



The perception of small ruminant grazers and stakeholders in the sustainable management of biological resources in the Mt. Oku forest reserve northwest region, Cameroon

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Abstract

This study examines the perceptions of stakeholders and small ruminant grazers on the sustainable management of biological resources in the Mount Oku area. Respondents were drawn from a cross section of small ruminant grazers and stakeholders involved in Pastoralism and the conservation of biodiversity in the Mt. Oku area. 145 small ruminant grazers were selected through random sampling and some concerned stakeholders (state technical ministries and NGOs) were also interviewed. Data was collected through administered questionnaires and interview guide on the; socio-economic characteristic of grazers, perception of stakeholders on the conservation of biodiversity as tool to sustainable management of natural resources in the Mt Oku area. Descriptive statistics including: means, frequency and percentages were used to describe the socio-economic characteristic of respondents. A multiple linear regression model was use to analyze the perceptions of stakeholders and small ruminant grazers in the study area. The results revealed that all of the small ruminant grazers (100%) were male folks. The results showed that majority of these grazers (55.2%) were adults with ages ranging from 41-60 years of age, followed by old men above 61 years making up (41%) and lastly by youths between 21-40 years who account for (13%) of the grazers respectively. Age, educational status and primary occupation has a significant difference (negative perception) on the perceptive desire for conservation of biological resources in the study area. The regression coefficients and their significance respectively were $R=3.791, P=0.00$; $R= 2.270...P=0.025$ and $R=3.026$.and $P=0.003$ respectively).

Keywords: Small Ruminant; Grazers; Biodiversity; Conservation; Sustainability and Human/Ecological Conflicts

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1. Introduction

A major challenge for pastoralists in Cameroon and the North West Region in particular is the need for the establishment of an appropriate and sustainable balance between food security and natural resource conservation. It is not easy to formulate and implement workable compromises between wildlife conservation and the people who live with wildlife (Terborgh et al., 2002). A wide range of ecological, social and political factors infringe on virtually all human-wildlife interactions, but the importance of these factors varies from one situation to another (Epule et al., 2014) (rephrase, varies with different situations).

Pastoralism is a wide spread form of resource extraction in the wild (extensive livestock grazing), with some reserve being grazed by livestock (Kothari et al., 1989; Mahazotahy, 2006)). The ecological impacts of livestock grazing on wildlife conservation as well as the data on livestock carrying capacity and indicators of overgrazing are not available (Saberwal, 1996). Over the years, Pastoralism and wildlife conservation must have been compatible in East and West Africa; but modernization processes and changes in pastoral populations and land use have altered the patterns of interaction between pastoralists, wildlife and their jointly occupied ecosystems (Galvin et al., 2002). The recent past has seen a decline in economic welfare and chronic states of under-nutrition for pastoral populations (Homewood, 1992). The alarming decreases in livestock and wildlife over the last decades suggest that the carrying capacity of rangeland has declined, possibly because there has been progressive rangeland degradation, resulting from excessive livestock densities, agricultural activities and restricted transhumance corridors. These factors comprise the core components of the system that exist in most of the savannah regions of Africa (Barrett and Arcese, 1995). These human-ecological systems consist of pastoralist, wildlife and livestock as their principal components. The centre of this complex system is land use; specifically land for conservation of biodiversity and human well-being. In Cameroon, wildlife residing outside and at the edge of protected areas is threatened by intensifying pressure from anthropogenic influence. In particular, depletion of the natural resources from rapid land use patterns human population growth and expansion of settlements, habitat loss and fragmentation, fencing and poaching and pastoralism. Unfortunately, there is little information that conclusively shows a decline in range production or those livestock densities in the study area (which study area). Mountains and Montane forest features prominently in the landscape of the world (sentence is hanging). The mount Oku area is one of such areas with the abovementioned characteristics. It is the largest mountain forest area in West Africa and a centre of a vast number of endemic wildlife species (FAO, 2002). It also has a very active pastoral community. This raises issues of balancing pastoral needs with biodiversity conservation.

