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Research Article

Traditional knowledge and attitude of the local communities towards wildlife conservation in and around fragmented Forest of Germeba Mountain in southern Ethiopia

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Article Info

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Abstract

The role of traditional knowledge and attitude of the local community about wildlife conservation is fundamental for sustainable wildlife conservation. Therefore, the study investigated the traditional wildlife conservation knowledge and factors that determine attitudes towards wildlife conservation in and around fragmented Forest of Germeba Mountain in southern Ethiopia. A total of 108 respondents were randomly selected and interviewed using structured questionnaire. Data were also collected using key informant interviews and focus group discussions. Descriptive statistics and binary logit model were employed to analyze the data. The results of the study revealed that the majority (77.8%) of the local community could identify wildlife species in the study area. 87 % of the respondents perceived a change in wild animals' abundance in their area. Generally, the vast majority of respondents (96.5%) had positive attitude towards wildlife conservation. Binary Logistic regression analysis indicated that educational status (p=0.05), age (p=0.01) and traditional knowledge (p=0.010) were significant variables in explaining attitude of local community towards wildlife conservation. The study revealed that the local community demonstrated a considerable level of traditional knowledge and positive attitude about wildlife conservation. Hence, the indigenous knowledge about wildlife conservation can be used as an input for knowledge-based conservation in the area.

Keywords: attitude, Nensebo, indigenous knowledge, wildlife conservation

1 Introduction

Traditional ecological knowledge is defined as a cumulative experience of knowledge and beliefs, handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment (Cheveau et al. 2008; Neuman 2021). Local ecological knowledge is a subset of local knowledge that passed down through generations and derived from the long duration of the know-how interacting with nature especially with wildlife through trial and error by virtue of their closeness with nature (Davis and Wagner 2003; Berkes 2018; Haq et al. 2023). People have traditional knowledge and customs practiced about the traditional values of wildlife such as cultural, medicinal and nutritional values (Ocholla et al. 2016).

Multiple forms and sources of knowledge are needed to support complex decisions regarding natural and human dimensions (Kadykalo et al. 2021). Inadequate details of ecological knowledge of a species indicate that more knowledge is likely to come from local knowledge than wildlife professionals would expect. The use of indigenous knowledge systems in wildlife management has now caught the interest of global scientists and policy makers (Sobrevila 2008; Aswani et al. 2018; Abukari and Mwalyos 2020).

Local ecological knowledge plays a vital role in ecological monitoring by providing early warning signs of ecosystem change and is valuable in validating scientific hypotheses and suggesting new research directions. It entails detailed observations of population ecology and species interactions, which arise from long-term association with a particular flora and fauna (Kimmerer 2002; Cebria´n-Piqueras et al. 2020; Haq et al. 2023). Therefore, including communities' traditional knowledge should be the starting point in any wildlife management endeavor because this knowledge is useful

to improve management system and to make wildlife conservation more participatory (Bajracharya et al. 2007; He S et al. 2020).

Attitude is either a positive or a negative response towards one or more stimuli or a rational evaluation of a particular entity, which reflects the beliefs or possible conduct and behavior that people hold about certain activities such as wildlife conservation (Karanth et al. 2008; Bragg and Reser 2012). Attitude can also relate to the point of views of communities about the benefits and problems they associate with the wildlife conservation and socio-economic variables (Redford and Stearman 1993; Ochieng et al. 2021; Duan et al. 2022; Legese 2024). Attitude is understood to be the major antecedent of people's behavior in relation to designing proper strategies and policies that can address local residents' needs and expectations and can be explored by further asking the indigenous people whether they like or dislike the conservation activities (Allendorf 2010; Tesfaye 2017).

