



## Assessment of Human-Wildlife Conflict in and Around Gemshat Forest Area, Wollo, Amahra Region, Ethiopia

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### ABSTRACT

The conflict between human and wild animal on same resources is common but seldom reported in Ethiopia. Assessment of human wildlife conflict around Gemshat Forest Area was carried out from November 2014 to May 2015. Nature of conflict and wild animals involved in conflict were recorded from victims through both open ended and fixed response questions in the questionnaire. In the study area, 207(82.8%), 193(77.2%) and 175(70.0%) informants identified Grivet monkey, Geladas and Guinea fowl as common crop raiders, respectively. However, Rabbit, Porcupine and Rodents were identified as minor crop pests. Damage of Faba bean, Pea, Sorghum, Barley and Wheat were reported more than Lentil and Maize. 134(53.6%) informants reported that the reason for crop damage was increased subsistence agriculture. Guarding, chasing and scarecrow were the practiced mitigation methods to protect their crops. Minimizing crop raiders was the first remedial measures suggested by the 108(43.2%) respondents. Shifting from agriculture to perennial plantation or animal husbandry or guarding day and night were the alternatives suggested remedial measures by respondents. Common fox and Hyaena were the most and Leopard was the least predators responsible for the loss of 590 domestic animals with a potential revenue loss of USD 41,740.00. Practices of active guarding followed by use of dogs or restrain of livestock nearby houses were adopted to protect respondent's livestock. Many respondents had negative attitude towards wild animals around the study area. In conclusion, the study area demands for sustainable and culturally acceptable conservation solutions to mitigate human wildlife conflict.

**Keywords:** Attitude, Crop damage, Human-wildlife conflict, Livestock predation, Local community, Gemshat Forest Area.

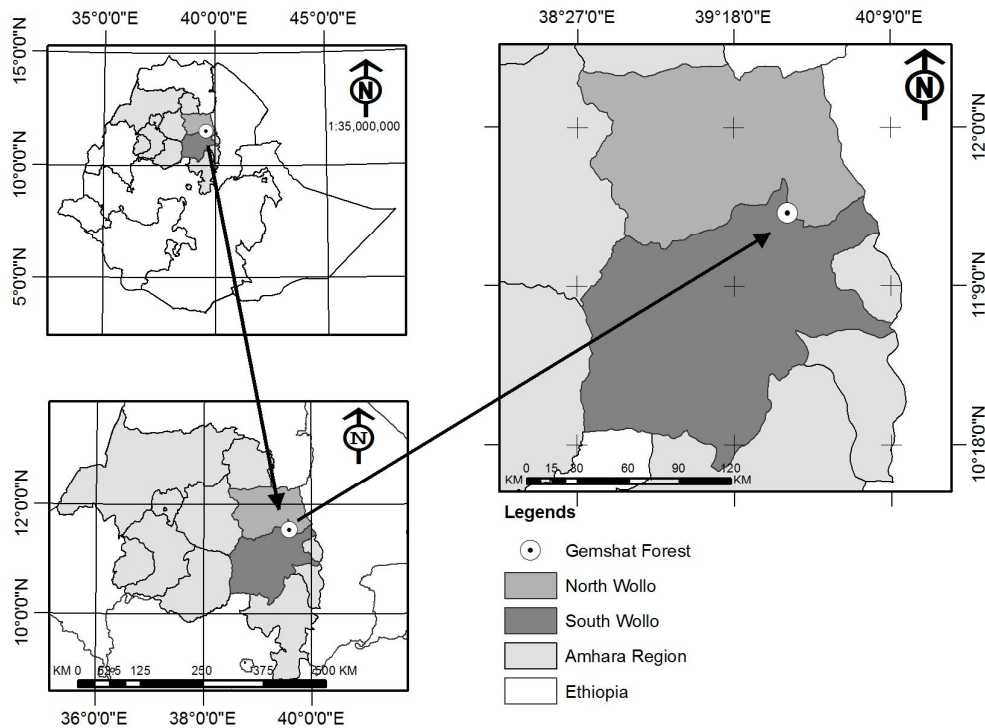
### INTRODUCTION

Human-wildlife conflict is a common phenomenon in both developing and developed countries (Bibi et al., 2013). Most common reasons for such conflicts are competition for resources, trade of wild animals and their products (Sillero-Zubiri & Laurenson, 2001). Explicitly, human-wildlife conflicts becomes apparent when wild animals cause damage to crops, kill livestock and humans and destroy properties (Bibi et al., 2013) and such conflicts are more prevalent along the borderline of the protected area (Karanth et al., 2013). In fact, species involved in conflict are more prone to extinction (Woodroffe & Ginsberg, 1998) and also create a basis for resentment due to undermine welfare of the people through crop damage and livestock predation.

