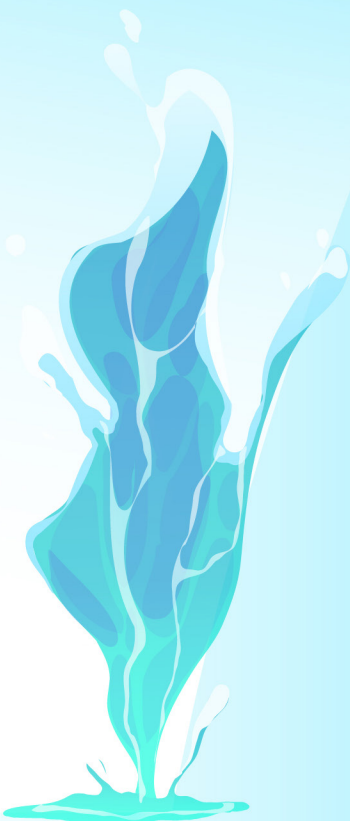




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Survey and Documentation of Mammal Wildlife Resource and Constraints in Somali Regional State of Ethiopia

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ABSTRACT

This study aimed to assess the diversity and abundance of mammal species in the Somali Regional state of Ethiopia, identify key threats, and document habitat preferences and distribution patterns. Three agro-ecological zones (Tepid to Cool Moist Plain, Hot Arid Lowland, and Warm Moist Lowland), covering approximately 83.95% (31.47 million ha) of the region, were purposively selected. Within each zone, three woredas were chosen, and in each woreda, three distinct habitat patches were identified based on vegetation structure and topography, yielding a total of 27 study sites. A descriptive research design was employed, utilizing key informant interviews (KIIs) and focus group discussions (FGDs). Findings indicate a declining trend in wild mammal populations, particularly antelope species such as the Lesser Kudu and Oryx, as well as carnivores like lions. Major threats include human settlement expansion, habitat degradation, recurrent droughts, and illegal hunting. The study recommends expanding protected areas, restoring habitats, and establishing community-based conservation initiatives. Emphasis is placed on integrating traditional ecological knowledge and promoting sustainable land-use practices. It also highlights the need for continued research, capacity building, education, and the development of supportive policies and legal frameworks for wildlife conservation.

INTRODUCTION

According to Ethiopian Wildlife Conservation Authority, it is recorded 240 species of mammals and 845 species of birds, of which 22 species mammals and 24 species of birds are endemic, six reptiles and 33 amphibians are also known to be restricted in Ethiopia (MoAWLCA, 1997). In the Somali region the wildlife habitat is due to unnecessary killing, deforestation, expansion of settlement and agricultural practices. The term wildlife applies correctly to both plants and animals in East Africa however it has come to imply particularly the wild fauna (Rashid, 1996). In the Somali Region, there are a number of mammals, birds, reptiles, amphibians, fish, and invertebrates uniquely adapted to the arid and semi-arid conditions. The most ferocious wild animals are Lion, Hyena, Leopard, Fox, Hunting dog, crocodile, various types of Snacks and Cobra while usually hunted wild animals are ORIX gazellabeisa (Bicoid), *Tragelaphus Scriptus* (Balanqo), *Tragelaphus imberis* (Goodir), *Tragelaphus stresiceros* (Qombor), *Gazella* species (Cowl-daba-cad), *Ammordracas clarkei* (Dabataag) and *litocranius walleri* (Garanuug), Other predominant wild animals are Zebra, Hare, Giraffe, Baboon, Hippopotamus, Ostrich, Monkey and Elephant (Ahmed, 1999). There are also a number of birds known only in the Somali Region which are restricted to the Somali-Masai biome, particularly along the four rivers of the region which are Wabi Shabelle, Ganaale, Weeyb and Daawo rivers, the last three rivers join at Doolow and make Jubbba river. Only two sites between Boqolmaanyo-Doolow and Lower Wabi-Shabelle to Wardheer are found to host 47 species relatively uncommon elsewhere in Ethiopia. The following bird species are restricted to survive in

the Somali-Masai biome and are little known to the rest of Ethiopia. These includes little Brown Bustard, White-winged Dove, Short-billed Crombec, Somali Bee-eater, Short-tailed Lark, Chestnut-headed Sparrow Lark, Hauglin's Bustard, Somali weatears, Hunter's Sunbird, Smaller Back Billied Sunbird Golden palm weaver, Somali Sparrow, parrot-billed Sparrow, Magpie Starling, Masked Lark, Collared Lark, Golden pipit, Monogolian plover, Violet-tipped Courser, Scaly Babbler, Jubbaland weaver and water thick-knee (Ahmed, 1999). The Somali Region in Ethiopia is a unique and diverse ecosystem that is home to a wide range of wildlife species, particularly mammals. However, there is limited scientific research and documentation on the wildlife resource-base as well as constraints faced by these species in this region. This research project therefore aimed to conduct a preliminary survey and documentation of the wildlife resource-base and constraints in order to inform future conservation efforts and management strategies. Thus, this piece of writings proposes a comprehensive research plan to document and survey mammal species in the Somali Region for it aims to address the lack of extensive scientific studies on the wildlife resources and constraints faced by these species. The research's objectives include assessing the diversity and abundance of mammal species, identifying threats and constraints faced, documenting distribution and habitat preferences, and providing recommendations for conservation strategies.

