Forest Valuation and Economic Policies

Learning from Mount Meru Forest Reserve, Tanzania

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Introduction

The presentation aims to share experiences from a field exercise designed to apply concepts and techniques of environmental economics and valuation of natural resources in understanding the influence of policy on use of natural resources. A second purpose is to demonstrate the use of valuation and how it can be used to influence planning and management of environmental resources on the ground.

The study area is located in Mt. Meru in northern Tanzania, to the west of Mt. Kilimanjaro. The ecosystem comprises several forest reserves, the Mt. Meru Catchment Forest Reserve (CFR) being the largest (26,433 ha). The Mt. Meru CFR was established in 1920. It is the source of several perennial rivers, which flow into the Kikuletwa/Pangani river system that is important as a source of water for irrigation and hydroelectric power generation. This makes the reserve a vital resource in the socio-economic and environmental fabric of northeastern Tanzania.

Small-scale irrigation is practised both on the slopes and in the plains immediately beneath the foothills of the mountain. Commercial flower farming is also extensively undertaken on the foothills. These activities make use of the river systems for irrigation purposes, both small and large scale.

The confluence of the Kikuletwa with the Pangani ultimately leads to Nyumba ya Mungu, the important hydroelectric dam that also supports a significant artisanal fishing industry. Further downstream are major irrigation schemes that critically depend on water from Mt. Meru. Finally, the water is used for hydropower generation at Hale before the water drains into the Indian Ocean near Pangani.

There is considerable competition for the finite water resources from Mt. Meru for various socio-economic activities. However, the flow of water is diminishing due to reduced forest area on the slopes of Mt. Meru.

Conceptual Framework

The concept of total economic value (TEV) is key to valuation of environmental resources such as the Mount Meru catchment ecosystem. From this perspective, benefits accruing from the Mt. Meru Forest Reserve include: Timber products from plantation forest, non-timber products including fuel wood, poles, medicines, thatching materials, ropes, animal fodder and eco-tourism benefits. There are also non-direct values such as sources of water, soil erosion control, climate regulation source of gene pool, bio-diversity conservation and wildlife habitat. Other benefits include option values and existence values. The concept of TEV can be depicted by the following formula:

$$TEV = DV + IV + OV + XV$$

Where:

TEV = Total economic value
DV = Direct values
IV = Indirect values
OV = Option values
XV = Existence values

However, when considering conservation benefits, we should not equally be concerned about conservation costs and their distribution. Usually, local communities forego a lot of benefits in terms possible agricultural and livestock production as well as timber and other forest products they could have harvested if the ecosystem was not declared forest reserve while others downstream enjoy benefits of conservation without paying for them. Valuation helps to quantify environmental benefits and costs and thus be of assistance in decision making on development and conservation issues.

Problem statement and study objectives

The problems surrounding Mount Meru Catchment Forest Reserve are numerous and complex, ranging from the ecological and economic to the social and political. Ecologically, this national forest has had its biodiversity value reduced. In 1965, for example, 13,000 ha out of the total of 26,433 ha were hived-off to establish Arusha National Park (Mkeya, 1994). In addition, during the 1950's, about 6,000 ha were excised to establish Meru softwood and Usa hardwood plantations to provide alternative sources of wood, as well as to act as a buffer zone to the forest reserve (ibid.).

Today, the forest reserve is even more insecure than it was 20-25 years ago due to increased human and animal activities whose impacts have increased the level of its degradation. This has resulted in increased conflict between the different resource users such as farmers, pastoralists, irrigation projects and Arusha urban users, who depend on it as their source of water supply.

