

**JIMMA UNIVERSITY**  
**COLLEGE OF NATURAL SCIENCES**  
**DEPARTMENT OF BIOLOGY**

**Diet, Habitat Use of Critically endangered Smien fox (*Canissimensis*Rüppell 1840) and Human Conflict in Menz Guassa Community Conservation Area , North Shewa Zone, Ethiopia.**

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## ABSTRACT

The main objective of this study was to investigate Simien Fox habitat use, diet, and its conflict with human in Menz Guassa Community Conservation Area in North Shewa Zone, Amhara National Regional State, Ethiopia. Data for habitat use, diet preference and human Simien Fox conflict were collected from September 2021 to January 2022. Data collection methods were focal group discussion and interviews to obtain information about the animal in the area), focal group watch (to determine habitat use), scat analysis (to determine feed items), and questionnaire (to determine conflicts between humans and the Simien Fox). Scats of Simien Fox were collected in four habitats of the species including the specific densities to identify food items used by the Simien fox. Habitat where scat was collected, date of collection, age of scats, time of collection, altitude of the collection site and position were also recorded. Scat droppings were checked for hairs, feather and bones of the animal matters that are consumed by Simien fox. For the questionnaire survey, a total of 100 people, 50 males and 50 females, were randomly selected from three villages to acquire data on the human-Simien Fox conflict. Quantitative variables were analyzed for mean values and percentage in MS Excel 2013 while the qualitative data were thematically presented and narrated. Scat analysis showed that Rodents were the principal diet (37.5%). But among livestock species, predation was more sheep 328 (89.1) followed by goat 27 (7.3). The habitat most commonly used by Simien wolf was Alchemilla shrub land in both wet and dry season (58.3% and 61.7%), followed by Mima mound (23.3% and 20%). The occurrence of Ethiopian wolf in the Festuca grass land and farmland habitats was low at 11.7% and 6.7%, respectively. The local people had conflict with Simien fox through habitat destruction on the human part, and domestic livestock predation on the animal part. The study suggests that government intervention together with the local people shall be needed for the sustainable conservation and management of this critically endangered species.

**Key words:** *Canis simiensis*, Conflict, Diet, Habitat use, Guassa Community Conservation Area, Simien fox



# 1. INTRODUCTION

## 1.1. Background of the study

The Simien fox (*Canis simensis*) is a canine native to the Ethiopian high lands. The Simien fox (*C. simiensis*) has long legs and elongated muzzle. Its overall color is ochre to rusty red. The throat, chest and under parts are white (Sillero-Zubiri, 1994). The average weight of the male Simien wolf is 16 kg whereas the female one is 12 kg (Sillero-Zubiri and Macdonald, 1997). The Simien fox feeds almost exclusively up on diurnal small mammals of the high altitude afro-alpine grassland community (Sillero-Zubiri, 1994; Sillero-Zubiri and Gottelli, 1995a, b). In the Bale Mountains, it feeds primarily on giant mole rat (*Tachoryctes macrocephalus*), Blick's grass rat (*Arvicanthis blicki*), and the black - clawed brush -furred rat (*Lophuromys melanonyx*) (Sillero-Zubiri and Gottelli, 1995b). Other food items include rock hyrax (*Procapra capensis*), young of common duiker (*Sylvicapra grimmia*), reedbuck (*Redunca redunca*) and mountain nyala (*Tragelaphus buxtoni*) (Sillero-Zubiri and Gottelli, 1995b; Malcolm, 1997; Sillero-Zubiri, 1994). The density of Simien fox is positively correlated with density of rodent prey and negatively with vegetation height (Sillero-Zubiri and Gottelli 1995a). The Ethiopian wolf is restricted to seven isolated mountain ranges of the Ethiopian highlands at altitudes of 3000 - 4500m asl (Marino, 2003; Gottelli and Sillero-Zubiri, 1992). According to Marino (2003), Simien fox populations occur north of the Rift Valley in the Simien Mountains, Mount Guna, North Wollo, South Wollo, Guassa-Menz and south-east of the Rift Valley in the Arsi and Bale Mountains.

In Ethiopia, there are still habitats with different vegetation zones that are not represented as conservation areas. The Menz-Guassa Community Conservation area highland is among the afro alpine ecosystems of Ethiopia. Like other similar ecosystems of Ethiopia, the Menz highland has been affected by human activity destruction of the vegetation and inappropriate land use practices have resulted in degradation of the fertile soil.

To rescue the remaining unique habitats, and the endemic plant and animal species, the Menz-Guassa area at present is communally protected and managed by the local people. In this regard, appreciable community mobilization work is done which might be model to other related ecosystems that are not legally protected as an area for biodiversity Conservation. This conservation area consists of different endemic animal species; among these, the endangered Simien fox and Gelada baboon.

## 1.2. Statement of the problem

The Simien fox is one of the endemic mammals of Ethiopia. *Canis simensis*, also known as the Simien fox, which is found on the high land part of Ethiopia, is currently rated as 'Critically Endangered' by the IUCN Red list which has suffered from a variety of human-related impacts. Similarly, as reported by Zelealem Tefera (2001), livestock from nearby villages stay for longer time, and local community used firewood more frequently in Guassa area and according to Newmark, *et al.* (1994) the major problem facing protected areas today is the increase in human settlement of adjacent lands and the unauthorized harvesting of resources within the protected areas in Africa. Menz Guassa community conservation area is one of the protected areas for wild life species including Simien fox. Both the flora and fauna composition made the area more attractive and source of income. The Guassa area is critical natural resource for the adjacent people of Menz, which provides various essential ecosystem goods and services such as fodder, fuel, building materials, household, farming and livestock rearing. The area is also important for the livelihood of local communities who harvest Guassa grass. These variety of human related activities on the other hand disturbs the inhabiting wild life such as the critically endangered Simien fox. Because nowadays Guassa is one of the major threats to biodiversity of the country that are unsustainable utilization of natural resources over-exploitation, deforestation, conversion of natural vegetation to farmland, forest fires, land degradation, habitat loss and fragmentation, extensive replacement of farmer's/local varieties/breeds by improved ones, invasive species, illegal trafficking of domestic and wild animals, poaching, wetland destruction, climate change and due to this reason studying about this research is important for the community improving the conflict between human and Simien Fox. So that, in order to design more appropriate actions for the future conservation of this threatened endemic species, it is important to study the habitat use, diet and conflict with human in Menz Guassa community conservation area.