LITERATURE REVIEW

Biodiversity of Ethiopian Wildlife

Ethiopia is home to a rich variety of wildlife, with an estimated 240 species of mammals and 845 species of

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birds, including 22 endemic mammal species and 24 endemic bird species (MoAWLCA, 1997). This diversity is attributed to the country's varied topography and ecological zones. Within this context, the Somali Region contributes uniquely to Ethiopia's biodiversity through its arid and semi-arid ecosystems, which harbor species well adapted to harsh climatic conditions (Ahmed, 1999).

Wildlife of the Somali Region

The Somali Region features diverse fauna, including large mammals such as lions, hyenas, leopards, and elephants, as well as antelopes like the Oryx and Lesser kudu. Several bird species, such as the Somali Bee-eater and Jubbaland Weaver, are endemic to the Somali–Masai biome, particularly along major rivers like the Wabi Shabelle and the Jubba system (Ahmed, 1999). These species rely on fragile ecosystems increasingly threatened by human encroachment and resource competition.

Threats to Wildlife and Habitat

Multiple studies confirm that anthropogenic pressures—such as illegal hunting, deforestation, agricultural expansion, and charcoal production, are the leading threats to wildlife in Ethiopia (Tefera, 2011; Effiom *et al.*, 2013). Similar trends have been reported in the Somali Region, where population pressure and unsustainable resource use have led to habitat degradation and declining wildlife numbers.

Traditional Ecological Knowledge and Local Use

The role of local communities in wildlife utilization is complex. In Somali culture, wildlife has traditionally been used for food, medicine, and cultural practices.

However, limited awareness of conservation and lack of documented traditional knowledge hinder sustainable practices (Ahmed, 1999; Rashid, 1996). Engagement with communities is thus vital for successful conservation.

Conservation Gaps in Policy and Practice

Ethiopia's wildlife conservation strategies have historically focused on highland areas and national parks, leaving arid lowlands like the Somali Region underrepresented (MoAWLCA, 1997). The absence of protected areas, inadequate enforcement, and lack of ecological data are major challenges impeding wildlife management in these regions.

Survey Techniques and Ecological Metrics

Modern wildlife surveys use both direct (visual counts, transects) and indirect methods (footprints, scat analysis) to assess population status (Ogutu *et al.*, 2006; Krebs, 2006). Biodiversity indices like Shannon-Weaver and Simpson's Index are commonly used to quantify species richness and distribution (Shannon & Weaver, 1949). These methods are effective in characterizing ecosystems, especially in difficult terrains such as the Somali Region.

Human-Wildlife Conflict and Conservation Strategies

As in many pastoral regions of Africa, human-wildlife conflict is common in the Somali Region, particularly involving large carnivores like lions. Conflict often leads to retaliatory killings, further endangering these species (Tefera, 2011). Studies recommend integrated conflict mitigation strategies, including community-based conservation and education (Haugaasen & Peres, 2005).

