

Human-wildlife conflict and community perceptions towards wildlife conservation in and around Wof-Washa Natural State Forest, Ethiopia: a case study of human grivet monkey conflict

Dereje Yazezew (✉ deredbu2003@gmail.com)

Debre Berhan University

Research Article

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Abstract

Background

Human-wildlife conflict (HWC) is predicted to increase globally in the vicinity of protected areas and occurs in several different contexts and involves a range of animal taxonomic groups whose needs and requirements overlap with humans. Human-monkey conflict exists in different forms more in developing countries and ranks amongst the main threats to biodiversity conservation. Grivet monkeys (*Cercopithecus aethiops aethiops*) are any slender agile Old-World monkeys of the genus *Cercopithecus*. This study was conducted to investigate the status of human grivet monkey conflict and the attitude of local communities towards grivet monkey conservation in and around Wof-Washa Natural State Forest (WWNSF), Ethiopia from September 2017 to May 2018. Questionnaire survey (143) was used to study the human-grivet monkey conflict and its conservation status. Data were analyzed using descriptive statistics and the responses were compared using a nonparametric Pearson chi-square test.

Results

Majority of respondents from both gender (male = 67.1%; female = 74.1%) were not supporting grivet monkey conservation due to its troublesome crop damaging effect. There was significant difference in respondents perceptions towards grivet monkey conservation based on distance of farmland from the forest ($\chi^2 = 12.7$, df = 4, P = 0.013). There was no significant difference in the techniques used by villagers to deter crop raiders ($\chi^2 = 14.73$, df = 15, P = 0.47). There was significant difference in respondents expectations on the mitigation measures to be taken by government ($\chi^2 = 40.01$, df = 15, P = 0.000). Based on the questionnaire result, $42.5 \pm SD 8.68$ of respondents in all villages elucidated that the causes of crop damage was habitat degradations.

Conclusion

The encroachment of local communities in to the forest area and exploitation of resources that would be used by grivet monkey and enhanced crop damage by grivet monkey exacerbated the HGMC in the study area. As a result grivet monkeys have been killed relentlessly as a consequence of crop damage. This was due to negative energy developed in human perspective. Thus, awareness creation education program and feasible crop damage prevention techniques need to be implemented.

Introduction

Human-wildlife conflict (HWC) is predicted to increase globally and occurs in several different contexts and spans a range of animal taxonomic groups[1, 2]. Currently, HWC is a global issue that has adverse consequences for both humans and wildlife [3]. Human Wildlife Conflict (HWC) arises from a range of direct and indirect negative interactions between humans and wildlife. This occurs when the needs and

requirements of human and wildlife overlap, which usually results in costs to both the local residents and animals when the needs of one impact negatively on the other [1, 4]. The loss, degradation and fragmentation of habitats through human activities such as, logging, animal husbandry, agricultural expansion and developmental projects [5–7] intensify the conflict. Ecosystems and habitats alarmingly dominated by humans, which trigger species including primates compelled to exploit new human resources to survive [8, 9].

Human activities like logging, deforestation, hunting, agricultural expansion, and other such factors intensely affected primate populations [10]. Accordingly, primates and humans are always in potential conflict over crops due to primates' renowned crop raiding behavior. Among wild animal species that cause damage to farmers' yield and trigger HWC, primates take the top ranking [11]. The genera *Cercopithecus*, *Papio* and *Macaca*, particularly baboons and grivet monkeys are some of the most serious crop raiders because of their intelligence, adaptability, wide dietary range, complex social organization and aggression [6]. As human populations expand and natural habitats shrink, people and animals are increasingly coming into conflict over living space and food. Although feeding on cereal crops increases foraging efficiency and nutrient intake for primates, it is nuisance for farmers due to crop loss [12, 13].

Grivet monkeys (*Cercopithecus aethiops*) are slender agile Old World monkeys of the genus *Cercopithecus*, inhabiting wooded regions of Africa and the most widely distributed of the guenon species, occur from Ethiopia to Senegal and from Sudan to South Africa [14]. So far, this species is considered to be a widely distributed and often common species in northern and central Ethiopia in altitude ranging from near sea level to approximately 3000 m a.s.l. [15]. However, because of habitat fragmentation for human settlement and cultivated land into previous wildlife habitats, the distribution of grivet monkey is highly challenging nowadays. In many areas, this monkey frequents human settlements and feeds extensively on crops [15–17], which exacerbate the conflict with humans.

