

ECONOMIC LOSS OF LIVESTOCK DEPREDATION AND ITS CONSERVATION IMPLICATION IN ETHIOPIA

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ABSTRACT: In Ethiopia human carnivore conflict (HCC) is escalating. Human population expansion, habitat destruction, and increasing disturbance in or around wildlife-inhabiting regions are some of the major drivers of human carnivore conflict (HCC). A large number of literatures and pre reviewed papers were used and SPSS software was used to analyze the number of predated livestock and identify which predator causes more predation per household. Livestock depredation and attacks on predation on managed wild animal species are all regular HCC concerns. This makes the income of the society were condensed and faced food crises in the country. *Canis aureus*, *Crocuta crocuta*, *Papio anubis*, *Panthera leo* and *Canis lupaster* are just a few of the animals who have taken part in the HCC and influenced the economy of the country. In Ethiopia, several papers on the human carnivore conflict are published but the presentation is very inconsistent which makes a good picture of main predators, livestock types predated, economic loss of predation per household difficult. The goal of this article is to review vast amount of information on the causes and consequences of HCC, predator–prey patterns across regions, household economic losses, and current conflict-mitigation strategies. Across the reviewed studies, a total of 8,590 livestock individuals were reported lost to carnivore depredation, resulting in an estimated economic loss of USD 90,072. Sheep and cattle emerged as the most heavily depredated livestock species, followed by goats, with losses disproportionately affecting households located near protected areas and community-managed forests. Livestock loss per household ranged from 0.07 to 6.66 animals, while household-level economic losses varied from USD 2.84 to USD 252.27, indicating strong spatial heterogeneity in livelihood impacts. Spotted hyena (*Crocuta crocuta*) and leopard (*Panthera pardus*) were the most frequently reported predators, followed by lions, African wolves, and Ethiopian wolves, with predator assemblages varying across landscapes. As a result, this data is vital in supporting policymakers and ecologists in formulating land use plan strategies to reduce HCC in Ethiopia, as well as developing fruitful and replicable wildlife educational and training activities.

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Key words: carnivore attacks, conflict mitigation, human–carnivore conflict, predator–livestock conflict

INTRODUCTION

Carnivores represent one of the most diverse groups of mammals, with approximately 250 extant species globally (Upham et al., 2019). Most species are primarily predators, and their ecological role depends on the availability of natural prey. However, rapid land-use change, decline of wild herbivore populations, and habitat fragmentation increasingly force carnivores to shift toward livestock as alternative prey (Ripple et al., 2014; Oriol-Cotterill et al., 2015). This shift escalates human–carnivore conflict, particularly in pastoral and agro-pastoral systems, where livestock losses often trigger retaliatory killing of carnivores through spearing, poisoning, or trapping (Kissui, 2008; Lichtenfeld et al., 2015; Carter & Linnell, 2016; Admasu et al., 2022).

Recent studies across Africa and Asia shows that declining natural prey density remains one of the strongest predictors of livestock depredation and subsequent carnivore persecution (Khorozyan & Waltert, 2019; Moghari et al., 2020; Loveridge et al., 2022). Carnivores play a critical role in maintaining ecosystem structure and function by regulating herbivore populations, suppressing mesopredators, and influencing vegetation dynamics (Ripple et al., 2014; Prugh et al., 2009). Their ecological importance is widely recognized in trophic cascade research, where the removal or decline of apex carnivores leads to ecosystem destabilization (Estes et al., 2011; Atkins et al., 2019). Given their ecological significance, conserving carnivore populations requires a clear understanding of human carnivore conflict patterns, including the extent of livestock predation, dominant predator species involved, and the effectiveness of locally used mitigation strategies (Carter & Linnell, 2016; Khorozyan & Waltert, 2019). Recent studies

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emphasize that community-based coexistence approaches, informed by accurate assessments of predation levels and local perceptions, are essential for sustainable carnivore management and for reducing conflict across rangeland landscapes (Lichtenfeld et al., 2015; Loveridge et al., 2022).

