TO CONSERVE OR NOT TO CONSERVE: A CASE STUDY OF FOREST VALUATION IN KENYA

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LANGAT D & CHEBOIWO J. 2010. To conserve or not to conserve: a case study of forest valuation in Kenya. Tindiret natural forest is one of the scattered forests which form the extensive Mau forest complex in Kenya. It is an important hydrological system for Lake Victoria. To provide strong arguments for more government investment in indigenous forest conservation, quality information and data on forest values need to be available for decision makers. There is, however, little information on economic values of most forests in Kenya. This study was aimed at estimating the total economic value of Tindiret forest. To estimate direct use values by the communities adjacent to the forest, household surveys were conducted with 109 households sampled from three villages within 5 km of the forest. Further information was obtained from discussions with key informants. The methods employed were market-based valuation techniques, market valuation of physical effects (MVPE) and use of secondary data and benefit transfer approach. The study established that the annual direct use value by local forest-adjacent households was approximately Kshs45 mil. The non-use values were estimated at Kshs113 mil per year and the opportunity cost of conserving the Tindiret natural forest was estimated at Kshs237 mil. Current benefits from Tindiret forest are inadequate to offset the opportunity cost of leaving the forest in its present state. The government and the local communities are subsidising the retention of the forest and this subsidy was estimated at Kshs78.5 mil per year through lost opportunity in agricultural settlement and income.

Keywords: Total economic value, conservation, direct use value, indirect use value

LANGAT D & CHEBOIWO J. 2010. Pulihara atau tidak: kajian kes penilaian hutan di Kenya. Hutan semula jadi Tindiret merupakan satu daripada hutan yang membentuk kompleks hutan Mau yang begitu luas di Kenya. Ia merupakan sistem hidrologi yang penting bagi Tasik Victoria. Bagi menyediakan hujah yang kukuh untuk menggalakkan lebih banyak pelaburan kerajaan dalam pemuliharaan hutan asli, maklumat serta data berkualiti tentang nilai hutan perlu disediakan untuk pembuat keputusan. Malangnya hanya terdapat sedikit maklumat tentang nilai ekonomi kebanyakan hutan di Kenya. Kajian ini bertujuan menganggarkan jumlah nilai ekonomi hutan Tindiret. Bagi menganggar nilai guna langsung oleh komuniti yang menetap di sempadan hutan, kami menjalankan satu tinjauan terhadap 109 keluarga di tiga kampung yang terletak dalam lingkungan 5 km dari hutan. Maklumat tambahan diperoleh daripada perbincangan dengan pemberi maklumat utama. Kaedah yang digunakan ialah teknik penilaian berasaskan pasaran, penilaian pasaran kesan fizikal (MVPE) dan penggunaan data sekunder serta pendekatan pemindahan faedah. Kajian menunjukkan bahawa nilai tahunan bagi penggunaan langsung oleh keluarga yang bersempadankan hutan ialah kira-kira Kshs45 juta. Nilai tanpa penggunaan dianggarkan sebanyak Kshs113 juta setahun dan kos melepas bagi memulihara hutan semula jadi Tinderet ialah Kshs237 juta. Ini menunjukkan bahawa faedah semasa daripada hutan Tindiret tidak mencukupi untuk mengimbangi kos melepas jika hutan dibiarkan dalam keadaan sekarang. Kerajaan serta komuniti tempatan sebenarnya menanggung kos pengekalan hutan dari segi hilang peluang dalam petempatan pertanian serta pendapatan dan subsidi ini dianggarkan sebanyak Kshs78.5 juta setahun.

INTRODUCTION

Forests play an important role in the livelihoods of local people in most developing countries. Forests supply these people with various products such as firewood, construction materials, medicine and fibres. In Kenya, the continued provision of these products and services are threatened by forest degradation and accelerated conversion of forestland to alternative landuses. Forestry in Kenya faces a number of challenges, which are closely linked to rapid human population growth (KEFRI 2000, 2005). The limited area of gazetted forestland, which is estimated to

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be 1.7% of the total land area, is decreasing. The continued degradation of forest resources requires concerted efforts by policy makers and researchers to slow or stop the loss of forest cover. In the recent past, the government has taken steps to entrench sustainable forest management and this is reflected in various government documents, legal reforms and policy papers (Ministry of Environment and Natural Resources 1994, 2007, Government of Kenya 2005) and the commitment by government to integrate environmental forest values in the National Development Planning processes (Gichere 2001).