Longitudinal studies on conservation threats of primates are an important step towards developing effective conservation management plan. In spite of this governing rational, only a few studies have been conducted in central highlands of Ethiopia where the conflict is severe due to a high rate of forest degradation and restriction of primates to patches of habitat surrounded by agricultural fields [16]. This study aimed to provide baseline information on current situation of human-grivet monkey conflict (HGMC) and the perceptions of communities towards this monkey conservation. The researcher predicted that HGMC did not vary with regard to the distance of farmland from the forest boundary. The researcher also predicted that the attitude of households may not vary depending on the gender.

Results

Demographic Characteristics and Socioeconomic profile of the Respondents

A total of 143 individuals participated for questionnaire survey (Table 1). The majority of respondents 59.4% ($n = 85$) were males, while 40.6% ($n = 58$) were females. There was no significant difference in the proportion of genders interviewed among villages ($\chi^2 = 6.74$, df = 5, p = 0.24). Most of the respondents 81.1% ($n = 116$) were married. Regarding educational level, most 83.9% ($n = 120$) were literate, and the rest 16.1% ($n = 23$) were uneducated. The family sizes of the respondents ranged from 1 to 11 with a mean of 4.82 ± 2.13 . From the total respondent, 52.4% ($n = 75$) possess family size of 4 to 6 individuals. There was significant difference in family size among villages ($\chi^2 = 21.82$, df = 10, p = 0.016). Among the households, 53.1% ($n = 75$) possess 0.5-1 ha of farmland while few 17.5% ($n = 25$) possess > 1 ha of farmland. There was significant difference among villages regarding farmland size ($\chi^2 = 19.52$, df = 10, p = 0.034). The majority of respondents 84.6% ($n = 121$) lack neither private nor communal grazing land and leave their cattle in the forest while only 11.9% ($n = 17$) possess private grazing land. There was significant difference in the proportion of households owning grazing land (One sample T test: $t = 59.6$, df = 142, p = 0.000). However, there was no significant difference in the proportion of households owning grazing land among villages ($\chi^2 = 11.98$, df = 10, p = 0.29). The livelihoods of all respondents were subsistence farming where they reared livestock and cultivated different crops like barley (*Hordeum vulgare L.*), wheat (*Triticum aestivum L.*), bean (*Vicia faba L.*), maize (*Zea mays*), pea (*Pisum sativum L.*), and lentil (*Lens culinaris Medikus*).

Table 1
Demographic characteristics and socioeconomic profile of respondents
around Wof-Washa Natural State Forest

characteristics	Category	N (frequency)	% (percent)
Age	18-30	41	28.7
	31-43	48	33.6
	44-56	31	21.7
	>57	23	16.1
Sex	Male	85	59.4
	Female	58	40.6
Marital Status	Married	116	81.1
	Single	27	18.9
Education	Uneducated	23	16.1
	informal education	48	33.6
	primary	50	35.0
	secondary	22	15.4
Family size	1-3	36	25.2
	4 - 6	75	52.4
	>7	32	22.4
Source of livelihood	Crop cultivation	5	3.5
	Crop & livestock	138	96.5
Farmland size	< 0.5 ha	42	29.4
	0.5-1ha	76	53.1
	>1 ha	25	17.5
Number of livestock	0-5	25	17.5
	5-10	78	54.5
	15-Nov	36	25.2
	>15	4	2.8
Grazing land	No, in barn	5	3.5
	Yes, private	17	11.9

