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Economic Value of the Bwindi and Virunga Gorilla Mountain Forests

AWF Working Papers

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The AWF Working Paper Series has been designed to disseminate to partners and the conservation community, aspects of AWF current work from its flagship African Heartlands Program. This series aims to share current work in order not only to share work experiences but also to provoke discussions on whats working or not and how best conservation action can be undertaken to ensure that Africas wildlife and wildlands are conserved forever.

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Cover photo: Tourist viewing gorillas in Bwindi Impenetrable Forest National Park

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Abstract

The Virunga and Bwindi afro-montane forests of Eastern/Central Africa are best known as home to the mountain gorilla *Gorilla beringei beringei*. A study was undertaken to estimate the economic value of the protected forests, and the distribution of benefits and costs between local, national and international stakeholders. Results suggested that the forests are generating positive benefits - both tangible and intangible - relative to costs; but that benefits are overwhelmingly accruing to the international community, with little-to-no benefit accruing to those countries containing the protected areas. The implications are that the international community should be paying a greater share for the benefits it enjoys; and that the real engine of development - and sustainable forest conservation - is likely to involve investment into local small-holder agricultural livelihoods.

Keywords: Virunga and Bwindi forests, mountain gorilla, total economic value, direct use value, indirect use value, non-use value, forest opportunity costs, benefit-cost distribution

Background/Introduction

The Virunga massif and Bwindi protected forest parks represent important local centres of diversity within East/Central Africa's biodiversity-rich Albertine Rift Valley. Particularly well-known as home to the world's only remaining natural populations of mountain gorilla (*Gorilla beringei beringei*), currently numbered at around 700 individuals, the long-term viability of both forests remains threatened despite the existence of long-running conservation programs that have helped generate substantial gorilla-viewing tourism income.

Two broad factors account for this situation: first, forests tend to be undervalued on a global scale, since they provide significant benefits which to date have received little attention, either due to lack of knowledge or difficulty in quantification. These include ecological services such as climate control, waterflow regulation, soil retention, and the wider benefits of atmospheric pollution control; biodiversity value; aesthetic value; value to future generations; and ethical value. Second, the socio-political-economic context within which the two forests exist is not conducive to natural resource conservation, being characterized by high human densities; severe land pressure; and perceived unequal distribution of tourism benefits - exacerbated by large-scale political conflict.

This study seeks to address these issues in three specific ways: (1) to determine a more accurate estimate of the true value of the forests, by conducting valuation of multiple forest benefits and costs; (2) to identify and explore important economic drivers within local livelihoods; and (3) examine the distribution of forest benefits and costs between international, national and local levels. Results are used to:

- provide a baseline from which to further refine and/or expand on the current study
- draw policy conclusions
- explore the economic impact of possible interventions

Study Area

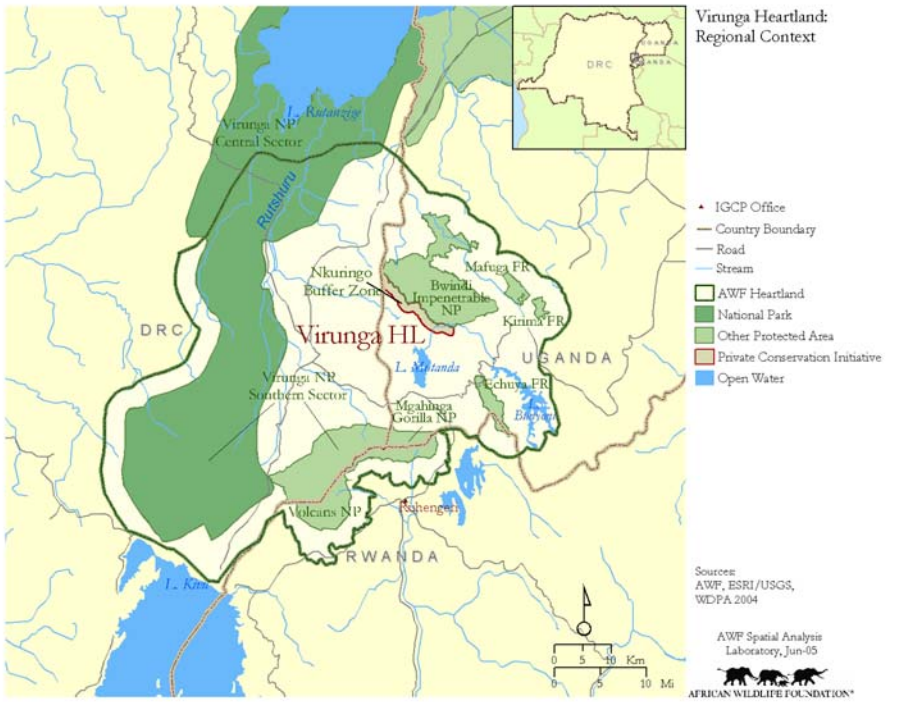
The forests of the Virunga volcanoes massif and Bwindi represent two isolated and protected afromontane tracts of a once more extensive forest, now supporting one of the highest human population densities in Africa. Together they represent important "epicentres" within the Albertine branch of East Africa's Great Rift Valley - an area listed in the top 20 of the Global 200 priority areas for biodiversity.