Carnivores require high-protein diets and occupy extensive home ranges, which frequently bring them into competition with humans, especially in landscapes surrounding protected areas (Carter & Linnell, 2016; Van Eeden et al., 2018). Many large carnivores are specialized ungulate predators, and when natural prey availability declines, individuals readily shift to depredating livestock, which is energetically profitable and often easier to catch (Khorozyan & Waltert, 2019; Cozzi et al., 2020). Consequently, livestock predation remains the most widespread driver of human–carnivore conflict globally (Inskip & Zimmermann, 2009; Khorozyan et al., 2020). Although less common than livestock losses, attacks on humans do occur and generate intense fear and trauma within affected communities, often leading to retaliatory killing of carnivores (Packer *et al.*, 2019; Loveridge *et al.*, 2022). The identity of conflict-causing carnivores varies regionally: wolves and bears dominate conflicts in Europe and North America, jaguars and tigers in South America and Asia, and leopards, hyenas, lions and jackals in much of sub-Saharan Africa (Ripple *et al.*, 2014; Broekhuis *et al.*, 2020).

In many rural communities in developing countries, human–carnivore conflict imposes substantial but highly variable economic burdens, often representing one of the most significant livelihood risks for households dependent on livestock (Miller *et al.*, 2016; Mkonyi *et al.*, 2017). Frequent livestock losses reduce local tolerance toward carnivores, reinforcing negative attitudes and driving retaliatory killing, which in turn contributes to population declines of threatened

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species (Kansky *et al.*, 2016; Carter *et al.*, 2020). Studies across Africa and Asia show that intolerance increases sharply when economic losses exceed household income thresholds, highlighting the link between financial impacts and conservation outcomes (Khorozyan & Waltert, 2019; Elliott *et al.*, 2020). Preventing further population declines and local extinctions therefore requires improved understanding of the ecological and socio-economic drivers of conflict, as well as the conditions that enable long-term coexistence between humans and carnivores in shared landscapes (Van Eeden *et al.*, 2018; Loveridge *et al.*, 2022).

METHODOLOGY

This study employed a narrative literature review approach. Relevant studies were retrieved from Google Scholar, Web of Science, Scopus, ScienceDirect, PubMed, and African Journals Online using the keywords “human–carnivore conflict,” “livestock depredation Ethiopia,” “carnivore attacks,” “predator–livestock conflict,” and “conflict mitigation.” Literature published between 2009 and 2024 was considered, with earlier studies included when essential for context. Only studies conducted in Ethiopia and reporting data on carnivore species, livestock losses, human impacts, or community responses were included. In total, 32 publications met the inclusion criteria. Key information such as predator species involved, types of conflict, livestock loss, and mitigation measures was extracted and synthesized thematically to provide an overview of human–carnivore conflict patterns across Ethiopia.

Human carnivore conflict in Ethiopia

Ethiopia is no exception to the widespread challenge of human–carnivore conflict, and livestock losses to hyenas, common jackals, leopards, lions, African wolves and the endemic Ethiopian wolf are well documented across different ecological regions of the country (Aberham *et al.*, 2017; Ayenew Biset *et al.*, 2019; Misganaw *et al.*, 2020). Recent studies further confirm that spotted hyenas remain the predominant livestock predators in many highland and lowland systems, while leopards and African wolves are major threats in forested and Afro-alpine landscapes, respectively (Salahadin & Dereje, 2021; Zelalem *et al.*, 2021; Hailu *et al.*, 2022). In Ethiopia, several papers are published on the human wildlife conflict but their very inconsistent presentation makes it difficult to obtain a good picture of main predators, livestock types

predated, economic loss of predation per household difficult (Mesele Yihune *et al.*, 2009; Fikirte Gebresenbet *et al.*, 2018; Anagaw *et al.*, 2010 and 2017; Misganaw *et al.*, 2020).

Increasing human population which cause habitat encroachment and land-cover changes and reduce the number of natural prey species worsen livestock predation, (Aberham Megaze *et al.*, 2017; Ayenew *et al.*, 2019; Yigrem *et al.*, 2016; Gidey and Bauer, 2010; Getahun *et al.*, 2021; Fikirte *et al.*, 2018). The level of livestock predation varied a lot from different regions depending on the predators' density and livestock management (Soulsbury and White, 2012).