### **1.3. Objectives of the Study**

#### **1.3.1. General objective**

- The general objective of this study was to study habitat use, diet and conflict with human of the critically endangered Simien fox (*Canis simensis*) in Menz-Guassa community conservation area, Ethiopia.

#### **1.3.2. Specific objectives**

- To identify the feeding items of Simien fox in Menz Guassa community conservation area.
- To determine seasonal variation of habitats used by Simien fox in the study area.
- To investigate habitat use of Simien fox in Menz Guassa community conservation area.
- To identify the presence and reasons of Simien fox human- conflict in Menz Guassa community conservation area.

### **1.4. Significance of the Study**

The finding of this study will be very important for assessing, gaining, identifying, recording and documenting diet, habitat use and conflict with human with Simien fox in Guassa community conservation area in Menz Gera Midir district.

The findings of this research will be also used as a spring board for other researchers who want to conduct further study on Menz Guassa community conservation area.

## 2. REVIEW OF RELATED LITERATURE

### 2.1. The Simien fox (*Canissimensis* Ruppell, 1840)

The Simien fox (*Canissimensis*) is also known as the Simien fox, Simien jackal or the Abyssinian wolf. Locally, the Simien fox is called by different names. In Amharic speaking areas of the South Mountains and in Menz-Gera Midir, it is called Key Kebero; in the Wollo area, it is called Seren; in Gojjam, it is called Walge; in the southeast of the country in Arsi and Bale mountains, among the AfaanOromoo speakers, it is usually called JedalaFardaa, but in few localities in the same area, it is also called Arouaye. The Simien fox crossed over from Asia during the Pleistocene period less than 1 million Years ago, when the sea level was lower, and Africa and the Middle East were connected. During the Pleistocene, the highlands of Ethiopia were predominantly afro-alpine moorland (Bonniefilet *et al.*, 1990), and these habitats were the ideal habitat for a variety of small mammals, particularly grass rats (Muridae). This afro-alpine environment must have morphologically shaped the Simien fox as a specialized rodent hunter (Gottelli and Sillero- Zubiri, 1992).

The afro-alpine habitat, characteristically represented by few mountain tops in the Ethiopian Highlands was widespread during the Pleistocene. During the last glacial period, the African tropics were generally colder and drier than at present. Consequently, the moorlands of East African Mountains were about 1000 m lower than they are now (Bonniefilet *et al.*, 1990). Extrapolation of the present distribution of afro-alpine habitat in Ethiopia suggests that up to 100,000 km<sup>2</sup> of afro-alpine habitat may have been available for the Ethiopian wolf and for its prey during the last glaciations (Gottelli and Sillero- Zubiri, 1992). The end of the Pleistocene brought climatic changes and forced the extensive Ethiopian afro-alpine moorlands to shrink to their present size, reducing the habitat available for the Simien fox by an order of magnitude.

Only about 2% (22, 750 km<sup>2</sup>) of the total land area of Ethiopia is above 3000 m. Of this, less than 10% at present consists of afro-alpine steppes or mountain grasslands suitable for the Simien fox, which is found only in a few localized mountain pockets (Yalden and Largen, 1992; Gottelli and Sillero- Zubiri, 1992; Malcolm, 1997; Marino *et al.*, 1999). The Simien fox is one of the four canid species in Africa; the others being *C. aureus*, *C. mesomelas*, *C. audustus* and *Lycaon pictus* (Zealealem Tefera, 2001). Systematic of the Simien fox was confusing due to lack of material on which to base its classification. Different travellers at different times

have given the species different names such as *Canissinusgervais*; *CanisorVulpeswalgeheuplin*; and *Simeniasimensis* (Yaldenet *al.*, 1980).

## **2.2. Habitat and Feeding Behaviour of the Simien fox**

The main habitat of the Simien fox is Afro-alpine, characterized by short grasslands (Sillero-Zubiri and Gottelii, 1995). The Simien fox commonly preys on small mammals and is specialized in rodent hunting. This makes it unique from the other carnivores. It feeds upon the endemic giant mole rats (*Tachyoryctusmacrocephalus*), the common mole rats(*T. splendens*) and the grass rat species (*Arvicanthisabyssinicus*, *A. blicki*, *Lophuromysmelanonyx*and*Otomystypus*). Besides the rodent species, the Simien fox has been seen Chasing young antelopes lambs, and hares (Sillero-Zubiri, 1994).The activity of the Simien fox is usually synchronized with the activity of rodents. It utilizes different hunting techniques in accordance with the size of the prey and forages throughout the day (Sillero-Zubiri and Gottelii, 1995).

## **2.3. Distributionof the Simien fox**

The Simien fox is probably the rarest canid in the world with fewer than 500 adult individuals surviving (Sillero-Zubiri and Macdonald, 1997). According to Sillero-Zubiri and Gottelii (1995), it occurs in a few mountain ranges of the Ethiopian highlands. It occurs in the Simien Mountains, mountain tops of the Wollo highlands around AbuneYoseph, AmbaFerit, Donkoro Chaka and other high altitude areas of the Wollo region and in the North Shoa area of MenzGuassa Community conservation Area. It also occurs in Arsi and Bale Mountains of Senatti plateau and other high altitude areas (Marino, 2003). However, the proportion of the Simien fox is different in all these areas. The density of rodents in different habitats largely explains the difference in habitat preference by the Simien fox (ZealeamTefera *al.*, 2005). There are two subspecies of the Simien fox.These are:*Canissimiensis*and*Canissimiensisciternii*. *C. s. simiensis* is located in the area west of the Rift Valley in Simien. Whereas the *C. s. citerniis* found in the southeast of the Rift Valley in the Bale and Arsi Mountains (Yalden and Lagen,1992).

