

1 **ASSESSMENT OF HUMAN-WILDLIFE CONFLICT IN AND AROUND**
2 **GEMSHAT FOREST AREA, WOLLO, AMAHRA REGION, ETHIOPIA**

3 Hailemariam Alemu, Krishnagouda Shankargouda Goudar* and Hussein Ibrahim

4 Department of Biology, College of Natural Sciences, Wollo University, Dessie, Ethiopia

5 *Corresponding Author. E-mail: kgoudar@wu.edu.et; Phone: +251924230052

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%) of 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 alternative 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 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

30

31 Human-wildlife conflict is a common phenomenon in both developing and developed
32 countries (Bibi et al., 2013). Most common reasons for such conflicts are competition for
33 resources, trade of wild animals and their products. (Sillero-Zubiri & Laurenson, 2001).
34 Explicitly, human-wildlife conflicts becomes apparent when wild animals cause damage to
35 crops, kill livestock and humans and destroy properties (Bibi et al., 2013) and such
36 conflicts are more prevalent along the borderline of the protected area (Karanth et al.,
37 2013). In fact, species involved in conflict are more prone to extinction (Woodroffe &
38 Ginsberg, 1998) and also create a basis for resentment due to undermine welfare of the
39 people through crop damage and livestock predation.

40 Agricultural practice and holding livestock is an integral part of local economy of most
41 developing countries around forested areas. The financial loss incurred due to crop raiding
42 and livestock depredation is rarely compensated though the loss due to such incidences
43 can be relatively high in developing countries (Linkie et al., 2007). Such encounter of crop
44 raiding was reported by a wide suite of species like elephants (Nyirenda et al., 2011), wild
45 boar (Linkie et al., 2007), rodents (Singleton et al., 2005) and primates (Oduntan et al.,
46 2012). Reports of livestock depredation by various carnivores is an another reason for
47 conflict similar to the crop raiding in different parts of the world which is represented by
48 different carnivorous in various countries (Kolowski & Holekamp, 2006; Kissui, 2008;
49 Dar et al., 2009; Kabir et al., 2014; Bhattarai & Fischera, 2014). Similar to the other
50 countries, conflicts between human and wild animals do exist in Ethiopia. Indeed the
51 reports are very few despite the conflicts are severe in Ethiopia (Yihune et al., 2008,
52 2009a, b; Gebeyehu & Bekele, 2009; Atickem et al., 2010; Yirga et al., 2011; Mekonnen
53 et al., 2012; Datiko & Bekele, 2013a, b; Kumssa & Bekele, 2013).

54 The damage caused by different wild animals in Ethiopia varies from place to place and
55 nature of the conflict depends on the species involved in the type and level of damage.
56 Conflict manifestation in terms of livestock depredation was reported where Spotted
57 hyaena, Leopard and Golden jackal are common (Yirga et al., 2011). Sheep depredation
58 by Ethiopian wolf (Yihune et al., 2008) and crop raiding by Geladas were reported around
59 Simien Mountain National Park (Yihune et al., 2009a). Yihune et al. (2009b) have
60 reported the pronounced problems of Common jackal to the local community and minimal
61 problems from Ethiopian wolf, Leopard, Vervet monkey, Hamadryas baboons and Crested
62 porcupine around Simien Mountain National Park. In Zegie Peninsula area, grivet monkey

63 was reported as major problematic animal (Gebeyehu & Bekele, 2009). As per the pastoral
64 people, Spotted hyaena followed by Leopard were responsible for predominant predation
65 of livestock in Bale Mountains (Atickem et al., 2010). Recently, crop raiding activity of
66 Bale monkey, endemic to the southern Ethiopian highlands, was reported in the regions of
67 Oromiya and Southern Nations (Mekonnen et al., 2012). The most problematic wild
68 animals that damage crops were Buffalo, Vervet monkey and Warthog (Datiko & Bekele,
69 2013a) and Hyaena and Leopard were responsible for livestock predation around Chebera
70 Churachura National Park (Datiko & Bekele, 2013b). However, Warthog was considered
71 as notorious pest in Senkelle Swayne's Hartebeest Sanctuary (Kumssa & Bekele, 2013).