Major factor escalating human carnivore conflict

Population growth

As the world's population continues to grow and technological expansion accelerates, the demand for agricultural and pastoral land has intensified, particularly in developing countries. This expansion often results in habitat degradation, fragmentation, and conversion of natural ecosystems into farmland and settlement areas (Hannah *et al.*, 2020; Song *et al.*, 2021). Shifting cultivation, land clearing, and encroachment for crop cultivation and livestock grazing increasingly alter ecological landscapes and reduce habitat availability for wildlife (Goldstein *et al.*, 2020). Human activities have now modified more than half of the Earth's terrestrial surface, with profound ecological consequences for biodiversity and ecosystem functioning (Ellis *et al.*, 2021).

Rapid global population growth currently exceeding 8 billion continues to drive land-use change, resource extraction, and expansion of human-dominated landscapes (United Nations, 2022). Ethiopia mirrors these global trends: with its population increasing from approximately, as

indicated in Fig.1, 42 million in 1984 to over 120 million in 2023, and is projected to surpass 150 million by 2035 (CSA, 2023). This demographic growth has intensified pressure on forests, rangelands, and protected areas, leading to habitat loss, reduced prey availability, and increased spatial overlap between people, livestock, and wildlife (Tefera *et al.*, 2019; Gashaw & Bekele, 2021). Consequently, expanding agricultural frontiers and settlement areas heighten the frequency of human–wildlife interactions and elevate the risk of conflict, posing a growing threat to biodiversity conservation across Ethiopia (Alemayehu *et al.*, 2022).

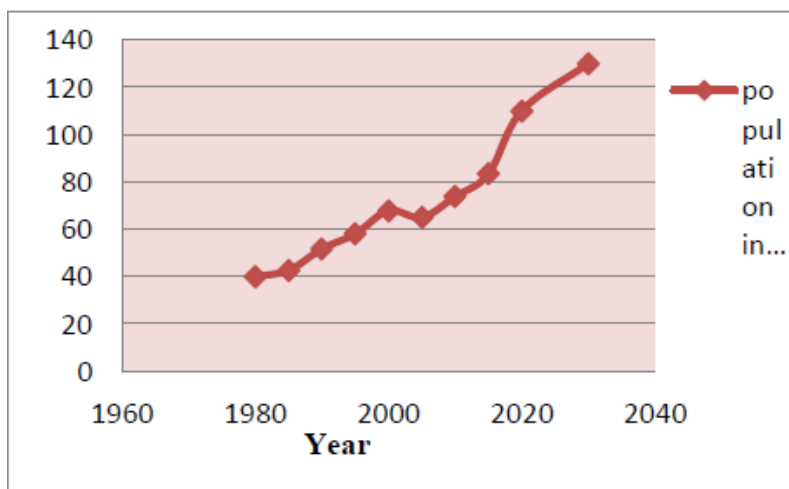


Figure 1. Trends of Human population growth in Ethiopia (Source of data: CSA and ICF International, 2011).

The Bale Mountains National Park, for example, has experienced increasing pressure from a steadily growing population (population is increasing almost linearly). Similarly, the human population in and around the Simien Mountains National Park has increased, and the local community has taken advantage of the park to graze their animals. Those who lived close to the park were able to take advantage of the resources all year (Mesele *et al.*, 2009). Similarly, wildlife has been a major source of conflict with local communities due to the proximity of local residents' farmlands to wildlife habitats in various countries in the region (Anagaw *et al.*, 2017;

Hailemariam, 2017). Human population growth, insufficient national or municipal land-use plans for districts surrounding the park, a lack of public understanding, and a poor attitude toward wildlife and conservation among the people all contribute to an increase in human-animal conflict.

