

Knowledge, Attitudes and Practices of Locals towards Greater Kudu (*Tragelaphus strepsiceros*, Pallas, 1766) Conservation in Lake Bogoria Landscape, Kenya

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Abstract

Several interventions have been suggested for averting and reducing wildlife declines including; securing dispersal areas and migratory corridors, strengthening and investing in local communities and landowners to create and develop community and private wildlife conservancies, and diversification of rural livelihoods through benefits from ecosystem services. Greater Kudu endemic to the Lake Bogoria landscape in Kenya is categorized as vulnerable to extinction due to unsustainable exploitation and management of resources although the continued economic importance of the Greater Kudu in the Lake Bogoria landscape is its best defense. A cross-sectional survey was conducted to analyze the status of knowledge, attitudes and practices (KAP) of locals towards the conservation of the Greater Kudu in the landscape. The survey was conducted using a semi-structured pre-tested questionnaire administered to target populations (N = 137 households). Face-to-face interviews of key informants (KI) and focus group discussions (FGDs) were also carried out. It was found that 84% of KAP respondents agreed that the landscape is rich with biodiversity while 77% of them agreed that conservation of the ecosystem is important for rural livelihoods. Further, 73% of KAP respondents agreed that the extinction of Greater Kudu in the Lake Bogoria landscape may lead to poverty. It is recommended that all-inclusive adaptive management and conservation strategies should embrace continuous monitoring, and understanding dispersal of Greater Kudu to ensure its survival, in the landscape for improved livelihoods.

Keywords

Knowledge, Attitudes and Practices Survey, Greater Kudu, Conservation,

Lake Bogoria Landscape

1. Introduction

Despite the fact that climate change is a growing threat, the main drivers of biodiversity decline continue to be overexploitation of species, agriculture and land use/cover change [1] [2]. Several interventions have been suggested for averting and reducing wildlife declines notably; securing dispersal areas and migratory corridors, strengthening and investing in local communities and landowners to create and develop community and private wildlife conservancies, and diversification of rural livelihoods through benefiting from ecosystem services, among others [3]. Local communities are increasingly recognized as stewards of their own environment, hence the increasing recognition of Community Based Natural Resource Management (CBNRM) which is dependent on the local context in which it operates, in particular, governance capacities; resource conditions; and local societies [4].

Previous studies in South Africa showed that wildlife in private and community sanctuaries were stable or increasing in contrast to the declines in protected areas and country-wide [5] [6]. Decades later, another study suggested that parks associated with community and private conservation initiatives do better than parks with no outreach programs [7]. Lately, Africa's designated protected areas and biodiversity hotspots are under threat, hence the importance of embracing proposed community participation through innovative strategies such as the integration of a wide range of species in the production landscape including the farming community for the conservation of Africa's mammals [8]. However, one of the greatest challenges facing environmental conservation is to balance human needs with the needs of the environment. Environmental conservation programs attempt to halt this disconnect between humans and nature by influencing the level of knowledge, attitudes and practices (KAP).

Therefore, the knowledge, attitudes, and practices (KAP) survey is a framework used to conduct representative studies on specific populations and focuses on investigating what humans know and feel about a topic as well as their associated actions [9]. KAPs can be used to gauge public knowledge and perception of threatened and exploited species, as well as the communities' current actions and willingness to act in favour of these outcomes. In matters related to environmental conservation, KAP framework is applicable to conservation and management studies as well as informing policy decisions. Respondents who are well informed on sustainability tend to have a positive attitude towards conservation [10]. Markedly, in a study to investigate KAP of locals towards carnivore coexistence with humans in a human-dominated landscape of southern Ethiopia, it was found that respondents who had better knowledge of carnivores also showed a positive attitude towards carnivores [11]. This was affirmed in a study in Sekong, Sesan, and Srepok (3S) Rivers, in South East Asia, where a KAP sur-

vey was conducted on a community-based conservation program that had been implemented to protect threatened water birds by utilizing direct payments to local communities for bird nest protection. It was also found that water bird populations increased and threats decreased as a result of the incentivized program [12].

In the last two decades, Kudus overhunting and habitat loss in northern Africa were found to have been counterbalanced by the management of the species in other areas [13]. However, the community wildlife department of Kenya Wildlife Service mostly focuses on community benefit and conflict resolution mechanisms, with less emphasis on knowledge and awareness creation programs [10] [14]. Greater Kudu at Lake Bogoria landscape in Kenya is vulnerable due to unsustainable exploitation and management of resources associated with poverty, poor land use, overstocking and unsustainable farming systems although the continued economic importance of the Greater Kudu in Lake Bogoria landscape is its best defense.

Therefore, the Lake Bogoria Integrated Management Plan (IMP), Friends of Nature Bogoria (FONB) and the Small Grants Programme (SGP) through Global Environment Facility (GEF) in partnership with Kenya Organic Agricultural Network (KOAN) and Egerton University provided a thrust for conservation of Greater Kudu in the landscape by working with local community conservancies and financing establishment of Greater Kudu monitoring transect lines. It is against this background that this study seeks to investigate factors affecting the knowledge, attitude, and practice of locals towards conservation of Greater Kudu in Lake Bogoria landscape. The findings generated contributes to Kudu conservation awareness programs and policy development for the sustainable production system in the landscape and improved livelihoods.

2. Methodology

2.1. Study Area

Lake Bogoria National Game Reserve lies between 0°20' North and about 10km North of the equator and 36°4' and 36°7' East in Baringo County. It has an altitude between 970 m a.s.l at the lake to 1650 m a.s.l on the Siracho escarpment. The Reserve lies close to the eastern wall of the Great Rift Valley and has its headquarters at Lobo Gate. Lake Bogoria National Reserve was gazetted as a wildlife protected area, via legal notice number 270 of 01/11/1970; and is found in boundary plan 216/26 delineating a total area of 107 km² [15] [16].