The Impact of Policies

Tanzania has undergone profound policy changes since independence in 1961. The most significant were population resettlement and a command economy that began with the Arusha Declaration in 1967. The policy of villagization was pursued with vigour after 1972, while state corporations were created to control "commanding heights of the economy". The 1972 policy of decentralization, for example, created a difficult political environment by abolishing an elected system of local governments. Under that policy, the conservation and management responsibility became solely that of central government. Thus, local authorities and the people became detached from them. It is believed that the period between 1972-83 is when the rate of encroachment and degradation of the natural forest increased tremendously. People built houses very close to riverbanks, although the law states that it is illegal to build within 30 m from both sides of the riverbank. Now, after almost 25 years, it is politically difficult to demolish houses built in the encroached lands in the natural forest and along riverbanks.

Economic policies pursued by the government since 1986 under the rubric of stabilization and structural adjustment (economic liberalisation) have had their consequences. Liberalisation of trade and markets, devaluation of the local currency and the opening of doors to private investment have boosted incentives for people to undertake more logging of timber and more intensive farming in the mountains (vegetables and coffee). In the plains, more land is being opened for extensive farming because it is more profitable to do so and population is rising. The policy of opening doors to investors has resulted into n expansion of the flower industry.

Other policy measures that affect the integrity of the catchment forest include tight fiscal policies that aim at reducing the government deficit but which result in down-sizing the government through retrenchment of staff responsible for enforcement of forestry laws and regulations. Meagre budgetary allocations to forestry departments and local governments do exacerbate forest degradation.

As a result of increasing economic activities around the catchment, degradation of the forest is occurring at very fast rate, leading to scarcity of water**.** As upstream users increase their consumption of water, downstream users of water, which include small holding farmers, plantation owners, urban dwellers, industries and hydroelectric power production, suffer as a result and conflicts of water are created while old ones intensify.

Approach and methodology

In trying to evaluate the resources of Mt. Meru Forest Reserve, the following data were collected:

- Irrigation projects and other users of water in the area;
- Water flows (discharges);
- Water tariffs;
- Livestock figures from villages surrounding Mt. Meru;
- Human population figures from villages surrounding Mt. Meru;
- Actors, both governmental and NGO's, active or interested in the conservation and management of Mt. Meru CFR.

Current prices of various goods and services were used to value the various quantities described in the data sets to get monetary value. These were taken as approximate values of the environmental goods.

The data sources for such a study are, by nature, varied. They range from interviews with responsible authorities; review of existing documents reports, maps and field surveys. Data and related information used to estimate the costs and benefits of re-forestation, land conservation and water conservation, were generated through the following methods:

- Interviews with stakeholders (Mt. Meru Catchment Forest Project, Meru-Usa Forest Plantations, Arusha Region Water Department, Soil Conservation and Agroforestry Programme in Arusha (SCAPA), Traditional Irrigation and Environmental Development Organization (TIEDO), Arumeru District Council, Ulyate Furrow Users Association in Arumeru, Continental Flowers and Kiliflora);
- Direct observations by visiting parts of the Mt. Meru CFR and its bordering ecosystem (Bangata village, Nkodmaala water gauging station on the Nduruma River, Continental Flowers and Kiliflora/Loliondo Roses);
- Review of relevant literature available at the Meru-Usa Forest Plantations, Mt. Meru CFR, SCAPA, TIEDO, the Global Environment Foundation (GEF)/ UNDP/NEMC project office and the course notes.

Main study findings

Mt. Meru Catchment Forest Reserve

This natural forest is surrounded by 31 villages having a total population of 80,148, which is about 24.9 per cent of Arumeru District's population of 322,000 from 1988 figures. These villages have a large number of domestic animals, as follows:

Dairy cattle	6396
Local cattle	36107
Goats	37377
Sheep	42496

These villagers and their animals depend on rivers and furrows connected to the rivers for their drinking water and for irrigation purposes. Hence, any degradation arising from the activities of the population, such as agriculture and livestock rearing, adversely affects the supply of drinking water and availability of pasture.

It is important to note here that degradation has a cost in terms of loss of production that is dependent on water. The method of market value of physical effect on production can be applied to estimate the economic loss of degrading the Mt. Meru catchment.