## **2.4. Threats and Conservation Status of the Simien Fox**

The continuous loss of habitat due to high altitude subsistence agriculture represents the major threat (Marino, 2003). Over grazing of highland pastures by domestic livestock, proposed development of commercial sheep farms and roads, conflicts over livestock losses, disease especially rabies, road kills and shooting (Marino, 2003), hybridization with domestic dogs (Gottelli *et al.*, 1994) are the main threats. The Simien fox is more restricted now than in the past (Yalden *et al.*, 1980) and considered as the rarest canid in the world. According to Marino (2003) there are seven persistent isolated populations for the conservation of Simien fox currently in Simien and Bale Mountain National Park, in Arsi hunting blocks, North Wollo, Denkoro forest in South Wollo and in Guassa area.

## **2.5. Wildlife Conflict With Human**

Naturally, organisms live together in an ecosystem for a long period of time. Then, through time, they show high degree of intrinsic stability and resilience to climate and other environmental factors in the given ecosystem. However, when humans entered these systems, the natural phenomena become disturbed.

One of the effects of human activities is introduction of exotic species. Most of the introduced species cannot develop an adaptive coexistence with the native species. In addition, in many cases, the introduced species are not capable of resisting predators, disease and other factors that occur in the environment. This resulted in human-wildlife conflict (Messmer, 2000). No animal is inherently a 'nuisance' or 'pest'. However, because their habitats are increasingly altered or managed by humans, certain wild species or individual animals may cause a significant problem to humans, other animals or the environment (Anonymous, 2001). Wildlife and people can dwell harmoniously if and only if the animals feel safe from human threat and if animals are not causing property damage or public health concern (Einarsen, 2002). Much of the current biodiversity crises arise as a result of increasing competition with humans for space and resources. Thus, protected areas become isolated islands of natural habitat and invaded by human settlement (Sitati *et al.*, 2005). Conflicts between human and wildlife populations are emerging as a major conservation issue worldwide. Human-wildlife conflict incidents are widespread but not evenly distributed because they are dependent on the proximity of wildlife. In addition, different

species cause different types of damage at different time of the year. The damage caused has different effects on the livelihood of households depending on their level of livelihood security before the incident (Mulongaet *al.*, 2003). Human-wildlife conflict affects species, particularly large mammals. Due to such Conflict, most are either critically endangered or declining rapidly. One major cause for human-wildlife conflict is increasing human population adjacent to the protected area. As human population increases and the demand for resources grow, the frequency and intensity of conflicts between protected areas and local people will increase (New market *al.*, 1993). This can be manifested by increasing encroachment of wildlife habitat. As a result, species that are unable to adapt to altered habitats are forced to decrease their number and invade the marginal habitats.

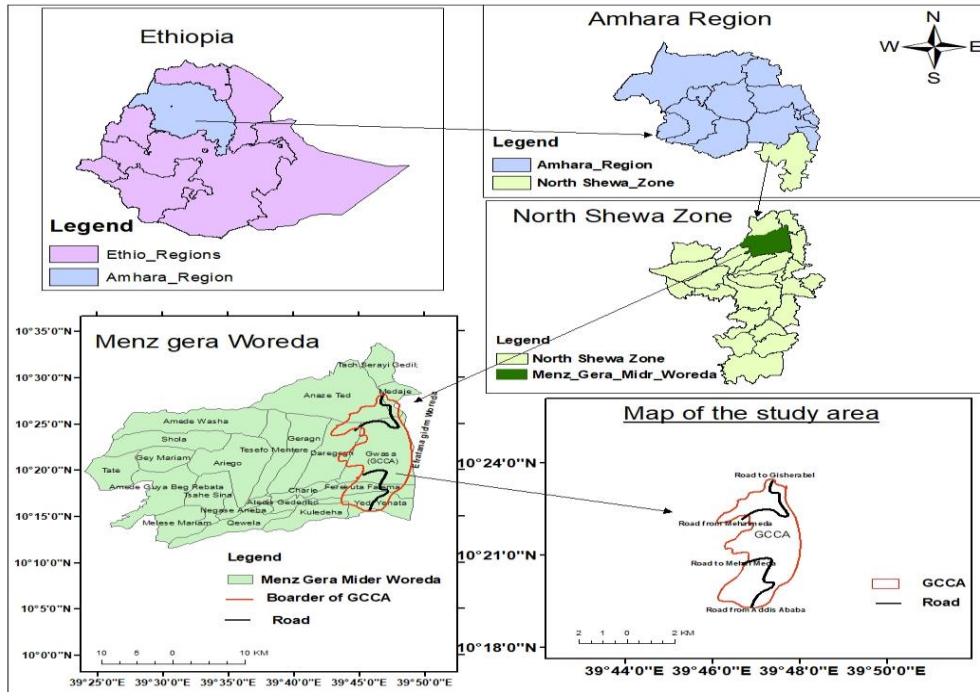
But those species that are able to adapt a changing ecology and survive in agricultural system become involved in a direct competition with humans (Kristin and Struhsaker, 1999;DeresseDejene, 2003).Increase in wildlife population in some areas can be considered as another cause of human wildlife conflict. In the past, rural resident's especially agricultural producers and tree growers were the cause of wildlife damage. However, more recently, urban dwellers and other wildlife stakeholders are highly experiencing wildlife damage (Messmer, 2000).

Traditionally, wildlife damage was agricultural problem. But, even overabundant wildlife populations are causing many other problems like residential damage and disease. Moreover, human-wildlife conflict includes human illness, wildlife attack, animal automobile collision and other (Messmer, 2000). Human-wildlife conflict situations often have a long history. They are complex situations and are unlikely to be resolved quickly. They cannot be solved by technical means (Osborn, 2000). Past efforts to solve the conflict have failed in different areas. No solution will work without site specific knowledge that can be practical or acceptable in any situation in any particular area. The development of practical tools and techniques are required to minimize conflicts arising from human modification of ecosystems.

