



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

POPULATION SIZE AND HUMAN-PRIMATE CONFLICT: A CASE STUDY
ON: GRIVET MONKEY (*Chlorocebus aethiops*) AROUND AWSIE NATURAL
FOREST, AMHARA REGION, NORTHERN ETHIOPIA

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May, 2021

Dilla, Ethiopia

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NATURAL FOREST AMHARA REGION, NORTHERN ETHIOPIA

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Declaration

This Msc thesis is my own original work, and was not presented in any university for similar specialization or other purposes. Source of the reference materials used in the thesis are duly acknowledged.

Name: Tilahun Tafere

Signature_____

Date_____

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Acronyms and Abbreviations

HWC _____-Human Wildlife Conflict

HPC _____-Human Primate Conflict

NMWANO- _____-North Mecha Woreda Agricultural and Natural resources Office

Abstract

*Human-primate conflict is common phenomenon in the world including tropical countries such as Ethiopia. They are among agricultural pests. This study was conducted to assess the population size, human-grivet monkey conflict and traditional practices used by the local people to reduce crop loss by grivet monkey. The study was carried out from June 2020 to December 2020 in three purposefully selected villages (Lay-gafit, Tach-gafit and Wekari) around Awsie Natural Forest. The data on human-grivet monkey conflict were collected through questioner, interview and direct observation. 3 and 2 Line transects were used to estimate the population size in dense and fragmented forests the length of 0.6 km respectively and to estimate the crop loss were used 5 quadrates that was 5m with 10m. The target populations in the study were 869 households from three villages. The sample sizes of this study were 274 households. Grivet monkey, porcupine, colobus monkey and others were identified as crop raiders. Grivet monkey was the major crop raider primate in the study area. Maize (*Zea mays*) crop was the main cultivated and more exposed to damage by grivet monkey was damaged at different stages in three kadas, 0.087% damage was at seedling, 4.19% was at flowering and 2.5% was in the maturation stage. The population size of grivet monkeys according to their age- sex category were 51 (13.6%) adult males, 65 (17.3%) adult females, 218 (58.1%) sub-adults and 41 (1%) were also juveniles. The population density of grivet monkey was 5 per hectare and 8 per hectare in dense and fragmented habitat respectively. More maize crop was damaged in flowering stage compare to seedling and maturation stages. Permanent guarding, making hanger bed, chasing with dog and making scarecrow were traditional methods used by local people to reduce crop loss by crop raiders. 175 (63.7%) of the respondents replied that permanent guarding was the main traditional methods used by the local people. Farmers should keep their farm against crop raiders cooperatively to minimize crop loss by using permanent guarding method in the study area.*

Key words/phrases- Awsie natural forest, crop damage human-conflict, grivet monkey conflict, population estimate

1. Introduction

1.1 Background of the Study

Primates are large charismatic mammals found in many of the world's tropical forests (Fashing *et al.*, 2012). They include lemurs, lorises, tarsiers, monkeys, apes and humans. Primates faced longer periods of reduced food abundance and were forced to use alternative sources such as meat, nuts, cereals or underground storage organs of plants (Bunn and Ezzo, 1993). Forest non-human primates are thought to be particularly vulnerable to local extinction in fragmented landscapes (Cowlshaw and Dunbar, 2000). Primates arose from ancestors that lived in the trees of tropical forests; many primate characteristics represent adaptations to life in the challenging three-dimensional environment C. Groves (2005). Primates occupy a wide range of habitats and they occupy a wide diversity of ecological niches (Robbins, and Hohmann, 2006).

Arboreal primates are often unable to cross non-forest areas, which results in low population densities, and are often subjected to direct human persecution (Chiarello and Melo, 2001). Grivet monkey is distinguished from the vervet (*Chlorocebus pygerythrus*) primarily by differences in fur and skin colour and the restriction of the later taxon southwards of Ethiopia in altitudes not more than 1500 m.a.s.l. (Yalden *et al.*, 1977). The grivet monkeys are distributed along the southeastern Sudan, north central Ethiopia and Eritrea (Kingdon, 1997; Groves, 2005). In the southern part of its range, it comes into contact with closely related vervet monkey (*Chlorocebus pygerythrus*), and Bale Monkey (*Chlorocebus djamdjamensis*) (Kingdon *et al.*, 1997). Hybridization between them is possible, and may present a threat to the vulnerable Bale monkey (Kingdon *et al.*, 1997).

Grivet monkey (*Chlorocebus aethiops*) is one of the most successful African primates occupying a wide variety of habitats (Barrett, 2005 as cited in Dessalegn Ejigu, 2019). Grivets inhabit a wide range of habitat types including savannah, woodland, forest, grassland, riverine and gallery forests (Kingdon, 1997). They need to live around a source of water, especially during the dry season. It is able to adapt in many environments (Kingdon *et al.*, 1997). Grivet monkey is a widely distributed and often common species in northern and central Ethiopia. Thus they occupy

a wide range of habitats from riverine and montane forests to open Acacia savanna (Yalden *et al.*, 1977).

In Ethiopia, human primate conflicts have been previously studied in Semien Mountains National Park where crop raiding by Gelada baboons (*Theropithecus gelada*) seriously affects farmers (Mesele *et al.*, 2008, Mojo *et al.*, 2014). However, few studies have been conducted in other parts of northern Ethiopia where the conflict might be severe due to a high rate of deforestation and degradation of habitat of primates to patches of surrounded by agricultural fields.

Consequently, species that are unable to adapt to modified habitats are being forced into small, marginal habitat patches. In small and fragmented populations, genetic diversity may be reduced owing to increased levels of drift and inbreeding. This reduced diversity is often associated with decreased fitness and a higher threat of extinction (Bergl *et al.*, 2008). As a result, the long term survival of many of these animals is questionable (IUCN, 2000).

Habitat loss has been and still is the greatest threat to biodiversity Hanski (2005). Increased competition for natural resources among multiple stakeholders with diverse interests is occurring worldwide within the current trends of globalization. Ecosystems and habitats are fast becoming human dominated, which means that more species, including primates, are forced to exploit new human resources to survive (Strum, 2010). Grivets are also known as African green monkey and savannah monkey, which is an Old World monkey with long white tufts of hair along the sides of the face. Some authorities consider this and all of the members of the genus *Chlorocebus* to be a single species, *Cercopithecus aethiops* (Groves *et al.*, 2005). It also referred as the savanna monkey or African green monkey and is the most widely distributed of the guenon species, found almost all across Africa, from Ethiopia to Senegal and from Sudan to South Africa (Shimada and Shotake, 1997).

The world mammals status analysis on global scale shows that primates are the most threatened mammals (Schipper *et al.*, 2008) making them indicators for investigating vulnerability to threats. Habitat loss and destruction are often considered to be the most serious threats to many

tropical primate populations because of agricultural expansion, livestock grazing, logging, and human settlement (Cowlshaw and Dunbar, 2000).

Deforestation and forest fragmentation have marched together with the expansion of agricultural frontiers, resulting in both habitat loss and subdivision of the remaining habitat (Michalski and Peres, 2005). This forest degradation results in reduction in size or fragmentation of the original forest habitat (Fahrig, 2003). Such process can affect the survival of the vulnerable species through a number of different mechanisms including reduction of the total amount of a habitat types and subsequent reduction in quantity and quality of food resources and sleeping trees, genetic deterioration by minimizing gene flow and edge effect which increase predation/disturbance by humans (Anderson *et al.*, 2007; Chaves *et al.*, 2012).

However, because of habitat fragmentation following expansion of human settlement and cultivated land into previous wildlife habitat the distribution of grivet monkey is being severely affected nowadays. With regard to habitat use, grivet monkey occupies a wide range of habitats from river in and mountain forests to savannas, open woodland and forest edges as well as in mangrove swamps, cultivated areas and urban parks (Fedigan, 1988; Zinner *et al.*, 2002; Getachew Gebeyehu and Afework Bekele, 2009). Like all other primates, grivets have evolutionary history of being a tropical species dependent on forests and their rich supply of food types for survival. Although their diet is dominated by plants of secondary growth, grivet monkeys can be regarded as opportunistic omnivores and with little specialization (Zinner *et al.*, 2002).

Crop damage affects farmers directly through loss of their primary food and cash resources. Crop raiding may cause substantial damage to agricultural crops that compromise local food security (Hill, 2000). The context of crop raiding must be understood before implementing deterrent interventions including the behavioral ecology of raiding species, crops grown on farms, and extent and frequency of raiding events (Sitati *et al.*, 2005). Farmer's perceptions about crop raiding should be assessed to ensure actions and anticipated outcomes address farmer concerns (Gillingham and Lee, 1999).

Primates and humans are always in potential conflict over crops due to the renowned crop raiding behavior of many primate species. The genera *Cercopithecus*, *Papio* and *Macaca*, particularly baboons and vervet monkeys are some of the most serious crop raiders because of their intelligence, adaptability, wide dietary range, complex social organization and aggression (Sillero-Zubiri and Switzer, 2001). Even though human herders may not have a perception of monkeys as pests, the indirect competition can drive monkeys into habitats, such as forests or plantations (Ciani *et al.*, 2001), where they cause significant damage and become pests.

Farming is the major source of food and income for poor rural households in developing countries, whose numbers are growing despite urbanization and overall economic growth. This suggests escalating conflicts in agricultural landscapes between the conservation of wild biodiversity and the provision of other ecosystem services on which the livelihoods of poor people critically depend (Bolwig *et al.*, 2006). These land uses, particularly the presence of settlements and of intensive or semi-intensive crop farming that renders habitats for wild fauna smaller and more fragmented, have a major effect on the distribution and abundance of wildlife (Fritz *et al.*, 2003). Thus, farmland expansion and intensification inevitably leads to a degradation of habitats for most types of fauna through changes such as the reduction in space and food resources, loss of roosting and nesting places, and fragmentation of habitats restricting movement and seed dispersion. At the same time, the new habitats created might not be those to which wild species are naturally adapted (Bolwig *et al.*, 2006).

The loss of habitat, degradation and fragmentation of habitats through human activities such as, logging, animal husbandry, agricultural expansion and developmental projects intensify the conflict (Fernando *et al.*, 2005). Few published paper is available about human–primate conflict in patch forests particularly for the grivet monkeys (*Chlorocebus aethiops*) in Ethiopia. Hence, the aim of the present study is to estimate the population size and assess the degree of human-grivet monkey interaction and propose the possible solution reducing the conflict in Awsie Natural Forest, Northern Ethiopia.