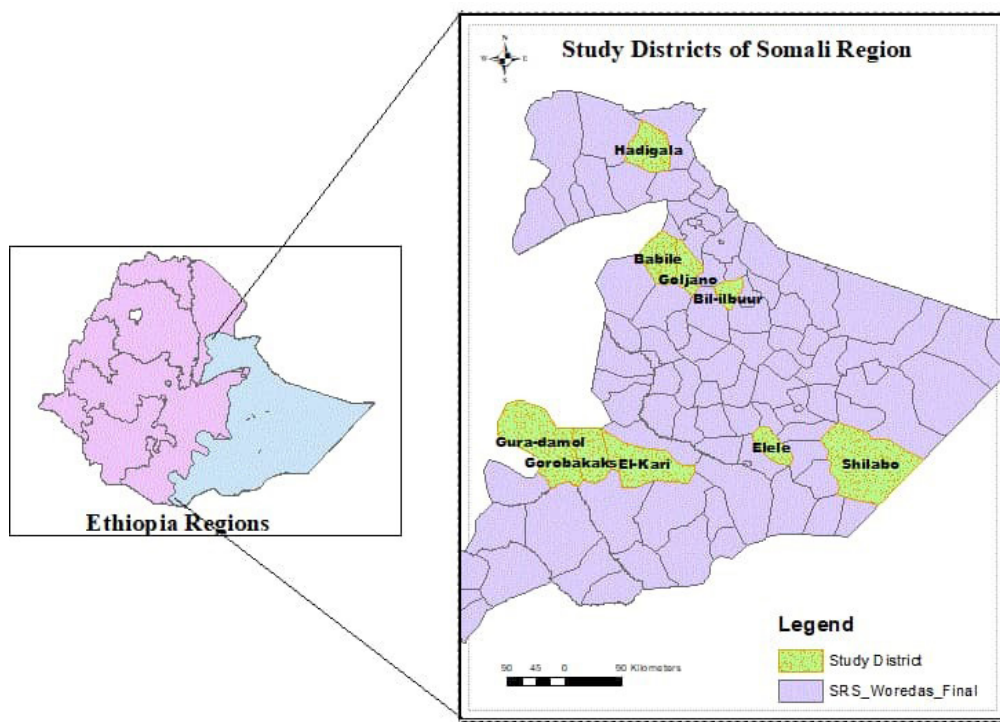


Figure 1: Map of intervention districts (Sampling locations in SRS)

MATERIALS AND METHODS

Description of Study Area

The Somali region, located between 7°26'19"N and 44°17'49"E) is found in the South-east of Ethiopia. Two areas (Garaale and Babile) were designated by as protected area. A climatic data for the study areas of ten consecutive years was obtained (ENMA, 2022). The study areas rainfall distribution, a long rainy season from June to September and a dry season from November to February in the semi-arid areas and short rainy (Deyr) season from October to December and long rainy season (Gu) from April to June in Dry arid Ogaden areas. The average mean monthly maximum temperature is above 27°C, and the average mean monthly minimum temperature is 15°C.

The average mean monthly rainfall of the areas varies between <500mm (December) and 1,200mm (July).

Sampling procedure and sample size

In this study three Agro-ecological zones (namely; Tepid to cool moist plain, Hot arid lowland, and Warm moist lowland) were selected purposively, which comprise 83.95% (31,474,039.9 ha.) of area coverage of Somali region. Each Agro-ecological Zones three Woredas were selected purposively, and each Woredas, three patches of habitats based on the vegetation structures and topography of the landscapes were purposively selected (i.e., 3 AEZs * 3 Woredas * 3 Habitats).

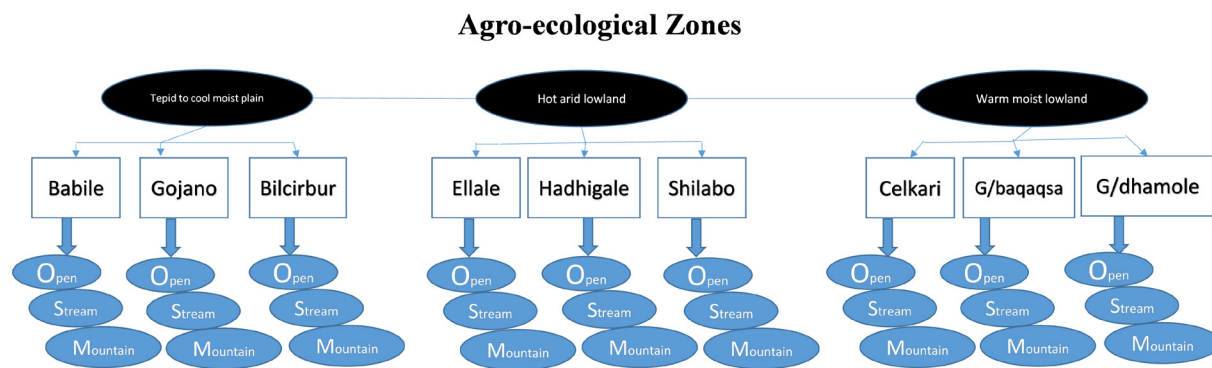


Figure 2: Agro ecological Zones of the study area

This study was based on the smallest administrative units, sub-villages, as sampling units in the hierarchy of the general administrative structure of the FDRE. Based on geographical positions (nearness) two different sites were selected as a target study area. Altogether, 90 respondents were selected for key informant interviews from each target sub-village (Table 1). Both qualitative and quantitative methods were employed to dig out historic and current information on wildlife, and human-wildlife interactions, and communities' attitudes towards wildlife. Close ended and open-ended questions were used to find out the current subjective population status of specific species, general wildlife population trends, and population trends based on carnivore and herbivore broad categories. A total of eighteen focus group discussions were held in the study areas (both sites in each district), one FGD in each sub-villages consisting of 8-16 members each. FGDs consisted of youths and elders, mostly males, with the exception of some with few numbers of female participants, to get agreed upon truths

about current and past social, ecological, and economic facts were conducted.

Data Collection Method

Apart the above a survey was conducted in 27 habitats from nine sampled woredas for eighteen consecutive days excluding travel and other business days covering a total distance of 600kms in field survey i.e. 22.2km for each selected habitat, when the activities of mammals are more active: early morning from 6:00 to 10:00 and from 16:00 to 19:00 (Legese *et al.*, 2019). During data collection, the observers was walking on foot along the road counts established and directly count all the individuals sighted with their respective species using unaided eyes and binocular. The presence of mammalian species was also detected based on sign marks, including footprints, faecal droppings, vocalizations and scent marks. Each sampling block were surveyed for six days during each of the three sampling phases mentioned below.

