EASTERN ARC MOUNTAINS CONSERVATION ENDOWMENT FUND (EAMCEF)

MFUKO WA HIFADHI YA MILIMA YA TAO LA MASHARIKI

ECONOMIC VALUE OF ECOSYSTEM SERVICES FROM EASTERN ARC MOUNTAINS OF TANZANIA

Introduction

The decline in the quality and quantity of ecosystem services society derives from mountain forests is a growing global concern (MEA, 2005). Mountain forests play four major roles: provisioning, regulating, supporting and cultural ecosystem services. Mountain forests provide freshwater for domestic and commercial uses, regulate storm flow hence reducing floods downstream, support agricultural production of various crops and fruits, supply clean air that support lives of humans and other living biodiversity, the landscape provide beauty for recreation, provide habitat for various biodiversity, and the forest have cultural touch with the communities living around.

Similar challenge is facing EAMs (EAMs) which extends from Taita Hills in Kenya to Udzungwa Mountains in South West of Tazania comprising of fourteen mountain blocks with similar characteristics. In these Mountain blocks the decline in the supply of ecosystem services not only threatens imbalance of biodiversity but also food security, energy production and consequently induces ecosystem services use conflicts between sectors of the economy. In EAMs such conflicts over ecosystem services are common and growing over time. For example, in North Pare and East Usambara the conflicts between livestock keepers and farmers are reported to grow over time, in Nguru, Uluguru and Udzungwa mountains flood plains similar conflicts have also been reported. In almost all EAMs there is illegal mining going on which not only destroys water sources hotspots and pollute water that flow downstream but also destroys river banks increasing flooding downstream.

Realizing the challenges facing the EAMs forests, Eastern Arc Mountains Conservation Endowment Fund (EAMCEF) conducted comprehensive study on economic value of the mountains with the purpose of understanding actual economic value of the mountains forests for justifying its conservation against alternative land use.

Study methodology

The study was carried out between 22nd January and 9th February 2018, by conducting field survey in 28 villages randomly selected from eleven EAMs blocks in Tanzania (East Usambara, West Usambara, South Pare, North Pare, Nguru, Nguu, Uluguru, Ukaguru, Rubeho, Mahenge, and Udzungwa).

The types of ecosystem services the catchment supply and usage at household level were established through individual household survey which involved interviews with randomly selected household members, village key informants, various officials from Rufiji, Pangani and Wami Ruvu Water Basin Offices, officials from water supply companies (i.e. Tanga UWASA, MOROWASA and DAWASCO), officials from Sugar and rice estates (Mtibwa Sugar, Kilomero Sugar and Kilombero Paddy Production Limited), officials from forests and nature reserves (i.e. Udzungwa Mountains National park, Amani Nature Reserve, Magamba Nature Reserve, Chome Nature Reserve, Nilo Nature Reserve, Uluguru Nature Reserve and Mkingu Nature Reserve), officials from forest plantations (i.e. Ukaguru, Mtibwa, Longuza and SAO Hill planted forests), agricultural and forest officers from Muheza, Mkinga, Korogwe, Lushoto, Same, Mwanga, Morogoro Rural, Mvomero, Kilombero, Kilolo, Mufindi and Mahenge districts. We also interviewed officials from TANESCO and visited all the hydropower plants in EAMs (i.e. Nymba ya Mungu, Hale, New Pangani fall, Kidatu, Kihansi, Mbingu Sisters, and Iyovi hydropower plants).

Ecosystem services supplied by EAMs were categorised into eight categories: (i) Agricultural ES, (ii) Extracted forest products, (iii) standing timber (iv)water resources (v) Biodiversity, (vi) Carbon sequestration, (vii) Bequest value or value of existence and (viii) Tourism. A discount rate/rate of return to capital of 9 percent as recommended by central bank of Tanzania (BoT) was used to account for the time preference in calculations. The exchange rate used throughout is USD 1=Tsh. 2,276.87/=.

The findings

Type of ecosystem services supplied by EAMs and their economic values

The EAM blocks supply a number of ecosystem services with multiple uses. The ecosystems services supplied give the mountains a remarkable economic value as indicated in the table below.

Categories of the Ecosystem services	Type of the ecosystem services	Total value (x 10^6 USD)	% of the total value
Agricultural products	Crops	3,186	1.34
	Vegetables	107	0.05
	Fruits	933	0.39
	Livestock	165	0.07
Extracted forest products	Natural forests	52	0.02
	Planted forests	19	0.01
Standing timber	Natural forests	88,770	37.44
	Woodland	58,878	24.84
	Planted forests	13,486	5.69
Water resources	Water (domestic, irrigation, livestock & industrial use)	321	0.14
	Hydropower	66,665	28.12
Biodiversity	Biodiversity value	4	0.0015
Value of	Bequest value	0.8	0.00033
Carbon sequestration	Forests	2,548	1.07
	Woodland		0.82
Tourism	Tourism	0.021	0.0000093
	EAM total value	**237,069**	**100.00**

The total economic value of EAM block ecosystem services is USD 237,069,472,267.08. Standing timber in natural forests account for 37.44% of this value followed by water resource used to generate hydropower (28.12%). Standing timber in woodland take the third place by accounting for 24.84% of the total value followed by standing timber in planted forests which account for 5.69% of the total value. Agricultural crops take the fifth place by accounting for 1.34% followed by fruits production which accounts for 0.39% of the total value. The mountain capacity to store carbon is high accounting for 1.07% in natural forests followed by woodland which account for 0.82% of the total value. Other ecosystem services account for less than 0.1% of the total value. Higher value in forest products implies that forest cover dominates the EAMs land area and it shows how important forest cover is for the mountain capacity to supply ecosystem services and support production of consumable goods.

The capacity to supply ecosystem services and support production of consumable goods varies across the mountain blocks. The table below clearly shows that variation among EAM blocks.

Name of mountain block	Total value (x 10^6 USD)	% of the total
East Usambara	7,014	2.96
West Usambara	15,404	6.50
South Pare	7,451	3.14
North Pare	1,896	0.80
Nguru	12,036	5.08
Nguu	10,335	4.36
Uluguru	26,278	11.08
Ukaguru	12,088	5.10
Rubeho	21,894	9.24
Mahenge	489	0.21
Udzungwa	122,185	51.54
EAM total economic value	**237,069**	**100.00**

Udzungwa mountain block accounts for a higher value among the EAM blocks followed by far by Uluguru, Rubeho, West Usambara, Ukaguru, Nguru, Nguu, South Pare and East Usambara. The mountain blocks account for 51.54%; 11.08%; 9.24%; 6.50%; 5.10%; 5.08%; 4.36%; 3.14% and 2.96% of the total value respectively. Other mountain blocks account for less than 1% of the total value. This also indicate how potential the mountain blocks are in terms of ecosystem services provision, forest stocks, agricultural production supporting services, regulating services and cultural services. In addition to the potential this also show how well preserved the block is, much of Udzungwa land cover is protected, it includes nature forest reserves, forest reserves and a national park. Plausibly this may explain the higher value in standing timber in both forests and woodland, hence higher value in carbon storage and water for domestic, industrial, farming uses and production of hydropower. This suggests that, there is a strong connection between forest condition and ecosystem services such as water which support life and human development.