### 3. MATERIAL AND METHODS

#### 3.1. Description of the Study Area

Menz Guassa Community Conservation area is located in the Amhara Regional State, with in the North Showa Zone Administration of Menz-Gera MidirWoreda,Ethiopia. The area is located at 265 km northeast of Addis Ababa by road and 135 km north of DebreBirhan, the capital of north Showa Zone. The capital of Menz -Gera MidirWoreda is Mehalmeda and it is 17 km from the Menz-Guassa Community Conservation area. Guassa area lies at latitude  $10^{\circ}15' - 10^{\circ}27'N$  and longitude  $39^{\circ}45' - 39^{\circ}49'E$ . The total area of Guassa is about  $111 \text{ km}^2$ . It forms part of the western edge of the Great Rift Valley. Its altitude ranges from 3200 to 3700 m above sea level(Zelalem Tefera,2001). Guassa is the part the Menz Geramidir Woreda and it is surrounded by five kebele admnistrations: Alphamidir(west),Yedi (south),Daregn(north), Chare(west),Wojed(north) and by two kebele(Dija and Mehalwonz) admnistrations of Ephratanagidm in the east(Fig.1)



**Figure1.**Map of Menz Gera MiderWereda(Source:Menze Gera MiderWereda Agricultural office,2014).



## **3.2. Habitat and Flora Types of the Guassa Area**

According to Zelealem Tefera (2001) six different habitat types 55.5% of the Guassa area.

### **3.2.1. Festuca grassland**

Occurs where the drainage is good and the soil is deep. It grows on steep to moderately steep slopes up to altitude of 3500 m above sea level. The plant species that are common in *Festuca* Grassland are: *Festuca abyssinica*, *F. simensis*, *F. richardii*, *F. macrophyll*, *Andropogona abyssinicus*, *Poashimperina*, *Trifolium burchellianum*, *T. multinerve*, *Alchemilla abyssinicus*, *Semecio vulgaris*, *Thymus schimperi*, *Helichrysum formosissiu*, and *Artemesia* spp.

### **3.2.2. Alchemilla shrub land**

Occurs on flat and gentle slopes and well drained areas, and is restricted to areas above 3200 m above sea level. It is the most extensive habitat type that covers 21.7% of the total area. Common plant species include: *Euryops spinifolius*, *Alchemilla abyssinica*, *Kniphofia foliosa*, *Thymus schimperi*, *Urtica simensis*, *Anthemistigreenis*, *Echinops steudneri*, *Ferula communis*.

### **3.2.3. Euryops-Festuca Grassland**

Euryops-Festuca grassland or Mima mound is usually interspersed with scattered mounds that can reach a height of 1.5 m and a diameter of 5-10 m. These mounds consist of high organic and deep soil that is made by the activity of the rodent community, the most important of which is the common Mole rat (*Trachyoryctes splendens*). The mounds are predominantly covered by *Euryops* and *Alchemilla* while the area in between the mounds is covered mainly by *F. abyssinica*. This habitat accounts for 15.5% of the total area of Guassa. It is commonly used as a den by wolves and it is important for human use as long as the *Festuca* grass is dominant.

### **3.2.4. Helichrysum-Festuca grassland**

This vegetation occurs on high ground and hill tops, where the soil is poor. The plants that are dominant in this particular habitat are: *Helichrysum splendidum*, *H. gofense*, *H. formosissimum*, *Pinnisetum* sp., *Alchemilla abyssinica* and *Echinops* sp. This habitat accounts 4.4% of the total area of Guassa. It is little used by humans since the *Helichrysum* shrub produces lots of smoke when burnt.

### 3.2.5. Erica moorland

*Erica* moorland is common in high ground areas with shallow and well-drained soil. The total area coverage of the habitat is 10.4% of Guassa. The *Erica* shrubland is collected for fire wood mainly during the wet season. The common plant species in the *Erica* moorland habitat are: *Erica arboria*, *Thymus schimperi*, *Trifolium burchellianum*, *Alchemilla abyssinica*, *Hellichrysum splendidum*, *Kniphofia foliosa*, *Swertia abyssinica*, *Rubus abyssinicus*, *R. stedneri* and *Urtica simensis*

### 3.2.6. Swamp Grassland

This habitat is permanently or temporarily inundated during the wet season. It accounts 3.7% of the total Guassa area. It provides a year round green grass to cut and carry home. The dominant plant species of this habitat are: *Carex monistachia*, *Carex fischeri*, *Hydrocotyle mannie* and *Alchemilla sp.*

## 3.3. Fauna Types of the Guassa Area

Among the small mammals, two shrew and six rodent species have been reported in Guassa area. *Crocidura thalia* and *C. baileyi* are the most widespread of the endemic shrews in Ethiopia (Yalden and Largen, 1992; in Zelealem Tefera, 2000). The rodent species found in Guassa include, porcupine (*Hystrix cristata*), common mole rat (*Tachyoryctes splendens*), the unstriped grass rat (*Arvicanthis abyssinicus*), the Harsh-furred rat (*Lophuromys flavopunctatus*), the Abyssinian meadow rat (*Stenocephalemus grisicauda*) and the Groove-toothed rat (*Otomystypus*). Two of the rodent species, *A. abyssinicus* and *S. grisicauda* are endemic to Ethiopia. The Ethiopian wolf (*Canis simensis*), Gelada baboon (*Theropithecus gelada*) and Abyssinian hare (*Lepus starcki*) are the endemic large mammal fauna of Guassa. The other large mammal species inhabiting the guassa area are: Grey duiker (*Sylvicapra grimmia*), Klipspringer (*Oreotragus oreotragus*), Common jackal (*Canis aureus*), spotted hyaena (*Crocuta crocuta*), Civet (*Civet civettictis*), Rattle (*Melivora capensis*), Egyptian mongoose (*Herpestes ichneumon*) and Serval cat (*Felis serval*).

Economic activities of the society

The dominant economic activity of the people is farming. Land holding throughout the entire Woreda varies from 0.75 to 3.5 hector per household with average holding of 1.4 hector. There are two farming seasons corresponding to the short and long rain seasons. The importance of 'Belg' (short rain season) is strongly emphasized in Menz. The dominant crops of the area are

barley, beans and lentils. Barley is the single most important subsistence crop. Land is ploughed in January and February for the short rain crop (Belg) and in June or July for the main rain season crop (Meher). The main draught animals are oxen, although horses and donkeys are used sometimes (ZealelemTefera, 2000).