Human activities often result to conflicts between human and wild animals, causing a remarkable shrink in wildlife numbers, and this modifies wildlife behaviour, demography and space utilization (Gavin et al., 2000; Fenn, 2003 and Rakotomalala, 2013). This is also the case of the mount Oku protected area. These human wildlife conflicts result in retaliatory killing of wild animals (Omondi, 1994). The protected area approach has

legitimized and encourages unsustainable land use outside the protected areas; placing further pressure on natural resources (Ecologist, 1993 and Wood et al., 2000).

Consequently, is it possible to make biodiversity to be compatible with Pastoralism? Obviously, there is a potential for conflicts between pastoralist and conservationist sometimes due to conflicting interests. So how can these conflicting interests be reconciled? This study aims at sticking a balance between Pastoralism and biodiversity conservation for the mount Oku area. The objective of the study was to examine the perceptions of stakeholders and small ruminant grazers on the sustainable management of biological resources in the Mount Oku.

2. Materials and Methods

2.1. The Study area:

Mount Oku (Kilum) and Ijim ridge form the largest remaining patch of montane forest in West Africa ((FAO 2002 and Forboseh et al., 2003). It has exceptional levels of flora and fauna endemic especially amongst bird's species (Forboseh and Maisels, 2002 and Forboseh and Ikuingei, 2001). Some amphibian species are endemic; with 5 species endemic only to Mt. Oku, 7 endemic to the Bamenda highland and 18 resisted (replace) to the highlands of Cameroon and Nigeria (Doherty-Bone and Gvozdik, 2017).

Mount Oku is the second highest mountain in West Africa, with an elevation of 3,011 meters. The grid reference of Mt Oku forest reserve is between latitude 6° 07'N to 6° 17'N and longitude 10° 20'E to 10° 35'E (FAO, 2002; Zaphinia and Jude, 2015). The Southern slopes are the Ejim Mountains while northern slopes are the Kilum Mountains. The forest reserve extends between 2022 m and 3011 m above sea level. Land under natural forest including degraded forest is 6900 ha area under tree and scrub savannah is 2400 ha; grass savannah 1240 ha and area occupied by lake Oku (Maawes) is 260 ha (Maisel and Forboseh, 1997). This area became a reserve in 1931, but it was not until 1975 that the demarcation of the forest boundary started. In the 1990s, forest legislation evolved from state ownership and management to participatory management with some local communities. Mt Oku forest covers a land area of 17,325 ha. A population of about 300.000 people lives within a day walks of the forest and depend on it for their livelihoods (FAO, 2002). It is managed by six (6) forest management institutions (FMI).The forest provides local employment and livelihood. Honey, woodcarving and the extraction of non-timber forest products are important local economies with the potential for improvement. The forest and Lake Oku have strong cultural significance. Pastoralism has been practiced in the Mt. Oku area for centuries before the creation of the protected area (FAO, 2002)



Figure 1. Map of Mt Oku (Source: Doherty-Bone and Gvozdik, 2017)

2.2. Data collection

Data was collected through the administration of questionnaires and interviews. The questionnaires were design to provide information that certifies the study objectives. The Kilum grazers union has two hundred and forty three (243) members and one hundred and forty five (145) members were interview for the study signifying 60% of the respondents.

2.3. Data analysis

- a. Data on the socio-economic characteristic, perception of stakeholders and challenges over conservation of biodiversity were analyzed. Descriptive statistics (mean, percentages and tables) were used to analyze the socio-economic data and the constraints faced by pastoralist in Mt Oku. Multiple linear regression analysis was used to assess the perception of Pastoralist and stakeholders on the conservation of biodiversity in the Mt Oku area.
- b. The multiple linear regression model involves two or more independent variables (where $n \geq 2$). The model is express below

$$Y = b_0 + b_1 x_1 + b_2 x_2 \dots \dots b_n x_n \quad (1)$$

Where:

Y = dependent or predictable variable, $X_1, X_2 \dots X_3$ are the independent or explanatory variables.
 $b_0 + b_1, b_2 \dots \dots b_n$ are regression parameters.

