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Human-Buffalo Conflict around Jorgo-Wato Protected Forest, Western Ethiopia

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Abstract: The conflict between human and Cape buffalo around Jorgo-Wato Protected Forest was investigated to identify the possible causes and mitigation strategies used by the local farmers to safeguard their crops. The study was carried out from July, 2015-June, 2017. Data on the incidences, locations, time and seasons of crop damage and techniques used by the local people to safeguard crops were collected using questionnaire in the form of interview and directly through on-site field observation. The study revealed that seven crop types such as *Zea mays*, *Sorghum bicolor*, *Triticum aestivum*, *Hordeum vulgare*, *Eragrostis tef*, *Pisum sativum* and *Vicia faba* were damaged. Among the respondents, 81.7±4.3% reported that *E. tef* was severely damaged, followed by *Z. mays* (68.0±17.5). They also mentioned that crop damage, mostly during the wet (72.7%) season than the dry season (6.7%). Though most respondents (91.8%) ignore the use of mitigation strategies, a substantial number of respondents (55.1%) utilized various methods to protect their crops against Cape buffalo. To reduce the present human-buffalo conflict, designing a corridor between Jorgo-Wato Protected Forest and Dardara mineral water and demarcation of buffer zone around the forest is highly crucial. Moreover, the cultivation of crops adjacent to the forest should be avoided as open crop habitats attract buffaloes during the wet season.

Key words: Cape Buffalo · Conflict · Crop Damage · Human-Wildlife Conflict

INTRODUCTION

Human-wildlife conflicts occur globally all over the world [1]. Recently, it has become more frequent and severe in developing countries due to high growth of human population, expansion of agricultural land [2] and human encroachment in the wildlife habitats [2]. The influx of people toward protected areas has been increasing seeking for fertile soil and livestock grazing [3]. An increase in human population around protected areas result in competition for resources between human and wildlife, which becomes evident for various types of conflicts [4, 5]. Livestock and agriculture are basic in the livelihood of rural people in developing countries [6] and mostly escalate human-wildlife and wildlife-livestock competition for resources [7]. Depredation of livestock, attack on humans, crop damage and disease transmission are the most common causes of human-wildlife conflicts [8]. Humans also have negative impacts on the diet, activity and ranging patterns of many wild mammals in protected areas [9]. Human-wildlife conflict is one of the most challenging tasks in the conservation of wildlife and wildlife habitats [10], especially around protected areas in Africa [11]. Though human-wildlife conflicts involve a diverse array of animals, larger herbivores, large carnivores and crocodiles are responsible for the majority of the conflicts [1]. Hence, knowledge of human-wildlife interaction around protected areas is vital for effective conservation of species and the area [12]. In areas of high human population, attempting to minimize or curb the scenario would not be achieved unless a well-designed buffer zone is established between protected areas and the surrounding communities to minimize direct human-wildlife interactions.

Despite their ecological and economic significance, African buffaloes have been noted for their negative impact on crops [13]. As described by [14], the expansion of farmlands around protected areas has increased human-buffalo interaction in the Zambezi valley of Zimbabwe. Conflicts between humans and various groups of animals have been extensively studied in Africa [2, 15, 16] and in Ethiopia [17-19], but studies about

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human-buffalo conflicts minimal [20]. African buffaloes come into conflicts with humans mostly due to crop raiding and injuries or death to humans when wounded during poaching. In Ethiopia, the reduction and absence of buffer zone between protected areas and adjacent communities are the main cause for the increasing frequency and intensity of human-wildlife conflicts. Moreover, human encroachments, shifting cultivation and unrestricted access of humans and livestock into protected areas have increased the frequency of conflicts. In the present study area, the issue of human-buffalo conflict was a recent phenomenon reported since buffaloes had colonized the area. This study, therefore, highlights the causes of human-buffalo conflicts and mitigation strategies used around JWPF.