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

82 MATERIALS AND METHODS

83 Study area:

84 The study was conducted in and around GFA which is located in the North eastern
85 Highlands of Ethiopia situated between 11° 32' 26.09" North latitude and 39° 35' 41.05"
86 East longitude. The GFA is found in the Amhara Regional State, at the boundary between
87 North and South Wollo zones (Fig. 1). It is located at a distance of 471 km away from the
88 Addis Ababa towards the north-east direction. There are eight peasant associations namely
89 Ambolamba, Embiswuha, Gatira, Gemshat, Molalie, Sindaemidir, Werkeyo and Zoble.
90 All are found adjacent to the GFA. The residents in and around GFA entirely belongs to
91 the Amhara ethnic group.

92 Survey procedure:

93 The survey invited a sample of 250 informants and included them from eight villages
94 around GFA after a brief orientation about the purpose of the study. This study was
95 conducted from November 2014 to May 2015 to gather data on local people experiences

96 with human-wildlife conflicts and attitude towards problematic wild animals. Data were
97 collected from respondents using semi-structured interview. Purposive sampling method
98 was used to select informants for this study. The informants were recruited according to
99 inclusion and exclusion criteria (Table 1). This was done by including both male and
100 female who have been experiencing human-wildlife conflicts. Out of 250 informants, 191
101 (76.4%) men and 59 (23.6%) women were included in this study. Most of the informants
102 were illiterate (58.4%) or had informal education (26.8%) followed by few of them
103 completed up to primary education (14.4%) and secondary school education (12.8%) and
104 above secondary school education (0.004%). Interviews were ensured for voluntary
105 participation with informed consent.

106 Pre-testing of semi-structured interview was conducted to ensure that all questions were
107 clear and a final version was prepared for the study data collection. The questionnaire
108 included both open ended and fixed response questions. As the incidences of crop raiding
109 and livestock predation by wild animals were noticed from preliminary investigation
110 conducted during October 2014, the focus was made on (i) reporting the opinion of local
111 communities on nature of domestic damage (ii) reason for crop damage and use of crop
112 protection techniques from informant's point of view and remedial suggestion to prevent
113 the crop loss (iii) type and number of livestock loss due to depredation and people
114 perception on trend of livestock depredation and (iv) attitude of informants towards
115 problematic wild animals. The financial loss for each respondent from livestock killed by
116 predators was calculated based on the market prices (Ethiopia Birr) from nearest town
117 which was then converted to US dollars for the different livestock types.

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

124 **Data analysis:**

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

129 **Ethical considerations:**

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

135

RESULTS

136 **Nature of the conflicts:**

137 As the practice of both crop farming and livestock rearing was common for residents
138 livelihood around study area, 225(90%) respondents reported the conflict happened due to
139 both crop damage and livestock depredation which was significant ($\chi^2 = 160.00$, $df = 1$, p
140 0.05) when compared with the crop damage alone. No incidence was reported on
141 livestock predation alone (Fig. 2).

142 **Conflict due to crop raiding:**

143 In the study area, 207(82.8%), 193(77.2%) and 175(70.0%) informants identified Grivet
144 monkey, Geladas and Guinea fowl as common crop raiders, respectively. The proportion
145 of respondents experienced the crop damage adjacent to the forest boundaries was
146 significant in Grivet monkey ($\chi^2 = 107.58$, $df = 1$, $p < 0.05$), Geladas ($\chi^2 = 73.98$, $df = 1$, p
147 0.05) and Guinea fowl ($\chi^2 = 40.00$, $df = 1$, $p < 0.05$). However, rabbit, porcupine and
148 rodents were identified by some of the informants as less problematic crop pests (Table 2).
149 The important crops in the study area like Faba bean, Pea, Sorghum, Barley and Wheat
150 were damaged more frequently by wild animals. The number of informants reported for
151 damage was significant in Faba bean ($\chi^2 = 65.53$, $df = 1$, $p < 0.05$), Pea ($\chi^2 = 26.89$, $df = 1$,
152 $p < 0.05$), Sorghum ($\chi^2 = 12.54$, $df = 1$, $p < 0.05$), Barley ($\chi^2 = 10.00$, $df = 1$, $p < 0.05$) and
153 Wheat ($\chi^2 = 9.21$, $df = 1$, $p < 0.05$). Lentil and Maize were the next most commonly raided
154 crops according to the informants. However, potato was damaged occasionally as they
155 cultivate them rarely (Table 2). 134(53.6%) informants thought that the main reason for
156 crop damage was due to increased subsistence agriculture followed by both increasing
157 population of crop raiders as well as increased subsistence agriculture. Some of them,
158 however, perceived that shortage of natural food/attraction of staple food as an alternative
159 reason for crop damage (Table 3). The respondents quotient for reason to crop damage
160 was significant ($\chi^2 = 266.48$, $df = 4$, $p < 0.05$). Among different mitigation strategies used
161 for crop protection, 232(92.8%) informants preferred to do all the activity like guarding,

