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Comparing opportunity cost measures of forest conservation in Uganda; implications for assessing the distributional impacts of forest management approaches

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Abstract: Reducing deforestation and forest degradation will mean imposing restrictions on the use of forest resources by households that currently use natural forests to maintain their livelihoods. An emerging issue in forest monitoring is the need to assess social and economic impacts in forest user communities of alternative policy and management approaches. Implicit but often unrecognized in forest management strategies focused on integrating people into forest management is that communities are not homogeneous , implying an important degree of variation in the costs of forest use restrictions across households. Quantitative economic methods are essential to a robust measurement of the real socio-economic impacts of forest management and conservation programs, and to adequately design compensation packages to offset local costs. A key entry point to understanding the scope of impact in design of a forest management program, under conditions of local subsistence use, is assessing the minimum compensation necessary to incentivize forest conservation. Two principal valuation approaches exist, financial and economic. The latter measures both financial and social values; but which approach should we use? The selection of valuation approach can dramatically impact estimates of the compensation required to affect real change in forest conservation. Empirical evidence on the divergence of different value measures are presented for four case study forests under different governance arrangements in Uganda. A contingent valuation (CV) survey was administered alongside a market price (MP) method household survey for park-adjacent households. In the CV survey respondents were asked to state their minimum 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, whilst the MP survey estimated total annual household income from all sources e.g. agriculture, livestock and forest access. Data were collected from households in areas adjacent to the forests according to a stratified random sample (n=690). Distributional differences in forest income and welfare values are examined, to illustrate the strengths and weaknesses of different valuation approaches for estimating the benefits of forest use. We find that a range of complimentary conclusions can be drawn from the two techniques. Together, they provide contrasting information on the importance of forest income to heterogeneous rural households and they can help assess the potential effectiveness of alternative forest management strategies and governance arrangements.

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1.0 Introduction

Deforestation and forest degradation are among the most important single sources of global greenhouse gas emissions (GHG), contributing up to 17% of total annual emissions. There is much global political support for the Reduction of Emissions from Deforestation and Forest Degradation (**REDD+**) initiative as land-use based approach to climate change mitigation. The underlying causes of land use change with particular reference to forest loss in the tropics are multifaceted and complex (FAO, 2009; Geist and Lambin, 2002). In developing economies, the most important source of income is agriculture. It is in these regions of the globe that that tropical forest loss is highest (Barbier 2007a). Reducing emissions form deforestation and forest degradation would likely require adopting restrictions on household use of forest resources. This could have important implications for impacted households. Yet, there is some skepticism regarding the ability of the opportunity cost approach to provide a reliable measure of the economic impact of forest use restrictions.

REDD+ is a performance based policy with payments made on the basis of verifiable reductions of emissions; much has been done focusing on the monitoring, reporting and verification (MRV) of carbon emissions levels. However the policy also has specified co-benefits, in that at a minimum it should do no harm to society and biodiversity. Whilst the monitoring framework for carbon emissions is well developed, the monitoring framework for social impacts is more primitive. Early efforts related to social impact assessment (SIA) have focused on establishing standards for conducting REDD+ projects and programs, in attempts to integrate biophysical, social and biodiversity benefits. These initiatives have resulted principally in the establishments of lists of indicators to be monitored at either the project or national level, coupled with narratives on best practices.

Some initiatives have proposed more detailed monitoring and reviews of alternative methodologies (e.g. Climate Community and Biodiversity Alliance (CCBA) Standards[1], Voluntary Carbon Standards (VCS)[2], Forest Trends (FT) Social Impact Assessment Guidelines[3] and ONF

[1] CCBA Standards http://www.climate-standards.org/standards/index.html
[2] VCS http://www.v-c-s.org/vcsmethodologies.html
[3] FT – SIA http://www.forest-trends.org/documents/files/doc_2436.pdf

International Guidelines[4]). A review of these proposals reveals a predominance of qualitative social appraisal methods and that they do not stipulate precise methodologies for quantifiable social impact assessment and monitoring. One exception is the approach proposed by the Center for International Forestry (CIFOR), in their global comparative study on REDD+ (Jagger et al. 2010). Jagger and co-authors recommend a quantitative household survey based approach, using market price methods to assess the financial value of forests to local users.