1.2 Statement of the problem

Although grivet monkeys are restricted to areas of Sudan, Ethiopia and Eritrea very few data is available about the current distribution and abundance of this primate taxon for its whole range(Zinner *et al*; 2002). Grivet monkeys were once reported as far as in the Nile River valley of the Sudan, but during the last 100 years they disappeared from many localities, due to progressive deforestation along the Nile River. The knowledge on the distribution of grivet monkey is little known in Ethiopia (Zinner *et al.*, 2002). In addition, compared to other such as the green monkey, only a few studies have focused on grivets (Fedigan, 1988; old Shimada and Shotake, 1997). In large parts of its supposed former range, the current distribution of the species is not clear. Most of the relevant data, for instance Eritrean grivet monkey stems from sources older than half century (Yalden *et al.*, 1977).Accordingly information on the status and distribution of grivet monkeys is incomplete and out dated(Zinner *et al*; 2001). This study indicated that not only population size but also about the estimation of damaged crops. Similarly, it is one of the common primates in Awsie Natural Forest and strong conflict with human interest. Crop damage is severe around Awsie Natural Forest, because about 92% of the woreda's economy depends on agriculture mainly maize cultivation (North Mecha Woreda Agricultural and Natural resources office, 2020).

1.3 Objectives

1.3.1 General Objective

The overall aim of this study isto estimate population size and asses the degree of human-grivet monkey (*Chlorocebus aethiops*) conflict around Awsie Natural Forest the existing situation.

1.3.2 Specific Objectives

- To determine the population size of grivet monkey in the study area.
- To identify causes for human- grivet monkey conflict.
- To estimate the amount of economic loss due to grivet monkey.
- To identify mitigation mechanisms for human- grivet monkey conflict.

1.4 Research Questions

- ✓ What is the population size of grivet monkey in the study area?
- ✓ What are the root causes of human-grivet monkey conflict in the study area?
- ✓ What is the extent of crop economic loss faced on farmers in the study area?
- ✓ What are the possible mechanisms used by the local community to mitigate human-grivet monkey conflict in the study area?

1.5 Significance of the study

The present study aimed at estimate population size, crop loss by grivet monkey as the major source of human-wildlife conflict come in contact with farming activities in the study area. This study can provide information about the population size, crop loss by grivet monkey. Meanwhile, this study is also aimed to maximize the understanding of people towards the primate conservation and to show how to bring the conservation and socio-economic stability of the farmers who are suffering from the attack of grivet monkey. Moreover, the data may be used as secondary sources for researchers who are working in the study area and also provides baseline data on human grivet monkey conflict. Hence, this study can have paramount importance in identifying the cause human- grivet monkey conflict and propose the possible solutions to mitigate the problem. Furthermore, this information will be available to the international community and hence, the concerned local and federal bureaus, behavioral ecologists and other conservation oriented stakeholders will use these findings in order to tune their conservation strategies to rescue the resource of the forest.

1.6 Scope of the study

The present study is delimited to the representative area: that is in and around Awsie Natural Forest in North Mecha district, West Gojjam, Amhara Region Northern Ethiopia. The study focuses on three villages (i.e. Wekari, Lay-Gafit and Tach-Gafit). Periodically, this study was confined to May 2020 to December 2020 G.C.

2. Literature Review

2.1 Morphological, physical description and taxonomy of grivet monkey

Morphologically adult males are heavier and taller than their female counterparts with 5.5 kg weight and 490 mm height for males, and 4.1 kg weight and 426 mm height for females (Cawthon-Lang, 2006). They possess long white tufts of hair along the sides of the face (Groves *et al.*, 2005) as cited in Dessalegn Ejigu, 2019). Their facial skin, hands, and feet are black. The face has a white line above the eyes; it has long white whiskers on the cheeks. The fur on the back has an olive color, while the front is white fur (Groves *et al.*, 2005; Dessalegn Ejigu and Afework Bekele, 2010).

The skin on the stomach has a blue tint. The approximate head and body length for males is 49 cm, and for females it is 42.6 cm. The length of the tail for males is approximately 30–50 cm (Cawthon *et al.*, 2006). Grivet infants are born with black hairs and pink faces and they gradually change through the first three to four months until their faces become black and their coats change to the light silvery-grey as the adults (Lee, 1979; Isbel, 1995).

The taxonomy of grivet monkeys is undergoing change and updated, moving all of the species from the genus *Cercopithecus* to a new genus *Chlorocebus* (Groves, 2005; Colin, 2005; Cawthon-Lang, 2006). The hierarchical scientific classification of grivet monkeys is as follows: Kingdom: Animalia, Phylum: Chordata, Subphylum: Vertebrata, Class: Mammalia, Order: Primates, Family: Cercopithecidae, Genus: *Chlorocebus*, Species: *C. aethiops*, (Grubb *et al.*, 2003; Colin, 2005; Cawthon-Lang, 2006 as cited in Dessalegn Ejigu, 2010).

2.2 Population estimation and trends of grivet monkey

Ethiopia has long been recognized for its richness in wildlife resources (Jacobs *et al.*, 2001) with a diverse mammalian fauna of 325 species within 52 families (Cole FR. *et al.*, 2001), of which 57 species are endemic to the country ((Jacobs *et al.*, 2001). There are 216 species and sub-species of primates in Africa (Grubb *et al.*, 2006). Grivet monkeys occupy wide diversity of ecological niches (Robbins *et al.*, 2006) as cited in Dessalegn Ejigu *et al.*, 2021).

There are species and sub species of primates in Ethiopia excluding *Homo sapiens* (Afework Bekele and Yalden, 2013). These primates are black and white colobus monkey (*Colobus guereza*), gelada baboon (*Theropithecus gelada*), grivet monkey (*Chlorocebus aethiops*), Hamadryas baboon (*Papio hamadryas*), olive baboon (*Papio anubis*), bushbaby or Senegal lesser galago (*Galagose negalensis*) and Somali lesser galago (*Galago gallarum*) (Butynski and de Jong, 2004), Black faced vervet (*Chlorocebus pygerythrus*), Bale monkey (*Chlorocebus djamdjamensis*), De Brazzae's monkey (*Cercopithecus neglectus*), Patas monkey (*Erythrocebus patas*), Sykes' Monkey (*Cercopithecus albogularis*) (Kingdon, 1997; Groves, 2005), and two subspecies of blue monkeys (*Cercopithecus mitisboutourlinii* and *Cercopithecus mitisstuhlmanni*) (Kingdon, 1997; Fairgrieve and Muhumuza, 2003).

2. 3. Habitat and distribution of grivet monkey

The grivet monkeys are distributed along the southeastern Sudan, north central Ethiopia, and Eritrea (Kingdon, 1997; Groves, 2005). In the southern part of its range, it comes into contact with the closely related vervet monkey (*Chlorocebus pygerythrus*), and Bale Monkey (*Chlorobus djamdjamensis*) (Kingdon *et al.*, 1997). Hybridization between them is possible, and may present a threat to the vulnerable Bale Monkey (Kingdon *et al.*, 1997)

Grivets inhabit a wide range of habitat types including savannah, woodland, forest, grassland, riverine and gallery forests (Kingdon, 1997; Nakagawa 1999; Barrett, 2005). They need to live around a source of water, especially during the dry season. The grivets need to live around a source of water, especially during the dry season. It is able to adapt to many environments (Kingdon *et al.*, 2008). Grivet monkey is a widely distributed and often common species in northern and central Ethiopia. Thus, they occupy a wide range of habitats from riverine and montane forests to open Acacia savanna (Yalden *et al.*, 1977 as cited in Dessalegn Ejigu, 2019).

But vervets in general are found throughout much of southern and eastern Africa, distributed from Senegal to Ethiopia and Somalia down to South Africa. They are not primarily forest dwellers, rather they are semi-arboreal and semi terrestrial, spending most of the day on the ground feeding and sleeping at night on the trees. They inhabit savanna lands and mountains up

to 4,000 m and they prefer riverine woodlands. They are habitat generalists, as it occurs from their widespread range in Africa. They are more widely distributed than any other African monkeys, being absent only from desert, high forest and open grassland (Cawthon-Lang, 2006; Chris and Stuart, 2006).

2.4 Conservation status of grivet monkey

Human-wildlife conflict is an increasingly significant obstacle to the conservation of wildlife and hence may result in radical decrease in the number of wildlife population. Human-wild animal conflict is an increasingly significant obstacle to the conservation of wildlife (Madden 2008as cited in Gizachew Girma, 2016). Almost half of the world's primate species are considered to be threatened (Mittermeier *et al.*, 2009as cited in Dessalegn Ejigu, 2019). Although grivet is not endangered, it is threatened through destruction of habitat by way of disappearing forests. It is preyed on by large snakes, leopards, humans and sometimes baboons (Rochester, 1999). The grivet is occasionally hunted as bush meat (Hill, 1998). They are killed for either commercial or subsistence purposes.

Habitat loss through deforestation is the primary threat for the species (Chapman *et al.*, 2000). As forest size and quality decreases, reduction of food sources for forest-dwelling primates and local extinction might result. In order to conserve these species and prevent future decline, conservation practice involving local people is a must (Wallis and Lonsdorf, 2009). Illegal hunting is also practiced in addition to habitat destruction in the area. However, regardless of different threats the grivet is common and rated as Least Concern by the IUCN (Kingdon *et al.*, 2008).Understanding the ecology of species is an important step in implementing efficient conservation measures. Moreover, the perception of the public towards biodiversity conservation is very limited when compared to the challenges faced.

2.5 The definition of human-wildlife conflict

Different researchers define human-wildlife conflict (HWC) in different ways. The World Wide Fund of Nature (2005) defined HWC as “any interaction between human and wildlife that results in negative impact on human social, economic, on conservation of wildlife population or on the environment.” The International Union for Conservation of Nature (IUCN, 2005) defines HWC

as a conflict occurring “When human population requirements overlap with those of wildlife, resulting in costs to both residents and wild animals.” HWC is the term commonly used to conservationists to describe friction between wild animals and people. The conflict emergence when wildlife and human requirement overlap with consequential costs to humans and wild animals, destruction of property by wildlife and killing of wildlife by people (Osei-Owusu, 2008).

The term Pest is typically defined as any animal that consumes crops during any stage of the agricultural cycle, from planting to post harvest storage (Naughton-Treves, and Treves 2005 as cited in Belay Worku, 2017). Conflict is difference or incompatibilities in interests or perception (Yasmi *et al.*, 2010 as cited in Assabe Regasa, 2017). Primates are one of the most frequently cite crop pests (Naught on-Treves, 1998; Hill, 2000) so primates and humans are always in potential conflict over crops. Pest primates often destroy unharvested farms causing economic losses to farmers. Crop damage is becoming serious for many residents around protected areas. Most primate population today face on going habitat disturbance, but not all primate species respond to disturbance in the same way while many primate species experience declines in population density when their habitats are disturbed (Cowlshaw and Dunbar,2000).

