Population status of Menelik's bush buck (*Tragelaphus scriptus* Menelik's) in Hawotu forest, West Arsi Zone, Ethiopia

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Abstract

Menelik's bush buck (*Tragelaphus scriptus* Menelik's) is among 12 endemic large animals found in Ethiopia. The present study was conducted to determine population status, age structure and identify major conservation challenge to the Menelik's bush buck in Hawotu forest. Data were collected from August, 2010 to February 2011 including wet and dry seasons. The study area was stratified in to three habitat type (Riverine, Natural Forest and Erica Forest) based on elevation and vegetation cover of the study area. Age structure and total counting of individuals were made along each transect. Data were collected by focus group discussion and questionnaire survey. Individual count was used to determine the current population size, seasonal distribution, and sex and age structure of Menelik's bush buck. The collected data was analyzed using descriptive statistics and compared with chi-square test. The average number of bush buck in the study area was 29 and 22 during the wet and dry season, respectively. There was no significant between the wet and dry seasons in the population size (x^2 =2.96, df =1, p> 0.05). Of the total observed, 37.3% male, 51% female and, 11.8% were young. There was no statistical difference between the number of males and females (x^2 = 0.34, df =4, p>005). The sex ratio of males to females was 1:1.36 during wet and dry seasons. There was no significant difference between the number of adult males and females (x^2= 0.1, df =2, p>0.05). The ratio of female to young was 1:4.33 and there was no significant different in the ratio observed during the wet and dry season (x^2=0.24, df=2, p>0.05). Major threats for Menelik's bush buck recorded in the study area were overgrazing, agricultural land expansion and human disturbance. Hence timely intervention is required to address these problems and conserving the population of Menelik's bush buck (*Tragelaphus scriptus* Menelik's).

Introduction

Ethiopia is a country of diverse altitudinal, physiographic and Biological features (EBI, 2014). The variation in the altitude of Ethiopia ranges from 110 m below sea level at Kobar sink in the Afar depression to the highest peak at Ras Dejen (4,620m asl) in the Simien Mountains (Yalden, 1983; IBC, 2008). It has very diverse climatic condition varying from hot and dry desert in the low land areas to cold and humid alpine habitats in the high lands. The high

lands of Ethiopia comprise the major part of conservation Internationals Eastern Afro mountain hot spot (Brooks *et al.,* 2004). The large extent of high land isolated from the rest of Africa and wide ranging climatic features have made Ethiopia the home of diversified fauna and flora (Yalden and Largen, 1992; Hillman, 1993). Out of the 284 mammalian species so far recorded from Ethiopia 31(11%) are endemic (Hillman, 1993). Many of these endemic animals are specifically associated with the altitude moorland and grass land habitats.

Bale Mountains are part of the eastern Afro-mountain hot spot of Ethiopia. This mountain harbors diverse endemic plant and animal taxa. The mountain contains species that are Ethiopian endemics, but there are also species that are found only in the Bale Mountains ranges. These mountain ranges are among the most important conservation area in the Ethiopia high lands that have also a very high international significance (IUCN, 2010). These mountains form the largest continuous area above 3000 m as l in Africa, supporting the most extensive Afro-alpine and sub- Afro alpine (Ericaceous) vegetation on the continent. According to Yalden *et al.* (1984) several races of bush bucks have been described and nine of these were accepted as valid subspecies. Among them, three sub species are believed to occur in

Ethiopia. The common bush buck *Tragelaphus scriptus* inhabits most of northern parts of the country including the Simien mountain and high lands extending as far as South as the Awash River Valley (Worku and Datiko, 2008). The Southern half of the country is mainly inhabited by the endemic subspecies *Tragelaphus scriptus* Menelik's bush buck. This species is found on the high lands of Bale, Arsi, Chercher, Western Shoa, Illubabor, Borena Saynt Worehimeno National Park and Mengasha Suba State Forest at altitude ranging between 2400m and 3440m. The third sub species *Tragelaphus scriptus fasciatus* is rare and is restricted to riverine forests of the south eastern parts of Ethiopia along the Wabishebelle River (Yalden *et al.,* 1984).