Others have argued that a quantitative economic approach based on the measurement of both priced and unpriced household losses is essential to adequately design compensation packages that appropriately offset local opportunity costs (Wunder 2009) and provide ongoing incentives for respecting newly adopted restrictions over forest use. However, the suitability of local opportunity cost assessments has also come into question. At issue is the ability of economists to adequately assess the levels of compensation necessary under certain market and institutional conditions, particularly where local use is illegal (Gregersen et al. 2010).

One underlying concern is the cost of SIA studies. There is a perception that quantitative methods are more costly to implement than qualitative methods. This is of course highly debatable and depends on the scope and nature of the enquiry that is ultimately adopted to deliver on developing indicators, standards and guidelines. Thus an emerging issue in social impact appraisal of REDD+ projects and programs is how to robustly and cost-effectively assess social and economic effectiveness, efficiency and equity (3E's) impacts in forest user communities (Jagger et al. 2009). Of the two principal valuation approaches, financial and economic, the latter is limited in scope to the subset of community losses normally measurable through some market transaction or their equivalent, whereas the economic method tries to also capture social values (attachment to the land; spiritual values) and other intangibles such as greater food security (e.g. the ability to rely on forest foods when crops fail). Which of these approaches should be used and what can the different valuations tell us about the 3E's

[4] ONFI REDD at Project Scale Guide http://www.onfinternational.org/en/publications/313-qguide-redd-a-lechelle-projetq-guide-devaluation-et-de-developpement.html

in project design and monitoring are the central questions posed in this research.

1.1 Objective

This paper presents empirical evidence on the differences of two different measures of the opportunity cost of forest conservation, based on four case studies in Uganda. We illustrate the strengths and weaknesses of different forest valuation approaches as well as the role of governance and socio-economic parameters in determining a household's propensity to use forest resources. In addition the paper provides a review of appropriate literature on the valuation techniques utilized in developing countries. This should serve as an entry point into the valuation literature for non-technical specialists.

1.2 The economic rationale for the household focus in community in forest management

There is increasing recognition that greater consideration must be given to community involvement in local resource management. Traditional techniques of forest management such as the "fences and fines" approach are viewed by some as having failed to conserve forest biomes in the tropics (Barrett & Arcese 1995; Johannesen 2005). The importance of involving communities in achieving positive results in forest conservation and management has also been widely acknowledged and draws on early experiences with wildlife conservation programs (Andrade 2003; Berkes 2004; Johannesen 2004; Leach et al. 1997; Leach et al. 1999; Naughton-Treves & Sanderson 1995; Noss 1997). However, despite the recognition of the role of communities in the management and use of forests, the implementation of community based forest conservation, or community based natural resource management initiatives have been criticized (Berkes 2004; McShane & Wells 2004), and the results 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).

We argue that one of the main reasons for the disappointing results has been inappropriate program design following the misidentification and poor quantification of the main social and economic

parameters that drive local people to make unsustainable or illegal use of protected areas. In particular, there is a need to recognize the role that the natural resources play in alleviating the poverty of some user segments and in the overall economic development of forest communities. There is thus a pressing need for quantitative information on the socio-economic value of protected areas to local communities as a means to develop practical solutions that effectively mitigate the conservation and development conflicts that forest managers are faced with. This is particularly important to help define realistic expectations about what can be achieved from a REDD+ project with a given budget.