Habitat Destruction and Disturbance

Habitat destruction refers to the loss or severe alteration of a wild animal's natural environment, which reduces the availability of critical resources such as forage, nesting sites, and breeding areas. Human activities—including tree cutting for charcoal, clearing land for settlement, livestock overgrazing, bush encroachment, regular burning, and obstruction of habitats—are major drivers of habitat degradation in Ethiopia (Getahun Shanko *et al.*, 2020; Mekonen *et al.*, 2020). These disturbances not only reduce plant cover but also fragment landscapes, limiting the space available for wildlife and increasing the likelihood of human–wildlife conflict (Leta *et al.*, 2016; Tefera *et al.*, 2019).

Recent assessments indicate that habitat disturbance is among the leading causes of human–wildlife conflict in Ethiopia (Admasu *et al.*, 2022). For instance, increasing settlement and land-use change in Chato Forest, Western Ethiopia, and Gera District, Southwestern Ethiopia, have intensified conflicts with carnivores and other wildlife (Leta *et al.*, 2016; Gashaw & Bekele, 2021). Encroachment by growing human populations has exacerbated wildlife habitat loss and fragmentation, elevating the risk of livestock depredation and crop damage (Demeke & Afework, 2013; Alemayehu *et al.*, 2022). Notably, a decade-long (1999–2009) human–leopard conflict near the Borena–Sayint National Park border resulted in seven human fatalities and the

retaliatory killing of two leopards, highlighting the direct consequences of habitat disturbance on both people and wildlife (Ayenew Biset *et al.*, 2019).

Consequences of Human–Carnivore Conflict

Human–carnivore conflict has particularly severe socio-economic and ecological impacts in Ethiopia, where rural livelihoods depend heavily on agriculture and livestock (Kidane *et al.*, 2025). Low-income households and agro-pastoralists, who rely primarily on livestock and crop production, are especially vulnerable to depredation events and related economic losses (Gashaw & Bekele, 2021; Alemayehu *et al.*, 2022).

A wide range of wild carnivores contribute to livestock predation in Ethiopia. Commonly reported species include spotted hyena (*Crocuta crocuta*), leopard (*Panthera pardus*), common jackal (*Canis aureus*), African wolf (*Canis lupaster*), Ethiopian wolf (*Canis simensis*), bat-eared fox (*Otocyon megalotis*), lion (*Panthera leo*), serval (*Leptailurus serval*), caracal (*Caracal caracal*), and occasionally Anubis baboon (*Papio anubis*) (Belayneh & Tolcha, 2020; Bezihalem *et al.*, 2016; Fikirte *et al.*, 2017, 2018; Misganaw *et al.*, 2020; Yigrem Kebede *et al.*, 2016; Tesfaye & Jatni, 2017; Salahadin & Dereje, 2021; Ayenew *et al.*, 2019). The identity and relative impact of predators vary by region, livestock type, and husbandry practices. For example, in Senkele Swayne’s Hartebeest Sanctuary, spotted hyenas are the primary predators of cattle, whereas common jackals target sheep in the Choke Mountains and Simien Mountain National Park (Misganaw *et al.*, 2020; Bezihalem *et al.*, 2016; Mesele *et al.*, 2009).

The consequences of predation extend beyond economic losses. Livestock predation reduces household income, undermines food security, and often triggers retaliatory killings of carnivores, further driving biodiversity decline. Human fatalities and injuries, though less frequent than

livestock losses, also contribute to heightened fear and negative perceptions toward wildlife (Ayenew *et al.*, 2019; Hailu *et al.*, 2022). Overall, these dynamics create a feedback loop: economic vulnerability drives intolerance, which leads to predator removal, further destabilizing local ecosystems and reducing coexistence opportunities.

Human deaths and injuries

In Ethiopia, human carnivore interactions have resulted in documented fatalities and injuries. For example, on the border of Borena Sayint National Park, seven people were attacked by leopards between 1999 and 2009, leading to the retaliatory killing of two leopards (Ayenew *et al.*, 2019). Around Chebera Churchura National Park, from 2007 to 2011, seven human attacks by lions, five by hyenas, and six injuries caused by leopards were recorded; local communities retaliated by killing two lions, two leopards, and six spotted hyenas (Alemayehu Acha & Temesgen, 2015). Similarly, in the Kafa Highlands between 2009 and 2013, 17 people were killed due to interactions with lions and leopards, while three human fatalities were reported in Gambella National Park from lion attacks (Fikirte *et al.*, 2018). Retaliatory killings often exacerbate biodiversity loss, as species such as leopards are targeted due to perceived threats to human life and livestock during guarding activities (FAO, 2009; Yirga *et al.*, 2013).

