International Journal of Agricultural and Life Sciences- IJALS (2016), Volume 2 (4) pp.80-86
http://dx.doi.org/10.22573/spg.ijals.016.s12200070

Available online at http://www.skyfox.co
ISSN: 2454-6127

RESEARCH ARTICLE

Assessment of large mammals potential in Tululujia Wildlife Reserve, Southwestern Ethiopia

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Received: Nov 2016 / Accepted: Nov 2016/ Published: Dec 2016

ABSTRACT: Ethiopia is among the world best biodiversity area in terms of richness and endemism of mammalian species. Although, the mammalian fauna is deteriorating rapidly, no comprehensive assessment and documentation including endemic fauna exists until now. This study was carried out to assess the population size, distribution, density of large mammals and threat, between June 2014 and February 2015 in Tululujia Wildlife Reserve. The study was conducted by stratification of the study area into natural forest and wooded grassland. The transect line sampling method that was laid in random fashion in each habitat types was used. Direct count method along sample transect lines was conducted to assess population size and distribution of mammals. And direct site observation and key informant interview. The totals of 19 species of large mammals were recorded in the study area. Mammalian composition and abundance varied in different habitats and seasons. Mammalian distribution was significantly higher in forest than wooded grassland. It was also higher during dry season than wet season. The Wild pig, Warthog and Colubus monkey, Vervet monkey, Chino monkey were commonly observed mammals, while African elephant and Leopard were the least frequently observed species. Poaching, encroachment by agricultural, and settlements and deforestation observed in the areas, causing enormous pressure on the flora and fauna. The area needs immediate measures like better protection for the conservation of mammalian diversity of this area on long run.
Keywords: Density, distribution, mammal, population size, Tululujia Wildlife Reserve, Ethiopia.

INTRODUCTION

Ethiopia is often known as 'the roof of Africa' due to its mountainous nature. It is endowed with extensive and unique environmental conditions, ranging from Ras Dejen at altitude of 4620-m.a.s.l to Dallol, 100 m.b.s.l at Kobar sink in Afar depressions (Tekalign, 2006).The wide variety of habitats in Ethiopia, ranging from arid desert, open grassland, and semi-arid savannas to highland diversity of cultures and ecology is further reflecting by forests and Afro-alpine moorlands, supports an exceptionally diverse fauna and flora. Ethiopia's uneven topography and the varied climatic conditions have endowed it with impressive wildlife species of Africa. Ethiopia is the home to various endemic, endangered, vulnerable and rare species (Mamo et al., 2012). The diversity of fauna and flora. Ethiopia is the home of biological diversity with high endemism (Tefera, 2011). Ethiopia is among the world best biodiversity area in terms of richness and endemism of mammalian species. Ethiopia and Tanzania are among the top 25 endemic rich countries of the world in terms of higher vertebrate species whereas Ethiopia, Kenya, Uganda and Tanzania are individually among the world leaders in terms of richness and endemic of mammals (Tefera, 2011). In Ethiopia 40 protected areas (national parks ,sanctuaries, wildlife reserves and an enclosures) cover roughly 16.4% of the country's geographic area (186000 km2). Those areas face many challenge due to growing population, borders conflict and drought (Tefera, 2011). Mammals are often the first taxa to be listed for a site. Ethiopia does contain largest concentration of large mammals within the national parks. However, complete inventory does not exist and endemism not well illustrated the species diversity for better management of biodiversity. The study of the species richness, endemism and rarity across geographical areas is essential to select the best places for conserving biodiversity (Tefera, 2011). Southern Nation Nationality and People Regional State (SNNPRS) is one of the nine national, regional states of Ethiopia. The region is uniquely endowed with diverse natural and cultural resources. The region has seven national parks; two of them governed by federal government, six Wildlife Reserve; of which two of them are functional and one is a sanctuary (Ademasu et al., 2012). Tululujia Wildlife Reserve is one of existing Reserve of Bench Magi Zone. No conservation activity has been done till 2011 accordingly wildlife abundance decreasing due to resettlement and agricultural expansion. It is essential conducting the assessment of mammalian potentials of Tululujia Wildlife Reserve to take any conservation measure in the area (Ademasu et al., 2012). Therefore, this study is relevant to filling the gap large mammalian potential information of the area for conservation measure and any management action. This study assesses the mammalian wealth of Tululujia Wildlife Reserve by (1) assessing population size and distribution pattern of mammals; (2) density of mammalian species, and (3) identify the threats to the Tululujia Wildlife Reserve.

