Impact of State Controlled Consumptive Management Approach on Community Economic Benefits from Conserved Natural Resources in Tanzania: Case of the Great Mahale Ecosystem

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ABSTRACT

This paper tried to answer the core question of whether protective management policies of natural resources can sustain the economic benefits expected from them by communities living around the natural resources in Tanzania. The paper is based on multiple linear regression analysis of cross-sectional data collected from 400 community members selected from 10 purposefully selected villages surrounding the Great Mahale Ecosystem in Western Tanzania, where a 3 A 1-4 scale questionnaire was administered. The findings revealed that, state-controlled consumption of firewood, logging and timbering had negative effects on potential community economic benefits from the natural resources. State-controlled access to firewood was the only variable that was found insignificant. The state-controlled consumptive policies on tourism and hunting, farming practices proximity to the conserved natural resource, wildlife games and wild fruits as well as access to medicinal plants were found to be beneficial to surrounding communities. The development of tourist hunting blocks would improve consumptive utilization not only under government managed natural resources but also under communal-indigenous approach. There should also be an integration of consumptive and non-consumptive approaches such as sustainable timber harvesting to maximize community economic benefit.

Keywords: *Community Economic Benefits, State- Controlled Consumptive Management Approach, Natural Resources, Greater Mahale Ecosystem, Tanzania.*

INTRODUCTION

Community Economic Benefit (CEB) is a wide term defined as value received by people such as food, energy, spiritual enrichment, recreation, and appealing experiences (Ribot, 2003; Murphree, 2009). DEFRA (2007) expanded the meaning by including direct use, indirect use, non-use, and option values to communities. While Venable (2016) stated CEB as any quantifiable gains in terms of money generated, saved, or cost reduced because of an action. Gains among others are revenues, profit, net income, creation of jobs, wealth creation, cash flow, lower cost of raw material and lower opportunity costs. Whereas the Millennium Ecosystem Assessment (MEA) (2005) defined CEB as "the gains people obtain from ecosystems" that include; leisure, entertainment, cultural activities, employment, tourist services and handicrafts. Economic Benefit Flow (EBF) which is synonymous but wider than CEB refers to the stream of shares gained that is controlled by a bundle of powers, rights, proximity, and social relationships (Ribot, 2003; Murphree, 2009). Furthermore, Milner-Gulland (2012) explained economic benefit flow as lines of complex social-economical-ecological interlinkages. Additionally, it is summarized as channels of gains that are affected by barriers, boundaries, and management approaches (Huton et al., 2005). This study examined the gain of community economic benefit from natural resources conservation to indigenous surrounding.

Most of the ecosystems in Tanzania such as the Greater Mahale Ecosystem (GME) contain vast terrestrial natural resources such as; forests, wildlife, and undulating landscapes. GME is among the World Biodiversity hotspots that in its undulating mountains, hosts endangered chimpanzees and supports more than one million human livelihoods (Leisher & Hess, 2017; TAWIRI, 2018). Unfortunately, its richness in natural resources is experiencing fast more degradation rate (10%) than the country's average rate of a country (6%) (William, 2018). The Greater Mahale Ecosystem applies consumptive or non-consumptive, government-state or communal-indigenous natural resources management approaches to conserve their nature (Paille*et al.*, 2015; TAWIRI, 2018). Good management of Greater Mahale Ecosystem terrestrial resources that are forests and wildlife may decrease the degradation rate, improve the economy of people and contribution to the Tanzanian

economy. Benefiting the Tanzanian community economy from natural resources management is crucial and possible as it happened in Malaysia, Costa Rica and Thailand (Scherl *et al*., 2004; Andam *et al.,* 2010; Amira *et al.,* 2015). In 2021 there was a 3% increase in annual direct employment contributed from natural resources management. Direct employment from natural resources management was estimated at 377,000 direct jobs in 2010 and it was estimated to rise to 497, 000 jobs (3.9%) by 2021 (NESR, 2017). To ensure community benefits from natural resources management is necessary while managing natural resources degradation. In order to halt forest and wildlife losses and rising of domestication trend, Tanzania set aside 32.5% of her land as reserve lands (NESR, 2017). This achievement is beyond 30 by 30 goal of conservation and desire of the globe (COP 26, 2021) and is beyond the 17% proposed by the Aichi target (IUCN, 2017; NESR, 2017). It is argued in NESR (ibid)) that since the land reserved for conservation is bigger by 20% of the land used for agriculture; it should substantially address community economic benefit (NESR, 2017). However, the reserved lands do not guide land conversion and domestication in village or community lands. A stepwise study on Social Assessment of Protected Areas (SAPA) by Franks & Small (2016) indicated that empowerment of people and the reduction of inequalities in costs and benefits increase conservation effectiveness.