The climate in the study area is arid to semi-arid regimes except in the moist highlands around Subukia. The climatic conditions are strongly influenced by the ITCZ (Inter Tropical Convergence Zone) and there are two distinct wet and dry seasons. Within the reserve and adjacent areas, the climatic conditions are harsh with temperatures at the Lake ranging from 18°C - 39°C with a daily mean of 25°C. Mean annual precipitation varies from 500 - 1000 mm and falls in two seasons April-May and October-November. The physiographic location of the reserve places it in the rain shadow of the surrounding fault scarps and highlands. The combination of weather variables and physiographic location give the

lake basin a hot, semi-arid climate.

According to the population and housing census conducted in 2019, the population of Baringo County was 666,763 (Figure 1). The Population in the County shows a constant positive trend. The landscape spreads to six locations in Baringo County—three in Mogotio (Baringo South) Sub-county namely; Koibos, Sinende and Kamar and three in Marigat Sub-county namely; Lobo, Kapkuikui and Sandai.

2.2. Research Design

Knowledge, attitudes and practices (KAP) cross-sectional survey was conducted using a semi-structured questionnaire administered to target populations (137 households) to analyze knowledge, attitude and practice (KAP) of local resource users towards conservation of the Greater Kudu in the study area. Face-to-face interviews of key informants (KI) guided by KI questionnaires and focus group discussions (FGDs) using FGD schedule were also carried out. The clusters for the study area were the six locations/wards (Koibos, Sinende, Kamar, Lobo, Kapkuikui and Sandai). Multi-stage systematic sampling procedure was applied. At a given interval, every *n*th household was selected after randomly selecting the first *n*th element as the starting point. The sampling interval was calculated by dividing the cluster population size by the desired sample size.

2.3. KAP Survey Data Collection

Conducting focus group discussions along with face-to-face interviews were used to assess participants' knowledge, attitudes, and practices. A cross-sectional survey using pre-designed and pre-tested questionnaires was conducted. The questionnaires were divided into two main sections. Section one entailed personal details of respondents while section two contained knowledge, attitudes and practices questions of locals towards Greater Kudu management and conservation. The reliability coefficient (Cronbach's alpha) ranges from 0 to 1, with 0 representing an instrument full of error and 1 representing total absence of error. A reliability

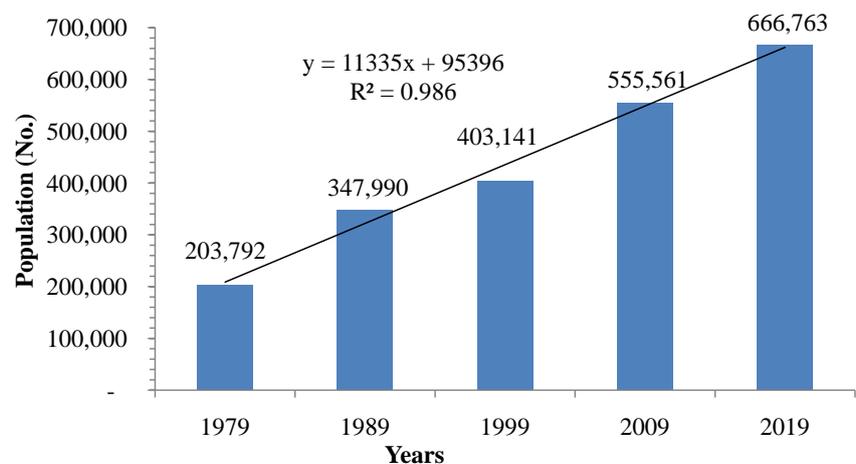


Figure 1. Baringo county population trends (Source: Kenya National Bureau of Statistics, 2019).

coefficient (alpha) of 0.7 or higher was considered acceptable reliability [17] [18]. For the pilot of this study, a reliability coefficient (alpha) of 0.76 was obtained.

3. Results

This section highlights background information of respondents of respondents by use of descriptive statistics (**Table 1**). From the survey, 60% respondents were male and majority of the respondents (65%) were aged between 31 to 50 years. It was also found that 45% of the respondents earned < KES 10,000 while 47% of the respondents were practicing crops farming and a similar percentage of the respondents were keeping livestock. Majority of the respondents (48%) had household size of between 5 and 10 persons. Although 98% of the respondents are land owners, 48% of the land owners have legal document (land title deeds). It was noted that 61% of the respondents belong to a conservancy group.

Table 1. Frequency of background information of respondents.

| Background information | Description | Frequency (%) |
|---|---------------------|---------------|
| <i>Gender</i> | Male | 60 |
| | Female | 40 |
| <i>Age (Years)</i> | <20 | 3 |
| | 20 - 30 | 37 |
| | 31 - 50 | 45 |
| | >50 | 15 |
| <i>Monthly Income</i> | <KES 10,000 | 45 |
| | KES 10,001 - 15,000 | 18 |
| | KES 15,001 - 20,000 | 21 |
| | >KES 20,000 | 16 |
| <i>Economic Activity</i> | Crop farming | 47 |
| | Livestock keeping | 47 |
| | Apiculture | 4 |
| | Others | 2 |
| <i>Household size</i> | <5 | 44 |
| | 5 - 10 | 48 |
| | >10 | 8 |
| <i>Land ownership</i> | Yes | 92 |
| | No | 8 |
| <i>Respondents with land title deed</i> | Yes | 48 |
| | No | 52 |
| <i>Membership to conservancy group</i> | Yes | 61 |
| | No | 39 |

3.1. Knowledge Statements towards Conservation

Responses on knowledge statements towards conservation were assessed using a 5 Likert scale coded as 1: True (strongly agree); 2: True to some extent (agree); 3: Neutral/not sure whether True or False (undecided/neutral); 4: False to some extent (disagree); and 5: False (strongly disagree). Summary of the findings is presented in **Table 2**.