Menelik's bush buck is distinguished from other sub species by its long dark brown coat, the white spots on the tights. The presence of remarkable reddish brown pelage on the head region, black nose stripe and the imperfect white chevron of the pale dorsal markings (Kingdon, 1997). The current conservation status of Menelik's bush buck as designated by (IUCN, 2002) is endangered due to anthropogenic activities including live stoke grazing on natural habitat. So that the main cause of minimization number of threatened species is the conservation status and human

activities in the area. The main focus of this study was to determine the population status of Menelik's Bush buck (*Tragelaphus scriptus* Menelik's) and threat in regards within Hawotu Forest, West Arsi, Oromia, Ethiopia. Although tropical forests account for about 52 % of the global total forest and exhibit the highest diversities (Vanlalnunpuia et al 2021), less attention is given for fauna diversity in this system. In Ethiopia, limited research has been conducted on Menelik's bush buck. Specifically, there was no documented information on population

Materials and methods

Study Area

The study was conducted in Oromia region Adaba worada, Buchakebele in Hawotu forest. Hawotu forest is found at a distance of 355km from Addis Ababa and 166 km from Shashamane city. Hawotu forest is located at 6^0 55 ′06 ″ N to 6^0 58′ 00″ N latitude and 39^0 27′ 36″ E to 39^0 28′ 46″E longitude (Fig.1). The altitude ranges from 2950m to 3400m above sea level. The Bucha Kebele covers an area of 186.2 km^2 the boundary of Bucha Rayya district belongs to Koma Wettich district in
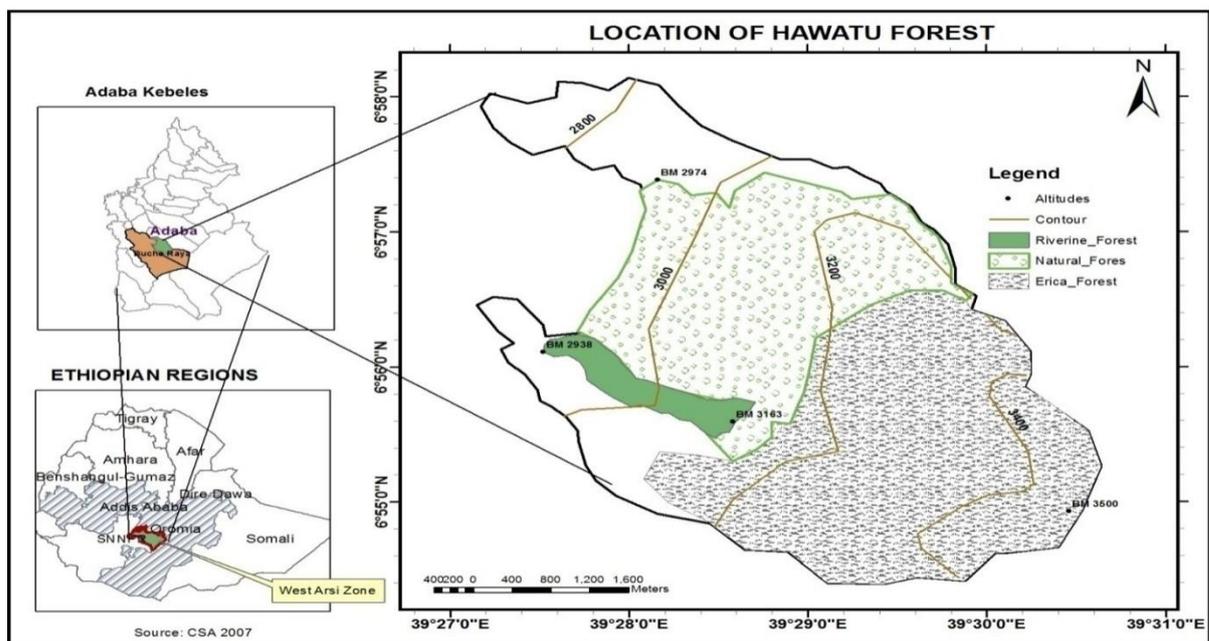

Figure 1. Location map of the study area.

status of Menelik's bush buck in Hawotu Forest. Hence, the current study is aimed at contributing to fill this gap by investigating basic ecological information on the study animal.

northern direction, Ejersa Chumulugo in Western direction, Baseta Bubbisa and Gama wallale district in south direction and Wegeharenna in east direction. The mean annual temperature of the Zone is

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found between 20-25 c in the low land and 10-15 c in the central high land. However, there is a slight variation of temperature by months. The study area is 1.5 km far from village and covers 25.5 km^2.