2.6 Human-wildlife conflict

Human-wildlife conflict is commonly described as conflict that occurs between people and wildlife (Woodroffe *et al.*, 2013), and actions by humans or wildlife that have an adverse effect on others (Conover, 2002). Conflict with wildlife can cause direct material and economic damage to crops, live stock and property (Woodroffe *et al.*, 2013). According to the International Union for the Conservation of Nature World Parks Congress, human-wildlife conflict occurs when wildlife requirements encroach on those of human populations, with costs both to residents and wild animals (IUCN, 2005). Human–wildlife conflict is intense in developing countries particularly in Africa including Ethiopia, mainly in and around protected areas where human and wildlife live in proximity (Getachew Gebeyehu and Afework Bekele, 2009).

Human wildlife conflict arises mainly because of the loss, degradation and fragmentation of habitats through human activities such as logging, animal husbandry, agricultural expansion, and developmental projects (Fernando *et al.*, 2005). Thus, HWC can be considered inevitable in all

communities where human and wildlife coexist and share the same habitat. As the habitat gets fragmented, the boundary for the interface between humans and wildlife increases, while the animal populations become compressed in insular refuges. Consequently, it leads to greater contact and conflict with humans as wild animals seek to fulfill their nutritional, ecological, and behavioral needs (Sukumar *et al.*, 1990).

Understanding the ecological and socio-economical context of the HWC is a prerequisite to bring about an efficient and long-term management of wildlife and its habitats (Sukumar *et al.*, 1990). The natural vegetation of the country has been destroyed by human and natural catastrophic and converted into agricultural and pastoral land (Demeke Datiko and Afework Bekele, 2011). As a result, wild animals resources of the country are now largely restricted to a few protected areas (Tewodros Kassahun and Afework Bekele 2008).

2.7 Human-primate/grivet monkey conflict

In Eastern and central Eritrea also indicated conflict between humans and vervet monkeys since both use common habitats extensively (Dietmar *et al.*, 2002). Different studies indicated that the kinds of crop grown and the types of direct preventive measures used are the main factors that might influence susceptibility of crop raiding by primates (Saj *et al.*, 2008; Marchal and Hill, 2009 as cited in Desselegn Ejigu, 2019). The location and distance of a property from their habitat is an important factor influencing vervet crop-raiding (Saj *et al.*, 2008).

Some studies feared that grivet monkeys might transmit some communicable diseases to human beings either directly or indirectly. This might be true as different parasites which are common for human beings are also found in non-human primates. Different gastrointestinal parasites such as pinworms, trichurids and schistosoma were detected from faces of Kenyan baboons (Halin *et al.*, 2003). Conflict with grivet monkeys is not limited only to the residents. Therefore, the fate of grivet monkeys could be influenced by different groups of people living at their community. This was also observed in other areas where the status of other primates such as red-tall monkeys in Kampala forests was highly influenced by the intensity of human activities (Baranga, 2008) as cited in Dessalegn Ejigu (2019).

The genera *Papio* and *Cercopithecus*, particularly, baboons and vervet monkeys are one of the most serious crop raiders because of their aggression, adaptability, wide dietary range, complex social organization and intelligence of the animal to recognize the absence of guards and the immediately rushes into the plantation fields forming different groups in different direction (Sillero-Zubiri and Switzer,2001). Establishments of protected areas are a major form of government intervention with local people as it leads to conflict with wildlife. Sometimes people around protected areas are forced to keep their farm uncultivated due to fear of crop raiders. Most primate populations today face on going habitat disturbance, but not all primate species respond to disturbance in the same way while many primate species experience declines in population density when their habitats are disturbed, several primate species are not threatened and these species will generally require less conservation attention (Cowlshaw and Dunbar, 2000 as cited in Belay Worku, 2016).

2.8 Causes and consequents human-wildlife conflict

Different researchers at different times have investigated the determinant factors that cause conflicts between human and wildlife in their respective research areas. The main causes of human-wildlife conflict as identified by different researchers across the globe in general and Ethiopia in particular. No single factor or cause explains HWC across the continent (Naughton-Treves and Treves, 2005). A set of global trends relating to human populations, habitat evolution and animal distribution and behavior has contributed to the escalation of human wildlife conflict worldwide (Lamarque *et al.*,2009as cited in Assabe Regassa, 2017).

A research conducted by Gobosho (2015) showed that habitat destruction, proximity to natural forest and increased subsistence utilization as the major causes of HWC in the study area. The major cause of human-wildlife conflict worldwide is the competition between growing human populations and wildlife for the same declining living spaces and resource (Madden,2008). The transformation of forests, savannah and other ecosystem in to agrarian areas or urban agglomerates as a consequence of the increasing demands for land, food production, energy and raw materials has leads to dramatic decrease in wildlife habitat(Sillero-Zubiri and Switzer,2001).

The major causes of human-wild animals conflict could be attributed to many factors ranging from wild animals population increase to human population increase (Edward, Frank,2012 as

cited in Gizachew Girma, 2016). More people means more cultivated land and hence a greater interface between people and wildlife. The world population is predicted to grow by over 50% in the next fifty years, from six billion in 2000 to over nine billion in 2050 and the increment in both wildlife and human population create competitions on fixed natural resource which leads to conflict (Sillero-Zubiri and Switzer, 2001).

The consequences of human-wildlife conflicts are crop destruction, livestock predation, human death and injuries are sometimes recorded. For example in Cameroon wildlife species responsible for human deaths and injuries include elephants, buffalo, lions and hippopotamus (Lamarque *et al.*, 2009). Human-wild animals' conflicts were happened when the actions of humans or wild animals have an adverse impact upon the other. It recognized that humans have profoundly impacted wildlife and the environment in many ways, through habitat loss, pollution, introduction and spread of exotic and invasive species, overexploitation, and climate change. Human-wildlife conflicts vary according to geography, land use patterns, human behavior, and the habitat and behavior of wildlife species or individual animals within the species (IUCN, 2005). Crop raiding is not a new phenomenon and it has most likely been occurring since humans started practicing agriculture (Joseline, 2010 as cited in Gizachew Girma, 2016).

2.9 Attitude of people to grivet monkey

There is a general perception that primates living in human modified landscapes or at the edge of reserve boundaries are often agricultural pests and can pose considerable costs to cultivators living in their vicinity (Hill, 2002). Due to such conflict, most primate species are either critically endangered or in decline status. However, studies of the ecological value of forest-dwelling primates have stressed their roles as potential pollinators, seed dispersers and as plant and seed predators (Estrada, 2006).

One fundamental influence on perceptions of local people towards primates is the general Cultural attitude. Levels of tolerance acceptance and even demand for interaction vary with cultural context (Gautier and Biquand, 1994). Cultural perceptions towards primates vary enormously and have shifted over time. Historically; primates are as sacred as guardians of

human settlements, as spirits of ancestors or as an embodiment of sexuality, wisdom and fortune in some areas. In some societies, monkeys may even be incorporated into the kinship or cosmological belief system (Cormier, 2002).

Monkeys and apes are kept as pets, sharing house hold areas and food, and acting as surrogate infants or dolls or exploited for their entertainment value. This may be a converse of the human companion animal relationship (Serpell, 1981). Crop losses due to primates were considered acceptable or normal within general crop yields. Perceptions of the significance of the primate problem might rank relatively low in the general context of pests. The relative suggestions that even minor losses can assume a major perceptual importance when farmers become engaged in a market economy. Primates are pests in a huge Variety of contexts in fields, tourist lodges, reserves, roadsides, temples or towns.

One key issue is increasing competition between primates and humans with the spread of agriculture and human activity into areas that previously sustained primates. There is little quantitative work on the socio-economics of pest primates and the importance of loss of subsistence as opposed to cash crops is unknown, either in terms of the economics of the losses or in relation to changing perceptions. However, primates dominate amongst pests that damage crops, particularly around African and Asian reserves, being responsible for over 70% of the damage events and 50% of the area of farms damaged (Naughton-Treves, 1998).

Almost all primate families have been identified as crop-raiders, although species differ in their ability to cope with encroaching human settlement. Rainfall, season, crop variety and characteristics, food availability, distance from forest, nearest farm or village and farm protection methods will have an impact on raiding (Biquand *et al.*, 1992; Hill, 1998; Naughton-Treves, 1998). The raiding frequency and intensity influence the attitude of local people towards primates. Local peoples' perception of conflict does not always correspond to reality; in some cases negative impact is only perceived and may result from confusing ecological factors by socioeconomic variables (Siex and Struhsaker, 1999).

Generally negative attitudes are functions of degree of contact with primates as pest and to a lesser extent with the risks perceived to result from direct primate-human contacts. Brief contact with monkeys in the absence of crop damage tends to promote positive attitudes (King, Lee, 1987; Knight, 1999), while even minimal experience of raiding leads to an attribution of blame that may greatly outweigh the extent of the damage (Naughton-Treves, 1997; Chalise, 2000, Hill, 2000; Chalise and Johnson, 2001 as cited in Belay Worku, 2016). It should be noted that societal expectations like myth, religious belief, and economic or political contexts establish initial principles for how humans are expected to behave towards monkeys. The subsequent experience of those people with monkeys is thus layered on a series of beliefs and expectations to produce perceptions of monkeys. Communities with subsistence economy even small losses can generate strong negative attitude toward wildlife (Oil *et al*, 1994 as cited in Gizachew Girma, 2016).

2.10 Some traditional practices used by community to reduce crop loss by grivet monkey

People can defend crop damage by using different methods such as guarding, chasing, strange scent, fencing, scarecrows and trapping to control their crop damage. Guarding was the most familiar method. Most farmers guarded their crops especially during the harvest season. Chasing and fencing were also the second and the third important methods, respectively. Yelling and throwing stones were the other methods used to chase wild animals away from the farmland (Musa Adem, 2009). Moreover, they spend additional labour, time and expenditure to protect their crop against wild herbivores (Sekhar, 1998 as cited in Belay Worku, 2016). Elements of a successful conflict management process include: (1) identification of clearly defined objectives; (2) establishment of clear definition will be made, prior to dealing with the issues; (4) inclusion of team building activities; (5) maintenance of continuity by not allowing substitutes; (6) implementation of guidelines and activities that promote active listening; and (7) achievement of success (Guynn, 1997 as cited in Gizachew Girma, 2016).