Understanding and documentation of existing local people's attitudes towards wildlife management are needed to address the wildlife conservation problems such as resource over exploitation and human-wildlife conflict and play a major role in the success of wildlife conservation (Charnley et al. 2007; Mogomotsi et al. 2020). Involving local communities in conservation activities often reduces conflict between local communities and conservation authorities (Holmes 2013; Ochieng et al. 2021). Participation of the local people can prevent problems such as increased illegal hunting, habitat encroachment or destruction, violence and would help to identify what kind of programs would facilitate the participation of people and to develop community-based conservation (Pimbert and Pretty 1997; Angwenyi et al. 2021). Previous studies have indicated that local communities around protected areas received less benefit from the wildlife conservation and poorly participated in management of protected areas (Bauer 2003, Gandiwal et al. 2014, Mekonen et al. 2017, Abukari and Mwalyosi 2018, Abukari and Mwalyosi 2019, Kegamba et al. 2022). Over decades this approach has been tested and proved to be ineffective for sustainable wildlife conservation. On the other hand, some studies have pointed out that active community participation in protected area management incorporating their traditional knowledge handed down through generations have promoted sense of ownership and positive attitude towards wildlife conservation (Epandaa et al. 2019; Park et al. 2020; Sinthumule and Mashau 2020; Ochieng et al. 2021; Werdel et al. 2024).

In developing countries, like Ethiopia, indigenous ecological knowledge is important because 85% of the people depend on natural resources which are found in wild areas for economic development and food security (Abebe et al. 2011; Wassie 2020; Kidane and Kejela 2021). Recently, conservation agencies in Ethiopia have begun to recognize the importance of incorporating local people's attitude in wildlife conservation, although in most conservation areas, limited efforts have been made to involve local people in wildlife management (Nishizaki 2005). Few studies have been conducted in Ethiopia to explore the opportunities and challenges of participatory wildlife conservation with emphasis on traditional knowledge and attitude towards wildlife conservation (Kumssa and Bekele 2014; Biru et al. 2017; Mekonen et al. 2017). However, considering the wildlife resources, topographic, agro climatic and socio-economic diversity in Ethiopia, more studies have to be carried out in different parts of the country. As a result, there is a need to document the local community indigenous knowledge and attitude towards wildlife conservation in different parts of the country to develop sustainable national wildlife conservation.

Fragmented Forest of the Geremba Mountain is an area with vegetation characteristics of remnant dry evergreen Afro-montane Forest in the lower altitudes, dominated by alpine bamboo in the middle altitudes and sparsely covered by Erica scrubland in the higher altitudes (Getachew 2019). The mountain is a home for diverse large wild mammals and birds including the endemic Menelik bushbuck and Bale Monkey (Jemal 2018; Worku and Girma, 2020). The area is mainly managed by the district environment and forest office with some participation of the local communities. Despite the fact that the area is home for diverse wildlife species, it is surrounded by human dominated landscape often encroaching in to the locations of wildlife habitat. However, there is no study that attempted to explore the traditional knowledge of the local communities and other actors that determine attitude of the local people towards wildlife conservation. Hence, this study investigates the existing indigenous knowledge and factors that affect the attitude of local communities towards promotion of sustainable wildlife (mostly large wild mammals) conservation in the study area.

2 Materials and methods

2.1 Description of the study area

Fragmented Forest of the Geremba Mountain is located in Arbegona district which is one of the 31 districts of the Sidama National Regional State of Ethiopia. It is located 74 km and 349 km from Hawassa (the capital city of the Sidana Region) and Addis Ababa, respectively. Geographically, Arbegona is situated between 6°38' to 6°49 ' N and 38°34' to 38°49' E (Figure 1).

Arbegona district is found in the southern two agro-ecological zones namely; Dega (86%) Ethiopia highland and mainly characterized by and Woyna Dega (14%) (Abel et al. 2016). The Annual rainfall ranges between 1250 to 1300 millimeter per year (Worku and Girma 2020) and the temperature ranges between 14 to 18 °C. The altitude extends from 2200-3336 m above sea level (Worku and Girma 2020).

The vegetation of the area is characterized by dry ever green Afromontane Forest with dominant plant species such as Erica arborea, Yushania alpina and Hagenia abyssinica (Getachew 2019). A total of 10 species of large wild mammals that included two endemic species (Chlorocebus djamdjamensis, Tragelaphus scriptus meneliki), Panthera pardus, Canis aureus, Crocuta crocuta, Felis serval, Papio anubis, Sylvicapra grimmia, Hystrix cristata and Orycteropus afer were documented in the area (Worku and Girma 2020). A total of 74 species of birds were found in the area (Jemal 2018).

