Role of Communal Consumptive Natural Resources Management Approach in Addressing Community Economic Benefit in Western Tanzania

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Abstract
The role of consumptive natural resources management in addressing community economic benefit in West Tanzania is much likely less known. This study was carried out to assess the impact of communal consumptive natural resources management on community economic benefit. A four-point numerical scale survey questionnaire was administered to 400 respondents, and an interview guide was administered to 40 Key Informants. Quantitative data were analyzed by SPSS, while qualitative data were analyzed by Excel framing summarizing technique. The research findings indicated that communal consumptive natural resources management had a close to strong correlation and significant positive impact on community economic benefit (CEB). The linear relationship between the communal natural resources management approach and community economic benefit (CEB)Pearson (r) covariance statistical relationship correlation coefficient result was Pearson -r (733) = .73, p<.001. The positive Pearson (r) above 0.7 implied that the relationship was a strong correlation. The impact of the communal natural resources management approach on community economic benefit (CEB) was calculated through multiple linear regression. Multiple linear regression coefficient B= 1.43 at 95% confidence interval (CI) = 1.34, 1.53; p=0.000. The result implied that an increase of one unit of the communal consumptive model was associated with a positive increase of 1.43 CEB. The positive increase in CEB suggests that the communal consumptive natural resources management approach significantly impacts community economic benefit (CEB). It is recommended that to maximize community economic benefit (CEB), communal consumptive natural resources management approaches should be focused on and given significant attention. Moreover, to maximize community economic benefit (CEB), an integrated hybrid combo of consumptive approaches such as sustainable timber, and non-consumptive approaches such as avoided deforestation and increased sequestration carbon credit is recommended for terrestrial natural resources management in western Tanzania.

Keywords: *Natural resources management, community economic benefit (CEB), communal-indigenous natural resources management, natural resources utilization, Greater Mahale Ecosystem (GME), Tanzania*

INTRODUCTION

To bring a balance between economic benefit and natural resources management has been on the world agenda (UNEP-WCMC, 2018; Andika, 2020; Keane *et al.,* 2020; COP 26, 21). Target 11 of the Aichi meeting states, "Protected areas are effectively and equitably managed" (CBD, 2011). Equitable management includes fair distribution of economic benefits (CBD, 2011). Regardless of the importance of economic benefits that can be accrued from conservation interventions, fewer studies have been conducted on conservation economic benefits (UNEP–WCMC, 2018). Following a few conducted studies, UNEP–WCMC (2018) report calls for assessing the flow of economic benefit from conservation as a priority. The economic benefit gained to the community from communal-indigenous natural resources management approaches is the interest of this paper.

Community economic benefit (CEB) is a broad term, however, in this study, the term gain is adopted as it is defined by The Millennium Ecosystem Assessment – MEA (2005). The MEA (2005) defined community economic benefit as "the gains people obtain from ecosystems". In this study, community economic benefit means all gains and opportunity costs people received or incurred from nature. Community economic benefit accrued from forest and wildlife natural resources management approaches in Greater Mahale Ecosystem was studied. The studied community economic benefits were either through government-state natural resources management or communal–indigenous management. The Greater Mahale Ecosystem (GME) in Western Tanzania practices government-state and communal–indigenous forest and wildlife management approaches and is among vulnerable degrading biological hotspots (Leisher and Hess, 2017; William, 2018). The study focused on forest and wildlife terrestrial resources management because they are the ones highly affected by land domestication and conversion (Piel *et al.,* 2013; Steffen *et al.,* 2015; Leisher and Hess, 2017; William, 2018). However, this paper will only limit itself to communal-indigenous consumptive natural resources management. The reason for limiting the paper is that natural resources management is broad;

therefore, it is challenging to attempt to address all approaches in one paper.

Management of terrestrial natural resources, specifically forests and wildlife in Tanzania and the Greater Mahale Ecosystem, has been either through government or communal approaches before and after independence (URT, 1998a; URT, 1998b; TAWIRI, 2018). Terrestrial natural resources management is either consumptive or non-consumptive (TAWIRI, 2018). Communal natural resources management is stipulated in the wildlife policy of Tanzania (URT,1998a) strategy as "involving rural communities and other stakeholders in taking joint responsibility for the sustainable management of wildlife and other natural resources". The wildlife policy also states, "to transfer management of Wildlife Management Areas (WMA) to local communities thus taking care of corridors, migration routes, and buffer zones and ensure that local communities obtain sustainable, tangible benefits from wildlife conservation. Furthermore, the forest policy of Tanzania (URT,1998b) stipulates communal forest management in the sixteenth policy statement, which states that "Biodiversity conservation and management will be included in the management plans for all protection forests. Involvement of local communities and other stakeholders in conservation and management will be encouraged through joint management agreements". However, the joint management mentioned shows that communities will be involved and not fully control natural resources. Additionally, on communal forest management, the forest policy of Tanzania (URT,1998b) thirty-ninth policy statement states that "local communities will be encouraged to participate in forestry activities". Although the two types of natural resources management, which are government and communal approaches, have been mentioned in the cited policies, the community economic benefit was not clearly stated.