In the past, Kenya's forests were valued for timber and there was less emphasis on other non-timber values. This has resulted in under valuation of forest resources and hence conversion to other landuses and subsequent degradation. The non-timber forest products (NTFPs), for a long time, have not been explicitly valued because they cannot be readily bought and sold as discrete items. Unlike conventional goods and services, most NTFPs and services have no market value and their prices are not easily determined (Hufscmidt *et al.* 1983, Pearce 1993, Campbell & Luckert 2002). In order to make wise decisions about the optimal allocation of forest resources or products, it is necessary that all values and services are taken into account. It is evident from studies undertaken elsewhere that the value of non-timber benefits sometimes outweighs the timber values alone (Peters *et al.* 1989) and its contribution to local economies can be gauged through accurate valuation.

There is a general consensus that a clear understanding of the values and contributions of non-timber forest products and services from forests to all stakeholders will give clear signals on the appropriate values for joint products. Thus, this will justify the fair allocation of scarce public resources for forestry activities and conservation (Godoy 1992, Godoy & Bawa 1993, Pearce 1993, Tewari 1994).

Recent attempts to determine economic value of forests through various valuation approaches in Kenya have provided ample evidence that non-timber forest values can be substantial (Emerton 1995, Wass 1995, Mogaga 2001). There is a growing body of knowledge on values attributed to forests apart from timber and this information is, unfortunately, only available for a few forests in Kenya. To provide strong arguments for government investment in forest conservation, obtaining quality information and data on forest values is an essential exercise that has to be undertaken especially for forests supporting provision of critical environmental services and facing immense human pressure. Thus, the objectives of the study were to (1) identify forest products services and non-timber values derived from Tindiret forest and (2) determine its total economic value to justify its conservation on economic grounds.

MATERIALS AND METHODS

Study site

Tindiret forest is one of the remnants of natural forest in western Kenya and is found within the Great Rift Valley. This forest forms an important watershed within the Mau Forests Complex, feeding major rivers and streams that make up the hydrological systems of Lake Victoria. It is rich in biological diversity and provides goods and services to adjacent households in addition to amelioration of the local microclimate (Wass 1995). The total forest area is estimated at 7080 ha and consists of high forest, grassland and planted forest. The forest is situated at 35.47° E and 0.04° N at an altitude of 2300 m. Annual rainfall is 1700 mm, evenly spread throughout the year with long rains occurring between March and June, while the short rains, between mid September and November. With an annual average of 17.4 °C, temperatures vary between a minimum of 10 °C and a maximum of 26 °C. The area occupied by the forest has undulating upland typified by rolling hills and sharp-topped ridges. These areas have soils comprising basalts and biotite gneisses. The soils are dominated by mollic and humic nitosols (Jaetzold & Schmidt 1982) and are of moderate fertility—generally good for growing tea and horticultural crops and livestock keeping. The forest is surrounded by human settlement mainly of Kipsigis to the south-east and Nandis (agro-pastoral communities) and Okiek to the north-west who mainly subsist on honey gathering within the forest.

Concept of total economic value

An intact natural forest yields many different products and benefits over time. Forests have potential value in terms of its growing stock

and this is normally captured by timber rents or revenues from harvesting of timber as represented by the stumpage value of the stock. Forests provide NTFPs, e.g. honey, medicine, fibres, fruits and dyes, which can be extracted and used by humans. The sustainable extraction of NTFPs, excluding the cost of extraction and marketing, gives us the value of NTFPs. In addition, forests also exert positive influences on other sectors of economy, e.g. agriculture, water conservation and soil protection. These values are aggregated to give the total economic value (TEV) of forests (Godoy 1992, Pearce 1993, Turner *et al.* 1994).

