(RESEARCH ARTICLE)

Exploring the management and integration of national parks in Northern Ethiopia: The case of Kafta Shiraro National Park

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Abstract

The study was conducted in Kafta-Shiraro in Northern region of Ethiopia. The study uses two important parameters to realize the objective of the study investigating themanagement and integration of the park, one is studying and explaining the community perceptions towards elephant (flagship species) conservation in Kafta Shiraro National Park (KSNP) and secondly compare and contrast the population structure and density of the (economically important plant) *Boswellia papyrifera* (Del.) Hochst inside and outside of the protected areas and the study contribute to the scientific bases for improved management of biodiversity and its conservation system. A total of 100 households were selected from 10 villages using a stratified random sampling. A rapid vegetation assessment survey was conducted in two Boswellia stands, inside the park and outside the park at villages in order to examine the status of the resource base. A total of 40 sample plots of size 20 X 20 m were laid at regular interval along parallel transects with smaller sample plots of size 5 X 5 m nested in the center of each plot for regeneration count. The conflicts between humans and wildlife in KSNP have been getting worse over time and underline the need to find a workable solution to stop the progress of encroaching human activities that are core factors in the conflict. The underlying factors were found to be free encroachment into the wildlife home ranges, mainly for cultivation and dry wood collection. The factors that contributed to the poor conservation of African elephant included weak community awareness and understaffed anti-poaching and patrolling team of the KSNP. The improper land use by host settlers locally called "wefrizemet" as well as legal settlers maximizes the level of habitat disturbance (threat of the elephants in the park) due to illegal cultivation with high number of livestock crossing to the park. *B. papyrifera* population structure illustrates that natural regeneration is lacking in all two study areas. Additionally, the population of Boswellia in the study areas is unstable and under threat due to lack of recruitments through regeneration. Based on the stands structure analysis, it is hypothesized that lack of natural regeneration is primarily caused by livestock grazing pressure and the absence of recruitment is largely caused by lack of seed production by mother trees as the result of intensive tapping of the frankincense. KSNP is deteriorating due to a lack of integration and development cooperation between the Park and the surrounding local community as well as administration the minimal managerial and institutional capacity of the Park, minimal alternative livelihoods for the surrounding communities, inadequate commitment among all officials in taking the Park as an issue of development agenda, absence of legal procedures and understandings on expansion of large scale farms, unplanned and non-integrated land use systems, and a lack of appropriate outreach programs needed to change the attitudes of the surrounding communities. Collaborative Park management is urgently required to rescue KSNP; agreement should be made from National to Woreda level stakeholders.

Keywords: Management; Integration; KSNP; Elephant; *Boswellia papyrifera*; N. Ethiopia

1. Introduction

It has long been recognized in the literature that protected areas do not exist in isolation from their surroundings [1, 2, 3, 4]. Early research on protected areas and their surroundings examined issues such as the management of conflicts

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between national parks and surrounding human communities [2] and the effects of national parks on surrounding communities [5, 6]. Previous research tended to focus on the establishment of national parks in developing countries and the negative outcomes (such as physical displacement or the loss of traditional uses of natural resources) that were a result of the 'mismatch' of a Western model of protected area management and local circumstances.

Today, a vast literature details the many challenges that relate to protected areas and their surroundings, in both developing and developed-country contexts. From the perspective of protected areas in developed countries, some of the more common challenges include a lack of trust between protected area managers and local residents [7, 8]; a low level of communication, cooperation and coordination between government agencies within a protected area's surroundings [9, 10 11, 12]; external pressures on protected areas' ecological integrity due to land development, habitat fragmentation, resource extraction, toxics and pollutants and exotic species [9, 11 13, 14,15]; and overuse from recreation and tourism [11, 15, 16].

The term 'integration' broadly means the integration of a protected area into its surroundings in order to address the challenges that exist in the context of its interaction with its surroundings. Examples of integration initiatives are:

- Building partnerships, collaborating, and cooperating with actors within a protected area's surroundings;
- Developing, participating in, and/or increasing support for local institutions;
- Increased public participation in protected area management and planning;
- Resolving conflicts and improving relations with local people; and,
- Engaging in ecological integration initiatives such as joint monitoring programs.