characteristics	Category	N (frequency)	% (percent)
	No, in the forest	121	84.6

Human-grivet monkey conflict

Based on the questionnaire survey, the common crop raiders in WWNSF in their ranking order were grivet monkeys (47.6%), bushbuck (37.8%), gelada (5.6%), porcupine (4.2%), rabbit (2.8%) and duiker (2.1%), where grivet monkeys were the most intensive. Accordingly, the majority of respondents from both gender (male = 67.1%; female = 74.1%) were not supporting grivet monkey conservation indicating that they have negative attitude to the monkey. More male (32.9%) respondents were interested to the conservation of grivet monkey as compared with females (20.7%). Pearson's Chi-Square test showed that there was significant difference between genders regarding their interest to grivet monkey conservation ($\chi^2 = 6.49$, $df = 2$, $P = 0.04$) (Table 2). There were no statistical difference in respondents' perceptions to grivet monkey conservation based on their marital status, education status and family size. Village of households and their cropland distance from the forest had significant impact on their perception of respondents towards supporting grivet monkey conservation. Majority of respondents (77.8%) having farmland 401m away from the forest supported the importance of grivet monkey conservation while those nearer to the forest argued against the issue. There was significant difference in respondents perceptions towards grivet monkey conservation based on distance of farmland from the forest ($\chi^2 = 12.7$, $df = 4$, $P = 0.013$) (Table 2). Respondents who argued grivet monkey conservation claimed several problems like damage to field crops, gardens, theft of backyard resources, children absenteeism from schooling, and extra workload of crop guarding which interrupt other socioeconomic activities. On the other hand, respondents those supported grivet monkey conservation stated that the monkeys are source of happiness, tourist attraction, heritage to the country and the generations to come.

Table 2
Community perceptions towards grivet monkey conservation around WWNSF

Is conserving grivet monkey important?							
variables	Categories	Important (%)	Not important (%)	I do not know (%)	χ^2	df	p value
sex	male	32.9	67.1	0.0	6.49	2	0.04
	female	20.7	74.1	5.2			
age	18–30	24.4	75.6	0.0	13.23	6	0.04
	31–43	25.0	75.0	0.0			
	44–56	35.5	54.8	9.7			
	> 56	30.4	69.6	0.0			
Marital status	married	25.9	71.6	2.6	1.91	2	0.39
	single	37.0	63.0	0.0			
Educational status	Uneducated	21.7	73.9	4.3	3.53	6	0.74
	informal education	25.0	75.0	0.0			
	primary	32.0	66.0	2.0			
	secondary	31.8	63.6	4.5			
Distance from forest (m)	< 200	24.5	72.6	2.8	12.7	4	0.013
	201–400	25	75	0.0			
	> 401	77.8	22.2	0.0			
Family size	1–3	36.1	63.9	0.0	7	4	0.13
	4–6	20.0	76.0	4.0			
	> 7	37.5	62.5	0.0			
Village	Chachahudad	41.2	58.8	0.0	22	10	0.013
	Giderach-Lankuso	13.6	86.4	0.0			
	Ayer	8.0	92.0	0.0			
	Silasie Gedam	38.7	58.1	3.2			

Is conserving grivet monkey important?

Mebreka`mba	42.1	47.4	10.5
Gifte	27.6	72.4	0.0

Among the various techniques (guarding by dog, guarding and scare away by humans, scarecrow and killing by trap) (Plate 1a-d) used to prevent crop raiding by grivet monkeys, $51.3\% \pm SD 15.2$ ($n = 74$) of respondents used to scare away grivets by human (Table 3). Although, killing was the least ($7.2 \pm SD 2.5$) used technique, it has been used to kill animals for two reasons : 1) reduce the number 2) to chase away troops of grivet monkey and discourage further crop raiding by using the dead animals as scarecrow (Plate 1d). There was no significant difference in the techniques used by villagers to alleviate crop raiding by grivet monkeys ($\chi^2 = 14.73$, $df = 15$, $P = 0.47$) (Table 3). Guarding using dog was the second effective technique where farmers either accompanied dogs with them or tied dogs at the periphery of farmland to be used as warning to grivet monkeys and as alarm for farmers (Plate 1a). Guarding and scare away by humans includes taking watch in the farmland field, chasing grivet monkey back to the forest, shouting and scaring and slingshots to scare the animals. Females and children are the most responsible family members to guard crop fields against crop raiders.

Table 3

Techniques used by respondents to prevent crop damage by grivet monkey around WWNSF

method of crop protection				
village	guarding by dog	Guarding & scare away by humans	Scarecrow	killing by trap
Chachahudad	17.6	58.8	17.6	5.9
Giderach-Lankuso	31.8	36.4	22.7	9.1
Ayer	44.0	28.0	20.0	8.0
Silasie Gedam	22.6	64.5	6.5	6.5
Mebrekamba	15.8	57.9	15.8	10.5
Gifte	24.1	62.1	10.3	3.4
Mean	26.0	51.3	15.5	7.2
Standard Deviation (SD)	10.5	15.2	6.1	2.5

The respondents have expected stakeholders including government bodies to design alternative crop damage prevention methods and compensation of damage to loosen the uptight HGMC. The households revealed that they would be delighted if government took measures like compensation strategies, reduction of the number of grivet monkeys and relocation options. Majority of respondents ($56.3\% \pm SD 23$) claimed eradication/relocation of grivet monkeys followed by financial compensation ($16.2 \pm SD 7.7$) including exception of farmland taxation (Fig. 2). There was significant difference in respondents view on the mitigation measures to be taken by government ($\chi^2 = 40.01$, $df = 15$, $P = 0.000$).