Bwindi Impenetrable National Park (BINP) lies wholly in south-west Uganda. Created in 1991, it protects one of the most diverse afromontane forests of the world, with a number of endemic trees, plants, and birds (Cunningham, 1996). The park consists of 32,100 ha. of rugged land - steep, narrow valleys bordered by hill crests of 1200 m. in altitude in the north and 2600 m. in the south. Before being established as a national park, the area was set up as forest reserve in 1932 and a

wildlife reserve in 1964. Throughout this period, timber was exploited and it is estimated that about 30% of the forest was cleared between 1954-91. Due to its unique characteristics and its richness, it was declared a UNESCO World Heritage Site in 1995 (Wild and Mutebi, 1996).

Located approximately 35 kms. to the south-west of Bwindi, the Virunga forest cloaks the chain of six spectacular volcanoes shared by three countries: Uganda to the northeast; Rwanda to the south; and the Democratic Republic of Congo (DRC) to the north and west. Whilst remaining a single contiguous unit, the forest comprises three separate national parks: Rwanda's Parc de Volcans (PNV); the Mikeno section of DRC's Parc de Virunga Sud (PNVi-Sud); and Uganda's Mgahinga Gorilla National Park (MGNP). After several excisions, the PNV portion comprises 160 sq. kms. of higher altitude forest; DRC's PNVi-S covers the largest section - 250 sq. kms.; whilst MGNP comprises a small section of 27 sq. km. Whilst separately administered, a relatively large degree of co-operation exists between parks - facilitated by such conservation partners as the International Gorilla Conservation Program, and perhaps encouraged by common interest in the face of political instability.

Map of Study Area



Both forests are surrounded by some of the highest human population densities in Africa, with up to 400 people per sq. km. around the Virunga volcanoes massif (Pers. Comm. 1), due to a combination of land pressure and rich volcanic soils apt for agricultural use. The dominant land use activity surrounding both forests is small-holder agriculture, with some 90% of the local population earning a living from farming (Pers. Comm 1).

Methods

Three main outputs were pursued:

- Forest benefits
- Forest costs
- Distribution of forest benefits and costs

Output 1: Forest Benefits

Forest benefits fall into three categories, all of which were investigated:

- direct use value (forest products)
- indirect use value (mountain gorilla-based tourism)
- non-use value (ecological service value; biodiversity, or existence, value; option (for future use) value; and bequest value)

A mixture of estimation methods was utilized. Direct use value and wildlife damage cost was investigated through formal face-to-face household surveys carried out by foot, following a randomized, structured transect and household selection process. The travel-cost method (for example, Brown and Henry, 1993) - which uses visitor expenditure as a proxy for value - was used to determine indirect use value i.e., gorilla-based tourism, where tourist expenditures on gorilla-viewing were ascertained through questionnaire surveys over an eight day period. In addition, through analysis of demand this methodology allows estimation of visitors' consumer surplus i.e., the additional value that accrues to visitors from their gorilla-viewing experience, over-and-above expenditure - in essence, what they were

willing to pay as opposed to what they did pay - a significant and commonly overlooked aspect of consumer benefit. Forest non-use value, together with forest opportunity cost, were estimated using contingent valuation - an emerging principal method for determining the implicit (non-market) value and/or cost of "goods and services" yielded by an environmental resource - in this case, the protected forests. Contingent valuation ascertained willingness-to-pay (WTP) amongst various stakeholders (local, national, international) to either prevent deterioration of the resource - forest cover or mountain gorillas - or to improve the condition of forest cover, as appropriate.

WTP was determined using a double-bounded dichotomous choice (or double referendum) bid method, with an open-ended follow-up question: respondents were given a scenario and asked if they were willing to pay a certain predetermined amount (bid) i.e., a discrete yes/no bid. Depending on the response, bids were either doubled or halved, and the question repeated. Respondents who answered no to both bids were then asked to nominate their bid i.e., an open-ended amount. The main advantages of this method are: (a) more accurate elicitation of WTP through use of two questions; (b) minimization of 'strategic bias' i.e., deliberately understating WTP, since respondents do not decide the amounts (except in the open-ended scenario, where care must be taken during analysis to discard obvious 'protest' bids); and (c) minimization of 'yea-saying', or giving what is considered to be the correct or desired answer (for example, Carson, 1998; IIED, 1997). Whilst possessing great flexibility and potential utility, the main weakness of contingent valuation is the reliance on peoples' views rather than market behaviour. Consequently there are many sources of potential bias - particularly the realism of the scenario; and how the scenario is explained. Results were then analyzed through use of a logistic regression model.