Regional integration can have varied or multiple goals. They might include addressing specific management problems, improving a protected area's ecological integrity, or moving towards economic or ecological sustainability in the protected area's surroundings.

Despite efforts at implementing the types of regional integration initiatives described above, regional integration problems still remain for protected areas around the world [5, 8, 17, 18]. There is a notable lack of research which explores how integration is being carried out within the context of national parks in Ethiopia or how the integration of national parks into their surroundings could be improved. Furthermore, integration as a concept remains unclear, under-studied, and undefined. Therefore, the study collects data by various observation methods in order to recommend problem solving solutions. In addition to this, the study provides and explain the community perceptions towards elephant conservationin KSNP and compare and contrast the population structure and density of *Boswellia papyrifera* (Del.) Hochst inside and outside of the protected areasand the study contributes to the scientific bases for improved management of biodiversity and its conservation system.

1.1. The Park

Kafta-Sheraro National Park (KSNP), which was recognized as Park in 2007 by the Regional Government of Tigray, is situated in the northwest of Ethiopia between 13° 50' and 14° 23' N and 36° 31' and 37° 29' E. It is bordered by Eritrea in the North and it is presumed to have an estimated total area of 5000 km².

Kafta-Shiraro is located in western Tigray, with its 500,000-ha area, it is expected to be one of the largest conservation areas in Ethiopia. It is bordered by Eritrea in the north, Shiraro in the east, Wolkaite in the south and Humera in the west. Within Tigray it is positioned in the woredas of Kafta-Humera and Tahtay-Adiabo. While the main river is the Tekeze, it is fed by a number of rivers that orginate in the Simen Mountains and highlands of Wolkait. Elevation ranges from 550 masl on the edge of Tekeze River 1800 masl on the highlands of Kafta.

The agro-climatic zone is identified as Qolla with an inclination to semi-arid. Vegetation communities within the reserve include *Acacia-Commiphora, Combretum-Terminalia*, dry evergreen montane woodlands and riparian types. The site has a mono-modal pattern of rain with high peaks in May and early September. Preliminary records show that the site conserves 42 mammalian and 95 avian species. In addition to the plant diversity, the Park is home to many ungulates, predators and other wild animal species. The presence of some mega wild animals such as the African elephant, Roan antelope and the Cranes (which use the area as a wintering site) and other migratory birds make the Park and its environs a significant site for the national as well as international communities. Other mammals such as Greater kudus and Bohor reedbucks were relatively common. The avifauna of the Park is rather immense. As a result, the Park is registered as one of the 73 Important Bird Areas in Ethiopia. The Brown-headed parrot, Parakeet, Little green bee-eater, and Demoiselle crane are of the few most attractive bird species of the Park.

1.2. Unique features

The reserve is important for the conservation of Elephants. It is one of nine sites in Ethiopia that conserve Elephants. The Elephant population in Kafta migrates seasonally between Ethiopia and Eritrea. At present the site is known to hold an estimated 100-150 individual Elephants. Besides Elephants, it conserves 42 mammals 167 birds and 9 reptile species. The site is extremely important and could well be the only site in the country for wintering Demoiselle Crane. A recent discovery shows that the northwestern border of the park holds more than 20,000 Demoiselle Cranes.

1.3. Data management and analysis

Results from the survey and relevant secondary data were organized, summarized and analyzed based on six independent variables such as; villages, sex, distance to the park, land type, number of years resided and level of education having different levels on each. The data obtained from the survey were collected and structured using Microsoft Excel before it was subjected to the distribution, Latest version software R is used for analysis. Chi-square test was used for analyzing the relationship and level of significance of the difference data categories by SPSS v16. The data was presented using tables, and graphs.