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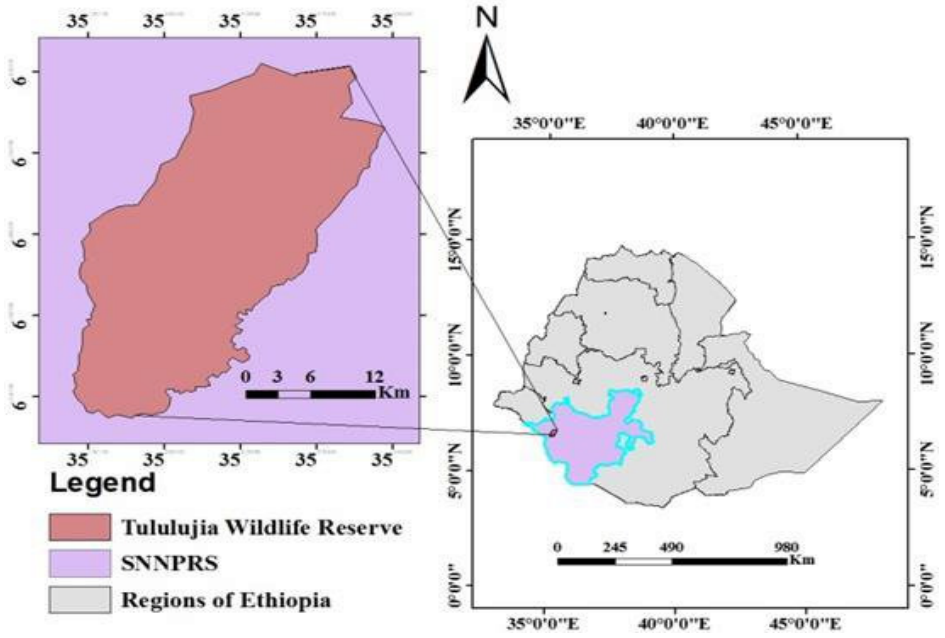

MATERIALS AND METHODS

DESCRIPTION OF THE STUDY AREA

The study area is located in the Southern Nation Nationality Peoples Regional State of Bench Magi Zone, particularly in Guraferda district, at about 606 and 45 km away from Addis Ababa and Mizan Teferi town respectively (Figure 1). It is located between 6°49'33" and 6°58'06"N latitude and 35°07'03" and 35°25' 02" E longitude (Menberu, 2011; GDAO, 2010). The altitudinal ranging from 900 to 2000 m.a.s.l characterizes the area (Denu, 2006). Tululujia Wildlife Reserve is cover about 578.5 km2area, bordered by Kuji, Otuwa and Biftu kebeles of Gurafered district to the north west, Bero district to the south, Gambela region to south west, Minitshasha and Debub Bench district to the east and north east respectively (Ademasu et al., 2012). The annual rainfall ranges from 1601 to 2000 mm (mean about 1332 mm) and temperature 20 to 29°C (GDAO, 2010; Menberu, 2011).

METHODOLOGY

STUDY PERIOD

The study was conducted between June 2014 and February 2015. It was carried out in two seasons; dry (December to February 2014) and wet seasons (June to August, 2015). During preliminary study, the accessibility, topography, infrastructures, mammalian occupancy of the study area and habitat stratification based on land cover feature (wooded grass land and natural forest habitat types) were collected.

SAMPLING DESIGN AND SAMPLING TECHNIQUES

The inventory was conducted stratifying the study area in to different habitats type; Natural forest and wooded grassland based on land cover features (Mamo et al., 2012; Girma et al, 2012). Survey was carried out by dividing the study area into different sample transects or censes zones in the two-habitat types of study area. Transect lines were placed on the stratified habitat types in a random fashion and proportional to an area of the habitat type (Varman and Sukumar, 1995). The adjacent transects were at least 1500 m apart and all transect lines were roughly parallel to each other and their ends were not less than 1000 m far from the habitat edge (Regassa and Yirga, 2013). The average transect width was 100 m in natural forest and 400 m in wooded grassland habitat types (that is, 50 m in natural forest and 200 m in wooded grassland from both left and right side of transect) of the study area (Bibby et al., 1998; Girma et al., 2012). The transect length was measured and located in the study area with help of global positioning system (GPS). The sample transect was covered 20% (116 km2) of the study area (578.5 km2). Which were 50.5 and 65.5 km2 natural forests and wooded grassland habitat respectively covered sample area. The mammalian species were counted by surveying along transect following direct sighting method.

