



**COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCE
SCHOOL OF GRADUATE STUDIES DEPARTMENT OF BIOLOGY**

**FEEDING ECOLOGY AND THREATS TO WILD AFRICAN CIVET (*Civettictis civetta*)
IN CHORA WOREDA, BUNO BEDELE ZONE, OROMIA REGIONAL STATE,
SOUTH WESTERN ETHIOPIA**

BONTU TOLESA

**A THESIS SUBMITTED TO THE DEPARTMENT OF BIOLOGY IN PARTIAL
FULFILLMENT FOR THE REQUIREMENTS OF MASTERS OF SCIENCE (M.Sc.)
DEGREE IN BIOLOGY**

ADVISOR: HABTE JEBESSA DEBELLA (PhD)

**SEPTEMBER, 2018, ADDIS ABABA,
ETHIOPIA**

**Feeding ecology and threats to wild African civet (*Civettictis civetta*) in Chora Woreda,
Buno Bedele Zone, Oromia Regional State, Southwestern Ethiopia**

Bontu Tolesa

A Thesis Submitted to Department of Biology School of Graduate studies Addis Ababa
University in Partial Fulfillment of the Requirements for the Degree of Master of Science in
Biology

September, 2018, Addis Ababa,
Ethiopia

Addis Ababa University
School of Graduate studies

This is to certify that the thesis prepared by Bontu Tolesa Emire entitled: Conservation status and threats to wild African civet Chora Woreda, Buno Bedele Zone, Oromia regional state Southwestern Ethiopia and submitted in partial fulfillment of the requirements for the degree of master of science in biology complies with regulation of the university and meets the accepted standards with respect to originality and quality.

Signed by the examining committee:

Examiner _____ Signature _____ Date _____

Examiner _____ Signature _____ Date _____

Advisor _____ Signature _____ Date _____

DEDICATION

This thesis is dedicated to my late father Tolesa Emire from whom I gained a lot of experiences in my life.

Acknowledgements

First of all, I would like to express my deepest gratitude and appreciation to my advisor Dr, Habte Jebessa Debella for his fruitful discussions, encouragement, constructive criticism, and consistent guidance starting from the title section up to the final version of this thesis.

I would also like to thank the Oromia Region Educational Bureau for providing my research fund. My gratitude also goes to Chora Woreda Agricultural and Natural Resource Office and Abdala-Darimu Civet Farmer Association for their unreserved cooperation in providing relevant information necessary for the thesis.

I am very grateful to my late father Ato Tolesa Emire and my mother W/ro Mestawot Ayana for nursing me with affection and love and for their dedicated partnership in the success of my life. I am also thankful to my brothers Jiregna, Bikila, Diriba and my sister Bilise Tolesa for their invaluable assistance to ward my study. I would like to thank all female M.Sc students of the Biology Department (my classmates), especially, my colleague Ageritu Ayalew for her valuable encouragement and information sharing.

List of Abbreviations and Acronyms

AAU	Addis Ababa University
BBFWE	Buno Bedele Forest and Wildlife Enterprise
CWANRO	Chora Woreda Agricultural and Natural Resource Office
EWCA	Ethiopia Wildlife conservation Authority
EWCO	Ethiopia Wildlife conservation organization Authority
FAO	Food and Agricultural Organization
Fig	Figure
Ha	Hectare
HH	House Holds
NGOs	Non-governmental organization
OFWE	Oromia Forest and Wildlife Enterprise
WSPA	World Society for the Protection of Animals

Table of contents

Contents	Page
ACKNOWLEDGEMENTS.....	v
List of Abbreviations and Acronyms	vi
Table of contents	vii
List of figure	ix
List of TableContent.....	x
List of appendix	xi
<i>ABSTRACT</i>	xii
1.1 Background of the study	1
1.2 Statement of the Problem.....	3
1.3.1 General Objective	4
1.3.2. Specific Objectives	4
1.4. Basic Research Questions	4
1.5 Significance of the Study	5
1.6. Scope of the Study	5
1.7. Organization of the study.....	5
2. REVIEW OF RELATED LITRATURE.....	7
2.1. Taxonomy of African civet	7
2.3. Civetry Sites and its Defecation.....	10
2.4. The life of African Civet.....	11
2.5. Threats to African Civets.....	12
2.6 .Population Ecology of African civet.....	14
2.7. Historical Background of Civiculture in Ethiopia	14
3. MATERIALS AND METHODS.....	16
3.1. Description of the Study Area.....	16
3.2. Research Design.....	18
3.3. Sources of Data	19
3.4. Sample and Sampling Techniques	19
3.5. Sample collecting procedure.....	20
4. RESULTS AND DISCUSSION	24
4.1 Results.....	24
4.1.1. Feeding ecology of African civet in the wild.....	24
4.1.2. Population status of African civet.....	27

4.1.4. The major threats of African civet and Conservation	30
4.1.5 Efforts of Rural Households and Stake holds on African civet Conservation	35
4.2. DISCUSSION	37
5. CONCLUSSION AND RECOMMENDATION.....	43
5.1 CONCLUSSION.....	43
5.2 RECOMMENDATION	44
6. References.....	45
7. APPENDEX.....	53

List of table

Table 2. Sample and sampling techniques of house hold heads.....	20
Table 3. List of total food items identified from scats of African civet in current study area	Error!
Bookmark not defined.	
Table 4. List of food items identified from scats of civets at each of study site	Error! Bookmark not defined.
Table 5. Number of civets surveyed in each site	Error! Bookmark not defined.
Table 6. Demographic characteristics of the respondents.....	30
Table 7. Purpose of hunting /trapping /civet from natural habitat	33
Table 8 .Methods of civet prevention from field crop	35
Table 9. Respondent responses on awareness /training/ on civet conservation and Management.....	36
Table 10. Strategy to control the target animal from further decline.....	36

List of Figure

Figure 1. Civetry.....	11
Figure 2. Map of the study area.....	17
Figure 3. Land use pattern of the study area.....	18
Figure 4. Field observations of civetries site.....	24
Figure 5. Population status of African civet.....	31
Figure 6. Clearing Forest for agricultural expansion in Ababora.....	32
Figure 7. The reasons for causes of decline African civet from local area	33
Figure 8. Fruit trees and crop plants to be damaged by civet.....	Error! Bookmark not defined.
Figure 9. Illegal trapping of civet around location of civetry in coffee forest by 'Futasa'	35
Figure 10. The stake holders who control civet from further decline	37

List of appendix

Appendix 7.1 Questionnaire -English Version.....54
Appendix 7.2 Gaafannoo Afaan Oromoo.....58

Abstract

*Feeding ecology and threats to wild African civet (*Civettictis civetta*) was studied in southwestern Ethiopia, Oromia Regional state, Buno Beddele Zone of Chora woreda from December 2017 to May 2018. A cross sectional research design was employed with descriptive survey method, which has supplemented by qualitative research to enrich quantitative data. In doing so, three kebeles were purposively selected based on distribution of African civet. The objective of the study was to investigate the feeding ecology of the African civet in the wild, to estimate the population survey, to identify the major threats and to examine conservation status of African civet in the wild. African civet is known for its production of civet musk ('Zibad') that is used as fixative in perfume industry. Ethiopia is the world's main supplier of civet musk. In spite of such a remarkable economic importance, little is known about current status of the indigenous population and conservation status of *Civettictis civetta* in the wild. Diet composition, population status, real threats and conservation status of civets were investigated. In the study sites, 13 civetries were identified, the continuous observation of fresh civet scats were conducted on six civetries which revealed the presence of 18 food items based on analyses of undigested remains of food item. Food items were present in varying frequencies of occurrences between different civetries. A total of 19 civets were recorded from six representative civetries which were selected for current study based on daily counting of fresh dropping in each civetry. About 126 household heads were selected using purposive sampling techniques to study the threat and conservation of African civet in the study area. SPSS software and Descriptive statistics were used to analyses data. The major factors contributing to the reduction of civets are; the fast disappearance of natural forest, attributed to agricultural land expansion, illegal hunting, traditional trapping methods and use for traditional medicine. Despite the fact that there were some efforts on parts of governmental and nongovernmental organization in mobilizing the rural community towards African civet conservation, the efforts of civet conservation by local communities in the study area are not adequate to mitigate the problems of civet decline. Based on the findings it is recommended to encourage and implement the following activities: controlling illegal hunting of African civet, awareness creation, trainings the local communities about conservation and sustainable utilization of civet and other wildlife, controlling illegal clearing of forest and agricultural land expansion, controlling traditional trapping methods of African civet and law enforcement –There should be strong law enforcement on part of the government on those who illegally and indiscriminately trap civet.*

Key words; African civet, civetry, threats, scat, feeding ecology, illegal hunting, population status, deforestation

1. Introduction

1.1 Background of the Study

The African Civet (*Civettictis civetta*, Schreber, 1776) has been historically the main Source of civet musk used in perfume industry. The word “civet” also refers to the distinctive musky scent produced by civets. The genus name “Civettictis” is derived from the French word ‘civette’ and the Greek ‘ictis’, meaning weasel, Old Italian Zibetho.

African civets exist in a wide range of habitats (Ray *et al.*, 2008). They inhabit forest, savanna, forest edges, dry areas along water course, farmlands, and human settlements in urban areas (Ray, 1995; Ray *et al.*, 2008; Dagnachew Melese *et al.*, 2014). *C. civetta* inhabits a variety of habitats ranging from moist tropical forest of southern and central Africa to dry scrub savannahs. They are rarely found in arid regions; however, can be found along river systems that project into the arid areas of Niger, Mali and Chad (Ray, 1995). It is a terrestrial mammal climbing trees only under emergency conditions.

African civets are omnivorous and opportunistic foragers. They feed on a wide variety of food items like plants, rodents, birds, insects, carrion, snails, centipede and millipede. Even they are adapted to eat foods, which are toxic to other mammals such as fruits of *Strychnos* sp., and highly decayed carrion. African civets as carnivores indicate the ecosystem health and integrity. They play a major role in maintaining the structure of food-web and community of lower trophic levels in the ecosystem they occupy (Palomares *et al.*, 1995). Their frugivorous behavior might influence the dynamics of forest, and shape of plant community structure through seed dispersal and regeneration (Mudappa *et al.*, 2010). As an ecosystem service provider, civets have a role in facilitating soil fertility due to the behavior of civetry formation.

African civets eat small mammals, birds, reptiles, amphibians, invertebrates and fruits. They have an excellent sense of smell, and they hunt prey in stalking manner like a cat. The African civet hunts exclusively on the ground at night, resting in thickets or burrows during the day (Macdonald, 2001; Williams, 2003; Wright, 2011). They are good seed dispersers and hence may affect plant community, genetic diversity and heterogeneity of the habitat. Communities of small mammals and insects may be regulated by civets as they feed on these animals. African

civets defecate in a communal latrine site called “civetry”. They use a single location for defecation for a long period. Civetries may play roles in territoriality, sexual attraction, and warning or defense behaviors. African civets deposit their droppings in one place creating middens or “civetries” or dung piles. They mark their territory using their perineal gland secretion known as ‘civet’ or civet musk (Hillman, 1993; Ewer, 1998; Nowak, 1999).

The civetry also provides information regarding diet composition of civets and its seasonality (Bekele Tsegaye *et al.*, 2008b), scent communication (Espírito-Santo *et al.*, 2007; Bekele Tsegaye *et al.*, 2008a), population size (Solberg *et al.*, 2005) and their potential for seed dispersal (Russo *et al.*, 2006). They are solitary animals, except during the breeding period, when they may form groups of two or more for a brief period of time. They use olfactory signals as a major means of communication between conspecifics (Ray, 1995; Bekele Tsegaye *et al.*, 2008a).

They have perineal scent producing glands as a deep pouch at the ano-genital region, anatomically divided into sacs in which the secretion is stored. They produce chemical signals from these glands and mark environmental objects in their home ranges. These marks can stay for a long period in their habitat. African civet has social, cultural and economical importance in Ethiopia (Yilma Delelegn, 2003). Civiculture (civet farming) plays a significant role in the economic history of Ethiopia, especially in the 18th and 19th century.

African civets are sexually mature at the age of 9–12 months (Ewer and Wemmer, 1974). They have a gestation period of 60 to 81 days (Kingdon, 1977). Data on availability of population dynamics of the African civet is fragmented and represent only few localities in some countries. In western Ethiopia, the reduction in the number of civet is due to intensive trapping by civet farmers to replace the dead individuals in captivity and to increase the number of civets in their farms (Yilma Delelegn, 2000). Nearly 40% of the civets captured from the wild die within the first three weeks of capture (WSPA, 1999). Civet farmers replace died ones from the wild, which may cause threat to local civet population.

All civets have perineal glands or scent-producing glands, located in a double pouch near the genital. The fatty yellow secretion of these glands has a distinctive musky odor used for olfactory

communications. Commercially, it is used as a perfume fixative (Hillman, 1992; 1993). The perineal gland secretion (musk) extracted from the civet was exported to various countries, and even it served as a currency in the past (Woodford, 1990). Civet musk is a foul smelling scent (strong smell) produced by the glands of the male civet (FAO, 2000). Males produce larger quantity and better quality musk than that of females. It is collected by scraping the glands at regular intervals of about a week using a spatula made of horn. A civet will yield from 800 to 1300 g musk a year.

Ethiopia has a worldwide monopoly for civet musk production and annually exports more than 3,000 kg of musk worth about US\$ 3,000,000 (FAO, 2000). Currently, civet farming is practiced as a means of income in many parts of Ethiopia (EWCO, 1999). But, the gain from the business to farmers is becoming low due to several factors such as the production of 'synthetic musk', black market, adulteration and abuse by middlemen (Yilma Delellegn, 2003). Major suppliers of crude 'civet' supporting perfume industry are African countries, primarily Ethiopia (Ray, 1995).

This research was initiated in August 2017. It was primarily aimed at study threats, current conservation status, feeding ecology and population survey of African civet in the natural environment. The threats to wild African civet in Buno Bedele zone, Chora district is in worsening due to hunting for economic purpose. This particular problem repeated for a long time and unlikely to change.