Wildlife and forest policies had few statements on economic benefit (URT, 1998a; URT, 1998b). The wildlife policy of Tanzania (URT,1998b) states that "The policy will continue to give wildlife economic value to rural communities to enhance rural redevelopment without prejudice to the environment, and in such a way that the benefit compensates for the opportunity cost of this form of land use". While the forest policy of Tanzania (URT,1998b), third policy statement states that "to enable participation of all stakeholders in forest management and conservation, joint management agreements, with appropriate user rights

and benefits, will be established." Such stated benefit did not specify how communities from natural resources management can accrue the economic or financial benefit. While economic benefit is a crucial point to be discussed in natural resources management, the how and access controls of regenerative natural resources are also crucial to avoid resource over-exploitation.

The study was pinned down by the optimal control theory that focuses on optimization. The theory states that in a normal undisturbed system, a situation trajectory $x(t)$ for all $t \geq t0$ is determined by initial data ($t0$, $x0$). Whereas, known initial state $x(t0) = x0$ are all function of time $t \geq t0$ and mathematical are $\dot{x}(t)=f(tx(t))$ (Weber, pp. 81-148, 2011). This meant that a decision maker's actions might influence the state's trajectory. Such actions include control over the dynamic process and can change the system flow (Moyo *et al.*, 2017). Optimal exploitation is attained at the climax of "n", a function of resource exploitation and development (Barber, 2007). Moreover, it is also accepted that natural resources should be controlled and regulated for sustainability (Lewis *et al.*, 2017). Such controls and regulations that optimize utilization have benefited the community economic benefit in some countries. Improved natural resource conservation and investment approaches have benefited the economy of Malaysia, Costa Rica, and Thailand (Scherl *et al.*, 2004; Andam *et al.*, 2010; Amira *et al.*, 2015).

There are substantial research and studies on the management of natural resources and the economy (Andam *et al.*, 2010; Amira *et al.*, 2015; Steffen *et al.*, 2015; Lewis *et al.*, 2017; Moyo *et al.*, 2017; Andika, 2020; Keane *et al.*, 2020). However, none of the studies dealt with specific natural resources management approaches impacting community economic benefits. This literature gap failed to address a continuously conflicting school of thought on a better natural resource management approach between government-state and communal-indigenous. The conflicting school of thought is also between consumptive and non-consumptive conservation approaches. Moreover, it is crucial to have sustainable utilization of natural resources that reduces resource degradation trends and address the community economy in this decade that faces severe climate change (Andika, 2020; COP 26, 2021). This study was carried out to address that literature gap and attempt to clear the two conflicting schools of thought. The study focused on determining the impact of different terrestrial natural resources management (TNRM)

approaches on community economic benefit (CEB) in Greater Mahale Ecosystem in western Tanzania. Specifically, this paper which is part of the study examined the impact of consumptive communal-indigenous natural resources that are forest and wildlife management approaches on community economic benefit (CEB) in Greater Mahale Ecosystem in western Tanzania. After that, a research-specific null hypothesis (H_1) was developed. H_1: Communal-indigenous consumptive terrestrial natural resources management approach did not have a statistically significant impact on community economic benefit.

METHODOLOGY

The study area

The research was carried out in western Tanzania within the Kigoma and Katavi regions, which form a large part of the western ecoregion (John *et al.*, 2019). This is where Greater Mahale Ecosystem (GME) is geographically positioned (TAWIRI, 2018), as seen in Figure 1. The area is a landscape that covers 18,200 km2 sited at Latitude 50.30' - 6^0.29' South and Longitude 29^0.43' - 30^0.37' East (Coulter, 1994). The area is within Lake Tanganyika basin or Congo headwater basin with Zambezian woodland ecoregions which provide a beautiful natural view (John *et al.*, 2019). The area is rich in biodiversity and is one of 34 world biodiversity hotspots (TAWIRI, 2018). Greater Mahale Ecosystem receives a unimodal rain season from November to April and a dry season from May to October (TAWIRI, 2018).

The Population in Greater Mahale Ecosystem is about 500,000 native Ha, Bembe, Fipa, Konongo, Pimbwe, Galla, Nyakarema, and Tongwe. The area has a fast-growing population of 4.8%, with poor-performing economic welfare of less than 150 USD per year per household (URT, 2012; Leisher & Hess, 2017; Hardee *et al.*, 2018). Social-economic activities depend heavily on natural resource utilization, including fishing, farming, and forest production (Leisher & Hess, 2017; Hardee *et al.*, 2018). In addition, some socio-economic activities are business, hotel, and tourism (Leisher & Hess, 2017). 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.