A rapid vegetation assessment survey was conducted in two *Boswellia* stands, inside the park and outside the park at villages in order to examine the status of the resource base. The two areas correspond to KSNP and unreserved forests but owned by different associations, individuals or organizations. A total of 40 sample plots of size 20 X 20 m were laid at regular interval along parallel transects with smaller sample plots of size 5X 5 m nested in the center of each plot for regeneration count. The first sample plot was laid randomly and the others systematically at pre-specified intervals to be distributed in the surveyed forests. 20 sample plots were taken from KSNP along three parallel transects with an interval of 500 m and 300 m interval between sample plots. Outside the Park also 20 sample plots were taken with similar design as of the KSNP.

Diameters of all trees with individuals taller than 2 m and more than 2 cm in diameter were measured for Height and Diameter at Breast Height (DBH). In the sample plots were measured and species type recorded. In the regeneration plots the number of *Boswellia* seedlings and saplings encountered were counted. Based on visual observation tapping intensity, damage type, possible cause of the damage and number of dead *Boswellia* trees were recorded from each sample plot. The population structure of the species is depicted using frequency histogram of diameter classes and number of regenerations.

1.4. Rank analysis

For management problem and major treats on elephants were ranked using preference ranking methods. In preference ranking method, index was computed with the principle of weighted average. The following formula was used to compute index as employed by Musa (2006):

$$Index = Rn*C1 + Rn-1*C2.... + R1*Cn \; / \; \Sigma \, Rn*C1 + Rn-1*C2.... + R1*Cn;$$

Where, Rn = Value given for the least ranked level (If the least rank is 5th, then Rn = 5, Rn-1 = 4, R1 = 1)

Cn = Counts of the least ranked level (in the above example, the count of the 5th rank = Cn, and the count of the 1st rank = C1)

Data collected for Demography using different techniques was presented using descriptive analysis, including tabular presentations, graphs and percentages.

2. Results and discussion

2.1. Community perceptions towards wild animals' conservation

The perception of respondents in the study area was classified in to positive, negative and neutral based on their support on the conservation of elephants in KSNP. The negative attitudes towards both elephants and other wildlife were developed as a result of crop or domestic animal damage by and the absence of compensation mechanisms. Yirmed [19] observed that 21.5% of respondents in Babbile Sanctuary had negative attitude due to the destructive action of elephants.

The attitude of respondents towards elephants in different villages differed significantly (χ^2 = 82.21, DF = 27, P <0.0001 showed in Table 1& 2). Of all the respondents in H/Selam, Mayweyni and Mykeyh villages (far to the park) showed ≥90 % positive support. About 70% of the respondents in Ruwasa had positive attitude towards elephants. About 40% of the respondents in Wuhdet showed positive support on the conservation of African elephants in KSNP (Table 1).

Table 1 Views of respondents towards elephant conservation in KSNP perceived in different villages.

Villages	Positive	Negative	Neutral	Test		
	N (%)	N (%)	N (%)	DF	χ^2-value	P-value
Adebay*	0(0.0)	10(100)	0(0.0)			
H/Selam	10(100)	0(0.0)	0(0.0)			
Wuhdet*	4(40.0)	6(60.0)	0(0.0)			
Mayweyni	10(100)	0(0.0)	0(0.0)			
Adigoshu*	4(40.0)	6(60.0)	0(0.0)			
Mykeyh	9(90.0)	0(0.0)	1(10.0)	27	82.206	<0.001
Adiaser*	1(10.0)	9(90.0)	0(0.0)			
Aditsetser*	0(0.0)	10(100)	0(0.0)			
Edris*	2(20.0)	7(70.0)	1(10.0)			
Ruwasa	7(70.0)	0(0.0)	3(30.0)			
Total	47(47.0)	48(48.0)	5(5.0)			

Note: The symbol (*) indicates villages relative nearby KSNP

Various reasons were suggested for why people had a positive feeling about the elephants, such as the importance of natural resource conservation and management for continuously utilizing, and being amongst God's creatures so they considered them as their cattle.

