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Cause and Effects of Human-Wildlife Conflict in Ethiopia: A Review

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Abstract:

In Ethiopia, human-wildlife conflict (HWC) is on the rise. Humans and wildlife are vying for limited natural resources. The goal of this review is to accumulate a vast amount of information on the causes and effects of HWC, including conflict resolution efforts around the country. A large number of literatures and peer-reviewed papers were used. Human population expansion, forest degradation, habitat destruction, and disturbance in or near wildlife-inhabiting regions are some of the essential determinants of HWC. Crop raiding, livestock depredation, and predation on managed wild animal species are all regular HWC concerns. Crop damage is the most common form of HWC. Despite crop loss and wildlife predation, they faced a food crisis in the same region. As a result of these instances, the country loses more money. Cercopithecus aethiops, papio anubis, Panthera Leo, Hippopotamus amphibious and Crocuta crocuta are just a few of the animals who have taken part in the HWC and influenced the economy. The review indicates that most researches have been focused on a certain area or animal species, and data was dispersed. Because HWC is a new threat to wildlife conservation, there are knowledge gaps that will require more research to demonstrate practical consequences.As a result, this data is vital in supporting policymakers and conservationists in formulating land use plan strategies to reduce HWC in Ethiopia, as well as developing successful and replicable wildlife educational and training activities.

Keywords: *Crop loss, livestock depredation, mitigation measure, wildlife conservation.*

1. Introduction

Human-wildlife conflicts (HWC) are a widespread occurrence around the world, especially in locations where humans and wild animals have similar needs (Radhakrishna, 2017; Torres *et al*., 2018). The most typical causes of such conflicts are resource rivalry between humans and wildlife, which leads in conflict along the protected area's border. This has significant consequences for human economic, cultural, and environmental well-being, as well as wildlife conservation (Amy and Hazzah,2016; Seoraj-Pillai & Pillay, 2017). As a result of expanding human populations, loss of natural habitat, and other factors, it is becoming a growing concern that affects human lives, livelihoods, and wildlife existence all over the world (Edet *et al*., 2019). On the other side, increasing wildlife populations as a result of effective conservation programs has exacerbated conflicts in some areas (Ozkazanc *et al*., 2019; Kilicoglu *et al*., 2021). Furthermore, other factors such as poor land-use planning and flawed development policies (Amaja *et al*., 2016) as well as natural factors such as droughts, bushfires, climatic changes, and other unpredictable natural hazards can contribute to a decrease in suitable habitats and intensify the occurrence and extent of such conflict (Ertugrul *et al*., 2019;Varol *et al*.,2021).

HWC is one of the most serious risks to household food security in terms of both income and social costs in rural areas. Crop raiding or livestock predation can have a significant impact on food security in rural areas. Crop-raiding species diminish the amount of surplus crops available for sale and may even deplete food supplies. Parents' reluctance to enable their children to attend school indicates the social costs. Local societies suffer if parents are afraid that their children will be hurt on their route to or from school, or if youngsters are forced to stay at home to assist preserve crop. The dread and uncertainty that animal threats can cause can be significant, and it can have a significant impact on local people's way of life and sense of well-being (Edet *et al*., 2019). It is also anticipated to be noted that HWC difficulties are more severe in underdeveloped countries, especially in Africa (Amare, 2015). According to (Edet *et al*., 2019), human-animal conflict is a major concern for conservation efforts across Africa, posing a significant challenge to local, national, and regional governments, wildlife managers, conservation and development agencies, and local populations.