Agricultural practice and holding livestock is an integral part of local economy of most developing

countries around forested areas. The financial loss incurred due to crop raiding and livestock depredation is rarely compensated though the loss due to such incidences can be relatively high in developing countries (Linkie et al., 2007). Such encounter of crop raiding was reported by a wide suite of species like elephants (Nyirenda et al., 2011), wild boar (Linkie et al., 2007), rodents (Singleton et al., 2005) and primates (Oduntan et al., 2012). Reports of livestock depredation by various carnivores is another reason for conflict similar to the crop raiding in different parts of the world which is represented by different carnivorous in various countries (Kolowski & Holekamp, 2006; Kissui, 2008; Dar et al., 2009; Kabir et al., 2014; Bhattarai & Fischera, 2014). Similar to the other countries, conflicts between human and wild animals do exist in Ethiopia. Indeed the reports are very few despite the conflicts are severe in Ethiopia (Yihune et al., 2008, 2009a, b; Gebeyehu & Bekele, 2009; Atickem et al., 2010; Yirga et al., 2011; Mekonnen

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**Fig. 1: Location of Yegof National Forest Priority Area**

et al., 2012; Datiko & Bekele, 2013a, b; Kumssa & Bekele, 2013).

The damage caused by different wild animals in Ethiopia varies from place to place and nature of the conflict depends on the species involved in the type and level of damage. Conflict manifestation in terms of livestock depredation was reported where Spotted hyaena, Leopard and Golden jackal are common (Yirga et al., 2011). Sheep depredation by Ethiopian wolf (Yihune et al., 2008) and crop raiding by Geladas were reported around Simien Mountain National Park (Yihune et al., 2009a). Yihune et al. (2009b) have reported the pronounced problems of Common jackal to the local community and minimal problems from Ethiopian wolf, Leopard, Vervet monkey, Hamadryas baboons and Crested porcupine around Simien Mountain National Park. In Zegie Peninsula area, grivet monkey was reported as major problematic animal (Gebeyehu & Bekele, 2009). As per the pastoral people, Spotted hyaena followed by Leopard were responsible for predominant depredation of livestock in Bale Mountains (Atickem et al., 2010). Recently, crop raiding activity of Bale monkey, endemic to the southern Ethiopian highlands, was reported in the regions of Oromiya and Southern Nations (Mekonnen et al., 2012). The most problematic wild animals that damage crops were Buffalo, Vervet monkey and Warthog (Datiko & Bekele, 2013a) and Hyaena and Leopard were responsible

for livestock predation around Chebera Churchura National Park (Datiko & Bekele, 2013b). However, Warthog was considered as notorious pest in Senkelle Swayne's Hartebeest Sanctuary (Kumssa & Bekele, 2013).

Considering the existence of human-wildlife conflict around different protected areas of the country, it becomes prime conservation priority to reduce human-wildlife conflict where people and wildlife co-occur (Karanth et al., 2012) and create a sustainable coexistence. In fact, knowledge of the underlying human and environmental drivers especially with reserve areas is mandatory for effective mitigation of human-wildlife conflict. So far, no attempt has been made to assess the magnitude of the wildlife conflict with local communities living adjacent to Gemshat Forest Area (GFA). In addition, crop raiding and livestock predation are perceived challenges faced by local communities. From this perspective, it is imperative to assess the human-wildlife conflict that occurs with local communities living adjacent to GFA.

## MATERIALS AND METHODS

### Study area:

The study was conducted in and around GFA which is located in the North eastern Highlands of Ethiopia situated between 11° 32' 26.09" North latitude and 39° 35' 41.05" East longitude. The GFA is found in the Amhara Regional State, at the

boundary between North and South Wollo zones (Fig. 1). It is located at a distance of 471 km away from Addis Ababa towards the north-east direction. There are eight peasant associations namely Ambolamba, Embiswuha, Gatira, Gemshat, Molalie, Sindaemidir, Werkeyo and Zoble. All are found adjacent to the GFA. The residents in and around GFA entirely belongs to the Amhara ethnic group.