1.2 Statement of the Problem

In Ethiopia, people use civet musk in traditional medicinal practice for headache, discoloration of skin, itching and even against cancer (Jemal Mohammed, 1999). In many parts of Ethiopia, civet farming is practiced as a means of income (EWCO, 1999). Hunting might be rendered more vulnerable in areas where preferred bush meat is scarce. But such practice is not common in Ethiopia. The population size of civet declined from the wild due to illegal hunting and reduction of natural forest for different purpose. In western Ethiopia, the reduction in the number of civet is due to intensive trapping by civet farmers to replace the dead individuals in captivity and to increase the number of civets in their farms (Yilma Delellegn, 2000). Nearly 40% of the civets captured from the wild die within the first three weeks of capture (WSPA,

1999). Likewise, a similar problem is observed in southwestern part of Ethiopia, Oromia Regional State, particularly in Buno Bedele Zone chora woreda. Ethiopia is the world's main supplier of civet musk. In spite of such a remarkable economic importance, little is known about current status of the indigenous population and conservation of *Civettictis civetta* in wild.

There are a number of captive breeding that is taking place by civet farmers in this district and they get their civet from civet trapper those used traditional trapping methods which may injured number of civet during trapping and killed them. The habitat loss through deforestation and agricultural land expansion were the other problems of the threat to African civet in the wild. However, still there was no research conducted on conservation status and threat to wild African civet in this district and the population decline of civet could be worsening when comparing to other wildlife in this area and the study were initiated due to these reason July 2017.

1.3. Objectives of the study

1.3.1 General Objective

The main objective of this study is to investigate the Feeding ecology and threats to wild African civet in Chora woreda of Buno Bedele zone.

1.3.2. Specific Objectives

- ✓ To investigate the feeding ecology of African civet in the wild.
- ✓ To survey population status of African civet in the study site
- ✓ To identify the major threats of African Civet in the study area.
- ✓ To examine conservation action of African Civet in the study area.

1.4. Basic Research Questions

The research seeks to give answers to the following basic questions.

1. What are the food items consumed by civet?
2. What are the major threats of African Civet in the study area?
3. What conservation actions were taken in the study area?
4. What is the estimated population status of African Civet in the study area

1.5 Significance of the Study

The significance of this study can be viewed from different angles.

- ❖ First, it is significant for Chora woreda farmers to gain awareness about the conservation of wild animals like civet and other animals.
- ❖ Second, the study result is important for agricultural and natural resource office to take measure that reduces hunting of civet and other animals and may save wild animals lives.
- ❖ It is also useful for farmers in the study area to develop the conserving habit of wild animals like African civet to protect their extinction from the local area.
- ❖ In addition, the study may pave the way for those who are interested to conduct a study on similar issues.

1.6. Scope of the Study

The scope of this study was to investigate Feeding Ecology and Threats to wild African civet in selected kebeles of Chora woreda, Buno Bedele Zone, Oromia regional state. The finding of this study could be useful as a base to solve some of the threat of civet if has been conducted widely included all the kebeles of the woreda. But because of wide geographical coverage of the woreda as well as for its manageability, the study delimited to conservation status and threats in three kebeles from Chora woreda of Bedele zone.

1.7. Organization of the study

This thesis is divided in to five chapters. In the first chapter, the introduction of the paper is presented. This covers background of the study, statement of the problem, objectives of the study, research questions, and significance of the study scope and limitation of study. Chapter two presents the literature review which encompasses definition of concepts of conservation and treats to civet. Chapter three provides description of the study area and the research methodology which encompasses descriptions of the study area, research design, sample size and sampling technique, data sources, methods of data collection and analysis. Chapter four, deals with finding of the study. Chapter five presents summary, conclusion and the recommendations of the research work

1.8. Limitation of the Study

It is obvious that research work cannot be free of limitation. Likewise, this study has some limitations. These include shortage of financial constraints and lack of organized secondary data due to the lack of adequate documentation and organized data base system in the study area. Moreover, there were absence of officials and some experts from office during data collection. In spite of these short coming, attempts were made to make the study as complete as possible. These attempts were arranging appropriate time schedule for every activity and paying tolerance to get the officers the required data.

2. Review of Related Literature

2.1. Taxonomy of African civet

African civet resembles genetically linsangs (Kingdon, 1977). They are not true cats, but they look like a member of the cat family. One can easily distinguish African civets by *their* disproportionately larger hindquarter, low-headed stance and erectile dorsal crest (Ray, 1995). African civet is classified under the Class Mammalia, Order Carnivora, Family Viverridae and Subfamily Viverrinae. The Family Viverridae consists of 20 Genera with 35 species (Nowak, 1999). However, as the recent classification of Wozencraft (2005), this Family consists of 15 genera with 38 species. Viverridae is one of the most diverse groups of the Order Carnivora Wozencraft (2005). The Viverridae are classified into four Subfamilies. These are Hemigalinae, Paradoxurinae, Prionodontinae and Viverrinae. The Asian palm civets (Hemigalinae and Paradoxurinae) are confined to South and South-east Asia, whereas Viverrinae is distributed across Asia, Africa and part of Europe (common genets). The Asian linsang (Prionodontinae) is distributed across Asia. Molecular studies have shown that Prionodontinae (Prionodon) is a sister group of the Family Felidae, and should now be erected as a Family (Prionodontidae) (Gaubert and Veron, 2003; Gaubert *et al.*, 2005).

Based on molecular studies, Gaubert and Cordeiro-Estrela (2006) have argued that the subfamily Viverrinae should be split into two subfamilies, namely; Viverrinae (terrestrial civets) and Genettinae (*Genetta* and *Poiana*). Some authors have categorized African civets under the genus *Viverra* (Rowe-Rowe, 1978); but, Ewer (1973), Rossevear (1974), Kingdon (1977) and Ray (1995) have described it under a distinct Genus, *Civettictis* as the only member of the genus (Ray, 1995).

Civets vary in size with large heavily built, long-bodied, long-legged and dog-like viverrids preferring to be near water. They have some cat-like appearance with long noses, slender bodies, pointed ears, long furry tail, short legs, non-retractile claws, and unlike other cats they are digitigrades (Wright, 2011). Civets with spotted or striped coat have five toes on each foot. There is webbing between the toes, and the claws are non-retractile or semi-retractile. The pointed ears extend above the profile of the head. Like domestic cats, ear flap has pockets or bursae on outside margins. Their teeth are specialized for an omnivorous diet, including shearing

carnassials teeth and flat-crowned molars in both upper and lower jaws (Ray et al., 2008; Gauberts et al., 2005). The African civet has gray coats with black markings, erectile mane, and long tail. They have different patterns of coat coloration from place to place. The body weight also show variation from region to region, and slightly between sexes.

2.2. Feeding Ecology

African civets are omnivorous and opportunistic foragers. They feed on a wide variety of food items like carrion, rodents, birds, centipedes, millipedes, insects, eggs, reptiles, fruits and vegetables (Kingdon, 1997; Wondmagegne Daniel, 2006; Ayalew Berhanu, 2007; Bekele Tsegaye *et al.*, 2008b). Eighty percent of the stomach contents of the African civet contained remains of wild fruits, carrion and rodents as reported from South Africa (Bothma, 1971). Insects also constitute significant proportion of their diet (Smithers and Wilson, 1979).

The African civet is omnivorous in diet and feeds mainly on fruit and small animals. It is even known to depend upon domestic food wastes. The omnivorous diet includes carrion, rodents, birds, eggs, reptiles, frogs, crabs, snails, insects, centipedes, millipedes, small mammals, fruits, and other vegetation. The African civet is able to eat items that are usually poisonous or distasteful to most mammals, including the fruits of *Strychnos* (bitter tasting plant), poisonous invertebrates (such as the centipedes and millipedes which most other species avoid) and snakes and highly-decayed carrion (Gittleman, 1996; Smithers, 1986). Prey is primarily detected by smell and sound rather than by sight. Poultry and young lambs are sometimes taken. They are most active about an hour or so after dark when they forage (Ray and Sunquist, 2001).

African civets do not use their paws and claws for catching prey. Instead, they kill the prey with their teeth. The killing methods include shaking their heads to break the prey's spine, throwing it around or the use of a killing bite wherein the grip is not released until the prey is dead. Civets display various hunting behaviors. The prey may be shaken so violently (death shake) that the spinal column is broken or a rodent may be bitten and thrown around (Estes, 1991; Shalu, 2000). African civets can consume about 2 kg of food at a time. They also can stay without food for about two weeks (Kingdon, 1977). They seem to have a unique digestive system to eat a variety of foods items.

The African civet hides and waits for prey to come along, and then they pounce and kill it by biting with their strong jaws (Hussein, 1999). When the civet grabs the prey in their jaws, it shakes the prey violently. When the prey is dead, civets then scarf down the food with little chewing in a very short period of time. This enables them to eat quickly and keep moving so that they are not targeted by larger predators (Estes, 1991; Nowak, 1999).

Grasshopper, crickets, termites, beetles and stick insects were among the most common insects in the diet of civets. They also prey on aquatic animals such as crabs, snails and mudskippers (Kingdon, 1977). In Ethiopia, the diet of civets is mainly composed of wild and commercial fruits. In addition to these items, they depend on a variety of food items based on seasonal availability in the area. They feed on bony materials, but it might not be digested (Wondmagegne Daniel, 2006; Ayalew Berhanu, 2007; Bekele Tsegaye *et al.*, 2008b). However, undigested bony materials were not seen in the scats of the small Indian civet (Sreedevi, 2001). Civets have an irregular habit of feeding. They feed large amounts of food when available (up to 2 kg of food in a single night), and in the absence of food, they can stay up to two weeks without food (Kingdon, 1977). They are nocturnal in habit and use their acute senses of smell and hearing to locate their prey. Unlike genets, civets do not chase prey. They grab from their hiding places. During prey capture, they use their teeth to bite and shake the prey violently to break the spinal column or may bite the prey and throw it vigorously (Kingdon, 1997).

When the prey animal is dead, they scarf down the food with little chewing in a very short period of time (Estes, 1991). This enables them to eat quickly and keep moving to escape from predators. Due to lack of shearing carnassials, efficiency of meat cutting in the species is low. Hence, they swallow the food with minimal chewing. Feeding habits of civets can be affected spatially and temporally, depending upon the type of habitats where they live. Studies in three different parts of Ethiopia have revealed variations in the diet composition, seasonality and preference of food items of civets. Where the habitat is heterogeneous, they feed on a wide variety of food items with only slight seasonal variations (Ayalew Berhanu, 2007). In this area, the main diet of civet is fruits (commercial and wild). Caracas feeding habit was also reported. In Jimma forest and Menagesha-Suba State Forest, the diet of civets showed significant seasonal

variations (Wondmagegne Daniel, 2006; Bekele Tsegaye *et al.*, 2008b). In both these areas, civets depend up on fruits for survival.

African civets as carnivores indicate the ecosystem health and integrity. They play a major role in maintaining the structure of food-web and community of lower trophic levels in the ecosystem they occupy (Palomares *et al.*, 1995). Their frugivorous behavior might influence the dynamics of forest, and shape of plant community structure through seed dispersal and regeneration (Mudappa *et al.*, 2010). As an ecosystem service provider, civets have a role in facilitating soil fertility due to the behavior of civetry formation. It is not only the largest representative of Viverridae, but also a bio indicator of forest habitat dynamics akin to most other Civet species (Mudappa *et al.*, 2010; Rabinowitz, 1991).

2.3. Civetry Sites and its Defecation

Civetry sites are not only used as a site of defecation; they may also have roles in communication, territoriality, warning and defense behaviors (Bearder and Randall, 1978; Jordan *et al.*, 2007) and regulation of physiological functions (Espírito-Santo *et al.*, 2007; Barja *et al.*, 2011). Using same place to defecate also benefits the animal to centralize waste and cut down on parasites and infection (Lamoot *et al.*, 2004). Ecologists also get information regarding the diet composition (Bekele Tsegaye *et al.*, 2008b), scent communication (Espírito-Santo *et al.*, 2007; Bekele Tsegaye *et al.*, 2008a), population size (Solberg *et al.*, 2005), mechanism of seed dispersal and evolution of plant community (Fiorelli *et al.*, 2013).

In contemporary ecological research, faeces of wild animals collected from latrine sites are used as a resource for genetic variability analysis within and between populations, gene distribution, gene frequencies, individual identification (Schwartz *et al.*, 2007) and phylogeographical studies (Beebee and Rowe, 2005).

African civets have communal latrines or dung piles called ‘civetries’. ‘Civetries’ or dungpiles are often established around tracks in clearings. Civetries also serve for olfactory communication and to mark territory boundaries. Scats are left in an unburied pile (Kingdon, 1997; Trites *et al.*, 2005; Bekele Tsegaye *et al.*, 2008).



Figure 1. Civetry (Picture: Bontu T., 2018).

Latrine site selection and defecation behavior of frugivorous animals have impacts on the genetic structure and heterogeneity of plant community in a given habitat through seed dispersal (Mudappa *et al.*, 2010) and soil enrichment (Lunt, 2011). Latrines may provide a rich microhabitat for seedlings, thus the African civets act as seed dispersal agent (Randall, 1977; Pendje, 1994). Civets do not bury their feces, but they accumulate it in open places. During defecation, perineal glandular secretion is added to the feces, making it to have a long-lasting odor. African civets use each civetry for a long period (Wondmagegne Daniel, 2006; Ayalew Berhanu, 2007; Bekele Tsegaye *et al.*, 2008b). They establish their latrines near pathways in open and relatively dry soil. Latrine sites are also a good source of communication for civets, having high density of scent marked objects surrounding civetries (Wondimagegne Daniel, 2006; Ayalew Berhanu, 2007; Bekele Tsegaye *et al.*, 2008a).

2.4. The life of African Civet

African civets are solitary during most of their life (Kingdon, 1997). They are seen in groups of two or more, only during reproductive activities for a brief period of time. They use olfactory

signal as a major means of communication between conspecifics (Ray, 1995; Bekele Tsegaye *et al.*, 2008a). The scent marks of civets can stay for a long period in their habitat. Communication between conspecifics is important not only in social organisms, but also in solitary species, to ensure reproductive success (Clapperton, 1989). Intraspecific communication between solitary carnivores and between social carnivores is achieved primarily by olfactory signals (Macdonald, 1980).