Output 2: Forest Costs

The costs of the forest were assumed to be limited to:

- wildlife damage
- opportunity cost, that is, the value of lost opportunities due to the existence of the forests

Two different methodologies were used to estimate forest costs amongst residents within 5 kms. of the forests: contingent valuation and estimation of income from agriculture. This allowed direct comparison for consistency of results. Both methodologies employed face-to-face household surveys using structured foot transects and questionnaires. For contingent valuation, local residents were asked what amount of annual compensation they would be willing-to-accept (WTA) in order to offset the costs of the forests' existence. As in the case of WTP (above), the double referendum bid method was used and analyzed in a similar manner. The second method, agricultural productivity, was used to determine the cost of the protected Virunga-Bwindi forests in terms of the value of lost opportunities resulting from their existence – most likely conversion to smallholder agriculture. Household questionnaire surveys were carried out amongst a total of 735 farmers within a 5 km. band around each forest, with the number of questionnaires conducted around each park determined by individual park size.

An important assumption made here is that forest opportunity cost is borne by local residents i.e., that they would be the beneficiaries of forest conversion. This would not necessarily the case; it could be argued that the costs are borne at the national level, if decisions concerning the most desirable alternative use of the forests rest within government policy.

Output 3: Distribution of Forest Benefits and Costs

In addition to determining overall value for each benefit and cost, breakdown between international, national and local levels was carried out wherever possible.

Results

Results are organized around the above four outputs:

A. Forest benefits
B. Forest costs
C. Distribution of benefits and costs between international, national and local levels

A. Forest Benefits

A.1 Direct Use Value: Forest Products

While it was hoped that respondents would feel sufficiently secure to divulge (illegal) resource use within the protected areas, results were not forthcoming. This is an area for possible further research.

A.2 Indirect Use Value: Gorilla-Based Tourism

Gorilla-based tourism levels vary considerably from year to year, dependent on prevailing perceptions of insecurity in the region. Results from sampled tourist expenditures were applied to the latest available annual visitor statistics (2000-2001). Annual gorilla viewing expenditures amounted to an equivalent of USD7.75 million - including USD2.78 million in gorilla tracking fees - and constituted 31% of total safari expenditure, on average. Annual 'consumer surplus' value accruing to international visitors amounted to a further USD5.89 million. The secondary impacts to the economy from gorilla tourism expenditures were also considered, using previously determined income- and tax-multipliers, and indicated additional benefits of USD4.48 million in terms of secondary income generation within the economy and USD3.10 million in tax generation.

Fig 1: Annual benefits accruing from gorilla-based tourism

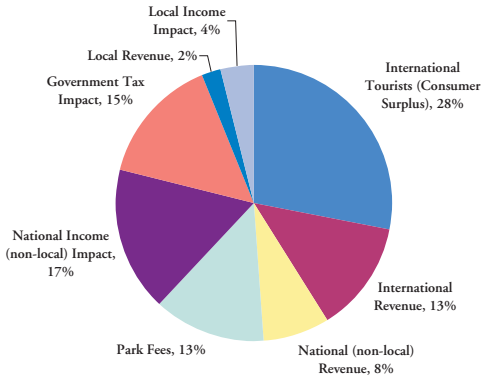
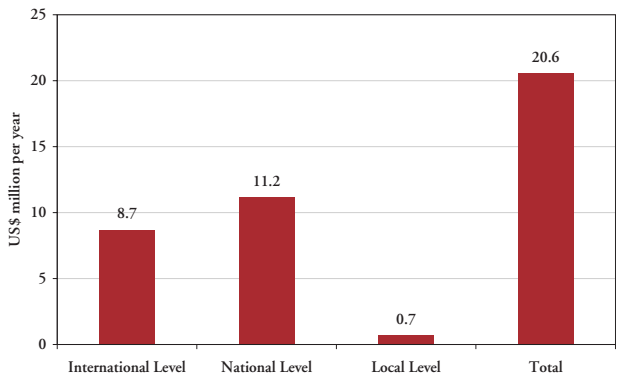


Fig. 1 above summarizes the benefits categories and levels. Overall, gorilla tourism generates USD20.6 million per year in benefits, with 53% accruing to the national level; 41% to the international level; and 6% to the local level. The largest single benefit component is international tourist consumer surplus (28% of total benefits) followed by national income generation (17%) and national tax impact (15%). International travel revenue and gorilla tracking fees both captured 13% of benefits. As implied, local gains (direct and indirect) constituted the smallest proportion of benefits. Official tourism statistics showed that for the year 2000-2001, gorilla-viewing operated at 41% of full capacity, suggesting potential for increasing revenues, with a maximum attainable value of USD51.7 million per year. However this makes no allowance for seasonal demand variations throughout the year. International visitors make up 84% of total visitor numbers to mountain gorilla parks, with 81% of all visitors being from three geographical blocks: Europe (42%), U.S.A. (20%), and Australasia/Japan (19%). The distribution of gorilla-tourism benefits across international, national and local levels is summarized in Fig. 2 below.

Fig. 2: Distribution of annual gorilla tourism benefits (2000/2001)



A.3 Non-use Value

Samples were drawn and estimation carried out for four populations:

- local residents surrounding the forests;
- national citizens;
- international citizens (non-gorilla tourists from the three major geographical visitor blocks); and
- ecological service value to agriculture based on the experience of the former, now deforested, Gishwati forest in Rwanda.