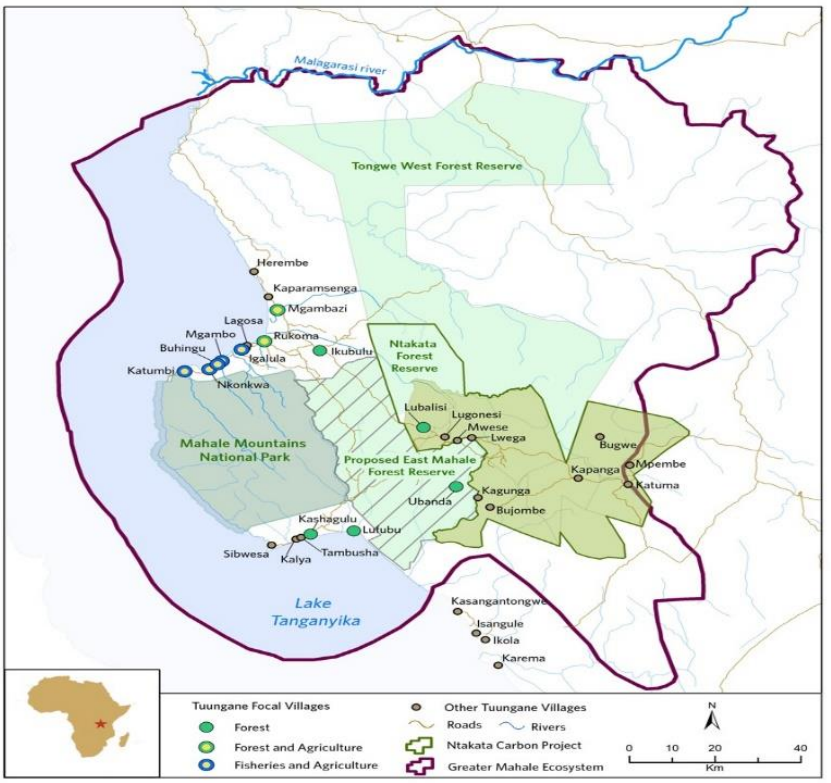

Figure 1. Map of Greater Mahale Ecosystem
Note: The light blue is part of Lake Tanganyika in the Greater Mahale Ecosystem

Methods

The research applied constructivist philosophy that combined empirical, expertise, and positivist approaches concurring with Novikov & Novikov (2013). Additionally, the research applied interpretivism of reviews on expert knowledge. The combined philosophy aimed to improve research quality, as it is suggested by Gravetter & Forzano (2012). The research strategy applied a four-point scaled survey questionnaire to collect data from 400 respondents in 10 villages around the Greater Mahale Ecosystem seen in Figure 1. The villages were around national parks, government forest reserves, wildlife hunting blocks, wildlife corridors, and communal forests. Sampled villages were Mwese, Lwega, and Lugonesi Kasenganyama, Kasangantongwe, Kasekese, Buhingu, Mgambo Katumbi, and Nkokwa.

Conservation- Economic benefit modeling and data processing

The study-specific objective was to examine the impact of the communal-indigenous consumptive terrestrial natural resources management approach on community economic benefit (CEB) in the Greater Mahale Ecosystem in western Tanzania. The study developed and tested a specific null hypothesis (H_1). H_1: Communal-indigenous consumptive terrestrial natural resources management approach does not significantly impact community economic benefit.

Mathematically, community economy benefit (CEB) is the summation of economic gains and value (EV) and is the function (f) of the terrestrial natural resources management approach (TNRM). The mathematical statement can be represented as follows: -

$$CEB = \sum(EV) \text{ and } CEB = f(TNRM) \quad (1)$$

Because the terrestrial natural resources management approach (TNRM) is the summation of resources utilization (RU) and natural resource controls and development (CD), then it can be written as: -

$$TNRM = \sum (RU, CD) \quad (2)$$

Reading together equation 2 and equation 1, and combining the two, mathematically, it is correct to state that community economy benefit (CEB) is a function (f) of resources utilization (RU).

$$CEB = f(RU) \quad (3)$$

Whereby resources utilization (RU) is composite of communal consumptive (CCT), communal non-consumptive (CNC), government consumptive (GCT) and government non-consumptive (GNC) resources utilization.