Contrary to this, all respondents from Adebay and Aditseser, 70% from Edris, 60 % from Wuhdet, and Adigoshu showed negative attitude towards elephant conservation. The respondents considered elephants as valueless because of their crop raiding activities and the need of cultivation inside the park. The responses from few of the people interviewed in Ruwasa (30%), Mykeyh and Edris were neutral (10%) (Table 1).

The percentage and number of respondents' perception per independent variable of the study are presented in Table 2. Out of all the studied factors land type, distance to the park and level of education had a significant influence on perception. Almost all of the residents in Kafta-Shiraro were not indigenous to the area, particularly the people in the study sites (Tabias). Some of the communities in the area were settlers from other drought prone areas of the region [20].

Such settlers were allocated a piece of land for farming. However, there were also other groups who settled in the same areas without having access to land (landless). The presence of such a gap in land holding led to significant variation in perception towards elephant conservation. The highest number of the respondents from the landless 60.0% (n = 3) had neutral attitude to the conservation of African elephants in KSNP but in reality, they need land for cultivation than elephants (Table 2). This attitude might be due to the need to have arable land for cultivation. Such group of settlers did not worry for the development of the park, as they didn't live permanently in the area. Their interest was getting high production and develops financial capacity, and return to their original area. However, some of these landless groups 40% (n = 2) had positive attitude towards the park and conservation of elephants.

Whatever they did not had their own agricultural plot, do not need land for cultivation from the conservation area but they need to use a land by rent from the people who had access to small agricultural plot. Compared to the respondents of land owners, the highest number 100% (n= 3) had positive support on the conservation of African elephants. These people did not worry on the additional need of land for cultivation rather they thought about the future development of the park and had better understanding on natural resource conservation. Some of the land owner respondents 52.17% (n = 48) had negative support on the conservation of African elephants in KSNP (Table 2).

This was due to the need of grazing land for their livestock in the park and complained on the penalty of Birr per animal. Dublin [21] underlines the increasing of human populations and expanding agriculture has increased the potential for conflict between humans and elephants in many regions. Elephants have been compressed into ever-smaller areas and their traditional migration routes have been cut off. As a result, humans and elephants compete directly for land that is becoming increasingly scarce.

Table 2 Influence of various factors on community perception.

Parameters	Level	Positive	Negative	Neutral	Test		
		N (%)	N (%)	N (%)	DF	χ^2	P-value
Sex	M	40(46.51)	42(48.84)	4(4.65)	1	2.12	0.452
	F	7(50.0)	6(42.86)	1(7.14)			
Land ownership	Owner	42(45.65)	48(52.17)	2(2.17)	2	22.21	<0.0001
	Land less	2(40.0)	0(0.0)	3(60.0)			
	Rent	3(100)	0(0.0)	0(0.0)			
Distance	Near	20(40.0)	30(60.0)	0(0.0)	1	82.21	<0.0001
	Far	27(54.0)	18(36.0)	5(10.0)			
Year of resided	0-3	21(46.67)	22(48.89)	2(4.44)	3	5.43	0.356
	4-7	20(50.0)	18(45.0)	2(5.0)			
	8-11	5(41.67)	6(50.0)	1(8.33)			
	>11	1(33.33)	2(66.67)	0(0.0)			
Level of education	Illiterate	12(32.43)	25(67.57)	0(0.0)	3	16.48	<0.0001
	Informal	14(51.85)	13(48.15)	0(0.0)			
	1-6	19(57.58)	10(30.30)	4(12.12)			
	7-12	2(66.67)	0(0.0)	1(33.33)			