MATERIALS AND METHODS

The Study Area: The Jorgo-Wato Protected Forest (JWPF) is located between 8°40' 20″ to 8° 48' 06″ N latitude and 35° 48' 01″ to 35° 56' 40″E longitude, between West Wollega and Buno Bedele Administrative Zones. The forest is particularly located between Nole Kabba (West Wollega) and Meko (Buno Bedele) districts with much of the forest being in Nole Kabba (Fig. 1). The altitude of the area ranges from 1,780 to 2,584 meters asl. The study area is characterized by subtropical zone (Woina Dega) climatic condition and receives a uni-modal annual rainfall. The wet season extends from April to October with the highest rainfall between June to September, whereas as the dry season ranges from November to March. The mean annual rainfall in the area from 1992 to 2014 was 1805 mm, with the highest mean monthly rainfall record 324 mm in July and the lowest of 9 mm in December. The mean monthly maximum temperature was 28°C recorded in February and March, but the mean minimum was12°C recorded in July and August.

Jorgo-Wato Protected Forest is one of the moist evergreen Afromontane forests located in the western parts of Ethiopia. It mostly comprises natural and plantation forest with many evergreen trees of over 30 meter high. Some of the dominant tree species observed in the forest include: *Syzygium guineense*, *Croton macrostachyus*, *Albizia schimperiana*, *Prunus africana*, *Pouteria adolfi-friedericii*, *Olea welwitschii*, *Ficus sur*, *Ekebergia capensis*, *Cordia africana* and *Teclea nobilis*. The moist evergreen montane forests of the south and southwest parts of Ethiopia are good sources of gene pools for several domesticated wild plants [21]. Similarly, JWPF is a good reservoir of *Coffea arabica*, *Aframomum corrorima* and *Rhamnus prinoides,* which are used as sources of income by the local communities. Plantation forest comprises *Eucalyptus* spp. *Cupressus lusitanica*, *Grevillea robusta* and *Pinus patula*. Jorgo-Wato Protected Forest is one among the many protected areas in the western part of Ethiopia that could be used as a