In many ways the type of activity that REDD+ might fund at the field level are close homologues to integrated conservation and development (ICD), community conservation (CC), or payments for ecosystem services PES (Brandon and Wells 2010) approaches. A broad assumption in all cases is that affected communities may be less inclined to unsustainably or illegally use local environmental resources when rural poverty and development needs are addressed along with resource management issues (Barrow & Murphee 2001; Hulme & Murphee 2001b; Newmark & Hough 2000). The importance given to communities and the role they play in the conservation of protected areas is driven not only by a concern for social justice, but also by a pragmatic assessment that they have the greatest impact on resources, either through direct unsustainable use, poorly enforced intuitional arrangements or through the ability to obtain development rights from governments.

The current emphasis on "communities" is not misplaced, but any intervention must be mindful that much unsustainable use of resource is not the result of collective decision-making. Instead, resource extraction and depletion is often the result of many decentralized decisions made daily by individuals and households. An individual decision on its own is not necessarily critically damaging to forest resources. However, the cumulative effects of clearing small areas here and there for crops, allowing animals to pasture in the conservation area, collecting wood or hunting, produce noticeable cumulative impacts. It is therefore essential to understand the household-level economic conditions and incentives that make the resource valuable to individual members of the community. (Hulme &

Murphee 2001b). Lutz (1994) goes further in proposing 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 management measures would (or should) 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. This type of analysis yields an important insight into 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 or households as the principal agents of change in forest conversion. The challenge in designing economically optimal forest management strategies is to estimate the loss of benefits (expected welfare loss or compensating variation) to households from attaining a given level of forest conservation.

Estimating the costs of forgone forest access, or incentives to pursue other land use activities (opportunity costs), thus requires a thorough inventory of the costs and benefits from forests to adjacent households as well as alternative enterprises. This paper contributes by developing a detailed understanding, in financial and economic terms, of the value of the benefits derived from protected areas at the household level and makes use of the resulting data to address questions about the efficacy of conservation management approaches to create incentives to mitigate the problems of illegal and unsustainable use.

2.0Methods

2.1.1 Financial *versus* economic analysis.

As a matter of clarification for non economists, it is necessary to understand the difference between financial and economic values. These terms have specific meanings in the economist's lexicon. Financial values are perhaps what most people are familiar with. They refer to the value of goods and services to individuals or businesses, as assessed by the price the items fetch in market transactions. What these prices tell us is that the individual purchasing the item values it at least as much as the price he paid for it. In many cases, this will understate the true value of the good or service for the individual. This happens any time an individual derives greater benefits than the price he has to pay to acquire the object or service, or, in the economists parlance, any time the individual would be willing to pay more than the price he has to pay.

Economic values, on the other hand, seek to measure the total benefits of the good or service, whether they are traded in the market or not. The (gross) economic value of a good or service is the total value of an individual is willing to pay for a good or service. This value is typically represented by the maximum amount that an individual would be willing to pay for the object. The net value is this same total willingness to pay (WTP) minus the cost or acquiring it. [5] These concepts apply equally to goods and services that are not transacted for on a market. This is especially true in the case of environmental services. For a farmer, the proximity of a forest might provide critical protection from soil erosion. As a result, the forest is providing an ecosystem service. Its value to our farmer is the difference between the benefits of farming in the presence of the standing forest and the value of farming once the forest has been cut. Conceptually (and ideally) the economic value can also be represented by the maximum that the farmer would be willing to pay in order to maintain the forest intact.

[5] The seller might also realize a profit or surplus by selling the object at a price that exceeds the cost of production. In this situation, the true net economic value of the object would include this "producer surplus", so that the total net value to society is equal to the total benefits from consumption minus the actual cost of production.

Viewed from a slightly more general perspective, economic values try to measure one of four variants of the basic question how much money (or, in developing countries, some other currency like rice or maize) would an individual need to give up so that when a new good or service is added to his consumption, his overall welfare remains the same. In the case of the erosion protection, the variant the question and the value of the ecosystem service could be the amount of money that the farmer needs to be paid in compensation so that he is no worse off after the forest has been logged. Less compensation would leave the farmer worse off, more would leave him better off. The true value of the service itself is that amount that leaves the farmer whole.

