possibility of seeing other wildlife	Low	Medium	
Increase in permit price	$100	$200	
Which option do you choose *(✔one only)*	❑	❑	❑

7.

Gorilla Trip Features	Option A	Option B	Neither
Tour group size	4	6	I would not choose either option to visit the gorillas and would conduct some other activity instead
Length of trek	Less than 1 hour	Between 1-3 hours	
Community benefit	No change	10% of permit price	
Possibility of seeing other wildlife	Medium	High	
Increase in permit price	$200	$150	
Which option do you choose *(✔one only)*	❑	❑	❑

8.

Gorilla Trip Features	Option A	Option B	Neither
Tour group size	4	6	I would not choose either option to visit the gorillas and would conduct some other activity instead
Length of trek	Between 1-3 hours	More than 3 hours	
Community benefit	10% of permit price	20% of permit price	
Possibility of seeing other wildlife	Low	Medium	
Increase in permit price	$25	$100	
Which option do you choose *(✔one only)*	❑	❑	❑

9.

Gorilla Trip Features	Option A	Option B	Neither
Tour group size	4	6	I would not choose either option to visit the gorillas and would conduct some other activity instead
Length of trek	Less than 1 hour	Between 1-3 hours	
Community benefit	10% of permit price	20% of permit price	
Possibility of seeing other wildlife	High	Low	
Increase in permit price	$150	$75	
Which option do you choose *(✔one only)*	❑	❑	❑

Finally can you please answer the following questions about your own preferences:

- What is the ***maximum*** number of tourists you would tolerate on your trek (bearing in mind the maximum of 8)? *(✔one only*) 1❑; 2❑; 3❑; 4❑; 5❑; 6❑; 7❑; 8❑

- What is the ***minimum*** number of hours (round trip) would you be willing to trek to view the gorillas? *(✔one only)*
  No less than ½ an hour ❑; 1 hour ❑; 2 hours ❑; 3 hours ❑; more than 3 hours ❑

- What is the ***maximum*** number of hours (round trip) would you be willing to trek to view the gorillas? *(✔one only)*
  Up to 1 hour ❑; 1 hour ❑; 2 hours ❑; 3 hours ❑; 4 hours or more ❑

- What is the ***maximum*** additional amount above the current permit price that you would be willing to pay?
  _____$US

- What is the ***lowest*** percentage of tourism permit revenue would you wish go to local communities who live around the park? *(✔one only)*
  2%❑; 5%❑;10%❑;20%❑;30%❑; other please specify_____