Data collection

A reconnaissance survey was conducted in July 2010 to collect basic information on topographic features, distribution and habitat of Menelik's bush buck, climate conditions, vegetation type and extent of the study area and to identify suitable sampling sites in Hawotu Forest. The present study was carried out during August 2010 - February 2011. The seasons were classified in to August-September (wet season) December- February 2011 (dry season). Direct field observation was made using binoculars and necked eyes depending on the distance between the observers and animals. Quantitative and qualitative data were collected on the population number, age structure, and threats following Buckland *et al.* (1993).

Establishing study area for population census

The preliminary survey study showed that the study area was heterogeneous in vegetation type and topography and classified in to three vegetation zones. These include Riverine Forest (RF), Erica

woodland (EWL), Natural Forest (NF). Classification of the study area was based on the habitat type. Censes zones were established in all three habitats following Buckland *et al*. (1993). Survey of Menelik's bush buck in the study area was on foot along a randomly selected transects lines. There were a total of twelve transect lines, which the number of transects among sample sites varied depending up on visibility (Norton-Griftith, 1978; Ndhlovu and Blakrishnan, 1991). The transect length of Erica woodland and Riverine were 1900 m and the transect length of Natural forest were 3200m. The width varied based on the visibility of each habitat type. As a result, in the natural forest (100 m), Erica wood and Riverine (80 m) transects width was used. The total length and the width of transects in each of the three habitat types were varied based on the habitat types. There was distance of 100m between two adjacent transects to avoid double counting. Four transects lines were established from each forest habitat in different study sites (Figure 2). Starting points of each transect were marked permanent colored markers. All habitats were surveyed at the same time and each habitat was counted by two individuals. Counting was carried out a day between 6 and 9 h in the morning. Each habitat was surveyed twice in a month for two months both during the dry (from

December to January) and the wet (from August to September) seasons according to (Brnesh *et al.,* 2015).

Figure 2. Establishment of transect line in Hawotu Forest (photo: Lema Mitiku, September, 2018).

During the transect survey, the number sex and age categories of the observed individuals were recorded. Body size, coat color and the presence or absence of horns were used to determine sex of individuals. Body size, horn size and shape were used to determine ages. Males are horned and dark-brown while females are hornless and light brown in color (Kingdom, 1997). Individuals were who were small in size recorded as young. Data on the status and potential threats of Menelik's bush buck were collected mainly through semi structured face-to-face questionnaire survey and field observations during the study period. To assess human activities around the study area, questionnaires were distributed to sample householders and interviews were conducted. Field observations were also made exhaustively along the study area to collect additional data and to verity information and compare responses gathered from the respondents

and interviewees on the status and threats of the species. Various human activities presumed to impact on Menelik's bush buck and its habitats were also recorded. This was intended to investigate the effects on encroachment by the local people and livestock on bush buck and their habitat in the forest, where the surrounding farmers are predominantly depended on subsistence farming and life stock rearing.

The questionnaire focused on demographic variables such as sex, age, educational level, occupation and years as residents in the respective villages as these entities can partially determines of local people towards community based forest area (Shibia, 2010). The questionnaires were administered to sample householders from three groups of community based forest members drawn by simple random sampling. A total 27 households (9 from each group) were randomly selected for the questionnaires survey. The selected samples represented 30 % of all households in the respective groups. Questions about population status, threats, time of the year when young were seen and the preferred habitat and vegetation were also raised.

Three trained research assistant were assigned to each group to administer and collect the data. The data collectors are members of community. One day training was given for assistance data collector

regarding the concept of each question in designed questionnaire and purpose of the study and principles of interview guide.

Data analysis

Data collected during the study period were analyzed using SPSS software for windows version 22. Descriptive statistics for analysis data and chi-square test (x^2) were used. Chi-square (x^2) was used to compare the population size of Menelik's bush bucks among the study sites and between the seasons. The sex ratio and age structure of Menelik's bush buck during wet and dry seasons computed using chi-square and descriptive statistics.