Civets are generally solitary, but they have a variety of visual, olfactory and auditory means of communication. Scent glands play a major role in the social life by leaving scents with specific communication signals such as social, reproductive and individual dominance strategy (Eisenberg and Kleiman, 1972). They are relatively short sighted, but hearing is acute, and olfaction is the key sense of communication (Kingdon, 1997). They also produce sound for communication, especially to show aggression such as growl, cough-spit and scream (Rosevear, 1974). To avoid predators, civets walk with their heads down very close to the ground and the tail parallel to the back. This helps them to move around freely without being noticed in addition to the camouflaging of the coloring of their back and tail. The white color of the face cannot be visible for predators when the civet is in this position.

Occasionally they gallop into the surroundings for protection. They can also make the hair on their back erected so that the bodies double in size (Kingdon, 1988). Usually predators may not locate civets as they camouflage (Trites *et al.*, 2005).

2.5. Threats to African Civet.

African civet is considered as a common animal in most of the habitats known for its existence (Ray *et al.*, 2008). Available data on population dynamics of the African civet is fragmented and represent only few localities in some countries. Population density of 9, 3 and 7 individuals per km² was estimated from Menagesha-Suba State Forest, Jimma and Wondo Genet areas, respectively, based on fecal counts from civetries (Bekele Tsegaye, 2006; Wondmagegne Daniel, 2006; Ayalew Berhanu, 2007). Population density of 1 individual per km² reported from southwest Gabon based on track count along transects in lowland forest (Prins and Reitsma, 1989). However, the population trend of the African civet in any of its known habitat is unknown in the absence of continuous studies (Ray *et al.*, 2008).

It is listed as “Least Concern” in the IUCN Red list as the species has a wide distribution range, its presence in a variety of habitats, its relative commonness across its range and presence in numerous protected areas and in human mediated areas (Ray *et al.*, 2008). However, localized declines were reported from Congo (Colyn *et al.*, 2004), South Africa (Rowe-Rowe, 1992) and western Ethiopia (Yilma Delellegn, 2000). Main reasons for the decline in the population of this species in these areas are different. In Congo, the cause is hunting for meat (Colyn *et al.*, 2004; Ray *et al.*, 2005). The local reduction in population size reported from former northern Transvaal Province, South Africa is due to habitat transformation (Rowe-Rowe, 1992).

In western Ethiopia, the reduction in the number of civet is due to intensive trapping by civet farmers to replace the dead individuals in captivity and to increase the number of civets in their farms (Yilma Delellegn, 2000). Nearly 40% of the civets captured from the wild die within the first three weeks of capture (WSPA, 1999). Hunting might be rendered more vulnerable in areas where preferred bush meat is scarce. African civets are one of the most abundant mammals found in bush meat markets in south east Nigeria, being used for both food and skin (Angelici *et al.*, 1999).

They are also hunted for meat in Cameroon, Congo, northern region of Central African Republic and Sierra Leone. However, it is among the bottom ranked species in both vulnerability and threat categories. Higher reproductive potential, small home range and small body size help African civets not to be vulnerable to changes in the ecosystem unlike big carnivores (Ray *et al.*, 2005). An increase in the human population might not affect generalist species that are probably less sensitive to habitat changes (Do Linh San *et al.*, 2013). They have relatively wide habitat tolerance within the more mesic areas where they get cover for their daytime refuges. They are tolerant of agriculture and other human modified habitats.

Thus, they persist in much of their ranges without targeted conservation activities. African civets are killed for raiding domestic animals and crops. Farmers view the civets as a pest, due to their raiding of gardens and poultry. Farmers easily hunt civets by dogs, snares or shoot by spotlight. Indiscriminate methods kill six civets for each jackal in South Africa (Rowe- Rowe, 1992).

Populations in close proximity to human settlements are vulnerable to predation by domestic dogs (Kingdon, 1977).

2.6 .Population Ecology of African civet

African civet is considered as a common animal in most of the habitats known for its existence (Ray *et al.*, 2008). Available data on population dynamics of the African civet is fragmented and represent only few localities in some countries. Population density of 9, 3 and 7 individuals per km² was estimated from Menagesha-Suba State Forest, Jimma and Wondo Genet areas, respectively, based on fecal counts from civetries (Bekele Tsegaye, 2006; Wondmagegne Daniel,2006;Ayalew Berhanu, 2007).

Population density of one individual per km reported from south west Gabon based on track count along transects in lowland forest (Prins and Reitsma, 1989). However, the population trend of the African civet in any of its known habitat is unknown in the absence of continuous studies (Ray *et al.*, 2008). It is listed as “Least Concern” in the IUCN Red list as the species has a wide distribution range, its presence in a variety of habitats, its relative commonness across its range and presence in numerous protected areas and in human mediated areas (Ray *et al.*, 2008). However, localized declines were reported from Congo (Colyn *et al.*, 2004), South Africa (Rowe-Rowe, 1992) and western Ethiopia (Yilma Delellegn, 2000).

2.7. Historical Background of Civiculture in Ethiopia

Earliest recorded history of the use of civet is from the Bible, when the Queen of Sheba (1013-982 BC) presented civet musk as an offering and gift to King Solomon. This is evidence that the practice of collecting musk from Civets was well established even before this time. In Ethiopia’s earlier history, Civet was an expensive item and was used as money for bartering and an expensive trade item (Pankhurst; 1961) when trade links were established with Egypt, Zanzibar and lands as far as India. The value of Civet was not less and perhaps even higher than other tradable items including ivory, gold and myrrh. Traditionally, civet is used as medicine for various ailments and is taken in tea or coffee (Jemal; 1999). Poncet (1709), the French traveler who came to Gondar (which was the capital of Ethiopia then) and was able to see other parts of Ethiopia in the late 1600s, reported to have witnessed that Enfranz in the northern Ethiopia/Gondar/ was an important town for civet trade. These civets were kept in captivity and

the odours (secretions) were scraped from its glands each week. Before his arrival at Gondar, Poncet came through the Kingdom of Sennar in Sudan whose main commodities were amongst other things ivory, tamarind, gold, and civet. Pankhurst (1968) describes that Gondar and other parts of northern Ethiopia, whose trade outlets included Massawa and the Sudan, exported quantities of civet all over the world. Civet was an important item of export for the lucrative trade in the 1800s in Ethiopia. Accordingly, in 1840, it was estimated that 13% of export item from Ethiopia, through the port of Massawa, consisted of civet musk (Woodford, 1990). Napoleon Bonaparte's expedition to Egypt in the 18th century and various other chronicles, including Shakespeare make mention of the trade in civet (Pugh, 1998). In 1872, Anatolia Cheche visited the area now known as Illubabor in Ethiopia. He wrote that the King of Jimma, Aba Jifar Abagambo, had set aside an area in his palace specifically where civets could calm and recuperate, after they had been captured from the wild in preparation for the collection of their civet musk (EWCO; 1999). Mesfin Admasu (1995) explains that according to oral history, traders introduced civet farming into the South and South-western Ethiopia from Northern Ethiopia. This industry was introduced first to a district known as Limu in Keffa region. From there it appeared to spread to neighbouring areas including Enarya, Jimma, and Wollega (Pankhurst, 1961, 1968). As a tradition, which has been around for a long time in history, civet farming is surrounded by a complex social dimension and plays a prominent role in the structure and relationships (including gender) of the people who produce it (Pankhurst; 1961, 1968). An interesting factor is that Muslim communities only handle traditional civet farming in Ethiopia. Oral literature explains that a legendary and great leader who lived in Limu, Keffa by the name Nessiru Allah, who was healed of an eye ailment by the application of civet musk, ordered that all followers of Islam to farm civet for their musk (Mesfin Admasu; 1995). The highest yield of civet nowadays come from districts in Sidamo, Shoa, Wollega, Keffa, and Illubabora (EWCO; 1992). Perhaps the most interesting fact about this trade is that it has existed through a long period of time and it has not seen any changes in the husbandry of the civets since Antonio Cheche visited Illubabora and Jimma areas a century ago (Fikadu Shiferaw et al; 1997).

3. Materials and Methods

3.1. Description of the Study Area

The study was conducted in Chora woreda, Buno Bedele Zone, Oromia regional state which is located to south west of Ethiopia. The woreda has currently 32 rural and 2 urban kebeles. Among these kebeles, the study was conducted in three purposively selected kebeles; namely, Ababora, Hawa Yember and Halelu Hadesa. Hawa Yember was with coffee, *Coffea arabica*, and Khat (*Catha edulis*) plantation. The Addis Ababa - Gambela asphalt road passes through this kebele. Ababora was close to human settlement dominated by crops such as maize, teff, sorghum and coffee *Coffea arabica* plantation. Halelu Hadesa was with coffee, Eucalyptus spp, Khat plantation and few natural forests.

The lowest annual temperature of the woreda is 9 degree centigrade and the highest annual temperature of the woreda is 31 degree centigrade. The rainy season starts from April and ends in October and its annual rain fall is 1500-2200mm. The woreda is characterized by weinadega 95.1 %, kola 1.5 and daga 3.4 % climate condition.

The woreda is bordered by Beddele Woreda in the East, Yayo woreda in the west, Degga and Algesach Woreda in the North, Dabo Hanna in Northeast and Setema woreda of Jimma Zone in the South. The woreda is located 515 Km far away from Addis Ababa in south west and 36 km far away from the Buno Beddele zone /Bedele town/ at west (CWANRO,2010).

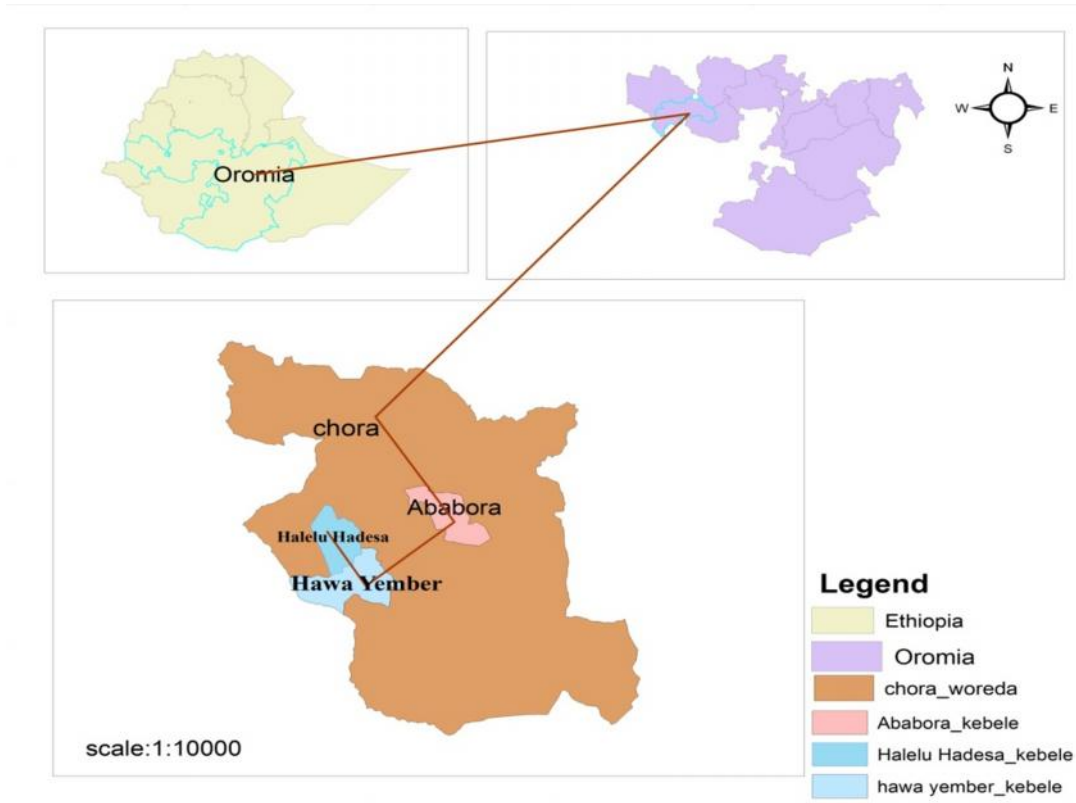


Figure 2. Map of the study area

The population of the town resides along the main transport routes to Gambela regional state and the way to Degga woreda. The woreda is known for its extensive coffee forest and broad leaf plants. The total population of woreda are 66259 (49.6%) are males and 67507(50.4%) are females (CWANRO, 2010). The land area coverage of this woreda is 78,860.79 hectares and the total cultivated land of the district accounts 48050.04 ha, grazing land 3500 ha, forest land about 15785.46 ha, it covers 1772 ha of wetland and human settlement land covers 9753.29 ha.

