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The Economic Benefits of Conservation: The Case of Udzungwa Mountain National Park and Kilombero Valley

*G. Jambiya**

Abstract

In developing countries that are heavily dependent on their natural capital, such as Tanzania, the debate on environmental protection is frequently about the balance between conserving areas in their natural state and developing and exploiting them. It is critically important for conservation to justify its existence not only from the biodiversity and tourism values, but also to values accruing external to the main conservation areas. One such area is the Udzungwa Mountain National Park (UMNP) in Tanzania, where a rapid appraisal of such values was attempted. The results highlight significant economic values that are attributed to the conservation of UMNP, but benefiting areas outside the conservation area. The results further highlight the importance of identifying and recognising the wider economic values of conservation, and show how relatively basic techniques with the available information and in a limited time span, can be applied to provide better information on economic values of conservation and consequently feed into more informed decision making. The results are also a basis for justifying more thorough valuation of a wider range of resources, costs and benefits. Such an approach is valuable for both conservation decision-making, identifying the distributions of costs and benefits of conservation and eventually modifying policy and practice to reflect these realities.

1. Introduction

This study was carried out around the Udzungwa Mountain National Park (UMNP), which is located in Tanzania, Eastern Africa. Within Tanzania, the park is situated in Kilombero District of Morogoro Region, and to its west is Iringa region (Figure 1). The eastern side of the UMNP comprises the Kilombero Valley, a valley from where tributaries from the Udzungwa Mountains drain into the Kilombero River. The north-western side of the Kilombero valley is a rich agricultural production area, producing a variety of

* Lecturer, Department of Geography, University of Dar es Salaam, Tanzania.

food crops, such as rice, maize and beans and cash crops such a sugarcane. The valley is one of Tanzania's more productive agricultural areas.

The Udzungwa Mountain National Park (UMNP) is one of the newer parks in the National Parks system of Tanzania, being formally designated in 1992 and operating under the Tanzania National Parks (TANAPA). The park is an area endowed with hundreds of different species of trees, shrubs, climbers and herbs of which around 50 are endemic to this area. Other important species include animals such as Red Colobus monkeys, elephants, lions and leopard. The area possesses a high degree of biological endemism and the biological richness.

About 100 years ago, the whole Udzungwa Mountain block was covered by forest. There would have been lowland and maintenance forest along the wetter eastern slope, dry evergreen forest on the plateau and deciduous forest giving way to woodland and thicket on the drier northern slope. In the last 80 years however, fire and to some extent settlement and agriculture, have reduced the cover and the greater part of the central plateau now comprising of *hyparchenia* bracken fern and *protea* woodland. Today the UMNP area embraces five forest reserves and contains undivided isolated pocket of forest.

To understand better the values of the UMNP the Total Economic Value (TEV) Model is used. The TEV consists of the Use and Non-use Values. The Use values in turn consist of the Direct, Indirect and Option Use Values. However, quite often our immediate concerns tend to lie only with the direct use values of a resource such as the UMNP which consist of a variety of production and consumption goods (see figure 2). This study focuses on the direct use values, which is why it declares that the values obtained here are only partial, but it also attempts to include some of the indirect values. Section 4 elaborates further on the TEV model. Because of the focus on the Direct Use values, a production function approach is used, which will identify, quantify and value the various uses of the UMNP.

2. Some Direct Economic Values of UMNP.

The area around the UMNP has some important economic activities which include:

- The regulation of microclimate of the area due to the existence of the forest reserve. This assists in bringing about adequate rainfall and moisture throughout the year.
- A source of water for many rivers and different tributaries especially into the Kilombero valley.

- Provisions of employment, secondary and tertiary economic activities through a range of organizations e.g. Tanzania National Parks (TANAPA) and other ecotourism related outfits, Tanzania Electric Supply Company (Tanesco), the ILOVO Kilombero Sugar Company, and the Kilombero Valley Teak Company (KVTC).
- It is a source of funding for maintenance of local schools, health facilities, transport and staff houses, which is done through the UNMP Community Conservation Programme (TANAPA, 1994).
- It generates wealth through a range of economic activities such as food and cash crop production, food security and nutrition through agriculture (rice, maize, and beans).
- It contributes to the production of hydroelectric power (HEP)
- Generally it contributes significantly to the district and national economies.

3. The Justification of Rapid Valuation

Georgiu et. al. (1997) accept that the most attractive valuation techniques are those which generate their own data, but then they ask, what is the cost of such surveys? The costs of such contingent valuations often range from between US$10,000 to US$250,000. In developing countries, such levels of resources are not easily available and so rapid appraisal may have to be applied pragmatically.

In a study in northern Nigeria, Eaton and Sarch (1998) noted that the Hadejia-Nguru Wetlands play a major role in the regional economy of the area. Attempts were made to value the production of most of the major sub-systems of the Hadejia-Jama'are floodplain, including irrigated farming, flood and rain fed agriculture, fisheries and livestock. However there is little information on the economic role of other wild resources harvested from the floodplain and the researchers attempted to fill in this gap. Despite the modest research results, the findings reveal some promising possibilities for using such methods to generate numerical information. With the use of rapid appraisal approaches, the data generated is often incomplete, and its usefulness has more to do with identifying and shedding light on the additional values of conservation, as in this case, accruing to adjacent and watershed areas. These additional values can be used to build both a case for additional valuation, and influencing both local and national decision-making about the value of conserving ecologically important areas.

The UMNP and Kilombero valley survey took just about a week and was sourced mainly from official records. Some data was difficult to access, largely due to administrative bottlenecks and poor record keeping. The lessons learnt from this study however, is that information can be generated, albeit its

incompleteness , which will contribute substantially to understanding of the magnitude of values generated by the conservation of the UMNP.

4. Conservation and Economic Benefits of the UMNP

Valuation is an important exercise in economic analysis of natural resources and is capable of generating important information for further justifying the conservation of the UMNP. The valuation exercise provides, among others, a means of quantifying the benefits that people receive from the UMNP. These include the costs associated with the management of the conserved area and the relative profitability of land and resource uses that are compatible with the conservation of the UMNP against those economic activities, which contribute to the degradation, or increased management costs of the UMNP. Valuation also helps to predict and understand the economic decisions and activities that impact on the integrity and status of the UMNP. Numerous valuation studies have been carried out and most have focussed on the target conservation area (Shyamsundar and Kramer, 1997). However, there is also a range of valuable economic benefits that accrue to areas outside the conservation areas and it is important to identify these.