Results gave an annual forest non-use value to local residents of USD0.2 million, and USD1.0 million to national citizens. Local ecological services were worth USD0.2 million annually. By contrast, non-use value to international citizens resulted in an annual estimate of USD186.5 million, motivated primarily by ethical and intrinsic (existence) values. However, the latter two estimates were based on relatively narrow sample populations and limited sample size due to time and resource constraints; both would benefit from greater in-depth treatment in order to verify results, particularly

given the significance of the result for international non-use value.

In addition, international ecological service benefit in the form of carbon sequestration was estimated through secondary sources, and valued at USD 0.7 million per year.

B. Forest Costs

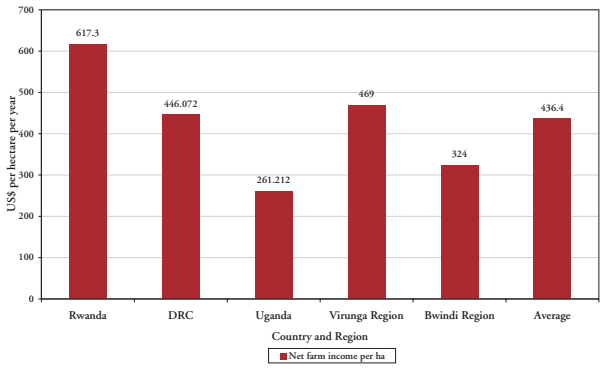
B.1 Wildlife Damage

Data concerning loss from wildlife damage was determined to be overstated and too inconsistent to be of use - for example it was commonly found that some respondents claimed damage significantly over-and-above claimed farm production. Again, this is an area requiring more focused and carefully designed research.

B.2 Opportunity Cost Estimate 2: Agricultural Productivity

Results gave an overall average net income per hectare of USD436 per year, translating into an annual (opportunity) cost of USD15 million in terms of forgone agricultural potential due the existence of the forests, assuming 50% of the existing park areas are cultivable. As depicted in Fig. 3, net income varied significantly between countries, being highest in Rwanda and DRC, as well locally between parishes and distance from park boundary. However, no significant difference was found regionally between Virunga and Bwindi.

Fig. 3: Net farm income by country and region



On average, 83% of income is derived from crops with the balance from livestock production. Woodlots represent a third common land-use, however, valuation proved problematic and was therefore excluded.

B.3 Opportunity Cost Estimate 1: Contingent Valuation

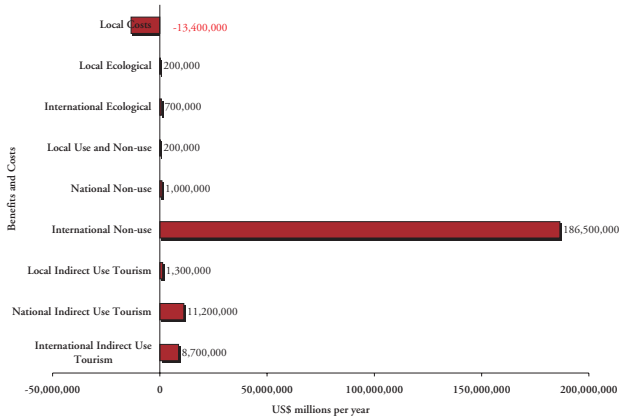
Results indicated an annual opportunity cost of USD13.4 million. This compares to the earlier, alternative estimate of annual opportunity cost of USD15.0 million estimated through the farm production survey. The proximity of the two results increases confidence as to the true magnitude of forest costs at the local level.

C. Aggregate Benefits and Costs, with Distribution between International, National and Local Levels

C.1 Aggregate Benefits versus Costs

Fig. 4 depicts the individual benefit and cost values over the estimated categories. The overall aggregate total gross economic value (gross benefits less local forest costs) of the protected Virunga-Bwindi forests is USD196.4 million on an annual basis. However, 90% of this total is derived from the non-use value of mountain gorilla habitat to the international community. Of the remaining benefits, gorilla tourism is responsible for 91%. However, it can be noted that the latter benefits are tangible, in contrast to international non-use value.

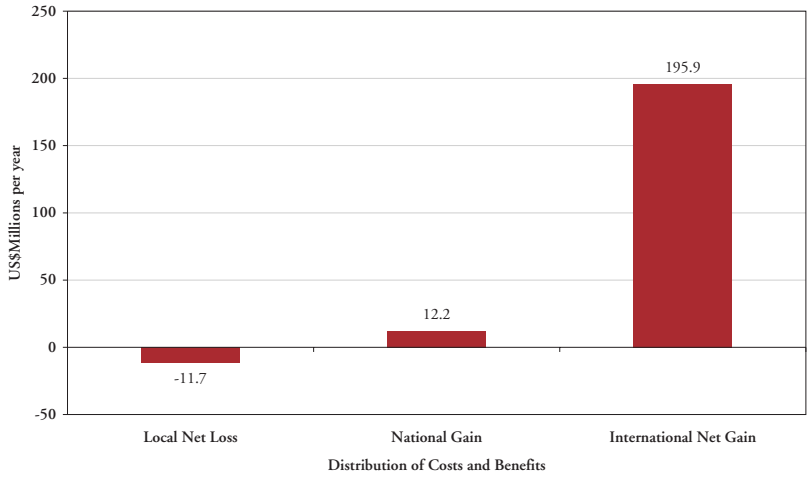
Fig. 4: Gross annual forest benefits and costs



Note: Overlap does exist between the following categories: 'local indirect use' and 'local use & non-use'; 'International non-use' and 'international ecological'. This is due to use of different (overlapping) methodologies to ascertain the respective values (see text for details).