Livestock is a key element of the economy in the mixed farming systems of northern Ethiopia. In Menz, the role of livestock in subsistence livelihood has increased because of unreliability of cultivation (ZelalmTefera, 2000). Livestock holding in Menz is low compared to other parts of the country, and only a few households can keep different forms of livestock. The average household owns one cow, a pair of oxen and one donkey while some house holdings own horses and mules. Sheep are the most common form of livestock in every household

### **3.4. Climate**

The central highlands of Ethiopia are characterized as temperate rain climate type, with distinct dry and wet months. However, considerable variation occurs as a result of differences in altitude and size of the mountain blocks. The climate of Guassa area is affected by northerly winds, which blow throughout the year. There is high rainfall, frequent hill storms and occasional snow at higher altitudes during the wet season and frequent frosts during the dry season. Therefore, the climate of the study area is unfavorable for most crops. However, the surrounding farming communities grow barley and some pulses (ZelalemTefera, 2000).

In the driest months (December, January and February), the day time temperature can be as high as 21<sup>0</sup>C while at night it can fall to -7<sup>0</sup>C, a diurnal fluctuation of 28<sup>0</sup>C. The diurnal temperature variation is low during the wet season with a day time temperature of 12<sup>0</sup>C and temperature of 3<sup>0</sup>C at night. This fluctuation is expected to cause high temperature stress on the flora and fauna of the area. In the early dry season, frost is very common and fog can be seen any time of the year. Guassa lies in an area influenced by the Equatorial Westerlies and the Indian Ocean air streams. The area receives rain from two different sources at different times of the year. In the Ethiopian highlands, rainfall increases with altitude until 3800 m, above which it begins to fall again. Rainfall of the study area is characterized by one main rain season (Kiremt or Mehir) during June, July, August and September and small rain season (Belg) during February, March and April. However, showers of light rain can occur in any month of the year.

In Guassa area the climate varies according to altitudinal gradients and the size of the mountain block. The weather at Guassa is often unpredictable, with days characterized by some combination of sun, fog, rain or wind while nights tend to be cold. Temperature at Guassa fluctuates widely over the course of almost any single day, invoking the old adage about African alpine ecosystems “summer every day, winter every night.” The high altitude of the area means that mild day and cold night temperatures are commonplace with day time temperature rising up to 26°C in the driest months and night temperatures dropping to below zero. The diurnal temperature variation is lower in the wet season with a day time of 12°C and night time of 3°C (Zelealem Tefera, 2001).

### **3.5. Geology and soil**

The formation of Guassa area during the Oligo-Miocene was a result of the tectonic and volcanic activity (Zanettin and Justen-Visentin, 1974; in Zelalem Tefera, 2000). Lava covered all the previous rock formations that had been formed prior to the formation of the Rift Valley. Guassa area contains 15-26 million year old Miocene rhyolites and basalts, sometimes referred as an Alaji-Molale formation and 20-26 million year old Oligo-Miocene basalts and Phonolites (Zanettin and Justen-Visentin, 1974; in Zelalem Tefera, 2000). On the plateau of Guassa area, the following formation of Trao series lava have been identified; Ashangi basalts, Aibastratoid basalts, Alaji rhyolites and Termaber basalts linked to central volcanism (Zanettin and Justen-Visentin, 1974; in Zelalem Tefera, 2000). The central highland soil is characterized by two principal types, originating from the disintegration of volcanic substrates intermingled with sand and limestone. These comprise: black clay soil (vertisols) and reddish brown heavy loam (red soil). The former type appears on flat plateau along the bottom of valleys. The latter appears on valley slopes and well-drained areas. Generally, the soil of Guassa area is deep. However, on higher ground, the soil is shallow and highly mineralized.

### **3.6.Methods**

#### **3.6.1. Preliminary survey**

Preliminary survey was conducted in Menz Guassa community conservation area from september to october 2021. During the Preliminary survey,habitat of the area determined,validity of questionnaires were asked using 20 randomly selected in habitats. In addition, it is used to identify the specific sample areas for different data collection.

#### **3.7. Data collection methods**

Data for habitat use, diet preference and human conflict with Simien fox were collected from september 2021 to January 2022 using the following procedures.

##### **3.7.1. Focal group watch Data to study habitat use of simien fox**

Focal group watch was made on two groups of Simien fox. One group that is inhabiting the boundary of the conservation area adjacent to the farmlands and the second group far from the conservation area mainly in human dominated agro-ecosystem closer to settlement areas. All available habitats are identified and classified based on the vegetation height following (ErmiasAdmassuet *al.*, 2004).Data to determine the habitat most used by simien fox was gathered using focal group watch. Focal group watch method was used to collect data of daytime habitat use by Simien fox using a format provided in Appendix 1. The method was involved for considering the territorial behavior of the species. Data was collected through daily visit. In every successful visit days, habitat type that the Simien fox sight was registered including the activity, time spent and GPS location.

##### **3.7.2. Scat analysis Data to determine diet items used by Simien fox**

The diet item used by Simien fox in Guassa community conservation area was determined using scat analysis. Scats of Simien Fox was collected in all habitats of the species including the specific densities to identify food items used by the Simien Fox using a format provided in Appendix 2.During the time of scat collection, the age of the sample was categorized into fresh, recent and old (Breuer, 2005). Area, location, date of collection, age of scats, time of collection, altitude of the collection site and position were also recorded. Scat droppings were checked

regularly for hairs, feather and bones of the animal matters that are consumed by Simien fox (Breuer, 2005). Identification of carnivore scat was carried out based on shape, colour, ingested material, diameter and odour. The faecal samples of the Simien Fox were sun dried and grounded in a mortar, and then washed in a sieve (1 mm) using hot water to separate hairs, bones, teeth and other prey components from other organic materials. Then the separated hairs were washed in acetone, dehydrated by 99.9% ethanol and dried on filter paper. Finally, it was observed under a stereo microscope by considering form, length, colour and diameter (Breuer, 2005).