There is no doubt that it is difficult to value the full range of benefits of the UMNP, largely because of the wide, variable and often unclear ecological, economic and management boundaries and also because the goods and services stemming from the UMNP are never bought and sold in the market. Some of the economic benefits generated by the UMNP are frequently overlooked not only by government and private industry, but also by the land and resource users in the area around the UMNP. Consequently, poor decisions are being made with regards to activities being carried out illegally in the UMNP, but also the potential of the UMNP to generate incomes, subsistence, employment and other benefits that have for long been under-emphasised in conservation and development policy, planning and practice.

Pearce and Moran (1994) note that the failure to capture the actual values of the resources, provides skewed political decisions and destructive policies. Once the values of biodiversity are captured, the basis for economic decision changes, and policies, which prevent or reduce biodiversity loss can be justified on economic grounds, and biodiversity can be protected by the market place and reinvented institutional mechanisms.

Despite the difficulties involved, an attempt to measure at least some of the more obvious and prominent socio-economic benefits is justified on the grounds that this information will reflect the overriding economic arguments for investing in and maintaining not only the biodiversity within the UMNP, but also the environmental services that emanate from the conserved area.

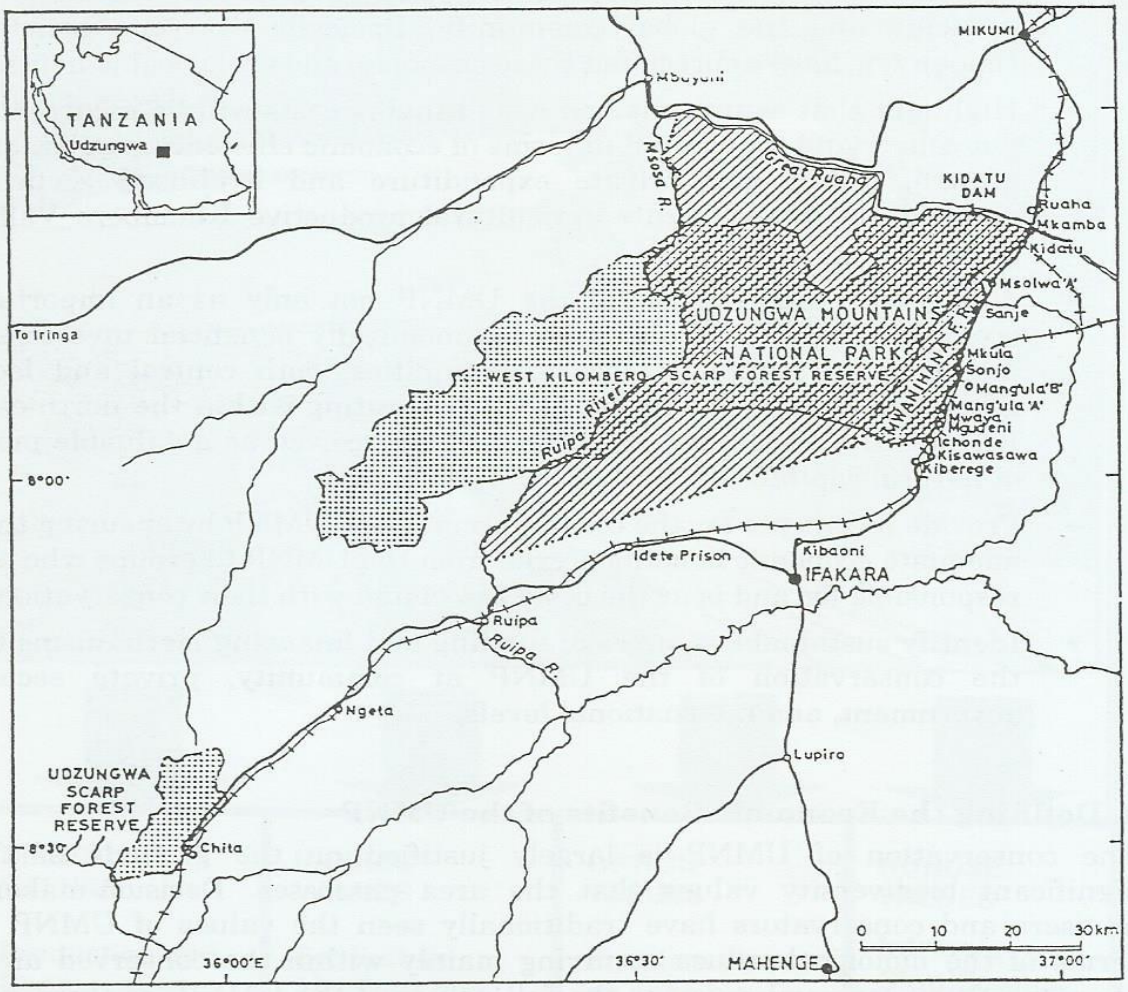

Figure 1: ***The Location of Udzungwa Mountain National Park in Tanzania***

The costs of conserving the UMNP include the opportunity costs of not utilising the resources within the park, plus the costs of managing the resources (by TANAPA, WWF, and others). Appreciating the economic benefits of the UMNP in terms of the valuable environmental goods and services it provides enables to make direct comparisons with other sectors of the economy when activities are planned, policies are formulated and decisions made. Valuing the UMNP among other things, helps to:

- Demonstrate the high values associated with the conservation of the UMNP and that its conservation provides quantifiable economic

benefits to individuals, households, local government, the national economy and the global community. Basically everyone benefits, though few have appreciated these economic and ecological benefits.

- Highlight that significant and wide-ranging costs will be incurred by not conserving the UMNP in terms of economic efficiency, equity, and growth, public and private expenditure and livelihood security, particularly in the highly agricultural productive Kilombero Valley area.
- Justify the conservation of the UMNP not only as an important ecological "bank" but also as an economically beneficial investment and land-use option to local communities, both central and local governments, and the private sector operating within the north-east Kilombero Valley. The UMNP must be perceived as a valuable piece of natural capital.
- Provide incentives for the conservation of the UMNP by ensuring that adequate economic benefits accrue from the UMNP to groups who are responsible for and bear the costs associated with their conservation.
- Identify sustainable sources of funding and financing mechanisms for the conservation of the UMNP at community, private sector, government, and international levels.