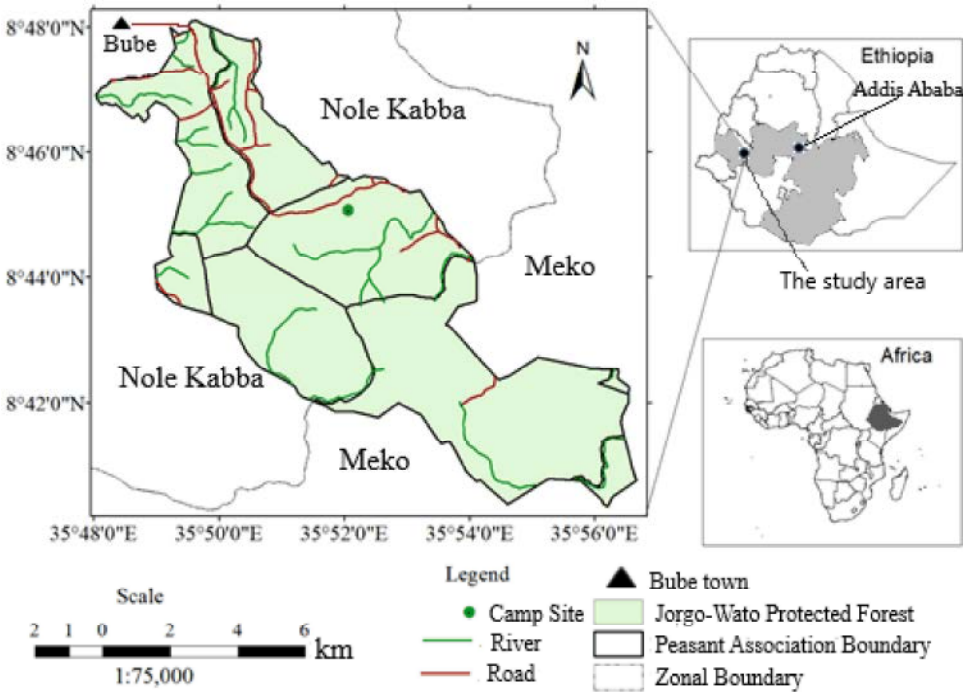

Fig. 1: Location map of Jorgo-Wato Protected Forest

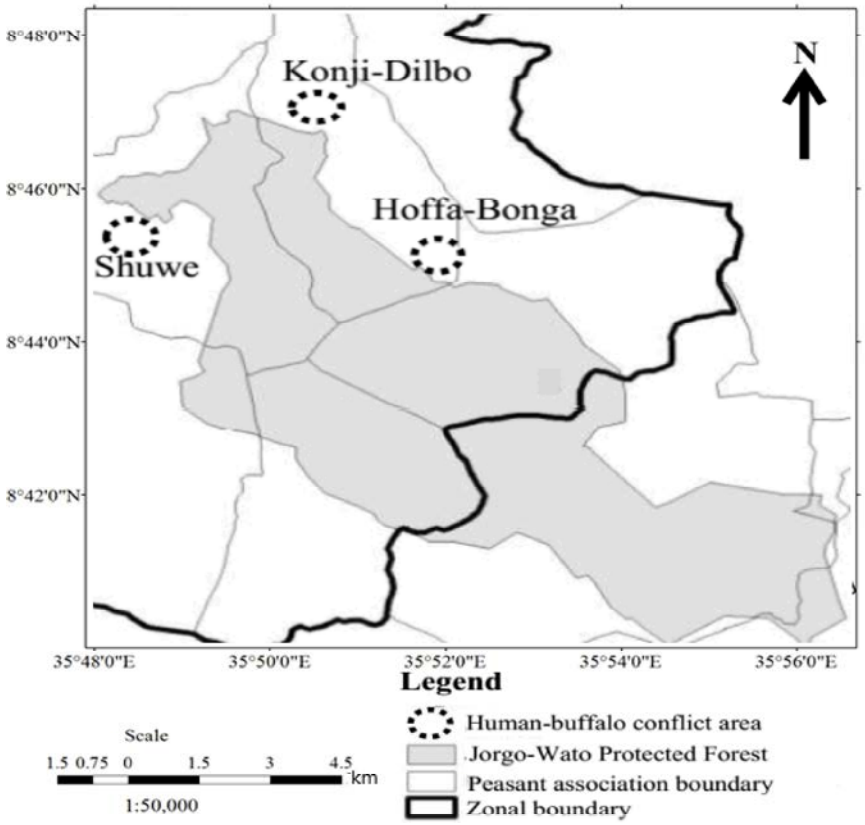

Fig. 2: The locations of human-buffalo conflict around JWPF

future carbon trade centre in the country. The forest is assumed to be under the "Participatory Forest Management" scheme, though it is severely threatened by various anthropogenic activities. Currently, the area of the forest is reduced due to severe human pressure for coffee plantation, shifting cultivation, selective logging and livestock grazing.

Data Collection: Information about the human-buffalo conflict was collected through questionnaire in the form of interview and by on-site field observations. Crop damage by buffaloes was recorded by visiting the places of incidences, recording details on evidences left during the occurrences, locations, time and seasons. In addition, mitigation strategies used by the local people were recorded. Three villages (Shuwe, Konji-Dilbo and Hoffa-Bonga) were identified as areas of frequent human-buffalo conflict. Household respondents involved in the interview include: Shuwe (N=23), Konji-Dilbo (N=17) and Hoffa-Bonga (N=9). The GPS locations of villages were recorded and geo-referenced on the map of the study area (Fig. 2). Reported cases of all crop damage among villages were tested by Kruskal-Wallis test and the difference in each crop damage between villages by Chi-square test. The views of respondents about mitigation strategies against crop damages by buffaloes and the seasonality of crop damages were done descriptively and by Chi-square goodness of fit test.

RESULTS

Many wild mammals are responsible for causing human-wildlife conflicts around the JWPF. Respondents mentioned that Cape buffalo, olive baboon, grivet monkey, bush pig, giant forest hog and crested porcupine are common crop pests, while leopard, common jackal, African wild cat and hyaena are predators of livestock. However, olive baboon and common jackal are known both as crop pests and prey on goat, sheep and calf.