A significant difference (P < 0.001) in peoples' attitudes towards the elephants was shown between the respondents from villages near to or far from the park. Most respondents 60.0% (n = 30) in the near villages had negative support on the conservation of African elephants. Whereas the respondents (n = 27, 54.0%) (Table 2) from the villages relatively far had positive support for the conservation of African elephant in the park. According to findings of Yirmed [19] HEC largely influenced the attitudes of people living inside and nearby the Silent area of the wildlife conservation areas. Dublin [21] suggested human elephant conflict (HEC) creates anger towards elephants from the communities who live with them because they can ruin people's livelihoods. Such anger undermines support for elephant conservation, and has led to farmers killing elephants or turning a blind eye to poaching in retaliation for the damage they have caused. Consequently, HEC casts a threatening shadow over the future of elephant conservation outside protected areas. In addition to this, IUCN [22] reported that, local peoples to nearby elephant conservation pressured on government to find solutions from grassroots level for elephants impinge on people. Demonstration against governments had taken place in Gabon, Cameroon and Kenya demanding the choice between elephants and human being. They challenged their respective government asking whether elephants have become more important than people.

2.2. Major problems for elephant conservation and threats to live in KSNP

The view of respondents was divided into four categories based on four independent variables. Respondents in both distance villages (near and far) claimed that Poor community awareness (lack of ownership mentality) was responsible for poor elephant's conservation in the area (Table 3). Their belief could be related to the fact that interests of villagers on clearing the bushes for cultivation and deforestation of key species for house construction and sales. In addition to this, the lower understanding of the community on elephants and the priority of the conservation area for the elephants taken as valueless rather using for cultivation. This interest of community concedes with the finding of Teshale [23] that stated 1174 households brought clearance in Kafta-Sheraro National Park.

Weak law enforcement and poor patrolling is a major problem next to poor community awareness. This may probably due to delay of development activities, that is starting from resettlement program in 2003, particularly nothing was done except employing scouts (forest guards) which opened access for illegal participants who are intensively using the resources of the park. Inconsistent boundary demarcation that failed to involve the communities in the description process; they said, this has escalated encroachment of humans and livestock. In addition to this, the number of scouts is very small to look after the huge park. This was in agreement with Yirmed [19] who noted that lack of owner ship is the main reason for poor elephant conservation in Babbile Sanctuary.

2.3. View of the community on identification of major threats

Followed the management problem for effective conservation of elephants in KSNP, views from the respondents were collected towards the threats of elephants. Their view was divided in to four categories based on the four independent variables. Respondents in both nearby and far to the park ranked habitat disturbance and illegal hunting consecutively (Table 3). The ranked of respondent's habitat disturbance as a major treat is probably due to the ongoing cultivation of their habitats with increasing risk of conflicts of interest with human cohabitants.

This result is correlated with others [24, 25, 26] who reported that the greatest threat to the survival of elephants in Ethiopia is habitat loss and the same Shoshani and Yirmed [27] in their report pointed out habitat disturbance as major threat for the survival of elephants in KSNP due to continuous encroached inside the cultivation of elephant's habitat.

Table 3 Household ranking of threats and major problems for effective management of African elephant in NEAR and FAR sample villages to KSNP.

	NEAR		FAR	
	N (index)	Rank	N (index)	Rank
Major problems as identified by local communities for effective management				
Poor community awareness.	20(0.40)	1	17(0.34)	1
Weak law enforcement and poor patrolling.	17(0.34)	2	16(0.32)	2
High population.	10(0.20)	3	12(0.24)	3
Free access for resources.	3(0.06)	4	5(0.10)	4
Threats				
Habitat disturbance.	21(0.42)	1	18(0.36)	2
Illegal hunting.	19(0.38)	2	20(0.40)	1
Livestock interference.	6(0.12)	3	10(0.20)	3
Feed Shortage.	4(0.08)	4	2(0.04)	4

The next threat for the African elephant in the park was illegal hunting. Poaching on African elephants for ivory was mentioned as serious threat. The least and as minor threat mentioned by the respondents were feed shortage.

This may be true as compared the total area of the park conservation area and clear bushes for agricultural crops, and the continuous firing. Lahm [28] also suggested the survival of elephants in Sri-lanka is in question due to the higher conflict of human interest of co-habitants and continuous with the total elephant population in the area, it is more than enough according to the finding of Lindeque and Lindeque [29] reported that elephants range occurring within protected areas (5000km^2) will provide secure habitat for 6000 elephants at an average stocking rate of 0.12 elephants perkm^2.