Respondents claimed that habitat degradation, proximity of crop land to forest, preferences of grivet monkey to crops, and degradation of food plants of grivet monkeys were the main causes of crop damage. On average $42.5 \pm SD 8.68$ of respondents in all villages elucidated that the causes of crop damage by grivet monkey is triggered by habitat degradations (Table 4). Proximity of crop land to the forest was rated as the second reason for crop damage by grivet monkeys and associated conflict. There was no significant difference in respondents view on the causes of crop damage by grivet monkeys among villages ($\chi^2 = 6$, $df = 15$, $P = 0.98$).

Table 4
Respondents' perception on the causes of crop damage by grivet monkeys around WWNSF

Village	Habitat degradation	preferences to crop	proximity of farmland to forest	food plants degradation
Chachahudad	58.8	5.9	11.8	23.5
Giderach-Lankuso	36.4	4.5	31.8	27.3
Ayer	44.0	12.0	24.0	20.0
Silasie Gedam	35.5	6.5	35.5	22.6
Mebrekamba	42.1	5.3	31.6	21.1
Gifte	37.9	10.3	31.0	20.7
Mean	42.5	7.4	27.6	22.5
SD	8.68	3.02	8.62	2.66

Grivet monkeys have been impacted with ruthlessness human persecution as a consequence of crop raiding. Respondents chase, shot and trapped grivet monkeys as a revenge of their crop loss (Plate 2). Deforestation, livestock grazing, wood collection for firewood and sale, and agricultural encroachments are becoming common and widespread practices in the study area. Residents around WWNF usually cut trees such as *Hagenia abyssinica*, *Prunus Africana*, *Olea europaea cuspidata*, *Olinia rochetiana*, *Ficus sur*, *Dombeya torrid*, *Myrica salicifolia*, *Allophylus abyssinicus*, *Ekebergia capensis*, *Podocarpus falcatus*,

Juniperus procera, *Maesa lanceolata*, *Ilex mitis*, *Celtis Africana* and others for purposes like house construction, firewood, timbering, animal fodder, fencing and household and farming utensils (Table 5), most of which used as food sources for grivet monkeys. Such overlapping of human goals with the needs of grivet further escalates the conflict and endangers grivet monkey conservation in the study area.

Table 5. Tree species logged by local communities around WWNF for different purpose

Forest product utilization						
Local name	tree species	timbering for house & utensil construction	fuel wood	animal fodder	Fencing	
Zigba	<i>Podocarpus falcatus</i>	✓		✓		
Tsid	<i>Juniperus procera</i>	✓			✓	
Zingerowonber	<i>Polyscias fulva</i>	✓				
Misargenfo	<i>Ilex mitis</i>			✓		
Weira	<i>Olea europaea</i>	✓	✓	✓		
Kelewa	<i>Maesa lanceolata</i>		✓		✓	
Weyel	<i>Pittasporum viridiflorum</i>	✓	✓	✓	✓	
Kosso	<i>Hygenia abyssinica</i>	✓		✓		
Tifie	<i>Olinia rochetiana</i>	✓	✓	✓	✓	
Ameja	<i>Hypericum revolutum</i>		✓	✓		
Shola	<i>Ficus Sur</i>					
Wulkifa	<i>Dombeya torrida</i>			✓		
Azamir	<i>Bersama abyssinica</i>		✓			
Kewot	<i>Celtis Africana</i>		✓			
Lanquso	<i>Urera hypselodendron</i>					
totakula	<i>Galiniera saxifraga</i>	✓	✓	✓		
Embus	<i>Allophylus abyssinica</i>		✓			
Kechemo	<i>Myrsine africana</i>			✓	✓	