4. Defining the Economic Benefits of the UMNP

The conservation of UMNP is largely justified on the grounds of the significant biodiversity values that the area possesses. Decision-makers, advisers and conservators have traditionally seen the values of UMNP in terms of the biological values occurring mainly within the conserved area. However these are nowhere near the full values of the UMNP, as there is a range of other valuable services that stem from the conservation of the UMNP. To obtain an overall picture of the values and benefits of the Mountain Park, it is necessary to employ the Total Economic Value (TEV) model that helps to identify the economic benefits of conserving the UMNP (Figure 2).

Direct Values: the raw materials and physical products that are used directly for production, consumption and sale. This include those contributing to livelihoods to communities outside and around the UMNP e.g. fuel wood, building poles, thatch, water for domestic use, water for agriculture (irrigated and rain-fed) and livestock, water for hydropower, estate and small holder agriculture, fishing, plantation forestry, sustaining wildlife, wild foods, medicines, pasture, recreation and research.

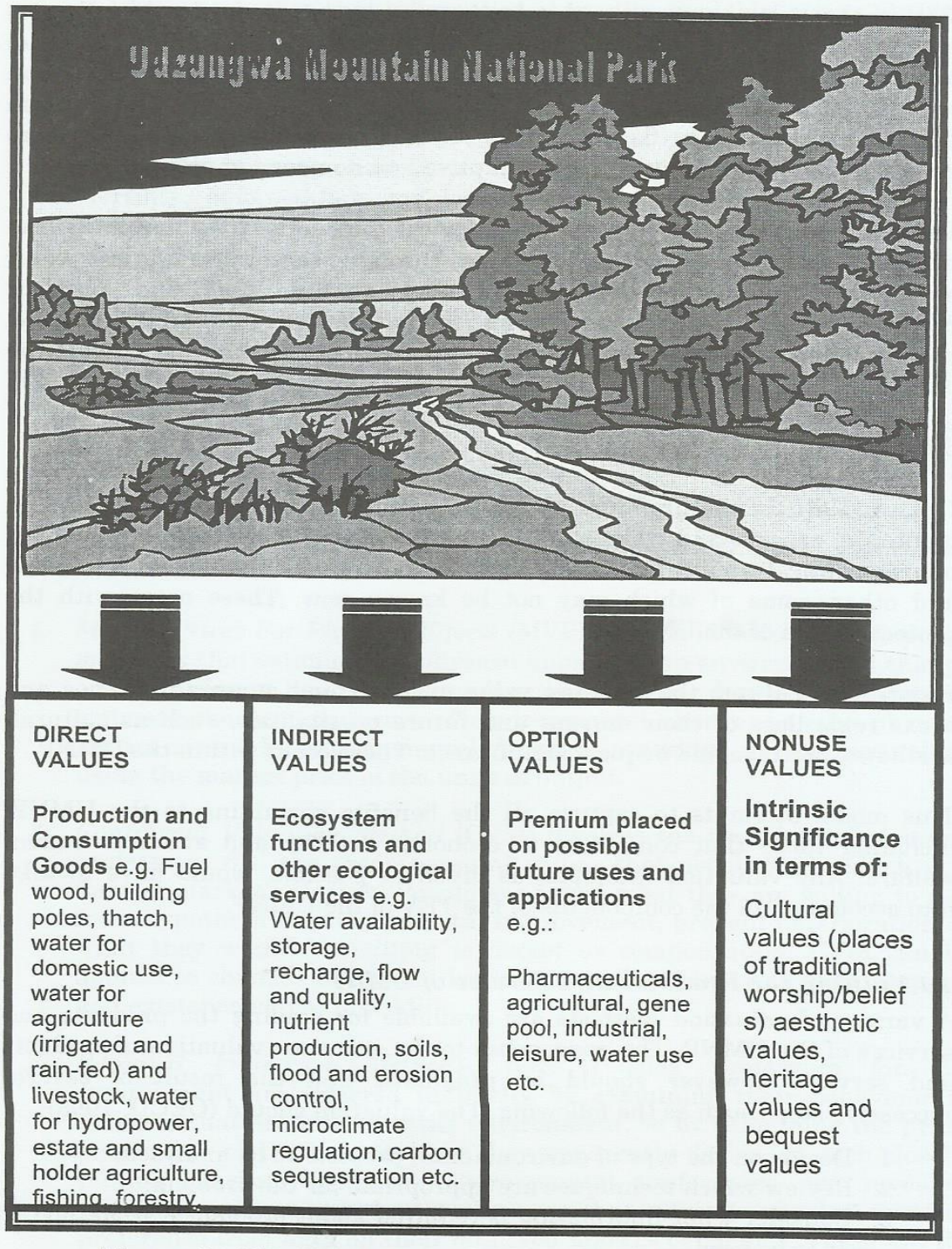

Figure 2: *The Total Economic Benefits of the UMNP*

Within the Kilombero valley the dominant economic activities include rice growing (both subsistence and commercial), sugarcane (small and large scale) and sugar production, teak plantations, subsistence agricultural production and livestock keeping. Other uses include hydroelectric energy production from the Kidatu Dam, fishing in the rivers that drain into the Kilombero valley, and wildlife utilisation (consumptive and non-consumptive uses).

Indirect Values: the important ecological functions that maintain and protect human and natural systems through services such as water availability, storage, recharge, flow and quality, soils and nutrient production, flood and erosion control, microclimate regulation and carbon sequestration. The indirect benefits are enjoyed both within and outside the park area. These include the availability of water during both the rain and dry seasons and the microclimate that is necessary for the production of different varieties of food and cash crops.

Option Values: the premium placed on maintaining the pool of forest and mountain species and genetic resources for future possible uses such as pharmaceutical applications/uses, agriculture, industrial, leisure, water use and other, some of which may not be known now. These occur with the protected area of the UMNP.

Existence Values: the intrinsic value of forest and mountain species and areas regardless of their current and future possibilities, such as cultural, aesthetic, heritage and bequest significance. These occur within the UMNP.

This model attempts to capture all the benefits pertaining to the UMNP, including those that contribute to economic activity and enhance human welfare. Any valuation attempts, as much as possible, would have to take into account of all the components of the TEV of the UMNP.