### **3.7.3. Questionnaire survey Data to determine Human-Simien Fox conflict in Guassa Area**

Questionnaire survey was conducted to determine the presence degree reason of Human Simien Fox conflict in study area. The questionnaire also consisted of questions which evaluate the attitude of the people towards wildlife and their knowledge of biodiversity conservation around the study district. A standard questionnaire was consisted of both open and close ended questions was prepared and presented to the local community. Of the families living in the study area 100 of them, 50 males and 50 females were randomly. The questionnaire was designed mainly to check whether there was a human-wildlife conflict or not in and around the Menz Guassa conservation area, the intensity and the fundamental causes of wild life related with Simien Fox. The questionnaire was provided in Appendix 3.

### **3.8. Data analysis methods**

Quantitative data were analyzed for frequencies and percentages using MS Excel 2013. Qualitative data were thematically presented and narrated.

## 4. RESULT AND DISCUSSION

### 4.1. Diet of Simien Fox

32 Scat were collected from Amemwasha, Sefedmeda and Rasketema from those Scat analysis (Table 1) showed that rodents were the principal diet (37.5%) followed by plant materials and birds 31.25% & 12.5 % respectively. Sheep (9.37%) and goats (6.25 %) were also predated by Simien foxes which accounted among the total livestock loss for the local people. The occurrence of prey differed significantly ( $P < 0.001$ ) in the fecal droppings of Simien fox. Site of fecal dropping not differed ( $P > 0.05$ ) in occurrence of prey type.

**Table 1.** Frequency occurrence of food items in scats.

Food item	No-of observations	%
Rodents	12	37.5
Plant Materials	9	28.13
Birds	4	12.5
Sheep	3	9.37
Goats	2	6.25
Plastics	2	6.25
Total	32	100.00

### 4.2. Habitat Use of Simien Fox

Simien Foxes live around in many different habitats including forests, grasslands, mountains and deserts. They also adapt well to human environments such as farms, suburban areas and even large community. Habitat use of Simien fox population (Table 2) inside the protected area in the human dominated major agro-ecosystem habitats was recorded in 60 day time locations. The most common location in both dry and wet season was Alchemilla shrubs land (58.3% and 61.7%). The use of Mima mound was seasonally documented (23.3% and 20%). The occurrence of finding Simien fox in the Festuca grassland and farmland habitats was low 11.7% and 6.7%, respectively. Simien fox used cover throughout the hours of daylight. They choice habitats to take rest and to remove human danger. Similarly, Zelalem Tefera,

(2005), revealed that the most frequent location of SimienFox was Euryops-Alchemilla shrubs land(60.27%) followed by Mima mounds (26%) in Menz area. Also similar study in Bale highlands, Ethiopia showed Euryoops Alchemilla shrubs land as the preferred day time resting locations of Simien fox despite large size coverage of farmlands (ErmiasAdmassuet *al.*, 2004).

**Table 2.**Frequency of Simien fox existence in different habitat types

Habitat type	Wet season		Dry season	
	No. of observations	%	No. of observations	%
Festuca grassland	7	11.7	6	10
Alchemilla shrub land	35	58.3	37	61.7
Mima mound	14	23.3	12	20
Farm	4	6.7	5	8.3
<b>Total</b>	60	100	60	100

In around protected area, Simien fox were more commonly seeing in bushland habitat. Bush land was the most favourite habitat type for day time resting. In Bale highlands, the majority of diurnal resting sites were recorded in the bush (ErmiasAdmassu et al., 2004). Woodland habitat was not available around the protected area. Cultivated farmlands adjacent to the protected area were the second habitat type where foxes sighted during the day time. Simien fox occupied along the border of the community conservation area as documented in 89 day time locations. Simien fox were seeing more commonly in the bush land and farmland.

Out of the total 89 successful visit opportunities, bush land (47.2 %) and farmlands (38.2 %) were the preferred resting places, grassland being the less favoured habitat type (14.6%). Rodent density along farmlands increases extensively during the wet season following production of barley crop. As a consequence, for the duration of wet season, the occurrence of locating Simien fox in farmlands was high. Particularly barley crop fields were more favoured day time resting locations during the months of October and November. The importance of Farmlands provide



cover from human disruption and also used for prey of feed source. Similar study was reported by Getachew (2010) in Guassa community.

**Table 3.** Simien Fox occurrence in different habitats around the protected area

Habitat Type	N	%
Bush	42	47.2
Grass	13	14.6
Farm	34	38.2
Total	89	100.00

#### 4.3. Demography of the population

General household characteristics of the respondents are presented in Table 4. Respondents were represented from villages: Alfa mider(36%), yegora(37.8%) and Yedie(26.2%). The study result indicated that 60 percent of the respondents were illiterate and 40 percent of them have an educational status from basic education up to elementary school. This shows that education in the study area not that much addresses most of the respondents in comparison to other area in the country. It is also obligatory to consider improvement of the education status in any rural or urban communities for adoption of new technologies. The respondents' average age was categorized in the active working age group. The age of respondents ranged from 19 to 70 years.

**Table 4.** Demographic and socio-economic characteristics of the households

Descriptor	Overall (N=150)
	Mean ± SD
<b>Family size</b>	7.46 ± 1.28
<b>Age</b>	43.42 ± 8.4
<b>Sex</b>	<b>N (%)</b>
Female	112 (74.7)
Male	38 (25.3)
<b>Education status</b>	
Illiterate	90(60)
Primary school (1-4)	36(24)
Elementary school (5-8 )	20(13.3)
Secondary school (9-10)	4(2.7)

The number of Livestock and pack animals was recorded in 150 households. The figure obtained revealed that sheep was the most common livestock with the highest figure in each successive years (Table 5). Sheep holdings ranged from 0 to 51. Next to sheep the second large number of livestock was recorded to cattle. Among pack animals, donkey was fairly common.