Buffaloes in Jorgo-Wato Protected Forest were observed and reported to cause damage on seven cultivated crops belonging to the family Poaceae and Fabaceae (Table 1). Crops damaged were *Zea mays, Sorghum bicolor, Triticum aestivum, Hordeum vulgare, Eragrostis tef, Pisum sativum* and *Vicia faba.* Feeding and trampling were the two common modes of crop

Fig. 3: A farmer claiming about wheat (A) and teff (B) damaged by Cape buffaloes in the Hoffa-Bonga village around JWPF

Table 1: Cultivated crops damaged by Cape buffalo around the JWPF

Scientific name	Family	Vernacular name	Mode of damages
Zea mays	Poaceae	Boqolloo	Feeding and trampling
Sorghum bicolor	Poaceae	Bishingaa	Feeding and trampling
Triticum aestivum	Poaceae	Qamadii	Feeding and trampling
Hordeum vulgare	Poaceae	Garbuu	Feeding and trampling
Eragrostis tef	Poaceae	Xaafii	Feeding and trampling
Pisum sativum	Fabaceae	Atara	Trampling
Vicia faba	Fabaceae	Baaqelaa	Trampling

Table 2: Reported cases of crop damage (%) by Cape buffaloes in the three villages around JWPF (N= Number of respondents)

	Respondents' responses for crop damage* (%)				
Villages	*E. tef*	*T. aestivum*	*H. vulgare*	*Z. mays*	*S. bicolor*
Hoffa-Bonga(N=9)	88.9	55.6	66.7	33.3	88.9
Konji-Dilbo(N=17)	82.4	17.6	41.2	88.2	35.3
Shuwe (N=23)	73.9	47.8	65.2	82.6	56.5
Mean ± SE	81.7± 4.3	40.3±11.6	57.7 ± 8.3	68.0±17.5	60.2±15.6

*Includes only crops damaged by feeding and trampling

damage by buffaloes. Except *P. sativum* and *V. faba,* which were damaged by trampling, the other crops were damaged both by feeding and trampling. Buffaloes were reported to damage crops only at night, and damage was severe once they invade crop fields (Fig. 3).

Hoffa-Bonga, Konji-Dilbo and Shuwe villages around JWPF experienced crop damage by Cape buffaloes (Table 2). Incidences of crop damage were not reported and recorded in other villages around JWPF. The majority (81.7±4.3%) of the respondents stated that *E. tef* was severely damaged, followed by *Z. mays* (68.0±17.5), *S. bicolor* (60.2±15.6%) and *H. vulgare* (57.7±8.3). *Triticum aestivum* (40.3±11.6%) was the least damaged crop by Cape buffaloes in the area. Overall reported cases of crop damage between villages differed significantly (Kruskal-Wallis H test, $P<0.05$). Though more *E. tef* damage was reported in Hoffa-Bonga (88.9%), there was no significant difference in *E. tef* damage reported between the villages ($x2=1.39$, df = 2, $P > 0.05$). However, reported cases of crop damages differed significantly between the three villages for *T. aestivum* ($x2 =19.99$, df=2, $P<0.05$), *H. vulgare* ($x2 =7.10$, df =2, $P< 0.05$), *Z. mays* ($x2 = 26.84$, df =2, $P<0.05$) and *S. bicolor* ($x2 =24.21$, df =2, $P<0.05$).

About 72.7% of respondents stated that wet season was the period during which most crops were damaged, followed by a dry season (6.7%). However, the remaining 20.6% expressed that crop damage occurs during both seasons. There was a significant difference in the reported cases of crop damage between seasons ($x2=81.91$, df=2, $P < 0.05$).

Mitigation strategies used by the villagers against crop damage by Cape buffaloes are given in Table 3. All the methods used were developed traditionally

Table 3: Mitigation strategies used against crop damage by Cape buffaloes around JWPF (% exceeds hundred due to multiple responses)

Mitigation strategies	Number of responses	Percentage (%)
Fire burns on the edge of crop fields	23	47.0
Human dummies	17	34.7
Guarding crop fields	27	55.1
None	45	91.8

as indigenous knowledge over a long period of time. The majority (91.8%) of the respondents revealed that they did not use any safeguard against crop raiding by Cape buffaloes. A substantial number of respondents (55.1%) expressed that crop damage by Cape buffaloes can be minimized by guarding. Human dummies (34.7 %) and fire burning (47.0 %) were used to prevent buffaloes from crop damage in the area. There was a significant difference between mitigation strategies used against crop damages by Cape buffaloes in the study area ($x2 = 36.63$, $df = 3$, $P < 0.05$).