Livestock predation

Livestock predation is the most common form of human–carnivore conflict in Ethiopia, directly affecting household income, food security, and attitudes toward wildlife. Large carnivores, including spotted hyenas, leopards, lions, African wolves, and Ethiopian wolves, prey on cattle, sheep, goats, donkeys, horses, poultry, and occasionally pets (Indris, 2021; Belayneh & Tolcha,

2020). Predatory behavior is influenced by prey availability, habitat conditions, and proximity to human settlements. Farmers and resource collectors who enter wildlife habitats for firewood or water are particularly vulnerable to attacks.

Recent studies demonstrate substantial economic impacts. Hailemariam *et al.* (2017) reported that 590 domestic animals were killed in northeastern Ethiopia, causing a household income loss of USD 41,740 from 250 informants. In Bale Mountains National Park, lions and hyenas accounted for 57% and 18% of 704 documented livestock depredations, respectively (Atickem *et al.*, 2010). In Chebera–Churchura National Park, lions, hyenas, and Anubis baboons killed 221 sheep, 306 goats, 206 cattle, 577 chickens, 36 donkeys, and 103 dogs, resulting in significant economic loss (Aberham *et al.*, 2017).

At the household level, livestock loss varies with in the study area , predator species, and husbandry practices. In Borena–Sayint National Park and Guassa Mountain Forest, approximately two sheep and over three cattle per household were lost annually in the surrounding districts of Alage College, Central Rift Valley of Ethiopia, while poultry predation was primarily caused by serval and white-tailed mongoose (Misganaw *et al.*, 2020; Table 1–3). Variations in carnivore abundance, livestock management, and the relative availability of prey explain differences in depredation patterns across Ethiopia.

Table 1. Livestock depredation and its economic loss in different localities of Ethiopia

Location	No Live stock	Economic loss \$	Livestock loss per household	Loss per household \$	year of study	Predators	References
BSNP	511	33,300	3.87	252.27	2016 to 2017 and	spotted hyena and leopard	(Ayenew Biset <i>et al.</i> , 2019)
BMNP	704	13054	1.94	36.06		spotted hyena, leopards and African wolves	Anagaw <i>et al.</i> , 2010)
BSNP	233	1173.9	1.01	5.1	(2013-2018	Leopards, Spotted hyena and Papio hamadryas	Salahadin and Dereje, 2021
CCNP	1149		3.25		2012–2014	Lions, Leopards, and Spotted Hyena	Aberham <i>et al.</i> , 2017
CCNP	1,364		4.55		2007 to 2011	Lions, Leopards, and Spotted Hyena	Alemayehu and Mathewos, 2015
SCMCF	745		2.4		2005 to 2007	spotted hyena, common Jackal, Leopard, and Jackal, African wild Dog, Caracal, and Serval	Yigrem <i>et al.</i> , 2016
GNP	31		0.89			lions and leopards	Fikirte <i>et al.</i> , 2018
EKH (kafa)	412	597	1.96	2.84	2009 to 2013	lions and leopards	Fikirte <i>et al.</i> , 2018
ACCRV	932		6.66		2018 to 2019	spotted hyena, common Jackal, mongoose,	Zelalem <i>et al.</i> , 2021
GFA	590	41,740	2.36	166.96	2014 to 2015	Common fox, Hyena and Leopard	Hailemariam <i>et al.</i> , 2017
GMF	492		1.97		1999 to 2002	spotted hyena, African and Ethiopian wolf, Serval	Anagaw <i>et al.</i> , 2017

AMNP	334		2.30				spotted hyena and, mongoose	Bizuneh <i>et al.</i> , 2018
SSH	1062	207	2.81	77.27	2016–2018		spotted hyena and African wolves	Misganaw <i>et al.</i> , 2020
KSNP	31		0.07		2014 to 2015		Atakilt Berihun	Atakilt <i>et al.</i> , 2016
Total	8590	90,072	36	541				