3. Description of the study area

3.1 Geographical location

Awsie Natural Forest is located in West Gojjam zone, Amhara region in Northern Ethiopia. It is also situated about 35 km south of Bahir Dar, the capital of Amhara National Regional State and 531 kilometers North West of Addis Ababa, Ethiopia's capital (North Mecha woreda Agricultural and Natural resources Office, 2020). Around the study area there are 869 households. It is one of the natural forest in North Mecha district located at a distance of 21km from Merawi town(North Mecha Woreda Agricultural and Natural resources Office, 2020).The study area has latitude and longitude of $37^{\circ}16' 30''$ – $37^{\circ} 19' 30''$ E and $11^{\circ} 17' 30''$ – $11^{\circ}21' 30''$ Nrespectively. The elevation of the study area 1000-2500 a.s.l which bordered on the south by Sekella District, on the south west by Awi zone, on the West by the Lesser Abay river which separates it from South Achefer and North Achefer District, on the North East by Bahir Dar zuria District and on the East by Yilmanadensa District. The study was conducted in West Gojam zone, Northern Ethiopia (North Mecha woreda Agricultural and Natural resources Office, 2020).

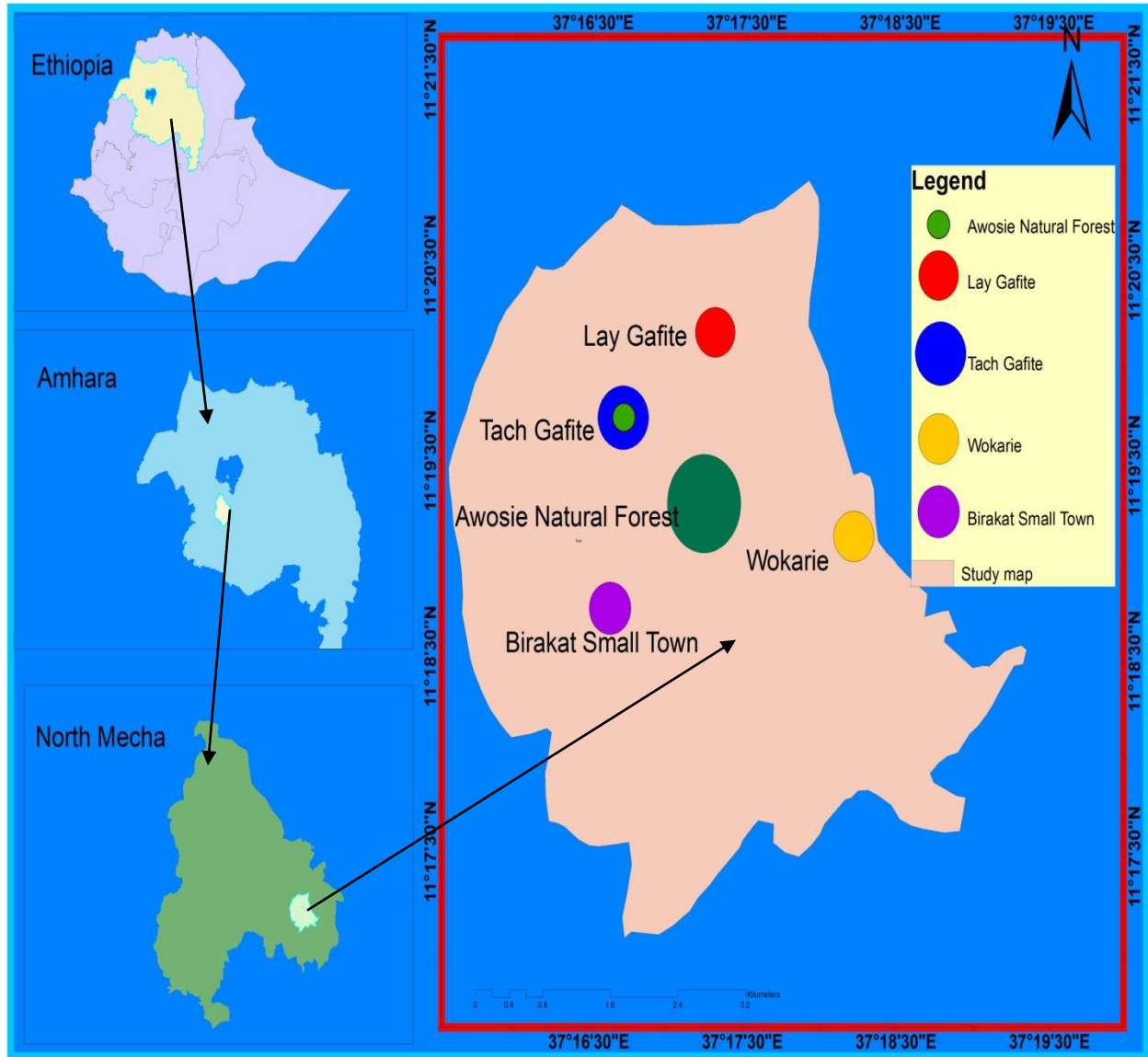


Figure-1. Map of the study area

3.2 Climate

According to North Mecha Woreda agricultural and natural resource office the climate condition of the woreda is 2%Kola, 18%Dega and 80%Woina-Dega. The annual rainfall pattern of the study area varies from 1500 to 2000 mm. The temperature varies from 23C° to 27C°. In the month of June, July and August is high rainfall months and December, January and February are low rainfall months. High temperature is recorded in March, April and May and low temperature is recorded in November, December and January (Desalegne *et al.*, 2016 as cited in Gebeyaw Molla, 2018).

3.3 Vegetation

The main species of plants found in this forest vegetation include broad-leaved and evergreen with important tree species such as East African yellowwood (*Podocarpus falcatus*), small-fruited teclea (*Teclea nobilis*), hochst (*Allophylus abyssinicus*), mucherenje (*Albizia gummifera*), baforonto (*Diospyros abyssinica*), Wanza (*Cordia africana*) and water berry (*Syzygium guineense*), eucalyptus (*Eucalyptus globules*), Warka (*Ficus vasta*), Bamba (*Ficus sycomorus*), Yedegainjori (*Rubusa petalus*), Dewanigirar (*Acacia seiberiana*), muguru (*Calpurnia auria*) and rushfoil (*Croton macrostachyus*) (North Mecha Woreda Agricultural and Natural Resources Office, 2020).

3.4 Fauna

The vegetation of Awsie natural forest also contains a variety of wildlife including Grivet monkey, Colobus monkey (*Colobus guereza*), Leopard, various species of birds and mammals and reptiles. Some of the common wildlife includes Grivet monkey (*Chlorocebus aethiops*), Porcupine (*Erethizon dorsatum*), Warthog (*Phacochoerus africanus*), African civet cat (*Civettictis civetta*), Leopard (*Panthera pardus*) and spotted hyena (*Crocuta crocuta*) (North Mecha Woreda Agricultural and Natural Resources Office, 2020).

3.5 Soil and Topography

The geology and soil of Ethiopia fall within the geological structural units of the horn of Africa (Mohr, 1971 as cited in Assabe Regasa, 2017). According to North Mecha Woreda Agricultural and Natural Resources office the topographic arrangement of the study area 4% valley, 13% hillslope, 8% mountainous and 75% gently sloped. The most dominant type of soil which covers 92% of the area is nitosol, the remaining soils vertisols and verticinitisols.

4. Materials and Methods

4.1 Sampling size and sampling design

Out of 36 kebeles found in North Mecha district two kebeles (i.e. Gafit and Birakat) were taken (using simple random sampling techniques) for this study because all kebeles more or less homogeneous in the cultivation way. Three villages purposively selected from two kebeles because of these villages were nearest to the Awsie Natural Forest and the conflict was highly on it (i.e. Tach-Gafit, Lay-Gafit and Wekari). Sample size was determined by probability sampling technique of Yamane (1967) formula:-

$$n = \frac{N}{1 + N(e)^2}$$

n = finite population correction factors of sample size (Yamane's formula, 1967)

Z = standard normal deviation (1.96 for 95% confidence interval).

P = 0.8 (Success proportion of the population of house heads)

q = 0.2 (Failure of the proportion the population of households)

e = the error of five percentage points (0.05).

N = total population of household heads

The p and q values were based on one pre question distributes to 10 household heads. Based on Yamane (1967) population correction factors, a total of sample household heads was selected using simple random sampling techniques from the total population in each village. Totally, 274 household heads (about 31% of the total number of study population of household heads) were included in the questionnaire and distributed to each house hold, of which 192(70%) and 82(30%) were males and females respectively. The sample size in three villages was 91 from 289 households, 95 from 300 households, and 88 from 269 households from Lay-Gafit, Tach-Gafit and Wokari respectively (Table-1). The sampling research design was mixed (both qualitative and quantitative).

Table-1. Sample size of the respondents from three selected villages

Name selected villages'	Population of house holds	Sample size
Lay-Gafit	289	91
Tach-Gafit	300	95
Wokari	280	88
Total	869	274

4.2 Preliminary survey

The physical environments of the study area were assessed and also networks were established with governmental office experts and local kebele leaders. This information helped to determine the study sites, identify the cause of conflict and severity of crop damage.

4.3 Pilot survey

Pilot survey was carried out in the selected villages based on the information gathered during the preliminary survey. During the pilot survey 9 individuals were randomly select in three villages and interviewed. The main purpose of the pilot survey was reliability of the questionnaire and to check whether it was applicable and suitable in the study area. It was also used to check whether the question can be understood by the respondents and also used to identify the period and the occurrence of human-grivet monkey conflict. In addition to that, it was used to identify the cause of HPC in the study area. Then based on the result from the pilot survey, the questionnaire were revised and developed.

4.2 Methods of data collection

To achieve the objectives of the present study, the following data collection methods were namely questionnaire, Interview and field observation/direct assessment modified from (Newmark *et al.*, 199, Maddox, 2003). Data on population size estimation was collect using line transect method. Data collection method was carried out from June2020 to December 2020.

4.2.1 Questionnaire survey

Questionnaire survey was used to acquire information on the various aspects of the study about the different variables with the questions being both open and close ended. It helped to get information from respondents regarding socio-demographic data (such as age, sex, educational status and marital status). The questionnaire survey was carried out between July and September, 2020 among local community and strictly in the three villages. Questions were distributed to three rural villages which found around the forest for 274 respondents.