Despite the diverse and distinctive nature of Ethiopia's topography and biological variety, human activities are depleting the country's natural resources (Datiko and Bekele, 2011; Tefera, 2011). Because the majority of Ethiopians are impoverished, small subsistence farming communities and, in certain circumstances, commercial farms next to natural habitats are frequently harmed by the presence and abundance of wild pest animal species. As a result, wild animal movement across the country is increasingly constrained to a few protected areas/habitats(Erena *et al*., 2019). It's also intended to look at the spatial pattern of wildlife crop raiding incidents in farms near wildlife habitats or within the foraging range of wild animal species. Increasingly, claims of crop damage caused by wildlife on crop farms are linked to human-wildlife interactions(Artelle *et al*., 2016; Sidhu *et al*., 2017). Buffalo, Grivet monkey, and Warthog were the most damaging wild animals to crops (Datiko and Bekele, 2013a). Hyena and Leopard, on the other hand, were reported to be the most destructive wild animals in all assessed villages, including baboons, which were more destructive in communities further away from the protected region. Leopards prefer to eat cows as prey. Hyenas have been blamed for a wide range of animal predation, from cattle to poultry (Kebede *et al*., 2016). This is primarily due to the transformation of the wilderness landscape as a result of increased human activity near wildlife areas. HWC has also emerged from the construction of conservation areas in close proximity to human livelihood activities (Tesfay, 2015).

Logging of natural forests is wreaking havoc on the ecosystem and wildlife. Geographic location, land use patterns, human activities, and the habitat and behavior of wildlife species or individual animals within species all have an impact on HWC (FAO, 2019). Mitigation of HWC is critical for wildlife conservation(Makindi *et al*., 2014;Erena *et al*., 2019). The most serious dangers to wildlife are residential and commercial development, agriculture, and aquaculture expansions into forest regions. For creating cost-effective conservation strategies, understanding the causes and consequences of HWC is crucial. Various HWC studies have been conducted; however, the majority of them are focused on a single region, and knowledge is disseminated. Local residents living within and/or surrounding nature reserves, as well as wildlife, are adversely affected by this contact. As a result, the purpose of this review is to accumulate a plethora of data on the causes and effects of HWC, as well as conflict reduction efforts in various parts of the country.

Several scientific papers and publications on HWC were evaluated, with a focus on developing countries, particularly Ethiopia. To examine important information on HWC, a variety of databases, Google scholar, and Google web were used. Several terms were detected in the keyword, title, or abstract of the published documents,

including HWC, crop-raiding, and livestock depredation. Finally, for this review article, 58 peer-reviewed publications and postgraduate thesis works were chosen.

2. Causes and forms human wildlife conflict in Ethiopia

Human population growth

As human populations spread into wild animal habitats, natural wildlife territory is displaced. Wild animals seek other sources of nutrition when natural prey/food sources become scarce. On the other side, human-made resources attract wildlife, resulting in conflict. The population density of wildlife and humans grows when geographical regions overlap, increasing their interaction and resulting in more physical conflict. Human byproducts give wildlife with abnormal options for food and sheltered refuge, as well as posing a potentially harmful hazard to both humans and animals. Humans compete for natural resources such as fish and grassland pasture, resulting in crop raiding, cattle depredation, and property destruction (Kaplan *et al*., 2011; Masago and Keweingoti, 2018). In fact, HWC has been more extensive in recent decades as a result of exponential human population growth and economic activities. Ethiopia's population has risen steadily over the last three decades, rising from 42.6 million in 1984 to 83.4 million in 2012, and is expected to reach 130 million by 2030, as seen in (Figure 1) (CSA and ICF International, 2011). Unchecked population growth puts undue burden on all of the country's natural resources, and would almost certainly have a negative impact on the environment.

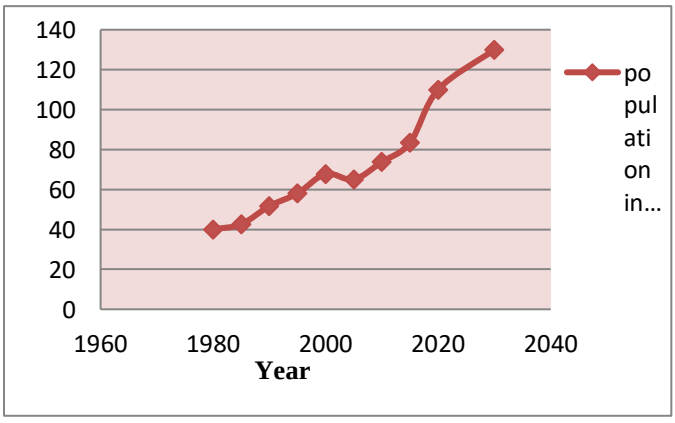

Figure 1: Trends of Human population growth in Ethiopia (Source of data: CSA and ICF International, 2011).