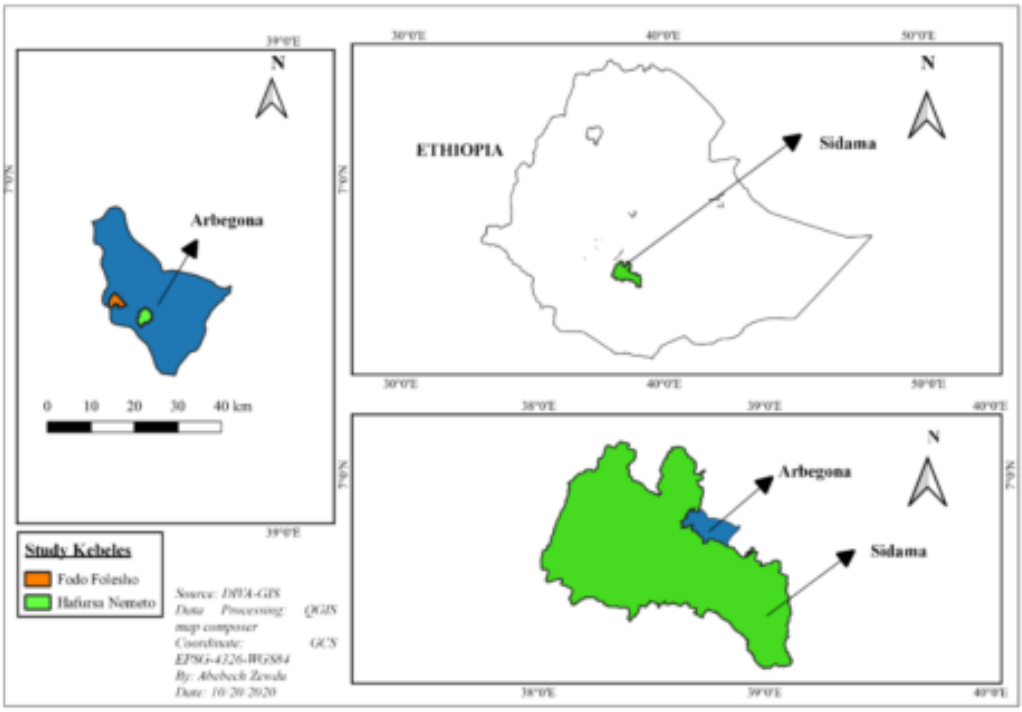

Figure 1: Location map of the study area.

Among the documented species, Wattled ibis (Bostrychia carunculata), Thick billed raven (Corvus crassirostris), Alpine chat (Cercomela sordida), Black winged love bird (Agapornis taranta) and Rouget's Rail (Rougetius rougetii) were endemic to Ethiopia and Eritrea (Jemal 2018).

Arbegona district has one urban and 38 rural kebeles (kebele is the lowest administration unit in Ethiopia). The economic activity of the district is mainly agriculture and rearing farm animals and cultivation of land. The majority of the community members practice mixed subsistence agriculture, and the study area receives substantial rainfall. There was a very low risk of crop loss (Quinlan et al. 2015) in the study area. Crops cultivated in the district are maize (Zea mays), wheat (Triticum aestivum), enset (Ensete ventricosum), barley (Hordeum vulgare), pea (Pisum sativum) and bean (Phaseolus vulgaris) (AWTCO 2003).

Fragmented Forest of the Geremba Mountain (i.e. Geramba Community Conservation Area) is home for unique flora and fauna adapted to high altitudes (Gezahagen et al. 2024). It also serves as a watershed, as it is a source of different rivers in Sidama National Regional State. There are more than 100 natural water springs within the mountain (AWTCO 2003). The natural beauty and biodiversity of Geremba Community Conservation Area make it an ideal destination for ecotourism.

2.2 Reconnaissance survey

We carried out a reconnaissance survey to be familiarized with local community life style, to know the area better, to understand the biophysical and socioeconomic characteristics of the study area as well as to gain understanding about the forest resource and wildlife conditions of the study area.