**Survey procedure:**

The survey invited a sample of 250 informants and included them from eight villages around GFA after a brief orientation about the purpose of the study. This study was conducted from November 2014 to May 2015 to gather data on local people experiences with human-wildlife conflicts and attitude towards problematic wild animals. Data were collected from respondents using semi-structured interview. Purposive sampling method was used to select informants for this study. The informants were recruited according to inclusion and exclusion criteria (Table 1). This was done by including both male and female who have been experiencing human-wildlife conflicts. Out of 250 informants, 191 (76.4%) men and 59 (23.6%) women were included in this study. Most of the informants were illiterate (58.4%) or had informal education (26.8%) followed by few of them completed up to primary education (14.4%) and secondary school education (12.8%) and above secondary school education (0.004%). Interviews were ensured for voluntary participation with informed consent.

Pre-testing of semi-structured interview was conducted to ensure that all questions were clear and a final version was prepared for the study data collection. The questionnaire included both open ended and fixed response questions. As the incidences of crop raiding and livestock predation by wild animals were noticed from preliminary investigation conducted during October 2014, the focus was made on (i) reporting the opinion of local communities on nature of domestic damage (ii) reason for crop damage and use of crop protection techniques from informant’s point of view and remedial suggestion to prevent the crop loss (iii) type and number of livestock loss due to depredation and people perception on trend of

livestock depredation and (iv) attitude of informants towards problematic wild animals. The financial loss for each respondent from livestock killed by predators was calculated based on the market prices (in Ethiopia Birr) from nearest town which was then converted to US dollars for the different livestock types.

During interview, the interviewer made the informant to step aside to avoid other family member influences on the responses. The correct identification of sighted predators was ensured by showing photographs of different predators to the informants. To characterize the attitude towards crop raiders and livestock predators, the response of likes and dislikes were categorized into positive (response of approving words), negative (response of derogatory words) and neutral.

**Data Analysis:**

All the collected data were analyzed using Statistical Analysis System (SAS) version 9.2. Descriptive statistics and chi-square test were used to analyze the data. p value for all tests was set at  $p \leq 0.05$ . Summary of statistical interpretation and percentage values are presented in Tables and Figures.

**Ethical considerations:**

The study was conducted after getting the ethical clearance from Institutional Review Board, Wollo University, Dessie, Ethiopia. Written consent was obtained from each study subject. Participants were informed the objectives of the study and their right to refuse filling the questionnaire at any time they want. Participants were informed that their answers would remain anonymous and confidential.

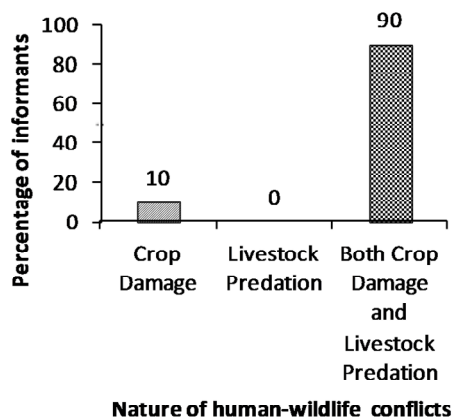
**RESULTS**

**Nature of the conflicts:**

As the practice of both crop farming and livestock rearing was common for residents livelihood around study area, 225(90%) respondents reported the conflict happened due to both crop damage and livestock depredation which was significant ( $\chi^2 = 160.00$ ,  $df= 1$ ,  $p \leq 0.05$ ) when compared with the crop damage alone. No incidence was reported on livestock predation alone (Fig. 2).

**Table 1: Inclusion and exclusion criteria**

<b>Inclusion criteria</b>		<b>Exclusion criteria</b>	
i.	The participant who own permanent resident adjacent to GFA.	i.	The participant who was guest or visitor or tourist to GFA.
ii.	The participant who has faced or being faced conflict of wild animals around GFA	ii.	The participants age less than or equal to 18 years old
iii.	The participants who were voluntary and agreed for providing the informed consent form.	iii.	The participants who were not willing to participate voluntarily and did not agree for providing the informed consent form.