DISCUSSION

Increasing competition for space and resources between humans and wildlife is the cause for escalation of human-wildlife conflicts around the world [22]. Though conflicts have existed for centuries, the trends have grown due to the high number of livestock, the growth of human population and increased shifting cultivation adjacent to protected areas [15, 23, 24].Human-wildlife conflicts have been common around JWPF, but human-buffalo conflict was recorded as a new event, since buffaloes invaded the forest. Respondent's response and on-site filed observations during this study showed that buffaloes consumed monocot crops than dicots, which could be attributed to the high grass (monocot) preference of buffaloes as reported earlier [25-27]. As noted by [28], African buffaloes had damaged crops around Serengeti National Park. In the present study, crop damage was reported in Shuwe, Konji-Dilbo and Hoffa-Bonga villages, which are located in the northwestern, northern and north-eastern parts of JWPF, respectively. Exclusive crop damage in these villages could be ascribed to the following reasons. First, the north-western, northern and north-eastern parts of JWPF relatively possess an open forest and resources which were used by buffaloes more during the wet season than during the dry season. As buffaloes frequented in the open forest, they gradually move out into adjacent croplands in search of more open habitats. Second, Dardara mineral water source is found at about 5 km from the northern edge of JWPF. Thus, Cape buffaloes take refugia there and frequently visit Dardara mineral water source at night damaging crops along the way. Third, Cape buffaloes have been more adapted to the northern parts of JWPF due to the presence sufficient rivers and forages.

Crop damage by Cape buffaloes were recorded more during the wet than during the dry seasons. During the wet season, annual herbs and understory vegetation grow longer in the forest and force buffaloes move out seeking for open habitats for resting, basking and rumination [29, 30]. Consequently, this has increased the probabilities that buffaloes move out and damage crops adjacent to the forest. During the dry season, buffaloes less likely moved out of the forest, but crops were reported to be damaged intermittently at irrigated lands. The status of crop damage by animals is also influenced by changes in the activity patterns and ranging behavior of the species [31]. Similarly, the size (area) of JWPF is not large enough to host large mammals like buffaloes requiring large home ranges. The small size of the forest could increase the possibility that buffaloes could accidentally move out into forest edges and cause crop damages. In the present study, maize was the only crop damaged at irrigated lands around Konji-Dilbo and Shuwe villages agreeing with the findings of [32], who reported that buffaloes frequent along the rivers closer to cultivated land during the dry season in the Zambezi valley of Zimbabwe. Variation in crop damages between villages in the present study area could be associated with the distance of cultivated land from the forest. There are various types of indigenous and modern mitigation approaches developed to reduce or curb human-wildlife conflicts [33-35]. Guarding, soap bar, kerosene, human dummies, traps, plastic bags and sound from old metals were some among the many traditional methods used as mitigation methods of human-wildlife conflicts. In the present study, guarding, fire burning and human dummies were the common mitigation measures employed to prevent buffaloes, but they were less effective as buffaloes did not show fear of humans and mitigation methods at night time. This could be the reason why most respondents did not apply any mitigation strategies around JWPF. Human-buffalo conflict occurs in some villages around JWPF, where Cape buffaloes frequent and humans cultivate crops closer to the forest. Moreover, the problem was more pronounced due to the lack of buffer zone around JWPF, which causes resource use overlap in the area. Therefore, to minimize the current human-buffalo conflicts around JWPF, abandoned land and steep sloppy areas not convenient for agriculture

should be demarcated as a buffer zone for the JWPF. Moreover, a corridor should be designed between JWPF and Dardara mineral water as buffaloes frequently visit the water damaging any crop along the way.

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