Anthropogenic effects are currently placing these protected areas at risk. HWC is a major worry for most individuals living near protected areas in underdeveloped countries because of their sedentary lifestyles (Amare, 2015). Resource scrambling occurs when the needs of a growing human population collide with the needs of protected areas. As Ethiopia's population expands, so does the need for space and resources, posing a threat to protected areas' wild animal habitat. An ever-increasing human population, for example, has put a burden on the Bale Mountains National Park (population is increasing almost linearly form). In a similar scenario, the human population in and around the Simien Mountains National Park has grown, and the local community has exploited the park to graze their livestock. Those that lived nearer to the park were able to take advantage of the resources throughout the year (Yihune *et al*., 2009a). Similarly, due to the proximity of local residents' farmlands to wildlife habitats in different countries in the region, wildlife has been a major cause of conflict with local residents (Atickem *et al*., 2017; Hailemariam Alemu, 2017). As a result, human population growth, insufficient land-use plans at the national or municipal level for regions near the park, a lack of public understanding, and a poor attitude toward wildlife and conservation among the locals all contribute to an increase in human-animal conflict.

Deforestation and forest degradation

Many wild animals and their natural habitats are threatened by deforestation, which results in land degradation, altering their life patterns in their selected areas. Ethiopia's climate and ecosystems are both diverse (Tefera, 2011). As a result, there are plenty of natural resources all around the country. Forests are home to wildlife, thus they are exploited for fuel wood, charcoal, and forest devastation, all of which contribute to species extinction (Alemayehu Deressa, 2017). It also diminishes the size of

essential habitats for wild animals, eliminates migration corridors, increases the frequency of encounters, and may result in confrontation between farmers and wild animals(Datiko and Bekele, 2011: Tewodros Kumssa and Afework Bekele, 2013). Deforestation has also risen in recent decades and is the leading cause of HWC. According to the World Development Indicator (2019), forest land cover in developing countries such as Ethiopia decreased from 14.69 percent in 1993 to 12.54 percent in 2016 (Figure 2). In a similar context, agricultural land coverage increased from 30.54 percent in 1993 to 36.26 percent in 2016 (Figure 3). The major causes, according to this, are agricultural development, rising construction material demand, and a lack of forest preservation and conservation policies (Gebru, 2016). On the other hand, significant forest tree cutting and exotic tree planted in place of native food plants forced monkeys and baboons to invade the Wondo Genet College staff lunch and residents' homes, which provided a broad variety of food items for them (Fenta, 2014). According to (Leta *et al*., 2016) and ETFF, (2007), expansion of subsistence agriculture along forest edge, coffee plantation, and proximity to natural forest has activities led to a rise in HWC in South Western Ethiopia and Bale mountain national park, respectively.

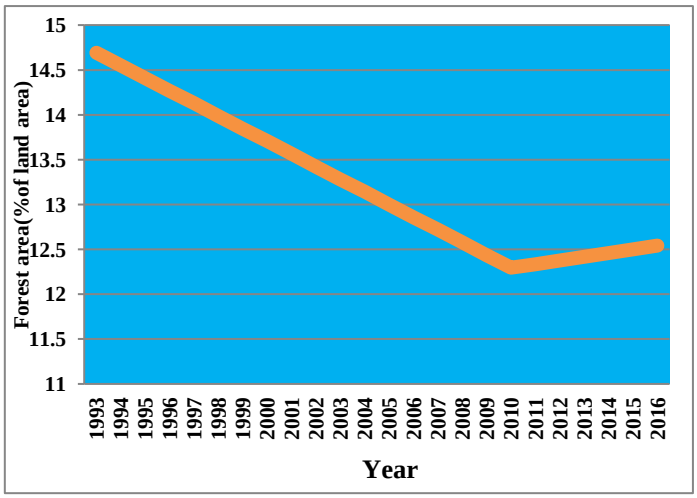

Figure 2: Forest land cover area of Ethiopia which is adopted from world development indicator, (2019)