Table 1: Survey Coverage by District, AEZs, Distance, and Observation Days

AEZs and Districts: 9	Tepid to cool moist plains			Hot arid lowland			Warm moist lowland		
	Babile	Goljano	Bilcirbur	Ellale	Hadhagale	Shilabo	Celkari	Gorbaqaqsa	Gurad amole
KM: 600	66.6	66.6	66.6	66.6	66.6	66.6	66.6	66.6	66.6
Days: 18	2	2	2	2	2	2	2	2	2

This study adopts descriptive research design. This was selected with the assumption that were helpful to obtain relevant information from concerned respondents on the, assessing the resource base information and attitudes of local communities towards wildlife importance, conservation and managements of pastoralist in selected Woredas of Somali regional state and to gain detailed data from large number of respondents to draw the necessary conclusion. To our knowledge, this was the first study to analyze community perceptions of wildlife conservation and management, in the study areas.

Primary and secondary sources were used to collect both qualitative and quantitative data. To obtain information on wildlife condition in selected districts, primary data were collected through observation, key informant interviews and focus-group discussions. On the other hand, the respondents were observed about their habits, culture and how they share the information very keenly using non participatory method and proportionate respondents were also used for focus group-discussions, mainly at evening time. Secondary data were collected from different sources like the regional BoFED, Statistical Authority, BoA, EWCA, MoEP, Academic Institutions, NGOs, districts, zones and regional concerned offices and others which are considered relevant sources for this research project.

Data Analysis

The study was analyzed (a) communities’ perceptions on poaching and (b) community involvement in anti-poaching activities as well as illegal trade trafficking

on wildlife in general and the endangered species like cheetah in particular. The analysis used a concept-driven coding approach to identify patterns and similarities between the various data obtained (Nowell *et al.*, 2017). To improve consistency between researchers, a priori coding framework was created by the research team using the data collection instrument (Blair, 2015). Emergent codes obtained from the households were included in the framework as and when they emerge. Data collected from field observations such as species compositions, number, abundance, distributions and wildlife status were analyzed using descriptive statistics and species diversity index. Mammalian species diversity of the study area were computed using Shannon–Weaver Index of diversity: $H' = -\sum Pi \ln Pi$, where H' is the Shannon index of diversity, Pi is the proportion of individuals of a species in a sample and $\ln =$ Natural logarithm (Shannon & Weaver, 1949). Simpson index of diversity is followed (1-D) using the formula: $J = a/a+b+c$, where ‘a’ is the observed common species in ‘a and b’ and ‘b’ = species present in ‘a’, but absent ‘b’: ‘c’ = species present in ‘b’, but absent in ‘a’; $S =$ the number of species in each habitat; $\ln =$ Natural logarithm was computed to determine the evenness and dominance among the mammalian species. Finally, relative abundance was used to compute for each species occurrence in the study areas.

RESULT AND DISCUSSIONS

Results

Agroecology-Based Wildlife Species Trend

Table 2: Trend of Wildlife on the Basis of Types of Species

Districts	Trend of Wildlife Based on Focus Group Discussion				
	Target Sub-villages	Increasing	Decreasing	Locally Extincting	Extinct
Babile	Kore	Caracal, Hyena, Jackal Qalami, Bakayle, Porcupine (Kashito)	Elephant, Lesser kudu, Mokey, Leopard, cheetah, Lion	Oryx, Giraffe	Rhinoceros, Wild dog, Ostrich
	Jida	Caracal, Hyena, Jackal Qalami, Bakayle, Porcupine (Kashito)	Elephant, Lesser kudu, Mokey, Leopard, cheetah, Lion	Oryx, Giraffe	Rhinoceros, Wild dog, Ostrich