Furthermore, in Costa Rica and Thailand, Andam *et al.* (2010) studied modern natural resources management through existence of protected areas. The study found that there was improvement in community economy welfare around protected area and country. This finding is similar to later study conducted by Lewis *et al.* (2017) on the global dynamic on protected areas and the other by Keane *et al.* (2020) on impact of wildlife management areas to community. State Controlled Consumptive Management Approach (SCMA) to natural resources management practiced around Greater Mahale Ecosystem comprises of government custodianship of governance, organisation, control, directing and developing resources on reserved or protected lands (URT, 2009). With regard to natural resources management, SCMA is commonly practiced in all national parks, forest reserves, game reserves and game-controlled areas (URT, 2009). However, the focus of

SCMA slightly varies with the nature of the natural resources at hand. For example, the wildlife policy of Tanzania (URT, 1998a) considers SCMA as the retaining of the ownership and overall responsibility for management of wildlife resources by the state to ensure that national priorities are addressed, and abuses are controlled. Such management practices are noted around Nkamba forest reserve and Nkamba hunting blocks. Further, the wildlife policy strategy implies that SCMA is confined to wildlife core habitats of national parks, game reserves, and game-controlled areas. Such management practices are noted around Mahale Mountain National Park and Katavi National Park. In the forest policy of Tanzania (URT,1998b), SCMA is linked to efficient forest management and conservation, commonly practiced around Tongwe west forest reserve, Mpanda line forest reserve and Masito Ugala forest reserves. The recent increase in encroachments of reserved and protected natural resources by communities living around the resources has raised concern about whether the respective communities are benefiting from the resources. This has also raised questions on the appropriateness of SCMA for natural resources. Thus, there is a need to examine the costs and benefits as well as socioeconomic impacts arising from the establishment and maintenance of protected areas and their distribution to communities for sustained utilization of such vulnerable natural resources. The aim of this paper was to examine the impact of SCMA of natural resources on potential economic benefit that the communities living around Greater Mahale Ecosystem in western Tanzania.

Methodology

The Study Area

This paper is based on the study conducted in communities living around the proximities of the Greater Mahale Ecosystem (GME) which comprises the Mahale Mountains National Park in western Tanzania and the surrounding natural habitat (Figure 1). Together with the Gombe National Park to the north and the Southern part of Lake Tanganyika to the south, these areas are known as homes of Tanzania's chimpanzees. In the GME only 11% of the natural habitat is protected and this is in the Mahale Mountains National Park

together with the Tongwe East Forest Reserve1. Species of conservation concern in this landscape included the eastern chimpanzee which occurs in some of the driest habitat anywhere throughout its distribution, red colobus, elephant, lion, sable, Kungwe apalis – an endemic bird and several plant species are only found here particularly in the Sitebi highlands. Land cover is a mosaic of primarily miombo woodland, thin patches of riparian forest, larger patches of evergreen forest, and tracts of open grassland and seasonal swamps (Figure 2). The population living around GME is growing at a fast rate of 4.8% but with poor performing economic welfare of less than 150 USD per year per household (URT, 2012; Leisher& Hess, 2017; Hardee et al., 2018). The fast-increasing population and the heavy dependency on natural resources exert pressure on natural resource utilization which is linked to natural resources management approaches.