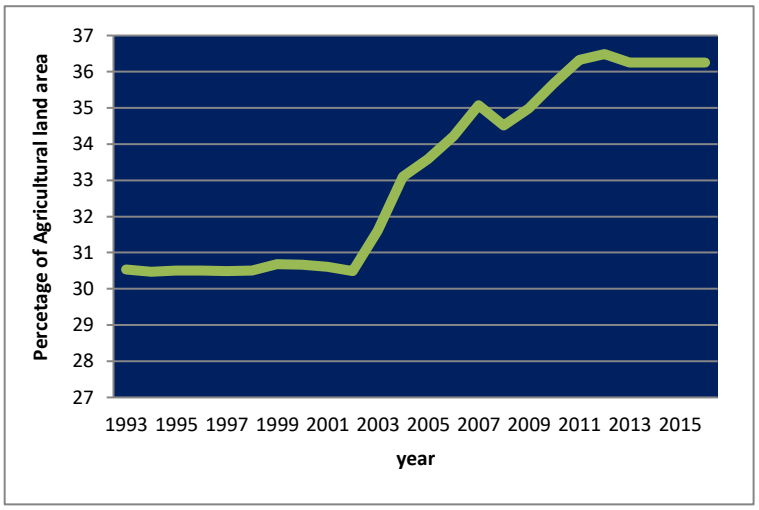

Figure 3: Agricultural land cover area of Ethiopia which is adopted from world development indicator, (2019)

Habitat destruction and disturbance

Habitat disturbance is the destruction of a wild animal's natural habitat. Humans kill or chase wild animals through digging, cutting, blocking their natural habitat with stones, and smoking. This practice is a major factor in the decline or extinction of wild species. Settlement in and around the national park, cattle overgrazing, regular fire and bush encroachment, tree cutting for charcoal, and the sale and construction of houses were all key contributors to habitat disruption in Ethiopia. Tree cutting was primarily related with new settlement, resulting in a deterioration of the area's remaining plant cover (Leta *et al*., 2016;Getahun Shanko,2020). This reduces the amount of space available for wild animals to feed, nest, and reproduce, reducing the likelihood of HWC(Mekonen, 2020). In Ethiopia, however, habitat disturbance was the most common source of HWC. According to (Leta *et al*., 2016;Asebe Regasa, 2017), disturbances of wild animal habitats are increased in Chato forest, Western Ethiopia, and Gera area, South Western Ethiopia, respectively. In the vicinity, there are public restrooms. In Ethiopia, however, rising human population encroachment has resulted in wildlife habitat degradation, fragmentation, and loss. As a result, HWC has increased (Demeke and Afework, 2013;Amare, 2015). For example, from 2004 to 2008, human–

elephant conflict at the Babile Elephant Sanctuary resulted in crop damage and the retaliatory slaughter of six elephants (Sintayehu and Kassaw, 2019).

3. Effects of human wildlife conflict in Ethiopia

Because agriculture and livestock holdings are a significant part of rural people's livelihoods and earnings, the HWC's impacts are especially severe in Ethiopia. Locals with a low level of living, as well as agro pastoralists, who rely solely on the production and income from their land, are particularly vulnerable. In Ethiopia, the damage caused by various wild animals such as *Cercopithecus aethiops*, *papio anubis*, *Panthera Leo*, *Hippopotamus amphibious*, *Syncerus caffe*, *Crocuta crocuta* and *Hystrix cristata* varies from place to place, and the nature of the conflict is dependent on the species involved in the type and level of damage (Hailemariam *et al*.,2017). In fact, there are a variety of circumstances that increase the occurrence of HWC. Direct threat to human life, direct competition for feed between domestic livestock and wild herbivores, and wild animal damage to agricultural crops are only a few of the key driving forces for HWC in Ethiopia (Fentaw *et al.*, 2017)and (Biset *et al*.,2019). I attempted to address some of Ethiopia's human-wildlife conflict's ramifications and effects.