Fig. 5 shows that the distribution of benefits and costs amongst stakeholder levels is heavily skewed: annual benefits of USD12.2 and USD9.4 million accrue to the national and international levels respectively, while a loss of USD11.7m is being absorbed at the local level.

Fig. 5: Distribution of annual forest benefits and costs between stakeholder levels



** Local tourism, use and non-use benefits less farming opportunity costs*

*** National direct and secondary tourism benefits plus non-use value, without consideration of National Park administration costs.*

**** International tourism consumer surplus and non-use value less tourism travel cost*

Conclusions

Five main conclusions emerge from the study:

1. From an economic standpoint, the Virunga and Bwindi forests should continue to be protected since, overall, they are generating significant benefits over-and-above the costs borne.
2. There should be a commitment to capturing a greater part of the potential revenue currently offered by mountain gorilla tourism, since tourism is the driving force of tangible benefits realized from the forests.
3. The international community is the major beneficiary of forest protection - mainly in terms of non-use value, but also significantly in terms of tourism benefits.
4. If it is assumed that the opportunity cost of the forests are being borne by the local community, then significant tangible benefits are being realized at the national level (foreign exchange repatriation not withstanding) whilst local communities are experiencing losses of a similar magnitude level. Alternatively, if it is assumed that the opportunity costs of small-holder agriculture are borne at the national level, meager tangible and non-tangible benefits are being realized both at the national and community levels.
5. The magnitude of international non-use value represents an appropriate potential source of funding for addressing these inequalities. However, the links between forest protection, international investment, and local development would require emphasis in order to ensure the twin outcomes of sustained forest conservation and local/national development.

Limits and Limitations

Some of the most important limits and limitations of the study have been alluded to. These include:

1. Study Design Gaps

The study set out to complete a full economic valuation of the Virunga-Bwindi protected forests. However, it was recognized from the start that such a goal could not be completed given the reality of limited resources. As such, the goal remained to design an appropriate methodology for better determining full economic value, and to complete the valuation as widely and fully as possible. Accordingly, resources dictated that the study be limited to the forests and areas immediately surrounding them. For this reason, the study remains a preliminary baseline on which to build with further study. The most important gap to fill is a full economic valuation of hydrological services throughout the water basins served by the Virunga-Bwindi systems – which include not only agriculture principally, but also extend to the fisheries of Lake Edward. Such a valuation will go a long way in better establishing the real worth of the forests at both local, national, and regional level – and will represent a crucial component of a full economic valuation. Other gaps include determination of protected area administration costs in arriving at net tourism revenues.

2. Inadequate Results

Four areas covered by the study require further work. At the local level both direct forest use value and direct forest costs (wildlife damage and banditry) failed to yield

positive results, due mainly to lack of revelation about what amount to illegal activities, and gross exaggeration, respectively. Proper determination would appear to require a less rapid assessment carried out by trusted enumerators. Plans for this are underway through *in situ* organizations. Also required is in-depth study to more accurately determine local tourism benefits. Those arrived at here required interpolation based on limited available data. Such a study should focus on the ownership status of tourism facilities and economic linkages between local suppliers and the tourism sector, as well as local multiplier effects. Lastly, given its significance, further work is needed to more accurately determine, or reinforce, results for international non-use value since the sample used in this study was both biased (international non-gorilla visitors to East Africa) and limited in size.

3. Contingent Valuation Methodology

Contingent valuation is especially hazardous in developing country context, where income is limited and the concept of constructed scenarios is both alien an untrustworthy. Results for WTP (willingness-to-pay) are therefore likely to be underestimated. However, the results reflected here can be considered encouraging, particularly if evaluated on the basis of percentage of income rather than outright dollar value. Traditionally, WTA (willingness-to-accept) compensation results tend to be overestimated particularly in poverty situations (Carson, 1998). However, the WTA results for forest opportunity cost were confirmed by the alternative analysis (small-holder agricultural value).

4. Opportunity Cost

Forest opportunity cost was assumed to belong to communities surrounding the forest rather than national governments or economies. This is not necessarily the case especially since, traditionally, protected areas tend to be viewed as state property. However, the case of local communities as beneficiaries is assuming increasing importance as issues of social and economic justice become more prominent. The issue of whose opportunity cost is discussed further below.