2.2.1 Sampling technique and sample size determination

Two study kebeles namely; Fidefolisho and Hafursa-Nemeto surrounding the community conservation areas were selected purposively based on the wildlife resource availability (the area is home for unique flora and fauna including Bale Monkey) and presence of wildlife human interactions (there are evidences of human-wildlife conflicts through crop-production and livestock harm and reactive killings of wildlife species) (Jemal, 2018; Worku and Girma 2020; Fekadu et al., 2022). The sample size was determined by using the formula developed by Yamane (1967).

$$n = \frac{N}{1 + N(e)^2}$$

Where, n = number of sample size, N = total number of population, e = is the level of precision for this study (9% precision was used). Using the formula above, 108 respondents/households were determined from the total number of 846 households in the two kebeles. Following the total number of households, the total number of respondents in each kebele was proportionally calculated (46 households in Fidefolisho and 62 in Hafursa-Nemeto).

Snowball selection method was used to identify the key informants

(Bernard 2002). From each kebele, we randomly selected five individual farmers and who were requested to provide us with names of 3 key informants (elderly people who have a good knowledge of community, wildlife relations and long histories of the area). Accordingly, a total of 15 key informants were nominated in each kebele, but the top ranking 5 key informants were selected in each kebele. In addition, 4 key informants were purposively selected from Arbegona district environmental protection office. Overall, a total of 14 respondents; 10 key informants from the two kebeles were selected. Two focus group discussions (one in each keble) were also carried out. A total of seven discussants comprising kebele officials, youth, women, wildlife professionals and religious/cultural leaders participated in the discussion (Krueger and Casey 2002).

2.3 Data collection

Quantitative (household survey) and qualitative (key informant interview and focus group discussion) data collection methods were used to collect data from the total of 108 households using structured questionnaire surveys that was conducted between December 2017 and January 2018. In the context of this study household includes one or more persons living together under the same roof or several roofs within the same dwelling that share common resources. The household heads were targeted as respondents. The household survey employed both closed and open-ended questionnaires. The questionnaire was prepared in English and translated into local language 'Sidamu Afu'.

A trial survey was conducted to test the household questionnaires' survey for clarity and understandability. We tested the questionnaire survey by interviewing 10 respondents (5 from each kebele) randomly selected and the trial survey feedback was used to improve the clarity and understandability of the questionnaire. The household survey was administered with close assistance of 2 local interviewers (enumerators) in each kebele that received secondary education and fluently speak the local language and Amharic, the national language of Ethiopia. The researchers could speak and write Amharic and English. Two days of training was given for the enumerators on how to administer the interview and collect data. The questionnaire was divided into four general parts: (1) household characteristics (gender, age family size, level of education, marital status, and migration status; (2) income and natural resource use questions (3) attitude of local community and (4) traditional knowledge of local community about wildlife conservation.

Community attitudes towards wildlife conservation was defined as human psychological tendencies to favor or disfavor in this case, agree or disagree to the statements given (Ajzen and Fishbein 1980; Abukari and Mwalyosi 2018). Focus group discussions were carried out to supplement and verify the data collected from the household interviews. Through the focus group discussion, in-depth information was extracted on the attitude of peoples towards wildlife conservation and the local knowledge of the local people during the discussion with knowledgeable elders, district agriculture and wildlife experts and kebele leaders.

Key informants' interviews were conducted after household interview and focused group discussion for triangulation of data obtained in household survey and focus group discussion. Issues that could be raised during focus group discussion such as dishonesty, which could lead to lack of in-depth answers about issues that would have been too sensitive or divisive, were addressed during the key informant interviews. The key informants' interview also targeted at exploring further information not addressed through the household survey. The interviews focused on obtaining information about traditional and ecological knowledge on wildlife conservation attitude towards wildlife conservation, status of human–wildlife conflict and their traditional mitigation measures. Information from key informant's interview was obtained using a pre-prepared checklist of open-ended questions.

2.4 Data analysis

The data were entered in Microsoft Excel spreadsheet 2013 and exported into SPSS version 21.0. Demographic characteristics of respondents were summarized using descriptive statistics. The findings from the key informant interviews and focus group discussions were analyzed using qualitative analysis methods. Likert scale was used to measure the attitude of the local community towards wildlife conservation (Likert 1932). In this study, the Likert scale was limited to three points because it is most frequently used in African contexts (where 1 = disagree, 2 = neutral, and 3 = agree) (Bless and Higson-Smith 2000). A multicollinearity assessment was also performed among the predictor variables, and it was found that intercorrelation levels were appropriate for analysis (mean Variance Inflation Factor ¡ 1.22) by calculating the variance inflation factors (VIFs), where (VIFs ¡ 5) implies the absence of collinearity (Akinwande et al. 2015).