3.2. Attitude Statements towards Ecosystem Conservation

Responses on attitude statements towards conservation were assessed using a 5 Likert scale coded as 1: Highly positive attitude towards conservation (strongly agree); 2: Moderately positive attitude towards conservation (agree); 3: Neutral attitude towards conservation (undecided/neutral); 4: Moderately negative attitude towards conservation (disagree); and 5: Highly negative attitude towards conservation (strongly disagree). Summary of the findings is presented in **Table 3**.

3.3. Practices Statements towards Ecosystem Conservation

Responses on practices statements towards conservation were assessed using a 5 Likert scale coded as 1: 100% of the time (always); 2: 71% - 99% of the time (often); 3: 35% - 70% of the time (sometimes); 4: 1% - 34% of the time (rarely); and 5: 0% of the time (never). The research findings showing the resultant means and standard deviations of the practice statements towards ecosystem conservation are presented in **Table 4**.

Table 2. Descriptive statistics of knowledge statements towards Greater Kudu conservation in Lake Bogoria Landscape.

| Knowledge Statements | Strongly Agree (%) | Agree (%) | Mean | Std. Deviation | N |
|--|--------------------|-----------|------|----------------|-----|
| The natural environment of Lake Bogoria landscape has changed over time | 63 | 31 | 1.47 | 0.718 | 137 |
| The amount of rainfall pattern in Bogoria landscape has changed over time | 74 | 23 | 1.31 | 0.615 | 137 |
| Temperature in Bogoria landscape has been increasing over time | 80 | 15 | 1.27 | 0.636 | 137 |
| More than eight (8) wildlife species are found in the Lake Bogoria landscape | 84 | 12 | 1.23 | 0.618 | 137 |
| Population of Greater Kudu in Lake Bogoria landscape is decreasing | 23 | 20 | 3.04 | 1.526 | 137 |
| Human activities is threatening the existence of Greater Kudu in Lake Bogoria landscape | 28 | 42 | 2.39 | 1.358 | 137 |
| Extinction of Greater Kudu in Lake Bogoria landscape leads to poverty | 42 | 31 | 2.23 | 1.467 | 137 |
| Greater Kudu conservation policies in Lake Bogoria landscape exists | 39 | 46 | 1.98 | 1.303 | 137 |
| Awareness creation and training of the local community is important in Greater Kudu conservation | 61 | 34 | 1.47 | 0.687 | 137 |
| Greater Kudu conservation is the responsibility of the Government not the local community | 20 | 12 | 3.34 | 1.472 | 137 |

Table 3. Descriptive statistics of attitude statements towards Greater Kudu conservation in Lake Bogoria Landscape.

| Attitude Statements | Strongly Agree (%) | Agree (%) | Mean | Std. Deviation | N |
|--|--------------------|-----------|------|----------------|-----|
| I consider the conservation of natural ecosystem very important in our community at this time. | 77 | 23 | 1.26 | 0.529 | 137 |
| I believe in the LBNR Integrated Management Plan (IMP). | 45 | 29 | 1.96 | 1.070 | 137 |
| I do not like people who destroy natural ecosystem | 77 | 16 | 1.40 | 0.927 | 137 |
| I think water pollution is a major concern in our community | 59 | 29 | 1.63 | 0.970 | 137 |
| I believe poaching of wildlife should be banned in LBNR. | 74 | 24 | 1.31 | 0.639 | 137 |
| I consider Greater Kudu population stable | 25 | 36 | 2.47 | 1.255 | 137 |
| I support Greater Kudu protection and conservation activities. | 65 | 34 | 1.37 | 0.542 | 137 |
| I think everybody, young and old, should engage in Greater Kudu conservation practices. | 66 | 33 | 1.35 | 0.523 | 137 |
| Community taboos and culture have contributed greatly to the conservation of the Greater Kudu. | 37 | 39 | 2.09 | 1.191 | 137 |
| Baringo County Government is very supportive of Greater Kudu conservation | 37 | 37 | 2.11 | 1.186 | 137 |

Table 4. Descriptive statistics of practice statements towards ecosystem conservation in Lake Bogoria Landscape.

| Practice Statements | Always (%) | Often (%) | Mean | Std. Deviation | N |
|--|------------|-----------|------|----------------|-----|
| I use charcoal in my cooking at home. | 10 | 10 | 3.74 | 1.291 | 137 |
| I use firewood in my cooking at home | 93 | 3 | 1.12 | 0.535 | 137 |
| I practice apiculture (beekeeping for honey) | 53 | 14 | 2.12 | 1.462 | 137 |
| I promote Greater Kudu Conservation for tourism. | 64 | 23 | 1.51 | 0.787 | 137 |
| I practice soil conservation in my farm. | 52 | 26 | 1.80 | 1.001 | 137 |
| I carry out activities that help maintain natural ecosystem | 48 | 34 | 1.78 | 0.929 | 137 |
| I participate in climate change mitigation and adaptation activities. | 47 | 34 | 1.85 | 1.056 | 137 |
| I support environmental conservation guidelines (e.g. no poaching, no dumping, no littering etc.). | 68 | 27 | 1.38 | 0.608 | 137 |
| I participate in voluntary activities to protect or conserve our ecosystem (e.g. cleaning, tree planting, etc.). | 41 | 31 | 2.12 | 1.251 | 137 |
| I read materials on environmental conservation and protection. | 22 | 32 | 2.62 | 1.324 | 137 |

3.4. Analysis KAP of Respondents in Lake Bogoria Landscape

Local resource users play an important role in human-wildlife coexistence and biodiversity conservation. The KAP survey was conducted to determine Human-Greater Kudu coexistence within and/or without the protected areas in Lake Bogoria landscape. A Chi-square test was conducted to evaluate factors affecting respondents' knowledge, attitudes and practices towards Greater Kudu conservation in the study area. It was found that respondent's KAP was influenced by gender, age, monthly income, economic activity engaged in, household size,

land ownership and membership to conservation group(s).