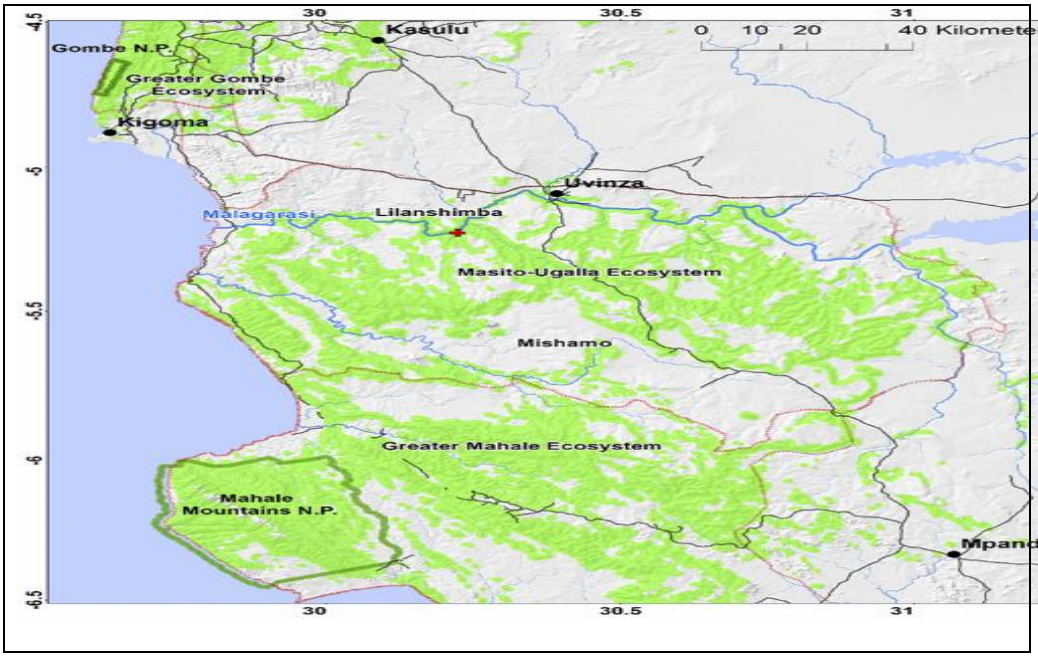

Figure 1: Map of the Greater Mahale Ecosystem

[1] https://albertinerift.wcs.org/Wild-Places/Greater-Mahale-Ecosystem.aspx

Figure 2: Vegetation cover and Nkondwe water fall in the Greater Mahale Ecosystem

Study Design and Data Processing

Data from a cross sectional survey was collected from 400 randomly selected community adults from 10 villages surround the GME. Oral interviewees with selected key informants were also conducted with community elders and community leaders. Data collection used a 4 scale questionnaire in line with Parrish et al. (2003) for ecological studies where 1=Strongly Disagree, 2=Disagree, 3=Agree and 4=Strongly Agree. The study used the 4-point scale to avoid bias and respondents clustering at center (opt cit). Table 1 shows the number of items for each of the nine variables for CEB and the number of items for each of the six variables for SCMA where the total of items for CEB and SCMA were 42 and 17 respectively. Table 1 also shows how the total scores range for each variable and the respective total scores for CEB and SCMA. The study used mean scores to classify the interpretation of findings into two clusters for each variable i.e. weak score hence low levels of agreement with the statement if less than mean, and strong score or higher levels of agreement with the statement if the score is above the mean.

Table 1: Data Processing Matrix

Variables	Items	Range of the total scores	Interpretation of mean score by weak (Wk) and strong (St)
Community Economic Benefits (CEB)	**42**	**Scale 42 – 168**	**If M ≤ 83 Wk; > 83 St**
Personal Income	7	Scale 7 – 28	If M ≤ 13 Wk; > 13 St
Profit from small business	5	Scale 5 – 20	If M ≤ 9 Wk; > 9 St
Cash flow	4	Scale 4 – 16	If M ≤ 7 Wk; > 7 St
Job Creation	5	Scale 5 – 20	If M ≤ 9 Wk; > 9 St
Wealth Creation	5	Scale 5 – 20	If M ≤ 9 Wk; > 9 St
Material costs	4	Scale 4 – 16	If M ≤ 7 Wk; > 7 St
Opportunity cost	5	Scale 5 – 20	If M ≤ 9 Wk; > 9 St
Incentives	3	Scale 3 – 12	If M ≤ 5 Wk; > 5 St
Ecological	4	Scale 4 – 16	If M ≤ 7 Wk; > 7 St
State Controlled Consumptive Management Approach (SCMA)	**17**	**Scale 17 – 68**	**If M ≤ 33 Wk; > 33 St**
Tourism hunting	2	Scale 2 – 8	If M ≤ 3 Wk; > 3 St
Farming	4	Scale 4 – 16	If M ≤ 7 Wk; > 7 St
Food Meat and Fruit	3	Scale 3 – 12	If M ≤ 5 Wk; > 5 St
Firewood and energy	3	Scale 3 – 12	If M ≤ 5 Wk; > 5 St
Medicine	2	Scale 2 – 8	If M ≤ 3 Wk; > 3 St
Logging	3	Scale 3 – 12	If M ≤ 5 Wk; > 5 St