Crop Raiding: -Crop damage is becoming a more prevalent source of financial loss and local discomfort in subsistence farming settings, as well as encouraging negative attitudes toward conservation-valued species. Wildlife in Ethiopia has been observed raiding agricultural crops, ranging from invertebrates like insect pests to vertebrates including small animals, birds, and huge mammals (Quirin, 2005). Crop loss not only affects farmers' ability to feed their families, but it also reduces monetary flow and has health, nutrition, education, and development implications (Masago and Kweingoti,2018;Edet *et al*., 2019). Although the loss of one to two hectors of crops products such as maize, bean, pea, sorghum, barley, wheat, and various vegetables and fruits to *Hippopotamus amphibious* or *Syncerus caffe* in a single night may appear insignificant on a national scale, it can mean the loss of the entire year's food supply, and the difference between self-sufficiency and destitution for the family in question.For example, according to a recent study conducted in Choffa woodland, Hawzien woreda, Eastern Tigray, Northern Ethiopia, baboon monkey and rodent damage to food crops results in the loss of 30,000 kg of crop produce each year(Teklay and Zeyede, 2017) and Swayne's hartebeests, *Phacochoerus africanus*, *Cercopithecus aethiops* and *Hystrix cristata* were also blamed for 58.18 percent of crop damage in Senkele Sanctury, East Shoa, South Ethiopia(Tewodros and Bekele, 2013). Crop raiding by wild animals in Cheha Woreda is another example. The majority of farmers in Guraghe Zone Southern, Ethiopia (88%) said that wild animals played a significant role in food scarcity and poverty (poor income) in the area(Mojo *et al*., 2014). Similarly, in Southern Ethiopia's Chebera Churchura National Park, Dawro zone, and Konta special district, the majority of the respondents (88%) stated that they were facing food shortages due to crop raider damage, as well as loss of sleep, time wastage, and health issues due to the constant guarding situation (Girma, 2016) (table1).

Table 1: Consequences of HWC studies on crop damage in Ethiopia for review

Source and Year of study	Region/location	Crop damage/% lost
Asebe Regasa (2017)	Chato Forest ,Western Ethiopia	28.1%or 22 quintals or11,000ETB
Berihun *et al*., (2016)	Kafata-sheraro national park, Nothern Ethiopia	> 31 quintals
Belay Worku, (2016)	Gida Ayan District,East Wollega,Western Ethiopia	33.28% crop damage
Fenta, (2014)	Wondo Genet, Southern Ethiopia	5100 Sugar stalk,1068kg Maize and Enset
Hailemariam *et al*.,(2017)	North eastern Ethiopia	10% crop lose
Leta et al., (2016)	Gera District, Jimma Zone, South Western ,Ethiopia	50% and 22% crop damage and livestock predation, respectively.
Mojo *et al*., (2014)	Cheha Woreda, Guraghe Zone SNNPR,Ethiopia	Most (88%) food scarcity and poverty in the area.
Teshome and Girmaye, (2017)	Choffa Forest,Hawzien Woreda Eastern Tigray, Northern Ethiopia	30,000 kg of crop product was lost per year

Livestock depredation; - One of Ethiopia's most serious HWC is the loss of cattle. Large carnivores, such as *Crocuta crocuta*, can be spotted throughout Ethiopia, but prey stocks appear to be decreasing. Domestic animals like as cattle, sheep, and goats, as well as cats, dogs, horses, donkeys, and camels, are known to be hunted and scavenged by the *Crocuta crocuta*. These predatory behaviors have previously been reported. Large animals like *Panthera Leo* and *Crocuta crocuta* are also known to be involved in fatal human attacks(USAID, 2013). Farmers and others who walk into the wildlife area to get fire wood or water from rivers or streams are among those killed. Predation on livestock by predators can reduce tolerance for already-vulnerable species, while potential dangers posed by conflicts with large-bodied carnivores' animal species can also have a negative impact on local attitudes toward animals. It is also obvious from recent research studies (Hailemariam *et al.*, 2017) that a total of 590 domestic animals were slaughtered in North Eastern Ethiopia, with an estimated revenue loss of USD 41,740.00 from 250 informants. In a similar scenario, in Bale Mountain National Park, *Crocuta crocuta* and *Panthera Leo* murdered 57 percent and 18 percent of the domestic animals respectively, out of 704 depredations(Atickem *et al*., 2010). In contrast, *Panthera leo*, *Crocuta crocuta*, and *papio anubis* killed 221 sheep (Ovis aries), 306 goats (Capra hircus), 206 cattle, 577 chickens (Gallus gallus domesticus), 36 donkeys (Equus africanus asinus), and 103 dogs (Canis familiaris) in Chebera Churchura National Park in Southern Ethiopia (Aberham *et al.*, 2017) (table 2). More money is lost in the country as a result of these occurrences. This regional variance in wild predator predation of livestock could be due to changes in carnivore numbers, husbandry practices, or relative abundance of different stock species.