2.4. Population structure of *Boswellia*

The other important parameter seen for the study of management and integration of the park is investigation on the economically important plant *B. papyrifera*. Population structure (proportion of individuals belonging to different size or age classes), density and regeneration status are commonly used indicators to evaluate impact of NTFP extraction from a given forest area [30, 31]. Information on population structure of a tree species indicates the history of the past

disturbance on the species and the environment and hence, used to forecast the future trend of the population of that particular species. The population structure of *B. papyrifera* in KSNP reserved forest and outside the park forests is given in Figure 1 and 2.

The population structure in both forests showed that the population is dominated by mature individuals with complete lack of juvenile and regenerating individuals (<5 cm DBH). All the individuals of the species in both surveyed stands have diameter greater than 5 cm. An inverse J-shaped curve that shows very high proportion of seedlings and saplings in relation to mature trees is considered to represent a healthy regenerating population [31]. Sharply declining densities of individuals in successively larger size (or age) classes produces the inverse J-shaped diameter class distribution for a species.
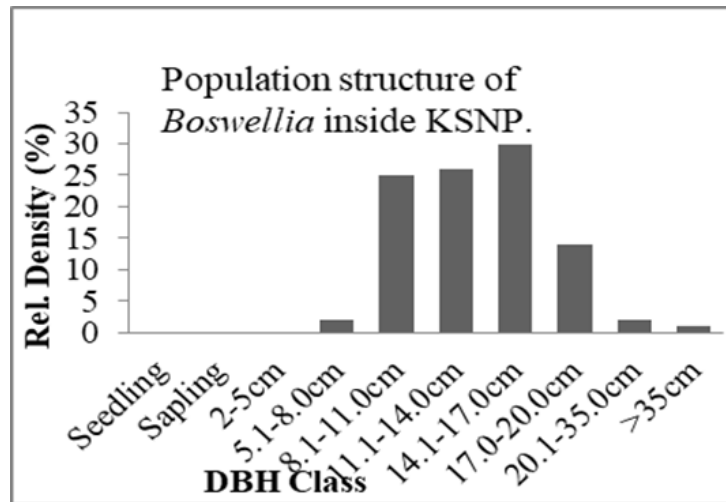

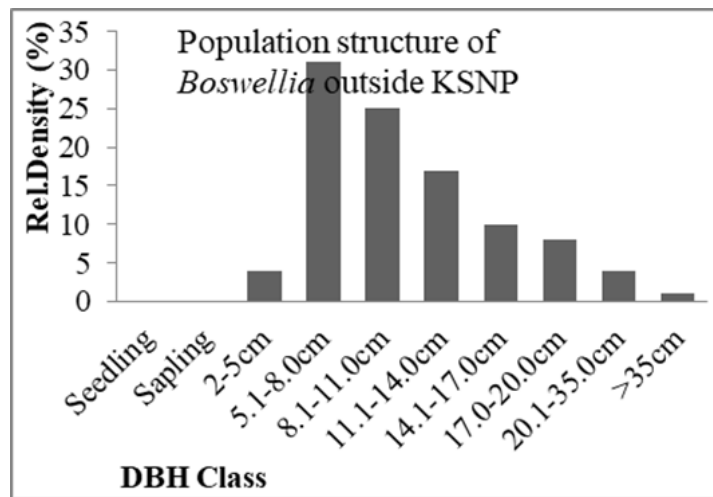**Figure 1** Population structure of *B. Papyrifera* inside KSNP