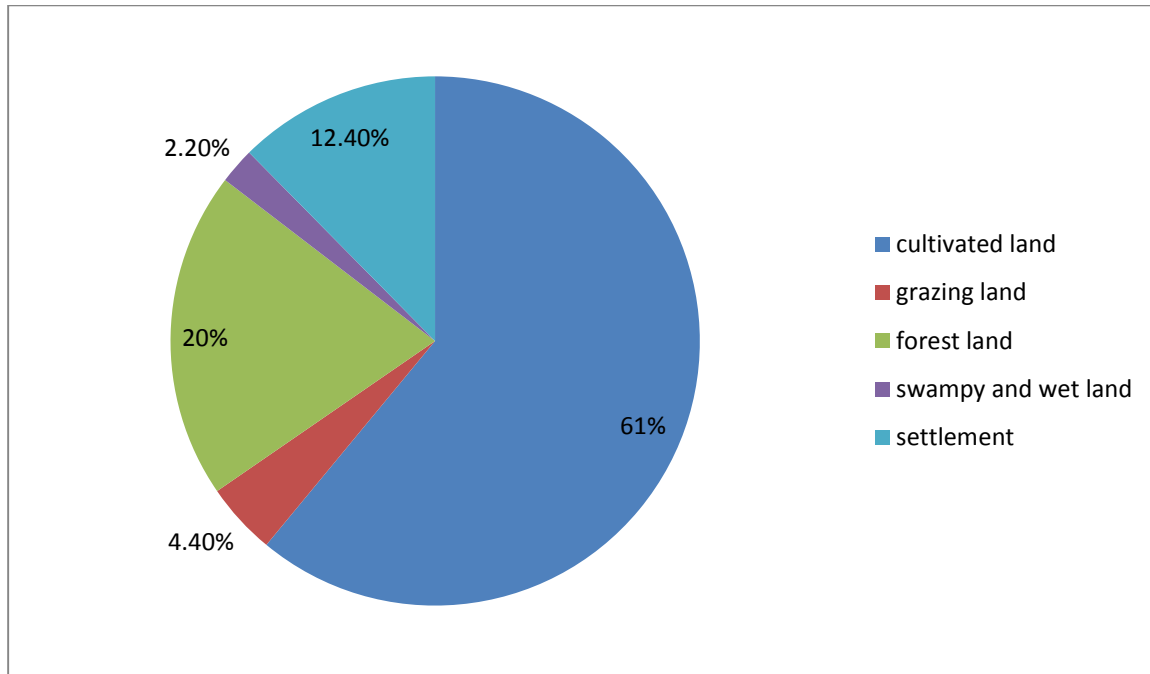


Figure 3. Land use pattern of the study area

The majority of the society in Chora woredas is agrarian and lives on agricultural products. Farmers in the area are engaged in subsistence farming of crop cultivation and livestock's rearing. The cash crops are like coffee and chat are used as a source of income whereas; maize, teff, sorghum, wheat, bean and others are important crops in the area. Formerly, peasants in Chora woreda are produce both cash crops and food crops in traditional methods. However, currently they change farming system and cultivating both cash crops and food crops in scientific method like using fertilizer, sawing crops in line, and scaling up experiences. In this woreda there are various species of mammals. African civet, apes, Colobus monkey, Pig, Porcupine, antelope and Velvet monkeys are some of the mammals observed in the area. The exotic plants Eucalyptus Spp. are the most dominant tree species in the area and it provides for construction and fire wood requirements of the local peoples.

3.2. Research Design

To obtain appropriate information cross-sectional research design with descriptive survey methods was used to describe the conservation status and threat to wild African civet. This design was considered as suitable for describing the existing situation, narrating facts and

investigating phenomena. It involves data collection from field observation of selected kebeles at one specific time as opposite to longitudinal methods which gathers data on factor over time and explains the current situation of the study. In order to address the stated objectives both quantitative and qualitative approaches were used. The information was collected then organized and analyzed accordingly. The purposive random sampling method was used in selecting key informants from each kebele.

3.3. Sources of Data

Both primary and secondary data sources were used for this study in order to achieve the objectives. To study feeding ecology and population survey the primary data sources were obtained from field observation which is essential to collect and record data in civetries. Also observations were done to support and supplement the data collected through other methods. By searching civetry site, undigested remains of food items in civet feces, survey of civet which was trapped by hunter; local government administration and non-governmental organizations.

To study threat and conservation survey relevant secondary data was obtained from questionnaire. Also published and unpublished office document, governmental and non-governmental organization, articles, journals, reports and books used.

3.4. Sample and Sampling Techniques

Thirteen civetries were located in the study area but for primary data six civetries were taken because, at this study since the civetries location site far away each other's it is difficult for daily observation.

For secondary data, local elder, civet trapper, kebele dwellers and civet owners were selected as a subject of the study using systematic random sampling techniques because they can give in depth information and appropriate for the subject of the study.

According to data obtained from Chora woreda Agricultural and Natural Resource Office, the population of the study kebeles comprised of 882 households in Ababora, 1009 households in Hawa Yember and 624 households in Halelu Hadesa kebeles. Totally the numbers of house hold heads are 2515. In this regards five percent respondent from the total of 2515 households of the

three kebeles taken, because since the population size were large and can not covered by this study. Based on these a total of 126 respondents were selected from each three kebeles proportionally by using systematic random sampling methods (Lund Research LtD., 2012).

Determining proportion

Formula $P = Ni/N$ Where P = Proportion

Ni = sample size of the kebeles

N = total population of the kebeles

$P=126/2515= 0.05$

$P=0.05$

Determining number of members be included in the sample from each three kebeles

Formula $Ni = N \times P$

Where Ni = samples to be taken from the kebeles

N = total population of the area

P =proportion

Table 1. Sample and sampling techniques of house hold heads

NO of kebeles	Name of kebeles	No_House holds population	Nxp	Ni
1	Ababora	882	882×0.05	44
2	Hawa Yember	1009	1009×0.05	50
3	Halelu Hadesa	624	624×0.05	32
Total		2515		126

3.5. Sample Collecting Procedure

African civets have specific latrine sites known as ‘civtries’ (Estes, 1991).They scent-mark environmental sign post in their territories, latrine sites and movement routes(Randall, 1979, and Hutching, 2000). All possible areas within the study sites were investigated extensively. Civetry search focused mainly on wildlife tracks, Civet trappers, farmers, cattle herders and firewood collectors were asked whether they have seen civtries anywhere in the study area. The researcher and a well trained assistant moved along the pathways in opposite direction searching for any sign of civet defecation sites. As there are a number of sign-posts surrounding civtries (Ayalew Berhanu, 2007; Bekele Tsegaye *et al.*, 2008a; Wondmagegne Daniel *et al.*, 2011).

Detailed observations were carried out at six civetries, selected on the basis of distance from each other to avoid the possibility of overlapping. Two representative civetries were selected in each three target kebeles. Namely, Sema, Semayero, Haro, Debeso, Kore and Hadesa were selected sites

Feeding ecology of African civets was studied using fecal analysis (Sutherland, 2006). Direct observation of undigested remains and examination of fresh dropping collected from dung piles (civetries) and fresh dropping samples were identified by observing undigested remains of plant and animal items. Important information such as color, number of feces, appearance and main components of undigested visible material were recorded during data collections. The food items were easily identified based on the remains of foods as bone, feather, shell, hair, leave, seeds and fruits were used to differentiate the items consumed by civets. The remains in the diet were used to infer the diet of civet. Presence and absence of fresh droppings were also recorded every day. The analysis was made by washing with tap water and filtering or by direct physical observation of the droppings (Bekele Tsegaye *et al.*, 2008a). Fresh droppings were identified from the old ones by observing the over laid sticks after each visit. Identification of the local names of remains of food items recoded in the droppings was made with the help of local elder and Chora Woreda Agricultural and Natural Resource management Office.

Population survey of African civet was estimated using all civetries identified within the sample sites. African civet establish permanent latrine site (civetries) and regularly for defecation and scent marking (Ray, 1995; Kingdon, 1997). The number of civet used each civetry were estimated by daily count of fresh dropping at each civetry. The number of fresh dropping and their sizes were recorded on daily basis to record age and structure of population (Putman, 1984). The size of fresh dropping was used to differentiate adult and young civet. Individuals visit more than one latrine sites and specific latrine will be used by more than one African civet (Randall, 1977). Fecal counting was performed for 15 days per month.

To threats and conservation measure survey of African civet's questionnaire were prepared. The informants were selected, on the basis of their perceived traditional knowledge/local experience

about African civets. These were brought together from the three selected kebeles. Data collection focused on socio-economic profile of the community, human-civet conflict, traditional uses, local attitudes towards African civet and habitats preferences in the study area. The questionnaires were prepared in English language and all carefully translated into local language Afan Oromo. Before actual data collection, the questionnaires were tested for validity through a pilot study.

In order to obtain adequate information for the study structured observation check list were used for data gathering. Observations were done to support and supplement the data collection through other methods. To identify the real threats to wild African civet were in the study area. An observation checklist that was helpful in identify the extent of civet threat in the study area as well as for cross-checking each survey questionnaire administered to the respondents. The study area was observed for 15 days per week using observation checklist and described the results of the observation. The objectives of the study were clearly addressed to all the sample of the study.

3.6. Method of Data Analysis

In order to answer the research question of the study, both quantitative and qualitative research methods. A quantitative method was used to quantify numerical data relating to the study, which was obtained from questionnaire. A qualitative method was used to explore the attributes and experiences of household heads toward civet conservation and threats. To this end, data from field observations were qualitatively analyzed and described through summarization and opinion interpretation after sorting, grouping and organizing them. The results were presented in the form of table, graph and text.

For diet analysis, all identified items from the feces were considered as items eaten by civets. Diet choice was calculated using frequency of occurrence of each of the food items expressed as percentage. The fecal contents were presented as frequency of occurrence and relative percentage. Frequency of occurrence was the percentage of scat in which an item was found, which is expressed as:-

$$\text{Frequency of occurrence} = \frac{\text{Number of occurrence of each item}}{\text{Total number of scat}} \times 100$$

Relative occurrence was the number of times the part of a given material was found as percentage of all items found and is calculated as;

$$\text{Relative occurrence} = \frac{\text{Number of occurrence of each items}}{\text{Total number of occurrence items}} \times 100$$

In a given season and habitat, food items with relative frequency of greater than five percent was consider as food items in the civet diet. Food items having frequency of occurrence greater or equal to 40% was taken a major food item of civets (Foster et al., 2010).

Regarding to population status, after counting the number of scats from each civetry on daily basis, calculation were carried out to estimate the number of civets belonging to each civetry.

SPSS soft ware was used to identify the statistical significance each of the results and simple descriptive statistical analyses were used to interpret the data.

4. Results and Discussion

4.1 Results

4.1.1. Feeding Ecology of African civet in the Wild

During the present investigation 13 civetries were located in the three study site. Continuous observations were carried out only on six civetries. Table.2. shows a list of items identified in the civet dropping with frequency and percentage of occurrence. Altogether, there were 18 food items observed from civetries throughout the study period. Twelve common food items were identified from feces to all study area and a total 673 occurrences of 18 items across the civetries and (figure 4) shows the field observation in the civetries site.



Figure 4. Field observations of civetries site

Table 2. List of total food items identified from scats of African civet in current study area

Local name	English name	Scientific name	Frequency	Relative (%)	Rank
Boqqolloo	Maize	<i>Zea mays</i>	81	12.0	1
Mishingaa	Sorghum	<i>S. vulgare</i>	39	5.8	10
Waddeessa	Cedar tree	<i>C. africana</i>	51	7.6	5
Buna	coffee	<i>C. arabica</i>	58	8.6	4
Meexxii	Palm trees	<i>P.reclinata</i>	67	10.0	2
Harbuu/Qiltuu/	Fig tree	<i>Ficus spp.</i>	41	6.1	8
Baddeessaa		<i>Syzygium guineense</i>	60	8.9	3
Timaatimii	Tomato	<i>L.esculentum</i>	7	1.0	18
Avokaadoo	Avocado	<i>Persea americana</i>	10	1.5	17
Hoomii		<i>Prunus africana</i>	43	6.4	6
Gagamaa		<i>O.welwitschii</i>	16	2.4	15
Afarfatu /Sarte/	Dracaena	<i>D. steudneri</i>	29	4.3	12
Ciilalluu	Snails	<i>Achatina fulica</i>	14	2.1	16
Goondaa	Ants		40	5.9	9
Lafee	Bone		33	4.9	11
Rifeensa bineensota	Animals hairs		43	6.4	6
Baala/marga	Leaves/grass		19	2.8	14
Baallee Simbirroo	Bird feathers		22	3.3	13
Total			673	100	

*Animals hairs and bird feathers were not diet items, but it should be considered as indication of the presence of unidentified animals and birds in the diet of civets.

Site-wise observations on observation frequency and the percentage of occurrence are given in the Table.2. The frequency of food items observed in the dropping of civets varied among the civetries. Civet dropping were contained both plant and animal prey during present study. The diets of African civets were mostly depends on fallen fruits and seeds of garden and wild plants in the study area.

The highest frequently observed undigested remains of food items in the civet scats were, Maize, Palm tree, *S. guineense*, *Coffea arabica*, *Cordia africana*, *Ficus spp* and *Prunus africana* with (12.0%, 10.0%, 8.9%, 8.6%, 7.6%, 6.7% and 6.4% respectively (Table. 2). The least consumed foods items were, leaves 2.8%, *O.welwitschii* 2.4 %, *P.americana* 1.5% and Tomato 1.0 %. *Zea mays* preyed at high proportion within all three target sites. After consuming the flesh part of fruits, civets excreted the undigested remains in their feces. Twelve food items were common to all three current study sites (*Z. mays*, *P. africana*, *C.africana*, *C. arabica*, palm, *Ficus spp*, *S.guineense*, Ants, Bone, Animal hair, leaves and bird feather).

Table 3. List of food items identified from scats of civets at each of study site

Name of Food items	Total No. of each food items	Observation of each food items at three study sites					
		Ababora		Hawa Yember		Halelu Hadesa	
			%	F	%	F	%
<i>Zea mays</i>	81	42	19.4	26	9.8	13	6.8
<i>Prunus africana</i>	43	14	6.5	13	4.9	16	8.4
<i>C.africana</i>	51	12	5.5	22	8.3	17	8.9
<i>C.arabica</i>	58	21	9.7	19	7.0	18	9.5
Palm	67	10	4.6	41	15.4	16	8.4
<i>Ficus spp</i>	41	16	7.4	13	4.9	12	6.3
<i>S. guineense</i>	60	23	10.6	20	7.5	17	8.9
Tomato	7	5	2.3	-	-	2	1.1
<i>P. americana</i>	10	4	1.8	6	2.3	-	-
<i>S.vulgare</i>	39	12	5.5	27	10.2	-	-
<i>Olea welwitschii</i>	16	-	-	9	3.4	7	3.7
<i>D. steudneri</i>	29	12	5.5	17	6.4	-	-
<i>A.fulica</i>	14	-	-	11	4.1	3	1.6
Ants	40	6	2.8	9	3.4	25	13.3
Bone	43	18	8.3	13	4.9	12	6.3
Animal hairs	33	13	6.0	4	1.5	16	8.4
Grass/Leaves	19	7	3.2	9	3.4	3	1.6
Bird feathers	22	2	0.9	7	2.6	13	6.8
Total	673	217	100	266	100	190	100

In the Ababora kebele, 16 undigested food items were identified, among these, *Z. mays*; *S. guineense*, *C. arabica*, *Ficus spp* and *Prunus africana* were observed at higher frequency. *P. Americana*, Tomato, Palm, *S.vulgare* leaves and *Dracaena steudneri* were the least consumed items by species at this site. *Olea welwitschii* and snail remains were not observed in dropping by researcher in the area. In addition non plant food items were also identified at higher frequency. Bone, Ants, animal hairs were observed at high proportion, while bird feathers were least consumed.