Goljano	Sanmadedhle	Lesser kudu, Geranuk, dik-dik, Hyena, Common chacal, Grivet monkey, Hamardias baboon, Wild cat, Rabbit, Common Warthog	Lion, leopard,	Oryx, Giraffe	Rhinoceros, Wild dog, Ostrich
	Qodaxle	Lesser kudu, Geranuk, dik-dik, Hyena, Common chacal, Grivet monkey, Hamardias baboon, Wild cat, Rabbit, Common Warthog	Lion, leopard	Elephant, Giraffe, Gazella	Rhinoceros, Wild dog, Ostrich
Bilcirbur	Mandoyaley	Dik-Dik, Hyena, Common chacal, Grivet monkey, Wild cat, Rabbit, Common Warthog	Oryx, lion, leopard, Gazella	Elephant, Gazella,	Zebra, Rhinoceros, Wild dog, Ostrich
	Bohalaley	dik-dik, Hyena, Common chacal, Grivet monkey, Wild cat, Rabbit, Common Warthog	lion, leopard, Oryx	Gazella,	Rhinoceros, Wild dog, Ostrich
Hot arid lowland					
Ellale	Dhure	Gazella, Common Warthog and Dig-Dig	Lion, Leopard	Oryx, lion, Lesserkudu,	Rhinoceros, Wild dog, Ostrich
	Bargun	Gazella, Common Warthog and Dig-Dig	Lion, Leopard	Oryx, lion, Lesserkudu,	Rhinoceros, Wild dog, Ostrich
Hadhagale	Biyo Garaca	Common Warthog, Common chacal	Gazella, Tortoise	Oryx, Somali wild ass (<i>Equus africanus somaliensis</i>)	
	Gedweyn	Common Warthog, and common chacal	Gazella, Tortoise	Oryx, Somali wild ass (<i>Equus africanus somaliensis</i>) and buffalo	
Shilabo	Baliwarir		Ostrich, Oryx	Dero	Rhinoceros wild dog
	Qarsoni		Ostrich, Oryx	Dero	Rhinoceros, Wild dog
Warm moist Lowland					
Celkari		Hyena	All others decreased	-	Elephant, Rhinoceros, Wild dog, Ostrich
		Giraffe, Hyena, Leopard, Caracal, Lesser kudu, Gerenuk, Lion, Jackal	Oryx	Lion	Elephant, Rhinoceros, Wild dog,
Goraba qaqa	Xagermoqor	Leopard, Giraffe, Hyena	Oryx	Lion	Lion, Zebra
	Gedir	Caracal, Hyena, Jackal, Tortoise, Leopard, Gerenuk	Lesserkudu, Cheetah	Lion	Elephant, Rhinoceros, Wild dog, Ostrich

Gurad hamole	Qundhi	Leopard, Hyena, cheetah	Oryx, Lesser kudu	Lion	Elephant, Rhinoceros, Zebra
	Elgari	Leopard, Hyena, Giraffe	Oryx, Girrafe	-	Elephant, Rhinoceros, Zebra

The FGD in the target sub-villages mentioned that some wild animals have gone on decreasing and some others increasing. There are also some which are on the process of local extinction. Among those decreased drastically Oryx and Lesser kudus are prominent ones from the antelopes. The FGDs also confirmed that wild animals like elephants with exception of Babili, Rhinoceros and zebras had already extincted from all study areas long years ago. Wild dogs are also locally extincted from most of the study areas (Table 2). It was revealed by the FGD participants that the reason for the extinction of those wild animals like elephants and rhinoceros was mainly

due to killings for their ivory tusks and horns respectively. Besides the above reasons, however, environmental degradation exacerbated by human settlement induced conflict factors contributed the highest share for the degradation of the natural resource in general and the wildlife in particular during the last 10 years.

**Wildlife Species, Number, Distribution and Status
Wildlife Species Composition**

Wildlife species composition in different agro-ecological zones as depicted in the following tables

Table 3: List of wildlife species with their relative abundance (road count) under Tepid to cool moist plains agro-ecological zone

		Tepid to cool moist plains								
		Babile			Goljano			Bilcirbur		
No	Species	O	S	M	O	S	M	O	S	M
1.	Ammodorcas clarkei	0	0	0	0	0	0	0	0	0
2.	Beyra	0	0	0	0	0	0	0	0	0
3.	Black backed jackal	0	2.7	2.7	0	0	0	0	0	0
4.	Common jackal	2.7	2.7	0	2.6	0	0	0	3.9	0
5.	Common warthog	0	0	0	0	3.9	2.6	19.7	7.8	0
6.	Geranuk	2.7	0	0	1.3	0	0	3.9	0	0
7.	Grivet monkey	67.6	0	0	42.1	19.7	0	39.2	0	0
8.	Guenther's dik-dik	0	0	0	0	0	0	0	0	0
9.	Hamardias baboon	0	0	0	0	0	13.2	0	0	0
10.	Isabeline gazelle	0	0	0	2.6	0	0	0	0	0
11.	Lesser kudu	8.1	0	2.7	0	3.9	1.3	0	0	2.0
12.	Olive baboon	0	0	0	0	0	0	0	0	0
13.	Rabbit	0	0	0	0	0	0	2.0	0	0
14.	Rock hyrax	0	0	0	0	0	0	0	0	0
15.	Salt dik-dik	0	0	10.8	0	0	6.6	0	17.6	3.9
16.	Somarring gazelle	0	0	0	0	0	0	0	0	0

O = open-plain land; S = streams/riverine; M = mountainous/hilly areas

The Tepid to cool moist plateaus areas of the study districts comprised 10 wildlife species. Grivet monkey, Common warthog, Salt dik-dik, Hamardias baboon, Lesser kudu, Common jackal, Geranuk, Black backed jackal, Isabeline gazelle and Rabbit were identified as common wildlife species among the three districts; and their relative abundance increased with the selected districts, from Babile, to Bilcirbur and then Goljano.