Analytical Model

Community Economic Benefits (CEB) is the accumulated sums from economic gains (EG) from natural resources. Economic gain is a function (f) of the natural resources management approach (NRMA). Mathematically this relationship is represented in equation 1.

$$\boldsymbol{CEB = \Sigma(EG) = f(NRMA)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 1$$

It is true that NRMA is the summation of resources utilization (RU) and resource controls and development (CD) as presented in equation 2.

$$\boldsymbol{NRMA = \Sigma(RU, CD)} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 2$$

Assuming that community CD is constant and provided by the state hence not controlled by communities benefiting from the natural resources, CD in equation 2 is assumed invariable. Hence combining equations1and 2 gives equation 3 where CEB becomes a function of resources utilization (RU).

$$\boldsymbol{CEB = f(RU)} \quad \text{.....3}$$

State controlled Consumptive Management Approaches (SCMA) of protected natural resources have a definitive RU and hence benefits to surrounding communities which comprises of perceived implications on policies imposed on potential gains from tourism hunting (TH), farming near conserved area (FM), access of meat and fruits for food (MF), firewood collection (FW), access to medicinal plants and wildlife (MD) and logging and timbering (LG). Equation 3 can be rewritten by substituting the composites as presented in equation 4.

$$CEB = f(RU) = f(SCMA) \quad \text{.....4}$$

Substituting composites of SCMA into equation 4, the functional form of CEB is as presented in equation 5:

$$CEB = f(TH, FM, MF, FW, MD, LG) \quad \text{.....5}$$

The analytical CEB model estimated in the current study was thus presented in a structural equation 6:

$$CEB = \beta^0 + \beta^1 TH + \beta^2 FM + \beta^3 MF + \beta^4 FW + \beta^5 MD + \beta^6 LG) + \varepsilon \quad \text{....6}$$

Ordinary Least Squares multiple linear regression was used to examine linear relationships between determinants of government-state consumptive resources management approaches and community economic benefit.

Results and Discussions

Impactful Descriptors of State-Controlled Consumptive Management Approach

The selected impactful descriptors of state consumptive utilization approach of forests and wildlife resources management in this study included hunting tourism, farming near conserved area, access to timber, firewood, wild game, wild fruits, and medicinal trees and wildlife. Table 2 shows an impact mean score for state-controlled consumptive management approach of 32.31 which is slightly below the expected impact mean score of 33. This suggests that there was a weak impact of the approach on community economic benefit in the area. Poor road infrastructure was mentioned as contributing factor that caused weak economic benefits. Interviewed community members testified the findings. The majority of young respondents felt that the benefit they gained was comparatively less due to the remoteness of the area and strictness of their access to the controlled forests. One community member living in the lower village around Greater Mahale Ecosystem, when asked on the consumptive conservation economic benefit from government forest and wildlife conservation, narrated as follows:

> *"Even though we have hunting blocks such as Nkamba forest hunting block, we receive very few hunting tourists may be due to remoteness, and due to our roads been poorly developed. Even when we harvest timber and logs from our forests, always there are few buyers. We do not make good money because of those reasons"*

In addition, about one in three interviewed community members were of the opinion that the government controls were not beneficial to the community by mentioning areas of community interest. One village leader commented:

> *"...government should build primary schools using money it collects from forest hunting blocks…. Again, health centers should also be constructed from money collected after selling confiscated timber from Tongwe West Forest reserves. Conservation of government forests and wildlife can for sure, be paying us in an indirect way but so far it's difficult to see any benefits."*

These opinions on less community economic benefits from government-conserved areas diverge from the findings by Andam *et al.* (2010) who studied modern natural resources management under government management. These results are also different from the review report on global dynamic on protected areas conducted by Lewis *et al.* (2017). Furthermore, the results are also different from Keane *et al.* (2020) who studied impact of wildlife management areas (WMAs) to community. All the mentioned studies concluded that the more protected areas the bigger the revenue and improvement in community economy welfare around protected area. Remoteness and less developed infrastructure in the Greater Mahale Ecosystem may be among the contributing reasons for government conserved areas to produce less economic benefit than expected. This study is designed to examine impact of state-controlled consumptive management approach on economic benefits expected from the Greater Mahale Ecosystem.