Abbreviation: - BSNP (Borena Sayint National Park), Kafa (kafa highlands of Ethiopia), BMNP (Bale Mountain National Park), CCNP (Chebera Churchra National Park), SCMCF (Sodozuria Community managed conservation forest), SSH (Senkele Swayne's Hartebeest Sanctuary), AMNP (Arsi Mountain National Park), GFA (Gemshat Forest Area), GMF (Guassa mountain forest), Alage College, Central Rift Valley

Table 2. Livestock species predated in different localities of Ethiopia

Area	Sheep	Goat	cattle	Donkey	Horse	Poultry	Mule	HH	Year	References
BSNP	0.54	0.30	0.10	0.05	0.02	0.00	0.00	230.00	(2013-2018)	Salahadin and Dereje, 2021
Kafa	0.83	0.17	0.26	0.01	0.36	0.00	0.04	210.00	2009-2013	Fikirte <i>et al.</i> , 2017
SCMCF	0.82	0.47	0.60	-	-	0.41	0.00	310.00	2005 to 2007	Yigrem <i>et al.</i> , 2016
SSH	0.74	0.39	1.47	0.11	0.10	0.00	0.00	378.00	2016–2018	Misganaw <i>et al.</i> , 2020
BMNP	0.27	0.30	0.16	0.03	0.12	0.00	0.00	362.00	1999 to 2002	Anagaw <i>et al.</i> , 2010
CCNP	1.19	1.29	2.06	0.00	0.00	0.00	0.00	300.00	2007-2011	Alemayehu and Mathewos 2015
CCNP	0.62	0.86	0.58	0.10	0.00	0.00	0.00	354.00	2012–2014	Aberham <i>et al.</i> , 2017
AMNP	0.33	0.00	0.37	0.21	0.00	0.66	0.00	145.00		Bizuneh <i>et al.</i> , 2018
BSNP	1.98	1.80	0.03	0.05	0.00	0.00	0.00	132.00	2016 – 2017	Ayenew <i>et al.</i> , 2019
GFA	1.10	1.20	0.00	0.00	0.06	0.00	0.00	250.00	2014 -2015	Hailemariam <i>et al.</i> , 2017
GMF	1.78	0.14	0.00	0.03	0.01	0.00	0.00	250.00		Anagaw <i>et al.</i> , 2017

ACCRV	0.35	0.51	3.54	1.12	0.81	0.07	0.26	140.00	2018 -2019	Zelalem <i>et al.</i> , 2021
Total	0.75	0.59	0.73	0.06	0.07	0.10	0.02			

Table 3. Livestock predation per house hold with their predators

Area	Livestock	Total loss	Loss per House Hold	Predator type										
				1	2	3	4	5	6	7	8	9	10	
SCMCF	Sheep	253	0.82	46	65	48	-	27	18	-				
	Goat	147	0.47	31	37	9	-	15	16	-				
	Cattle	186	0.6	71	55	-	-	-	21	-				
	Chicken	128	0.4		11	-	-	-	-	-	83			
	Donkey	31	0.1	3	6	-	-	-	10	-				
SSH	Sheep	279	0.74	-	212	-	-	-	-	-			67	
	Goat	147	0.39	-	115	-	-	-	-	-			32	
	Cattle	556	1.47	-	556	-	-	-	-	-			-	
	Donkey	43	0.11		43									
	Horse	37	0.09		37									
Kafa	Sheep	209	0.99	35				174						
	Goat	59	0.28	24				35						
	Cattle	56	0.27	2				54						
	Donkey	3	0.01					3						
	Horse	38	0.18	1				37						
	Mules	8	0.04					8						
BMNP	Sheep	241	0.67	17	121	92					11			
	Goat	238	0.66	105	60	24					49			
	Cattle	120	0.33	5	115									
	Donkey	17	0.05		17									
	Horse	88	0.24		88									
CCNP	Sheep	48			48									
	Goat	106			106									
	Cattle	54			54									
	Donkey	30			30									
AMNP	Chicken	96	0.66								96			
GMF	Sheep	445	1.78		11								351	83
	Goat	35	0.14							1			16	18
	Cattle	1	0.004		1									
	Horse	3	0.012		3									
Total		3702	12		1793	173	311	42	65	144	96	466	101	