**Fig. 2: Nature of conflicts around Gemshat Forest Area**

#### Conflict due to crop raiding:

In the study area, 207(82.8%), 193(77.2%) and 175(70.0%) informants identified Grivet monkey, Geladas and Guinea fowl as common crop raiders, respectively. The proportion of respondents experienced the crop damage adjacent to the forest boundaries was significant in Grivet monkey ( $\chi^2 = 107.58$ ,  $df= 1$ ,  $p \leq 0.05$ ), Geladas ( $\chi^2 = 73.98$ ,  $df= 1$ ,  $p \leq 0.05$ ) and Guinea fowl ( $\chi^2 = 40.00$ ,  $df= 1$ ,  $p \leq 0.05$ ). However, rabbit, porcupine and rodents were identified by some of the informants as less problematic crop pests (Table 2). The important crops in the study area like Faba bean, Pea, Sorghum, Barley and Wheat were damaged more frequently by wild animals. The number of informants reported for damage was significant in Faba bean ( $\chi^2 = 65.53$ ,  $df= 1$ ,  $p \leq 0.05$ ), Pea ( $\chi^2 = 26.89$ ,  $df= 1$ ,  $p \leq 0.05$ ), Sorghum ( $\chi^2 = 12.54$ ,  $df= 1$ ,  $p \leq 0.05$ ), Barley ( $\chi^2 = 10.00$ ,  $df= 1$ ,  $p \leq 0.05$ ) and Wheat ( $\chi^2 = 9.21$ ,  $df= 1$ ,  $p \leq 0.05$ ). Lentil and Maize were the next most commonly raided crops according to the informants. However, potato was damaged occasionally as they cultivate them rarely (Table 2). 134(53.6%) informants thought that the main reason for crop damage was due to increased subsistence agriculture followed by both increasing population of crop raiders as well as increased subsistence agriculture. Some of them, however, perceived that shortage of natural food/attraction of staple food as an alternative reason for crop damage (Table 3). The respondents quotient for reason to crop damage was significant ( $\chi^2 = 266.48$ ,  $df= 4$ ,  $p \leq 0.05$ ). Among different mitigation strategies used for crop protection, 232(92.8%) informants preferred to do all the activity like guarding, chasing and planting scarecrow to protect their crops from damage. In addition to this, few of them practiced controlling with dogs to protect the crops (Table 3). The choice of different mitigation strategies among informants was significant ( $\chi^2 = 829.08$ ,  $df= 4$ ,  $p \leq$

0.05). 108(43.2%) informants suggested means of minimizing crop raiders is either through displacing them to other areas or removing them completely. 48(19.2%) and 37(14.8%) respondents adopted some of the remedial measures like shifting from agriculture to either perennial plantation or animal husbandry practices, respectively. However, 43(17.2%) respondents practice guarding day and night as remedial measures to prevent their crop loss (Table 3). The opinion of remedial suggestion to prevent the crop loss was significantly different ( $\chi^2 = 97.64$ ,  $df= 4$ ,  $p \leq 0.05$ ) among informants.

#### Conflict due to livestock depredation:

More than half of the respondents experienced this conflict from Common fox and Hyaena. However, incidence of livestock predation by Leopard was reported by 96(38.4%) respondents. The proportion of respondents' that experienced the livestock predation was not significant in Common fox ( $\chi^2 = 3.60$ ,  $df= 1$ ,  $p > 0.05$ ) and Hyaena ( $\chi^2 = 0.40$ ,  $df= 1$ ,  $p > 0.05$ ). In the study area, a total of 590 domestic animals (574 sheep and goat, 01 cattle and 15 pack animals) were lost due to predation with estimated revenue loss of USD 41,740.00 (Table 4). Among different mitigation strategies used for livestock protection, many of the informants believed that active guarding help them to protect their livestock from predators. In addition to this, few of them used dogs and keeping domestic animals near to their house as alternative techniques to protect the livestock. Some of them did not provide any response (Table 4). The choice of mitigation strategies among informants was significantly different ( $\chi^2 = 188.43$ ,  $df= 3$ ,  $p \leq 0.05$ ). Among informants, 216(86.4%) perceived increased trend of livestock depredation and the proportion of respondents opinion on trend of livestock depredation was significant ( $\chi^2 = 320.26$ ,  $df= 2$ ,  $p \leq 0.05$ ).

#### Attitude towards problematic wild animals:

Of all the informants, 244(97.6%) had negative attitude and 6(2.4%) were neutral for crop raiders. Similarly, 212(84.8%) of the respondents were negative to livestock depredators and 35(14.0%) were neutral while 3(1.2%) were positive. The proportion of respondents attitude was significant for both crop raiders ( $\chi^2 = 226.57$ ,  $df= 1$ ,  $p \leq 0.05$ ) and livestock predators ( $\chi^2 = 304.13$ ,  $df= 2$ ,  $p \leq 0.05$ ).

#### DISCUSSION

Incidents of wildlife damage, loss of crops and livestock and even injury or death of local people, occasionally, are quite obvious with human settlements around protected areas (Studsrod & Wegge, 1995; Sillero-Zuberi et al., 2007; Karanth et al., 2013).