(Adapted from; Tanko et al., 2013)

- c. The perception of stakeholders and small ruminant grazers by age, education, occupation and their willingness to conserve biodiversity in the Mount Oku protected area were analysed. The results in Table 4 below shows the distribution of one hundred and forty five (145) questionnaires administered to small ruminant grazers in the Mt. Oku protected area in 2016, classified by current age, level of education, primary occupation and desire to conserve biodiversity. In the analysis of these data, the current perception of respondents as a dependent variable of interest and age, educational status and primary occupation as independent variables. The dependent variable has two categories of responses with "Yes=1 or No=0". The original datasets included date of interview and date of birth of respondent. It was possible to calculate age in single years, but use ten years interval for convinces. Similarly, the survey-included information on highest level of education attained but for convinces purpose simple distinction such as formal and informal education was used. Primary occupation was also classified into: grazing, beekeeping, hunting/gathering, wood carving, medicinal plants collection and civil servants as occupations of respondents but, for convinces it was classified into three categories: grazers, non-timber forest products (NTFP) and civil savants. Finally, the desire for conservation of biodiversity was measured as simple dichotomy coded as Yes or No and therefore naturally categorical variant. The fact that all predictors are treated as discrete factors allows us to summarize the data in terms of numbers. Grouping the data leads to small dataset and made the work easier. The aim of this analysis was to find out to what extent the perceptions of small ruminant grazers on the conservation of biodiversity are influenced by socioeconomic characteristics such as age, educational status and primary occupation of respondents.

3. Results and discussion

160 questionnaires were administered to small ruminant grazers in the Mt. Oku protected area. 145 copies of the questionnaire were retrieved, representing 91% of the total distributed.

3.1. Socio-Economic characteristics of small ruminant grazer

The data presented in this section shows the various interrelated components, such as age distribution, gender, marital status, education and primary and secondary occupations. These components provide the information that led to the effective understanding of small ruminant grazers in the study area.

3.1.1. Gender distribution of the respondents

Results showed that only men were involved in small ruminant grazing in the Mt Oku protected area, and women were not involved (Table 1). Women are not involved in grazing activity probably because it is very tedious and risky, since graziers have to walk long distances, daily, to herd flocks up the mountains above 2500m, above sea level. Areas of this altitude are rich in pasture for livestock to browse on. The finding from this study are in line with that of FAO (2002) who found that, the vegetation in the Mt Oku protected area is characterised by grassland with no trees or shrubs at altitude above 2500m; making it suitable for grazing activities.

Table 1. Gender distribution of respondent

Parameters		
Category	Frequency	Percentage (%)
Male	145	100
Female	0	0

Source: Field survey, 2016

3.1.2. Age distribution of respondent

Table 2. Age distribution of respondents

Parameters		
Age (years)	Frequency	Percentages (%)
20 - 40	20	13.8
41 - 60	80	55.2
Above 61	45	31
Total	145	100

Source: Field survey, 2016

The results in Table 2 shows that the majority of small ruminant grazers were within the age range of 41- 60 years (55.2%), followed by respondents with ages above 61years, who account for 31% of the small ruminant grazers and lastly the youths within the ages of 20-40 years who make up 13.8%. The low level of youth involvement in grazing activity may be due to lack of interest in livestock grazing, human wildlife conflicts and diversification of livelihood activities, since grazing is not longer a lucrative and appealing business. Also, the forceful eviction of grazers in the Mt Oku area has caused many youths to change to an alternative livelihood

sources other than grazing. Some youths have also migrated to urban areas to work in factories. Women are left out of this important economic activity, and for livestock grazing to have an impact on the livelihood of the community, women should play a key role in small ruminant grazing activity (Niamir-Fuller, 1994).

3.1.3. Marital status and number of wives of respondents

The results in Table 3 depicts that all interviewed respondents were married 100%. Amongst the married coupled majority of respondents are polygamous with men married to two (2) wives making up 51.7% , followed by monogamous couples who make up 40.7% and lastly 7.6% of respondents were married to three wives (3) respectively.

Table 3. A cross table showing marital status and number of wives

	Number of wives			Total
	One	Two	Three	
Marital status of Respondents married	59	75	11	145
Percentage (%)	40.7%	51.7%	7.6%	100%

Source: Field survey, 2016

3.2. The perception of small ruminant grazers on biodiversity conservation

The majority of small ruminant grazers (74.5%) have a negative opinion on the conservation of biodiversity and only 25.5% were in favour of the conservation of biodiversity in the Mt Oku area. These opinions of grazers were influence by factors such as primary occupation, educational status and age of respondents. The survey also revealed that 80.7% carried out grazing as their primarily occupation, and 15.9% relied on Non-timber forest products (NTFP) which included; beekeeping, wood carving, medicinal plant collection, rodent hunting, amongst others. Civil servants constituted only 3.4%. 55.9% of respondent had informal education and only 44.1% had attended primary school⁵ shows that F-cal (137.040) is very high indicating that the model fits well to the data and the results are highly significant even at 5% probability levels.