Table 4: List of wildlife species with their relative abundance (road count) under Hot arid lowland agro-ecological zone

		Hot arid lowland								
		Ellale			Hadhagale			Shilabo		
No	Species	O	S	M	O	S	M	O	S	M
1.	Ammodorcas clarkei	0	0	0	0	0	0	28.6	0	0
2.	Beyra	0	0	0	0	0	1.2	0	0	0
3.	Black backed jackal	0	0	0	0	1.2	0	0	0	7.1
4.	Common jackal	1.3	2.5	0	0	0	0	0	7.1	0
5.	Common warthog	15.2	2.5	3.8	1.2	8.4	0	28.6	14.3	0
6.	Geranuk	6.3	0	3.8	0	0	0	0	0	0
7.	Grivet monkey	0	0	0	0	0	0	0	0	0
8.	Guenther's dik-dik	0	0	0	0	0	0	0	0	7.1
9.	Hamardias baboon	0	0	0	0	0	0	0	0	0
10.	Isabeline gazelle	0	0	0	4.8	0	0	0	0	0
11.	Lesser kudu	0	0	0	0	0	1.2	0	0	0
12.	Olive baboon	0	0	0	0	0	0	0	0	0
13.	Rabbit	0	0	0	0	1.2	1.2	0	0	0
14.	Rock hyrax	0	0	0	0	0	0	0	0	0
15.	Salt dik-dik	11.4	0	6.3	0	0	2.4	0	0	0
16.	Somarring gazelle	30.4	16.5	0	14.5	63.9	0	0	0	0

O = open-plain land; S = streams/ riverine; M = mountainous/ hilly areas

The Hot to warm arid lowland areas of the study districts comprised 12 wildlife species Somarring gazelle, *A. clarkei*, Common warthog, Salt dik-dik, Black backed jackal, Common jackal, Guenther's dik-dik, Geranuk, Isabeline gazelle, Beyra, Lesser kudu and Rabbit were identified as common wildlife species among the three districts; and their relative abundance increased with the selected districts, from Hadhagale to Shilabo and then Ellale.

Table 5: List of wildlife species with their relative abundance (road count) under warm moist lowland agro-ecological zone

		Warm moist lowland								
		Celkari			Gorbaqaqsa			Guradamole		
No	Species	O	S	M	O	S	M	O	S	M
1.	Ammodorcas clarkei	0	0	0	0	0	0	0	0	0
2.	Beyra	0	0	0	0	0	0	0	0	0
3.	Black backed jackal	0	0	0	0	0	0	0	5.0	0
4.	Common jackal	9.8	0	0	0	0	3.0	0	0	5
5.	Common warthog	23.8	9.5	0	0	12.1	0	0	30.0	0
6.	Geranuk	0	4.8	0	6.1	9.1	24.2	10.0	0	0
7.	Grivet monkey	0	0	0	0	0	0	0	0	0
8.	Guenther's dik-dik	19.0	0	0	0	0	0	0	0	0
9.	Hamardias baboon	0	0	0	0	0	0	0	0	0
10.	Isabeline gazelle	0	0	0	0	0	0	0	0	0
11.	Lesser kudu	0	0	4.8	0	0	3.0	0	0	0
12.	Olive baboon	0	0	0	0	0	0	0	0	0
13.	Rabbit	0	0	0	0	0	0	0	0	0
14.	Rock hyrax	0	0	0	6.1	12.1	0	0	0	0
15.	Salt dik-dik	0	9.5	9.5	6.1	18.2	0	40.0	0	10.0
16.	Somarring gazelle	0	9.5	0	0	0	0	0	0	0

O = open-plain land; S = streams/riverine; M = mountainous/hilly areas

The Hot to warm moist midland areas of the study districts comprised 9 wildlife species Salt dik-dik, Common warthog, Geranuk, Guenther's dik-dik, Rock hyrax, Somarring gazelle, Common jackal, Black backed jackal and Lesser kudu were identified as common wildlife species among the three districts; and their relative abundance increased with the selected districts, from Guradhamole to Celkari and then Gorabaqsa

Wildlife Species Diversity and Abundance in different agro-ecological zones and districts.

In different agro-ecological zones.

Wildlife species evenness was significantly higher in the Tepid to cool moist plains than Hot arid lowland and Warm Moist Lowland areas. This result indicates that in the Hot arid lowlands and Warm moist lowlands wildlife were equally distributed. (Table 6). Wildlife species diversity were significantly increased from Bilcirbur, Goljano, and then Babile District areas of the Tepid to cool moist plain agro-ecological zones. While, it increased from Shilabo, Ellale, and then Hadhigale District areas of the Hot arid lowland agro-ecological zones (Table 6). Whereas, Wildlife species diversity were significantly

increased from Guradhamole, Gorabaqsa, and then Celkari District areas of the Warm moist lowland agro-ecological zones (Table 6). Wildlife species evenness were significantly increased from lowest of Goljano, then Bilcirbur and Babile District areas of the Tepid to cool moist plain agro-ecological zones were equally distributed (Table 6). While they were significantly increased from Hadhigale, then Shilabo, and Ellale District areas of the Hot arid lowland agro-ecological zones (Table 6). Whereas, wildlife species evenness was significantly increased from Gorabaqsa, then Guradhamole, and Celkari District areas of the Warm moist lowland agro-ecological zones (Table 6).