1 (leopard), 2 (Hyena), 3 (Common Jackal), 4 (Lion), 5 (African wild dog), 6 (Caracal), 7 (Serval), 8 (White-tailed mongoose), 9 (African wolves), 10 Ethiopian wolf

Consequences on Wildlife Conservation

Human–carnivore conflict imposes severe consequences for wildlife populations, particularly species most prone to conflict. Anthropogenic mortality including retaliatory killing and hunting has been reported to threaten survival, local population stability, and even contribute to extinctions (Sintayehu & Merkebu, 2019; Gashaw & Bekele, 2021). Such human- induced mortality not only affects the survival of globally endangered species but also disrupts ecological balance and biodiversity (Leta et al., 2016; Alemayehu et al., 2022).

For instance, the Walia ibex (*Capra walie*) population in Simien Mountains National Park has declined due to habitat loss from agricultural expansion (Mesele Yihune et al., 2008). Similarly, in Senkele Wildlife Sanctuary, the area decreased from 200 km² in 1972 to 54 km², and the Swayne’s hartebeest population dropped from over 3,000 to approximately 800 individuals due to human settlement and land conversion (BIDNTF, 2010). In Bale Mountains National Park, over 60% of land above 3,200 m has been converted to farmland, contributing to the decline of the endemic Ethiopian wolf (*Canis simensis*), whose population fell from around 700 individuals (Fig.2) in 1986 to 200 in 2000 (BIDNTF, 2010).

Carnivore populations have also been affected. Lion and hyena densities in Ethiopia are estimated at 2–5 and 4–8 individuals per 100 km², respectively, although these estimates include areas with high human encroachment where lions are unlikely to persist (Yirga et al., 2014). Population data on Ethiopian lions remain scarce, yet declines could have serious implications

for regional conservation, as Ethiopia forms a critical corridor connecting East and Central African lion populations (Fikirte Gebresenbet et al., 2009).

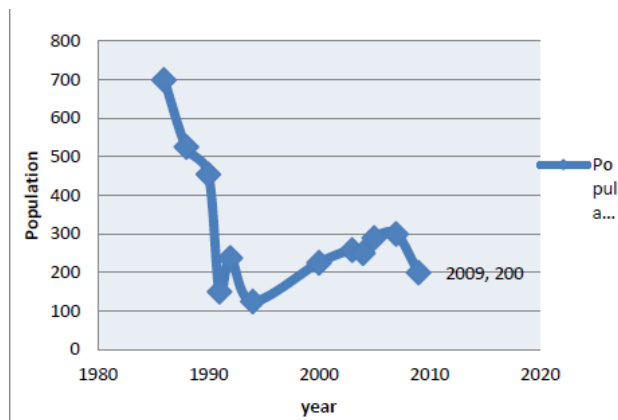


Figure 2. Population trend of Ethiopian wolf in Bale Mountains National Park (Source: BIDNTF, 2010).

Community strategies to mitigate human carnivore conflict

Several proposals for successful human carnivore conflict prevention measures have been offered by researchers from across the country. This section outlines some of the empirical findings of scholars across the countries that have looked into this case. Many Ethiopian farmers use dogs to guard their livestock and livestock enclosures with thorn bush kraals (Yigrem *et al.*, 2016; Anagaw Atickem *et al.*, 2010; Aberham *et al.*, 2017; Getahun *et al.*, 2021), voluntary resettlement (Mesele Yihune *et al.*, 2009), keeping cattle in houses or fenced fields at night and not grazing livestock in forest (Fikirte *et al.*, 2017) and herding their livestock in a herd in the pasture (Alemayehu and Mathewos, 2015) were very effective methods of reducing livestock depredation. Cattle depredation in Southeastern Tigray, Northern Ethiopia, was reduced through habitat burning, killing, and poisoning, according to Gidey and Hans Bauer (2010). Similarly,

According to Yigrem *et al.*, (2016) in different villages of around sodo community conservation forest the farmers used different methods, such as guarding with dogs is effective to keep their livestock from predators (Fig.3).