Logistic regression analysis was carried out to determine which demographic variables such as gender, age, and level of education helped to explain why some respondents held a positive attitude and others held a negative attitude towards wildlife conservation in the community conservation area as depicted in the model.

The model is represented as:

$$P = \frac{e^{-}}{1 + e^{-}} \quad \text{(Equation 2)}$$

Where, P = Probability of an individual saying 'no' (zero = unwilling) or 'yes' (1 = willing) for the statement wildlife conservation is important (the dependent variable). The assumption in this model is that the probability that an individual supports wildlife conservation is independent of their demographic and socio-economic characteristics, i.e.,

$$\ln\left(\frac{P_i}{1 - P_i}\right) = \beta_0 + \beta_1 X_1 + \cdots + \beta_k X_{ki} \quad \text{(Equation 3)}$$

Where: i denotes the i^{th} observation in the sample; P is the probability of supporting wildlife conservation is important. β_0 is the intercept term, $\beta_1 \ldots \beta_k$ are the coefficients associated with each explanatory variable $X_1 \ldots X_k$ (Scott and Willits 1994; Hosmer and Leme 2000). The independent variables that affect attitude are described in Table 1 below.

3 Results

3.1 Demographic and socioeconomic characteristics of the respondents

Out of a total of 108 respondents, 91 were males (84.3%) and 17 (15.7%) were females. In those households represented by females, females are the heads of the households. Among the respondents, 86 (79.6%) didn't go to school, while 22 (20.4%) received formal education. 106 (98.1%) of the respondents were predominantly farmers by occupation. The fact that respondents were mainly farmers might have a direct impact on the local communities' attitude towards wildlife conservation due to the fact that their livelihood is entirely dependent on subsistence agriculture, which is influenced by human-wildlife interactions. Likewise, nearly all (105, 97.2%) of the respondents were born in the area and spent their life there, while only 3 (2.8%) respondents lived in the area for 11-15 years. As residents stay longer in the area, they have the opportunity of developing more knowledge and skills on traditional ecological knowledge since they are closer to the wildlife resources and their interactions with humans.

3.2 Income and forest resource utilization

Greater than 96% of respondents' income was from mixed agriculture (crop cultivation and livestock rearing), whereas crop cultivation only (0.9%), trade (0.9%), and civil servant or employment (1.9%) contributed as sources of income for few respondents. In both kebeles, all respondents had their own grazing area for their livestock. The local community perceived that the community conservation area renders the following ecosystem services in order of importance; fresh air and water, grass for livestock, firewood, shade, construction material, and honeybee and wild fruits (Table 1).

3.3 Knowledge of local community towards wildlife conservation

The respondents could list names of mammal species in the community conservation areas and around their settlement areas. The number of species listed was used as an indicator of knowledge about wildlife. The number of listed wild animals ranged from 3 to 9 with a mean of 5.0 ($\pm$0.12). The majority (83.3%) of respondents were able to list the names of more than 4 wildlife species correctly (Fig. 2). Respondents use color, size, sound, footprint, and bite mark or feed leftovers to identify wildlife species. About 5% of respondents stated only animals' color and size help them to identify species, 17.6% use color, and 77.8% use color, sound, and size combined. Eighty-seven percent of respondents reported a change in wildlife species abundance over the last decade.

The majority of the respondents (89.4%) perceived the values of wildlife conservation. The reported values of wildlife conservation in the community conservation area as perceived by respondents were economic, ethical, medicinal, nutritional, aesthetic, bequest, and option values. Option value, economic value, ethical value, and medicinal values were the top four ranked (66.6%) values of wildlife conservation in the area. The key informants (elderly and traditional healers) mentioned that spotted hyena dropping is used for an anti-abortion remedy for domestic animals. Dried meat of crested porcupine (Hystrix cristata) is said to be used for the cure of lung disease of cattle and humans. More than half (61.1%) of the respondents had traditional knowledge of controlling crop raiders and livestock depredators. Around the community conservation area, most of the crop damage was caused by crested porcupine (Hystrix cristata) and common duiker (Sylvicapra grimmia). The focus group discussion revealed that the local people employed species-specific traditional wildlife damage mitigation methods. For instance, burn horn of cow to prevent porcupine damage as an odor repellent, fence crop land, construct watch out towers in the crop land as a protective measure against most crop raiders. Other crop raiding measures include the use of sound-making materials, put visual signs inside the crop field to scare away the animals, plant thorny plants, spray sheep and goats' pea to some crops, and spray soap and gas in the crop fields so that animals may assume there is a human being standing around.