**Table 2: Response of informants on human-wildlife conflicts with reference to crop raider and crop damage**

Attribute	Response	Villages								Overall (n=250)	
		Ambolamba (n = 30)	Embiswuha (n = 29)	Gemshat (n = 32)	Gatira (n= 33)	Molalie (n = 32)	Sindeamdir (n = 33)	Werekyo (n = 31)	Zoble (n= 30)		
Major Crop raider	Grivet monkey	Yes	30 (100)	26 (89.7)	23 (71.9)	33 (100)	20 (62.5)	16 (48.5)	31 (100)	28 (93.3)	207 (82.8)
		No	00 (00.0)	03 (10.3)	09 (28.1)	00 (00.0)	12 (37.5)	17 (51.5)	00 (00.0)	02 (06.7)	43 (17.2)
	Geladas	Yes	28 (93.3)	13 (44.8)	22 (68.8)	25 (75.8)	30 (93.8)	33 (100)	12 (38.7)	30 (100)	193 (77.2)
		No	2 (06.7)	16 (55.2)	10 (31.3)	08 (24.2)	02 (06.3)	00 (00.0)	19 (61.3)	00 (00.0)	57 (22.8)
Guinea Fowl	Yes	26 (86.7)	18 (62.0)	00 (00.0)	30 (90.9)	16 (50.0)	30 (90.9)	28 (90.3)	27 (90.0)	175 (70.0)	
	No	04 (13.3)	11(37.9)	32 (100)	03 (09.1)	16 (50.0)	03 (09.1)	03 (09.7)	03 (10.0)	75 (30.0)	
Minor Crop raider	Rabbit	Yes	05 (16.7)	06 (20.7)	00 (00.0)	09 (27.3)	26 (81.3)	06 (18.2)	20 (64.5)	07 (23.3)	79 (31.6)
		No	25 (83.3)	23 (79.3)	32 (100)	24 (72.7)	06 (18.8)	27 (81.8)	11 (35.5)	23 (76.7)	171 (68.4)
	Porcupine	Yes	11 (36.7)	02 (06.9)	00 (00.0)	02 (06.1)	00 (00.0)	07 (21.2)	03 (09.7)	07 (23.3)	32 (12.8)
		No	19 (63.3)	27 (93.1)	32 (100)	31 (93.9)	32 (100)	26 (78.8)	28 (90.3)	23 (76.7)	218 (87.2)
	Rodents	Yes	00 (00.0)	01 (03.4)	01 (03.1)	03 (09.1)	00 (00.0)	00 (00.0)	09 (29.0)	07 (23.3)	21 (8.4)
		No	30 (100)	28 (96.6)	31 (96.9)	30 (90.9)	32 (100)	33 (100)	22 (70.9)	23 (76.7)	229 (91.6)
Name of the crop damaged by crop raider	Faba Beans	Yes	30 (100)	13 (44.8)	11 (34.4)	33 (100)	17 (53.1)	26 (78.8)	29 (93.5)	30 (100)	189 (75.6)
		No	00 (00.0)	16 (55.1)	21 (65.6)	00 (00.0)	15 (46.9)	07 (21.2)	02 (06.5)	00 (00.0)	61 (24.4)
	Pea	Yes	29 (96.7)	10 (34.5)	07 (21.9)	33 (100)	00 (00.0)	29 (87.9)	28 (90.3)	30 (100)	166 (66.4)
		No	01 (03.3)	19 (65.5)	25 (78.1)	00 (00.0)	32 (100)	04 (12.1)	03 (09.7)	00 (00.0)	84 (33.6)
	Sorghum	Yes	28 (93.3)	18 (62.1)	16 (50.0)	32 (96.9)	06 (18.8)	16 (48.5)	31 (100)	06 (20.0)	153 (61.2)
		No	02 (06.7)	11 (37.9)	16 (50.0)	01 (03.0)	26 (81.3)	17 (51.5)	00 (00.0)	24 (80.0)	97 (38.8)
	Barley	Yes	00 (00.0)	27 (93.1)	29 (90.6)	00 (00.0)	31 (96.8)	33 (100)	00 (00.0)	30 (100)	150 (60.0)
		No	30 (100)	02 (06.9)	03 (09.3)	33 (100)	01 (03.1)	00 (00.0)	31 (100)	00 (00.0)	100 (40.0)
	Wheat	Yes	00 (00)	28 (96.6)	28 (87.5)	00 (00.0)	31 (96.9)	32 (96.9)	00 (00.0)	30 (100)	149 (59.6)
		No	30 (100)	01 (03.4)	04 (12.5)	33 (100)	01 (03.1)	01 (03.0)	31 (100)	00 (00.0)	101 (40.4)
	Lentil	Yes	00 (00)	10 (34.5)	00 (00.0)	00 (00.0)	32 (100)	26 (78.8)	00 (00.0)	30 (100)	98 (39.2)
		No	30 (100)	19 (65.5)	32 (100)	33 (100)	00 (00.0)	07 (21.2)	31 (100)	00 (00.0)	152 (60.8)
	Maize	Yes	29 (96.7)	01 (03.4)	00 (00.0)	33 (100)	00 (00.0)	00 (00.0)	31 (100)	00 (00.0)	94 (37.6)
		No	01 (03.3)	28 (96.6)	32 (100)	00 (00.0)	32 (100)	33 (100)	00 (00.0)	30 (100)	156 (62.4)
	Potato	Yes	00 (00.0)	00 (00.0)	00 (00.0)	00 (00.0)	00 (00.0)	00 (00.0)	04 (12.9)	01 (03.3)	05 (02.0)
		No	30 (100)	29 (100)	32 (100)	33 (100)	32 (100)	33 (100)	27 (87.1)	29 (96.7)	245 (98.0)