For a typical forest, the TEV comprises use and non-use values. The use values include direct use value (DUV), indirect use value (IUV) and option values (OV) while the non-use values include existence values (EV) (Turner *et al.* 1994). The total economic value of any forests can be determined from a combination of all these values by the use of the model given in equation 1.

$$TEV = DUV + IUV + EV + OV \quad (1)$$

In order to capture the total economic value of the forest a combination of valuation methods were used because there is no single valuation method that can capture all forest values.

Sampling techniques and data collection

The study was undertaken in three villages of three sublocations bordering the forest: (1) Kunyak of Chilchila Location Kipkelion Division, Kericho district, (2) Koigener and (3) Kipyaor of Chebangang location, Tindiret division of South Nandi district. According to the 1999 census the three sublocations have a total population of about 10 000 people and 2049 households. Sample households were randomly selected from a detailed list of households provided by local chiefs and village elders of the three villages. A questionnaire survey was administered to 109 households during fieldwork from March 2005 till May 2005. For the purpose of this study, a household was defined as a unit whose members live, cook and eat together. Primary data were obtained using a detailed questionnaire, which had sections on household characteristics, forest uses (usage of the forest, quantities of forest products extracted) and livestock ownership (type and number). Other primary data were obtained from community meetings held in forest-adjacent villages. Secondary data were obtained from government offices and local community-based organisations.

Valuation of direct uses

The data obtained from household surveys were basically recall data and these were used as a basis for estimating direct use values. Forest products like timber, poles and honey with developed markets were valued using equation (2) and products (firewood and forest grazing) without or with undeveloped markets were valued using market prices of substitute or proxy products (kerosene and hay respectively).

$$T_v = Q_m (P_m) - C \quad (2)$$

where

T_v = total value of product
Q_m = quantity of goods extracted
P_m = the forest gate price of goods
C = transaction costs

The total value of the product(s) was the aggregate for all households surveyed and extrapolated for the total population adjacent to the forest.

Valuation of indirect use

Forest provides positive influences on productive sectors but its value cannot be measured directly, e.g. watershed protection and soil conservation. The market valuation of physical effects (MVPE) was used to estimate the soil conservation benefits of this forest.

In this study, we based our analysis on comparative role of forests as compared with other landuse. Secondary data sources were consulted to arrive at possible estimates and we relied mainly on a study by FAO/IISA (1991). Based on these data, two hypothetical situations were assumed to give indicative values for the intangible value of this forest for soil conservation (details of calculations are in Appendix 1).

Benefit transfer approach

The benefit transfer approach was used to estimate potential values of the forest biodiversity for future industrial use and the carbon sequestration

value of the forest. There are limited data from Kenya that can be used meaningfully to estimate these values but studies from elsewhere suggest that benefits are likely to be modest and difficult to measure (Aylward & Barbier 1992). Tropical forests have biodiversity values in the range of USD0.01–21.00 ha^{-1} (Pearce 1993) and because Kenya is not well endowed in biodiversity like rainforest countries of South America or Asia, the value is likely to be lower than those quoted for biodiversity-rich countries. We used one-third of the highest value cited by Pearce (1993) to estimate the potential future value of this forest.

Carbon sequestration

The net benefits from carbon sequestered in forests and other undeveloped areas can be expressed in terms of the damage the carbon would do if released as carbon dioxide following conversion of land. The value would reflect the difference between the amount of carbon sequestered under present and future landuses. In this study, there were no local data on the actual potential of forest to sequester carbon and again we relied on studies undertaken elsewhere. The net global cost of converting tropical forests to agricultural use was estimated at USD320–1600 ha^{-1} (Pearce 1993) while the value of carbon sequestration in Brazilian Amazon was USD70 ha^{-1} $year^{-1}$ (Fearnside 1997). To indicate the likely magnitude of the service offered by this forest, we used two-thirds of the value cited by Fearnside (1997) to give an estimate of benefits of retaining the forest for carbon sequestration.