Different methods are applied to impute the two types of value, economic and financial. Both approaches can also be used to investigate the variation in values of forest access across individuals, and what drives this variation. The focus of this study is forest income from a market price study to assess the annual financial value to forest adjacent households and a contingent valuation to assess the welfare value to reflect the full economic costs of a loss of access to forests. This next section discusses these different methods to estimate both financial and economic values.

2.1.2 Market price method to assess financial values

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 generalized 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 generalized conclusions based on common factors or trends identified between sites of varied context, utilizing data gathered in a systematic and directly comparable manner. The market price method utilizes a household survey to assess the volumes of goods produced on farm or harvested from the forest, often alongside other household income e.g. wage labor or small business

activities. Prevailing market price values are used to estimate total financial values of goods.

The market price method and the collection of household economic survey data are 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 1940s, as indeed have many other countries. Household surveys provide a rich source of economic data on economic behavior (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) analyzed 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) present a financial and economic cost and benefit analysis of smallholder rattan cultivation in Kalimantan, Indonesia, showing that economic returns to rattan production are less than financial (market) returns. The authors 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).

Other studies go beyond the descriptive use of resources to examine relationships between the levels of forest use and other social and economic factors in bids to better understand resource dependency. Cavendish (1999a, 1999b) examines the importance of the way in which multifarious environmental goods interact with a 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, whilst Sander (2004) conducted a study of forest values and dependency in Mdagascar. Jagger (2008)assessed the effects of Uganda's forest sector decentralization reform on rural household incomes, demonstrating that the reforms in fact had little impact overall, but poorer household forest incomes were reduced relative to wealthier households. The key message from these studies is that understanding the dependency issue is critical in designing equitable and effective land use and forest management policies.

Vedeld at al (2004) make a useful contribution to our knowledge through a meta analysis of several studies based on market price method data, highlighting the poverty environment relationship and determinants of use of environmental resources. 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, while very useful in understating local level issues related to forest use, do not easily yield general conclusions on how successful a management approach might be in other contexts. The studies, however, underscore the importance of quantitative economic methods in understanding and monitoring the social impacts of current and proposed forest management practices.

2.1.3. Contingent Valuation and its application in developing countries

The contingent valuation method (CVM) uses a direct approach to measure the economic value of environmental goods and services. It asks people through surveys or experiments what they are willing to pay (WTP) for the good or willing to accept (WTA) for the loss of the good (Boyle 2003). Contingent valuation is particularly attractive because it can estimate values where markets do not exist or where market data cannot be applied, serious limitations of market price valuation methods. CVM is widely used to measure use values, existence values, option values, and indirect 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 in the context of a constructed market. 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.

Despite many methodological advances, critique of CVM now focuses on issues related to 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)

There is a well established narrative on the application of CVM in developing countries e.g. Hanley and Barbier (2009). Applications in developing countries have focused mainly on the valuation of water supply, improved sanitation and health services and the valuation of environmental amenities arising from national parks (Kramer et al. 1992; Kramer et al. 1995; Whittington 1998; Willis & Garrod 1996). In addition a few publications have focused on a critical assessment of the application of different valuation methods in the context of forest and biodiversity management (e.g. Bishop, 2003; Christie et al. 2008; Cambell and Luckert, 2002). Mekonnen (1997) applied a 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, also

using a WTP-CV scenario. In contrast Smith et al. (1998) use a willingness to accept (WTA) approach to analyse the level of compensation required to induce land use changes among farmers in Peru in order to favour carbon sequestration. Kramer and his co-authors (1992, 1995) also look at farmer's WTA compensation in exchange for modifying their land use practices for watershed enhancements. .

Despite the fact that CV 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 CV in a developed versus a developing economy. Whittington (1998) states that many studies have been conducted without better prior knowledge of the cultural context in which they are to be applied.

Mekonnen (1997) regarded 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 nonetheless 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. The skill of the researcher in posing appropriate lines of enquiry to produce relevant values is paramount.