Table 2: Consequences of HWC studies on livestock depredation in Ethiopia for review

Source and year of study	Region/location	Livestock depredation /% lost
Acha & Temesgen (2015)	Chebera Churchura National Park ,Southern Ethiopia	1364 in three years lost
Berihun *et al*.,(2016)	Kafata-sheraro national park, Nothern Ethiopia	>31 ape and monkey they eat sheep and got after 1984/85 famine
(Biset *et al*., 2019)	Borena Sayint NP,northern Ethiopia	511& over the last five year US$33,300
Demeke & Afework, (2013)	Chebera Churchura National Park ,Southern Ethiopia	997 Domestic
Gidey Yirga and Hans Bauer, (2010)	Sothern Tigray, Northern Ethiopia	85 domestic and US $3470 within five years
Girma Gizachew,(2018)	Arjo Dhidhiesa Sugar Factory, Western Ethiopia	596 domestic in three years
Hailemariam *et al*., (2017)	North eastern Ethiopia	5 90 and US$ 41,740
Fentaw .T& Duba.J,(2017)	Yabello Protected Area, Southern ,Ethiopia	(36.6%) Loss and (33.3 %) disturbance of household livelihood
Tewodros Kumssa and & Afework Bekele,(2013)	Senkele Sanctury, East Shoa, South Ethiopia	28 domestic animal

Consequences on Wildlife Conservation

Human-caused harm, death, and extinction have been observed in species most exposed to conflict (Sintayehu and Kassaw, 2019). Human-caused mortality has ramifications for not only the survival of some of the world's most endangered species, but also for ecological balance and biodiversity preservation (Leta, *et al*., 2016). For example, the population of Walia ibex in Simien Mountains National Park has declined as agricultural growth has impacted their habita(Yihune *et al*., 2008). In a similar scenario, the Senkelle Wildlife Sanctuary's total area was 200 km2 in 1972, with over 3000 Swayne's hartebeest population, but it has since shrunk to only 54 km2 with 800 population due to population growth and agricultural expansion, and in the BMNP, reports indicate that 60% of all land above 3,200 m has been converted into farmland and Ethiopian wolves are in decline, with the population dropping from 700 in 1986 to 200 in 200 (BIDNTF, 2010) (Figure 4). Furthermore, according to a survey by (Yirga *et al*., 2014) , *Panthera leo* and *Crocuta crocuta* densities are between 2 and 5 per 100 km2 and 4 and 8 per 100 km2 respectively. Extrapolation to a densely encroached area where *Panthera Leo* is unlikely to occur is included in these estimations,

and *Panthera Leo* density and abundance in Nechisar National Park are exceedingly low. In truth, we still know very little about Ethiopian *Panthera Leo*. The need for more information is vital because reductions in Ethiopian *Panthera leo* populations could have major implications for lion conservation, as Ethiopia is the only link between East and Central African *Panthera leo* populations(Gebresenbet *et al*.,2009).