3.3. The Coefficient for individual variable contributions

These results were tested for an age effect using the data classified by age only. Moreover, the estimated age effects based on setting the age model to the two-way classification in Table 4 would be the same as those estimated in the previous section, and have the property of reproducing exactly the proportions using perception in each age group. In all cases the estimated effects, standard errors, and likelihood ratio tests based on differences between deviances were the same. The deviances varied by each group, however, because they depend on the context of desiring conservation of biodiversity by age, education and occupation of respondents. The dependent variables are highly significant at 1% and 5% maximum.

Table 4. The perception of small ruminant grazers on conservation by age, education and their willingness to pay for conservation activities in the Mount Oku protected area

Parameters	Frequency	Marginal Percentage
Opinion of respondent on the conservation of biodiversity	Yes	37 25.5%
	No	108 74.5%
Primary Occupation of Respondent	Grazers	117 80.7%
	NTFPs	23 15.9%
	Civil savant	5 3.4%
Age of respondent	20-40yrs	47 32.4%
	41-60yrs	40 27.6%
	Above 61yrs	58 40.0%
Educational status of the respondent	Primary school	64 44.1%
	No formal education	81 55.9%
Valid	145	100.0%
Missing	0	
Total	145	

Source: Field survey, 2016

Table 5. ANOVA for the multiple linear regression model

ANOVA

		Sum of Squares	df	Mean Square	F	Sig
Equation 1	Regression	80.131	3	26.710	137.040	.000
	Residual	27.677	142	0.195		
	Total	107.808 ^a	145			

Notes:

- This total sum of squares is not corrected for the constant because the constant is zero for regression through the origin.
- The independent variables are: age, educational status and occupation of respondents while the dependent variable is opinion of respondents on conservation of biodiversity in the study site.

Table 6. Coefficient for individual variable contributions to the results

		Unstandardized coefficients				
		B	Std. Error	Beta	T	Sig
Equation 1	Age	0.141	0.037	0.367	3.791	0.00
	Education	0.125	0.055	0.237	2.270	0.025
	Occupation	0.193	0.064	0.296	3.026	0.003

The trend to protect biodiversity (concept of ecosystem integrity) is mostly based on bias that consider the range lands to be over grazed by small ruminant livestock's and therefore threatening wildlife and biodiversity, poverty and creating conflicts (Niamir-fuller, 1999; Reynolds and Stafford-smith, 2002). The concept of ecosystem integrity is increasingly challenged by scholars (Mortimore et al., 2009 and Reynold et al., 2007) who said climate change and drought are causes of range land degradation rather than livestock as first thought. Although changing perception and livelihood options, block of transhumant corridors, sedentary life of pastoralist, hunters and beekeepers is sometime blame for over use of resources (Behnke et al., 1993) and degradation as more pastoralist are push out of nomadic lifestyle, increasing pressure on natural resources within a small area. Pastoralists are good in adapting to climate change and often look for alternatives to resources they cannot access. Overall, pastoralists should be involved in decision pertaining to the conservation of protected areas.

3.4. Constraints phase by small ruminant grazers in the Mt. Oku area

Table 5 shows that the majority of small ruminant grazers 45% were evicted forcefully within the Mt. Oku area at the early stages of the project to protect the forest. The forestry Law No. 78/23 of December 2, 1978 on the protection of national parks and Decree No. 95/531/PM of August 23, 1995. Setting the modality for the

implementation of the forest regulations on the protection of protected areas; this is followed by respondent's (grazers union) who were summoned before the high court of Bui (29%); poor policies accounted for 19% and lastly was the economic situation of the grazers (6.9%).