Table 6: Effect of Agro-ecological zones on wildlife species diversity, species evenness, species richness, total wildlife abundance at different types of habitat patches

Factor Levels and interaction effect	Shannon diversity	Species Evenness	abundance	Species richness
Tepid to cool moist plain areas				
Babile	0.083 ^a	0.79 ^a	86.43 ^a	3.1 ^a
Goljano	0.071 ^b	0.72 ^b	9.2 ^b	3.0 ^b
Bilcirbur	0.032	0.79 ^a	78.75 ^a	4.2 ^a
Hot arid lowland areas				
Ellale	0.207 ^b	0.79 ^a	85 ^b	4.3 ^a
Hadhagale	0.219 ^a	0.60 ^b	94.20 ^a	3.8 ^a
Shilab	0.062	0.74 ^a	99.20 ^a	3.5 ^b
Warm moist lowland				
Celkari	0.103 ^a	0.77 ^a	79 ^b	4.1 ^a
Gorabaqsa	0.071 ^b	0.59 ^b	103.19 ^a	3.1 ^b
Guradhamole	0.038	0.73 ^a	91.25 ^a	3.3 ^a
Production System (PS)				
F (df = 2, 22)	0.01	4.31	0.1	0.05
P	0.339	0.04	0.77	0.822
Lsd	NS	0.06	NS	NS
Grazing Type (GT)				
F (df = 2, 22)	11.03	8.49	3.02	2.45
P	0.001	0.001	0.065	0.095
Lsd	0.13	0.08	NS	NS

Df = degree of freedom, F-ratio = F test value, P = probability value; NS = non-significant. Means with the same letter in columns within each production system (PS) are not significantly different at $P \leq 0.05$.

Wildlife Species Similarity

The highest three Jaccard coefficient similarity index (0.69, 0.63 and 0.25) for wildlife species composition was recorded between the Babile-Goljano district areas of the Tepid-cool moist mid highland; and Celkari-Gorabaqsa

district areas and Ellale-Shilabo district areas of the Warm moist plain and Warm moist lowlands, respectively. The lowest three Jaccard coefficient of similarity index (0.18, 0.20 and 50) was obtained between the Ellale-Hadhagale and Hadhagale-Shilabo district areas of the Hot arid

lowland; and Bilcirbur-Shilabo district areas of the Tepid-cool moist plain and Hot arid lowland: and Cekari-Guradhamole district areas of the Warm moist lowland, respectively (Table 7). This result indicated that wildlife species similarity was high between Babile-Goljano and Celkari-Gora-baqaqsa district areas in both Tepid-cool moist plain and warm moist lowland areas. Less species

similarity was recorded between Warm arid lowland and Tepid-cool moist plain of the Ellale-Hadhagale and Hadhagale-shilabo district areas. This result could be related to the variation of species communities between the Tepid-cool moist plain and Hot arid lowland district patch habitat type

Table 6: Effect of Agro-ecological zones on wildlife species diversity, species evenness, species richness, total wildlife abundance at different types of habitat patches

	Agro-ecological Zones								
	Tepid-cool moist plains			Hot arid lowland			Warm moist lowland		
	Babile	Goljano	Bilcirbur	Ellale	Hadhagale	Shilabo	Celkari	Gorabaqsa	Guradhamole
Tepid-cool moist plains									
Babile	-								
Goljano	0.69	-							
Bilcirbur	0.63	0.67	-						
Hot arid lowlands									
Ellale	0.38	0.44	0.50	-					
Hadhagale	0.25	0.31	0.36	0.18	-				
Shilabo	0.22	0.18	0.20	0.25	0.18	-			
Warm moist lowland									
Celkari	0.44	0.50	0.56	0.71	0.36	0.33	-		
Gorabaqsa	0.50	0.56	0.63	0.57	0.27	0.22	0.63	-	
Guradhamole	0.57	0.44	0.50	0.67	0.30	0.43	0.50	0.57	-