Figure 2 Population structure of *B. papyrifera* outside KSNP

The bell shaped structure that was found in the surveyed stands in the study area (Fig 1) indicates that the population of *Boswellia* in the study area is unstable and under threat due to lack of recruitments through regeneration. Similar population structures of *B. papyrifera* were reported from Metema district, North-western Ethiopia and North Gonder Zone, [32, 33]. Several studies in Sudan by Khamis [34], Adam [35] and in Eritrea [36] have also reported unstable populations of *B. papyrifera* in different sites. This is an indication that the species is under threat not only in the study area but also in several geographical locations in the region of its distribution due to continuous tapping for incense production, human induced fire, overgrazing and climatic anomalies. For instance, Rijkers *et al.* [37] illustrated that untapped trees produce three times higher healthy and filled seeds than tapped trees with germination success being highest in stands with untapped trees (> 80%) and lowest in ones with tapped trees (< 17cm). The same authors also indicated that at tree level, sexual reproduction decreased with increasing tapping regime irrespective of tree size.

2.5. Density of *Boswellia* stands

The densities of *B. papyrifera* were 78±64 trees ha^{-1} and 54±48 trees ha^{-1} in KSNP and outside the park, respectively (Table 4). The density of the tree species observed in the two stands shows variation.

The highest density (78 trees ha^{-1}) was registered from KSNP and the lowest (54 trees ha^{-1}) from outside the park forests (Table 4). The density indicates the disturbance level of the two stands. These figures are lower than the density of *B. papyrifera* in Metema, North-western Ethiopia (64-225 trees ha^{-1}) reported by [33]. Higher densities of *B. papyrifera* trees were also reported in different sites in Eritrea (80-270 trees ha^{-1}) [38] and Sudan (114 trees ha-1) reported by Khamis [34].

Table 4 Density and frequency of *B. papyrifera* inside and outside of KSNP

Area	Average Density of *B.papyrifera* trees ha^{-1}	Density of >10tree species trees ha^{-1}	Frequency of Occurrence %
Inside KSNP	78 ± 64	121 ± 72	77
Outside KSNP	54 ± 48	84 ± 68	80

More than 10 tree species that include *Acacia etabica, Acacia tortilis, Acacia polycantha, Combretum molle, Dalbergia melanoxylen, Ozorea insignis, Sterculia setigera, Tamarindus indica, Terminalia brownii* and *Ziziphus spinachristy* were found in association with *B. papyrifera*. The density of all tree species found in the surveyed stands was found to be 121±72 trees ha^{-1} and 84±68 trees ha^{-1} in KSNP and outside the park forests respectively (Table 4). Boswellia constitute by respective 77% and 80% of all the tree species in the two areas. Higher frequency of occurrence (percentage of stocked sample plots) of *B. papyrifera* was observed in stands, 77% at KSNP and 80% at outside the park (Table 4). This shows the uniform distribution of the individuals of the species in both areas. There is a visible change in the population of the species. Woreda agricultural office experts and local community members indicated that natural mortality, intensive tapping, continuous tapping without resting period, mis-tapping (deep tapping), and termite attack are the major causes for the decline of the population of the species.

There is no supervision of production areas and no management and protection activities being carried out. The local community blames the outsiders/ migrant frankincense producers for the death of Boswellia trees that since they are not permanent residents in the area, they tend to maximize yield from trees by making many tapping spots. On the other hand migrant tappers (outsiders) blame the locals for improper tapping and using improper tapping tools.

2.6. Natural regeneration status of *Boswellia*

No seedlings and saplings of the species were encountered in all the sample plots. Khamis [34] also found that there was no regeneration of *Boswellia* trees in Jebal Marra, Sudan showing that lack of regeneration and/or establishment of the species is a common problem in the Sudan. However, Adam and El Tayeb (2008) reported that they encountered quite high number of seedlings of the species in the same area. The possible reason for the discrepancies could be the season of the regeneration survey that Adam and El Tayeb [39] conducted that the regeneration survey immediately after the rainy season and the survey was conducted during the dry season in case of the present study. The variation in the regeneration results can be taken as an indicator that *Boswellia* has the ability to produce ample quantities of seedlings but these seedlings face difficulties of establishment. The lack of regeneration of the species could be attributed to intensive tapping, continuous tapping of the trees, fire, and over grazing [32, 34].