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DATA COLLECTION

Direct count method used along selected sample transects, is effective method to determine population size and its distribution of the species for mobile and has variable group sizes across the season (Beehner et al., 2006). Mammalians population was counted by direct observation along the sample transect simultaneously to avoid double counting. The sample count was conducted at the time that mammals became active, during morning hours (6:00 to 10:00am) and afternoon (2:00 to 7:00 pm) (IUCN-ASG, 2008; Tekalign and Bekele, 2011). The distribution of mammals was assessed by via ground survey in each habitat type during wet and dry seasons. During the study period, silent detection method was practiced to minimize disturbances and moved along transect on foot; carful detection and count of mammalian was made with the help of binocular. This study was also supplemented with key informal interview and direct site observation to assess the threat of the area (Abu, 2011). The following formula as adopted by Ayalew (2009) and Regassa and Yirga (2013) was used to calculate the population density and estimated population size of mammals:

Density=Numbers of individual in the area / Total area (1)

Data analysis

After data collected, it was analyzed by using statistical package for social science (SPSS) version 20. One-way ANOVA was used to compare the variation mammalian population distribution in the two habitats type and during wet and dry seasons with 95% confidence intervals. The individual mammal's density as per squared kilometer calculated by Microsoft office excels 2007 based on the above formula.

RESULTS

POPULATION SIZE AND DISTRIBUTION OF LARGE MAMMALS

The 19 species of wild mammals were recorded and identified during the study area (Table 1). The most frequently sighted species were Wild pig, Warthog, Colubus monkey and Vervet monkey in descending order. Seasonally variations of species composition and abundance of large wild mammals were observed in different habitats. The highest number of species was recorded in the natural forest during the dry season (Table 1). Natural forest and wooded grassland habitats had also considerably highest number of species during wet seasons; while wooded grassland habitat had lowest species number during dry season. The highest numbers of individual's mammals' number were recorded in natural forest habitat during dry season and the lowest was recorded in wood grassland habitat during dry season (Table1). The mean number of mammas abundance in forest habitat type was the highest during dry season (191 individuals); while the lowest during dry season in wooded grassland (45 individuals) (Table 1). This finding was showed as five near threatened and one threatened species were existed, namely lesser kudu, Greater kudu, Waterbuck, Buffalo and Bushbuck are near threatened species and African elephant are threatened species. Therefore, this study will act as baseline information to study activity pattern, reasons of migration and habitat preferences of African elephant, lesser kudu, Greater kudu and Buffalo. The distributions of

Table 1. The population size and distribution of mammals.

S/N	Common name	The abundance mammals during wet season		The abundance of mammals during dry season		Population size of mammals in the area
		Wooded grassland habitat	Forest habitat	Wooded grassland habitat	Forest habitat	
1	Colubus monkey	66	172	41	266	545
2	Olive baboon	46	91	94	106	337
3	Spotted Hyena	0	9	0	34	43
4	Wild pig	123	401	92	428	1044
5	Porcupine	20	29	48	56	153
6	African Elephant	8	9	6	4	27
7	Chino monkey	46	102	7	199	354
8	Vervet monkey	90	47	85	187	409
9	Common Jackal	27	11	45	25	108
10	Dikdik	46	107	31	84	268
11	Greater kudu	51	72	46	43	212
12	Warthog	162	289	164	246	861
13	Buffalo	45	12	42	15	114
14	Lesser kudu	81	112	67	98	358
15	Civet cat	48	0	0	12	60
16	Leopard	5	14	8	6	33
17	Dicker	85	61	65	44	255
18	Bushbuck	61	47	0	38	146
19	waterbuck	0	42	12	22	76
	Mean	53.15	85.6	45.3	100.26	540.3

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large mammals were not evenly distributed in different seasons and habitat type. The distributions of mammals were statistically significant different between forest and wooded grassland ($p<0.05$). The distribution of mammals in forest was higher than wooded grassland habitat type in a relation with mean numbers of mammals (that is, 186 and 99 mean numbers of mammals in forest and wooded grassland habitats respectively) (Figure 2). The distributions of mammals were not statistically significant different between wet and dry seasons ($p>0.05$). However, the distribution of mammals during dry season was considerably higher than wet season based on mean number of mammals (Figure 2).

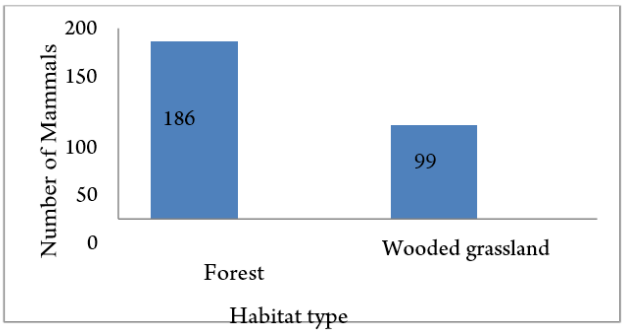

Figure 2. Mammalian distribution in forest and wooded grassland habitats based on mean.