Gender

It was found that more males (52%) than females (29%) of female respondents significantly agreed that Greater Kudu population in the landscape is decreasing ($X^2 = 17.8$, $p = 0.001$) and also majority of males (79%) compared to females (56%) agreed that human activities threaten the existence of Greater Kudu in the study area ($X^2 = 13.4$, $p = 0.009$). It was significantly different ($X^2 = 12.7$, $p = 0.013$) that 82% of male respondents compared to 60% of female counterparts believed in the LBNR Integrated Management Plan (IMP) and 76% of male vis-a-vis 57% of female respondents practice beekeeping ($X^2 = 11.2$, $p = 0.024$). Additionally, more males (87%) than females (72%) participated in climate change mitigation and adaptation activities ($X^2 = 110.1$, $p = 0.039$; $P < 0.05$) and more males (59%) than females (47%) read materials on environmental conservation and protection ($X^2 = 13.7$, $p = 0.008$).

Culturally, females in the study area are responsible for indoor activities such as children up-bringing and cooking, while males are responsible for outdoor activities such as farming and livestock rearing. Women play an important role in managing natural resources like food and animal fodder, water, fuel wood and forests, landscaping and soil conservation both at the family and community level. In Rwanda, land tenure reforms that improved land access for legally married women led to a significant increase in soil conservation investment by female-headed households [19]. In case of biodiversity loss, women and girls are the ones burdened most by the increased time required to obtain necessary resources such as water, fuel wood and medicinal plants, which reduces the time they can spend on income-generating activities and education.

From the survey, males seemed to have had better knowledge of Greater Kudu management and conservation than females. Therefore, it is important to consider gender mainstreaming as a way of enhancing KAP of women and girls to enhance Greater Kudu management and conservation in the landscape. This can be achieved by training more women on the importance of Greater Kudu conservation and empowering them to become trainers in the community. To ensure attitude change and participation of women in conservation activities, the conservancies should enhance women-related enterprises and formation of women's groups as an avenue for women to easily access information.

Age of respondents

The responses on whether rainfall patterns in the landscape had changed over the years varied significantly depending on the age of respondents ($X^2 = 30.1$, $p = 0.003$) where 25% of respondents below 20 years of age were not sure while 100% of those aged > 50 years agreed that rainfall pattern has changed over time. Similarly, it was observed that ($X^2 = 24.0$, $p = 0.021$) whereas 25% of those below 20 years were not aware that the landscape is a home to more than (8) wildlife species, all of those aged > 50 years affirmed awareness of wildlife abundance in the landscape.

It was also found that all respondents below 20 years of age had a highly posi-

tive attitude towards Lake Bogoria Integrated Management Plan compared to 40% of those aged between 20 and 30 years ($X^2 = 29.6$, $p = 0.003$). It was also noted that 75% of the youngest respondents showed a negative attitude towards people who destroy natural ecosystems compared to 98% of the respondents aged between 31 and 50 years ($X^2 = 22.1$, $p = 0.037$). In addition, all the respondents of age below 20 years and those of age between 31 and 50 years of age demonstrated highly positive attitudes that poaching should be banned from the landscape and their commitment to support Greater Kudu protection and conservation activities while 5% of those > 50 years had negative attitude on the same ($X^2 = 17.3$, $p = 0.044$). It was further noted that 50% of those aged below 20 years did not agree that community taboos and culture have contributed to the conservation of the Greater Kudu while 86% of respondents aged > 50 years affirmed that community taboos and culture have contributed to the conservation of the Greater Kudu ($X^2 = 32.6$, $p = 0.001$).

In sharp contrast, all the respondents aged below 20 years used charcoal for cooking while none of those aged > 50 years used charcoal for cooking ($X^2 = 37.7$, $p = 0.000$). In addition, 50% of respondents aged < 20 carry out economic activities that help maintain the natural ecosystem as compared to 91% of those aged > 50 years ($X^2 = 37.7$, $p = 0.000$). Correspondingly, 75% of respondents aged below 20 years participate in climate change mitigation and adaptation activities while 95% of respondents aged of more than 50 years do the same ($X^2 = 26.2$, $p = 0.010$). On the contrary, all the respondents below 20 years of age do support environmental conservation guidelines (e.g. no poaching, no dumping, no littering etc.) as compared to 85% of those between the ages of 31 to 50 years ($X^2 = 30.1$, $p = 0.000$). It was also found that 85% of respondents aged > 50 years participate in voluntary activities to protect or conserve our ecosystem (e.g. cleaning, tree planting, etc.) while 50% of those below 20 participate in voluntary activities ($X^2 = 28.7$, $p = 0.004$).

According to [20] traditional ecological knowledge can shape the process and outcomes of adaptation to climate change because it is a part of social, economic, and cultural systems, and influences individuals' preferences, beliefs, daily practices, perceptions and responses. In most cases, this indigenous ecological knowledge is hardly documented for reference and/or has been particularly ignored in Africa. The findings from this study, the responses of older age groups are based on the fact that long-term rainfall changes and wildlife abundance are reliably observed for more than 40 years. Such observations constitute indigenous ecological knowledge which is critical in identifying localized climate change and associated mitigation measures for ecosystem sustainability. However, lack of a standardized means of passing down this wealth of information is creating an indigenous knowledge gap in the landscape.