Discussion

In recent decades, human population growth and the related expansion of agricultural and industrial activities have intensified HWCs [18, 19]. In the developing countries like Ethiopia, the livelihoods of most

of the peoples living in the rural area are depended on livestock holdings and agriculture which made HWC the most intensive [3]. Recently, HWC undoubtedly ranks amongst the main threats to conservation of wildlife in Africa [11]. This study also revealed that the communities around WWNSF experienced intensive conflict with grivet monkeys over crops. The livelihoods of all communities in the study area were subsistence farming where they reared livestock and cultivated different crops on small land size [16]. Among the households, 53.1% possess 0.5-1 ha of farmland while about 17.5% possess > 1 ha of farmland where they produce crops like *Hordeum vulgare L.*, *Triticum aestivum L.*, *Vicia faba L.*, *Zea mays*, *Pisum sativum L.*, *Lens culinaris Medikus*. Similar result have been reported by [18] where most of the respondents produce a limited number of crops on a plots of land. The attitudes of respondents to the conservation of grivet monkeys were negative and differences were observed with reference to gender, distance from the forest and village/localities of cropland relative to the forest.

The present study revealed that human grivet monkeys' conflict is a customary interaction within the WWNSF boundary. In spite of several factors causing human primate conflict, crop raiding is the frontline reason that becomes heightened during the months from sowing crops to harvesting. Respondents having cropland closer to the forest area had negative attitudes towards grivet monkey conservation due to greater incidence of damage to their crops, replicating the trend of crop damage reported from earlier studies [2, 13, 16, 20, 21]. Respondents are pleased to chase out the monkeys from the periphery of the forest facing the cropland. This is contrary to the thought that resolving HWC lies on evading wildlife attractions to human habitation instead of getting rid of monkeys, which indeed requires a change in human habits, entrenched ways of thinking and the expenditure of public and private resources [22].

Households around WWNSF prevent crop damage against grivet monkeys by guarding their crop land using scarecrows including carcass of killed grivet monkey [21], dogs, children and females vigilance, and even trapping animals. Over 76.3% of respondents used guarding (51.3% by human and 26% by dogs) to deter grivet monkey against crop damage while other methods were preferred by less proportion of the respondents. Other studies revealed that guarding is the most effective and commonly used method to prevent crop raiding from crop raiders [2, 18, 20, 21, 23]. Killing was the least effective method in this study area where the action is forbidden by the law of the country to protect the wildlife from mass persecutions. Moreover, scarecrow was ineffective to deter crop grivet monkeys from crop damages as the animals habituated the symbol and become non-responsive after a certain timeframe. The result was agreed with [12] who reported that the effect of scarecrow in preventing crop damage by wildlife is temporary.

Crop-raiding by wildlife like grivet monkeys perceived as a significant problem causing a serious hazard to the food security and livelihoods of smallholder farmers' households [20], which leads households to develop negative attitude and resentful attack on primates. Understanding the attitude of local communities towards wildlife is very crucial to attain long term success of conservation endeavor [24]. The questionnaire survey revealed that, the anticipated perceptions of respondents to tackle HGMC in WWNSF were eradication/relocation of grivet monkey followed by financial compensation. Moreover, they would be very thrilled if government bodies intervene to reduce the population size of the animals by

killing. Similarly, [20] reported that relocation and killing of problematic wildlife were the actions that households recommend to combat HWC that they experienced in Ngangao forest, Kenya. Studies revealed that the negative impact and resources damage posed by wildlife are the priority area that need to be reduced by developing mitigation measures, accurate and reasonable verification of damages, and compensation schemes to economic impacts [25].

Respondents revealed that the main cause of crop damage by grivet monkey in WWNSF was triggered by habitat degradations. Local communities were encroached to the forest to collect wood for sale, fuel wood and cut trees used for animal fodder, and made household and agricultural utensils from the forest. This finding is similar to studies conducted on red-tailed monkeys in Uganda [26] and on grivet monkey in Batiero Church forest, Ethiopia [16], inferring that conversion of forest for agricultural farmlands and other purposes lead many nonhuman primates to concentrate on crops as their main source of food. Respondents less considered the impact of grivet monkey preference on crops to be a reason for crop raiding. In line with this finding, [9] in Lake Nabugabo, Uganda, reported that nutritionally anthropogenic and wild food are similar. However, [16] in Batiero Church forest, Ethiopia, reported that human-primate conflicts were intensified during crop maturity and harvesting stages when grivet monkeys had preference to feed on the crops which differed from this result. This might be due to patchiness, degradation and lower quality of the habitat in Batiero Church forest where reduction in the availability of natural food sources leads the animals seeking alternate food sources [23]. Accordingly, human expansion into natural habitats worldwide has been the root of the hot conflict between wildlife and humans where natural food sources of wildlife are replaced by anthropogenic ones [22].