4.1 Valuing the Products and Service of UMNP

A variety of valuation methods are available for valuing the products and services of the UMNP. The approaches to the economic valuation of products and services however should be pragmatic and the result of several successive steps such as the following. The valuation should (OECD, 1995):

1. Decide on the type of environmental problem to be analysed;
2. Review which techniques are appropriate for the problem;
3. Consider what information is required about problem A if method B is to be used;

4. Assess whether that information is readily available, accessible, and at what cost;
5. And, depending on the answer to (4), reconsider the choice of valuation method.

Insofar as the values and issues of the UMNP and the Kilombero Valley are concerned, the environmental issues consist of *Green Issues* e.g. soil erosion and fertility, deforestation and loss of habitats. The *Blue Issues* include surface water pollution and ground water contamination and the *Global Issues* are mainly biodiversity and species loss.

The categories of impact include productivity, health, amenity and existence values. For example, soil erosion will affect agricultural productivity, while water contamination will affect health and also cost of defensive measures. Deforestation will affect both productivity, through loss of forest products and services and amenity e.g. local climatic effects and landscape, while the loss of biodiversity affects existence values, reduce amenity (to tourists) and productivity (tourist royalties).

There are three main kinds of valuation methods (OECD, 1995) that can be applied and these are:

1. *Market Prices For Physical Effects* (MVPE) which includes *dose-response measures* that estimate the physical impacts of an environmental change on production or health; *damage functions* that use dose response data to estimate the economic cost of environmental change, i.e. the physical impact caused by environmental change is converted to economic values using the market price of the units of output.

2. *Contingent Valuation Method* (CVM) involves the use of peoples' *stated preferences* (i.e. the environmental values that people say), which is a form of market research. People are asked what they are willing to pay for a hypothetical environmental improvement, prevent deterioration or what they would be *willing to accept* as compensation. CVM can be applied to changes in air and landscape quality, improved water supply, and existence values of wildlife

3. *Revealed Preference Methods*. Here peoples' preference for the environment are inferred indirectly by examining their behaviour in markets that are linked to the environment, so by examining the prices people pay or the benefits that they apparently derive, in such closely-related markets, peoples' environmental preferences are revealed. Within this there are three techniques that estimate peoples' revealed preference from data on their observed market behaviour. These are the

travel cost method (TCM) which uses time and cost incurred in visiting and enjoying a natural site, *avertive behaviour* (AB) and *defensive expenditure* (DE) – which includes *cost of illness* (CI), in which information about what people spend to protect themselves against an actual or potential decline in the environmental quality, or to treat an illness. Finally, the hedonic pricing method (HPM) commences from the fact that the price of a property reflects, amongst other things, the quality of the environment that is located in. It is a complex approach and uses econometric analyses of large data bases to unbundled environmental attributes from the various factors making up the price of a piece of land.

Table 1 Matching Valuation methods to the Impacts

Products/Services	Valuation methods
Forestry products	Demand/supply analysis Market prices Surrogate market prices
Carbon sequestration	Reduction in expected future damage cost from climate change Market valuation of physical effects Defensive expenditure –Avertive behaviour – Cost of illness
Plants used in traditional medicines	Substitute prices Contingent valuation methods
Biodiversity conservation Ecotourism Non-use values Potential medicinal plants	 Travel cost method Contingent valuation *Market prices* Contingent valuation Expected value of a plant as source of medicinal substances
Agricultural Production from down stream water supply	Demand/supply analysis *Market prices* Surrogate market prices
Protective services provided to property and production activities (e.g. against soil erosion and flooding)	Reduction in expected future damage cost from climate change *Market valuation of physical effects* *Defensive expenditure – Avertive behaviour* (cost of replacement, rehabilitation cost methods, cost of relocation, additional establishment costs) Demand/supply analysis Market prices
Generation of electricity	Demand/supply analysis *Market prices* Surrogate market prices

5. The Direct and Indirect Benefits accruing to the producers in the Kilombero Valley

5.1 Smallholder Agricultural Production

The District per capita income is Tsh 57,355/= which is just above the National Per Capita Average of 55,200/=.[1] One reasons for it being above the national average is the output from the Kilombero valley, much of which stands to benefit from the waters flowing from the UMNP area.The District is largely dependent on agriculture, with a large part of production occurring within the Kilombero Valley. The major food crops include maize, bananas, rice, beans and cassava and the main cash crops are cotton, sugar cane and sunflower. Some crops such as maize, rice and beans are also cash crops.

Much of the smallholder agriculture is rainfed, despite the immense potential for irrigated agriculture. The very low use of agricultural inputs is also another reason for low levels of output. Yields for maize range between 7- 12 bags (90 kgs.) per acre or between 630 - 1080 kgs. of maize per acre. For rice, the yields without fertiliser are between 7-10 bags of paddy, whereas with fertiliser this can reach 25 bags of paddy. A crude calculation of earnings from the smallholder production sector that just takes into account the production of maize and rice shows that an annual earning of *at least* 3,970,425,000/= is realised from agriculture alone.[2]

The Kilombero valley is producing a substantial amount of food, especially rice. In 1999, it produced about 40,000 metric tons of paddy whose market value is around 24,000,000,000/= (or US$ 30,000,000/=).[3] This is a significant amount for the district and national economy, but also very important in terms of household food security and local livelihoods.

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[1] District files (1999-2000).

[2] In David Hoyle's (1997) WWF-TANAPA Socio-economic Survey, an average income of 40,000/= per acre or 100,000/= per Ha is estimated. Taking this figure and multiplying by the total area cultivated in 1998/99 season, some 2,130,800,000 Tsh is generated from rice growing each year. This figure is not too far from our calculations. Our figures are based on the following calculations: 53,000 acres (21,000 Ha) X 8 bags per acre = 424,000 bags X 6000/= per bag (sold at harvest) = shs. 2,544,000,000/=. As for maize production 33,9625 acres x 7 bags per acre = 237,737.5 x 6,000/= per bag (at harvest) = 1,426,425,000/=. The combined incomes from just rice paddy and maize amounts to Tsh 3,970,425,000/= each year. The figures for other crops are not included yet, so the actual income is very much higher than the 3.9 billion Tsh per annum.

