HUMAN - WILDLIFE CONFLICT: INTENSITY OF DOMESTIC DAMAGE CAUSED BY WILD ANIMALS AROUND YEGOF NATIONAL FOREST PRIORITY AREA, SOUTH WOLLO, AMHARA REGION, ETHIOPIA

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Abstract

Damage manifestations in terms of crop damage and livestock depredation are common in Ethiopia and reporting of such domestic damage in the vicinity of Yegof National Forest Priority Area was achieved by collecting information using the pretested semi-structured questionnaire from November 2013 to May 2014. The anubis baboon (Papio anubis) and grivet monkey (Chlorocebus aethiops) were identified as major crop pests and maize crop was more vulnerable than other crops. Increase in population of crop raiders was perceived reason for crop damage. Guarding was the best believed mitigation strategy. Though the informants lack remedial measures, some alternative was suggested to minimize primates through displacing them to other areas and remove them completely. Leopard (Panthera pardus) and striped hyaena (Hyaena hyaena) were reported as major predators of livestock and both accounts for a loss of 1,993 domestic animals, hitherto. Despite this loss, most of the informants had positive attitude. In conclusion, the study area demands for sustainable and culturally acceptable conservation solutions to mitigate domestic damage.

Keywords: Attitude; Crop damage; Human-wildlife conflict; Livestock predation; Local community; Yegof national forest priority area.

Introduction

Human-wildlife conflicts, universal problems, are prevalent and create serious problems when wildlife activities intersect with those of humans [1]. Such incidents occur when wild animals leave protected area frequently, and enter into the human settlements or when human reaches to close proximity with wildlife to explore the natural resources of nearby forest for their livelihood [2]. Human-wildlife conflicts are continuous and it can be a various forms which include crop raiding, livestock predation, property damage and attacks on humans [2, 3]. In many countries, crop raiding and livestock depredation have been identified as a key form of human-wildlife conflicts and are more prevalent along the borderline of the protected area [4, 5]. In fact, species involved in conflict are more prone to extinction [6] and also create a basis for resentment due to undermine welfare of the people through crop damage and livestock predation.

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Economic losses incurred due to domestic damage such as crop raiding and livestock depredation by wild animals can be relatively high in developing countries and are rarely compensated for their losses [7, 8]. Such encounter of crop raiding was reported by a wide suite of species like elephants [8-12], wild boar [7, 13], rodents [14] and primates [5, 15-18]. Similar to the crop raiding, incidents of livestock depredation by various carnivores reported in different parts of the world which is exemplified by wolves, bears, jaguars, pumas, tigers, lion, hyena and leopards killing livestock in Europe, South America, Asia and in Africa [19-29]. Occurrence of crop raiding and livestock depredation in developing country like Ethiopia is similar to the other countries. In fact, the situation of such conflicts can be still severe. However, very few studies are reported on Human-wildlife conflict in this country [30-39].

Ethiopia is ecologically diverse country with unique endemic species and is mostly restricted to the different protected areas. In Ethiopia, the damage caused by different wild animals 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 *Crocuta crocuta*, *Panthera pardus* and *Canis aureus* are common [35]. Predation of sheep by Ethiopian wolf [30] and conflict of crop raiding by gelada baboon was noticed around Simien Mountain National Park [31]. The pronounced problem of common jackal to the local community was reported around Simien Mountain National Park [32]. This study also emphasized that local community experienced the minimal problems from Ethiopian wolf, leopard, vervet monkey, hamadryas baboon and crested porcupine. In Zegie peninsula area grivet monkey was reported as major problematic animal [33]. As per the pastoral people, spotted hyena followed by leopard were responsible for predominant predation of livestock in Bale Mountains [34]. Recently, crop raiding activity of Bale monkey, endemic to the southern Ethiopian highlands, was reported in the regions of Oromia and Southern Nations [36]. The most problematic wild animals that damage crop were buffalo, vervet monkey and warthog [37] and hyena and leopard were responsible for livestock predation around Chebera Churachura National park [38]. However, warthog was considered as notorious pest in Senkele Swayne's Heartbeest Sanctuary [39].

Considering the existence of human-wildlife conflict around different reserve areas of the country, it becomes prime conservation priority to reduce human wildlife conflict where people and wildlife co-occur [40] and create a sustainable coexistence. So far, no attempt has been made to assess the magnitude of the wildlife conflict with local communities living adjacent to Yegof National Forest Priority Area which has experienced several distractions in the past times [41]. In addition, crop raiding and livestock predation are perceived challenges faced by local communities. From this perspective, it is imperative to assess the intensity of domestic damage incurred by wild animals around Yegof National Forest Priority Area.