Seeds of *S. guineense*, Palm tree, *Ficus spp* and *Prunus africana* when present in droppings, were mostly not in combination with other food items, suggested that when it is ripen, it is contributes most of food of civets. In this area, the latrine sites were within natural forest and coffee forest.

In the Hawa Yember kebeles, seventeen food items were recorded. Among these, Palm trees, *S.vulgre*, maize *Zea mays*, coffee *coffea arabica*, *C.african*, *Syzygium guineense* and *Dracaena steudneri* were observed at higher frequency, while sorghum, *Ficus spp*, *Olea welwitschii*, leaves and *P.americana* were at least frequency of occurrence. Non plant food items, *A. fulica*, bone, animal hairs, Ants and bird feathers were observed from feces of civet in combination of others items. Tomatoes were not recorded from scats by observer.

In the Halelu Hadesa site, 15 food items were identified *C. arabica*, *C.africana*, *Syzygium guineense* , palm trees, sorghum, *Zea mays*, *Ficus spp* and leaves recorded at higher frequency of occurrences, while tomatoes and *Olea welwitschii* were observed at low frequency. Ants, animal's hairs, bird feather, bone were recorded at higher proportion. The other remain *A. fulica* was least consumed items. *P.americana*, *S.vulgare* and *Dracaena steudneri* were not recorded in the dropping of civets at this site.

4.1.2. Population Status of African civet

The three selected study kebeles has low population of African civet (*C. civetta*), as shown the 13 of civetries found within three kebeles. The daily observation (counting) of species scats shows that adults and young civets were used the same latrine site at different proportion. The observation results from the civetries indicated that the different age classes defecate at different frequency in the different civetries during the current study. The size of scat is used to differentiate the presence of adults and young civet in the area.

Table 4. Number of civets surveyed in each site

Civetry location site	Number of civet recorded	Adult	Young
Haro	2	2	-
Hadesa	5	2	3
Debeso	6	4	2
Kore	3	1	2
Sema	1	1	-
Semayero	2	1	2
Total	19	11	8

A total number of 19 civets were recorded around the current study area, based on daily fecal counting in civetry and fresh dropping observation. A total of 19 civets, 11 were adults and 8 young were recorded. Among these, seven were in the Hawa Yember kebeles (two in Haro and five in Hadesa) civetries location site, nine were in Ababora kebeles (six in Debeso and three in the Kore) civetries location site and Three were in Halelu Hadesa kebeles (one in the Sema and two in the Sema Yero) civetries location sites.

Ababora area contained good civet population than the other two samples kebeles. The civet used the same civetry in Debeso site were more than that of the other civets of those used other civetries sites. Since African civets' solitary animals, at some civetry site only one civet was used for defecation, suggested that only one civet is present in that area.

4.1. 3. Results from Questionnaire Surveys

4.1.3.1. Demographic Characteristics of the respondents

The (Table 5) bellow provides the surveyed households' profiles, which includes sex, age, marital status, educational back ground and major jobs of the total households.

Table 5. Demographic characteristics of the respondents

Demographic Characteristics of Households		Frequency	Percent(%)
Sex	Male	123	97.6
	Female	3	2.4
	Total	126	100.0
Age	10-25	18	14.3
	26-45	49	38.9
	46-65	37	29.3
	66-80	22	17.5
	Total	126	100.0
Marital Status	Single	12	9.5
	Widowed	5	4
	Married	98	77.8
	Divorced	11	8.7
	Total	126	100.0
Educational Background	No-schooling	73	58
	1-8	10	8
	9-10	21	16.7
	11-12	14	11
	Others	8	6.3
	Total	126	100.0
Major livelihood activity	Crop production	93	73.8
	Civet Farmer	4	3.2
	Mixed farm	17	13.5
	other	12	9.5
	Total	126	100.0

Majority respondents (97.6%) were male, while (2.4%) were female headed households. With regard to the age structure, the majority 38.9% of the respondents were 26-45 years old followed by 29.3% of respondent aged 46-65. The respondents are between 66-80 years olds accounts for 17.5% of the sampled households and only 14.3% of the respondents were between 10-25 years old. Regarding job activity the majority 73.8% of the respondents were relied on crop

production, while 13.5%, 3.2% and 9.5 % of the respondents were mixed farming, civet farming and other respectively. To give relevant information about key informants the following data were indicated in the table below.

4.1.4. The Major Threats of African civet and Conservation Action

Ninety eight percent of household involved in the questionnaire survey had lived in the study area for more 15 years. Most (90.5%) of rural households relied on agricultural farm and while the remaining 9.5% relied on civil service and other small business.

About 96 percent of respondents list the wildlife that is found in the study area and 4% of respondent did not reply their idea. Fifty seven point nine percent of the participants reported Antelopes, African civet, Pig, Tiger, porcupine and others wildlife face declining population order of relative importance from area, (31.0%) of respondents mentioned African civet, pig and Antelopes were the top animals become declining from study area due to hunting for different purposes and the remaining (11.1%) did not reply. Seventy three percent of the respondents were well familiar, (16.7%) were little familiar with African civet, 10.3% of respondents had no idea about the animal. This might indicated that the most indicated that most local people have some real knowledge of the civet and that participation of local could assist wildlife conservation.

Habitats were the normally encountered African civet varied. With 35.7%, 45.2%, and 8.7% of respondents claiming to experience seeing the civet in agricultural crop field, in the forest, settlement area respectively and while the remaining 10.3% of respondents seeing the African civets around Riverine area. No one of respondent has been seeing civet in deforested area.

According to respondents from three target kebeles (80.2%) and information obtained from civet farmer the population of the African civet in the wild become declining through the last two decade and 5.6%, 10.2%, and 4% of respondent were indicated increase, have no information about the population of the target species and no change respectively.

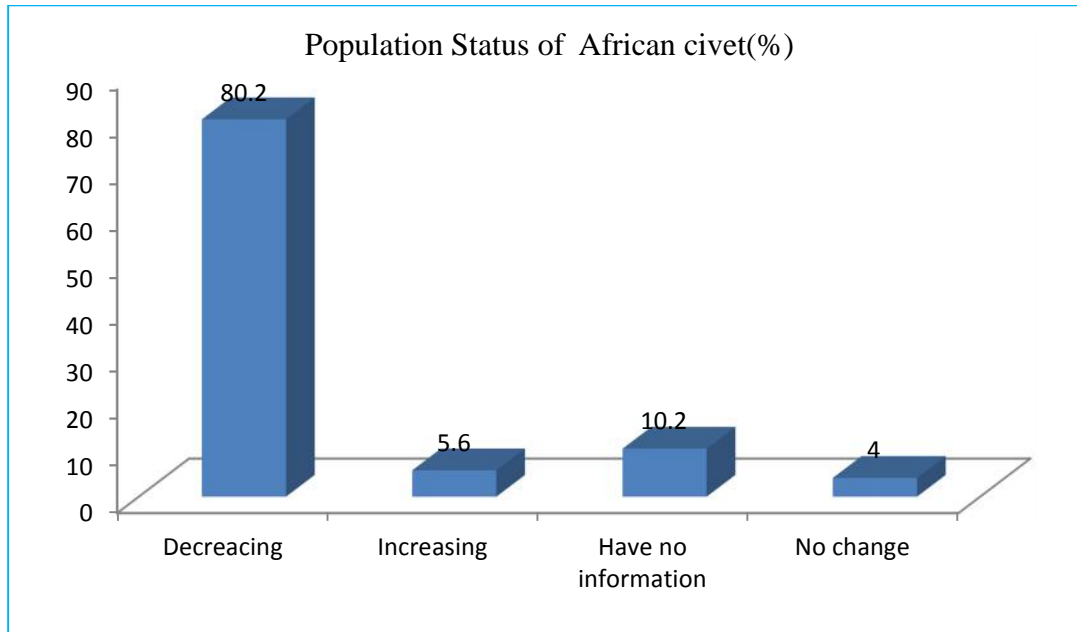


Figure 5. Population status of African civet

Most respondents point out factors that they thought contributed to the decline African civet. 34.1 percent of respondents indicated that habitat loss through deforestation and agricultural expansion were decline population of civet from the area, illegal trappers who selling civet to civet farmer, over hunting by local people for traditional medicine and illegal killing/poaching/ to protect from their crops reduce the civet population from target area 21.4%, 16%, and 19 % respectively and remaining 9.5 % no give opinion. The (figure 6) forest deforestation in the study area for agricultural land expansion the study area.



Figure 6. Clearing Forest for agricultural expansion in Ababora

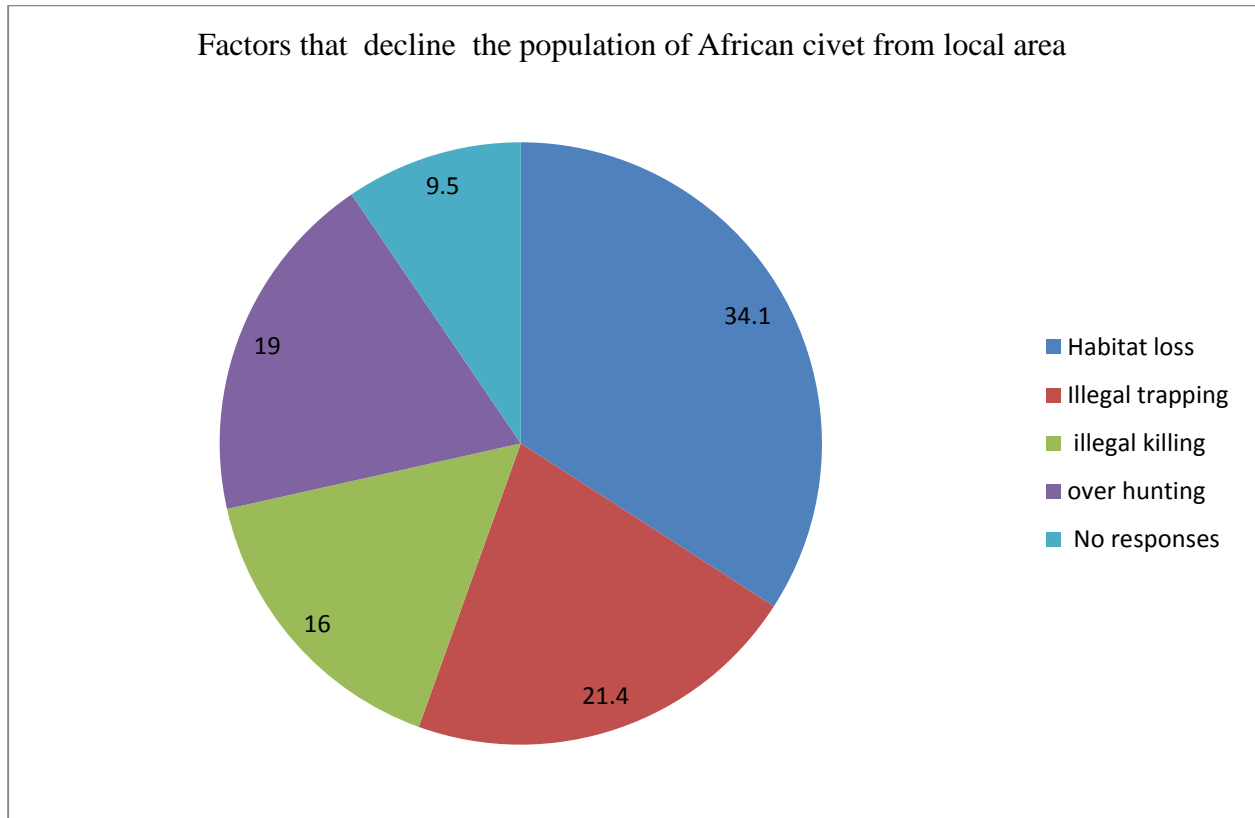


Figure 7. Factors that decline the population of African civet from the local area

Most of the civet trapper/ hunter/ responded that they have no permission to hunt /trap/ civet from the wild (98.4%), while few respondents indicated that (1.6%) have permission to trap civet, those respondents were almost civet farmer trap civet from the natural habitat the this species. The majority participants also explained that they do not know hunting wildlife without permission is illegal and majority of them know hunting wildlife without permission is illegal.

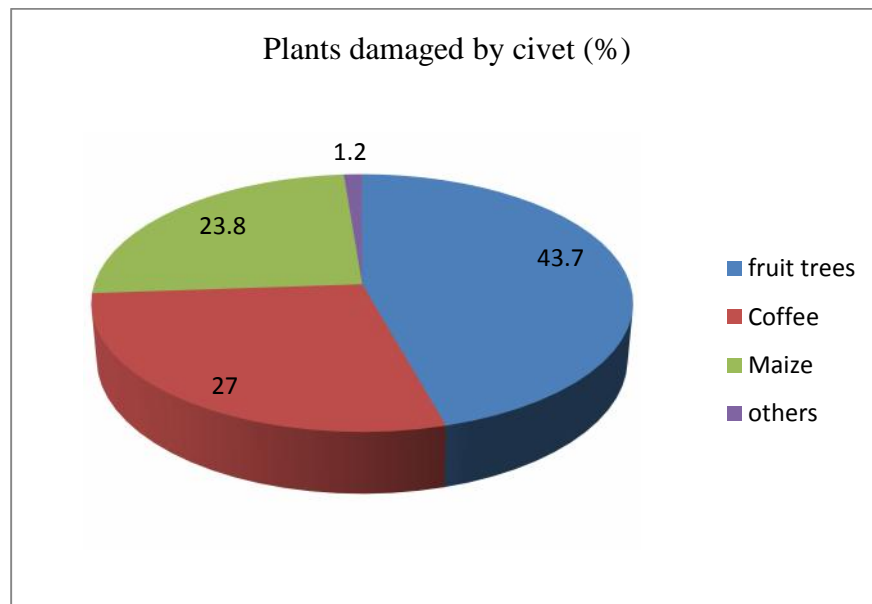
Most of the respondents responded that the main purpose of hunting /trapping / African civet from the natural habitats is for source of income (44.4%), While some of them reported that for economic value /income/, to protect from field crops medicinal cultural value (24.4%, 19.8% and 11.1%, respectively). All respondents (100%) indicated that only Male African civet needed for captivity due to high production of their civet musk.