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Table 2 Kilombero District Crop Production Data 1996 - 1999

	1996/97		1997/98		1998/99	
	Ha	*Metric Tons*	*Ha*	*Metric Tons*	*Ha*	*Metric Tons*
Paddy	2158	40770	16594	29458	21308	40,485
Sugarcane (outgrowers)	1905	158107	1370	113,710	1501	124,383
Bananas	777	9967	1152	11520	812	10,150
Cassava	16385	16385	1633	16330	2370	23,700
Maize	10537	23708	8855	20268	13,585	33,962
Beans	-	-	-	-	172	129
Sunflower	220	134	957	59	-	
Cotton	1027	387	73	59		

Source: District Agricultural Office files (2000)

5.2 The Sugar Industry.

One of the dominant agricultural production activities carried out in the Kilombero Valley on the northeastern side adjacent to the UMNP is both large scale and smallholder sugarcane production. There is also a sugar production factory in the area, so that the cane that is produced locally is sent to the factory for production of sugar and other by-products.

The sugar industry has stakeholders ranging from sugar growers to sugar producers and cane production is both rain-fed and irrigation agriculture. Much of the water originates from the Udzungwa Mountains either as water from the streams and rivers that flow from the mountains or from the microclimate that results from the mountain's (and its vegetation) existence.

The single largest producer of sugarcane in the area is the Kilombero Valley Sugar Company a parastatal company under the Sugar Development Corporation (SUDECO). The public company has been sold under the on-going privatisation scheme in Tanzania and is now owned by the ILOVO Sugar Company of Natal, South Africa. The KSC is locally referred to as ILOVO. With the exception of ILOVO no other sugarcane grower processes sugar locally. All the other commercial sugar growers depend on ILOVO as a single market for their sugarcane.

Sugarcane is grown in the 'sugarcane zone' which cover the two estates K1 and K2 plus the outgrowers' area. This zone is located around the Msolwa and Ruembe Rivers. The cane is grown in generally flat lands with gradients rarely exceeding 1%. However, in some of the outgrowers' land cane is grown on much sharper gradients.

5.2.1 The ILOVO Kilombero Sugar Company

The factory produces about 50,000 tons of brown sugar annually. ILOVO buys the cane and processes it their factory at Kidatu. The sugar is then sold within and outside Tanzania. The other source is outgrowers who grow the sugarcane. Most of the outgrowers grow sugar in small farms of size between 1-5 acres. Just a handful of small farmers have farms of more than 10 acres.

5.2.2 Production

Approximately 45,000 tons of brown sugar is produced annually (figure 3). The Company intends to expand production to ± 600,000 tons of cane with the bulk of the expansion area occurring within the outgrowers' area. The ultimate objective is to reach the production capacity of 1 million tons of cane and produce 100,000 tons of brown sugar annually, about Tsh 17 billion (gross).

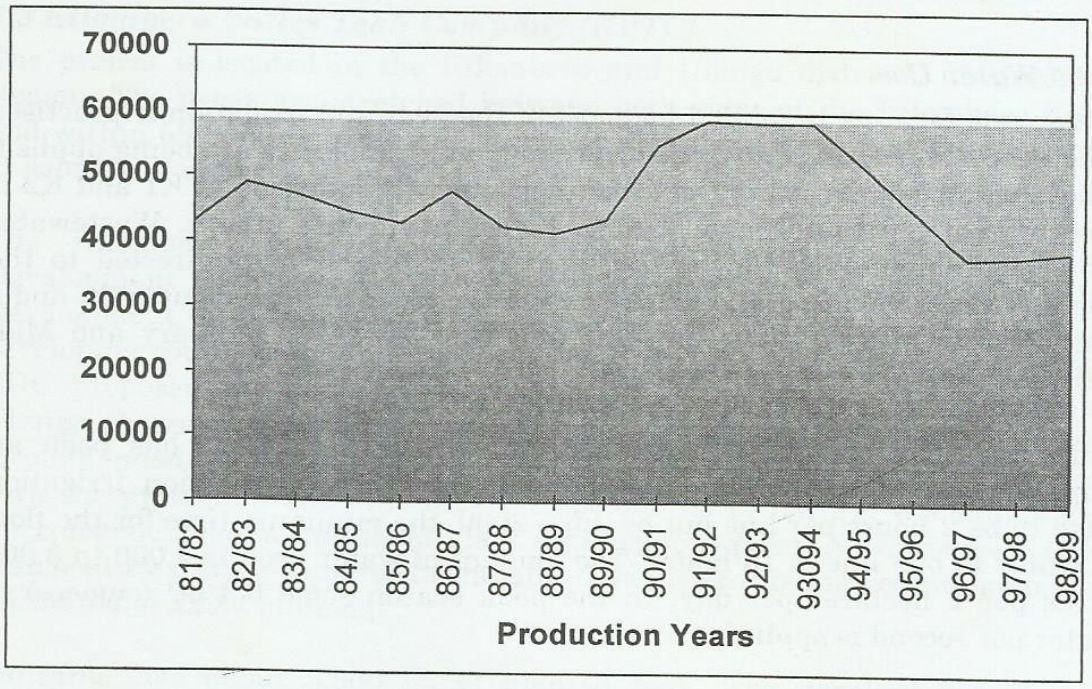

Figure 3: ***Sugar production at ILOVO KSC 1981 -1999***

5.2.3 Employment

ILOVO Kilombero Sugar Company is the largest employer in the Kilombero Valley. It has on its payroll about 700 permanent employees and some 2000 others who are temporarily employed during the harvesting season, between June to December. Over 99% of the employees are recruited locally, with

many coming from within the Kilombero and nearby areas. Some of the temporary labour is from Morogoro and Iringa Regions.

5.2.4 Outgrowers Scheme

The outgrowers' cane is grown as a dry land crop and is rainfed. There is also very little use of fertilisers and herbicides. There is also a program to improve farming practices by applying some fertiliser, i.e. about 70kgs of N/Ha and use herbicides that compete with the cane for food. There are some production arrangements between ILOVO and the outgrowers, mostly around K1. The outgrowers' production area covers some 1909 Ha, out of which 1788 Ha is to be harvested in the current year. Under this scheme, small growers with an average of 2 acres of cane grow the bulk of the cane. There are plans to expand the outgrowers' output to 3564 Ha to produce some 2220,000 tons of cane, and also improve the ratio to 10:1 (10 tons of cane to 1 ton of sugar from the present 11:1).