n = Number of informants; Percentage values are presented in parentheses

**Table 3: Response of informants on human-wildlife conflicts with reference to reason for crop damage, techniques used for crop protection and remedial suggestion to prevent crop loss**

Attribute	Response	Villages								Overall (n=250)
		Ambolamba (n = 30)	Embiswuha (n = 29)	Gemshat (n = 32)	Gatira (n= 33)	Molalie (n = 32)	Sindeamdir (n = 33)	Werekyo (n = 31)	Zoble (n= 30)	
Reason for the crop damage by Crop raider	Increased crop raider population	01 (03.3)	01 (03.4)	03 (09.4)	00 (00.0)	00 (00.0)	00 (00.0)	00 (00.0)	02 (06.7)	07 (02.8)
	Increased subsistence agriculture	17 (56.7)	15 (51.7)	08 (25.0)	15 (45.5)	24 (75.0)	17 (51.5)	20 (64.5)	18 (60.0)	134 (53.6)
	Increased crop raider population and subsistence agriculture	10 (33.3)	13 (44.8)	21 (65.6)	10 (30.3)	08 (25.0)	12 (36.4)	06 (19.4)	07 (23.3)	87 (34.8)
	Lack of natural food/ Attraction of staple food	00 (00.0)	00 (00.0)	00 (00.0)	07 (21.2)	00 (00.0)	00 (00.0)	03 (09.7)	03 (10.0)	13 (05.2)
	Unknown	02 (06.7)	00 (00.0)	00 (00.0)	01 (03.0)	00 (00.0)	04 (12.1)	02 (06.5)	00 (00.0)	09 (03.6)
Mitigation strategies used for crop protection	Guarding	00 (00.0)	00 (00.0)	00 (00.0)	00 (00.0)	05 (15.6)	00 (00.0)	03 (09.7)	02 (06.7)	10 (04.0)
	Chasing	00 (00.0)	00 (00.0)	00 (00.0)	00 (00.0)	00 (00.0)	00 (00.0)	01 (03.2)	00 (00.0)	01 (00.4)
	Scarecrow	00 (00.0)	00 (00.0)	00 (00.0)	00 (00.0)	01 (03.1)	00 (00.0)	00 (00.0)	01 (03.3)	02 (00.8)
	Guarding, Chasing and Scarecrow	30 (100)	29 (100)	32 (100)	33 (100)	26 (81.3)	33 (100)	22 (70.9)	27 (90.0)	232 (92.8)
	Using dogs	00 (00.0)	00 (00.0)	00 (00.0)	00 (00.0)	00 (00.0)	00 (00.0)	05 (16.1)	00 (00.0)	05 (02.0)
Remedial measures to prevent the crop loss	No response/ Do not know	03 (10.0)	00 (00.0)	01 (03.1)	00 (00.0)	01 (03.1)	04 (12.1)	00 (00.0)	05 (16.7)	14 (05.6)
	Minimize crop raiders	11 (36.7)	25 (86.2)	30 (93.7)	15 (45.5)	12 (37.5)	06 (18.2)	09 (29.0)	00 (00.0)	108 (43.2)
	Guarding day and night	09 (30.0)	00 (00.0)	00 (00.0)	01 (03.0)	18 (56.2)	08 (24.2)	05 (16.1)	02 (06.7)	43 (17.2)
	Shifting from agriculture to perennial plantation	05 (16.7)	03 (10.3)	00 (00.0)	05 (15.2)	01 (03.1)	04 (12.1)	11 (35.5)	19 (63.3)	48 (19.2)
	Shifting to animal husbandry	02 (06.7)	01 (03.4)	01 (03.1)	12 (36.4)	00 (00.0)	11 (33.3)	06 (19.4)	04 (13.3)	37 (14.8)

n = Number of informants; Percentage values are presented in parentheses

Table 4: Response of informants on human-wildlife conflicts with reference to livestock predation.