Materials and Methods

Study area

The study was conducted beside Yegof National Forest Priority Area, South Wollo, Amhara region, Ethiopia (Fig. 1) and this forest has been reported as dry evergreen afromountain forest [41] dominated by *Juniperus procera* and *Olea europaea* on Yegof Mountain [42]. This forest priority area is located 380 km away from Addis Ababa towards north. The site is located between 11°01' to 11°03' North latitude and 39°4' to 39°44' East longitude with an elevation between 2000 and 3014 meters above sea level [41]. The annual temperature of study area ranges from 12.7°C to 27.1°C while the average annual rainfall is about 1001 mm [41]. According to the inventory made by Amhara Region Culture and Tourism office, Bahir Dar, Ethiopia, this National Forest Priority Area supports a wide variety of wild animals, majorly, gelada baboon, Menelik's Bushbuck, wild pig, leopard, anubis baboon, striped

hyaena, common mole rat. The National Forest Priority Area is surrounded by Kombolcha, Dessie, Kallu and Albuko wareds (Districts).

Fig. 1: Location of Yegof National Forest Priority Area
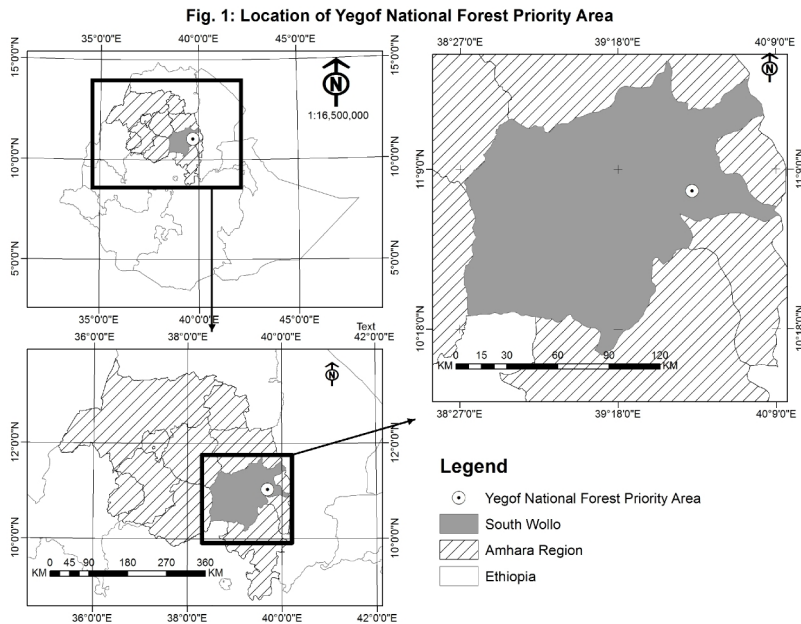
Fig. 1. The study area

The seven villages adjacent to the Yegof National Forest Priority Area, namely Aliager, Jaruager, Yegof and Yigarea villages from Dessie Zuria, Sherifager and Metara villages from Kombolcha Zuria and Albora from Albuko Zurea were selected in view of the fact that the residents of these villages have been experiencing crop raiding and livestock predation. The economy of all residents nearby this priority area is based on subsistence farming. The main crop includes maize, barley and wheat for subsistence utilization and commercial purposes. The average farmland holding per informant was 1.19±0.34 hectare and producing 5.46±1.87 quintals, annually. Livestock includes cattle, goat, sheep and pack animals like donkey, horse and mule [41], have reported the practice of livestock grazing in spite of presence of guards who keep the forest from human pressures and same kind of activity is continuing, occasionally. The dominant ethnic group in the study area is Amhara.

Methods of data collection

Survey involving a sample of 250 informants was included from seven villages settled adjacent to Yegof National Forest Priority Area. This study was conducted from November 2013 to May 2014 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 which was done by including both male and female who have been experiencing human-wildlife conflicts. Out of 250 informants, 173 (69.2%) men and 77 (30.8%) women were included in this study. Many of the informants were illiterate or had informal education (65.2%) followed by few of them completed up to secondary school education (22.4%) and above secondary school education (12.8%). Interviews were ensured for voluntary participation with prior consent.