5.2.5 Water Use

Sugarcane farming is rainfed for most of the year and irrigation is practised when the dry season sets in. Basic production technologies are being applied, where water for irrigating the large-scale sugar plantations at K1 and K2 is drawn from the Ruaha and Msolwa Rivers by electric pumps. Wastewater from sugar manufacturing is collected in ponds and later directed to the sugar plantations for irrigation. Irrigation is carried out for about eight and a half months in total, between June and November and January and Mid-March.

Since the privatisation of Kilombero Sugar in 1998, there has been an improvement in the irrigation system. Before the privatisation irrigation used to be 2 hours per line but by June 2000, the minimum time for the flow of water in one line is 10 hours. The amount of water used is 4,000 to 8,000 litres per 2 hectares per day. In the peak season some 6.3 m^3 (cumecs) of water per second is applied.

What is evidently clear is that both the water coming from parts of the UMNP and the microclimate that exists because of the conditions prevailing in and around the UMNP are of critical importance to the sugar industry as a whole. The importance of this factor is noted by the farm manager who believes that the preservation of the evergreen forest on the Udzungwa Mountain is of the utmost importance so as not to cause any adverse climatic change and to prevent soil erosion".

One other important function is the flood and soil erosion control. For example, on the mountainsides north of the Ruaha River, an unprotected area of Kilosa District, a growing size of smallholder farming is practised on the very steep slopes. During the rains, serious soil erosion and landslides occur. On the opposite side of the river, i.e. in the UMNP area this is not happening. The resulting soil being carried downstream has caused some serious flooding and siltation between the Ruembe and Nyamvisi rivers, between K1 and K2, threatening to waterlog and destroy the cane in the area. The costs for removing the silt over the last three years has amounted to Tanzania shillings 418,000,000/=. This can be taken as an indicative figure (defensive expenditure/avertive behaviour) of the extent that the protected area of the UMNP is saving ILOVO from additional damage downstream, thus highlighting an additional indirect value/benefits from the conservation of UMNP.

5.3 Kilombero Valley Teak Company (KVTC)

The project is located in the Kilombero and Ulanga districts, of Morogoro Region. The areas are stretched between both sides of the Kilombero River and within 50-80 km of Ifakara Township which is the district Headquarters of Kilombero district, about 350 km by rail from Dar es Salaam (see figure 1).

The Kilombero Valley Teak Company (KVTC) is a Commonwealth Development Corporation (CDC) Investment initiative. The Commonwealth Development Corporation (CDC) is investing in various long-term projects in developing countries in areas of agriculture, forestry and industries. In 1991 CDC proposed the establishment of a teak forest in the Kilombero and Ulanga Districts in Morogoro Region. A feasibility study in the same year recommended the establishment of 10,350 Ha of teak over 18 years, together with the protection and enrichment of 25,000 ha of natural woodlands and the construction of a treatment plant for telephone poles. All these were to be managed by a fully resourced company. The peak-funding requirement was estimated at £29.4 millions

Tanzania has about 3,500 ha of planted teak. The development of teak plantations in selected localities is seen as an effective way to reduce future exploitation pressures on Tanzania's natural hardwood forests. Such development produces within 5 to 10 years, general-purpose building poles and in 30 years, timber that will substitute some of the country's premium hardwoods, such as *Ptercarpus angolensis* (Mninga). *An additional environmental benefit that can be expected from teak plantations is the incremental gain in fixed carbon.*

G. Jambiya

5.3.1 Impacts of the KVTC on the Local and National economies

The project has been constantly providing the equivalent of approximately 1000 full-time and seasonal jobs for men and women in about 10 villages within the vicinity of the project. This makes the project the second biggest employer in the area after the ILOVO Kilombero Sugar Company (KSC). The project is also paying land rent at Tanzania Shillings135/= per acre amounting to some Tanzania Shillings 9,503,662.50 or US$ 11,880 (FY 2000) to the Kilombero District Council

The KVTC project is a net generator of foreign exchange for Tanzania. Gross foreign exchange proceeds from teak sales are estimated at over Sterling £18 million (at 1992 prices) per annum from Year 34 onwards. KVTC also provides a "social fund" of US$10,000 plus US$2 per planted Ha per annum to compensate the local communities for loss of use of their land. KVTC and PLAN International (PLAN) have agreement for the provision of some essential social service to the adjacent communities. Meanwhile a small demand for thinnings has emerged at Ifakara town, reducing the demand pressure on poles from natural forests, but also placing a new natural resources product in the market.

5.3.2 Emerging small business settlements

Small settlements have emerged in a relatively short time of the company's existence with proximity to the company's operations, e.g. at Lupiro. This small settlement is characterised by small services and businesses, which is good for the local economy and the creation of off-season and non-farm jobs. In addition, villages within the KVTC are beginning to exhibit positive signs of development and business activity.

5.3.3 Environmental Effects

There is considerable evidence of a growing number of wildlife utilising the refugia on KVTC land especially in the Madabadaba-Mafinji plantation. Zebra, waterbuck, elephants, warthogs, puku, monkeys, leopard and lions have been spotted at different times in the area. Baboons are one species that are destructive to the seedlings. In the Mafinji-Nakafuru plantations many of the larger animal species can be seen from time to time, while in the Narubungo, Idete and Ichima plantations that lie right next to the UMNP it is mainly the smaller species such as monkeys that are seen.

5.4 The Tanzania Electric Supply Company (Tanesco)

The Tanzania Electric Supply Company (TANESCO) owns and operates the Kidatu Hydroelectric Dam and power plant at Kidatu. Water from Udzungwa

Mountains is being used for various socio-economic developments. Kidatu is one of the major inputs into the country's electricity grid. Although the water that flows into Kidatu HEP dam comes from several tributaries that form the Great Ruaha, an important part of the water flow also originates from the UMNP and especially during the drier parts of the year, when these flow help maintain the dam's water levels. Benefits accrue both at national and local levels. At a national level, the tangible benefit from hydropower generation at Kidatu is significant in that it is the largest hydropower facility in the country, producing about a half of all power generated. Kidatu dam has a storage capacity of 125 million cubic metres of water. Tanesco pays the relevant Ministry a water right fee of Tsh. 125m per annum. The electricity generated is connected to the national grid system supporting a substantial part of the Tanzanian economy. At the local level, TANESCO provides electricity to some of the villages adjacent to Kidatu. The power station also employs 240 persons.[4]

In 1999, the dam generated some 1,150,386,000 MWH of electricity out of which 1,116,441,501 MWH was sent out, with a market value of Tsh 72,568,697,565,000/= or US$ 90,710,871,956. Even though the drainage from the UMNP consists of a tiny proportion of the total amount of water provided, it is still significant in monetary terms (around US$ 900,000,000 per annum) and it has further values by not creating any silt that would drain directly into the dam and affect production and maintenance costs. There is no doubt of the economic and strategic importance of the UMNP for the optimal performance of the HEP.