Table 5. Constraints phased by small ruminant grazers in the Mt. Oku area

Category	Frequency	Percent	Ranking
Economic situation	10	6,9	4
Policy	26	19,0	3
Ecological	45	44,8	1
Litigations	29	29,3	2
Valid Total	145	100,0	
Mean	3.71		
Std. Deviation	0.618		

The rearing of livestock in the study area started as early as the beginning of the 20th century. This grazing activity has been influenced by ecological, political and economic reasons (Ndenecho, 2008) and communities have been using their indigenous knowledge and practices to manage natural resources for centuries (Nunes et al., 2001; Turner and Hienaux, 2002; Feldt, 2015). The communities adjacent the mountain strongly rejected the idea of protecting the forest with subsequent government failure to gazette the area in 1936, 1961, 1963 and finally in 1975 the demarcation of the forest borders was successful even though communities fail to respect the borders (FAO, 2002; Asanga, 2002). In 1986 with the coming of Birdlife International, the forest conservator began to force pastoralists to adapt themselves into new political and economic realities. In the past, pastoralists have grazed their flocks on harvested lands used for field crops, vegetables and on mixed farming zones particularly during the dry seasons. However, the re-establishment of park boundaries has blocked transhumance corridors, increased grazers/park manager, farmers/grazers conflicts and hence the amount of pasture, water points amongst others. The available space for small ruminant grazers has reduced (Schilling et al., 2012; Turner et al., 2014; Feldt, 2016). These actions have reduced herd size and standard of living for pastoralists and their families.

The ecological problems, in particular over-grazing and grazing on wildlings and shrubs resulted to policy considerations with the introduction of eco-guards to protect the forest assisted by the Fons and traditional councils (Zaphinia and Jude, 2015). Their main role is to protect the forest from any human activities including

the small ruminant grazers at 2800m above sea level, an area of mainly of grassland vegetation. This stringent control restricts pastoralist and their flocks to roam even during transhumance periods. This policy has had a negative impact on the livestock numbers and pastoralist themselves. Also the lengthy court case with Grazers union that took almost six years for a decision to be taken made matter worst. Consequently, it has increased poverty, theft, joblessness and crime wave amongst pastoralist. There have been recorded evidences of livestock seizures by traditional leaders (Fons) and administrative officers during periods of 1986 to 1989. In the past, small ruminant grazing was a primary source of income to grazers. The uncertainty in rainfed agricultural production and climate change is unforeseen (Riginous and Haffman, 2003; Dickhoefer, 2010). This is in line with the studies of Abu-Rabia, (1994) who found that the introduction of regulations and laws on black goats' owners and green patrols in Negev uplands of Israeli had negative impacts on the Bedouin communities. Despite the difficulties, small ruminant grazing is still a worthwhile venture to undertake; if human resource, access to land, good relationship with traditional authorities and a flock size of between 100 to 200 sheep or goats will keep this activity moving.

4. Conclusion

The struggle over the use of natural resources remains the root cause of Pastoralist/wildlife conflicts in the Mt. Oku protected area of the North West Region, Cameroon. This research work was designed to capture the challenges phased by small ruminant grazers resulting from competition over the use of natural resources in the study area. It is within this context that this study was carried out. Its purpose was to examine the perceptions of stakeholders and small ruminant grazers on the sustainable management of biological resources in the Mount Oku area. The results of this survey re-emphasized the serious nature of the conflicts that exist between the conservators of this reserve and the small ruminant grazers union. Pastoralist and wildlife cohabitated and shared the same resource for centauries for their wellbeing. The study found that 100% of the respondents were men. There is no collaboration between park managers and grazers union; and grazers have a negative perception toward biological resource conservation in the study area. The multi linear regression results revealed that there is a significant difference at 5% probability level. This results corroborates the findings of Manu et al. (2014) in which they attributed causes of farmer-grazer conflicts in 24 communities to be based on resource sharing. Small ruminant grazing patterns are affected by many constraints such as conservation policies, economic and ecological conditions of the said area. Consequently, household structures, family economy, size of flocks and rural urban migration are very visible. In previous decades, small ruminant grazing was a primary source of income, livelihood source and created middle class within the pastoralist communities but they have been highly improvised. To revive this protected area and amend the relationship between pastoralist and protected areas; providing watering points for livestock outside the boundaries of forest will reduce encroachment and degradation inside the protected forest. Promote energy conservation by reducing the quantity of wood use, education and awareness through teaching and encourage restoration activities, Afforestation and reforestation programs and to crown it all provide alternative livelihood sources to small ruminant grazers.

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