DENSITY OF MAMMALS

This study was showed that high relative density of species was recorded in the forest during the dry season. The individual's density of large wild mammals recorded during the dry season was higher than the density during the wet season (Table 2). The Wild pig had the highest relative density as compared with other mammals, while Warthog and Colubus monkey the succeeding ranked as highest mammalian density in the study area (Table 2).

THREATS POACHING

Shooting of game animals are the major problem in the study area. During the study period, several carcasses of mammals were observed in this study area. Nineteen different mammals' carcasses were observed. As the local people were indicated that Buffalo, Waterbuck, Warthogs, African elephants, lesser and Greater kudu were killed by people living adjacent to this conservation area frequently for their trophy. Different body parts of mammals: skin, fresh and dry meat, horns and tail hairs were observed commonly during study period. Most poaching activities were takes place in the dry season when the people are free from agricultural activities and were engaged to collect honey. It showed as illegal hunting of large mammals was there frequently in this study area. This results to local extinction and migration of animals. Which is clearly viewed on the species of African elephant, Buffalo, Lesser and Greater kudu and Water buck.

Table 2. Density of mammals.

S/N	Local name	Density mammals during wet season		Density mammals during dry season		Density in the area
		Wooded grassland habitat	Forest habitat	Wooded grassland habitat	Forest habitat	
1	Colubus monkey	1.01	3.43	0.63	5.27	4.69
2	Olive baboon	0.7	1.82	1.43	2.1	2.9
3	Spotted Hyena	0	0.18	0	0.68	0.37
4	Wild pig	1.88	8.0	1.4	8.48	9
5	Porcupine	0.31	0.58	0.73	1.12	1.32
6	African Elephant	0.12	0.18	0.09	0.08	0.23
7	Cheno monkey	0.70	2.04	0.11	3.94	3.05
8	Vervet monkey	1.37	0.94	1.29	3.70	3.52
9	Common Jackal	0.41	0.22	0.69	0.49	0.93
10	Dikdik	0.70	2.14	0.47	1.66	2.31
11	Greater kudu	0.78	1.44	0.70	0.85	1.83
12	Warthog	2.47	5.77	2.5	4.87	7.42
13	Buffalo	0.69	0.24	0.64	0.29	0.98
14	Lesser kudu	1.23	2.24	1.02	1.94	3.08
15	Civet cat	0.7	0	0	0.24	0.51
16	Leopard	0.07	0.28	0.12	0.12	0.28
17	Dicker	1.29	1.22	0.99	0.87	2.19
18	Bush backs	0.93	0.94	0	0.75	1.26
19	Waterbuck	0	0.84	0.18	0.43	0.66
Total		15.39	32.47	13.0	37.9	

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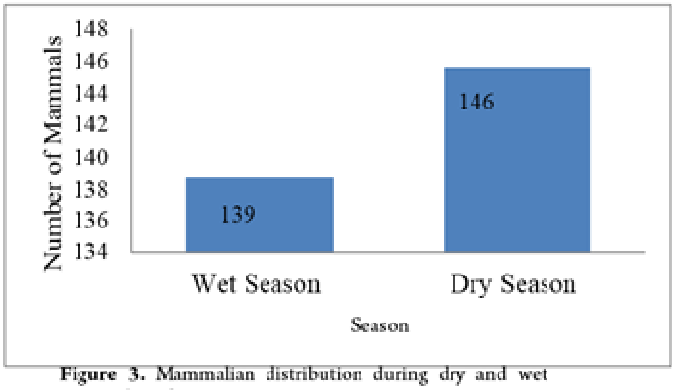

Figure 3. Mammalian distribution during dry and wet seasons based on mean.

AGRICULTURAL ENCROACHMENT

In the Tululujia Wildlife Reserve, agricultural expansion by different investors and deforestation of tree for agricultural land round / border apparent reduction of wild animal's potential. There is also settlement of local community around the conservation area was one cause of human wildlife conflict and wildlife migration due to human disturbance. However, the intensity of illegal settlement problem was severely encountered in the district, but not as similar as that Wildlife Reserve which was moderate level. Honey harvesting activities by local people in Reserve was cause of wildfire in wooded grassland habitat. The same sites are the most important feeding and refuge areas for large animals like African elephants, lesser kudu, Greater kudu and Buffaloes. Therefore this human activity was also other cause human wildlife conflict and habitat distraction.