Conclusion

The finding of this study revealed that there was a strong conflict between human and grivet monkeys in and around WWNSF. This study, therefore, provides baseline data on crop damage for developing feasible wildlife management plan to enable friendly long-term coexistence of local communities with grivet monkey and other wildlife in and around WWNSF. Because crop-raiding by wildlife including grivet monkeys is the main cause that leads local communities develop negative attitudes and engaged in revengeful killing of wildlife to exterminate locally. Hence, grivet monkeys have been impacted with ruthlessness human persecution as a consequence of crop raiding. Forest alteration into agricultural lands and degradation due to cutting of trees for sale and firewood represents the most detrimental human activity that trigger HWC. Mitigation measures of HGMC need to focus on techniques that would not result in local extermination of grivet monkey population rather simply deter these animals in such a way that they stay in the forests, their natural home. Farmers also need to be encouraged to shift their crops productions which are unpalatable to grivet monkeys. More education can be launched to create awareness among local communities on the importance of wildlife and create job opportunities to reduce unemployment to mitigate the pressure of local people on wildlife and the forest.

Methods

Description of the study area

The study on HGMC and community perception to crop lose by grivet monkey (*Cercopithecus aethiopes aethiops*) was conducted in and around Wof-Washa Natural State Forest (WWNSF), which is located in North Shoa Zonal administration, Amhara National Regional State, Northwestern highlands of Ethiopia. The study area extends approximately between 9°42'- 9°47' N latitudes and between 39 ° 43'- 39 ° 49'E longitudes (Fig. 1). Topographically, the forest is situated along the altitudinal gradient between 1,650 m asl near Gift Michael where it merges into *Acacia* scrubland on the valley floor to 3,700 m asl at the top of the Rift Valley escarpment near Kundi on the plateau ridge.

The long history of settlement and cultivation coupled with deforestation and cattle grazing have led to intense pressure on the land, decreased soil quality, soil erosion and deforestation. Beyond the hillsides are mostly very steep and hard to cultivate, plot sizes are commonly very small with an average land holding ~ 1.5 ha in Amahara Region [27].

The main characteristic plant species at the higher altitudes are *Hagenia abyssinica*, *Olea europaea cuspidata* and *Juniperus procera*. *Podocarpus falcatifolius*, *Allophylus abyssinicus*, *Haleria lucida*, *Euphorbia abyssinica*, *Polyscias fulva* and *Olinia rochetiana* at the middle. Above 3,000 m *Erica arborea*, *Hypericum revolutum* and giant *Lobelia* spp. are the most dominant species with few *Hagenia abyssinica* and *Pittosporium viridiflorum* below inaccessible cliffy and steep slope areas. Generally, there are over 394 species of plants, of which, 46 species (12%) are endemic to Ethiopia while 7 (2%) are nearly endemic [28, 29].

Data collection

In order to evaluate the perceptions of farmers on crop damage by grivet monkey, the researcher surveyed villagers living around WWNSF from August 2017 to June 2018. Questionnaire surveys were administered for 143 households in six grivet monkey localities near WWNSF (Ayer, Chachahudad, Giderach-Lanquoso, Silasie Gedam, Mebreqamba and Gifte). These households were randomly selected by following a pattern of skipping one household, and the second household interviewed. The survey questionnaires were administered to farmers within their farming area or residence by the researcher and field assistants [30]. Questionnaires included both open and close-ended questions to get information about communities' perceptions on HGMC, their socioeconomic situation, measures they took to mitigate losses, attitudes to grivet conservation. A single person aged 18 years was taken to represent a household and the average interview session per sampled household was 25–35 min.

Data analysis

Data were analyzed using Statistical Package for Social Sciences (SPSS) software version 25. Descriptive statics and Pearson Chi-Square test had been used to analyze the data. Chi-square test was used to determine the significant differences among villages with regard to perceptions to crop damage

by grivet monkeys, techniques used in protecting crop damage, attitudes towards conservation of grivet monkeys. All statistical tests were two-tailed with 95% confidence intervals and level of rejection set at $P = 0.05$.