The findings also indicated that respondents < 20 (youth) seemed to be more knowledgeable on currently trending environmental conservation affairs although they depicted limited indigenous ecological knowledge on Greater Kudu management and conservation. It is recommended that diversity, equity and in-

clusion (DEI) should be incorporated in Greater Kudu conservation strategies to facilitate the preservation of indigenous ecological knowledge in the study area.

Monthly Income

As defined by Jiao *et al.* [21], environmental income consists of subsistence and cash income from environmental goods, wages from natural resource-based activities, and direct transfer payments for environmental services. For this study, the income that was assessed is the total income of the respondent. Total income is composed of three income categories: environmental income, agricultural income (from crop and livestock production) and non-farm income (wages, business, remittance, pension, and other income sources).

The monthly income of respondents significantly affected their responses on whether the natural environment of the landscape has changed over time ($X^2 = 24.0$, $p = 0.020$). All the respondents earning between KES 15,001 to 20,000 agreed that the natural environment has changed over time as compared to 83% of the respondents earning between KES 10,001 to 15,000. A similar trend was observed for responses on the number of species living in the landscape where all respondents earning monthly income of between KES 15,001 to 20,000 agreed that more than 8 wildlife species are found within the study area while 92% of the respondents earning between KES 10,001 to 15,000 affirmed the same ($X^2 = 31.7$, $p = 0.002$). It was also noted that 82% of the respondents earning between KES 15,001 to 20,000 demonstrated a positive attitude towards the importance of Integrated Management Plan as compared to 53% of the respondents earning between KES 10,001 to 15,000 ($X^2 = 31.5$, $p = 0.002$). Consistently, 96% of the respondents earning between KES 10,001 to 15,000 significantly varied from the other respondents (100%) who thought that everybody, young and old, should engage in Greater Kudu conservation practices ($X^2 = 20.6$, $p = 0.002$).

An inverse relationship between KAP statements towards Greater Kudu conservation and household monthly total income was evident. The respondents, who earned more than KES 15,000 which is the minimum wage in Kenya constituted 37% of all respondents interviewed and appeared to be more enlightened in Kudu conservation information thus demonstrating a positive attitude towards Kudu conservation than those earning less than KES 15,000. This finding was a contrast of Buncag, *et al.* [22] observation that household income had an inverse proportionality with the respondents' willingness to pay for the conservation of Marine Protected Areas in Lemery, Batangas, Philippines. The findings further show that the livelihoods of the majority (73%) of the local resource users are dependent on the sustainability of Greater Kudu for revenue generation in the landscape—they were earning less than 15,000, the minimum wage recommended in Kenya indicating that they are more vulnerable to fall below the poverty line. In a study by Tekelenburg *et al.* [23], with the objective of building a theory on the relationship between biodiversity and poverty three conclusions were made. Of importance is the third conclusion that reducing poverty while conserving biodiversity is a “win-win” situation and can be achieved on a local scale. Because of ecosystem sensitivity to degradation in the study

area, it is recommended that with good governance, policies on poverty alleviation and Greater Kudu protection strategies should be developed and implemented.

Economic activity

Strategies that provide both environmental and economic benefits can inspire conservation commitment, regardless of whether they are led by men or women. Knowledge of the respondents varied significantly based on their main economic activity with 26% of the crop farmers agreeing that Greater Kudu's population in the landscape has decreased compared with 60% of the livestock farmers ($X^2 = 24.0$, $p = 0.020$). Furthermore, 80% of the respondents who were keeping livestock agreed that the extinction of Greater Kudu in the Lake Bogoria landscape could lead to poverty as compared to 67% of the respondents practicing crop farming ($X^2 = 23.1$, $p = 0.027$). The majority of crop farmers (97%) always used firewood for cooking as compared to 80% of those practicing apiculture ($X^2 = 54.0$, $p = 0.000$).

Diverse human activities, including land-use change, vehicle traffic on roads, and resource extraction, have led to displacement, decreased fitness, and extinction of plants and animals globally and continue to threaten populations [24]. The main economic activities in the study area were crop farming, livestock keeping, beekeeping, and the collection of forest products. Those practicing crop farming appeared to show less concern for the status of Greater Kudu conservation. This could be attributed to negative attitudes due to human-wildlife conflicts where Kudus sometimes stray and feed on farmers' crops. According to Mekonen [25], human-wildlife conflicts have negative impacts on both human and wildlife. It is therefore important to create awareness and training of the local resource users on possible conservation measures to ensure peaceful co-existence between human and Greater Kudu and formulate rules and regulations to be implemented by the community including equal revenue sharing and reduction of human settlement encroachment into the National Reserve to enhance spatial and temporal refuge to such sensitive biodiversity.

Household size

The household sizes (*i.e.* the number of occupants of a household) of respondents significantly affected their attitude towards people who destroy natural ecosystems ($X^2 = 18.6$, $p = 0.017$). It was noted that 73% of the respondents from households of more than 10 persons do not like people who destroy ecosystems compared to 95% of respondents from households of between 5 and 10 people. It was also noted that 91% of respondents from households of more than 10 people significantly differed ($X^2 = 15.0$, $p = 0.020$) in support of environmental conservation guidelines (e.g. no poaching, no dumping, no littering etc.) as compared to 98% of respondents from households of less than 5 people.