Results and discussion

Bush bucks' populations were distributed in to the three habitat types. The number of bush buck counted varied per habitat type. The highest (70. %) number was recorded in Riverine during both seasons and the lowest (3.9%) number was recorded in Erica forest area during both seasons. The comparative use of different habitat types by bush buck in the study area was indicated by the number of individuals observed in each habitat type. The Riverine was the most highly utilized habitat during both seasons and Natural forest the second habitat type utilized during wet and dry seasons. However, bush backs mostly did
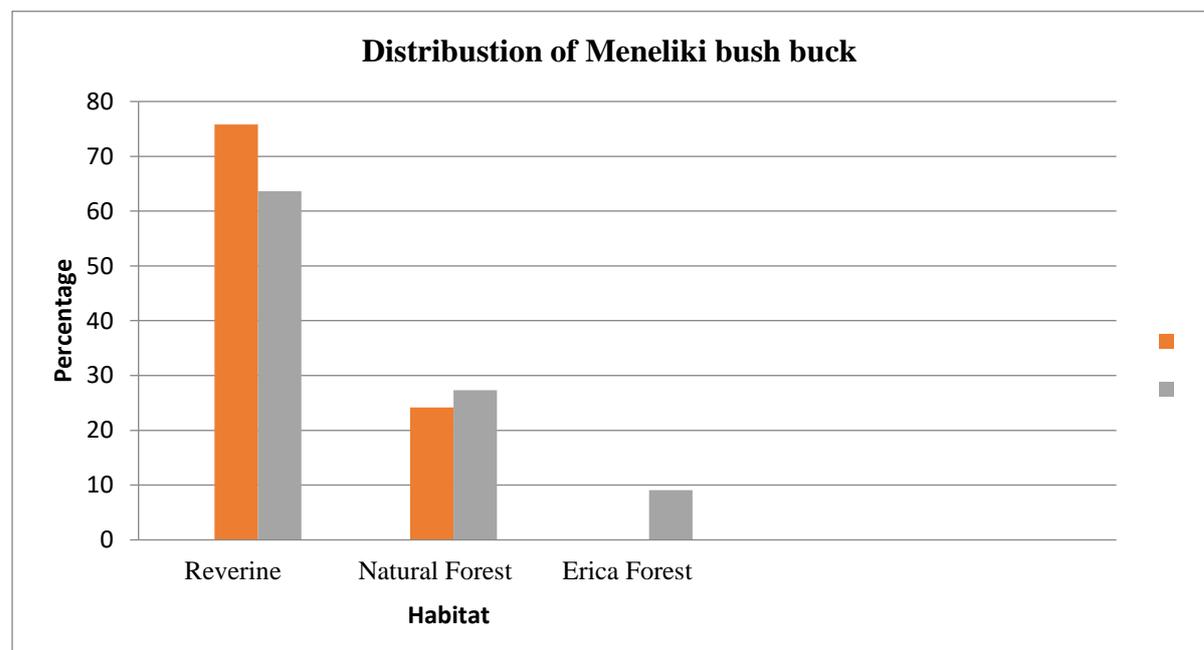

Figure 3. Habitat association of Menelik's bush buck observed in the study area across season.

not spend their time in Erica forest during wet seasons. The variation in the number of bush bucks observed in different habitats types was no statically significant ($x^2 = 0.19$, df=4, p > 0.05) (Figure 3).

The maximum number of bush buck recorded was 29 during the wet seasons and 22 during the dry seasons. The average number of individuals during wet and dry seasons was 25.5. The maximum average numbers of bush buck were recorded in Riverine forest and minimum average numbers of bush buck were recorded in Erica forest. There was no statistically significant difference (x^2=2.96, df =1, p>0.05) between wet and dry seasons population size among each study site. However, there was a slight increment of population size in the wet seasons as compared to the dry season (Table 1).

The age structure of total population was dominated by adults (Table 2). Out of 29 counted individuals of bush bucks, 15 adults, 10 sub adults and 4 young individuals were recorded during the wet seasons. During the dry seasons, 22 individuals of bush buck were recorded, 13 were adults, 7 sub adults and 2 young. Adult individuals were the first largest proportion in terms of their number and sub adults were the second proportion.

The young category showed the least proportion in terms of their number counted

during wet and dry seasons. Even through the population was characterized by more adult individuals, there was no statistically difference ($x^2 = 0.38$ df= 2, p >0.05) between the number of individuals and in each age category during both wet and dry seasons. The counted individual was categorized in to male, female and young. Out of the total number of Menelik bush buck counted during the present study period, 37.3 % males, 51 % were females and 11.8 % were young (Table 3). The numbers of females relatively higher than the other age groups in both seasons. There was no significant difference during wet and dry season(x^2 =0.34, df =4, p>0.05).

Table 3. Age and sex composition of Menelik's bush buck during wet and dry seasons.