Table 6. Purpose of hunting /trapping /civet from natural habitat

Items	Frequency	Percent (%)
For musk extraction	56	44.4
For source of income	31	24.6
To protect from field crops	25	19.8
For medicinal value and cultural value	14	11.1
Total	126	100.0

According to a high proportion (43.7%) of respondents identify fruit trees as the most damaged by African civet, while others t (27%) of the respondents indicated coffee as the most damaged field crops , (23.8%) identify maize to be damaged by African civet and the remaining (1.2%) respondent did no reply.

Figure 8. Fruit trees and crop plants to be damaged by civet



Local farmers were took different measurement to prevent civet damage. 38.1 percent of respondents identified lethal trapping such as ‘Bendo,’ Wetemed’ and ‘Futasa’ using shooting or spearing (11.1%), use guard and fence (18.3%), while (8.7%) respondent answered that they use

hunting dogs and remaining (23.3%) respondents tolerate civet and did not take any measurement on animal.

Table 7 .Methods of civet prevention from field crop

Items	Frequency	Percent (%)
Using killing trap such as ‘Bendo’ and ‘wetemed’	48	38.1
Neutral	30	23.8
Using preventive methods such as guarding and fencing.	23	18.3
Attempt to killing by using shooting	14	11.1
killing by hunting dog	11	8.7
Total	126	100.0



Figure 9. Illegal trapping of civet around location of civetry in coffee forest by ‘Futasa’

4.1.5 Efforts of Rural Households and Stakeholders on African civet Conservation

Awareness is inevitable in order to conserve and manage the African civet and others wildlife from local declining. Accordingly, the sample households were asked whether they had been

given training or awareness creation on the civet conservation and management by experts from Chora Woreda Natural Resource and Wildlife conservation management and on governmental organization working on natural resource management.

Table 2. Respondent responses on awareness /training/ on civet conservation and Management

Items		frequency	Percent (%)
Do have awareness/training/ about civet conservation and wildlife management by woreda natural resource and wildlife conservation management	Yes	19	15.1
	No	105	84.9
	Total	126	100

As indicated in the (table 8) above, only about 15.1 % of the respondent received awareness/training/ on civet conservation and management by woreda natural resource and wildlife conservation management. The respondents stated the main issue of training focus on wildlife conservation, protection and Sustainable utilization of wildlife, whereas; high proportion of respondent (84.9%) did not get any awareness/training/ issues under consideration.

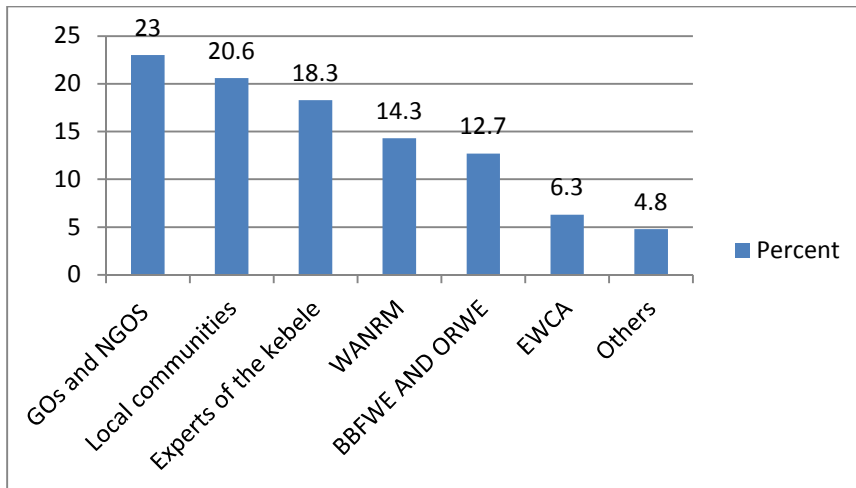
House hold respondents indicated respectively the main strategies to control African civet from further population declined as follows, giving awareness and training to local communities about civet conservation and managements (32.5 %), controlling illegal hunting (26.2 %), controlling traditional tapping methods (22.2 %), giving awareness for local communities about economic importance of the African civet (13.5 %) and others (5.6%) claimed that establishing rule and regulation at local level by participating community.

Table 9. Strategy to control the target animal from further decline

Item	Frequency	Percent (%)
Giving awareness for local community about sustainable utilization and conservation management of wildlife	41	32.5
Controlling illegal hunting	33	26.2
Controlling traditional trapping methods of civet	28	22.2
Giving awareness for local community about economic importance of target animal	17	13.5
Other	7	5.6
Total	126	100.0

In addition (20.6%) of the respondent indicated the responsible body to control African civet decline from the area are communities, 23 respondents (18.3%) indicated Natural resource experts at kebeles level, 18 respondents (14.3%) claimed that woreda Agricultural and Natural resource managements, 29 respondents (23.0%) claimed that Governmental and Non-Governmental Organization should be responsible to control the animal from local extinction, 8 respondents (6.3%) indicated EWCA should be responsible to control the civet and while others 16 respondents (12.7%) claimed that BBFWE and OFWE are responsible body to control African civet decline from wild and 6 respondents (4.8) stated others.

Figure 10. The stake holders who control civet from further decline



4.2. Discussion

African civets are known to eat diverse food items (Smithers, 1986). Understanding the ecology of African civet is important for its conservation, management and husbandry considering the increasing civet farm industry for civet musk. Both sexes are important for civet farm (Ralls, 1971; Ray, 1971). The Visual observation of undigested remains of food items in the dropping (scats) in the civetries revealed a variety food items from the faeces of the species.

This present investigation reiterates that African civets are omnivores evidenced by the presence of eighteen items as scats analysis of undigested food items. The visual observation of undigested remains of food items in the dropping (scats) in the civetries revealed a variety food items from the faeces of the species. Similar study Mohammed (1999) and Bekele et al., (2008) African civet mainly feed maize crop in captivity; a maize diet is also related to high musk production, and fecal analysis confirms that wild civets eat maize. There are various common food items present in feces of civets, food with bone and hairs were present in high proportion and occasionally the grasses/ leaves/ were also retained.

African civets highly damaged maize among the farm crop and they move long distance to eat it. African civets mainly consume fruits when availability is high and alternative foods are scarce. Palm tree, *Syzygium guineense*, *C. arabica* and *C.africana* were the highest proportion of the items for an extended time. Chances of dropping fruits are higher when it is well ripened and fall to the ground since the civet is not arboreal animals.

The presences of these fruits in civet scats were not in combination with other food items. Pieces of bone/ animal hair constituted the high proportion in civet the dropping. Bird feathers were occasionally in the scats of civet, but such items might have been consumed from different aves species. During the present investigation in the natural habitat through observation of undigested remains of food items in the scats in civetries also revealed a variety of items from the dropping of civet.

African civets do not damage seeds of the various fruits; they consume and assist in dispersing them away from the parent plants, where the seeds have a higher chance of predation. The species are also a reliable disperser as it consumes a variety of plant species. Most of the germinated plants were observed on civetries located site. Such as *C. africana*, Tomatoes, *D. steurine* and *S.guineense* germinated nearby latrine site. This finding is supported by Eisenberg (1989) which show that, African civets mainly feed fruits when availability is high and alternative foods are scaring. The food items identified during the current study does not mean that civets consumed only these are items, some food items are soft and have been completely digested and were difficult to identify by physical observation of scats.

People from Ababora were known with farm crops and coffee plantation. The civets in this area had the highest level of consumption of crop plants (maize and sorghum) and different fruits of plant species. The farmers in this area were control the civet by traditional prevention methods, especially from maize fields and these methods may injury the animal. This is in accordance with the study of Kingdon (1977) which show that, farmers view the civet as a pest due to its raiding of cultivated gardens.

The civet in Halelu Hadesa area had the highest level of consumption of fruits of coffee, *Ficus spp*, *C .africana*, *palm*, and *S.guineense*. This kebele the known with coffee plantation and few natural forests, the density of these fruit bearing plants were high in coffee forest and trees which provide shade for coffee.

According to Ayalew Berhanu (2007) the number of civet used civetry per night ranged between 0-14 individuals. Similarly, current investigation noted that, based on daily counting of fresh scats in civetry, the number of civets used latrine site per night range between 0-9 individuals, more civetry users were recorded from civetries located in Debeso which nearby farm land and Coffee plantation site and civetry with few users located in Sema site were only one civet was observed. All civets did not use latrine site every night. In some nights, civetries were observed without fresh scats. Out of the 90 days of observation on the civetries during the study period, 83 days had fresh droppings and 7 days were the absence of fresh droppings.

There are licensed and non licensed civet farmers who buy civets from civet hunters or trappers in Chora district. The main purposes of hunting African civet from the wild are for economic value or for source of income, especially for musk extraction, traditional medicine and cultural value and to protect from field crop.

African civets being nocturnal, trapping are set at night when animals began to move about looking for food from around at night and go back to their resting place before day break. Hunters/trappers/ locally, called ‘Tirignignachow’ search for the tracks around civetry, scent mark, around crop field, especially, maize and set their traps materials at these points, for the civets have a habit of excavating at the same spots continuously. Hunters /trapper/need to be able to distinguish the foot print of the African civet and this is only possible at muddy spots where the tracks show clearly. Some of the local community knew people that live-trap and sell this species for income.

During the current research period, one civet observed which trapped by traditional method known as ‘Futasa’. This trap method caught the leg of the animals and results the wound/injury/ around the leg when the civet struggle to escape from trap which may causes death of the animal.

According to information obtained from civet farmer, the cost of male civet range from 550-900 Ethiopian birr depending on the health, age, size of perineal gland and quality of musk that the animal produces and payable after nine day ‘salgi’ of capture to ensure survival and well feeding of captive food such as maize soap. The need to capture new animals to replace the dead animals in captivity is usually carried out without knowing the total population in the wild. There are also reports (Pugh, 1998) that animals are mistreated while in captivity and during the process of musk extraction.

The majority of animals , generally males, because of their higher civet musk production kept for the trade of civetone are taken from the wild, and such off-takes are likely to have localized impacts on wild population as well as potentially to lead to different sex ratio (pugh,1998). In relation to this, almost all of the respondents noted that male is needed in captivity for extraction civet and female civets were released into the natural habitat.

Most respondents indicated that, the current study area is modified by anthropogenic factors. The loss of tropical forest evidenced worldwide and in Ethiopia for that matter Chora woreda is no exception. Many tropical and subtropical forests around the world are being cleared for agricultural land expansion and other forest products as a result, civets and many others wild animals are driven away even wiped out from their natural habitats.

The recent development in terms of converting farm lands which in the past was reportedly used to grow maize in commercial crop, coffee(*coffea arabica*), Khat(*Catha edulis*) and Eucalyptus tree was seen by household head to pose the most devastating effect on the availability of suitable living condition for this species in the three selected kebeles. It is feared that such a development may lead to increased human-African civet conflict and thus endangering the long term survival of the civet. According to information obtained from local elders, forests covered their local area before past two decades. During that time, local forests had been inhabited by a great diversity of wildlife. Nonetheless, deforestation dislocated wildlife and biodiversity from the area.

The destruction of habitat by intensive deforestation is a major threat to African civets in the study area. Riverine areas where civets prefer are also exhaustively being used for irrigation farming of maize, Khat and different vegetables and clearing the undergrowth vegetation in coffee plantations are also the others factors. African civets mainly feed fruits when availability is high. The fruity bearing trees those civets prefer for their diets (*C.africana*, Palm tree, *Ficus spp* and others being cleared for the purpose of human needs, the species move long distance to search their diets.

Over hunting by local people for people for traditional medicine were the other factors that contribute to reduce population of the target animal from the area. This finding is supported by Sifu et al. (1996) and Mohammed (1999) the use of traditional of civet musk for traditional medicine is of high economic importance to the local community who has developed this with centuries of experience

African civets are becoming victims of local extinction due to illegal hunting and trapping without permission. However, illegal trapping of the civet for selling to traditional civet farmer and poaching for traditional medicine can cause injury to the animals and can contribute to the declining population of the African civet in the long run. Injuries that could result in the death of the civets at the time of trapping are other potential challenge for the survival of the African civets in Ethiopia. Trapped civets face disturbance and discomfort in the traditional methods of trapping and transportation. This is in accordance with study of Yilma Delelegn (2000) which shows that, the reduction in the number of civet is due to intensive trapping by civet farmers to replace the dead individuals in captivity and increase the number of civets in their farm.

5. Conclusion and Recommendation

5.1 Conclusion

African civet *C. civetta* musk (Zibad) is an important exports commodity in Ethiopian country and support the economic contribution to earn foreign currency income of the country.

Hence, the main findings of the research are concluded below based on the review of literature and analysis and interpretation of the data. The study found that the major threats of African civet are hunting, deforestation, use in traditional medicines, use for cultural value and constant trapping of African civet from their natural habitat for captivity.

In the current study area, the natural forests are being cleared for agricultural land expansion including (Coffee, Khat and Eucalyptus plantation), and other field crops, the African civet and other large wildlife are driven away from the natural habitats. Also African civets are rest at day time around Riverine area, however this habitat were converted into irrigation farming, as a result the species loss their habitat and migrated into other area where prefer for their life.

Finally, the finding of this study also disclosed that conservation and management of target animal by rural households in the study area not adequate to mitigate the problem of local decline of civet population, feeling the fact that there were some efforts on part of governmental and nongovernmental organization in mobilizing the local community towards African civet conservation and sustainable utilization.

However, the training and or education given to create awareness were not enough and on a regular basis to change community's attitude and perception of civet conservation. This would have future implication for those actors to provide the training/awareness/ appropriately so that the establishment process end up with success.

5.2 Recommendation

The destruction of habitat and hunting the African civet for various purposes were the major threat of African civet. As *C. civetta* is nocturnal animals, it is difficult to estimate their population and conservation status in the wild (William 2003). Sustainable wildlife conservation often benefits from active participation of local communities.

Based on the findings and conclusion of the study, the following recommendations have been suggested to minimize threats and enhance efforts of civet conservation in selected kebeles of Chora Woreda, Buno Bedele zone.