According to Liu *et al.* [26], household dynamics influenced per capita consumption and thus biodiversity through the consumption of wood for fuel, habitat alteration for home building and associated economic activities and greenhouse gas emissions. An increase in household numbers resulted in higher per

capita resource consumption. This affects the attitude of respective local resource users. From the findings above, it is evident that the larger household sizes tend to have a negative attitude towards conservation. Such households in rural areas like Lake Bogoria landscape often have limited access to a wide resource base rendering them more vulnerable to ecological impacts because of dire need for basic needs. To cushion them, it is important to suggest alternative resource bases to avoid overreliance on natural resources which may lead to overexploitation.

Land ownership

It was found that 33% of immigrant respondents were aware of the existence of Greater Kudu conservation policies in the study area which was significantly different from that of 86% of native respondents ($X^2 = 12.1$, $p = 0.033$). It was also significantly different that none of the immigrant respondents knew whether Baringo County Government is supportive of Greater Kudu conservation compared to 75% of the native respondents ($X^2 = 20.4$, $p = 0.000$). Similarly, it varied significantly that 97% of the native respondents always used firewood for cooking in their homes, compared to 68% of the immigrant respondents ($X^2 = 45.1$, $p = 0.000$). It was also found that 89% of native respondents were committed to promoting the conservation of Greater Kudu for tourism compared to 33% of the immigrant respondents ($X^2 = 12.7$, $p = 0.005$).

This pointed out that native respondents were more knowledgeable and demonstrated a positive attitude towards Greater Kudu conservation than immigrant respondents. It affirmed the findings of [27], that the local community has a more positive attitude towards biodiversity conservation than visitors in Bako National Park, Sarawak, Malaysia. However, to highlight its relevance on Kudu conservation in the study area, indigenous ecological knowledge should be interlinked with scientific knowledge and documented to improve accessibility of this place-based knowledge that contributes to understanding Greater Kudu ecology for sustainability and improved livelihoods.

All the respondents owning land in the landscape had a positive attitude that conservation of the natural ecosystem was important vis-a-vis 91% of the respondents without land ownership this was significantly different ($X^2 = 11.8$, $p = 0.003$). Furthermore, a significant difference in the attitude of respondents was noted where 58% of the respondents the legal land owners considered the Greater Kudu population stable compared with 91% of respondents without legal land ownership ($X^2 = 10.7$, $p = 0.030$). It was also significant that all land owner respondents demonstrated a positive attitude that everybody, young and old, should engage in Greater Kudu conservation practices as compared to 91% of those without legal land ownership (91%) ($X^2 = 12.3$, $p = 0.002$).

It was observed that land owner respondents were more knowledgeable with a positive attitude towards Greater Kudu conservation than those without legal land ownership status. This is usually the case in communities that depend on natural resources for their livelihoods—they are more attentive to conservation of such resources. Land tenure systems, poor land use policies and the resulting

settlements in the savannah of East Africa have been noted to be impacting wildlife [28]. According to De Vos & Cumming [29], community co-management of protected areas is expanding and privately owned protected areas are being considered for achieving conservation targets in a difficult economic climate. They noted that private lands have the potential to increase the resilience of protected area networks. In addition, pastoral areas that were privately owned became important for populations of wild herbivores during the growing season in Lake Mburo National Park, Uganda despite a pronounced presence of livestock [30]. This shows that land ownership provides an avenue for synergistic implementation of Greater Kudu conservation policies in Lake Bogoria landscape.

Membership to conservation group(s)

The responses varied significantly ($X^2 = 11.9$, $p = 0.018$) on whether or not human activities threaten the existence of Greater Kudu with 68% of respondents who are members of a conservation group agreeing that human activities do threaten the existence of Greater Kudu in the landscape as compared to 28% of non-members to a conservation group. A similar trend was observed on whether poaching of wildlife should be banned in the study area where all the respondents belonging to a conservation group significantly ($X^2 = 20.8$, $p = 0.000$) agreed that poaching should be banned while 6% of the respondents who do not belong to any conservation group disagreed. Further, 66% of respondents belonging to a conservation group considered the Greater Kudu population to be stable in the study area as compared with 47% of respondents not belonging to any conservation group ($X^2 = 10.9$, $p = 0.028$).

The respondents on whether community taboos and culture contributed to the conservation of the Greater Kudu varied significantly depending on whether the respondents belonged to a conservation group or not ($X^2 = 22.4$, $p = 0.000$) with 87% of respondents who were members of a conservation group demonstrated a positive attitude that community taboos and culture have contributed to the conservation of the Greater Kudu compared to 60% of respondents not belonging to any conservation group. It was also found that it varied significantly that 13% of the respondents belonging to a conservation group used charcoal for cooking as compared to 28% of the respondents who did not belong to a conservation group ($X^2 = 15.1$, $p = 0.005$).

It was also found that respondents who are members of conservation groups are keen on sustainable farming practices with 13% of the respondents not practicing soil conservation on their farms compared to 33% of the respondents who did not belong to a conservation group ($X^2 = 13.1$, $p = 0.011$). Likewise, 74% of respondents who do not belong to conservation group participated in climate change mitigation and adaptation activities in the landscape as compared to 86% of respondents who are members to conservation group ($X^2 = 11.3$, $p = 0.023$). Similarly, 82% of respondents who were members of conservation group participated in voluntary activities to conserve our ecosystem (e.g. cleaning, tree planting, etc.) it was significantly different that 57% of the non-members of the

conservation group participated ($X^2 = 16.7$, $p = 0.002$).

Generally, the respondents who are members of community conservancies were more knowledgeable and depicted a positive attitude towards Kudu conservation. The critical role played by these conservancies cannot be over-emphasized as they equip local resource users to become stewards of their own environment. It has been found that the effectiveness of these conservancies greatly depends on the local context in which they operate, in particular, governance capacities; resource conditions; and local societies [4]. The County Government of Baringo may consider enhanced incentives for locals who strive to ensure ecosystem sustainability as a motivation for them to become members of conservancies.