Attribute	Response	Villages								Overall (n=250)	
		Ambolamba (n = 30)	Embiswuha (n = 29)	Gemshat (n = 32)	Gatira (n= 33)	Molalie (n = 32)	Sindeamdir (n = 33)	Werekyo (n = 31)	Zoble (n= 30)		
Name of the predator	Common fox	Yes	10 (33.3)	24 (82.8)	20 (62.5)	32 (96.9)	09 (28.1)	08 (24.2)	28 (90.3)	09 (30.0)	140 (56.0)
		No	20 (66.7)	05 (17.2)	12 (37.5)	01 (3.0)	23 (71.9)	25 (75.8)	03 (09.7)	21 (70.0)	110 (44.0)
	Hyaena	Yes	10 (33.3)	16 (55.1)	01 (03.1)	33 (100)	10 (31.3)	19 (57.6)	28 (90.3)	13 (43.3)	130 (52.0)
		No	20 (66.7)	13 (44.8)	31 (96.9)	00 (00.0)	22 (68.8)	14 (42.4)	3 (09.7)	17 (56.7)	120 (48.0)
	Leopard	Yes	06 (20.0)	17 (58.6)	21 (65.6)	00 (00.0)	17 (53.1)	17 (51.5)	2 (06.5)	16 (53.3)	96 (38.4)
		No	24 (80.0)	12 (41.4)	11 (34.4)	33 (100)	15 (46.9)	16 (48.5)	29 (93.5)	14 (46.7)	154 (61.6)
Number of Livestock loss per year	Cattle	00	00	00	00	01	00	00	00	01	
	Sheep/Goat	43	94	67	104	48	68	81	69	574	
	Pack animal	00	06	00	00	02	03	01	03	15	
Cost of livestock loss per year (USD)	Cattle	00	00	00	00	285	00	00	00	285	
	Sheep/Goat	3010	6580	4690	7280	3360	4760	5670	4830	40180	
	Pack animal	0	510	0	0	170	255	85	255	1275	
Techniques used for livestock protection	No response	01 (03.3)	23 (79.3)	10 (31.3)	02 (06.1)	01 (03.1)	00 (00.0)	02 (06.5)	00 (00.0)	39 (15.6)	
	Active guarding	20 (66.7)	05 (17.2)	22 (68.8)	18 (54.5)	27 (84.4)	22 (66.7)	13 (41.9)	28 (93.3)	155 (62.0)	
	Keeping dogs	03 (10.0)	01 (03.5)	00 (00.0)	05 (15.1)	01 (03.1)	00 (00.0)	05 (16.1)	01 (03.3)	16 (06.4)	
	Limiting domestic animals near house	06 (20.0)	00 (00.0)	00 (00.0)	08 (24.2)	03 (09.4)	11 (33.3)	11 (35.5)	01 (03.3)	40 (16.0)	
Trend of livestock predation	Increased	21 (70.0)	25 (86.2)	31 (96.9)	33 (100)	26 (81.3)	27 (81.8)	27 (87.1)	26 (86.7)	216 (86.4)	
	Decreased	01 (03.3)	03 (10.3)	00 (00.0)	00 (00.0)	00 (00.0)	00 (00.0)	01 (03.2)	00 (00.0)	05 (02.0)	
	Unknown	08 (26.7)	01 (03.4)	01 (03.1)	00 (00.0)	06 (18.8)	06 (18.2)	03 (09.7)	04 (13.3)	29 (11.6)	

n = Number of informants; Percentage values are presented in parentheses; 1USD = 20.00 ETB (Price of February, 2015)

GFA which supports a different array of wildlife are prone to conflict with people. In the present study, informants reported the conflicts with wildlife due to crop raiding and livestock depredation were significant as many of them practice both crop production as well as livestock rearing for their subsistence. The reason for such incidences nearby GFA could be wild animals moving outside the forest area or people approach to the natural resources for their domestic needs. Similar reasons for human-wildlife conflict were identified around protected areas (Woodroffe & Ginsberg, 1998; Ogra, 2008).