4.2.2 Field observation

Direct field observation was another method that was used to collect primary data and carry out through systematic observation (Assabe Regasa, 2017). The field observation was carried out three farmers' maize crop 0.25ha (1 kada in the study area language) of each, and one time per a week from June 2020 to November 2020 to estimate the amount of crop which was damaged by grivet monkey, and to estimate population size of grivet monkeys. It was used to understand part, stage and amount of crops damaged by grivet monkey. In addition to that observation was also important to identify the animal species that cause crop damage through assessing the teeth marks left on the damaged plants and foot marks of the animals.

4.2.3 Interview

This method helped to acquire useful and detailed information about the study area. Interview was carried out to collect qualitative information from the selected three villages. Interviews held to farmers conducted to establish in depth information about the impact of human-Grivet monkey conflict and mitigation mechanisms for the researcher around Awsie Natural Forest. Interview is often helpful to make field notes during and immediately after each interview about observation, thoughts and ideas can help data analysis process (May K M. (1991). Interview was taken with randomly selected 2-3 respondents in each village because house holders were homogeneous in the way of cultivation. This technique was to qualitative way what they know or think about the research problem, structured and semi-structured questions were prepared.

4.3 Estimation of crops damage by pest primates (Griwet monkey)

Totally three study sites were selected to estimate crop loss due to pest primate (grivet monkey). From all the three sites three farmers crop land were selected randomly which are near and had equal distance from edge of forest. Three plots of each 0.25 hectares (1kada) or 50m by 50m were placed randomly within the crop stands of three farmers in each site, a total 7500m² area and were observed ones in a week for five months to estimate the amount crop damage in each stage from the three farmers which sited from the three villages. For each cultivated land the type of crop grown condition of the crop before damage, area of damaged portion, part of the crop eaten and type of crop species eaten were recorded. The observation was conducted starting from June 2020 to November 2020.

4.4 Estimation of population size of pest primates (Griwet monkey)

At the time field work the researcher used the information on movement patten activity and sex of the individuals of grivet monkey obtained from the local community during the preliminary survey. Direct counting method was used to count the population of grivet monkey by moving on foot throughout the whole study sites which were divided in blocks. The observation was carried out the average of two days per a week for three months. Two habitat type sites were observed (dense and fragment habitats). The total area of the intact sampled forest was 60 hectares (0.6 square kilometers), of which the dense forest habitat was 36ha (0.36km²) and 24 ha (0.24km²) was also fragmented forest. Direct counted on their feet mark on the land by walking on foot was used to estimate the population size and their sexes.

The dense forest was divided in transects and each sampled by 3 line transects that has a length of 0.6 km and width of 0.2 km, then counting of grivet monkey through line transect method. The fragmented forest was divided 2 transects by length of 0.6 km and width of 0.2 km. Therefore in line transects the boundary was marked by using natural symbol and artificial way such as string and stone. The population size of a grivet monkey was categorized into three age-sex groups namely, adult male and female, sub-adult male and female, and juvenile based on their body size and sex. The population density was calculated by the following formula. The area of the forest was taken from district agricultural office.

Where:

The census was conducted through the transect line

$$D = N/2 \times L \times W$$

L= length of transect

W=1/2 width

n = number of individual counted in each the entire sampled forest.

$N = D \times A$, N= Total population size

Where D=population density per m²

A=Total extent of habitats

4.5 Data collection on farmers traditional practices to defend crop Raiding by grivet monkey

During the study period the respondents used different traditional methods to defend crop raider and reduce the crop loss. These data were collected through questioner and direct observation and assessment of tangible evidences on the type, when and how they used the technique on the field.

4.6 Data analysis

Collected data were analyzed mainly by using frequency and percentage for the compression and interpretation. The finding was presented in table, figure and pie chart to estimate the amount of crop was damaged and to determine population size.

5. Results

5.1 Demographic characteristics of the respondents in the study area

From the total 274 randomly selected households, 34 (12.4%) of the respondents were between the age of 14-25 yrs, 98 (35.8%) were between age of 26-37 yrs, 107 (39.1%) were between the age 38-57 yrs and the remain 35 (12.7%) respondents were above 58 yrs ages (Fig.2).

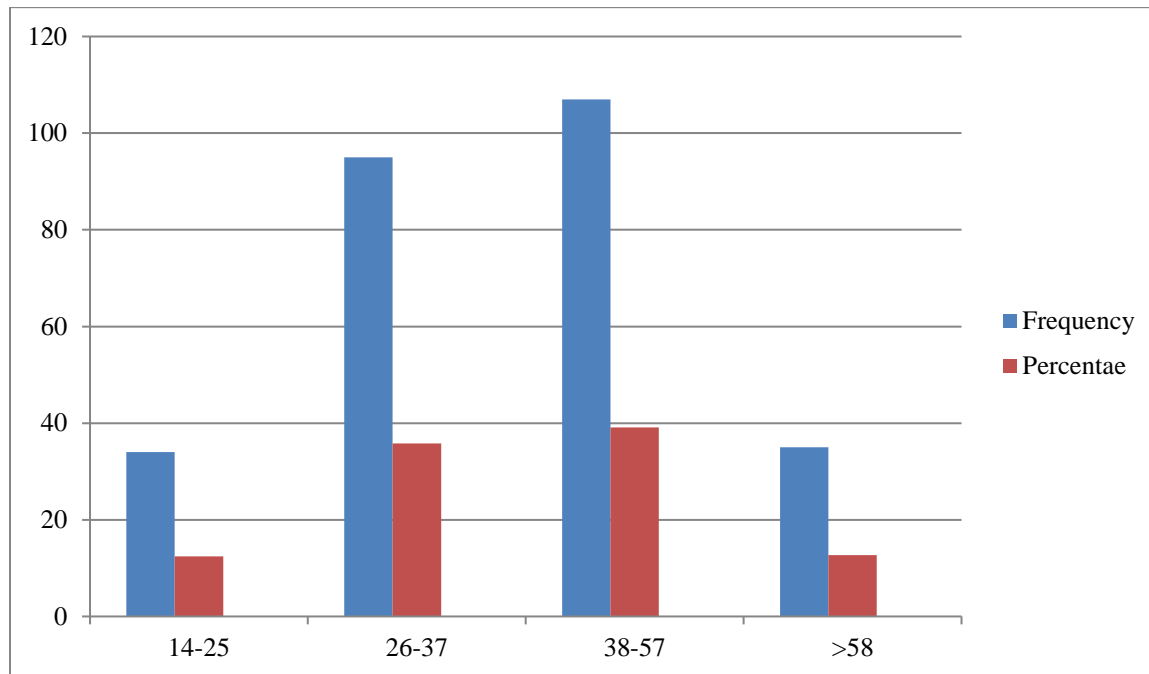


Figure- 2 Age categories of the respondents

Regarding the sex characteristics of the respondents 70% (n= 192) of them were males and 30% (n= 82) were females. This indicated that, the household representation is predominantly led by men and hence the proportion seems unfair as compared to male to female ratio. This is because traditional, it is a patriarchal society or male was the head of family as well as easily communicate with male (Fig.3).

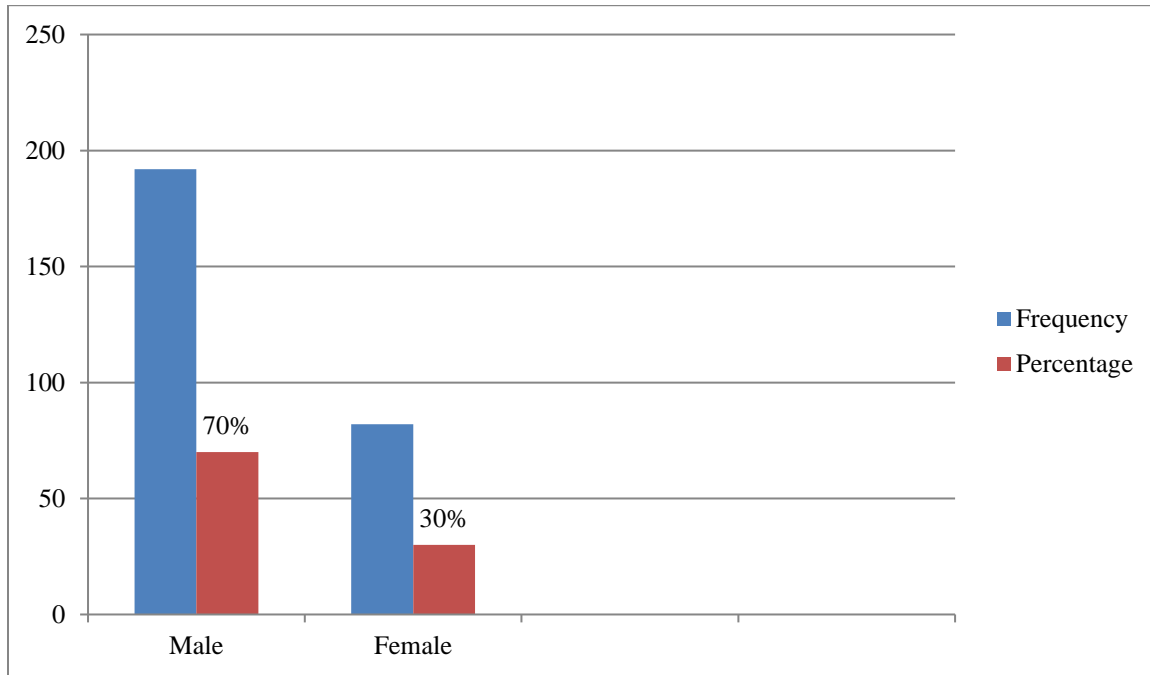


Figure-3. Sex ratio of the respondents

Figure -4. Showed the educational level of respondents. Among all the individual participated in this study, 58 (21.1%) were illiterate, 106 (38.7%) were able to write and read, 60 (21.9%) were attended elementary school and 50 (18.3%) have attended secondary school up to college.