DISCUSSION

The 19 of species of large mammals were identified in the study area, which can be compared with similar studies in different parts of Ethiopia that have used similar transect techniques. According to Girma et al. (2011) take an example, in and around Wondo Genet forest patch19 species of large mammals are identified which is similar with this study. Where as in Simien mammals during assessment, but buffalo is due to high Mountains National Park (SMNP) 12 species of large level human disturbance particularly illegal killing for mammals are identified, which is similar with this study. Where as in Simien Mountains National Park (SMNP) 12 species of large mammals are identified, 25 species is found in the Harena forest and also 21 species is identified in Chilalo Glama Forest Priority Area. According to Admasu et al (2012) is recorded at about 9 species of large mammals in Tululujia Wildlife Reserve. This study was recorded 19 species of mammals which was considerably difference from Admasu et al. (2012) in terms of individual number and mammalian species diversity in Tululujia Wildlife Reserve. The mammas abundance in forest habitat type was the highest during dry whereas the lowest was in wooded grassland during dry season as compared to wet season distribution. The possible explanations for this could be sever ant bite and human disturbance were occurred more during the wet season than dry season, particularly in the forest habitat. In addition, human activities including agricultural activities were often high during the wet season; those were contributed to limiting the sight of mammals. Furthermore, the excessive rain during wet season, which obviously boost up regeneration and growth of herbaceous and ground vegetation might have provided thick cover for the animals, which makes sighting of them difficult. According to Girma et al. (2011) the excessive rain during wet season can be attributed to poor viewing of animals due to vegetation outgrowth which is similar with this study. This finding was showed as five near threatened and one threatened species were existed. This indicated how the area is important in terms of keeping unique world biodiversity. However, the illusive and shy behaviors of the animal, human disturbances (poaching, wood collection, fire caused by especially Surma people deliberately burn grass, investment expansion etc.) and ant biting wild in the area might have contributed not direct sighting of the animal and lowering in population numbers of the species. Moreover, the species were observed to migrate to other forest area of Gambella region.

The distributions of large mammals were not evenly distributed in different seasons and habitat type. Mammalian distribution was based on the availability of food, shelter, water and the distance from humans. Different animals have different food and habitat preference, therefore their distribution varies of mammals across the habitat types. The distribution of African elephant was low as compared to other large wild mammals this was due to migration of elephant caused by high-level human disturbance in their habitat of African Elephant and illegal hunting of elephant for the ivory in the study area may be the possible reason. In addition to those Leopard, Spotted hyena, Civet cat, Waterbuck, Common jackal and Buffalo also have low distribution in mammals during assessment, but buffalo is due to high level human disturbance particularly illegal killing for trophy and high habitat destruction. Wild pig and Warthog were

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relatively high distribution in Tulululjia Wildlife Reserve. The density of large wild mammals recorded during the dry season was higher than the density during the wet season. The density variation was due to availability of food and low density of predator as well as tolerance of anthropogenic effect for these animals. This study is similar with (Abu, 2011) finding; the densities of mammals were related to food quality and availability. African elephant had the lowest density in the study area. If not conservation measure has taken African elephant may be locally extinct due to illegal hunting for trophy.

CONCLUSION

This study reveals that, 19 species of large mammals were inhabited in Tulululjia Wildlife Reserve. The distribution and composition of species of mammal varies in different seasons and across the habitat type in study area. The abundance of mammals in forest habitat was higher than wooded grassland habitat type; therefore the distribution of mammals in forest was considerably higher, than wooded grassland habitat type in the study area. The distribution of mammals in the study area during dry season was higher than wet season. The Wild pig, Warthog and Colubus monkey had the highest relative density in descending order hence, those species was densely populated in the study area while African elephant was rarely observed species in Tulululjia Wildlife Reserve.

Apart from the importance Tulululjia Wildlife Reserve; poaching, agricultural encroachments especially by investor, deforestation, illegal settlement and human wildlife conflict were evidently observed in the areas, putting an enormous strain on the flora and fauna. Therefore, the need of urgent conservation measures to save this conservation area.

ACKNOWLEDGMENT

The author would like convey his gratitude to Bench Magi Zone culture and tourism office for their support of all his research work without hesitation. He would like to say thanks to Guraferda district Administration office and police station for order of security personnel to help during the study period. They would like to express the heart full thanks to Guraferda district culture and tourism.

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How to cite this article
Belete, T., & Melese, M. (2016). Assessment of large mammals potential in Tulululjia Wildlife Reserve, Southwestern Ethiopia. *International Journal of Agricultural and Life Sciences*, 2(4), 80-86. doi: 10.22573/spg.ijals.016.s12200070.

CONFLICTS OF INTEREST
"The authors declare no conflict of interest".