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 CV in developing countries to help evaluate a wide range of projects.

Whittington (2004) discusses the impacts of cross-cultural communication in implementing CV studies in developing countries and 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 CV 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 norm. 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 CV in developing countries to measure preferences for environmental goods and services has an established pedigree. Early applications may have suffered due to poor design. However there is now enough contemporary experience about the need for contextual adaptations to make CV a very useful and applicable tool.

2.2 Study context, sampling and method

Ugandan gazetted natural forests are managed under a deregulated para-statal system through national and district forest authorities with varying responsibilities over different governance classifications of forests e.g. Central forest reserves, district forest reserves, nature reserves, forests on private land. In addition, the Ugandan Wildlife Authority manages forests in national parks. The rest of Uganda's natural forests are on private land. Sampling was designed to reflect the variety of governance and bio types to assess differences between cases. Four forest sites were surveyed, representing the four predominant forest types in Uganda described in the Table 1 below.

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.

2.3 Survey design and sampling

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. The survey questionnaire 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 January to July 2006. Financial information was collected in 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.

The CVM survey was administered alongside the market price method household survey of social and economic costs and benefits of forest access to forest adjacent households. In the CVM section, 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. 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 WTAC (Willingness to Accept 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 resource management scheme in collaboration with local 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 from the protected area on an annual basis. A second treatment used a “provision point”, to try to reduce

hypothetical over-statement of WTAC amounts. 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 was 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. Much time was spent in discussion with the survey team to ensure their full comprehension of the underlying concepts behind the survey 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 neighbors 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 CVM exercise was significantly aided by the accompanying Market Price survey. This may have helped to produce a more considered response to the CVM question and avoid confusion in responses. 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 680 households in communities around each of three different protected areas (Table 2), 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. Although 680 households were interviewed, the *n* value in the tables sometimes varies e.g. 670, 675 etc. This is due to missing variables, resulting in a household being excluded from a certain parts of the analysis.

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) 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 1 Data collection sample frame

Protected Area	**Bio Type**	**Governance Type**	***No of Households in survey***
Queen Elizabeth National Park	Savannah Woodland & Grassland	Strict National Park (no community co-management)	*329* *(11 communities)*
Bwindi Impenetrable Forest National Park	Afromontane Forest	National Park with some community co-management	*232* *(8 communities*
Budongo Forest Community Forest Reserve (Masindi District)	Tropical High (Closed Canopy) Forest	Forest on private land, community owned and managed	*60* *(2 communities)*
Tengele Forest, Collaborative Forest Management	Tropical High (Closed Canopy) Forest	Forest Reserve (public land), with community co-management	*59* *(2 communities)*
		Total households	***680***

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.).

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. 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.

3.0 Results

3.1 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 2 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 2 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 3 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 3) 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 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

There was no significant difference between sites in the proportion of household members, above the age of 15 years old, having no formal and secondary education (Table 4). 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 endeavored 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 5 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 in 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 found (Table 5). This is a reflection of the relative land scarcity and population densities of the different areas rather than agro ecological potential. Bwindi has the highest population density and Budongo the lowest. Both, along with Tengele, are characterized 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.

3.2 Market Price Survey results

Table 6 shows that the mean household income across all sites was just over $1010 per annum. There were however significant differences in annual household income between sites (ranging from a little over 0.05 USD per household in Bwindi to 44.16 USD per Household in Tengele.

Table 6 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	Forest 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	69.15	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	65.88	2.13

hh= household

From this data we see that the respondents in this survey are overwhelmingly poor by international standards e.g. per capita income less than the $2[6] 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 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.