Ethical statement

The study was approved by the ethics committee of Debre Berhan University, college of Natural and Computational Sciences, Department of Biology, Ethiopia. Permission was obtained from the Ethiopian Wildlife Conservation Authority (EWCA) and Tarmaber Woreda administration office. The researcher contacted participants of the study in face to face and informed them the purpose of the study in their mother tongue (Amharic language) and assured about confidentiality of their say before, during and after the research. Participants were assured of anonymity and that information would be used for the study in question. Informed consent was obtained from study participants before the commencement of each questionnaire. The participants were granted that withdraw from the questionnaire and discussion at any time had no risk.

Abbreviations

GPS

Global Positioning System

HGMC

Human Grivet Monkey Conflict

HWC

Human Wildlife Conflict

SD

standard Deviation

SPSS

Statistical Package for Social Sciences

WWNSF

Wof-Washa Natural State Forest

Declarations

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Authors' contributions

DY proposed the research idea and collected the data from the respondents, organized and analyzed the data, interpreted the findings, and wrote the manuscript.

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Availability of data and materials

All data generated or analyzed during this study are included in this published article [and its supplementary information files].

Ethics approval and consent to participate

The study was approved by the ethics committee of Debre Berhan University, college of Natural and Computational Sciences, Department of Biology, Ethiopia. The methods were carried out in accordance with the relevant guidelines and regulations of Ethiopian Wildlife Conservation Authority (EWCA). Moreover, permission was granted by the EWCA to conduct the research. This research adhered to the ethical and legal requirements of the American Society of Primatologists Principles for the Ethical Treatment of Non-Human Primates. Additionally, informed consent was obtained from all participants before the commencement of the study. All respondents included in the study population are aged 18 and above years old. Accordingly, the researcher did not consent from guardian/parents or other legal representatives.

Consent for publication

This manuscript does not contain any individual person's data, and further consent for publication is not required/ applicable.

Competing interests

I declare that there are no competing interests to declare, because the research is solely my own work.

Author details

Affiliation: Debre Berhan University, College of Natural and Computational Science, Department of Biology, P.O. Box 445, Debre Berhan, Ethiopia