5.5 Tourism

The tourist industry is still very much in its infancy in this area. The number of visitors to the UMNP is still quite low, but a growing one. Incomes from tourism are consequently also small but growing (Figure 4), suggesting that there is ample scope for increasing revenues and benefits from tourism visits provided some appropriate investments and marketing is put into place. The latest direct incomes from gate fee stands at some Tsh 12.3 million for 1999/00. However, if Contingent Valuation Methods (CVM) such as the Revealed Preference and Travel Cost Methods were to be applied, then these figures would be significantly higher. Moreover, the visitors are a mix of tourists and people who come for much higher values, i.e. scholars and scientists.

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[4] Information sourced from the HEP facility in Kidatu and Tanesco Head Office.

6. Snapshot of the main values

Despite the fact that only partial values were captured in the survey, most of these are the principal ones based on market values. A summary of the values (costs and benefits of conservation) is shown in table 3. However, there are some approximate values, such as carbon sequestration functions, which are arrived at using benefits transfers derived from calculation derived elsewhere. These values are approximate and they are a reflection of only the main outputs derived from specific economic activities, which has as one of the major inputs the microclimate conditions and some of the water flowing from the UMNP into the Kilombero Valley and into the HEP dam.

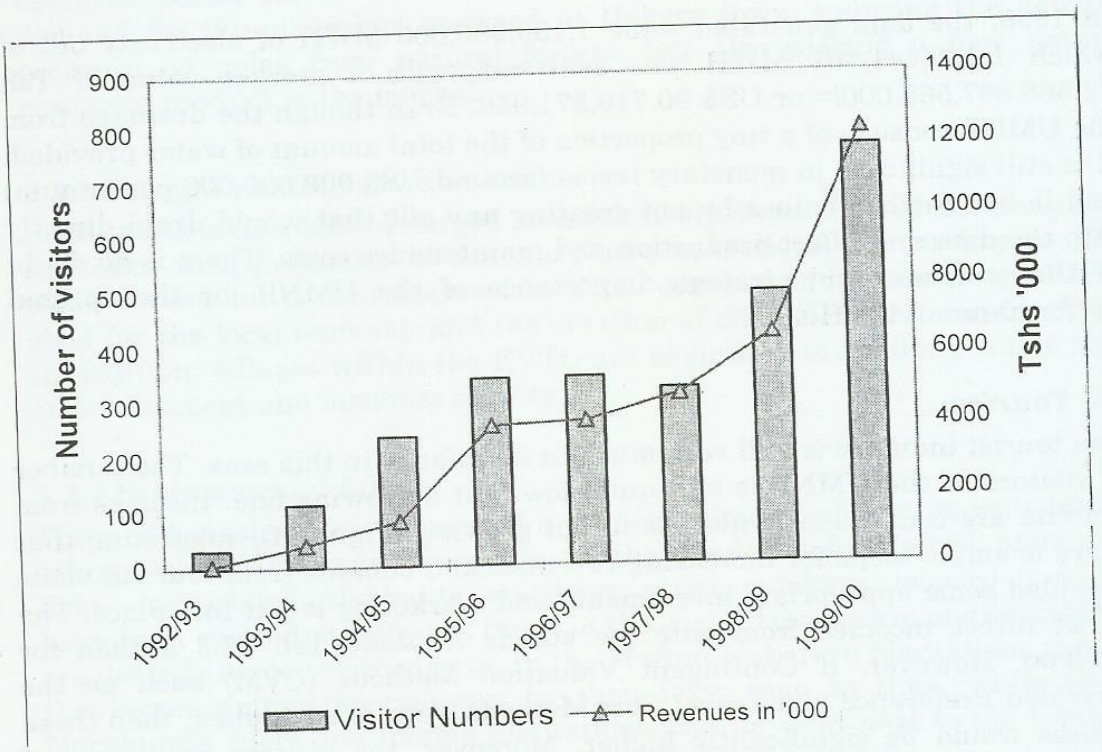

Fig.4: ***Trends in Number of Tourist Visitors and Gate Fees at UNMP 1992-2000***

Source: UNMP Files, 2000.

The monetary value show that the secondary economic benefits stemming from the conservation of UMNP are indeed substantial and especially when compared to the level of investments being made (costs). Just taking the direct financial and economic benefits accruing to both the large agro-industrial concerns in the Kilombero Valley are significant, for example, the annual income just to ILOVO KSC amounts to 17 billion shillings, (1999), for the projected teak exports it is 20 billion shillings, and agriculture (just maize and rice) 4 billion shillings (1999). HEP generation amounts ± 84 billion shillings a year (1999). There are other incomes such as tourist gate fees of about 12 million shillings. The data from Table 3 indicate that the downstream benefits of water produced from the conservation of UMNP are substantial, and once the missing figures are obtained from the variety of valuation techniques and sources available, then it is most likely that the values of benefits would increase even more.

An interesting scenario would be: What would happen to these values if the UMNP were not conserved at all? What would be the impact on the local climate and water availability? Of course the biological diversity would be lost, there will be little or no research or tourism activities, agriculture would change substantially, and production would decline, siltation into the dam will increase, affecting HEP and sugarcane production. The net impact in terms of losses in monetary terms would be substantial.

7. Conclusions and Recommendations

A number of conclusions can be made regarding the distribution of the "externalised" benefits of biodiversity conservation in the Kilombero Valley.

The study has shown that it is possible to conduct a low cost (in terms of funding and time) and rapid valuation of a particular environmental resource, even though it may not be complete for want of some data sets that would require more time or resources.