Pre-testing of semi-structured interview was conducted to ensure that all questions were clear and a final version was prepared for sampling. The questionnaire included both open

ended and fixed response questions. As the incidents of crop raiding and livestock predation by wild animals were noticed from preliminary investigation, the focus was made on (i) reporting the opinion of local communities on nature of domestic damage (ii) reason for the tendency of crop damage, 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 lost due to predation and people perceptions on trend of livestock predation and (iv) attitude of informant's towards problematic wild animals. 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 assured 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 Management and Data Analysis

During data collection process, the data was checked for completeness. The collected data was analyzed using Statistical Analysis System (SAS) Version 9.2. Descriptive statistics and Chi square statistical tests 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.

Results

Nature of domestic damage

Among all informants, majority of them practice subsistence agriculture for their livelihood, which include both crop farming and livestock rearing. As the agricultural practice is in close proximity to this priority area, majority of the informants reported the incidence of crop damage (10.8%), livestock predation (0.8%) and both crop damage and livestock depredation (88.4%) and such occurrence was significant ($\chi^2 = 344.88$, df = 2, $p \leq 0.05$) among informants.

Crop damage

As per the informants, *P. anubis* and *C. aethiops* were perceived as the major species responsible for crop damage. The proportion of respondents experienced the crop damage adjacent to the forest boundaries was significant in both *P. anubis* ($\chi^2 = 48.4$, df = 1, $p \leq 0.05$) and *C. aethiops* ($\chi^2 = 15.37$, df = 1, $p \leq 0.05$) (Table 1). Maize, an important staple locally, was the most frequently cited crop damage by the forest primates ($\chi^2 = 94.22$, df = 3, $p \leq 0.05$). Because of its importance as a staple food, maize crop was grown enormously in this locality and that becomes major crop for crop damage. Barley was the next most commonly damaged crop according to the informants. However, wheat and other crops were damaged occasionally as they cultivate them rarely (Table 1). Most of the informants believed that the main reason for tendency of crop damage was due to increase of *P. anubis* and *C. aethiops* population from the other reasons like increased subsistence agriculture, both population increase of crop raiders as well as increased subsistence agriculture. Some of them, however, do not know reason for this cause (Table 1). The respondents quotient for reason for tendency of crop damage was significant ($\chi^2 = 107.60$, df = 3, $p \leq 0.05$). Among different mitigation strategies, many of the informants preferred to do active guarding to protect their crops from damage. Of alternative feasible mitigation strategies, such as chasing and planting Scarecrow seemed popular. However, using of all guarding, chasing and scarecrow was also preferred next to the guarding only (Table 1). The choice of different mitigation strategies among informants was significant ($\chi^2 = 177.61$, df = 3, $p \leq 0.05$). In fact, many of the informants did not suggest any remedial measures and even they did not know any remedial measures to control crop damage. Some of the informants suggested minimizing the number of crop raiders either through displacing them to other areas or removing them completely as alternatives (Table 1). The opinion of remedial

measures to control crop damage was significant (χ^2 = 36.86, df = 1, p ≤ 0.05) among informants.

Table 1. Response of informants on human wildlife conflicts with reference to crop damage.