Table 2: State Consumptive Natural Resources Management variables

Variables-composites	**Calculated mean score**	**Std Deviation**	**Expected Impact mean score**
State Consumptive Management Approach(SCMA)	32.31	12.317	33
Tourism and Hunting (TH)	3.47	1.639	3
Farming near conserved area (FM)	8.79	2.536	7
Access to Meat and Fruits for Food (MF)	4.90	2.399	5
Firewood collection (FW)	5.28	2.744	5
Access to Medicinal plants and Wildlife (MD)	4.53	2.044	3
Logging and timbering (LG)	5.33	2.583	5

Table 2 shows that the calculated impact mean for *hunting tourism* in state consumptive natural resources management approach was 3.47. The derived mean was slightly above the strong mean of 3 by 0.47 points. The finding suggests that the perceived community economic benefit from hunting tourism in government-managed forests and wildlife areas such as hunting blocks was strong. The other variables had mean scores slightly above the expected mean score except for one variable, *access to meat and fruits for food* which had a mean score (4.90) which is below the expected mean score of 5.

Benefits from Tourism and Hunting (TH) and Farming in Conserved Areas (FM)

Moreover, Figure 3 indicates that the majority of respondents strongly disagreed that hunting blocks in government natural resources managed areas are active and whether hunting quota and permits were issued. The farming impact computed mean was 8.79 with a computed mean of 1.79 points above the expected impactful mean score of 7. The data suggested a strong impact on the community economic from farming around government-protected areas. Response on detailed assessment of farming near government conserved area showed that 26.6% agreed that farms produce more harvest near government conserved areas (Figure 3). That was a bit surprising result but it was affirmed by interviewed people. One famous agro-pastoralist responded by saying:

> *"All of us wish to have a farm near Nkamba forest. Near Nkamba forest reserve, there are strong controls, more fertile land, and there is less fire occurrence". That is why many of us would prefer to have a farm near that land". Even though it is a long-distance walk from our villages, if you get a farm in that area, you are sure of bump harvest."*

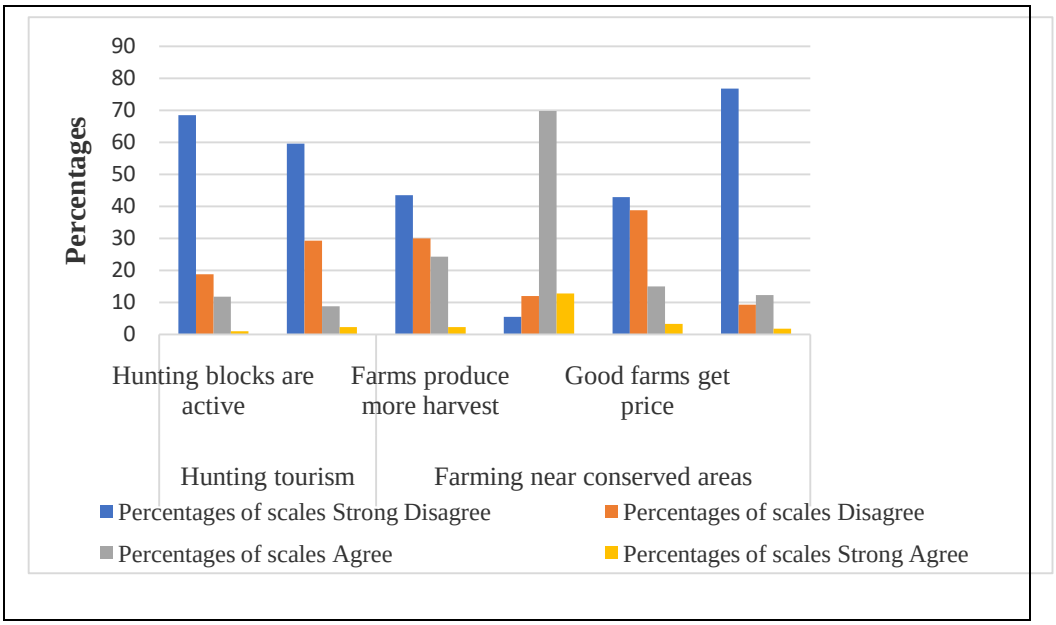

Figure 3: Benefits from Tourism and Hunting and Farming in Conserved Areas

However, there was a mixed feeling and response on compensation upon destructive wildlife. One of the interviewed key informants had a reservation that, the main challenge of farming in conserved areas was destructive wildlife such as baboons, as he said:

> *"The main challenges of farming near that forest are the struggle to protect crops from destruction of baboons and vervet monkeys. These wild animals feed on our crops yet we are not allowed to kill them since they are protected by state forces"*

Figure 3 shows that only 14.1% of the respondents agreed that they were compensated when crops were destroyed by wildlife. The finding is in line with some key informants. One farmer who lived in the area for more than 20 years, when asked whether farmers' crops were compensated when destroyed by wildlife, he said:

> *"Sometimes, we are compensated when our farm crops are destroyed by wildlife especially when the wildlife comes from National Park. For example, when hippo destroyed rice near Kasekese, we were paid". "Even though it is not every time we are compensated, for example, sometimes, chimpanzee enter our farms and take a few sugar canes, no one compensates that. Chimpanzees are not destructive wildlife compared to baboons".*

Benefits from Access to wild meat and fruits (MF) and Firewood Collection (FW)

Table 2 shows that impact of controlled access to wild meat and fruits from government-state managed natural resources had a mean score of 4.90 just below the expected mean of 5. Figure 4 shows that a few (12.1%) respondents agreed on the availability of enough bush meat implying that wild game and fruits are not much accessed in government conserved areas. Conservation impact of firewood and energy access in government-state managed natural resources had a mean score of 5.28 just above expected mean score of 5 (Table 2). Even though it was a strong mean, the difference was small. Majority of respondents (70%) disagreed that they accessed firewood, wood for charcoal and wood for sell from the government-conserved forests and wildlife-controlled areas (Figure 4). One interviewed

old woman who lived in the upper villages around Greater Mahale Ecosystem, when asked on access to firewood commented as:

> *"We collect firewood from our farms and from non-conserved forests that are general lands. Often, we do not collect firewood from government conserved forests because of fear of being attacked by wild animals. Sometimes the game officers are harsh and harassing…..it's not good to fight government…..*

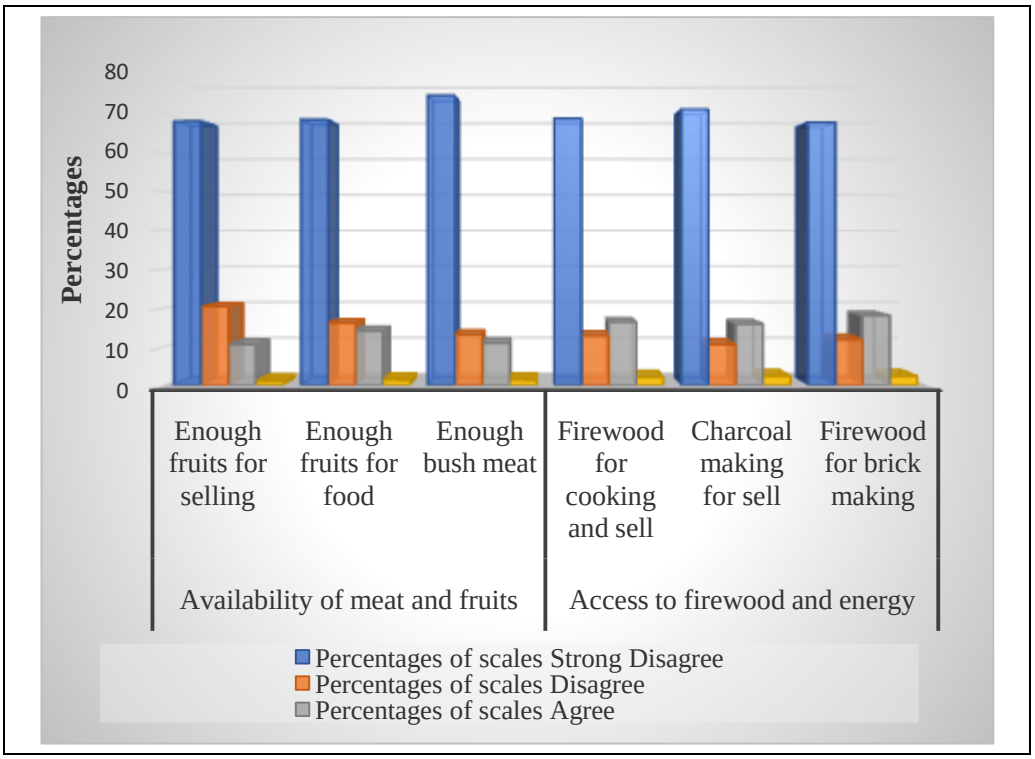

Figure 4: Benefits from Wild Meat and fruit and Firewood Collection

Benefits from Access to Medicinal Resources (MD) and Logging and Timbering (LG)