3. Conclusion

This study assessed community perceptions and major threats of African elephant, and quantified the various negative impacts made by humans on elephants and on *Boswellia.* It also indicates that the conflicts between humans and elephants in KSNP have been getting worse over time and underline the need to find a workable solution to stop the progress of encroaching human activities that are core factors in the conflict. The underlying factors were found to be free encroachment into the wildlife home ranges, mainly for cultivation and dry wood collection. Most of the factors land holding type, village distance and level of education influenced perception of respondents, with relatively high negative attitudes exhibited by Illiterate settlers who look only for cultivation land. The improper demarcation of the park and delayed of developmental activities facilitated to develop negative attitude on local communities towards the conservation of elephants in the area. The factors that contributed to the poor conservation of African elephant included weak community awareness and understaffed anti-poaching and patrolling team of the KSNP. According to the

respondents, the major threat for the survival of African elephants in KSNP consistently is habitat destruction and illegal hunting. The ongoing cultivation of elephant habitats with increasing risk of conflicts of interest with human co-habitance is high, and the occurrence of wildfires. The improper land use by host settlers locally called "wefrizemet" as well as legal settlers maximizes the level of habitat disturbance (threat of the elephants in the park) due to illegal cultivation with high number of livestock crossing to the park.

The other important parameter seen for the study of management and integration of the park is investigation on the economically important plant *B. papyrifera* shows the population structure illustratesthat natural regeneration is lacking in all two study areas. Additionally, the population of *Boswellia* in the study areas is unstable and under threat due to lack of recruitments through regeneration. Based on the stands structure analysis, it is hypothesized that lack of natural regeneration is primarily caused by livestock grazing pressure and the absence of recruitment is largely caused by lack of seed production by mother trees as the result of intensive tapping of the frankincense. Forest ecosystems have complex interrelationships that extraction of non-timber forest products (NTFPs) can seriously affect plant populations as negatively as timber harvesting.

KSNP is deteriorating due to a lack of integration and development cooperation between the Park and the surrounding local community as well as administration the minimal managerial and institutional capacity of the Park, minimal alternative livelihoods for the surrounding communities, inadequate commitment among all officials in taking the Park as an issue of development agenda, absence of legal procedures and understandings on expansion of large scale farms, unplanned and non-integrated land use systems, and a lack of appropriate outreach programs needed to change the attitudes of the surrounding communities.

Recommendation

The federal and regional government should pay attention to the park in the enhancement of local prosperity, to generates supplementary income and expands job opportunities as well as acting as a tool for the conservation of the natural environment. In addition to this, the local administration urgently should re-allocate farmers that had legal and illegal arable land inside the park.

Developmental activities should be put into practice. Wildlife management authorities should encourage ensuring that protected areas with elephants receive adequate patrolling, and that law enforcement staff are well housed, equipped, well trained and led, and adequately remunerated. Improve the extension services and training in awareness creation and knowledge development of the local community on the importance of biodiversity conservation, and the participation of local people in design, planning, implementation and evaluation should be encouraged.

To calm down the major threats of African elephant (habitat disturbance and illegal killing) involving a wide range of activities that is impossible for the management authority to carry out all conservation related functions by itself, there should be delegation of some duties and broad participation and cooperation from a spectrum of institutions. To ensure laws, coordination is required with the police, and perhaps with the military authorities as well as with the local government.

The current population status and threats to the species resulted from commercial extraction of the product without proper planning and management of the resource reveals that the commodity chain is unsustainable from the perspective of ensuring steady supply of the product. The assumption that NTFP extraction is less destructive than timber harvesting is unfounded in the case of frankincense in the study area. Sound knowledge of the resource base and regular monitoring is essential to check negative impacts posed to their source from commercial harvesting of NTFPs to take remedial actions in time.

Collaborative Park management is urgently required to rescue KSNP; agreement should be made from National to Woreda level stakeholders.

Compliance with ethical standards

Statement of informed consent

Oral informed consent was obtained from all individual participants included in the study.

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