Attribute	Response	Villages							Overall (n=250)
		Aliager (n = 40)	Jaruager (n = 34)	Yegof (n = 42)	Yigarea (n = 30)	Sherifager (n = 38)	Metara (n = 30)	Alborea (n = 36)	
Crop raider - *P. anubis*	Yes	37 (92.5)	23 (67.6)	28 (66.6)	17 (56.6)	28 (73.7)	22 (73.3)	25 (69.4)	180
	No	03 (07.5)	11 (32.3)	14 (33.3)	13 (43.3)	10 (26.3)	08 (26.6)	11 (30.5)	70
Crop raider - *C.aethiops*	Yes	27 (67.5)	22 (64.7)	27 (64.3)	14 (46.7)	29 (76.3)	14 (46.7)	23 (63.9)	156
	No	13 (32.5)	12 (35.3)	15 (35.7)	16 (53.3)	09 (23.7)	16 (53.3)	13 (36.1)	94
Type of crops damaged by crop raider	Maize only	13 (32.5)	20 (58.8)	27 (64.3)	20 (66.7)	16 (42.1)	15 (50.0)	15 (41.7)	126
	Barley only	06 (15.0)	08 (23.5)	08 (19.0)	02 (06.7)	11 (28.9)	04 (13.3)	03 (08.3)	42
	Wheat only	09 (22.5)	01 (02.9)	04 (09.5)	00 (00.0)	05 (13.2)	04 (13.3)	02 (05.6)	25
	Other crops	12 (30.0)	05 (14.7)	03 (07.1)	08 (26.7)	06 (15.8)	07 (23.3)	16 (44.4)	57
Reason for the tendency of crop damage by crop raider	Increased population	16 (40.0)	19 (55.8)	29 (69.0)	11 (36.7)	25 (65.9)	13 (43.3)	14 (38.9)	127
	Increased subsistence agriculture	13 (32.5)	11 (32.4)	08 (19.0)	11 (36.7)	06 (15.8)	10 (33.3)	10 (27.8)	69
	Both Increased population and subsistence agriculture	05 (12.5)	00 (00.0)	04 (09.5)	03 (10.0)	07 (18.4)	03 (10.0)	06 (16.7)	28
	Unknown	06 (15.0)	04 (11.6)	01 (02.4)	05 (16.6)	00 (0.00)	04 (13.3)	06 (16.7)	26
Mitigation techniques used for crop protection	Guarding	11 (27.5)	08 (23.5)	25 (59.5)	27 (90.0)	20 (52.6)	29 (96.7)	11 (30.5)	131
	Chasing	02 (05.0)	03 (08.8)	07 (16.6)	02 (06.7)	02 (05.2)	00 (00.0)	02 (05.5)	18
	Scarecrow	03 (07.5)	00 (00.0)	00 (00.0)	00 (00.0)	01 (02.6)	00 (00.0)	01 (02.8)	05
	All (Guarding, Chasing and Scarecrow)	24 (60.0)	23 (67.6)	10 (23.8)	01 (03.3)	15 (39.4)	01 (3.33)	22 (61.1)	96
Remedial suggestion to prevent the crop loss	No response/ Do not know	22 (55.0)	30 (88.2)	42 (100)	28 (93.3)	20 (52.6)	11 (36.6)	20 (55.5)	173
	Minimize crop raiders	18 (45.0)	04 (11.7)	00 (00.0)	02 (06.6)	18 (47.3)	19 (63.3)	16 (44.4)	77

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

Livestock depredation

From livestock predation perspective, few of the informants experienced this conflict from *P. pardus* and *H. hyaena*. The proportion of respondents experienced the livestock predation was significant in both *P. pardus* (χ^2 = 57.60, df = 1, p ≤ 0.05) and *H. hyaena* (χ^2 = 92.41, df = 1, p ≤ 0.05). As per the informants view, a total of 1,993 domestic animals (1073 sheep and goat, 796 cattle and 124 pack animals) were lost hitherto due to predation (Table 2). The mixed opinion was reported for trend of predation, in which perception of increased trend of predation was higher among people. The proportion of respondents opinion on trend of predation was not significant (χ^2 = 2.984, df = 2, p > 0.05).

Table 2. Response of informants on human wildlife conflicts with reference to livestock predation.

Attribute	Response	Villages							Overall (n=250)
		Aliager (n = 40)	Jaruager (n = 34)	Yegof (n = 42)	Yigarea (n = 30)	Sherifager (n = 38)	Metara (n = 30)	Alborea (n = 36)	
Livestock predator - *P. pardus*	Yes	13 (32.5)	04 (11.7)	11 (26.1)	02 (06.6)	17 (44.7)	04 (13.3)	14 (38.8)	65
	No	27 (67.5)	30 (88.2)	31 (73.8)	28 (93.3)	21 (55.2)	26 (86.6)	22 (61.1)	185
Livestock predator - *H. hyaena*	Yes	11 (27.5)	04 (11.8)	05 (11.9)	10 (33.3)	08 (21.1)	05 (16.7)	06 (16.7)	49
	No	29 (72.5)	30 (88.2)	37 (88.1)	20 (66.7)	30 (78.9)	25 (83.3)	30 (83.3)	201
Number of livestock lost due to predation	Cattle	112	120	120	093	155	090	106	796
	Sheep and Goat	128	169	107	165	143	113	248	1073
	Pack animals	016	016	031	018	015	017	011	124
Trend of predation	Increased	17 (42.5)	11 (32.4)	14 (33.3)	12 (40.0)	26 (68.4)	07 (23.3)	09 (25.0)	96
	Decreased	08 (20.0)	07 (20.6)	18 (42.9)	08 (26.7)	07 (18.4)	16 (53.3)	15 (41.7)	79
	Unknown	15 (37.5)	16 (47.0)	10 (23.8)	10 (33.3)	05 (13.2)	07 (23.3)	12 (33.3)	75

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

Attitude towards problematic wild animals

Overall attitude of the informants was positive for crop raiders and livestock predators. Among all informants, positive (69.2%) attitude was more than negative (22.0%) and neutral (8.8%) for crop raiders. Similarly, positive (68.4%) attitude was more than negative (23.6%) and neutral (8.0%) for livestock predators. The proportion of respondents attitude was significant for both crop raiders (χ^2 = 151.25, df = 2, p ≤ 0.05) and livestock predators (χ^2 = 147.46, df = 2, p ≤ 0.05).