Conservation impact on community economy through access of medicinal plants, medicinal wildlife, timber, and logging found to be a most valued benefit in Greater Mahale Ecosystem. The medicinal benefits impact in

government conserved forests and wildlife management areas mean was 4.53 (Table 2). The mean was significantly stronger for 1.5 points above the strong mean of 3 (Table 2). Almost one third (30%) of respondents strongly agreed to access medicinal plants for cure and treatment (Figure 5). This is a substantial number to suggest that community depend on government forests and wildness to access traditional medicines. One elderly man who live in remote village that does not have a dispensary was asked on the economic benefit of medicinal resources extracted from GME had this to say:

> *"Not only village forests, but also government forests are very important to us for accessing medicinal plants…. You know, you cannot find all type of needed medicinal trees in one forest…..Some of them are in our farms, others in village forest, others in riparian forests and others are in government forests…..We normally go to all forests to get medicine…"*

Access to medicinal plants and medicinal wildlife seemed to be of a great value to remote community of Greater Mahale Ecosystem implying that this might be essential in the conservation compliance as also observed by Tchakatumba *et al.* (2019). Trees were not only accessed for medicine but also were accessed for timber and logging purpose.

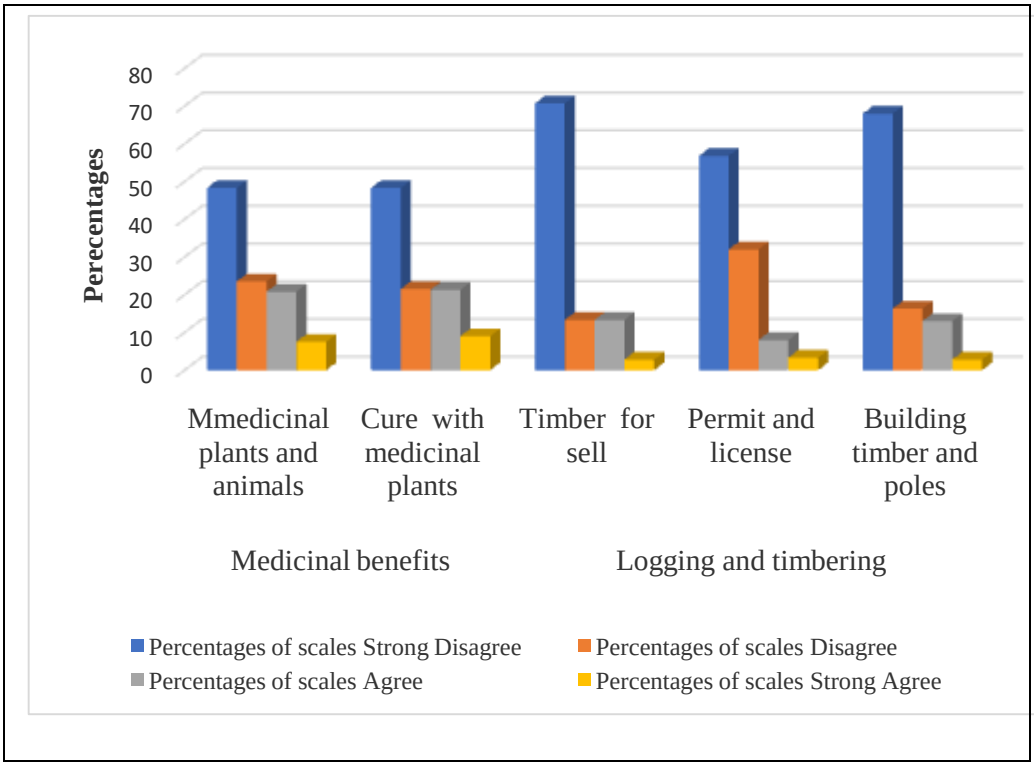

Figure 5: Benefits from Medicine resources and Logging and Timbering

Conservation impact on community economy through access of logging and timbering mean was 5.33 just 0.33 points above strong mean of 5 (Table 2). Although it was expected that community would have stronger conservation impact to community economy, from timbering and logging permit, it was not the case in this study. Majority (88.8%) of respondents strongly disagreed to access timbers and logs from government conserved forests (Figure 5). The finding implied that timber harvesting benefit was minimal to the studied community. Poor infrastructures such as poor road networks were associated with poor timber business even in government-state conserved forests. Moreover, some community members had concerns on how the little money they gained from timber business was utilized. One interviewed young man who was also a member of village natural resource committee in village around Greater Mahale Ecosystem when said:

> *"…Timber is harvested from the government forests for people with pay for the permits, however, I do not know if we get any share of that money and what that money is used for. I just recall one-time when logs were confiscated and sold at 600 million Shillings and the money was used to construct Karema health facility…"*

The information suggested that there was less transparency in financial matters and less financial accountability. The finding agreed with Child & Barnes (2010) and Galvin *et al.* (2018)'s findings which found some questionable financial management. The finding showed that questionable financial management was not only in communal natural resources management but also in government-managed natural resources.

Impact of SCMA of Natural Resources on CEB

Table 3 presents findings from the multiple regression analysis on impact of state consumptive natural resources management on community economic benefit. The findings are based on structural model 6. The model had a good fit of 0.63 and therefore it had strong predictive power. The linear correlation coefficient was r = 0.79, p<.001 implying a strong linear relationship between government-state consumptive natural resources management variables and community economic benefit.