162 chasing and planting scarecrow to protect their crops from damage. In addition to this, few
163 of them practiced controlling with dogs to protect the crops (Table 3). The choice of
164 different mitigation strategies among informants was significant ($\chi^2 = 829.08$, $df = 4$, p
165 0.05). 108(43.2%) informants suggested means of minimizing crop raiders is either
166 through displacing them to other areas or removing them completely. 48(19.2%) and
167 37(14.8%) respondents adopted some of the remedial measures like shifting from
168 agriculture to either perennial plantation or animal husbandry practices, respectively.
169 However, 43(17.2%) respondents practice guarding day and night as remedial measures to
170 prevent their crop loss (Table 3). The opinion of remedial suggestion to prevent the crop
171 loss was significantly different ($\chi^2 = 97.64$, $df = 4$, $p = 0.05$) among informants.

172 **Conflict due to livestock depredation:**

173 More than half of the respondents experienced this conflict from Common fox and
174 Hyaena. However, incidence of livestock predation by Leopard was reported by
175 96(38.4%) respondents. The proportion of respondents' that experienced the livestock
176 predation was not significant in Common fox ($\chi^2 = 3.60$, $df = 1$, $p > 0.05$) and Hyaena (χ^2
177 $= 0.40$, $df = 1$, $p > 0.05$). In the study area, a total of 590 domestic animals (574 sheep and
178 goat, 01 cattle and 15 pack animals) were lost due to predation with estimated revenue loss
179 of USD 41,740.00 (Table 4). Among different mitigation strategies used for livestock
180 protection, many of the informants believed that active guarding help them to protect their
181 livestock from predators. In addition to this, few of them used dogs and keeping domestic
182 animals near to their house as alternative techniques to protect the livestock. Some of them
183 did not provide any response (Table 4). The choice of mitigation strategies among
184 informants was significantly different ($\chi^2 = 188.43$, $df = 3$, $p = 0.05$). Among informants,
185 216(86.4%) perceived increased trend of livestock depredation and the proportion of
186 respondents opinion on trend of livestock depredation was significant ($\chi^2 = 320.26$, $df = 2$,
187 $p = 0.05$).

188 **Attitude towards problematic wild animals:**

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

194 **DISCUSSION**

195 Incidents of wildlife damage, loss of crops and livestock and even injury or death of local
196 people, occasionally are quite obvious with human settlements around protected areas
197 (Studsrød & Wegge, 1995; Sillero-Zuberi et al., 2007; Karanth et al., 2013). GFA which
198 supports a different array of wildlife are prone to conflict with people. In the present study,
199 informants reported the conflicts with wildlife due to crop raiding and livestock
200 depredation were significant as many of them practice both crop production as well as
201 livestock rearing for their subsistence. The reason for such incidences nearby GFA could
202 be wild animals moving outside the forest area or people approach to the natural resources
203 for their domestic needs. Similar reasons for human-wildlife conflict were identified
204 around protected areas (Woodroffe & Ginsberg, 1998; Ogra, 2008).

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

228 reported to be guarding (Hockings et al., 2009; Datiko & Bekele, 2013a). Apart from
229 using traditional techniques to protect their crops, most of the informants suggested to
230 reduce the population of crop raiders either through translocation to other area or remove
231 them completely. However, removal of problematic troop of primates potentially creates
232 an empty range which invites another troop to occupy that empty range (Lamarque et al.,
233 2009). Hence, the conflict situation in the study area demands for better management
234 practices.

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

260 such as reduction of natural prey/food (Lamarque et al., 2009) or pull factors like reduced
261 anti-predatory skills of livestock (Jackson, 2012).

262 It is known fact that wild animals, especially, carnivores commonly generate negative
263 attitudes among rural residents in many regions of the world where they prey upon
264 domestic animals (Oli et al., 1994) which is also true in the present study area. Similar
265 findings have been reported in many other countries such as India and Pakistan (Oli et al.,
266 1994; Dar et al., 2009) and even in Ethiopia (Gebeyehu & Bekele, 2009; Kumssa &
267 Bekele, 2013).

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

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Table 1: Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
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.