3.5. Key Informants Report

This section summarizes key Greater Kudu conservation priorities as presented by purposively selected key informants (KI) by virtue of their position, responsibilities and experience in the management and running of the landscape and conservation activities. Key informant questionnaire was administered to each KI individually and they were made to understand that their participation was voluntary. Twenty-two (22) KIs were interviewed thirteen of which were coordinators of conservation activities in the study area while 4 of them were government administrators. The rest of the interviewees were technocrats in Greater Kudu conservation. It is important to note that 68% of the KIs had lived/worked in the landscape for > 40 years and gained substantial experience in matters Kudu conservation.

From KI survey, issues presented were ranked in order of frequency as mentioned by the respondents. The issues that were to be addressed included:

- 1) The importance of Greater Kudu in the study area;
- 2) The stability of the Kudu population;
- 3) The dominant land use/cover adjacent to Lake Bogoria landscape;
- 4) Activities that promote the conservation of the Kudu;
- 5) Activities that threatened the Kudu existence;
- 6) Impact of economic activities on the Kudu conservation;
- 7) Challenges to the Kudu conservation;
- 8) Solutions to challenges affecting the Kudu conservation.

Human activities cause environmental pressures like pollution, overexploitation of natural resources and land use/cover changes. The environmental impacts resulting from such pressures are dependent on the level of such human activities and the technology applied during the implementation of such activities. It is therefore important to be deliberate in ensuring that such human activities are implemented in a sustainable way to minimize land use/cover changes so that rangelands, the Kudu endemic ecosystem are prioritized in conservation as one way of reducing threats to Greater Kudu existence. All informants affirmed that Greater Kudu is important for improved livelihoods in the study area. They also agreed that Greater Kudu population has increased in the recent

past due to efforts put in place by the Government in collaboration with conservation partners who are mainly operating community conservancies. These conservancy groups create an avenue for raising awareness in the community and exposing local resource users to sustainable ways of utilizing natural resources.

As shown in **Figure 2**, 86% of the informants agreed that none of the conservation strategies is superior to the other instead they all complement each other.

This finding also supports the development of all-inclusive rangeland management strategies and policies to address socio-ecological matters of Greater Kudu conservation. These strategies and policies must have a more balanced socio-ecological perspective that ensures net gain in the interaction of resource use between humans and the Kudu—aiming at supporting the functionality and productivity of the study area ecosystems and their ability to sustainably provide the Kudu a thriving environment as well as address the needs of local resource users.

Key Informants (77%) confirmed that human economic activities are the main threats to Greater Kudu existence with 9% highlighting hunting (**Figure 3**). The major infrastructural development in the study area is an all-weather road mainly accessing the Lake Bogoria Game Reserve. The agricultural-related economic activities are important in addressing food security and nutrition for the livelihoods of local resource users. It is therefore imperative that sustainable ecosystem practices, such as agroforestry through the integration of indigenous trees producing marketable timber and non-timber forest products, soil conservation measures, water harvesting and water use efficiency techniques, controlled livestock grazing and improved land tenure systems should be considered. The Kudu dispersal corridors should also be mapped and conserved to ensure that their watering points and breeding areas are preserved. Benefits paid to local resource users from revenue collected from Greater Kudu related tourism as an incentive for conservation may also be enhanced.

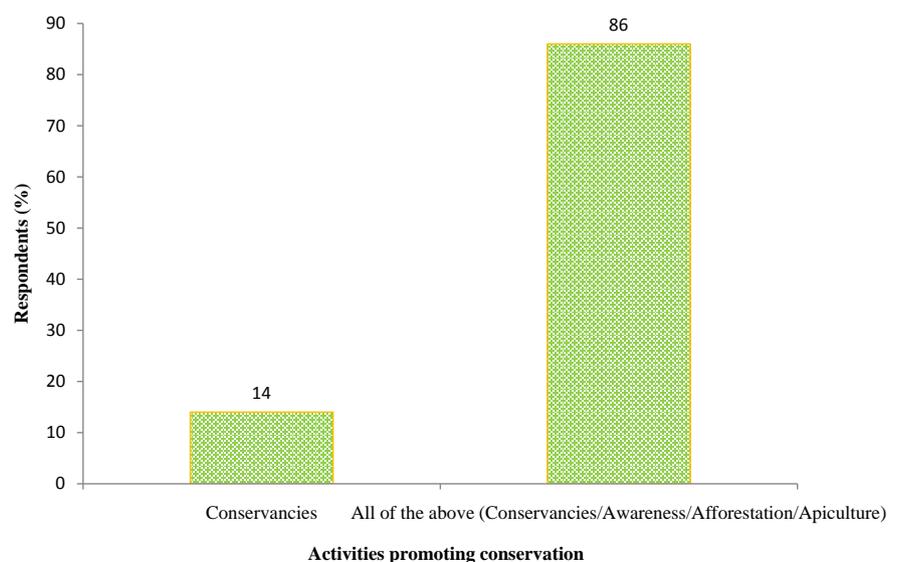


Figure 2. Activities promoting conservation in Lake Bogoria Landscape.