Table 3: Multiple Regression Analysis Results

Variables	β	t	p	SE
Constant	36.927		.000	
Tourism and hunting (TH)	.124	.774	.043	.346
Farming near conserved area (FM)	.160	5.144	.000	.283
Access to Meat and Fruits for food (FM)	.082	2.394	.017	.336
Access to Firewood collection (FW)	-.029	-.776	.438	.322
Access to Medicinal plants (MD)	.150	4.467	.000	.379
Logging and timbering (LG)	-.120	-2.965	.003	.369
State Consumptive Management Approach (SCMA)	.791	34.667	.000	.043

R^2=0.68 p=0.05

Multiple regression analysis presented in Table 3 revealed that unlike other variables, state-controlled consumption of firewood collections (FW) and

logging and timbering (LG) had negative effects on potential community economic benefits from the natural resources. State controlled access to Firewood collection (FW) was the only variable that was found insignificant (p=.438) whereas the rest of the variables indicated to have significant impact on potential community economic benefits expected of natural resources around the state-controlled consumptive management approach. Overall, the aggregated State Controlled Consumptive Management Approach (SCMA) of Greater Mahale Ecosystem had a positive significant impact (β=0.79, p=0.000) on the expected potential benefits to the community living around the ecosystem.

Conclusion and Recommendations

This study concludes that state consumptive natural resource management approach has significant impact on community economic benefit. Irrespective of the fact that the Greater Mahale Ecosystem is remote with less developed economic infrastructures, the state consumptive utilization of natural resources positively impacts the community economic benefits. Controls on access to firewood was found negatively impacting community economic benefits. This implies that an increase in state controls on access to firewood would decrease even further the expected benefits of the resource to communities around the Greater Mahale Ecosystem. The state controlled consumptive policies on other variables such as; tourism and hunting, farming practices, wildlife games and wild fruits and access to medicinal plants are beneficial to surrounding communities.

State consumptive policies on natural resources utilization should focus more on the four variables i.e. tourism and hunting, Farming near conserved area, access to meat and fruits for food, access to medicinal plants with positive impact on community economic benefits. Benefits from tourists and hunting are expected to have a significant multiplier positive impact on communities which in turn gives assurance on community support to conserve the ecosystem. Development of tourist hunting blocks would improve consumptive utilization not only under government managed natural resources but also under communal-indigenous approach. To improve the tourist circuit, the development of infrastructures such as road networks is

necessary. There should also be the integration of consumptive and non-consumptive approaches such as sustainable timber and avoided carbon credit to maximize community economic benefit. Finally, there is a need for the state to undertake natural resources valuation in Greater Mahale Ecosystem and other alike conserved areas in the country. This would enhance the country's total economic valuation of its natural capital, natural asset, and real wealth.

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