- Controlling illegal hunting of African civet *Civettictis civetta*.
- Giving awareness and training for the local communities about conservation and sustainable utilization of civet and other wild life.
- Controlling illegal clearing of forest and agricultural land expansion.
- Controlling traditional trapping of methods of African civet.
- Law enforcement- there should be strong law enforcement on part of the government on those who illegally and indiscriminately trap civet.

6. References

- Angelici, F.M., Luiselli, L., Politano, E. and Akani, G.C. (1999). Bushmen and mammal fauna: A survey of the mammals traded in bush-meat markets of local people in the rainforest in southeastern Nigeria. *Anthropozoologica* 30: 51–58
- Ayalew Berhanu (2007). *Feeding Ecology, Scent Marking and Movement Patterns of the African Civet in Wondo Genet Forest, Ethiopia*. M.Sc.Thesis, Addis Ababa University, Addis Ababa.
- Barja, I., Silván, G., Martínez- Fernández, L. and Illera, J. (2011). Physiological Stress responses, fecal marking behavior and reproduction in wild European pine martens (*Martes martes*). *J. Chem. Ecol.* 37: 253–259.
- Bearder, S.K. and Randall, R.M. (1978). The use of fecal marking sites by spotted Hyena and civets. *Carnivore* 1: 32–48
- Beebee, T. and Rowe, G. (2005). *An Introduction to Molecular Ecology*. Oxford University Press, New Delhi.
- Bekele Tsegaye, Afework Bekele and Balakrishnan M. (2008a). Feeding ecology of the African Civet *Civettictis civetta* in the Menagesha–Suba State Forest Ethiopia. *Small Carnivores Conservation* 39: 19-24.
- Bekele Tsegaye., Afework Bekele and Balakrishnan, M. (2008b). Scent-marking by the African Civet *Civettictis civetta* in the Menagesha- Suba State Forest, Ethiopia. *Small Carnivores Conservation* 38: 29-33.
- Bekele Tsegaye (2006). *Ecological Studies on African Civets (Civettictis civetta)*. M. Sc. Thesis, Addis Ababa University, Addis Ababa
- Bothma, J. D. (1971). Food habits of some Carnivora (Mammalia) from Africa. *Ann. Trans. Mus.* 27: 15–25.
- Burfield, T. (2005). *Ambergris Update: Modified from Monograph in Natural Aromatic Materials – Odours and Origins*. Written and updated by AIA Tampa.

- Brooks, T.M., Pimm, S.L., Kaposi, V. and Ravilious, C. (1999). Threat from deforestation to montane and lowland birds and mammals in insular South-East Asia. *J. Anim. Ecol.* 68: 1061–1078.
- Clapperton, B. K. (1989). Scent-marking behavior of the ferret, *Mustela furo* L. *Anim. Behav.* 38: 436–446.
- Colyn, M., Dufour, S., Condé, P. C. and Van Rompaey, H. (2004). The importance of small Carnivores in forest bush meat hunting in the Classified Forest of Diécké, Guinea. *SmallCarniv. Conserv.* 31: 15–18
- Do Linh San, E., Ferguson, A.W., Belant, J.L., Schipper, J., Hoffmann, M., Gaubert, P., Angelci, F.M. and Somers, M.J. (2013). Conservation status, distribution and species richness
- Dagnachew Melese, Suryabhadgavan, K.S., Melakneh Gelet and Balakrishnan, M. (2014). Remote sensing and geographic information system-based African civet habitat mapping in Andracha, Ethiopia. *J. Appl. Rem. Sense.* 8: 1–12.
- Do Linh San, E., Ferguson, A.W., Belant, J.L., Schipper, J., Hoffmann, M., Gaubert, P., Angelci, F.M. and Somers, M.J. (2013). Conservation status, distribution and species richness
- Eisenberg, J. and Kleiman, D.G. (1972). Olfactory communication in mammals
- Espírito-Santo, C., Rosalino, M.L. and Santos-Reis, M. (2007). Factors affecting the placement of common genet latrine sites in a Mediterranean Landscape in Portugal. *J. Mammal.* 88: 201–20.
- Estes, R.D. (1991). *The Behaviour Guide to African Mammals: Including Hoofed Mammals, Carnivores and Primates*. University of California Press, Berkeley.
- EWCO (1999). *General Information on Oromia Wildlife Resource*. Ethiopian Wildlife Conservation Organization, Addis Ababa.
- Ewer, R.F. (1973). *The Carnivores*. Cornell University Press, Ithaca.
- Ewer, R. F. (1998). *The Carnivores*. Cornell University Press, Ithaca.
- Ewer, R. F. and Wemmer, C. (1974). The behavior in captivity of the African Civet, *Civettictis civetta* (Schreber, 1776). *Zeitsch. Fiir Tierphy.* 34:359–394

- FAO, (2000). World Watch List for Domestic Animal Diversity. Food and Agriculture Organization of the United Nations, Rome.
- Fikadu Shiferaw, Getachew W/Michael and Tesfaye Hundessa. 1997. Field Report on Traditional Civet Holdings in Oromia Region. A report to the Ethiopian Wildlife Conservation Organisation. Addis Ababa, Ethiopia. 12 pp.
- Fiorelli, L.E., Ezcurra, M.D., Hechenleitner, E.M., Arganaraz, E., Taborda, J.R.A., Trotteyn, M.J., von Baczko, M.B. and Desojo, J.B. (2013). The oldest Known communal latrines provide evidence of gregarism in Triassic Mega herbivores. *Scient. Rep.* 3: 3348–3356.
- Foster, R.J., Bart J. Harmsen, B.J. and Don Caster, C.P. (2010). Sample-size effects on diet analysis from scats of jaguars and pumas. *Mammalia* 74: 89–93.
- Gaubert, P. and Cordeiro-Estrela, P. (2006). Phylogenetic systematic and tempo of evolution of the Viverrinae *Phylogenet. Evol.* 41: 266–278.
- Gaubert, P., Taylor, P. and Veron, G. (2005). Integrative Taxonomy and Phylogenetic Systematics of the Genets (Carnivora, Viverridae, *Genetta*): A New Classification of the most Speciose Carnivoran Genus in Africa. In: *African Biodiversity: Molecules, Organisms, Ecosystems*, pp. 371–383,
- Gaubert, P. and Veron, G. (2003). Exhaustive sample set among Viverridae reveals the Sistergroup of felids: the linsangs as a case of extreme morphological convergence With in Feliformia. *Proc. R. Soc. Lond. B.* 270: 2523–2530.
- Gittleman, J. L. (1996). *Carnivore Behavior, Ecology and Evolution*. Vol. 2. Cornell University Press, Ithaca.
- Hillman, J. C. (1993). *Ethiopia: Compendium of Wildlife Conservation Information*, Vol.2. Ethiopian Wildlife Conservation
- Hillman, J. C. (1992). *Review, of the Traditional Civet Musk Extraction and a Proposal for Establishing a Model Civet Research Project in Ethiopia*. Ethiopian Wildlife Conservation Organization, Ministry of Agriculture, Addis Ababa.
- Hussein, S. A. (1999). Mustelids, viverrids and herpestids of India: Species profile and conservation status. *ENVIS Bull.* 2:1–38.

- Hutchings, M.R. and White, P. C. L.(2000). Mustelid scent-marking in Managed ecosystem: implication for population management. *Mamm.Rev.* 30:157–169.
- Kebede Sifu, Mebratu Kifle & Yasin Jemal 1996. Preliminary study on the traditional practices of civet handling in Illubabora. Illubabora Zone Agricultural Development Department, Mettu, Illubabora, Ethiopia.
- Kumara Wakjira 2005. Better handling of African Civet for quality musk extraction. *Agriculture and Rural Development Journal* 2: 31–34.
- Jemal Mohammed (1999). The African civet (*Civettictis civetta*) and its Farm prospect in Oromia Region. *A Paper Presented at the Workshop on the Preliminary Assessment of Traditional Civet Keeping in Oromia, Nekemet.* Agricultural and Development Bureau of Oromia, Addis Ababa.
- Jordan, N. R., Cherry, M. I. and Manser, M. B. (2007). Latrine Distribution and patterns of use by wild meerkats: implications for territory and mate defense. *Anim. Behav.* 73: 613–622.
- Kingdon, J. (1977). *East African Mammals: An Atlas of Evolution in Africa. Carnivores.* Academic Press, London.
- Kingdon, J. (1997). *The Kingdon Field Guide to African Mammals.* Academic Press, London.
- Kingdon, J. (1988). *East African Mammals: An Atlas of Evolution in Africa, Vol. 3, Part 1.* University of Chicago Press, Chicago.
- Lund Research LtD.(2012).<https://study.com/academy/Lesson/systematic-random-samples-definition-formula-advantages.htm>. [Accessed on 3rd December 2017].
- Lunt, N. (2011). The Role of Small Antelope in Ecosystem Functioning in the Matobo Hills, Zimbabwe. PhD Dissertation, Rhodes University, Grahamstown.
- Macdonald, D. W. (1980). Patterns of scent marking with urine and Faeces among carnivore communities. *Symp. Zool. Soc.* 45: 107–139.
- Macdonald, D. W. (2001). *The New Encyclopedia of Mammals.* Oxford University Press, Oxford.
- Mathai, J. (2010). Hose's Civet: Borneo's mysterious carnivore. *Nature Watch* 18: 2–8.
- Poncet, M. (1709). *A Voyage to Ethiopia: 1698–1701: With Particular Reference to the*

Kingdoms of Dongola and Sennar. Covent Garden, London

- Mesfin Admasu. 1995. History of Civet Farming and Trade in Ethiopia. Proc. Civet Farming, Musk Production and Trade Workshop. May, 1995. Ethiopian Wildlife Conservation Organisation. Addis Ababa, Ethiopia. 72-78
- Mohan, L. (1994). Trade in civetone from the Indian small civet (*Viverricula indica*) from Malabar, India. *Small Carnivore Conserv.* 10:13.
- Mudappa, D. Kumar, A. and Chellam, R. (2010). Diet and fruit choice of the Brown palm civet *Paradoxurus jerdoni*, a viverrid endemic to the Western Ghats rainforest, India. *Tropical Conservation Science* 3: 282-300.
- Nowak, R.M. (1999). *Walker's Mammals of the World*. Johns Hopkins *Annual Review of Ecology and Systematics* 3: 1-32.
- Palomares, F., Gaona, P., Ferreras, P. and Delibes, M. (1995). Positive Effects on game species of top predators by controlling smaller Predator populations: an example with lynx, mongooses, and rabbits. *Conserv. Biol.* 9: 295–305.
- Pankhurst, R. (1961). *An Economic History of Ethiopia: From Early Times to 1800*. Lalibela House. Addis Ababa.
- Pankhurst, R. (1968). *Economic History of Ethiopia: 1800-1935*. Haile Selassie I University Press. Addis Ababa.
- Pendje, G. (1994). Fruit consumption and seed dispersal by the African Civet *Civettictis civetta* in Mayombe, Zaire. *Revue D Ecologie-La Terre et la vie* 49: 107–116.
- Prins, H. H. T. and Reitsma, J. M. (1989). Mammalian biomass in an African equatorial rain forest. *J. Anim. Ecol.* 58: 851–861.
- Pugh, M. (1998). *Civet Farming: An Ethiopian Investigation*. World Society for the Protection of Animals, London.
- Putman, R.J. (1984). Facts from faeces. *Mammal Rev.* 14: 79–97.
- Rabinowitz, A.R. (1991). Behavior and movement of sympatric Civet species in Huai Kha Khaeng Wildlife Sanctuary, Thailand. *Journal of Zoology* 223:281-298.
- Ralls K. (1971). Mammalian scent marking. *Science* 171: 443–449.
- Randall, R.M. (1977). *Aspects of the Ecology of the Civet Civettictis civetta (Schreber, 1778)*. M.Sc. Thesis, University of Pretoria, Pretoria.

- Randall, R. M. (1979). Perineal gland marking by free-ranging African Civets, *Civettictis civetta*. *J. Mammal.* 60: 622–627.
- Ray, J.C. (1995). *Civettictis civetta*. *Mammalian Species* 488: 1-7. University, Baltimore.
- Ray, J.C, Gaubert, P. and Hoffmann, M. (2008). *Civettictis civetta*. In: *IUCN 2013. IUCN Red*
- Ray, J. C. and Sunquist, M.E. (2001). Trophic relations in a community of African rainforest carnivores. *Oecologia* 127: 395–408.
- Ray, J.C., Hunter, L. and Zigouris, J. (2005). *Setting Conservation and Research Priorities for Larger African Carnivores*. WCS Working Paper No.24. Wildlife Conservation Society, New York.
- Rosevear, D.R. (1974). *The Carnivores of West Africa*. British Museum of Natural History, London
- Rowe-Rowe, D.T. (1978). The small carnivores of Natal. *Lammergeyer* 23: 1–48
- Rowe-Rowe, D.T. (1992). The Carnivores of Natal. Natal Parks Board, Pietermaritzburg.
- Russo, S. E., Portnoy, S. and Augspurger, C. K. (2006). Incorporating Animal behavior into seed dispersal models: Implications for seed Shadows. *Ecology* 87: 3160–3174.
- Schwartz, M.K., Pilgrim, K.L. and McKelvey, K.S. (2007). DNA Markers for identifying individual snowshoe hares using Field collected pellets. *North West Sci.* 81: 316–322.
- Shalu, T. (2000). *Civettictis civetta*, Animal Diversity Web. Accessed 3 December, 2017
http://animaldiversity.ummz.umich.edu/site/accounts/information/Civettictis_civetta.html.
- Smithers, R. H. and Wilson, V. J. (1979). Checklist and atlas of the mammals of Zimbabwe Rhodesia. *Nat. Mus.Monu. Rhodesia* 9:1–47.
- Smithers, R. H. N. (1986). The Mammals of South African Sub region. University of Pretoria, Pretoria.