The overall household income value is consistent with previous studies conducted by this author of $1009 per household per annum (Bush et al. 2004). In terms of consumption of forest products in the home, proportions were roughly comparable, 75.4% (Bush et al, 2004) compared to 65.9% in this study. However the value of forest goods in total household income is lower in both absolute and proportional terms. Household forest income in Bush et al (2004) was on average $188 (Bush et al, 2004) compared to $22 in this study and represented 19% of household income compared to 2.13% correspondingly. This is a reflection of the different focus and sampling strategies employed as in this study e.g. areas with higher level of protection were chosen, even though the range of biomes surveyed are similar. In the Bush et al. (2004) study impacts of governance arrangements were not an explicit

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

criteria and the sample was chose to reflect the general institutional and enforcement situation in Uganda at that time and included sites where forest was found on private and communal lands with no legislated restrictions on local use.

Table 7 presents the distribution of mean forest income between income groups (quartiles). The first observation is that between income groups forest income increase with increasing overall income. Data were classically heteroscedastic showing increasing sample variance with increasing income and in all cases there were households who derived no forest income. Data illustrate that in financial terms, forests contribute more to total household income for high income households than low income households.

Table 7 Mean annual forest income by income group

Income group	N	Mean $	Std. Deviation	Std. Error	Minimum	Maximum
Lowest 25%	170	1.93	8.37	0.64	0	92.63
Lower Middle 25%	170	9.23	37.72	2.89	0	303.16
Upper Middle 25%	170	10.79	52.46	4.02	0	505.26
Highest 25%	170	63.01	423.64	32.49	0	1547.37
ALL	680	21.24	215.22	8.25	0	1547.37

3.3 Contingent Valuation

Table 8 shows the mean willingness to accept compensation for loss of forest access by site. The mean overall was $417 (S.E.=17.26) with no significant difference between sites.

Table 8 CV Mean willingness s to accept compensation annually for loss of access to local forest resources

Site	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Budongo	60	485.88	482.42	62.28	42.11	2631.58
Tengele	59	448.35	506.98	66.00	52.63	3157.89
Bwindi	229	410.41	409.95	27.09	0.00	2631.58
QEPA	327	404.72	457.06	25.28	0.00	2631.58
ALL	675	417.68	448.31	17.26	0.00	3157.89

Table 9 displays the CV bid values by income group (quartile). Values were significantly different between cases ($F=2.796$, d.f. = 3, $p<0.05$). Interestingly values increase and then decrease with income group, indicating a bell shaped relationship, but showing that the welfare values of the highest income group was lower than that of the lower groups.

Table 9 CV mean willingness to accept compensation by income groups

Income quartile	N	Mean $	Std. Deviation	Std. Error	Minimum	Maximum
Lowest 25%	169	419.18	453.23	34.86	0	2631.58
Lower middle 25%	170	491.48	528.05	40.50	0	2631.58
Upper middle 25%	168	407.32	414.82	32.00	26.32	3157.89
Upper 25%	168	351.85	374.49	28.89	0	2631.58
ALL	675	417.678	448.31	17.25	0	3157.89

3.4 Social and economic influences on CV 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 forest resource may also be determining factors of 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 given proxy measure where these were surveyed. The variables that most closely correspond to such social, economic and institutional factors are described in Table 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.

Multi-collinearity is a common problem in analysis of cross-sectional data (Green, 2003). The severity of multi-collinearity among explanatory variables was checked using the Variance Inflation Factor (VIF) comparison. According to Gujarati (1995), if VIF exceeds 10, this is considered as an indicator for the existence of serious multi-collinearity problems between repressors'. VIF estimates for the repressors' are calculated and show that there were no serious multi-collinearity problems as no parameter had a value greater than 2.1.