Most often, herbivores particularly Grivet monkey, Geladas and Guinea fowl were asserted crop pest by residents around GFA. Similarly, the most frequently identified and reported crop pests are primates in different African countries such as Uganda (Naughton-Treves et al., 1998), Zambia (Nyirenda et al., 2011) and Ethiopia (Yihune et al., 2009a; Gebeyehu & Bekele, 2009; Mekonnen et al., 2012; Datiko & Bekele, 2013a; Kumssa & Bekele, 2013; Mohammed et al., 2017; Goudar et al., 2017). The most important descriptive factor for such crop loss is proximity to forest edges or probable surrogates (Studsrod & Wegge, 1995; Linkie et al., 2007). Shortage of forest based food or being opportunistic (Naughton-Treves et al., 1998) probably be the other factors. Despite that, attraction of primates due to palatable crops growing around reserve area (Datiko & Bekele, 2013a) cannot be discounted either. Some of the informants reported the same reason. According to Datiko & Bekele (2013a) particular food like Maize, Teff and Sorghum attract crop raiders around Chebera Churchura National Park in Ethiopia. The informants of the present study also confirmed similar situation adjacent to GFA in which Faba beans, Pea, Sorghum, Barley and Wheat were highly preferred by primates as these crops were growing more often in the study area. As per the respondents, the reason for crop damage was increased subsistence agriculture followed by both increased subsistence agriculture as well as increased primate populations. Similarly, it was reported that the reason for crop damage in Namibia was due to the larger wildlife populations (Jones & Elliott, 2006). In India, increased population density and range were the other reason for crop damage (Studsrod & Wegge, 1995; Engeman et al., 2010). The present study revealed that guarding, chasing and planting scarecrow were most effective for crop protection. The most common practice to protect the crops across the agriculture-wildlife interface was reported to be guarding (Hockings et al., 2009; Datiko & Bekele, 2013a). Apart from using traditional techniques to protect their crops, most of the informants suggested to reduce the population of crop raiders either through translocation to other area or remove

them completely. However, removal of problematic troop of primates potentially creates an empty range which invites another troop to occupy that empty range (Lamarque et al., 2009). Hence, the conflict situation in the study area demands for better management practices.

In addition to the occurrence of crop damage, livestock depredation by wildlife predators is another kind of human-wildlife conflict in different parts of the world which are more common around protected areas. According to USAID (2013), Leopard and Hyaena are the main livestock predators in Ethiopia. It is also evident from the research papers (Atickem et al., 2010; Yirga et al., 2011; Datiko & Bekele, 2013b) that the damage caused by different wild animals varies from place to place in Ethiopia and nature of the damage depends on the species involved in the type and level of damage. In the present study, Common fox was predominant livestock predator followed by Hyaena and Leopard. Livestock are inherently vulnerable to depredation due to their reduced anti-predatory skills (Jackson, 2012). Considering the fact that variety of domestic prey available to the predators, medium sized livestock like goats and sheep are most vulnerable than cattle and pack animals to predation since medium sized can be killed and heave to a safer place easier (Dar et al., 2009; Bibi et al., 2013). Indeed, collective counts as reported by informants, a total of 590 domestic animals were killed with an estimated revenue loss of USD 41,740.00 from 250 informants. Similarly, in Chebera Churchura National Park, out of 997 domestic animals depredation, around 200 animals (sheep, goat and cattle) were killed by Leopard and Hyaena in three years, in which 75.5% of animals were killed by Leopard (Datiko & Bekele, 2013b). However, in Bale Mountain National Park, out of 704 domestic animals depredation, 57% and 18% of the animals were killed by Spotted hyaena and Leopard, respectively (Atickem et al., 2010). These incidences account more economic loss than the present study. This regional variation in livestock predation by different wild predators could be attributed to differences in densities of carnivores, husbandry practices, or relative abundance of different stock species (Kolowski & Holekamp, 2006). Most of the informants reported the increased trend of livestock predation in recent past. This increased trend may be influenced by either push factors such as reduction of natural prey/food (Lamarque et al., 2009) or pull factors like reduced anti-predatory skills of livestock (Jackson, 2012).

It is known fact that wild animals, especially, carnivores commonly generate negative attitudes among rural residents in many regions of the world where they prey upon domestic animals (Oli et al., 1994) which is also true in the present study area.



Similar findings have been reported in many other countries such as India and Pakistan (Oli et al., 1994; Dar et al., 2009) and even in Ethiopia (Gebeyehu & Bekele, 2009; Kumssa & Bekele, 2013).

In conclusion, it is evident from the result that the human wild animals conflict in the current study area was due to crop raiding and livestock depredation. Consequently, the result also implies that most of the local communities had negative attitude towards wildlife. Therefore giving attention is mandatory to resolve such kind of conflicts. Since the alleviation of conflict is like a two sided equation, the sustainable and culturally acceptable conservation solutions are necessary to find a balance between conservation priorities and the needs of people who live adjacent to wildlife which enables coexistence and sharing of resources at same level.

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