5. Agricultural Productivity

It must be borne in mind that estimation of forest opportunity cost based on current conditions does not take into account future improvements in agriculture that would result in higher forest opportunity costs, thereby requiring forests to further justify their economic existence. However, this effect is tempered by the fact that forests services to agriculture are assumed to be significant, and therefore take on greater value as agricultural productivity increases. This aspect is discussed more below.

Discussion

The following discussion considers future trends in benefit-cost distribution and policy, and focuses on important economic factors that are likely to dictate future scenarios. Some were identified during the course of the study from the primary data; others are conceptual in nature. Together they constitute a relevant set of economic criteria driving future benefit-cost dynamics around the Virunga-Bwindi forests.

A. Long-term Worth

Long-term worth was assessed by computing the net present value (NPV) of the annual set of values over a 29-year horizon. Based on the common economic argument that the value of an asset in the future is worth less than its present-day value (mainly due to uncertainty), this is the process of expressing annual values over the next 29 years in 'today's dollar' terms, through application of an appropriate 'discount rate' i.e. the rate at which future benefits are discounted each year into the future. Choices of varying discount rate allow for consideration of differing time preference (in broad terms, "priority time horizon") amongst stakeholders, for example: a conservation organization; government planning agency; private entrepreneur; or farm small-holder at the forest edge; where it can be expected that each differs in attitude towards the value of future benefits relative to present-day needs. For example, net present values derived from this study's annual set of values can be represented for different stakeholder groups as depicted in Figure 6: equivalent forest benefits worth USD5,894 million to the conservationist over a 29-year period (assuming 0% (no) discount) may be worth only USD1,962 million to a government planning agency (working with 10% discount rate), versus a mere USD524 million to the rural small-scale farmer (surviving under a 40% discount rate), respectively (a similar scenario also affects future costs). Choice of time preference is therefore a major determinant of resource value over time, as is the set of assumptions

underlying the choice. The underlying value of such analysis is in understanding divergent attitudes and resource use behaviour amongst stakeholders; and in taking such considerations into account.

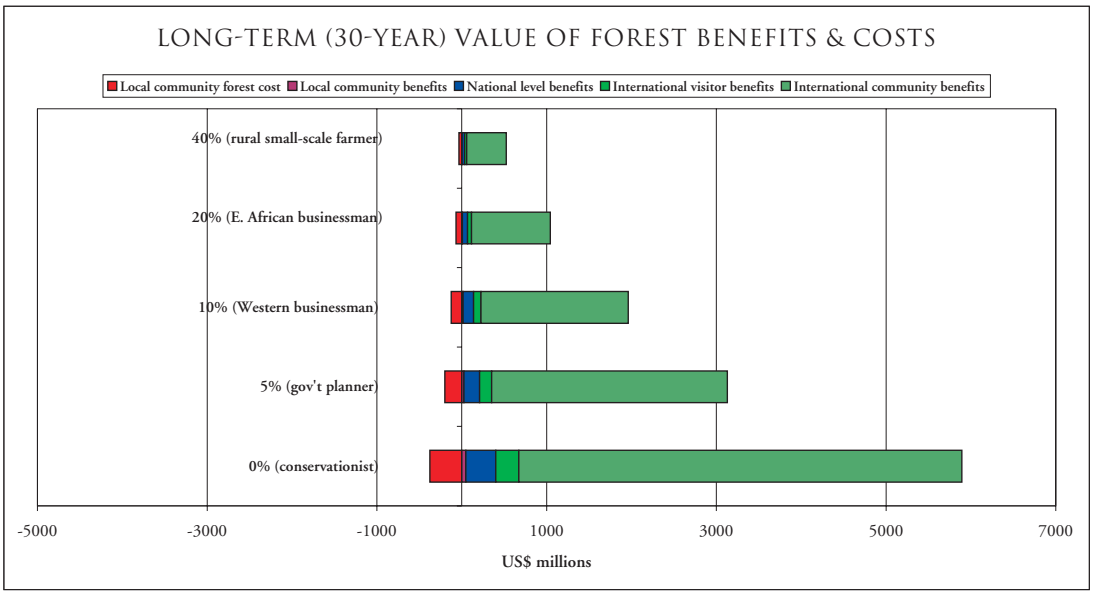


Fig. 6: Long-term value of forest benefits and costs from differing perspectives

B. Realization of International Non-use Value

Whilst representing a very significant source of benefit (USD186.5 million per year according to this study), this value is only currently articulated to the tune of approximately USD3.0 million per year (Lanjouw, pers. comm.) – this being the investment value of internationally funded conservation enhancing programs related to the two forests.

One conclusion of this result is that significant levels of untapped funds exist, with potentially far-reaching implications for fundraising.

In addition, there are also implications for current donor funding levels and conditions. First, such results suggest that international donors should significantly increase current funding support levels. Second, there is an accompanying - more controversial - implication that donor funding should be driven by a greater sense of obligation, rather than by discretion as is currently the case. Such assurances would enable more appropriate levels of investment into conservation. The challenge is in developing the appropriate mechanisms.