Opportunity costs of conserving Tindiret forest

In the absence of the forest, the land occupied by Tindiret natural forest could be put under human settlement and agricultural and livestock production. Therefore, the opportunity cost of maintaining this forest is the net benefits foregone from the potential agricultural and livestock production. In our analysis, we used tea growing to calculate the opportunity cost of conserving Tindiret forest. Tea growing is an established economic activity in the area. We obtained and used tea production data from the Tea Research Foundation of Kenya. So the opportunity cost of conserving the Tindiret forest is the net revenue obtained when the forest is converted to tea production.

Net benefit of conservation

This is the total economic value of the forest less the cost of maintaining it. This includes the costs of managing the forest in a year and the opportunity cost (OC) of the forest in its present state as a conservation area. In this study, it was not possible to obtain data on operational costs from forest department but it was assumed to be negligible. Therefore, the net benefit (NB) of conservation can be summarised by the expression below:

$$NB_{conservation} = NB_{direct\ use} + NB_{indirect\ use} + NB_{non\text{-}use} - OC_{conservation} \quad (3)$$

RESULTS

Direct use values

This forest is important to communities adjacent to the forest for various products and services (Figure 1).

The total direct use derived from the forest by households was Kshs45 mil and most of the values were from timber, poles, firewood and forest grazing. However, this value should be taken as conservative considering that these values were recall data from interviewed households (exchange rate USD1 = Kshs70).

About half of the forest-adjacent residents collect and use firewood from Tindiret forest (54.3%). The monetary value of firewood used in the three villages was about Kshs6800 per household per year. The total value of this use was Kshs13.9 mil.

Most village houses are made from timber, poles and rafters. Most households (51.4%) collect these materials from the forest.

About 60% households in the study areas collect grass for roofing. The cost of replacing a grass thatched house with a permanent one would be taken as surrogate value of thatch grass house. Data from the villages indicated that a medium house with corrugated iron sheets would cost about Kshs40 080 and would last for 30 years. Average annual replacement cost of corrugated iron sheets was taken as the surrogate value of grass thatched house which was Ksh1330 for

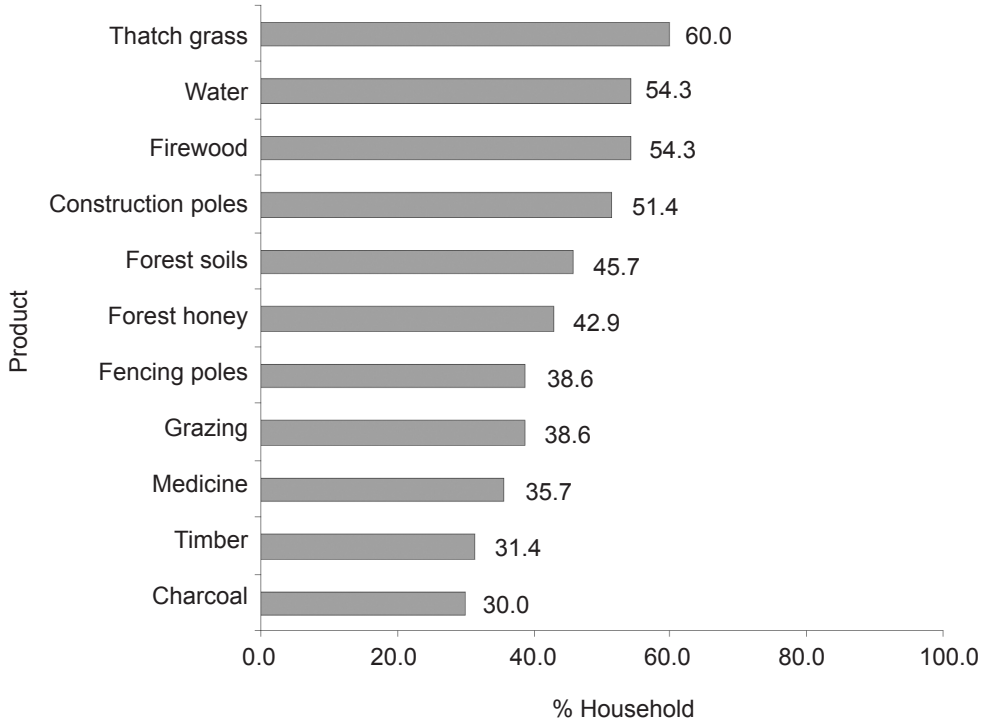

Figure 1 Importance of Tindiret forest to adjacent households (n = 109)

each household/year (Kshs40 000/30). The total value of this product was Kshs2.7 mil for the 2049 households.