Season	Number of Bush bucks observed		
	Male	Female	Young
Wet	11	14	4
Dry	8	12	2
Mean	9.5	13	3

The mean sex ratio of males to female was 1:1.36 during wet and dry seasons. There was no significant difference between the number of adult males and females ($\mathbf{x}^2 = 0.1$, df =2, p >0.05). Mean sex ratio of female to young was 1:0.23. There was no significant difference in the ratio observed during the wet and dry seasons($x^2 = 0.24$, df = 2, p >0.05). Out of the 27 respondents, 81.5 %

were male while 18.52% were female. Concerning the educational level of the respondents as shown in (Table 4). 6(22.2%) of respondents did not attended school. while 7(25.9%) learned grade 1-4, about 7 (25.9%) were grade 5-8, about 4(14.8%) were grade 9-10, about 2(7.4%) were grade 11-12 the remaining 1(3.7%) had a college diploma.

Table 4. Socio-demographic characteristics of thee sample respondents (n=27) in the study area

		Frequency	Percentage
Age	20-30	9	33.3
	31-40	4	14.8
	41-50	7	25.9
	51-60	5	18.52
	60 above	2	7.41
Sex	Male	22	81.5
	Female	5	18.52
Educational Status	Illiterate	6	22.2
	1-4	7	25.9
	5- 8	7	25.5
	9-10	4	14.8
	11-12	2	7.4
	college	1	3.7
Marital status	Single	8	29.6
	Divorce	1	3.7
	Married	18	66.7
	Widow	-	-
Family size	1-2	2	7.4
	3-4	10	37.04
	5-6	8	29.6
	above	7	25.9

Out of the total population covered by the study, the majorities 18 (66.7 %) married, about 8 (29.6%) were single, 1 (3.7 %) divorced. The proportion of family size of

the respondents were 2 (7.4 %) and 10 (37.04 %) having family size 1-2 and 3-4 respectively. From the total respondents only 8(29.6%) and 7(25.9%) has family size 5-6 and above 6 respectively. Survey conducted in three groups revealed population status of Menelik's bush buck in study area (Table 5) most respondents (88.9%) respond the Menelik's bush buck population has declined in number and area of distribution over the last 10 years in their locality. However, 3.7% of the responds remarked that the Menelik's bush buck populations have increased while 7.4% of respondents were not sure whether the populations of Menelik's bush buck increased or decreased.

As indicated in (Table 6), respondents were asked the major threats to the Menelik's bush buck in Hawotu forest. Out of the 32 respondents 40.7 % replied that over grazing, 22.3 % agricultural expansion, 29.6 % both grazing and agricultural expansion and 3.7 % both human disturbance and hunting were responded.

Table 1. Numbers of Menelik's bush buck were sighted in each study site.

Season	Riverine	Natural forest	Erica Forest	Total
Wet	22	7	0	29
Dry	14	6	2	22
Total	36	13	2	51
Mean	18	6.5	1	25.5

Table 2. Number of individual in each age categories in both seasons.

Age categories	Seasons		Mean	(%)
	Wet	Dry		
Adult	15	13	14	54
Sub-adult	10	7	8.5	33.3
Young	4	2	3	11.8
Total	29	22	22.5	100

Table 5. Feedback of respondents on the population status of the Menelik's bush buck in Hawotu Forest

Factor	Revinane	Natural Forest	Erica Forest	Frequency	(%)
Increase	1	0	0	1	3.7
Decrease	7	8	9	24	88.9
No change	0	0	0	0	0
No idea	1	1	0	2	7.4

Table 6. Respondents view on potential threats to Menelik's bush buck in study.

Factor	Revinane	Natural Forest	Erica Forest	Frequency	(%)
Agricultural expansion	3	2	1	6	22.3
overgrazing	4	3	4	11	40.7
both	2	2	4	8	29.6
Human disturbance	0	1	0	1	3.7
hunting	0	1	0	1	3.7

The average number of Menelik's bush buck was decreased from 29 (wet season) to 22 (dry season) in the studied area. This might be due to the presence of enough food during the wet season because the user groups hedge and provide fodder for their livestock in the study area, but less in the dry season which similar with (Brnesh *et al.,* 2015). The average number of Menelik's bush buck (*Tragelaphus scriptus* Menelik's*)* was decreased from 72 to 64 in Wof –Wash Forest. When food resource availability gets low, bush bucks often leave their original habitat in order to search for sufficient food resources. So, moving or traveling a long distance to find their food it there is high food availability. Though there was slight seasonal difference in their population size but, the seasonal variation of their status was not statically significant. During this study it was seen that some census zones had different number of individual animals than others. The variations in census zones might be due to habitat quality, influence of human activities and livestock distribution and availability of resource in the area. Habitat quality is associated with the palatability of the plant, height of the grass and less disturbance. During the study period Menelik's bush buck were observed in all the three habitat type but with different number of individuals.