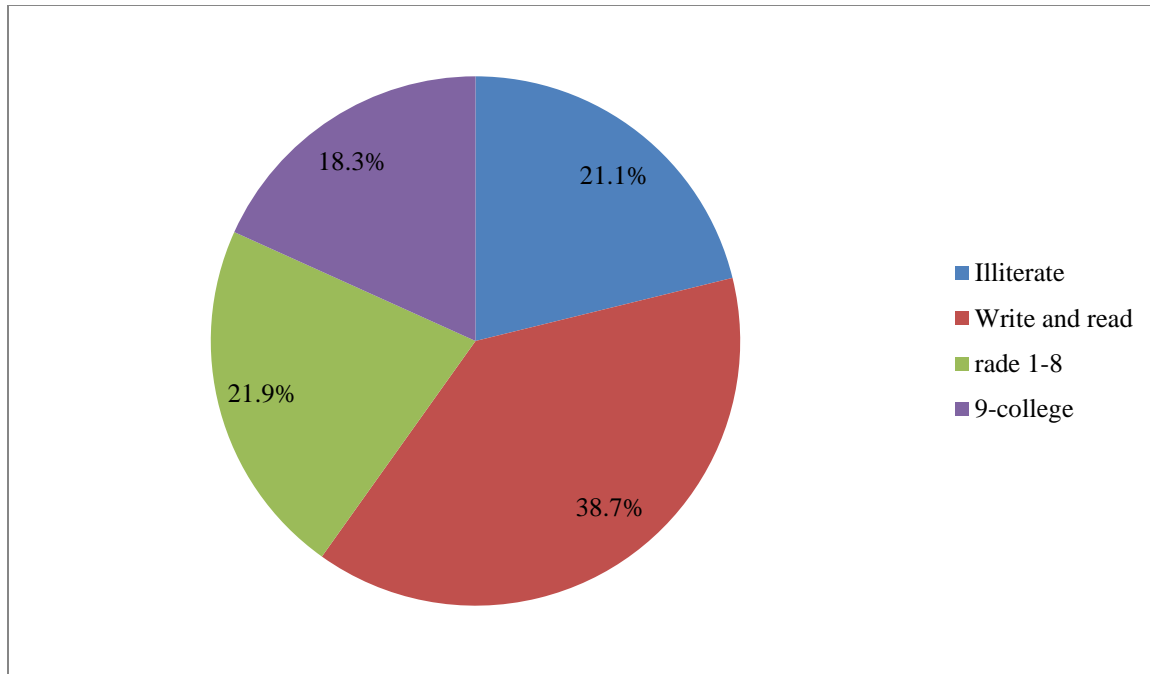


Figure-4. Educational level of the respondents in percentage

Concerning the marital status of respondents 240 (87.6%) of the participants were married 240 (87.6%) were married, 20 (7.3%) were single, 8 (2.9%) were divorced and the remain 6 (2.2%) of them were widows (Table.2).

Table-2. Marital status of the respondents

Marital status	Frequency	Percentage
Married	240	87.6
Single	20	7.3
divorced	8	2.9
Widow	6	2.2
Total	274	100

5.2 Economic activities of the respondents

From the total households, 271(99 %) stated that they have their own farm land and the remain3 (1%) stated that do not have their own farm land. So most of the farmers had their own farm land in the study area (figur.5).

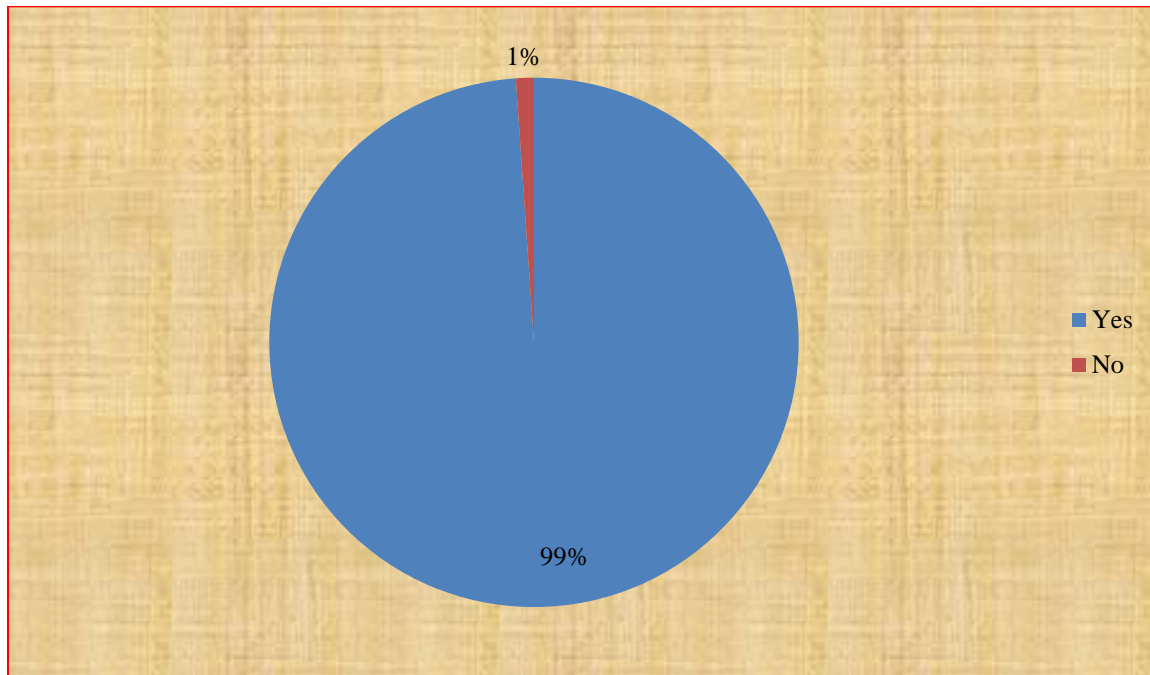


Figure.5. Indicated that whether respondents had farm land or not

From the total households that have had their owned farm land, 33(12.3%) of them had 0.5ha, 55(20.3%) had 2ha, 71(26.2%) had 2-4ha, 99(36.4%) also had 1-5ha and the remain 13(4.8%) of them had more than 5ha in the study area (figure.6).

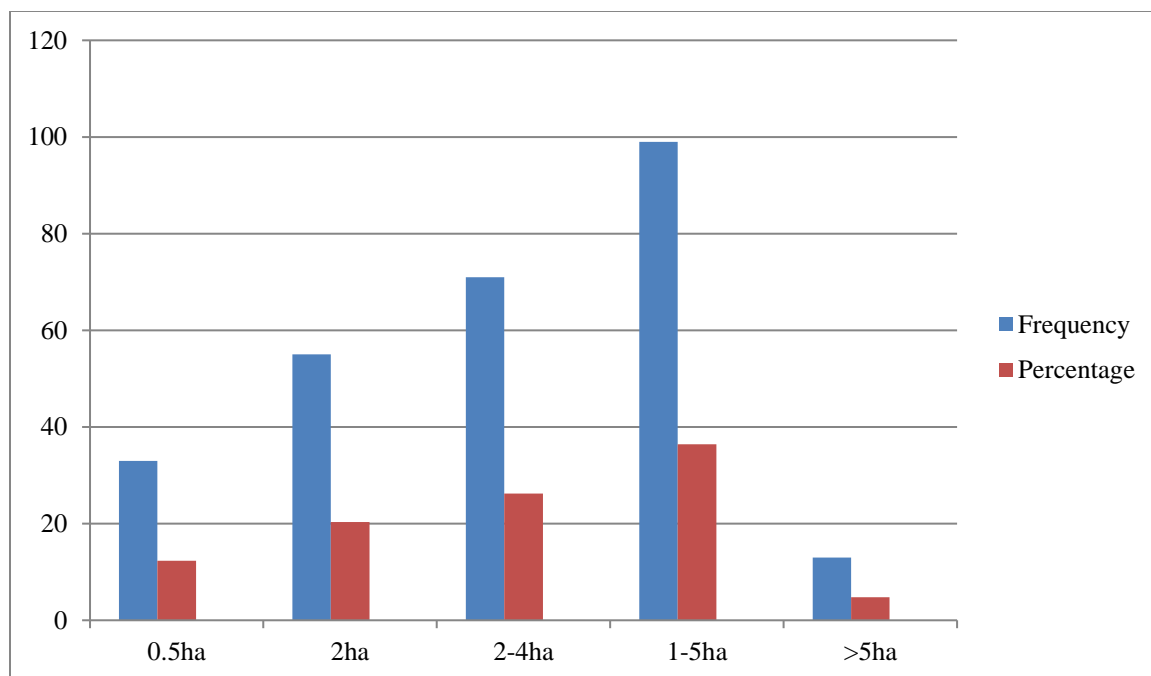


Figure -6. Respondents' farm land size in hectare

According to the questioner survey obtained from the respondents, maize, teff and others cereal crops were the major crop grown in the area and they were the most important crops cultivated by many farmers. Out of the total farmers cultivating crops in the area 160 (58.5%) cultivated maize among other crops, 25 (9%) cultivated teff, 31 (11.3%) cultivated millet, 28 (10.3%) cultivated wheat, 22 (8%) cultivated all crops and the remain 8 (2.9%) of them also cultivated other crops which were grown in the study area. Hence, maize was the most cultivated crop in the study area (Table-3).

Table .3. The type of crops cultivated in the study area

Types of grown crops	Number of respondents	Percentage
Teff	25	9
Millet	31	11.3
Maize	160	58.5
Wheat	28	10.3
All crops	22	8
Others	8	2.9
Total	274	100

From the total respondents participated in this survey, 93.4% of them said that their livelihood depend on farming, 3.6% of the respondents depend on trading and the remain 3% of the respondents depend on other economic activities in the study area (fiure.7).

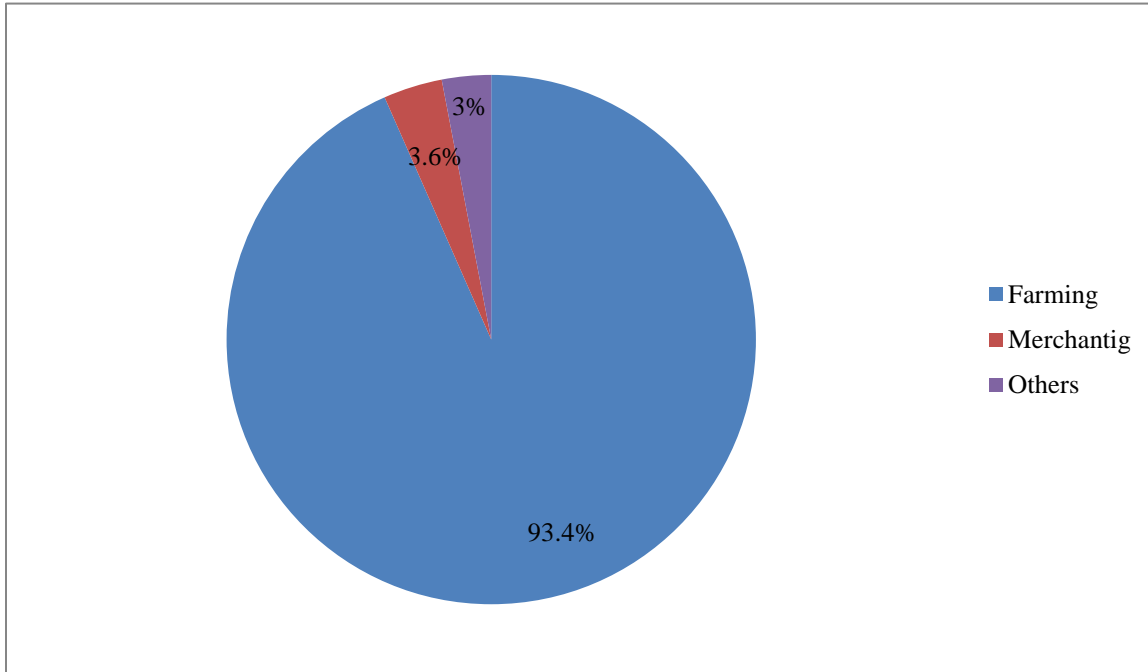


Figure-7. The percentage livelihood of households

5.3 Cause of the conflict between human and grivet monkey

Out of the total respondents, 268 (98%) of them confirmed the presence of conflict between human and crop raiders and the remain 5 (2%) of the respondents disagreed the presence that there was no conflict between human and crop raiders because their farm lands were far from the forest and not suitable to cultivate crops consumed by grivet monkey rather used as grazing to team animals (Table-4)