Following Green(Green 2003) and Deaton (Deaton 1997), a TOBIT model was chosen for analysis of selected variables that could have had a hypothesized causal influence on bid value. A Tobit model was utilized, 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 could be where a respondent may in fact be willing to pay to conserve the local forest resource; 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. Only 472 observations were included in the model statistics as a full set of data on all of the parameters was not available. The variables included in the model and hypothesized effects on forest WTA value are described in table 10. Both the variables DISTMARK and DISTPA had a high number of missing entries. This was particularly 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 10 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
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

Table 11 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
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 11, show only three significant explanatory variables of bid value in the model, AGRILAND, APAI, and 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 is of interest. The relationship was negative, indicating that those households with more agricultural land hold a lower value for protected area access (as measured by their stated WTAC) 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. APAI had a significant positive effect, which is consistent as higher levels of income from the protected area would also imply higher welfare values. The GTDUMMY3 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 12), we see that there are some distinct differences. Tengele (GTDUMMY3) households have a high mean land holding with a low standard deviation from the mean compared to the other sites.

Table 12 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.

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 interesting 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*) will have no significant change on local use of the protected area.

4.0 Conclusion

4.1 Values and valuation methods

The Market Price method estimates show that the proportionate contribution of forest access to mean annual total household income was. However this mean of 2% of household income is an average across all households in the sample, many of whom reported no forest income. Paradoxically the financial value of local forest resources was much higher for high income households than low income households. It is often suggested that poverty that is a driving factor behind forest use and thus that improving incomes will reduce forest use. These findings suggest the opposite: that *ceteris paribus* improving income may increase the off take of forest goods.

In welfare terms as measured by minimum WTA compensation, the opportunity cost of forest conservation was almost as much as 50% of total annual household income and nearly 20 times more than the financial cost value of forest goods form the MP study. This difference, whilst large, is not surprising, as the methods essentially measure different things. The welfare value reflects the substantial non-market use of forest resources and the potential local economic losses imposed by forest management policies. It can also reflect the level for market imperfection in that the substitutability of goods for money in a peasant farming economy, in the face of sudden scarcity, is low. Alternative resources are often not available, even if households have money to buy them. In a perfectly functioning economy market prices also more adequately reflect use values. Economic cost estimates are also driven by the value of access to forest resources as insurance in times of local scarcity. An important finding was that social (non-market) values associated with forest income can be higher for low income households than for high income households. This probably reflects the difference between household dependence for low income households (few alternatives to forest income) versus use as a livelihood alternative for high income households.

Determining what social and economic parameters affected economic values 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 access to smaller areas of farmland. 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.

Institutional factors are also an important determinant of economic values. 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 formalize 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 dependent 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 the loss of options to convert the forest to agricultural land for cash crop production. Such dynamics may be decreasing the willingness of the community to take part in collaborative management efforts.

4.2 Which value should we use in implementing the 3E criteria?

The choice of valuation approach can dramatically affect our estimates of the scale of compensation required to affect real change in forest conservation. Ideally we should attempt to use

both financial and economic approaches as they are different but complementary measures of opportunity cost.

The financial values track quantity changes and market variables giving important insights into the changing nature of demand and supply of forest products. The economic (welfare) value give s a quantitative measure of the social impacts of policy and management approaches helping us to understand equity and dependency issues. Forest conservation strategies using direct or indirect compensation methods must do more than compensate the financial values lost to ensure local equity. Simply improving incomes, a central tenet of poverty alleviation programs, may not help to conserve forests, especially without effective enforcement of regulations, a critical issue related to effectiveness. The described results are critical issues when thinking about efforts to pursue community based approaches to forest management approaches and. 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 forest resources 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 behavior and perceptions towards sustainable forest management. A quantitative understanding the scope and nature of costs and benefits helps realistic planning in terms of understanding the investments required to implement successful programs.

These findings also have important implications for the choice of forest management approach when comparing direct versus indirect methods of creating incentives. Research by Groom and Palmer (2008) on the cost-effectiveness of direct payment approaches e.g. PES, contests the findings of Ferraro and Simpson (2002) that they are in fact a superior alternative to indirect approaches e.g. ICD. 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 inmost developing country contexts. 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 local institutional context is essential, a critical efficiency criteria. 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.

These findings highlight the need to quantitatively account for the changes in financial and economic values of forest access as a result of community forest management initiatives, if they are to be successful.

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