3.4 Attitude of local community towards wildlife conservation

Greater than 93.5% of the respondents agreed that poachers should be punished. A great number of respondents (91.7%) felt an increase in wild animals' number is important for the future generation. Others stated that it is important to protect and conserve wildlife because these wild animals are endangered in the wild and they could face extinction (Table 2). On average, the majority of respondents (84%) expressed a positive view of wildlife conservation despite incurring significant costs in terms of livestock and crop losses from wild animals (Table 2).

Although local people had a positive attitude, 96% of households experienced crop damage and livestock depredation. Crested porcupine was the most frequently mentioned species (84.3%) that caused damage to crops and vegetables, followed by common duiker (51.9%). Baboons and monkeys also caused considerable damage to crops.

Table 1: Descriptions of independent variables used in the model.

Variable	Type	Categories/Details	Expected signs/remarks
Age of respondent	Continuous	Youth (18-24), Adult (25-64) and Elderly (>65)	Positive
Family size of household	Continuous	Few (4 to 7), Moderate (7 to 12) and large (above 12)	Negative
Total land holding size of respondent	Continuous	small (¡1 hectar), Moderate (1 to 2 hectares), large (¿3 hectares)	Positive
Distance from the forest	Continuous	near (¡1 km), moderate (1 to 3km), far (¿3km)	Positive
Tropical livestock unit	Continuous	Few(¡10), moderate (10-30), large (¿30)	Negative
Gender of respondents	Dummy	Male (0), Female (1)	Positive towards male
Educational level of respondent	Categorical	Illiterate (0), Literate (1)	Positive
Benefits from forest resources	Categorical	No (0), Yes (1)	Positive
Incidence of human-wildlife conflict	Categorical	No (0), Yes (1)	Negative
Knowledge about wildlife conservation	Categorical	No (0), Yes (1)	Positive

Table 2: Local communities' view on ecosystem services obtained from fragmented forest of Geremba Mountain.

Kebele	n	Grass for livestock	Honeybee and wild fruits	Shade	Construction material	Firewood	Clean air and water
Fide Folisho	46	30.4	4.3	28.3	23.9	26.1	63
Hafursa Nemeto	62	29	16.1	24.2	14.5	30.6	35.5
Total		59.4	20.4	52.5	38.4	56.7	95.5

3.5 Factors affecting attitude of local community towards wildlife conservation

Binary Logistic regression analysis indicated that educational status ($p = 0.05$), age ($p = 0.01$), and traditional knowledge ($p = 0.010$) were significant variables in explaining the attitude of the local community towards wildlife conservation. Age and traditional knowledge were the strongest variables influencing the attitudes of local people. However, variables like gender, family size, land holding size, length of residence, distance from the forest, conflict, benefits from the forest, and TLU were not significant variables (Table 3).

4 Discussion

4.1 Traditional ecological knowledge of local community towards wildlife conservation

Local ecological knowledge is important for sustainable natural resource management. Various studies have pointed out the importance of local ecological knowledge for participatory decision-making of natural resource management (Asah et al. 2014; de Freitas et al. 2015; Boafo et al. 2016; Cummings and Read 2016; Gouwakinnou et al. 2019; Cebria´n-Piqueras et al. 2020; Cronkleton et al. 2021; Haq et al. 2023). The results of the study have indicated that respondents demonstrated good knowledge of ecosystem services that Geremba Mountain renders. The respondents recognized the area's several ecosystems' services. First and foremost, the fresh air provided by the natural surroundings contributes to a healthier environment, enhancing overall well-being. The lush grass in the area serves as grazing land for livestock.