- Solberg, K.H., Bellemain, E., Drageset, O., Taberlet, P. and Swenson, J.E. (2005). An evaluation of field and non-invasive genetic Methods to estimate brown bear (*Ursus arctos*) population size. *Biol. Conserv.* 128: 158–68.
- Sreedevi, M. B. (2001). *A Study on Certain Aspects of Breeding and Behavior of the Small Indian Civet, Viverricula indica* (Desmarest). PhD Dissertation, University of Kerala.
- Sutherland, W.J. (2006) *Ecological Census Techniques*, 2nd ed. Cambridge University press, NY, USA.
- Trites, A., Joy, W. and Ruth, (2005). Dietary analysis from fecal Samples: how many scats are enough? *J. Mammal.* 86: 704–712.
- William J. (2003). The story of civet. *Pharmace. J.* 271: 859–861
- Wright, J. (2011). Cats, musk, gold and slaves: staples of the northbound Saharan trade. *North Afr. Stud.* 16: 415–420.
- Wondmagegne Daniel, Afework Bekele, Balakrishnan, M. and Gurja Belay (2011). Collection of African Civet *Civettictis civetta* perineal gland secretion from naturally scent-Marked sites. *Small Carniv. Conserv.* 44: 14–18.
- Wondmagegne Daniel (2006). *Ecological Studies on African Civet (Civettictis civetta) in Jima, Ethiopia*. M.Sc. Thesis, Addis Ababa University, Addis Ababa.
- Woodford, J.D. (1990). *Conservation and Utilization: The Status of Wildlife in Ethiopia*. Ethiopian Wildlife Conservation Organization, Addis Ababa.
- Wozencraft, W. C. (2005). Order Carnivora. In: *Mammals Species of the World*, pp. 548–559, (Wilson, D. E., Reeder, D. M., Eds). Johns Hopkins University Press, Baltimore.
- World Society for the Protection of Animals (1999). *Civet Farming: An Ethiopian Investigation*. World Society for the Protection of Animals, London.
- Xavier, F. (1994a). *A Study on Small Indian Civet (Viverricula indica) as a Sustainable Wildlife Resources*. PhD Dissertation, University of Kerala, Thiruvananthapuram.
- Yilma Delelegn (2000). Sustainable utilization of the African civet (*Civettictis civetta*) in Ethiopia. *IUCN 2nd Pan-African Symposium on the Sustainable use of Natural Resources in*

Africa. Ouagadougou.

Yilma Delelegn (2003). Sustainable Utilization of the African civet (*Civettictis civetta*) in Ethiopia. In: *Second Pan-African Symposium on the Sustainable Use of Natural Resources in Africa*, pp. 197–208, (Bihini, W., Musiti, W., Eds). IUCN, Gland.

7. Appendices

Appendix 7.1. Questionnaire -English Version

Questionnaire for Household heads

The main purpose of this question is purely academic and your response will be kept confidential and only serves the research purpose. This questionnaire is carefully designed to collect information /data/ for the research work regarding to identify **“Conservation status and Threats to wild African civets in selected kebeles of Chora woreda, Buno Bedele Zone, Oromia Regional State southwestern Ethiopia”**. Hence, your genuine, frank and timely responses have great important to determine success of the study. Your short, precise and honest response is highly appreciated. So, you are kindly requested and sacrifice some of your time and fill questionnaire objectively and completely.

Note:

- a. It is not necessary to write your name on the questionnaire
- b. Please be informed that the information you give will be kept secret and hence try to express your ideas candidly

General Direction:

- a. Please try to answer question in accordance to the instruction provided.
- b. Make a circle to your choice that you agree on and give additional comments where necessary.
- c. For questions that require other opinion, please give your short and precise answer

Thank you in advance for your cooperation

Checklist of semi-structured questionnaires for formal/quantitative survey

Part I. Demographic characteristics of Respondents

1. Sex of the household head
A, Male B, Female
2. Age of household head_____
3. Marital status of household head
A, Single B, Widowed C, Married D, Divorced
4. Educational background of household head
A, NO-schooling B, Primary school C, senior secondary school
D, complete secondary school E, if others, please specify_____
5. What is current major livelihood activity of household? A, crop production
B, civet farmer C, mixed farming
D, other (specify)_____
6. Kebeles _____
7. For how long have lived this kebeles?
A, Less than 5 yrs B, less than 10 yrs C, more than 15 yrs

Part II. Questionnaires related to real threats to wild African civet

1. Do you know some of the wild life that is found in this area?
A, Yes B, No
2. If your answer for question no.1 is Yes, Would you list at least six of them in a declining order of relative importance?
3. How much are you familiar with the wild animal known as African civet.
A, very little B, very well C, No idea at all
4. Where do you normally experience seeing the African civet
A, in agricultural crop fields B, in the forest area C, Settlement area D, deforested area E, Riparian area.
5. What is your own observation about the population of African civet?
A, Increasing B, Decreasing C, No change D, No idea at all
6. If declining, what are the main reasons?

- A, Habitat loss due to deforestation and agricultural expansion
 - B, illegal trappers who sell the civet to civet farmer
 - C, illegal killing
 - D, over hunting by local people for traditional medicine
7. For what purpose do the local people hunt/trap/ African civet from their natural habitat?
- A, for source of income B, musk extraction C, Medicinal value D, to protect from field crop
8. How civets are trapped from their natural habitat.
- A, by hunting dog B, by 'Bendo' C, 'Wetemedi' D, 'Futasa'
 - E, other(specify)_____
-
-
9. Can you trap civet easily from surrounding area?
- A, Yes B, No
10. Among female and male civet which one is needed for captivity and musk extraction?
- A/ female B, Male
11. If your answer for question no.10 is No, why?
- A, due to their habitat destruction
 - B, due to scarcity of civet food from surrounding
 - C, the civet is getting far away because of anthropogenic activities
 - D, other(specify)_____
-
-

Part III. Questionnaires related to conservation to Wild African civet

1. Do you hunt /trap/ civet with permission?
- A, Yes B, No
2. If your answer for question no.12 is No, do you know that hunting wild animals without permission is illegal?
- A, Yes B, No

3. Which of the following field crop can damage by African civet is known to cause?
 - A. Maize B, Coffee C, fruit trees D, other
4. What measure do local farmer take to prevent the damage?
 - A, using preventive methods such as guarding and fencing
 - B, attempt killing the animals using shooting/ spearing/
 - C, attempt killing the animals using killing traps such as ‘Bendo’ and ‘Wetemedi’
 - D, attempt killing animal by hunting dogs
 - E, Neutral
5. Do have awareness about wildlife management and civet conservations?
 - A, Yes B, No
6. What do you think to be done in order to protect the African civet from further declined from local area?
 - A, controlling illegal hunting
 - B, controlling traditional trapping methods of civet
 - C, giving awareness for local community about economic importance of target animal
 - D, giving awareness and training for local community about sustainable utilization and management, E, Others
7. Who take the responsibility to protect the African civet from further declined?
 - A, local communities
 - B, Natural resource experts of the kebeles level
 - C, the woreda Agricultural and Natural Resources managements
 - D, Governmental and Non-Governmental Organization
 - E, Ethiopia Wildlife Conservation Authority
 - F, Oromia Forest and Wildlife Enterpris
 - G,other(specify)_____

Appendex 7.2 Gaafannoo Afaan Oromoo abbotii warraaf dhiyaatan

Kaayyoon gaafannoo kanaa qorannoof akka ta'e isin beeksisaa isinis yaada keessan soda tokko malee akka guutani kabajaan isin gaafadha. Gaafannon kunis of-eeggannon kan qophaa'eef oddeennoo ga'aa mata;duree qorannoo "Haala kunuunsaafi ragaa fi miidhaa bineensa bosonaa xirinyii" jedhamtu irratti aanaa Cooraa, Godina Buunnoo Beddellee naannoo Oromiyaa Kibbalixa Itiyoophiyaatti waan hojjetamuuf raga funaannachuuf ta'a. Isinis kana hubattanii gaafii gaafatamtaaniif odeeffannoo ga'aa akka kennitan kabajaan isin gaafadha.

Hub

1. Maqaa keessan waraqaa irratti barreessuun hin barbaachisu.
2. Deebii keessan iciitiin eeguun barbaachisaadha.

Kallattii

- a. Gaaffii gaafatamtan akkaataa gaafatamtaniin guutuun yaalaa
- b. Deebii kee kan itti amantuu irratti mallatto geengoo ka,i.
- c. Gaaffii ibsa ykn yaada keessan barbaaduuf deebii gabaabaa fi ifa ta'e kennuu yaalaa

Deggorsa naaf gootaniif galatoonma!!!

Haala Jirenya Namoota Gaafannof Filatamman

1. Saala: A. Dhiira B. Dhalaa
2. Umrii _____
3. Haala gaa'elaa A. Kan hinfuuna ykn kan hin heerumne B. kan irraa du'e ykn kan jaala duute.
C, kan fudhe ykn ka heerumte D, kan hiike kan hiikte
4. Sadarkaa barnoota :_ A, Kan hin baranne B, sadarkaa 1^{ffaa} C, Sadarkaa 2^{ffaa}
D, sadarkaa ol'aanaa E, Daballata yoo jiraate ibsi
5. Gosa hojii irtatti bobba'ee jiraatu: A, Oomisha midhaanii gosa garagaraa B, Horsiisa Xirinyii
C, Horsiisa beeylaadaa fi aqonnaa D, kan biroo
6. Ganda _____
7. Yeroo hangamii ganda kana jiraattan? A, waggaa 5 gadi B, waggaa 10 gadi C, waggaa 15 oli

II. Gaafannoo miidhaa Xirinyii irra ga'u waliin wal-qabatu

1. Bineensota bosona naannoo kana jiraatanu muraasa isaan beektuu?
A, Eeyyee B, Lakki
 2. Yoo deebiin gaaffii lffaa eeyyee ta'e, muraasa isaanii kan naannaa kana baduuf deeman tarreessi.
-
-
-

3. Waa'ee bineensa bosonaa xirinyii jedhamtu hagam beekta?
A, Baay'ee Xiqqoo B, Daran C, Odeeffannoo hin qabu
4. Xirinyii eessatti argitee beekta? A, Lafa qonna B, Bosona keessatti C, Naannoo mna jireenyaa
D, Naannoo bosona manca'ee E, Naannoo caffee
5. Haala baay'ina Xirinyii naannoo kana akkamitti hubattan? A, Dabalaa jirti B, Hirrachaa jirti
C, jijjiiramni hin jiru D, Odeeffannoo hin qabu
6. Yoo hir'achaa jiraatte sababnii isaa maali jette yada ?
A, Dawoon isaanii baduu sababa manca'uu bosona fi baballachuu lafa qonnaa
B, Adamoo seeraan alaa C, Seeraan ala ajjeesuu
D, Barbaachisummaa qoricha aadaaf akka malee adamsuu
7. Faayidaa maaliif namootni Xirinyii adamsu ykn qabu? A, Madda galiif B, Urgooftuuf
(Zibaadii) irraa
Irraa argachuuf C, Qorichummaaf D, midhaan isaanii irraa ittisuuf
8. Xirinyiin bakka uumamaan jirattan keessaa akkamii qabamuu danda'uu?
A, Saree adamsituun B, Bendoo C, 'Wexamadiin' D, Futtasaa /kiyyoo
E, kan biraa yoo jiraate ibsi _____

9. Akka salphaatti xirinyii naannoo keessanii argachuu dandeessuu?
A, Eeyyee B, Lakki
10. Yoo deebii kee gaaffii 10^{ffaa} lakkii ta'ee maaliif? A, Sababa manca'uu bosonaa Fi dawoo isaanii B, sababa hanqina soorata C, Dhiibbaa ilman namaa irraan geessisu D, kan biro yoo jiraate ibsi
- 11, Saala lamaan keessaa kantuu baay'inan urgooftuu kennuun nama keessatti barbaachisaa?
A, Korma B, Dhaltuu

III. Gaafannoo kunnunsa Xirinyii waliin wal qabate

1. Xirinyii warri qaban ykn warri adamsan gurgurran eeyyama qabu?
A, Eeyyee B, Lakki
2. Yoo deebiin kee gaaffii 2^{ffaa} lakkii ta'ee, seeraan ala bineensa bosonaa adamsuun yakka akka ta,e beektuu ? A, Eeyyee B, Lakki
3. Gosa midhaanii armaan gadii keessaa xirinyiin isa kam miiti?
A, Boqqolloo B, Buna C, Ijaa mukaa D, kan bira yoo jiraate ibsi
-
4. Qote-bultoonnii mala akkamii fayyadamanii midhaan isaanii irraa xirinyii eegu?
A, Dallaa/ ijaara fayyadamun B, meeshaa kaneen akka eeboo faayaddamun C, Bendoo, Futtaasaa fi kkf fayyadamuun D, Saree adamsituun E, Hin eegan
5. Eegumsaa fi kunuunsa xirinyii irratti hubannoo qabdu? A, Eeyyee B, Lakki
6. Akka xirinyiin naannoo kanaa hin badneef maaltu godhamuu qaba jette yadda?
A, Adamoo seeraan alaa to'achuu
B, maa aadaan xirinyii qabuu to'achuu
C, Hawaasa naannoof hubannoo waa'ee barbaachisummaa xirinyii kennuu
D, Haala itti fayyadamaa fi eegumsa xirinyii irratti leenjii hawaasaf kennuu
E, Yoo kan biraa jiraa jette ibsi
7. Qaamota armaan gadii keessaa akka xiriniin naannoo kanaa hin badneef eenyutu itti gaafatamummaa fudhata?
A, Hawaasa naannoo B, Itti gaafatamaa qabenya uumama sadarkaa gandaa irra jiru
C, Waajjira qonnaa fi bulchiinsa qabeenya uumamaa aanaa
D, Dhaabbata mootummaa fi miti-mootummaa
E, Abbaa taayitaa eegumssa bineensota bosonaa Itiyoophiyaa
F, Ejeensii bosonaa fi bineensota bosonaa oromiyaa
G, Ejeensii bosonaa fi bineensota godina Bunno Bedelle

Declaration

I, Bontu Tolesa Emire confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis. The material contained in this thesis has not previously been submitted for a degree at Addis Ababa University or any other university and all the sources of materials used for thesis are acknowledged.

Name Bontu Tolesa Emire
Signature _____
Date- August 2018
Place- Addis Ababa University

This thesis has been submitted for examination with my approval as an academic advisor.

Advisor; Habte Jebessa Debella (PhD)
Signature _____
Date _____

Appendix 7.3 Field observations of civetries site



Appendix 7.3 Clearing Forest for agricultural expansion in Ababora



Appendix 7.5 Illegal trapping of civet around location of civetry in coffee forest by 'Futasa'