Table-4. The number of respondents participated on existence of conflict in the study area

here was conflict between human and grivet monkey	Number of respondents	Percentage
yes	269	98
no	5	2
Total	274	100

201(73.3%) of the respondents believed that the cause of conflict was due to habitat destruction and fragmentation by means of road construction and expansion of farm lands, and 73(26.7%) of respondents justified that due to food items preferences by grivet monkey. However, the respondents revealed that the major cause of human-grivet monkey conflict was habitat destruction by the community, due to expansion of farm land and house construction.

Table-5.list cause of conflict between human and grivet monkey in the study area

Cause of conflict	Number of respondents respond	Percentage
Habitat destruction	201	74.7
Selection of food items in farm land	68	25.3
Guarding related problem	-	-
Total	269	100

258(94%) of the respondents replied that the damage was high from August to December, 4(1.7%) of the respondents replied from that from January to April and the remain12 (4.3%) of the respondents replied that from May to July (Fig. 8).During the months of August to December, the conflict was high because in those months maize found at flowering and ripen stage. From months of May to July the conflict was little because at these crops are found less in seedling stage. So, Maize was the most cultivated and more vulnerable crop compare to other crops because of it is easy to handle to grivet monkey.

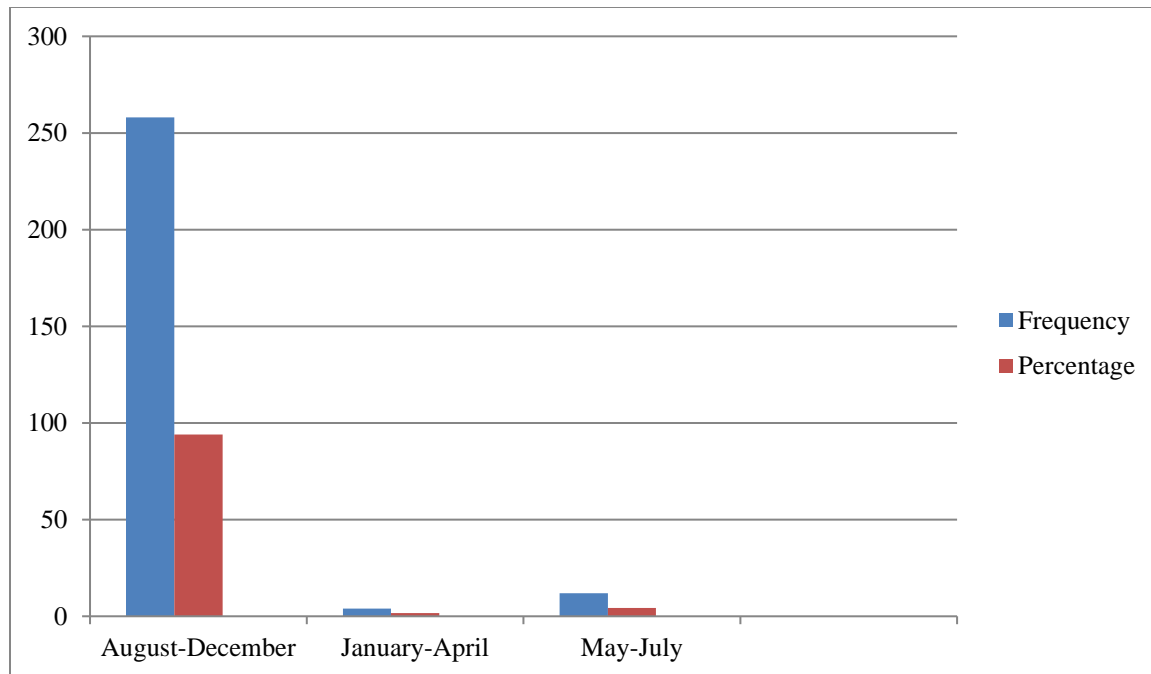


Figure-8. The frequency of Crops damaged in different months

The result obtained from the respondents showed that the crop damage was varied based on the location of farm land. From the total respondents inquired, 255(93%) of the respondents replied that their farm land were near to forest, 13(5%) of the respondents stated that medium and the remain 6 (2%) of the respondents also replied that far from the forest (Table-6). According to the respondents reported crops which found to near site which was highly damaged by grivet monkey. Whereas the damaged amount of crops does not depend on the distance to the forest to the farm lands in the study area (Table. 6).

Table -6.The damaged amount of crops related to distance to the forest

Damaged of crops based on location to forest	Number of respondents' response	Percentage
Near	255	93
Medium	13	5
Far	6	2
Total	274	100



Figure-9.Maize crop cultivation near to Awsie natural forest
(Photo by: Tilahun Tafere)

5.4 Estimation of population size of grivet monkey

Three groups were found during the study period and each group contained 120-130 individuals in the study area. The total population size of in such three groups in the study area estimated to 375. The findings indicated that there was 179 and 196 individuals grivet monkey in dense and fragmented forests respectively. Among the total population grivet monkeys estimated in the study 51(13.6%) were adult male, 65(17.3%) were adult female, 218 (58.1%) were sub-adult male and female and 41(1%) also were juveniles (Table-7). The population density of grivet monkey was 5 per hectare and 8 per hectare in dense and fragmented habitat respectively.

Table .7. The population size of grivet monkey in the study area

Habitats	Groups	AM	AF	SAM & SAF	Juvenile
Dense forest	1	8	11	36	5
Fragmented forest		10	13	39	6
Dense forest	2	9	12	33	7
Fragmented forest		8	10	37	8
Dense forest	3	9	8	35	6
Fragmented forest		7	11	38	9
Total	3	51	65	218	41

AM- stands on Adult Male, AF- stands on Adult Female, SAM -stands on Sub-Adult Male and SAF- stands on Sub-Adult Female.

5.5 Estimation of damaged crops by grivet monkey

Out of the total 22,800 grown maize in three kada (0.75ha), 20(0.087), was damaged at seedling stage, 955(4.19%) was damaged in flowering stage and 576(2.5%) also damaged in the maturation stage by grivet monkey. This also calculated in quintal estimated to 5quintal (500kg), which costs in #6000 ETB. Therefore, this study showed that maize at flower at stage and ripen stage was more damaged by grivet monkeys and the conflict was high between households and grivet monkey compare to seedling stages of maize (Table-8).

Table – 8. Amount of maize crop was damaged in different stages by grivet monkey

Crop raider name	Grown maize crop	Amount of economic hammering in different development stage of maize					
		seedling	%	Flowering	%	Ripen	%
Grivet monkey	22,800	20	0.087	955	4.19	576	2.5
Total	22,800	20	0.087	955	4.19	576	2.5

5.6 Traditional practices used by the local people to reduce crop damage by grivet monkey

The result obtained from questioner, interview revealed that 175(63.7%) of the respondents used that permanent guarding, 34(12.5%) of the respondents used chasing with dog, 41(15%) of the respondents applied hanger bed and the remain24 (8.8%) of the respondents also used scarecrow to defend their cops from grivet monkeys and reduce loss in the study area. In additional, most respondents believed among traditional preventing methods permanent guarding was the best practices followed by hanger bed, chasing with dog respectively (Fig.10).

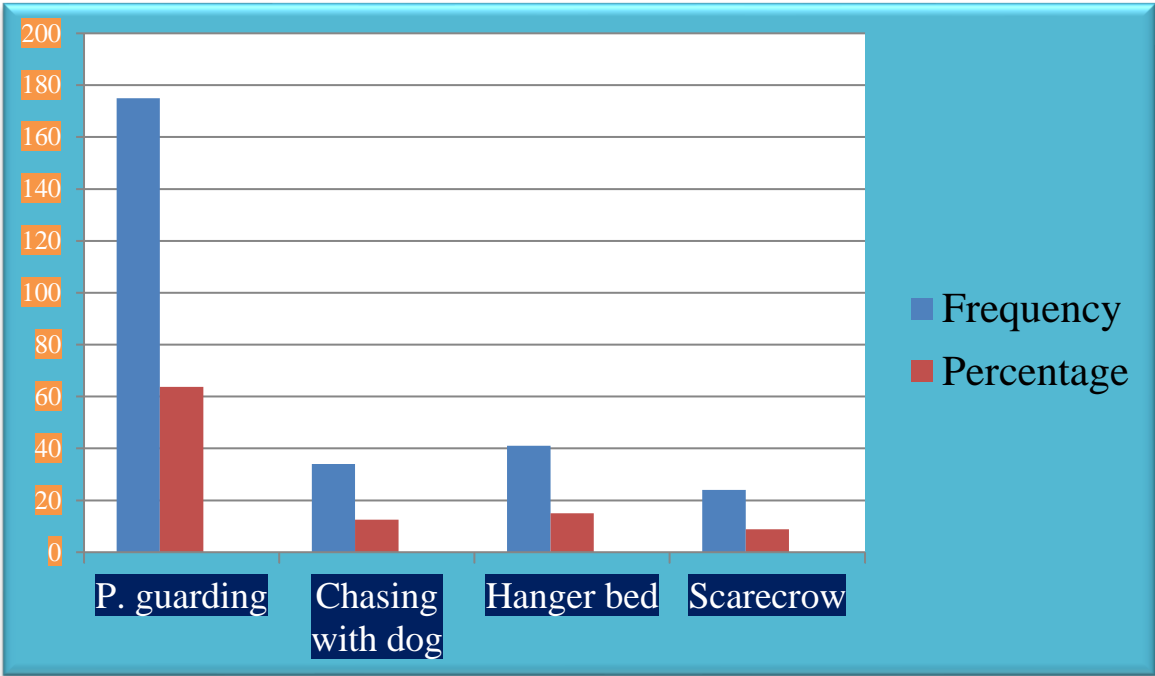


Figure-10. Traditional defending methods in of the local people from grivet monkey



Scarecrow



Guarding

Figure -11. Traditional defending methods of the local people
(Photo by:- Tilahun Tafere)



Hanger bed



Grivet monkeys were killed by hanger bed



Chasing with dog

Figure.12. Traditional defending methods and the respondent was interviewed during data collection
(Photo by:- TilahunTafere)

6. Discussion

The population size of grivet monkey was 375, These were 51 (13.6%) adult male, 65 (17.3%) adult female, 218 (58.1%) and 41(11%) juveniles in the study area. The same study by Dessalegn Ejigu and Afework Bekele, 2010 reported that a total of 44 individuals consisting of 11 adult males, 16 adult females, 13 unidentified sub-adults and 4 juveniles were identified in the troop. These findings more or less similar with the result of the present study because similar climate, geographical distribution and other external factors.