Even though, the Menelik's bush buck were evenly distributed in the Hawotu Forest; it showed high preference for Riverine vegetation during both wet and dry seasons. Out of the total individuals of Menelik's bush buck observed in the wet season, 75.8% of the total population utilized Riverine habitat. In the same manner, 63.6% of the total population of Menelik's bush buck were used this habitat during the dry season. However, it is less distributed in Erica forest habitat. This type of habitat selection may be influenced by vegetation type, the presence of water, topographical features, predator avoidance and availability of food and other environmental factors among habitats and between seasons within each habitat. Regarding Menelik's bush buck distribution, the possible reason could be the Riverine vegetation was the main source of food, water and cover in both wet and dry seasons (Mamo *et al.,* 2010). The age structure of total population was dominated by more adults. But the number of sub–adults and young individuals counted during both seasons varies slightly. It indicated that Menelik's bush bucks are seasonal in their reproductive behavior, hence, there was no significant difference between each age category during both wet and dry seasons.

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The sex ratio and age distribution of individual mammals is necessarily for the evaluation of the viability of the animal species. These showed the structure and dynamics of the population (Allopp, 1978). Based on this understanding, the population dynamics allow for the protection and eventual survival of an animal species. The result of the present study revealed that the mean male to female sex ratio was 1:1, 36 and1:4, 37 during the wet and dry seasons, respectively. Females were dominant in the bush buck population which indicates that bush buck have a potential to increases in their number. The possible reason for variation in sex ratio may be largely due to increases in mortality of male because they are more prone to predation than females and less vigilant when engaged in social interactions or because their condition in poor due to permanent agonistic interaction with other males (Wronski *et al.,* 2006). Even if an equal sex ratio of animals at birth is assumed, there is an increased mortality in young male ungulates (Ndhlovu and Balakrishnana 1991). Their solitary nature towards forming small groups also enhances the vulnerability of males toward predators (Jacobsen, 1974). This is because males leave their mother after maturity, while females remain there to from a mother clan (Wronskiet al. 2006).

The explanation for male mortality is that sub-adult males are distributed often in less favorable habitat as the central core area is inhabited by territorial males (Wronski 2005). Moreover, illegal hunting by poachers mostly affects males which reduce the sex ratio. Local people remarked that number of human population increased for past 10 years in Hawotu Forest. Due to increasing human population, encroachment in to the wild life area increases and more lands adjacent to the wild life area is used for farming, which creates pressure on Menelik's bush buck populations. (Robinson and Bennett 2004) Explained, humans are commonly physically inseparable from natural systems due to the heavy dependence of local people on natural ecosystems for their subsistence living in most of tropical developing countries.

Livestock grazing in Hawotu Forest area is a common practice especially during the dry seasons the livestock are moved in to open area in the forest, where they are until the end of harvest (Stephens *et al.*, 2001). The major problem facing protected areas in Africa today is the increase of human settlements in adjacent lands and the unauthorized harvesting of resources from protected area (Newmark *et al.,* 1994; Muhammed and Elias 2021). As Sebsebe (1996) stated, increases in human

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population have significantly disturbed and eliminated Ethiopia's high land habitat due to expansion of high altitude agriculture, shifting cultivation, heather fires and overgrazing by livestock. Local people of study area occupied the land for different purposes. Cutting of trees for fuel wood construction of houses and fence, and timber production were commonly observed practices of local communities in the study area.

Conclusions

The present study has revealed information on the distribution, population status, habitat utilization and threats to Menelik's bush bucks in Hawotu Forest. Distribution of species depends mainly on the presence of enough cover that ensures the species with protection against lives stock grazing and deforestation. The presences of less young in the Menelik's bush buck population indicate that less reproductive potential and sustainability of species in the study area. The study has clearly indicated that livestock abundance has negative impacts on the population status of population of Menelik's bush buck both in dry and wet season. Due to the ongoing intensive human activities in the forest, population status of the bush buck is declining. Human associated disturbances in the habitat such as livestock grazing,

deforestation and agricultural expansion are factors threaten the survival of the species in the study area. The overall status of the current population of Menelik's appears to be immediate threat in the study area. There are many conservation problems that bushbuck could affect the species in this area. The threats include human induced habitat loss and degradation through deforestation, livestock grazing, encroachment and environmental degradation.

Conflict of interests

The authors declare that they have no competing interests.

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