$$RU = \sum (CCT, CNC, GCT, GNC) \quad (4)$$

Therefore, substituting the first RU composites of CCT in equation 4 to equation 3, will produce the following equation: -

$$CEB = f(CCT) \quad (5)$$

Because communal consumptive (CCT) natural resources utilization is a composite of community tourism hunting (THC), farming near the conserved area (FMC), access to meat and fruits for food (MFC),

firewood collection (FWC), access to medicinal plants and wildlife (MDC) and logging and timbering (LGC), therefore equation 5 can be expanded as follows: -

$$CEB = f\ (THC, FMC, MFC, FWC, MDC, LGC) \quad \text{.....(6)}$$

The composites in equation 6 can be termed as $X_1, X_2, X_3 \ldots\ldots X_t$. The composites have constant regression terms to be generated or estimated $\beta_0, \beta_1, \beta_2, \beta_3 \ldots\ldots \beta_t$, whereby β_0 = Regression coefficient, which is Y (CEB) value when all X (CCT) values are zero. When random error term of ε is applied, then equation (6) can be re written as follows:

$$CEB = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots\ldots\ldots + \beta_t X_t + \varepsilon i \quad \text{.....(7)}$$

And therefore, equation 7 can be re-written as follows: -

$$CEB = \beta_0 + \beta_1 THC + \beta_2 FMC + \beta_3 MFC + \beta_4 FWC + \beta_5 MDC + \beta_6 LGC + \ldots \varepsilon i \quad \text{.....(8).}$$

Equation (8) is the model of communal-indigenous consumptive natural resources management (CCT) – community economic benefit (CEB) in this study. Equation (8) was used to compute the impact of communal-indigenous consumptive natural resources management approaches on community economic benefit.

The research used Statistical Package for Social Scientists (SPSS) to analyze quantitative data. Data were coded; variables were given numerical scales, and their values were entered into SPSS. Descriptive statistics, statistical correlation, and multiple linear regression techniques were used to test statistical relationships between communal consumptive (CCT) resource management approaches and community economic benefit (CEB). In addition, the Excel framing method conducted and summarized qualitative KII to triangulate and complement quantitative statistical information.

Stevens (1996) used multivariate statistics for social sciences studies to select sample size. The study chose Stevens (1996) because it is a suitable method of calculating sample size when the study has many independent variables. The study used the largest independent variable (m) to determine the minimum sample size (N) by applying Stevens (1996) formula of N= 50 +8m for multiple linear regression (Stevens, 1996). In

studying community economic benefit, which was a dependent variable, there were 19 independent variables. Independent variables were resources control and development (5), consumptive utilization (6) and non-consumptive utilization (8). Therefore, Stevens (1996) minimum sample size (N) = 50 + (8 X 19) =202. However, the study opted to take 400 sample size, which is bigger than 202. Making the sample size larger than Stevens' calculated sample size is because the larger the sample size, the smaller the effect can be detected, while small samples can detect a large effect size. The research wanted to ensure the detected impact size was not contributed by a small sample size.

Furthermore, Multicollinearity statistical pair-wise correlation tests among variables were performed in line with Gujarati (2004) and found out that there were no multicollinearity effects. Cronbach Alpha was also computed for testing the instrument's reliability. Cronbach Alpha were 0.7 and above and therefore, were accepted as commonly considered good and acceptable for reliability and internal consistency of variable relations (Almquist *et al.*, 2019).

RESULTS AND DISCUSSION

Impact of communal-indigenous consumptive natural resources management on community economic benefit

Greater Mahale Ecosystem applies a communal-indigenous natural resources management approach, among others. Consumptive utilization of natural resources, mainly forests, and wildlife resources, included hunting tourism, access to timber, firewood, wild game, wild fruits, and access to medicinal trees and wildlife. Communal-indigenous natural resources management consumptive utilization impacted the community economy with a mean of 31.17 (Table 1), which was slightly below the average of a strong mean of 33. The data suggested a relatively close to the strong relationship between communal-indigenous consumptive natural resources management and community economic benefit. Close to strong communal-indigenous consumptive natural resources mean was associated with poorly developed infrastructure and attested by interviewed people. For example, one interviewed natural resources government officer employed in one district around Greater Mahale Ecosystem for more than ten years; when asked about communal-indigenous consumptive utilization economic benefit, his response was:

> *"Community have weak governance and cannot make strong resources extractive plans", he added "community cannot develop road infrastructures even to places*

> *where they wish to extract resources",* he completed by saying, "*therefore, community cannot realize tangible consumptive natural resources benefit without support of district government".*

Among reasons that cause less impact of consumptive communal natural resources management on economic benefit were poor road network and accessibility. One interviewed trained forest patrol young man when asked about the economic benefit gained from the communal consumptive approach, showed concern by saying:

> *"We receive few hunting tourists, and it is difficult to sell our timber at a good price because our villages are remote with less developed road infrastructure".* He added, "*Our hunting blocks are also poorly functioning because of poor roads, hunting tourists do not prefer to come to our area".*

The findings on infrastructure challenges and remoteness align with Huton *et al.* (2005), who showed that channels of gains in economic benefit face barriers and boundaries. Such barriers include accessibility like what is experienced in Greater Mahale Ecosystem.