The results show the values that are obtained can be used to highlight the economic benefits and importance of different parts of the physical landscape external to but linked to the conserved area, through cause and effects, both actual and potential.

The groups that enjoy the benefits from the conservation of UMNP are not necessarily the ones who bear the costs associated with conservation, e.g. the local communities immediately adjacent to the UMNP and the conservation authorities together with international conservation organization and through various aid and grants (TANAPA, WWF and DFID).

Table 3 The distribution of benefits and costs of conservation

Distribution of biodiversity costs and benefits around the UMNP		
	Benefits	Costs
Global beneficiaries	Carbon sequestration functions. The present value of future damage is between $11.4 and 83.6 million (9,120,000,000/= - 66,880,000,000/=).[5]	Investment costs – through international conservation partners about $900,000 (720,000,000/=) over 5 years
Government budget	Royalties, taxes and licence fees. Water use (Tanesco) 125,000,000/= per year Land use (KVTC) 9,503,662.50 per annum Other fees include livestock feeding fees of 100/= per head of livestock in the flood plains during the dry season – payments accrue to District Council	Investment costs from (TANAPA) 300,000,000/= (1999/2000)
Commercial profits	Income from tourist visitors as TANAPA gate fees Tsh 12,377,696.50 - last year (minus Travel Cost) Gross income from the production and sale of electricity worth at least 84,000,000,000/= Tsh a year. Income from the sugar industry worth (>17 billion) or 17,120,000,000/= a year Fisheries (n.a) Livestock incomes (n.a.) Potential incomes from teak exports Tsh 20,160,000,000/= a year.	Energy substitution costs (costs of producing the same energy through thermal generation = higher production costs and less profits). Introduction of alternative technologies Importation of sugar/substitutes: These could be cheaper but inferior products
Household livelihoods	Agriculture output worth (almost 4 billion) – Tshs 3,970,425,000/= a year Domestic energy inputs. Fisheries production from the streams and rivers (n.a.) Maintenance of soil fertility and agricultural productivity (n.a.) Other biological resources (n.a.)	Costs of participating in biodiversity conservation activities (n.a.) Unsustainable fuel wood use forgone (n.a.) Loss of land and resource use opportunities in protected areas (n.a.)

[5] Brown and Pearce (1994) cited in Pearce and Moran report net changes in carbon content of between 36 to 200 tonnes of carbon per hectare in tropical rainforests. If the forests of the UMNP were to be exploited and cleared for agriculture and other uses, between 68,400 – 4,218,000 tonnes of CO_2 would be released. Using Fankhauser's (1994) calculations for the future damage cost of climate change of between US$600 – US 4400 per hectare, shows that the present value of future damage would stand at between $11.4 and 83.6 million.

The economic benefits of conserving the UMNP are accruing to groups that bear few of the conservation costs. In some instances there are groups that benefit appreciably, and yet they take the benefits for granted, and this also includes the adjacent communities, who in discussions do not easily relate the benefits of water and microclimate regulation to the existence of the UMNP and are more concerned about non-timber forest products from the same area. Of course these (NTFP) also have considerable livelihood values and thus will need to be valued too.

The data and information generated is an important part of the assessment of the costs and benefits of conserving the UMNP. It can be used to justify conservation by highlighting the more realistic and external values (positive externalities) of conservation, direct and indirect, and contributes to the formulation of a more effective biodiversity conservation strategies and action plans (Emerton 1998). Insofar as the biodiversity conservation strategies and action plans are concerned, it identifies groups that can be targeted by or participate in biodiversity activities, and who may potentially contribute towards the costs associated with conservation.

Biodiversity conservation in the UMNP is not a cost-free activity. It has direct expenditures of about 440 million shillings (1999/2000) to maintain and develop the conservation area, but also interferes with economic activities and thus incurs opportunity costs. Examples of such social costs are crop destruction and general disturbance from wild animals, threats to security of people from marauding animals, and land shortage for communities in the eastern parts of the mountains due to the squeeze by the UMNP in the east and sugar estates in the north east of the Kilombero valley and other competing land uses such as large private and government farms, and the teak plantations.

This information raises the need for new financing mechanisms and these can include some of the more pertinent beneficiaries in and around the Kilombero Valley. Additional resources are needed to offset and compensate for many of the conservation costs, so not only does finance need to be generated, but mechanisms also be established which ensure that funds and benefits also accrue to the individuals, groups, organizations and institutions that bear the costs of biodiversity conservation.

As in most developing countries, in Tanzania available sources of funding for conservation are very limited. In the case of the UMNP, TANAPA is drawing resources from other parks e.g. Kilimanjaro National Park (KINAPA) and Serengeti National Park to invest in UMNP, but these are not enough

considering the range of activities that conservation now entail (protection, infrastructure development and maintenance, employment and community conservation services (TANAPA, 1994)). Both government budgets and donor funding levels are low and face severe competition from other sectors such as education, health, development and maintenance of public infrastructure, defence and security, democratization and others, all of which are often seen to have a more urgent need and priority claim on public finance compared to biodiversity conservation (Emerton, 1998).

Given that sources of private and commercial investment funding are limited and face strong competition from activities that can easily demonstrate themselves to be more profitable and thus secure investment opportunities ahead of conservation. Under these circumstances, such a valuation approach can begin to provide economic figures for arguing the economic as well as ecological cases for conservation, which can supplement and improve existing sources of funding (e.g. not only from TANAPA, WWF, and DFID but also others).

There are also additional benefits that accrue internationally, through carbon storage (carbon sequestration), and this aspect justifies biodiversity conservation in the area as a global priority, but also to seek external financial assistance for implementing conservation strategies. The study shows that a good valuation study is most useful, effective and efficient when it has a clearly defined purpose and audience, for example to secure funding for global ecosystem services from the Global Environment Facility (GEF). It can also be used present an economic rationale for a share of the national budget, or to look into the possibility of beneficiaries such as ILOVO KSC, TANESCO, KVTC and others to share some of the costs of conservation or to identify and develop means for neighbouring communities to derive benefits from the protected area.

Finally, it makes an important contribution by identifying gaps in the TEV model that will require to be filled in order to construct a more accurate model, which shows most, if not all values of the UMNP and thus its importance to conservation, locally and globally, but also its contribution to the economic development at both levels. More than only identifying gaps, it also shows what is possible using other approaches and techniques, if a little more time and budgetary resources are available.

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