Each household collect about 60 poles every year and the price per pole at the time of survey was Kshs120. With 2049 households bordering the forests the extraction was about 123 000 poles, valued at Kshs15 mil.

A typical household in the adjacent area has at least three cattle, three shoats and two donkeys. According to local administration officials, 25% of fodder is obtained from the forest and the number of free ranging animals at any time is about 2000 and 38.6% of the households send their animals to graze inside the forest. The conservative value of forest grazing was Kshs13 mil (Appendix 2 for detail calculations).

Most residents bordering the Tindiret forest get small amounts of forest honey. The activity is more popular among residents in Koigener village, a large honey-gathering community. In total, 43% of households adjacent to the forest collect honey from the forest amounting to 420 kg/year, which contributes Kshs84 000 to the local economy.

Indirect use values

Tindiret forest has potential to sequester carbon and this value was estimated at Kshs23 mil. The soil conservation value of this forest, under assumptions of the study, was Kshs12 528/ha and the total benefit for this service was Kshs86 696 000/year. The potential future value of biodiversity for industrial use was estimated at Kshs3.5 mil/year.

The net return from growing tea in the area is about Kshs50 000/ha (Tea Research Foundation 2006). It is assumed that if the total area under forest is put under tea with the best agronomic practices, net returns from tea growing is Kshs237 mil and this is the opportunity cost of Tindiret forest.

The total use and non-use values of this forest is Kshs158.5 mil yet the opportunity cost of conservation is Kshs237 mil. Therefore, the net benefit of conservation is Kshs(45. 04 + 3.5 + 23 + 87) – Kshs237 mil = Kshs-78.46 mil.

DISCUSSION

There is a high value of subsistence forest use to local households. The average local value is worth Kshs20 000/year for the majority of 2049 households. This value is equivalent to one third of their subsistence livestock production. The total direct use value by local households was Kshs45 mil but this was considered conservative because other values such as forest soils, forest

foods, fibres, medicinal uses and cultural values were not estimated. A similar study in eastern Kenya, Southern Rift and Mt Kenya showed that local utilisation of local forest by the communities is substantial and any action to deny the households from forest use would limit their livelihood opportunities (Emerton 1995, Wass 1995, Emerton 2001, Mogaga 2001). It is evident from this study that forests play a critical role in rural livelihoods, yet given the rising competition over forestland for agriculture, such information also indicates the urgent need to make forestry more meaningful economically to the local people so that they can see the importance of forest conservation.

This forest has Kshs23 mil as carbon stock and this is a value that accrues as a global benefit and it is difficult to indicate how such global benefit can be internalised or appropriated in Kenya. The value given here is based on studies elsewhere and if proper valuation of this forest is undertaken, the potential for this value is enormous.

Soil erosion is affected by many factors and the relations are complex. Soil erosion induced by rainfall is related to the intensity and periodicity of rain, soil type, slope, the nature of vegetation and the agricultural practices prevalent within a given area. The extent of erosion can vary from one area to another because of the variation in these contributory factors. The lack of quantitative data did not allow for estimation of forest soil conservation benefit flow in a meaningful manner in the Kenyan context and the value reported here was based on a hypothetical situation of the role of forest in soil conservation. We used secondary data from another study and the value of Kshs87 mil should be used with caution because the result will change with different sets of assumptions. However, it can still give an indicative value for this service.

When all values were aggregated, the net benefit of conservation was negative indicating that the forest in its current state was not accruing benefits commensurate with the opportunity cost. The current benefit from this forest is inadequate to offset the opportunity cost of leaving the forest in its present state. This study reinforces the findings by Norton and Southey (1995) that the Government is heavily subsidising conservation in Kenya because most of the benefits, although substantial, accrue to global community and Kenyans have no way of appropriating the values. The values like carbon sequestration are global values whereas the local communities bear the costs of maintaining these forests.