Table 1: Communal-indigenous consumptive natural resources management variables

Variables-composites	Calculated Mean	Std. Deviation	N	Estimated strong mean
Communal consumptive	31.17	11.858	733	33
Hunting tourism	3.23	1.521	733	3
Farming	7.23	2.737	733	7
Meat and fruits	5.07	2.316	733	5
Firewood	5.78	2.488	733	5
Medicinal	4.59	2.068	733	3
Logging and timbering	5.27	2.359	733	5

Note: N=733.

Hunting tourism in conserved communal forests and wildlife-managed areas

The impact of communal-indigenous hunting tourism on the community economy in and around communal forests, wildlife corridors, and wildlife dispersal areas computed mean in Table 1 was 3.23. The studied mean was just above the average strong mean of 3. The data suggest the existence of a strong relationship. The numbers insinuate that hunting tourism is also happening in the community-managed blocks. However, the majority (75.3%) and (62.8%) disagreed that hunting blocks are active and hunting quota permits are issued, respectively (Figure 2). The

quantitative findings speak the same language as qualitative interview opinions. One elderly respected person in one lower village of the area, which is not participating in avoided deforestation carbon credit business, was interviewed. When he was asked about the performance of hunting blocks in community lands, he had reservations and hesitation on whether they benefit economically. He cited and mentioned Lyamgoloka, which is a wildlife corridor connecting Mahale Mountain National Park and Katavi National Park, by saying:

> *"Setting aside land for hunting blocks is not promoting our community economy because there are no hunting tourists. We do not receive money for conserving our communal land for hunting.* He added, *for example, I do not know how much money and benefit we get for conserving Lyamgoloka".*

The finding and feeling call for enhanced resource utilization that addresses community economic benefit, which concurs with Keough and Blahma (2006) and Russel et al. (2018) argument that resources should be in community custodianship to be utilized in a more rewarding way.

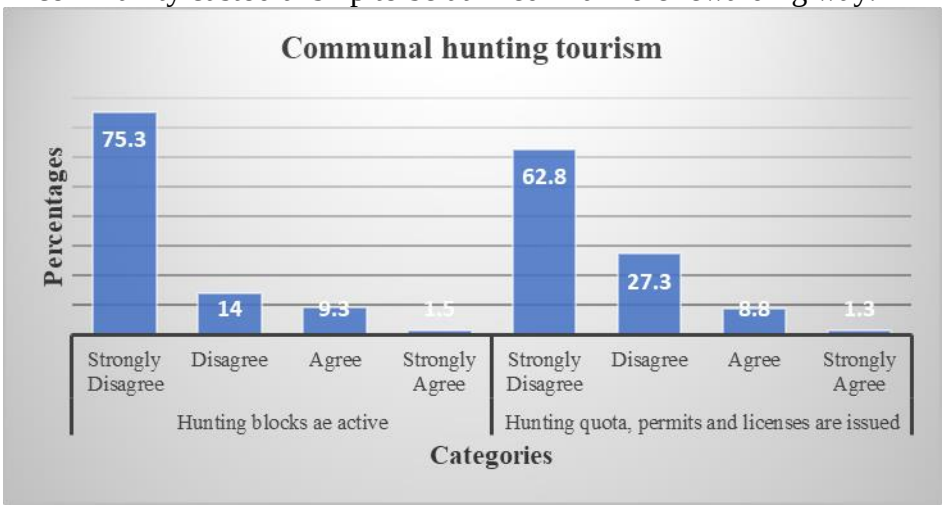

Figure 2: Hunting tourism in communal-indigenous conserved areas

Farming near communal conserved forests and wildlife management areas

The impact of farming near communal forests and wildlife corridors on the community economy under the communal-indigenous natural resources management approach was slightly strong, with a computed mean of 7.23 (Table 1). The studied mean was just a slight 0.23 points above the strong average mean of 7. The data suggests not a very strong impact. Most respondents (75%) strongly disagreed that farming near

conserved communal areas such as forests and wildlife corridors produces more harvest (Figure 3). More than half of the respondents (63%) disagreed on whether enough water is available for farming.

Furthermore, nearly half (43%) of respondents disagreed that they receive good farm gets price and 44% disagreed that crops destroyed by wildlife are compensated (Figure 3). Again, this was a skewed finding with a majority disagreement. This finding suggests pessimism for conservation on the acceptance of land use for agriculture.