Additionally, the availability of firewood is crucial for many households, as it is a primary energy source for cooking and heating. This reliance on local resources fosters a sense of resource availability in their surroundings, as families can gather firewood without the need for extensive travel. Together, these elements underscore the area's value, highlighting its role in supporting both the daily lives and cultural practices of the respondents. This community awareness about the values of wildlife conservation can be an important input for wildlife managers to promote the sustainable conservation of wildlife resources (Calfukura 2018; Song et al. 2021). The local communities were also very familiar with wildlife species in the area and could identify those using scientific taxonomic features such as size and color. Studies have revealed that local communities are traditionally wildlife ecologists who could assist professionals during scientific species identification in the field (Brooks et al. 2008; Padmanaba et al. 2013; Stern and Humphries 2022; Werdel et al. 2024).

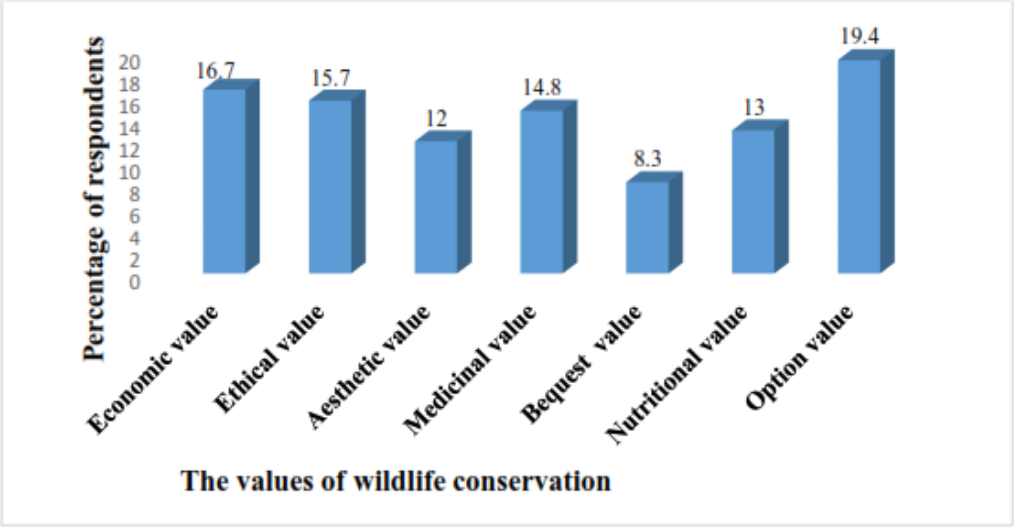

Figure 2: The values of wildlife conservation in Geremba mountain forest fragment

Table 3: Respondent views on wildlife conservation (percentages)

Statements/views	Likert scale category		
	Agree	Undecided	Disagree
Conservation of Wildlife is important for ecosystem health	88.0	8.3	3.7
Wild animals are important for the community	56.5	17.6	25.9
Wild animals should be managed well in your area because they are becoming more endangered	90.7	0	9.3
Current generation should take responsibility for increasing wildlife populations for the sake of future generations	91.7	0	8.3
People who poach should be punished	93.5	0	6.5

The respondents also perceived well the values of wildlife conservation such as economic, ethical, medicinal, and future values of conserving wildlife. This indicates that the community has a good understanding of the values of wildlife conservation that is advocated by wildlife managers. This, in turn, greatly helps to design a more participatory approach to wildlife conservation in the area. In participatory wildlife conservation, the community role is central, and the community participates in all regards of wildlife management, including actively involving in decision-making (Abukari and Mwalyosi 2018; Dawson et al. 2021; Werdel et al. 2024). Many authors contemplated that community-based wildlife conservation is the most promising approach to modern wildlife management (Songorwa et al. 2000; Holmes 2013; Abukari and Mwalyosi 2019; Gouwakinnou et al. 2019; Ochieng et al. 2021). The traditional medicinal applications of these animals, as highlighted by the respondents, also pave the way for more in-depth exploration of indigenous knowledge regarding their contributions to wildlife conservation (Abebe et al. 2022). This might also be a good tip for sustainable conservation of the wildlife resource in the area (Kendie et al. 2018).