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	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)
	monkey	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 (90.1)	28 (90.3)	27 (90.0)	175 (70.0)
No		04 (13.3)	11(37.0)	32 (100)	03 (09.1)	16 (50.0)	03 (09.9)	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 (70.09)	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)

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

391 **Table 3: Response of informants on human-wildlife conflicts with reference to reason for crop damage, techniques used for**
 392 **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)

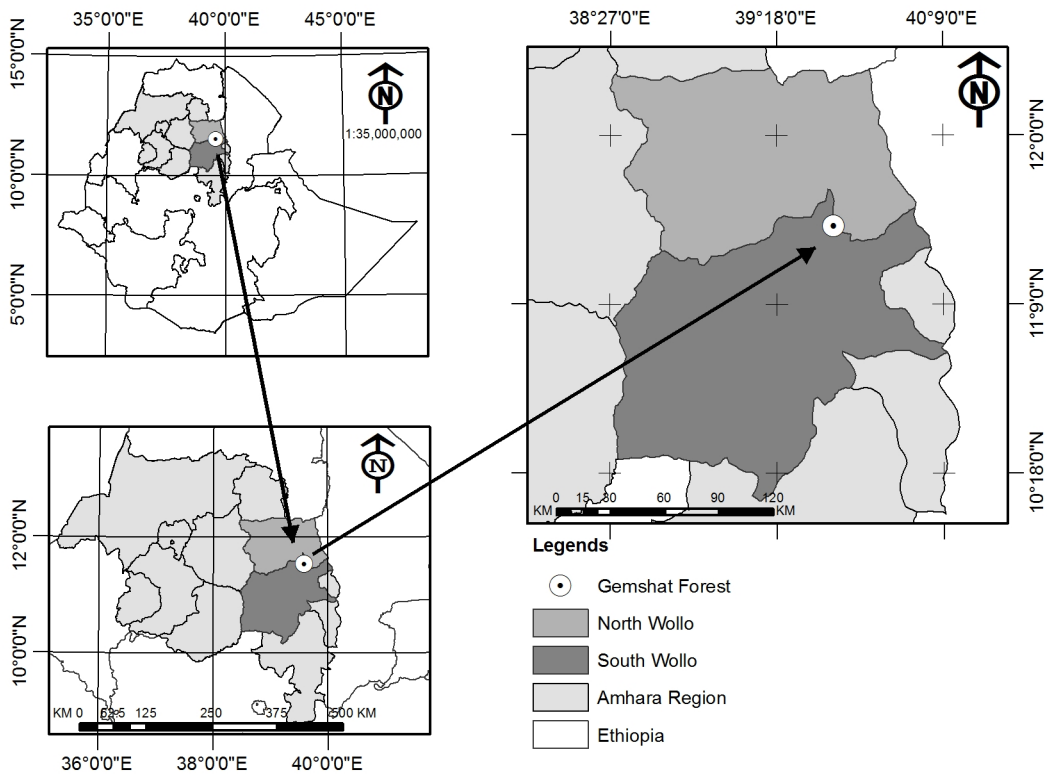
393 n = Number of informants; Percentage values are presented in parentheses

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

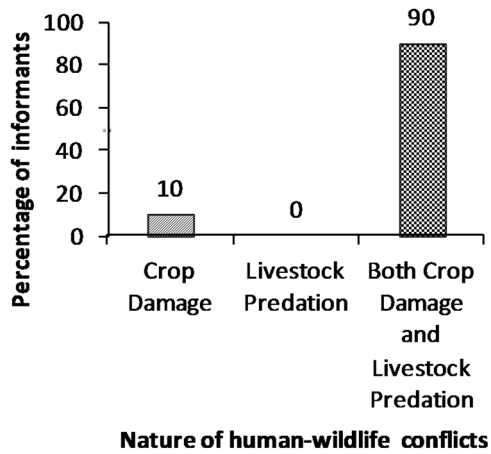
Attribute	Response	Villages								Overall (n=250)	
		Ambolamba (n = 30)	Embiswuha (n = 29)	Gemshat (n = 32)	Gatira (n= 33)	Molalie (n = 32)	Sindeamdir (n = 33)	Werekyo (n = 31)	Zoble (n= 30)		
Name of the predator	Common fox	Yes	10 (33.3)	24 (82.8)	20 (62.5)	32 (96.9)	09 (28.1)	08 (24.2)	28 (90.3)	09 (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)	

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



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Fig. 1: Location of Gemshat Forest Area



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Fig. 2: Nature of conflicts around Gemshat Forest Area