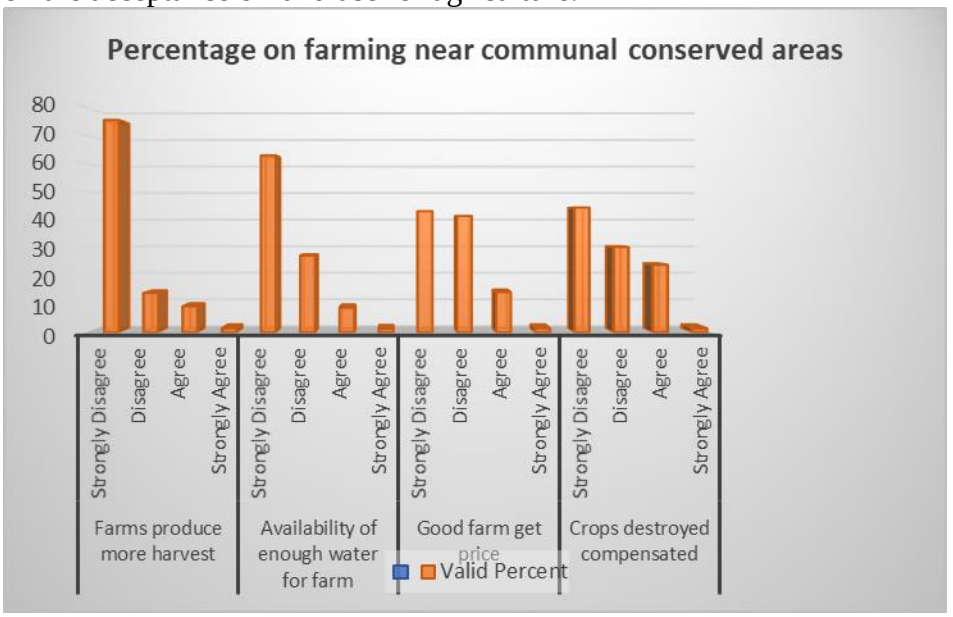

Figure 3: Farming near a communal – indigenous conserved area

Game and fruits access in communal conserved forest and wildlife areas

Conservation impact on community economic benefit was studied through the availability and access of meat–wild game, and fruits for use in the communal-indigenous managed resources approach. Studied natural resources included communal forests and wildlife corridors with a computed mean of 5.05 (Table 1), almost close to an average strong mean of 5. Respondents who disagreed on the availability of enough fruits for selling were 63.5%. More than half (63%) disagreed with the access to enough fruits for food, and 74% disagreed with the availability of enough bush meat (Figure 4). The quantitative finding suggests that the community relies less on wild game and wild fruits for food or business

such as for sale. Interviewed people confirmed the information. For example, one elderly Tongwe tribe man, when asked about access to fruits and wild game, he said: *"There is enough food in our community and traditionally we do not depend on wild fruit and bush meat for food. We normally do not hunt wild games like newcomers to our land"*. Furthermore, one government official from one district of the Greater Mahale Ecosystem, when asked about community access to wild fruit and wild games for food, he said:

> *"Our region is among of country food basket regions, and we always have a good agricultural harvest. People less rely on wild fruit and meat.* He added, *although we opened wild game meat butcher in some towns like Mpanda, most people who purchase that meat are not indigenous people".*