CONCLUSIONS AND RECOMMENDATIONS

Tindiret forest is classified as a protective forest from where adjacent communities extract small quantities of forest products. The forest is important in sustaining the livelihood of these people. This direct use value of the forest is about Kshs45 mil/year. This is still a conservative estimate because not all use values were estimated. Though the forest provides benefits to local communities through direct uses, the local communities suffer human and crop losses by wildlife from the forest.

Based on results of this analysis, the government and local communities are subsidising the retention of the forest. This subsidy is presently estimated at Kshs78.5 million through lost opportunity in income. Though the opportunity cost of conservation exceed use and non-use values, the forest should be conserved, as the consequences of change in use can be enormous. The forest should be conserved as other opportunities are explored and developed to diversify sustainable use of the forest. The only way the local community can benefit more and appreciate the presence of the forest is to develop more non-consumptive uses of the forest like honey production, ecotourism promotion and initiation of projects which integrates conservation and development of forest-adjacent villages. The Kenya Forest Service and Kenya Wildlife Service should explore the potential of the area as a tourism destination so that revenues from recreation can offset the high costs of maintaining the forest. Other avenues should be explored to compensate Kenya and the communities for maintaining the forests because most of the non-use values are accruing to global community and Kenya bear the costs of conservation.

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Appendix 1 Calculation on potential soil conservation value of Tindiret forest

Assumptions:
(a) The forest is undisturbed humid forest with litter layer of at least 50 mm, a canopy with 75% cover with 90% area covered by at least 50 mm of litter
(b) The above humid forest is converted to maize cultivation with 80% vegetative cover, with intermediate input
(c) The soil susceptibility to erosion is intermediate
(d) Bare ground of soil loss due to rain induced erosion is 0.5 cm of topsoil per annum
(e) Maize output/ha is 45 bags and the price per bag is Kshs1600.00 (according to 2004 prices).

Cover factor (C) for the humid forest is 0.001 and the soil loss for this cover is 0.001 × 0.5 cm = 0.005 cm.

On conversion to maize with conditions stated, C for stated conditions is = 0.30, soil loss per annum for this cover is 0.30 × 0.5 cm = 0.15 cm. Therefore, soil loss measured in terms of incremental top soil eroded due to rain induced erosion is (0.15 – 0.005) cm = 0.145 cm

Gross value of maize is Kshs72 000.00.

Using yield loss equation, Y = 1.2 X, where Y = productivity loss in per cent; X = soil loss in cm (source: FAO/IIASA 1991), the soil loss of 0.145 cm occasioned by changed landuse causes a reduction in yield of 1.2 × 0.145 = 0.174% or Kshs12 528.00.

Soil conservation value of this forest under the assumptions stated can, therefore, be estimated at Kshs12 528.00/ha. This will, however, change with different sets of assumptions. Using this scenario, the estimated benefit for this forest under the above assumptions is Kshs86 696 000 per annum (total forest area is about 7000 ha).

Appendix 2 Valuation of grazing

A typical household in the adjacent area has at least three, three and two cattle, shoats and donkeys respectively.

According to local administration officials, 25% of fodder is obtained from forests and the number of free ranging animals at any time is about 2000 and 61.4% of the households graze their animals inside the forest. Since the data we collected were temporal, it was not possible to get exhaustive information and, in most cases, we relied on secondary data and use of substitute method in estimating the value of forest fodder. From literature, the dry fodder requirement for livestock is taken to be about 2–3% of the body weight per day (Ganesan 1993) and the typical cattle in the areas weighs between 200–300 kg (Ministry of Agriculture and Livestock 2005). The minimum quantity of fodder required for maintenance is therefore between 4–9 kg per day. The cattle grazing within Tindiret forest is about 2000 and therefore requires 7300 and 16 425 tonnes of fodder each year. Forest grazing is not an all year round activity and provides about 25% of fodder resources for each cattle each year. Thus, the forest provides between 1825 and 4100 tonnes of fodder and this is equivalent to 60 770 to 136 740 bales of hay. Based on these assumptions, the conservative value of forest grazing is about Kshs13 mil. This is the estimate gross value of the forest for forest grazing.