C. Whose Opportunity Costs?

When viewed at the country level - irrespective of whether who is bearing the opportunity costs of forests - benefits from gorillas are, on balance, only off-setting the losses incurred. When viewed at a local level, populations are gaining little-to-nothing from the forests and, at worst, are bearing the cost of others' benefit. Whilst at the very least conservation should not impose an economic burden on national economies/local livelihoods ('do-no-harm'), it can be argued that benefits should reflect the value of services - in this case, gorilla conservation - being provided to society-at-large, rather than costs of provision only. Given the current distribution of benefits and costs, this principal obliges the major benefactor, the international community, to increase in-country benefits whether local or otherwise.

D. Implications of Small-holder Farming Livelihood Constraints on Protected Areas

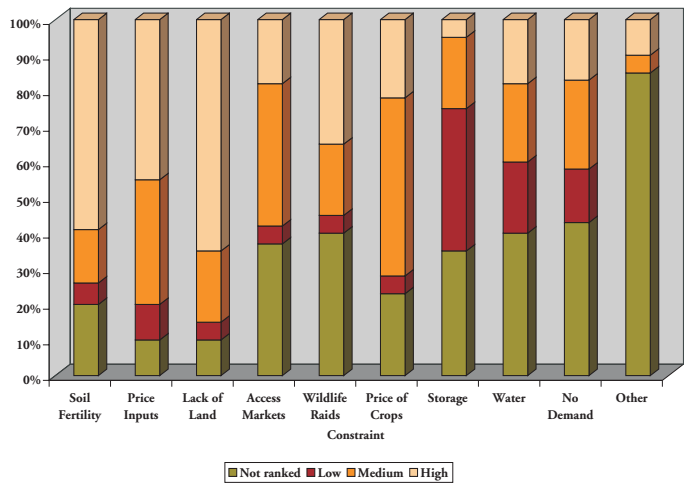
During the course of the main study, major constraints to improved farming livelihoods were identified and ranked by respondents (Fig. 7):

Constraints fall into two categories: those concerning production; and those concerning markets. While market constraints hold important implications for longer-term development, production concerns directly impact shorter-term food availability.

Some salient points can be highlighted from this and other secondary data that emerged from the study:

- The linked constraints of declining soil fertility and lack of land are critical to the future prospects of forest conservation. Fallow land – the principal method of maintaining soil fertility (see Fig. 8 below) - is becoming unavailable, especially in the Virunga region (DRC; Rwanda; and Mgahinga, Uganda) where less than 10% of households utilize fallow land. Bwindi differs significantly, with 53% fallow use.

Fig. 7: Ranked constraints amongst small-holder farmers

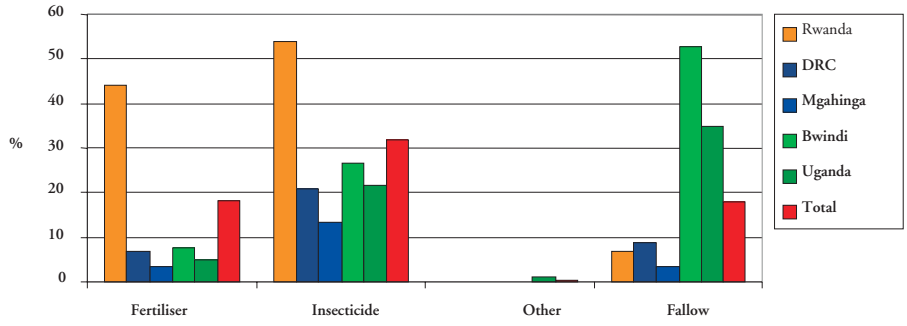


Note: chart show the proportion of farming households considering each ranked each constraint as high, medium of low per country. Original rankings (1-9) were divided into three categories: high (corresponds to ranks 1-3); medium (4-6); low (7-9). The fourth category is not ranked which is equivalent to no importance rather than forgotten.

- By universal principal, lack of available new land necessitates that labour is substituted by capital inputs (e.g., fertilizer and insecticide use; mechanization) in order to increase land productivity, "intensification". Mechanization levels were found to be scarce to non-existent throughout, while use of fertilizer and insecticide around the parks is illustrated in Fig. 8. Results suggest that in Rwanda capital investment into intensification is occurring, while similar substitution is at an earlier stage around Bwindi (where land is more available, although apparently less fertile given respondents concerns). The situations around Mgahinga and in the DRC, however, much more serious – other things being equal. These results are reinforced by the corresponding income levels (Fig. 4), all of which suggest that lack of capital represents a severe constraint to improved livelihoods in the case of the Virunga-Bwindi region and that, by extension, pressure to convert forest to farmland will continue to grow over time.
- The situation is exacerbated by a lack of economic alternatives – for example, 81% of all working-age children in agricultural households are involved with farming. In addition, further pressure is generated by positive population growth rates.
- However, results suggest that the returns to investment into agriculture are relatively high, where on average each dollar invested can be expected to return USD6.40 in direct income across the two regions. This implies that, under current productivity levels, an annual investment of USD68.10 per hectare would negate the desire to convert forest to farmland by yielding additional income equal to that expected over the longer term from converting the forest (i.e., USD436 per ha.). This latter statement, however, does not allow for the fact that the immediate returns from forest conversion are likely to be higher.