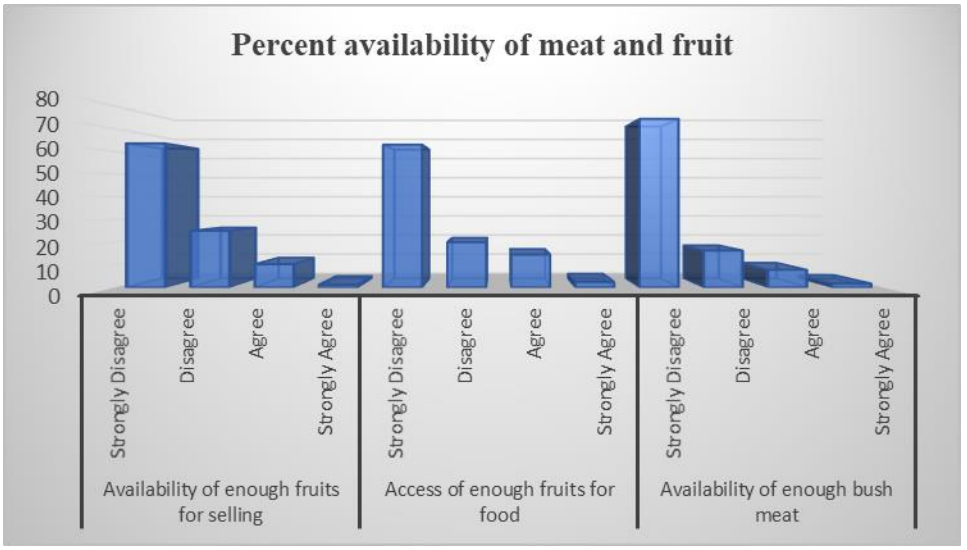

Figure 4: Availability of fruits and meat in conserved communal areas

Firewood and timber access in communal managed forests

The impact of access to firewood and energy from communal-indigenous managed natural resources approach on community economy computed mean was 5.78 (Table 1), slightly above the average strong mean of 5. The mean was not a very strong mean. The data suggested that the community depended less on the communal forest to access firewood. Interviewed people confirmed the information. An interviewed older woman in one of the area villages, when asked about access to firewood for energy, said:

> *"There are enough trees for firewood in our village. We get firewood from our farms and other non-conserved forests that are general lands and not from conserved forests".*

The impact of logging and timbering on the community economy computed mean was 5.27 (Table 1), just 0.27 points slightly above the average mean of 5. The findings suggested less economic benefit from logging and timbering in communally managed forests. Interviews confirmed the finding. One respectful person on the shores of Lake Tanganyika had this to say when interviewed on forest logging and timbering communal conservation benefits: *"Our community benefits from our forests by accessing timber and logs".* However, he had a different opinion by saying, *"The timber and logs are not for sell rather for community development works such as making school desks".*

Moreover, one interviewed a young man at one of Ntakata villages who hesitated that they access timber in the communal forest, saying: *"We benefit by accessing building timber and poles from our forests, even though most time we harvest poles for building in non-conserved forests".* The findings show that communities benefit from conserving their natural resources in different ways. Those benefits likely enhance conservation value which concurs with Tchakatumba *et al.* (2019) conclusion, which showed that when the community benefit from conserved resources will value the resource.

Medicinal trees and wildlife access in communal managed forests

The impact of medicinal plants and medicinal wildlife access on the community economy was highly valued in Greater Mahale Ecosystem. The medicinal benefits computed mean in communal managed natural resources approach was 4.59 (Table 1), which was the strongest mean, 2 points above the average expected mean of 3. Medicinal benefits include access to and use of different trees and wildlife to cure or prevent diseases. The higher score in medicinal value showed the community's high dependence on trees, wildlife, and nature. Interviewed people affirmed the findings. For example, one famous elderly person who lives in a remote Greater Mahale Ecosystem village that does not have a dispensary, when asked about communal medicinal forests and wildlife benefits, while pointing to the forest, said:

> *"That is our hospital", "Our forest is very important for us because we access medicinal plants and use them for cure, healing, and treatments." "Even though*

> *we are in a remote area, and we don't have health infrastructures, we access different medicinal plants in our forests for different diseases treatments such as typhoid".*

The realized medicinal benefit is in line with Tchakatumba *et al.* (2019) conclusion that when local communities benefit from natural resources, there are both increases in economic welfare and compliance with natural resource management.

Econometric Model analysis and hypothesis testing
Null hypothesis testing- H_1:
The study developed and tested a specific null hypothesis (H_1) through multiple linear regression techniques. The specific null hypothesis stated that H_1: Communal-indigenous consumptive terrestrial natural resources management approach does not significantly impact community economic benefit. Model fit test correlation, linear correlation, and multiple regression correlation were done to make a mathematical decision on the specific null hypothesis.

Model fit test correlation between communal-indigenous consumptive natural resources management approach (CCT) to community economic benefit (CEB) computed. The study R Square (R2) correlation model fit test showed an adjusted R Square of 0.54. The R Square of 0.54 is 54% explicated variation in community economic benefit explained by the inclusion of communal-indigenous consumptive utilization. The model has a good but not very strong R2 of 0.54, and therefore it has a moderate predictive ability (54%) as ranked by Almquist, Ashira & Brännström (2019) and Profillidis & Botzoris (2019).

Linear correlation relationship test between communal-indigenous consumptive natural resources management approach (CCT) to community economic benefit (CEB) computed. The Pearson (r) covariance statistical relationship correlation coefficient was calculated. The result was Pearson -r (733) = .73, $p<.001$. The positive Pearson (r) above 0.7 implied that the relationship was a strong correlation as per Almquist, Ashira & Brännström (2019) and Profillidis & Botzoris (2019) ranking and interpretation of Pearson (r).

Multiple linear regression analysis testing was performed for the impact of communal consumptive natural resources management (CCT) on

community economic benefit (CEB), and the results are presented in Table 2 below. In addition, communal-indigenous natural resources management consumptive utilization composites that were community hunting tourism (THC), farming near the conserved area (FMC), access to game meat and fruits for food (MFC), firewood collection (FWC), access to medicinal plants and wildlife (MDC) and logging and timbering (LGC) were analyzed and presented in Table 2 below.