**Table 5.** Number of livestock recorded for the entire district (2019-2021)

Livestock species	Year			Total
	2019	2020	2021	
Sheep	31,450	22,894	22,460	76,804
Goat	426	376	340	1,142
Cattle	856	806	797	2,459
Donkey	398	367	406	1,171
Mule	98	107	102	307
Horse	138	109	104	351
Total	33,366	24,659	24,209	82,234

Among livestock (Table 6), mean sheep holding per household was the highest. The lowest mean livestock holding was documented to mule. On average 10.8 sheep were owned by each respondents. The trend showed that there was a reduction in sheep number. The reasons for the decreasing trends of sheep population in the study district was mostly due to the Simien fox predation and disease occurrence. Farming and livestock rearing were basic economic activities of the people. Livestock rearing specially sheep rearing was their major income source.

**Table 6.** The mean values of livestock holding per household by the local people

Livestock species	Year		
	2019	2020	2021
	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD
Sheep	11.34 $\pm$ 5.14	10.82 $\pm$ 2.14	10.25 $\pm$ 2.38
Cattle	3.52 $\pm$ 1.2	3.32 $\pm$ 0.94	3.08 $\pm$ 1.28
Goat	1.50 $\pm$ 0.52	1.32 $\pm$ 0.66	1.13 $\pm$ 0.59
Donkey	1.4 $\pm$ 0.91	1.54 $\pm$ 1.12	1.66 $\pm$ 0.38
Horse	0.64 $\pm$ 0.52	0.48 $\pm$ 0.59	0.44 $\pm$ 0.61

#### 4.4. Human –Simien Fox Conflict

Factors like human activities and carnivore behavior increase the risk of conflict. The local people of Guassa community had conflict with Simien fox and it is depend on particularly through habitat destruction and domestic livestock predation.

#### 4.5. Sources of Human Simien fox conflict and attitudes towards fox

##### 4.5.1. Livestock predation

The problem of livestock predation is prominent in the study area since extensive livestock husbandry is practiced. A total of 368 domestic livestock loss due to carnivore predators was recorded since 2019. The weight of predation differed among predators ( $P < 0.001$ ). Simien foxes were the third predator next to Golden Jackals and serval cat. Among livestock species (Table 7), predation was powerful on sheep followed by goat. The current finding was in line with (Vos, 2000) in which the decline in number of predator is probably related with the decrease in the number of livestock and lack of wild preys.

**Table 7.** Number of livestock predated (2019-2021)

Livestock Species	Predator				Total
	GoldenJackal	Serval cat	Simien fox	Hyaena	
Sheep	220	52	48	8	328
Goat	10	13	4	0	27
Cattle	0	0	0	2	2
Donkey	0	0	0	11	11
Mule	0	0	0	0	0
Horse	0	0	0	0	0
Total	330	65	52	21	368

#### 4.5.2. Habitat destruction by local people

The local people induced a variety of anthropogenic factors like destruction of habitat and cultivation of land for farming which account for the great decline of number of Simien fox. Out of the total 57 successful visit opportunities in day time resting cover, the number of Simien fox observation was high at rehabilitated land (56.2 %), and followed by grazing area (26.3%)(Table 8). According to Treves and Karanth(2003), humans can allow the recovery of carnivore population and promote conflict with them by rehabilitating the deforested area. Farm land (12.3%), deforested area(5.2 %) and road sides (0%) were with low observation of Simien fox. Increasing number of domestic animals destroy the forest habitat and compete with the wild Ungulates.

**Table 8.** Red Fox observation in different habitats around the protected area (2019-2021)

Habitat Type	N	%
Rehabilitated land	32	56.2
Deforested area	3	5.2
Grazing area	15	26.3
Farm land	7	12.3
Road sides	0	0
Total	57	100.00

#### 4.5.3. Perception of the community towards Simien fox

Respondent's attitude towards the Smien fox was related to livestock predation. There was no difference in attitude towards Simien fox between villages. Some of the respondents had positive attitude towards Simien Fox while large number of respondents showed negative perception to Simien fox.

## **5. CONCLUSION AND RECOMMENDATION**

### **5.1. Conclusion**

The most common location of Simien fox at Guassa conservation area was Euryops-Alchemilla shrubland in both wet and dry season (58.3% and 61.7%). The use of Mima mounds was documented seasonally (23.3% and 20%). The occurrence of finding Simien fox in Festuca grassland and farmland habitats was low 11.7% and 6.7%, respectively. Simien foxes were the third predator next to golden Jackals and Serval cat. Scat analysis showed that rodents were the principal diet (37.5%) followed by plant materials and birds that constituted 31.25% and 12.5 % of the prey items, respectively. Sheep (9.37%) and goats (6.25 %) were also preyed by Simien foxes which accounted among the total livestock loss. In the conservation area Simien fox was found to have spent less time in the presence of human related activities while it spent similar amounts of time in the presence and absence of livestock. These findings suggest Simien fox can cope with, or adapt to, the presence of livestock but they are largely disturbed by the local human activities like farming, livestock grazing and grass cutting.

### **5.2. RECOMMENDATIONS**

Based on the present study, the following recommendations have been made:

- ✓ The most habitat type of Simien fox was Euryops-Alchemilla shrubland and Mima mounds, so that providing the scientific basis for conservation of Guassa grass and the endangered Ethiopian Simien fox should be practiced.
- ✓ The local community should not destruct the habit of Simien fox, as it has been the reason for human conflict.
- ✓ To minimize the human conflict of Simien fox, guarding and changing sheep grazing system (away from Simien fox habitat) should be implemented.

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## 7. APPENDICES

### Appendix 1: Data collection sheet for habitat use

Date	Time	Habitat type	GPS location

**Appendix 2:** Scat sample collection sheet for diet study

Date	Time	Place of collection	GPS location	Remark

**Appendix 3:** Questionnaire for Simien fox-human conflict in MenzGuassa Community conservation Area.

The purpose of this data collection for scientific and educational purpose and never used for commercial purpose or is transferred to a third body.