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Plates

Plates 1 and 2 are available in the Supplemental Files section

Figures

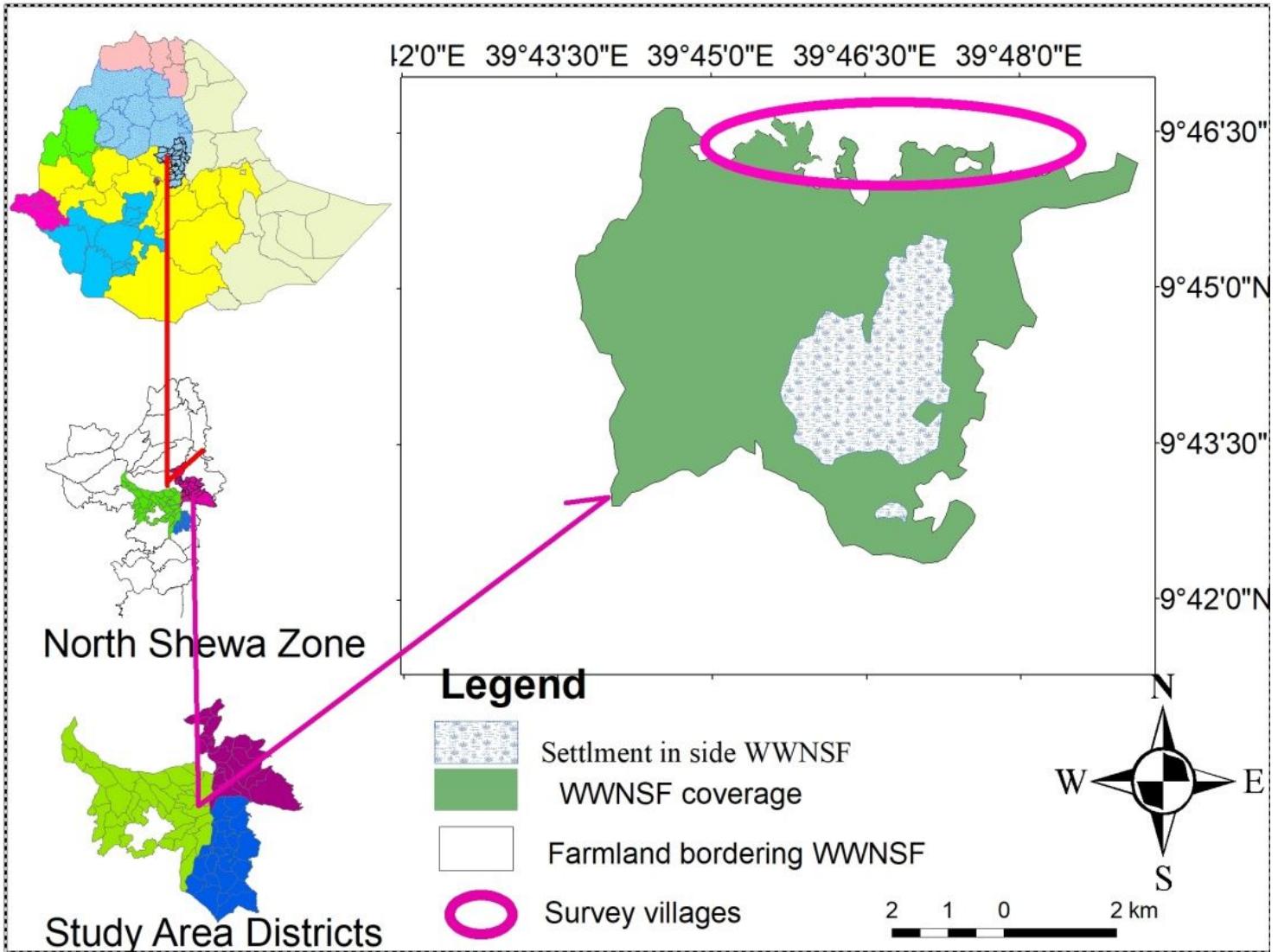


Figure 1

Map of the WWNSF

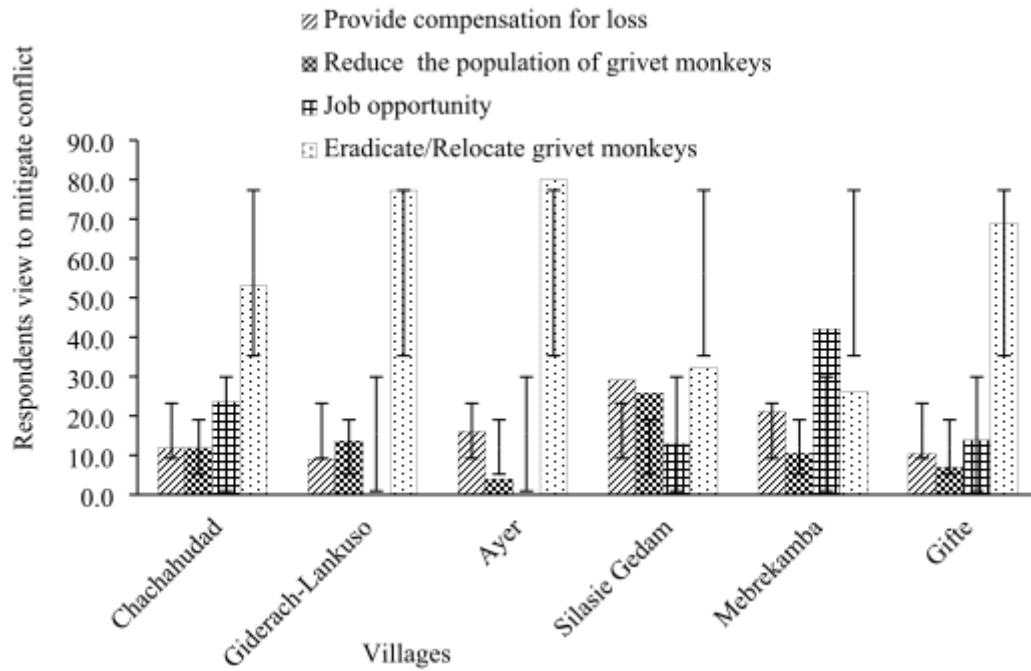


Figure 2

Respondents opinion on the options to be taken by the government and other stakeholders

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