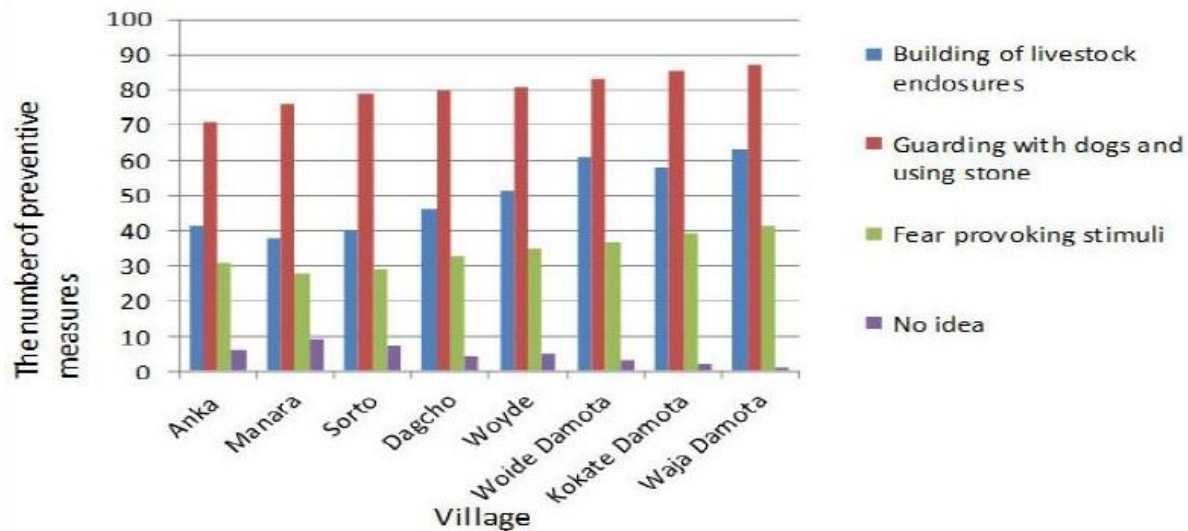


Figure 3. Preventive measures to reduce livestock depredation in relation to distances among different villages around sodo community conservation forest

SUMMARY

The review demonstrated that human-carnivore conflicts in Ethiopia are particularly severe for individuals living within or near protected areas. However, the level of conflict, the source, the effects, and the measures they employed to mitigate the conflict were all different. Spotted hyena, leopard, common jackal, lions, African and Ethiopian wolf, African wild dog, caracal, serval and Common fox are the common carnivores that depredated livestock. Such carnivores were found to cause more losses to the people living in different areas of Ethiopia. The spotted Hyena, leopards and the common Jackal were the most destructive wild carnivores in most areas of Ethiopia. Hyenas prey on more than one cattle per household in Swayne's Hartebeest Sanctuary, and more than two cattle per household were lost in Chebera Churchra National Park.

Around two sheep killed per household in Guasa Mountain forest by Ethiopian wolf, African wolf and hyena. To defend their livestock, they have traditionally used a variety of techniques. Guarding with dogs and building livestock enclosure are the most preventive measures of livestock depredation from predators.

RECOMMENDATIONS

Addressing human–carnivore conflict in Ethiopia requires coordinated efforts between policy makers and local communities. Priority should be given to strengthening locally appropriate mitigation practices, including improved livestock husbandry, construction of secure night enclosures, and strategic use of guarding dogs. Government and conservation agencies should invest in community education programs to raise awareness about carnivore behavior and promote coexistence. Establishing equitable and transparent livestock compensation or insurance schemes is essential to reduce retaliatory killing and build positive community attitudes toward wildlife. In addition, systematic monitoring and research are needed to identify conflict hotspots and evaluate the effectiveness of mitigation interventions.

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