When taken together, the above discussions under sections A, B and C appear to argue that international non-use value represents an appropriate level of untapped funding for investment, either into local livelihoods and/or national priorities – depending on whether forest opportunity costs are deemed to be carried by local communities or the national economy, or a combination of the two.

Fig. 8: Percentage of households using: fertilizers, insecticides, other inputs or fallow



Two avenues are possible (a) increased benefits from tourism and (b) increased development investment into local livelihoods.

E. Scenarios

To order to explore possible future outcomes, the impact of a number of important economic driving factors on international, national (non-local) and local benefits and

costs was assessed by developing a sequence of scenarios. These specifically examined:

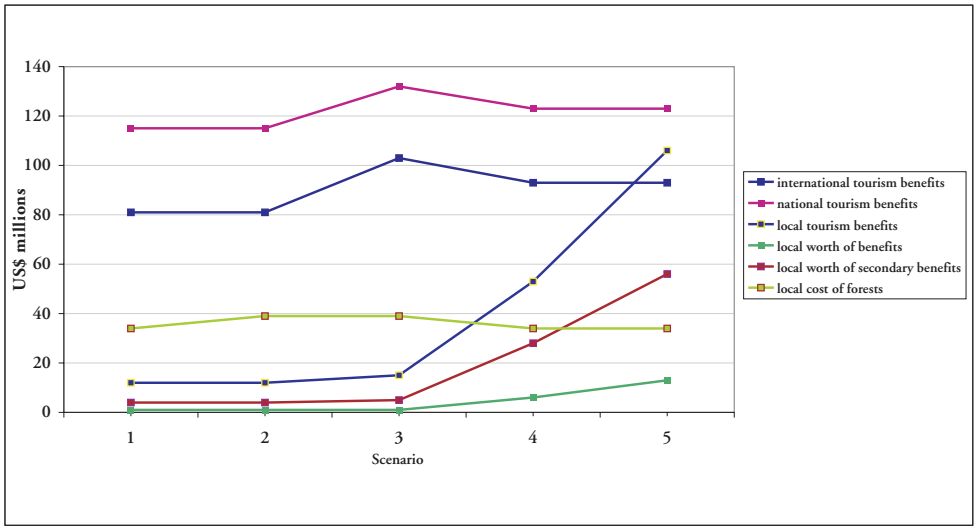
- gorilla tourism monetary benefits accruing to the international, national, and local levels;
- opportunity cost of the forests to local residents;
- value of tourism revenue at the local level;
- the economic multiplier (spin-off) effect of tourism revenue at the local level, based on suggested potential returns to agriculture.

The main economic 'drivers' considered were: differing stakeholder time preference; forest opportunity cost dynamics; soil fertility trends; international gorilla tourism demand; non-use value to international citizens; and returns to investment into local communities.

The five scenarios are ordered as a progressive sequence, the outcomes of which are largely self-explanatory. In particular, they illustrate the effects of different income scenarios, primarily as they relate to the local level. The results are given below, followed by notes on each scenario.

The outcomes suggested that a significant increase in the share of tourism benefits at the local level, even coupled with a sustained growth in tourism, is only likely to improve - rather than sustain - rural livelihoods adjacent to the forests. Additional investment into the development of the main local livelihood - agriculture - is likely to prove the real engine of development, and by extension, sustainable forest conservation.

Fig. 9: Long-term benefits & costs: scenario outcomes



Note: All amounts are net present value, or worth, over a 29-year period. It is important to note that international, national, and local tourism benefit are valued from the perspective of a policy maker and, accordingly, are based on a time preference rate of 10%, whilst the remaining values are from the standpoint of subsistence-level rural communities, based on a time preference of 40%.

Scenario notes:

Scenario 1:

- Current levels of benefits/costs with no change over time.

Scenario 2:

- Opportunity cost increasing at 4% annually due to population growth.
- Local time preference (discount rate) rising at 10% every 10 years due to increase in opportunity costs.
- Result: increase in opportunity cost to communities of USD5.0 million.

Scenario 3:

- Tourism increasing at 5% per year until 75% capacity, level thereafter.
- Benefit gains at all levels.
- Minimal gain from local perspective (USD1.0 million gain in local multiplier effect).
- Opportunity cost and time preference still rising due to minimal gains.

Scenario 4:

- Same increase in tourism
- Local share increased from 5 to 25% of tourist expenditure at park level (increase of USD1.6 million per year at equal expense of international and national shares).
- No increase in opportunity cost and time preference improving due to significant benefits.
- At local level conservation benefits and multiplier effects (USD6.0 + USD28.0 million) now equal the opportunity cost of the forests.

Scenario 5:

- Same as Scenario 4, with additional annual investment of USD2.0 million into local communities (matching local gorilla tourism receipts under Scenario 4).
- Local level time preference improving due to significant benefits, further increasing value of benefits received.
- Substantial benefits flowing to local level when viewed from either policy or local perspective.

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