Source of Water

In addition to supplying water to the farmers and supporting the livestock populations of the area, Mount Meru is also a major catchment area for water supply to a population of 250,000 in the municipality of Arusha. It is also the source of some of the more important rivers that flow into Nyumba ya Mungu hydroelectric dam.

Decline in the levels of water flowing in these rivers has forced the government to resort to drilling a number of boreholes in order to meet the increasing demand for water, within the rapidly growing urban population of Arusha Municipality. The cost of drilling boreholes can be considered as a replacement cost arising due to degradation of the catchment forest.

Although most water use from Mt. Meru is for small-scale irrigation and domestic use, the biggest commercial water users are the Arusha Urban Water and Sanitation Authority (AUWSA). The Authority has 15 major boreholes with an average annual capacity of 7,404,729 m^3 per annum. All these boreholes have been constructed to supplement the dwindling surface water supply form rivers, caused by the degradation of the CFR. Little thought appears to have been given, however, to the fact that the groundwater sources are also supplied form the Mt. Meru catchment. The Authority also taps surface water from 2 major springs, with an average annual water yield of 6,359,054 m^3 per annum. From the distribution of the above-mentioned amounts of water, the Authority earns more than TSh 1 billion. This benefit must be weighed against the cost of drilling over and above the normal cost of distributing the water.

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The Cost of Alternative Sources of Water

The cost of drilling one borehole in the areas surrounding Mt. Meru is between TSh 10-12 million, with an average production ranging from 80-300 m^3/hr.

Thus, if one were to attempt to replace surface sources of water with groundwater sources, it would need a colossal sum of money. That makes the assumption that there would be water available from groundwater sources. However, there is evidence that the amount of groundwater obtained from long-term boreholes is falling. It must also be remembered that such groundwater accumulates from infiltration that takes place on the slopes of Mt. Meru. Degradation of the Catchment Forest Reserve affects the groundwater recharge as well as surface water flows.

Discussion in the light of valuation

Cost of Replanting

On average, about 150 ha of plantation forest is harvested every year (MUTPO 1999). It is planned that by the year 2001, the rate of planting and that of cutting or harvesting will be normalized so that for every hectare harvested, there will be an equivalent replacement planting. The cost of planting one hectare of trees and that of taking care of them was found to be TSh 209,000 per hectare (equivalent to US$ 240 at the current exchange rate of 1 US$ to 800 T Sh).

When it comes to thinning (commercial), thinners pay because they utilize the thinned young trees for building purposes and as fuel wood or firewood. They pay TSh 500 per cubic meter of trees that give an income of about TSh 100,000 per hectare (MUFPO 1999). However, this income is still far below the cost of TSh 209,000 derived above.

It should be noted that this total cost does not include the cost of constructing murram roads in the plantations which is T Sh 250,000 per kilometre while that of maintaining such roads is TSh. 1000 per meter. Also, it does not include the salaries of staff in the Meru-Usa forest plantations office. Therefore the cost of planting and raising one hectare of tree seedlings is quite high.

Replacement Cost of Environmental Degradation

Human activities notably agriculture and pastoralism are the main causes of the degradation. Expansion of farmland into the catchment forest reserve is one of the major causes of forest degradation. Increase in human population has lead to an increase in the demand for farmland. This also occurs in the plantation forests, although it is illegal. Grazing of animals also causes a lot of degradation. This is common on the western part of Mt. Meru, while agriculture is more visible on the southeastern side of Mt. Meru.

The outbreak of fire is another cause of forest degradation. The loss of forest cover due to fire about 1670 hectares in the period 1996/97 to 1999/2000

Systems of joint management, i.e. involving the villagers in the management and conservation of the forests, have contributed significantly to the reduction of fire occurrences because this system reduces the opportunity costs that villagers living adjacent to the forest normally forego. Inter-cropping, known as *taungya*, is allowed to be practised by villagers in the plantation forests, and has contributed to the reduction of fire incidents.