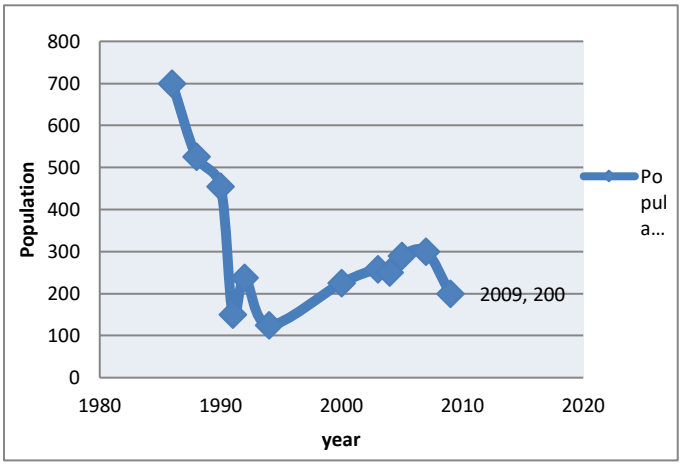

Figure 4: Population trend of Ethiopian wolf in BMNP (Source: adopted from IUCN and EWCA in BIDNTF, (2010).

4. Community strategies to mitigate human-wildlife conflict

Researchers from all throughout the country have made a variety of recommendations for successful HWC mitigation techniques. This section summarizes some of the empirical results of researchers who have studied this case in various sections of the country. Many Ethiopian farmers use self-defense to protect their crops from wildlife damage. Farmers in the Babile elephant sanctuary, for example, use traditional crop protection measures such as remaining in the field, hurling things, making noise by pounding drums or shouting loudly, and digging wide and deep trenches as barriers against elephant crop raiding, and the methods are effective(Reddy and Sintayehu, 2014). Similarly, Mojo *et al*., 2014 observed that, Cheha Woreda subsistence farmers construct stone walls and utilize locally built traps to deter wild *Hystrix cristata* and *Potamochaerus larvatus* from destroying their crops. According to Gidey Yirga and Hans Bauer (2010), cattle depredation in Southeastern Tigray, Northern Ethiopia, was mitigated through habitat burning, killing, and poisoning. Crop flying during harvesting, on the other hand, is one of the most effective ways to avoid crop damage. Crop farmers in Ethiopia's western region claimed that in-field guarding was the most successful method of preventing crop raiding by wild vertebrate pests, with all other methods classified as supplemental and ineffective. In the same situation, guarding was thought to be the most effective protective strategy for limiting crop damage caused by the animal in the region(Abdulfatah Abdu, 2017; Asebe Regasa, 2017; Biset *et al*., 2019).

HWC has indirect effects in addition to the obvious ones. Other costs to household members may include an increased need to guard fields, disruption of schooling because children are needed to help guard family fields, increased risk of injury from wildlife, and a restriction on school students going to school because they are involved in deterring crop raiders species (Masago and Keweingoti, 2018;Yonas *et al*., 2014; Fenta, 2014). Alternative crops, such as ginger and chili, have been supported on the boundary line of the crops plantation to assist limit the animals that visit the plantation fields, as highlighted by (Fenta ,2014; Miller et al., 2016).

5. Conclusion and recommendation

The review clearly demonstrated that there are severe human-wildlife conflicts in Ethiopia, particularly among individuals who live within or next to nature areas. However, the level of conflict, the source, the effects, and the measures they employed to mitigate the conflict were all different. Concerns are developing about the harm caused by wildlife and the resulting conflict, which has led to local people feeling unsafe in their houses as wild animals periodically visit them in quest of food, particularly during times of scarcity when crops are few. Crop-riding by wild animals and cattle depredation were other key factors in the war. To

defend their cattle and crops, they have traditionally used a variety of methods, including repellents and physical barriers such as guards. As a result, the following recommendations are made for urgent consideration by all stakeholders, based on this information:

- Because the capacity of smallholder subsistence farmers to cope with losses varies even within the same region, the government should be required to give compensation for losses
- Adapting the poverty reduction strategy/policy. The local people are encroaching protected areas to expand their farming lands and grazing areas. This can be reduced by using strategies like subsidizing agricultural inputs, facilitating credit access, expanding their market access, and improving their poor way of farming.
- Controlling the population growth rate in the site in particular and at the country level in general. The proper way will be reducing the number of new immigrants to PAs, expanding access to family planning services, and depopulating the area.
- Furthermore, the people must be educated on how to eliminate the causes of wildlife conflict. Because the fight is dynamic, specific strategies depending on current events can be included.

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