**A.** Socio-demographic characteristics of the respondents.

1. Respondent number.....
2. Age .....
3. Sex.....
4. Residence.....
  - a. Kebele.....
  - b. Village.....
  - c. Woreda.....
  - d. Distance from the study area.....
5. Marital status.....
6. Family size.....
7. Educational level (for family members).....
  - a. no formal education.
  - b. primary education.
  - c. secondary education.
  - d. beyond secondary education..

**B.** Household Economy and Resource Use

1. Do you keep livestock? If yes,
  - a. number of cattle.....
  - b. number of sheep and goats.....
  - c. number of pack animals.....
2. Do you have private grazing field? Yes/ no
  - a. if yes, size of grazing land in hector.....
  - b. for how long do you keep your livestock in private grazing area?.....
3. Where do you keep livestock during the night time?.....

C. Simien fox –human conflict and Damage

1. The type of wildlife you know in the area

.....  
.....  
.....

2. Do you agree that protecting Simien fox is important?

3. What kind of problems do you face because of wolves?

- a. Livestock
- b. Disease transmission
- c. Others (Breeding with domestic animals such as dog).

4. Have you ever lost any livestock by Wolf? Yes/No

a. If you say yes, type and number of livestock's taken by wolf?

S. No	Type	Number	Time	Year

5. Which animals are the most problematic in terms of livestock predation?

	Predator	Prey	Number killed		
			In 2021	In 2016	In 2011
1					
2					
3					

6. What are the potential and actual conflicts humans are causing to wolves?

List, down.

7. List the type of wild animals that you know in the Guasa community conservation area?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

8. What are the different techniques used to control or reduce the damage caused by Simien fox?

- i. \_\_\_\_\_
- ii. \_\_\_\_\_
- iii. \_\_\_\_\_

9. At what season the Simien fox attack the community, list the specific month that mainly attack the community?

\_\_\_\_\_

**Appendix 4.**Habitat use and scat analysis of Simien fox in Guassa Community Conservation Area in Menz Gera Midir District, North Showa Zone, Ethiopia.

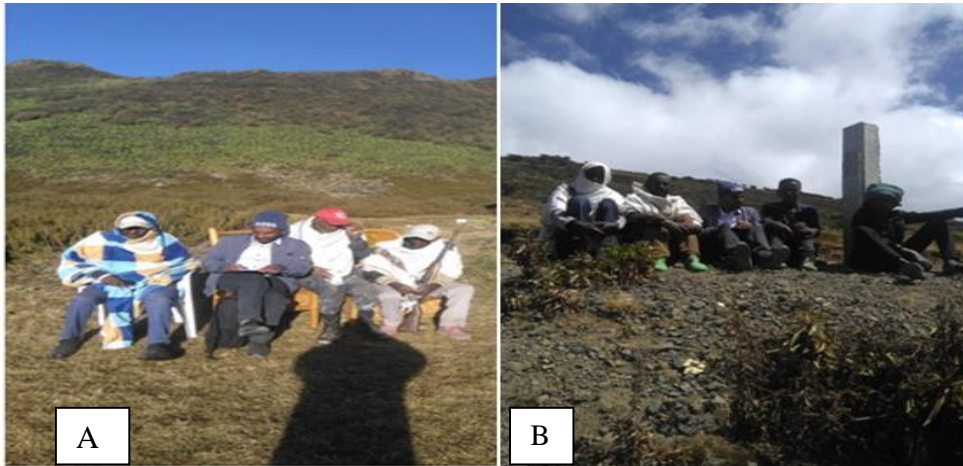
**A. Habitat**

Date	Time	Habitat	GPS		
			Latitude	Longitude	Altitude
1/10/21- 14/10/2021	14	Farm Land	10 <sup>0</sup> 19' 32.969'' N	39 <sup>0</sup> 48' 33 .346'' E	3040m
10/11/21- 13/12/21	35	Euryops Alchemilla shrubland	10 <sup>0</sup> 17' 44.895'' N	39 <sup>0</sup> 48' 5.238'' E	3328m
14/12/21- 18/12/21	4	Festuca grass land	10 <sup>0</sup> 17' 50.650'' N	39 <sup>0</sup> 47' 33 .606'' E	3543m
19/12/21- 26/12/21	7	Mima mound	10 <sup>0</sup> 17' 59 .379'' N	39 <sup>0</sup> 47' 35 .672'' E	3230m

**B. Scat analysis**

Date	Time	place of collection	GPS		
			Latitude	Longitude	Altitude
10/11/21- 1/12/21	22	Amemwasha	10 <sup>0</sup> 18' 1.329'' N	39 <sup>0</sup> 47' 40.616'' E	3426m
2/12/21- 26/12/21	25	Sefedmeda	10 <sup>0</sup> 19' 34.953'' N	39 <sup>0</sup> 48' 32.217'' E	3382m
3/1/22- 30/1/22	27	Rasketema	10 <sup>0</sup> 19' 34 .512'' N	39 <sup>0</sup> 48' 29.183'' E	3393m

**Appendix 5.** Focus Group Discussion in Guassa Community Conservation Area in Menz Gera Midir District, North Showa Zone, Ethiopia.



A = Focus discussion group at local part of guassa known as Regreg

B = focus group discussion at the another local area of Gussa known as Sefedmeda

**Appendix 6.** Collection of scats sample of Simien fox from guassa community conservation area.



**Appendix 7.**Ethiopian Simien fox at guassa community conservation area.(Photo by MekashaMekonnen in 2022).



**Appendix 8.**Simien fox scat analysis in the laboratory by MekashaMekonnen in 2022.





**Appendix 9.** Focus group interview questions to the community.

1. Where most of the time Simien Fox are located?
2. How to protect your live stock from attacking by Simien Fox?
3. Is there any similarity between Golden Jackal and Simien Fox?
4. Is there any negative interaction between human and Simien Fox?
5. Do you have any awareness about the economical importance of the Simien Fox?
6. How do Simien fox important for the environment?
7. What Simien Fox eat?
8. When the Simien Fox observed on the farm land rather than the Guassa community conservation area?
9. Is the Simien Fox population increase or decrease time to time?
10. What is your attitude towards the Simien Fox?

**Thank you for your volunteers**