The cost of replanting the 1671.6 ha of forest lost through fire damage, will be: TSh 209,000 x 1671.6 ha = TSh 349,364,400

This figure is far below the actual value of lost resources, when one considers the value in terms of reduced agricultural production (especially food production) and forest products for the 31 villages due to environmental degradation.

Alternative Water Replacement Costs

Due to the reported reduced flows in the river systems emanating from Mt.

Meru, an exercise of looking into replacement costs for a major estate, which presently depends upon surface water abstraction.

At the moment the two Kiliflora flower farms, with a total of 37 hectares, take water from the Usa River. Their water right allows them 1226.9 m^3 per day. The present abstraction license works out somewhere in the order of 35 m^3 per hectares. If the farm were to obtain the above amount of water from groundwater, they would have to incur extra costs amounting to TSh 11, 000,000 (US $ 13750).

On the other hand, the Municipal Water Supply Authority in Arusha spends an average of TSh 351,500,000 per year on electricity (US $ 439,375). If one assumes that this amount is the cost arising from pumping from 14 boreholes (b/h) for 22 hrs daily for one year, then the average cost per borehole is Tsh 25,107,142 per borehole per year. If the Kiliflora farms were to operate for only 10 hours per day, then the annual cost would still be in the order of TSh 11,412,337 per year.

The total potential replacement cost for the farm complex would therefore be, in the first year, in the order of TSh 22,412,337 (initial borehole cost of 11 million T Sh plus running costs). This would be on top of the considerable electricity bill, which the company already faces, notably for chilling and cooling flowers.

The cost of abstracting water from the River Usa is TSh 1000 per 1000 m^3 abstracted, as per the tariffs for uses for flower farming. Therefore this represents an annual cost of approximately TSh 365,000, (US $ 456) compared to the annual running costs of TSh 11,412,337 (US $ 14,654).

From the above calculations, it can be seen that the replacement cost for abstraction of water from boreholes, if the river source were to become unavailable, would be extremely high. Annual running cost, not taking into account the capital cost of borehole installation, would be in the order of TSh 10,271,103 per year. The results also show that surface water abstraction is, indeed, greatly underpriced.

Conclusions and Recommendations

From the above discussion and analysis, a number of conclusions can be drawn. First, the issues pertaining to the use of natural resources in and around Mt. Meru CFR are complex and many. As the human population in the area and Arumeru District continues to increase, demand and uses of the resources will increase. The number of animals also continues to rise, thus increasing or intensifying conflict between the users. As the human and animal populations continue to rise, the value of this natural forest and its surrounding areas as a source of water supply and major producer of food will continue to increase. Its importance and impact goes far beyond the Arumeru District boundaries.

The second is that Mount Meru CFR has a very large catchment value, whose replacement cost cannot easily be estimated. Rivers such as Malala, Tengeru, Ngarenaro, Usa and Maji ya Chai, are flowing in a Southeast direction, before entering Nyumba ya Mungu dam. The Pangani River flows through the Pangani and Hale hydropower plants. It's continued degradation will adversely affect the generation capacity of the country.

The forest reserve supplies water to Arusha Municipality, estimated to have 250,000 people in 1999 and to many settlements in the dry but densely inhabited Arumeru District. The water is used for irrigation of coffee plantations, flower farms and as water supply to the inhabitants and large livestock population. Continued degradation of the natural forest will reduce water supply from surface sources, thus forcing the government to construct boreholes, which is an expensive way of meeting the increasing demand for water from various water users in Arusha Municipality and Arumeru District.

Forest plantations are an expensive way of trying to restore natural vegetation cover. Further degradation will only impoverish the people in Arumeru District and Arusha Municipality.

Another conclusion is that the replacement cost for abstraction of water from boreholes, if the river source were to become unavailable, would be extremely high. This realization of the high cost of alternative supply of water has policy implications for increasing conservation efforts in the catchment area. Surface water abstraction is, indeed, greatly underpriced.