However, the respondents have agreed that some wildlife species such as spotted hyena, crested porcupine, olive baboon, and grivet monkey have caused crop damage. The community might not be tolerant to crop raiders and livestock depredators as the number increases and the problem intensifies (Tufa et al. 2018; Nuili et al. 2019). This interaction can lead to escalated human-wildlife conflict that, in turn, poses retaliatory killing of animals and wildlife habitat destruction. As a result, there must be mitigation measures to promote human-wildlife coexistence sustainably (Biset et al. 2019; Epandaa et al. 2019; Ochieng et al., 2021). For example, the community has some traditional mitigation measures against these damages such as fencing, guarding, and the use of different repellents. Therefore, it is essential to incorporate these traditional mitigation strategies into contemporary human-wildlife conflict management techniques to minimize damage and foster positive perceptions within the local community (Tufa et al. 2018). Similar studies elsewhere have demonstrated that human-wildlife conflict is among the top-ranking factors that negatively affect local people's attitude towards wildlife conservation and sound mitigation measures (Graham et al. 2005; Hariohay and Roskaft 2015; Tufa et al. 2018; Biset et al. 2019; Mekonen 2020).

4.2 Factors affecting attitude of local community towards wildlife conservation

The logistic regression analysis revealed that age, education and traditional knowledge about wildlife conservation significantly affect respondents' attitude towards wildlife conservation. The impor-

Table 4: Binary logistic regression analysis results of the relationship between demographic and socio-economic factors that influence the attitude of the local community in fragmented Forest of Geremba Mountain.

Independent Variables	B	SE	Sig.
Gender	-0.04	0.15	0.78
Age	-0.44	0.17	**0.01***
Education level	1.05	0.54	**0.05***
Family size	0.26	0.34	0.44
Length of residence	-0.24	0.47	0.61
Distance from forest	0.23	0.31	0.41
Conflict	-0.69	0.73	0.34
Land holding size	0.26	0.41	0.52
TLU	0.08	0.091	0.33
Traditional knowledge	2.38	0.923	**0.01***
Benefits from the forest	0.01	0.26	0.98

tance of education and awareness creations programs for prompting positive attitude towards wildlife conservation among local community have been reported by many authors (Kideghesho et al 2007; Gandiwa et al. 2014; Biru et al. 2017; Ardoina et al. 2020). Education and traditional knowledge about wildlife conservation increased positive attitude, whereas age inversely favored positive attitude (older respondents demonstrated negative view than younger ones). The observed less interest of old people in wildlife conservation could be related to the limited education that old people received. Furthermore, old people may know the historic damage of wildlife to crops and livestock, which was rarely recognized and compensated. Awareness creation is very important tool in wildlife conservation to promote positive attitude towards wildlife conservation (Browne-Nuñez and Jonker 2008; Wu et al. 2020; Legese, 2024). Higher level of education could create the opportunity for better knowledge towards the environment in general and wildlife resources in particular. Hence, those people with higher level education have better knowledge on wildlife conservation (Biru et al. 2017; Mekonen, 2020). Furthermore, information on importance of wildlife conservation can be acquired through awareness campaigns organized by local wildlife/natural resource professionals (Browne- Nuñez and Jonker 2008; Tufa et al. 2018; Umar and Kapembwa 2020). However, the negative attitude of respondents towards wildlife conservation among older age respondents, unlike some studies (e.g. Ochieng et al. 2021) is mainly due to lack of formal education and not able to perceive well the awareness campaign effort made in the area.

5 Conclusion

Form the results of the study it can be concluded that the local communities have some indigenous knowledge and awareness about wildlife and wildlife conservation. This in turn has created a positive attitude towards wildlife conservation. However, the results at the meantime pointed out that there were some incidences of human-wildlife conflict that might cause economic loss in the long run and jeopardize the attitude of the local people towards wildlife conservation. The study has also clearly revealed the importance of education and awareness creation for sustainable wildlife conservation.

Traditional human-wildlife conflict mitigation schemes such as guarding and fencing crops, deterring wildlife species. In addition, modern approaches towards mitigating human-wildlife conflicts such as buffer zone management and modern livestock husbandry practices that avoid free grazing of livestock should be implemented. To maintain a positive attitude towards wildlife conservation among local communities, human-wildlife conflict incidences should be mitigated in a sustainable manner. Awareness creation programs by local relevant government should be strengthened well and in-reach all community members through community workshops and with partnerships with local schools.

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