Discussion

Living around protected areas entails different types of conflict such as incidents of wildlife damage, loss of crops and livestock predation and even injury or death of local people, occasionally [4, 43, 44]. Yegof is one of the National Forest Priority Areas which support a different array of wildlife that are prone to conflict with people. From the present study the conflicts with wildlife over crops and livestock reported by informants near priority area was significant as many of them practice both crop production as well as livestock rearing for their subsistence. Such incidents nearby National Forest Priority Areas are mainly due to either straying of wild animals outside the forest area [2, 6] or people approach to the natural resources for their domestic needs [2].

Local residents asserted the crop damage done by some populations of primates particularly *P. anubis* and *C. aethiops* in their vicinity. Primates are the most frequently identified crop raiding animals and were reported as pest in Uganda [15, 45], Zambia [12] and Ethiopia [31, 33, 36, 37, 39]. According to few studies the most important explanatory factor for crop raiding is proximity to forest edges or probable surrogates [7, 43]. On the other hand, shortage of forest based food or instead opportunistic [45] probably be the other factors. Nevertheless, attraction of primates due to palatable crops growing around reserve area [37] cannot be discounted either. According to [37] particular food like maize, teff and sorghum attract crop raiders around Chebera Churchura National Park, (Ethiopia). The informants of the present study also confirmed the same situation adjacent to Yegof National Forest Priority Area in which maize was highly preferred by primates. Majority of the respondents believe that the sole reason for the tendency of crop damage was due to increased primate populations. In fact, larger wildlife populations [46] or increased population density and range may be the probable answer for agricultural problems [43, 47] in the study area. Among different mitigation techniques like guarding, chasing and planting scarecrow, informants found the active guarding

was most effective for crop protection. The most common practice to protect the crops across the agriculture wildlife interface was reported as guarding [37, 48]. Apart from using traditional techniques to protect their crops, most of the informants had no suggestion to prevent their crop loss except the opinion of reducing the population of crop raiders either through translocation to other area or remove them completely. However, removal of problematic troop of baboons potentially creates an empty range which invites another troop to occupy that empty range [49]. 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 [50], leopard and hyena are main livestock predators in Ethiopia. The informants of the present study also confirmed that the leopard and hyena are responsible for their livestock predations. In addition to this, other parts of the country also witness livestock predation by leopard and hyena [34, 38] as livestock are inherently vulnerable to depredation due to their reduced anti-predatory skills [51]. Considering the fact that variety of domestic prey available to the leopard and hyena, medium sized livestock like goats and sheep are most vulnerable than cattle and pack animals to depredation since medium sized can be killed and heave to a safer place easier [26, 52]. Indeed, collective counts as reported by informants, a total of 1,993 domestic animals were killed, hitherto, by wild animals. Similarly, in Chebera Churchura National Park, out of 997 domestic animals depredation, around 200 animals (sheep, goat and cattle) were killed by leopard and hyena in three years, in which 75.5% of animals were killed by leopard [38]. However, in Bale Mountains, out of 704 domestic animals depredation, 57% and 18% of the animals were killed by spotted hyena and leopard, respectively [34]. This regional variation in livestock predation by different wild predators could be attributed to differences in densities of large carnivores, husbandry practices, or relative abundance of different stock species [20]. More than one third 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 [49] or pull factors like reduced anti-predatory skills of livestock [51].

Despite their livestock loss, majority of the people showed positive attitude towards the wildlife. However, except very few neutral responses, some of them indicated the negative attitude towards wildlife. Similarly, majority of the people living with conflicts of Ethiopian wolf around simien mountain national park reported the positive attitude [30]. This positive attitude among informants might be attributed to positive biophilia or positive perceptions about nature's rights [23].

Conclusions

In conclusion, the conflict of crop raiding and livestock predation is prevalent beside Yegof National Forest Priority Area. The positive attitude among local community, despite their loss, indicates the better chance of implementation of appropriate conservation measures to diminish 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 some level.

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