The population size of sub-adult male and female was greater than compare to adult males and adult females as well as to juveniles in the study area. Similar studies conducted by Dessalen Ejigu *et al*; 2021 reported that adult males were greater than juveniles. The population density of grivet monkey was 5 per hectare and 8 per hectare in dense and fragmented habitat respectively in the study area. The same study by Dessalegn Ejigu *et al*; 2021 stated that on the average there was about four grivet monkey per hectare in Zegie penula. Similar study on population size of grivet monkey was conducted by Dessagn Ejigu, 2019 at different parts of Amhara region reported that 25.8%, 34%, 22.7% and 17.5% respectively.

The main cause of human and pest primate mainly grivet monkey conflict around Awsie Natural Forest was habitat destruction in the case of expansion of farm land, house construction and road construction. This finding was supported by Mesele Yihune *et al*; 2008 stated that the cause of human-grivet monkey conflict is habitat destruction in Bale and around the Semen Mountain National Parks. Grivet monkeys are attracted to maize and other crops in the farm lands because of less available nutritional rich food in their destructed habitat. Because crops they were more nutritious than the food that a primate would eat in the forest, their habitat was destructed by people cause more crop-raiding. The human –grivet conflict around Awsie Natural Forest increased time to time and affects not only economy loss but also their social interaction their energy and time. This was supported by Getachew Gebeyehu and Afework Bekele, 2009 stated that there is an increasing tendency of crop damage by grivet monkey. In addition, it was, indicated that not all crops were equally damaged by grivet monkey during the study period. According to the result obtained from the respondents, maize was the most vulnerable crop to damage by grivet monkey. The result of this study is supported by the same study conducted by

Warren (2008), who reported that maize was the most frequently consumed crop by raider in West Africa, Gizachew Girma (2017), who conducted in their study that of 73.4%, 80.99% maize crop was damaged by grivet monkey respectively. The amount of crop damage was varied in different stage of maize crop. The damage was severe at flowering stage (4.19%) followed by maturation stage (2.5%) and the least was at maturation stage (0.089%). This result agreed with the study of Hill (2000) carried out in Uganda, who reported that during seedling stage the farm land was clear and the guard can control the pest easily by watching them from farm distant.

The farmers in the study area introduce different strategies to reduce crop loss against pest primates. Similar studies also showed that guarding was well linked method in different parts of Africa to reduce crop damage (Sillero-Zibiri and Swetzer, 2001 as cited in Assabe Regasa, 2017). In addition to that Hill (2005) stated that guarding crops against damage wild animals is common practice across the agriculture-wild animal interface. Making scarecrow, chasing, and hunting and hanger bed also were common methods used in the study area, among these, guarding crop permanently was the effective method to protect crops from damage of crop raiders. Related study conducted by Ram and Kandel (2008) reported that, the most commonly used crop protection strategies was securing their field constant watchfulness during crop season mainly July to November.

The result of the present study indicated that effective guarding required that people present in the fields from 01:00- 09:00 of the day throughout the seasons when crops were vulnerable to damage. Similar study conducted by Kate (2012) reported that, people had other tasks to complete including attending school, household chores, trading in the local market and employment for local chores. In the study site the guarding activity was done by men, women and children to protect their crop from the damage by grivet monkey. The same study was done by Kate (2012) and Hill (2000) who reported that in Hoima district (Uganda) young children, men and women were involved in guarding who covered first, second and third rank respectively. During this time, farmers guard crops even during the morning and night time. The findings of the present study indicated that human-grivet monkey conflict was increased during July to November seasons because these were their cultivated seasons and crops found in flowering and ripen stages in the study area.

7. Concussion and Recommendation

7.1 Conclusion

The present study was carried out to assess the of human- pest primate conflict and estimate population size of grivet monkey. Peoples in the study area complained that crop damage by grivet monkey is a great impediment to their output. They also stated that maize was their main cultivated and profitable crop but due to crop raiders most the farmers retreat from growing it. The cause of human-grivet monkey conflict was when grivet monkey visited to the farmland, and damage crop as a result of habitat destruction by the local people for the purpose of maintained their livelihood. More maize crop was damaged in flowering and ripens stages compare to seedling stage.

The population size of adult female was greater than adult male, sub-undefined adult greater than compare to adult male and to adult female and juveniles also that contained the least population size in the study area. There were three groups of grivet monkey each contained 120-130 individuals and total of 375 population size found in the study area. Permanent guarding was the main and the best defending method to crop raiders to the local people in the study area. During guarding activity the local people lost their time, energy and reduce social relation to their relatives especially the seedling stage to harvesting season in the study area. The respondents used hanger bed defending mechanism and killed many grivet monkeys, this also the cause of the risk of conservation of natural resources. Grivet monkey was the main impediment to the output of farmers in the study area. In the study area the human-grivet monkey conflict was high between August and November seasons because those were crop cultivation seasons in the study area. So, the degree of conflict between human and grivet monkey was different in different seasons in the study area.

7.2 Recommendation

The human- grivet monkey conflict was high due to lack of resource and habitat overlap between them. It was also a serious problem that reduces the efficiency of crop productivity. Mainly, maize from the finding of this study the following recommendations were made to reduce the human wildlife conflict in the area.

- Farmers should keep their farm against crop raiders to minimize crop loss by using effective method, permanent guarding in the study area.
- Farmers cultivate maize crop in monoculture way and keep in cooperatively mechanisms.
- The environmental natural resources managers and agricultural office of North Mecha woreda should give awareness to the local people about important of natural resources, how to protect their crops and increase their yield.
- The chair men of Gafit and Birakat should work hard to increase the awareness of the local people about the significance of natural resources conservation.
- The kebele leaders and village leaders set up rule and regulation protect this natural forest from deforestation, grazing with team animals and construction their house and expand their farm land.
- Farmers should shift that farm land to grazing area, the grazing area also to farm land.
- The land administration and chair men of Birakat and Gafit kebeles should give other farm land farmers have the surrounding of the forest as composition way.
- Farming close to forest should be minimized.
- Protection and rehabilitation activities are very important for the existence of biodiversity and ecosystem.

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9. Appendices

Questioners were filled by respondents around Awsie Natural Forest in West Gojjam, Amhara region, Northern Ethiopia

Appendix I

Questionnaire for the survey on respondents' demographic information, crop damage and other activities. Both closed-ended and open ended structured questions will be prepared. If the questions are closed you have to circle and if it is open ended give your own suggestion.

1. Respondents'

Village_____

Sex_____

Age [14____25], [26____37], [38____55], [>56]_____

2. Educational back ground

A. Illiterate B. Write and read C. 1-8 D. 9-college

3. Marital status of the respondents

A. Married B. Single C. Divorced D. Widow

4. What is your main economic activity?

A. farming B. merchating C. pastoralist D. others

5. Do you have your own farm land?

A. Yes B. No

6. How much the size of your farm land?

A. 2ha B. 0.5ha C. 2-4ha D. 1-5ha E. greater than 5ha

7. Which type of crop do you cultivate on your farm land?

A. Teff B. Maize C. Degussa D. Wheat D. All crops E. Others

8. There is the forest around your farm land?

A. Yes B. No

9. If your answer yes in question number 7, are there crop raiders in the forest?

A. Yes B. No

10. If your answer is yes in question number 8, list down the name of crop raiders?

11. There is conflict between human and these crop raiders?

A. Yes B. no

12. If your answer is yes in question number 10, what is the cause of the conflict?

A. Destruction of habitat B. lack of food in the forest

C. selection of foods items in the farm land D. guarding related problems

13. List down in rank crop raiders' name based they damage crops.

1st. _____

2nd _____

3rd _____

14. At what location of the crops damaged more by primate pest?

A. near to the forest B. medium C. far to the forest

15. At which season crop raiders more damage your crops?

A. January-April B. May-July C. August- November

16. Which type of crops is more preferable to damage by crop raiders?

17. List in rank of damaged crops by crop raiders.

1st _____

2nd _____

3rd _____

18. List down traditional methods to prevent crop damage from crop raiders?

19. List down traditional methods to prevent crop damage by crop raiders in rank?

1st-----

2nd-----

3rd-----

4th-----

Appendix II

Data collection sheet by direct observation of crop damage by grivet monkey

Name of data collector_____

Place_____

Season_____

Time_____

No	Wild animals Observed	Time of Observation(day or night)	Type of Crop that grows in the study site	Amount of damaged crop in ratio	Mitigation mechanisms used to control crop raiders	Remarks
1						
2						
3						
4						
5						
Total						

Data collection sheet for population Estimate of Grivet monkey by direct observation

Date_____

Species name_____

Place_____

Site_____

Name of data collector_____

No	Types of groups	Based on the age and sex their number			
		Adult male	Adult female	Sub-adult male and female	Juvenile

Appendix. III

Data collection sheet semi- structured questions was interviewed to get important information regarding to the study area.

1. What is the name this forest?

2. What type of crop raiders found in the forest?
3. There is conflict between human and crop raiders?
4. What is the origin and cause of conflict?
5. Among crop raiders in the forest which type of crop raider highly damage the crop?
6. Which type of crop is more vulnerable to damage by crop raiders?
7. At which distance found crops are more damaged by crop raiders?
8. At which season the conflict is highly between human and crop raiders?
9. At which stage of crops are more damaged by crop raiders?
10. What is happening the conflict time to time?
11. What are the possible traditional mechanisms to prevent crop damage by crop raiders?
12. Which is the best traditional method to prevent crop damages from crop raiders?