Table 2: Multiple linear regression analysis for communal consumptive conservation approach on community economic benefit

Composites	**B**	**95% CI**	**β**	**t**	**p**	**SE**
Community tourism hunting	-2.194	-3.321, -1.066	-.143	-3.820	.000	.574
Farming near a conserved area	1.678	.952, 2.405	.198	4.535	.000	.370
Meat and Fruits for food	1.471	.925, 2.018	.147	5.289	.000	.278
Firewood collection	.778	.079, 1.477	.082	2.185	.029	.356
Medicinal benefit	1.524	.912, 2.356	.192	4.114	.000	.361
Logging and timbering	-.901	-1.538, -.265	-.090	-2.780	.006	.324
Communal consumptive	1.431	1.335, 1.527	.734	29.242	.000	.049

Note. CI = Confidence Interval for B, SE = Standard Error, p=0.000

The multiple linear regression analysis showed interesting findings that setting aside communal forests and hunting blocks will negatively impact community economic benefit, as shown in Table 2 above. The result showed that hunting tourism regression coefficient B= -2.19 at 95% confidence interval (CI) = -3.21, -1.066; p=0.000. The interpretation is that an increase of one unit of communal hunting tourism is associated with a decrease of 2.194 community economic benefit (CEB). Because p<5% and the confidence interval (CI) does not include a null value (x=0), it is statistically significant at the 5 % level. This finding speaks the same language as the above-quoted hesitating community interviews' perceptions of community economic benefit when land, forests, and wildlife areas are set aside for hunting tourism.

The findings presented in Table 2 also showed interesting value attached to medicinal plants and medicinal wildlife access in villages around the Greater Mahale Ecosystem. Access to medicinal impact on community economic benefit regression coefficient B= 1.52 at 95% confidence interval (CI) = .912, 2.356; p=0.000. The interpretation is that an increase of one unit of medicinal plant and wildlife access is associated with an increase of 1.52 community economic benefit (CEB). Because p<5% and

confidence interval (CI) does not include a null value (x=0), it is statistically significant at the 5 % level. The importance of access to medicinal plants and wildlife in communal forests was supported by community interviews as noted above under the medicinal plant and wildlife section.

The result of communal-indigenous natural resources management multiple linear regression analysis to community economic benefit is shown in Table 2. The result was regression coefficient B= 1.43 at 95% confidence interval (CI) = 1.34, 1.53; p=0.000. The interpretation is that an increase of one unit of the communal consumptive model is associated with an increase of 1.43 community economic benefits (CEB). Because p<5% and the confidence interval (CI) does not include a null value (x=0), it is statistically significant at the 5 % level. The findings above of multiple regression coefficient B= 1.43 at 95% confidence interval (CI) = 1.34, 1.53; p=0.000 was sufficient evidence against the null hypothesis (H_1) that stated communal-indigenous consumptive terrestrial natural resources management approach does not have a statistically significant impact on community economic benefit. Therefore, the null hypothesis (H_1) was rejected in favor of the alternative hypothesis. The result suggests that it could be true that the communal-indigenous consumptive terrestrial natural resources management approach may have a statistically significant impact on community economic benefit.

CONCLUSIONS

The general conclusion of this study is that community economic benefit (CEB) is most likely impacted by the communal consumptive terrestrial natural resource management approach. Moreover, regardless of Greater Mahale Ecosystem being remote with less developed infrastructures, communal consumptive utilization of natural resources grows the community's economic benefits (CEB).

RECOMMENDATIONS

The study recommends that improving the Western Tanzania tourist circuit is necessary to tap the low-hanging ripe fruit opportunity of the circuit. The relatively few hunting tourist activities in Greater Mahale Ecosystem (GME) should be developed. The development of tourist hunting blocks will improve consumptive utilization under communal-indigenous managed natural resources and under the government-state

managed approach. Furthermore, the Western Tanzania tourist circuit can link with Western Tanzania Ecosystem (WTE) conservation network.

The study also recommends integrating consumptive and non-consumptive approaches such as sustainable timber and avoiding deforestation and degradation of carbon credit to maximize community economic benefit.
Furthermore, this study recommends undertaking natural resources valuation in Greater Mahale Ecosystem (GME) and whenever possible in Tanzania. This will enhance Tanzania's knowledge of its natural capital, natural asset, and real wealth. Understanding how wealthy the Country is will enable realistic development plans. Natural resources are natural capital and a country's real wealth. Therefore, Total Economic Valuation (TEV) is recommended for Tanzania.

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