Discussion

Wildlife trend and community attitude

The cumulative result of the three AEZs, KIIs and FGDs show that there is a decreasing trend of wild animals. Some antelopes like Lesser kudu, Oryx and carnivores like lions have gone under decreasing trend owing to settlements and related natural resource degradations along with recurrent droughts and illegal hunting. This agrees with Tefera (2011) that also illustrates reduction of diversity and density along with distribution of wildlife throughout Ethiopia in the past century owing to various anthropogenic pressures. The decrease in antelopes (especially Lesser kudu) is attributed to its use as food and medicinal purpose. The three major reasons for the reduction of wild animals are human settlement induced factors (increase in livestock population; and deforestation for settlements and agriculture), recurrent droughts and illegal hunting in their order. These findings are in line with Demeke *et al.* (2015) which states that there are major land use changes which are associated with expansion of cropland cultivation and human settlements into areas that previously serves as wildlife habitats. The decrease in lions is mainly due to human lion conflict as a result of human and livestock attacks. The same situation was also reported by Kabsay *et al.* (2007) that asserted the human lion conflict in Soro District of Hadiya Zone, Zone 3 of the Afar Region and Liben Zone of the Somali Region are the best examples where depredation cases of hundreds of livestock of various types and significant number of

people by lions were reported. The negative attitudes of communities towards the carnivores also originate from carnivore attacks against humans and livestock. Based on the study it is evident that there is gradual shift from pure pastoralism to agro pastoralism which is also another threat to wildlife habitats and cause for wildlife population reduction in the area as farming needs two things at the same time; one sedentary settlement and another, clearing of the vegetation. Jabessa *et al.* (2015) stated that people who are relinquishing the pastoralist system (which writers connote them as TOPs, drop-outs or transitioning pastoralists) have been increasing from time to time even though no survey has been made yet to substantiate quantitatively. Most KIIs and FGDs mentioned frequent sightings of giraffe in some of the study areas according to two members of Hagarmogar kebele during the FGD “We always come across each other specially in the water points during the nights it comes around our settlements.” During the ground study the team observed three giraffes in Warm moist lowland areas (Gorabaqsa District). The team also observed five giraffe foot prints at a time in the same place. It was also common to observe these foot prints in many places in both target district sites (celkari and Gorabaqsa). This might show better giraffe population in the target areas and vicinities than other areas. This agrees with Fedlu *et al.* (2021) which stated it is well known that frequency of sightings have strong connection with wildlife abundances. It was also evident that the human settlements are not densely populated

in the area based on the data collected from FGDs and actual ground observations.

In Wildlife Resource-Base and Mammal Species Diversity the preliminary survey identified a wide range of mammal species in Somali Region, including but not limited to elephants, lions, cheetahs, leopards, hyenas, gazelles, giraffes, and various antelope species. The region's diverse ecosystems provide suitable habitats for these mammals. In terms of Endemic and Threatened Species the study revealed the presence of endemic and threatened mammal species in Somali Region (Table 1.) These include the Somali wild ass (*Equus africanus somaliensis*), Speke's gazelle (*Gazella spekei*), and the Ethiopian wolf (*Canis simensis*). The conservation of these species is of utmost importance to maintain the region's biodiversity.

When it comes to Constraints to Wildlife Conservation (Habitat Loss and Fragmentation)

The expansion of agriculture, urbanization, and infrastructure development has led to habitat loss and fragmentation, posing a significant threat to wildlife populations in the Somali Region. Encroachment into natural habitats has resulted in reduced available space for wildlife and increased human-wildlife conflicts. Poaching and illegal wildlife trade is prevalent issues in Somali Region. The demand for wildlife products, such as ivory, skins, and bush meat, has led to the decline of several mammal species. Strengthening law enforcement and raising awareness among local communities are crucial to protect the wild life. Finally, as shown in the result Wildlife species evenness being significantly higher in the Tepid to cool moist plains than Hot arid lowland and Warm Moist Lowland areas indicates that in the Hot arid lowlands and Warm moist lowlands wildlife were equally distributed and Therefore, this could be related to the presence of settlements and recurrent droughts in the Ellale, Shilabo, Celkari and Guradhamole district areas. The significantly increasing Wild life species diversity and Evenness from lowest of one agro ecological zone and/or location to the other could also be related to the presence of illegal hunting, recurrent droughts and human settlements as well as high grazing pressure and mobility of humans and livestock.

CONCLUSION

The following conclusions can be drawn from the results of the research: As shown in the analysis above it was important in providing insights on how the perceptions, attitudes, and current practices may influence wildlife sustainability and its supporting institutions. This is crucial for rethinking the design of conservation policies that allow for effective management and planning, sensitive to local realities. In the study areas anthropogenic factors had been highly increasing through past years causing high degradation on the natural resources in general and wildlife resources in particular. Had it not been for human and livestock disturbances it would have been possible to observe a better wild animal population, including

giraffes, than actually seen on the ground. There is illegal hunting of antelopes like lesser kudu and others for medicinal and other purposes, which cannot be special for giraffe too, though not mentioned by respondents. Based on the road count study, FGDs and KIIs, and observations from the ground, the findings depict that there can be the better population of giraffes in warm, moist lowland areas than other areas. From FGDs, KIIs and other informal communications, it is evident that the number of carnivores, with the exception of hyena, in general and lions in particular, has diminished a lot in the past years. The main cause for this reduction is human-carnivore conflicts that resulted in killings using guns, poisoning, and traps. In addition to the above discussion based on the preliminary survey and documentation of mammal species in the Somali Region, the following potential conservation strategies can be recommended for the sustainable management of mammal populations.

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