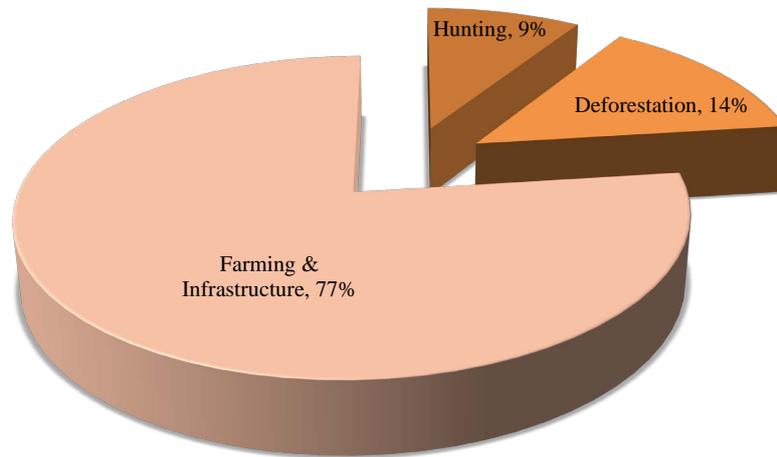


Figure 3. KI responses on threats to the existence of Greater Kudu in Lake Bogoria Landscape.

Although 13% of the respondents (believed that environmental destruction is the main challenge towards Kudu conservation, most of the Key Informants (77%) were of the opinion that the challenges are multipronged (Figure 4). A legal framework exists on wildlife conservation and related challenges under Kenya Wildlife Services (KWS), but it is not tailor-made to effectively carry out conservation activities specific to Lake Bogoria landscape. Greater Kudu conservation activities including compensation of crop farmers for losses due to the Kudu grazing on their crops or deliberate expansion of production of Kudu's forage and watering points are lacking yet this incentive will address environmental concerns related to socio-economic activities. Establishing Greater Kudu conservation areas and continuous exposure of Kudu conservation information to the local resource users are key strategies that the respondents pointed out as important in overcoming the challenges above.

3.6. Focus Group Discussions

Focus Group Discussion (FGD) participants were purposely selected based on knowledge by virtue of their positions, responsibilities and experience in the management and running of the landscape and conservation activities. The first FGD was attended by members from Chuine, Kiborgoch and Irong Conservancies. The second FGD was attended by members of Smart Agriculture and Irrigation women groups. The third FGD was attended by members of pasture production groups. A total of 24 participants attended the discussions. The key findings were that:

- 1) **Greater Kudu population** has been increasing because of expansive awareness creation by conservation partners in the recent past.
- 2) **Greater Kudu is important** to the people of Lake Bogoria landscape.
- 3) **Major land use types in the study area:** farmlands, wetlands, rangelands, grasslands, acacia forest, water bodies, shrines, salt lick areas, conservancies, grazing areas, lodges and settlement areas.

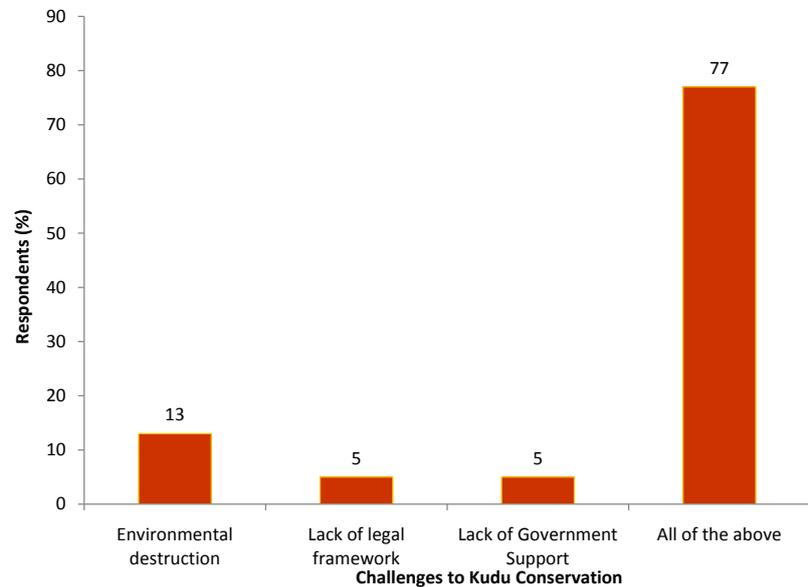


Figure 4. Responses on challenges to Kudu Conservation in Lake Bogoria Landscape.

4) Activities inside and outside the protected area that promote Greater Kudus conservation: Apiculture, taboos and culture where the most mature horn of Kudu is used in sacred rituals, establishment of monitoring transect lines, and revenue sharing for bursaries.

5) Activities inside and outside the protected areas that threaten Greater Kudus: poaching, human population creating pressure on land, scarcity of potable water, Kudu habitat/corridors destruction, pests and diseases, extreme weather conditions, culture/indigenous knowledge erosion, encroachment to conservation areas and lack of awareness.

6) Strategies to reduce the impact of the activities that threaten Greater Kudu: increase Kudu watering points, ensure Kudu corridors are identified and preserved, pasture production to substitute natural forage for Kudus, pest and disease management to be mainstreamed with Kudu conservation, revenue sharing policy to be reviewed to ensure more resources generated from Kudu tourism is plowed back for Kudu conservation, periodic Kudu census/monitoring, capacity building, and students who benefit from Kudu revenue bursaries to organize Corporate Social Responsibility (CSR) activities towards Kudu conservation (create scholarship database).

The FGD findings reflected in-depth perceptions of local resource users' KAP towards Greater Kudu conservation as they were presented during KAP survey and KI interviews. The most important outcome of the FGDs was the strategies to reduce impacts of threats to Greater Kudu existence. The strategies proposed originated from the selected local resource users as ways of seeking local solutions using a participatory approach.

4. Conclusion

From the KAP survey, KI interviews and FGDS, it was evident that KAP of the

local resource users affect sustainability of Greater Kudu. It was also noted that although conservation of the Kudu is more beneficial to majority of local resource users than any other economic activity in the landscape, regular census of Kudu population is not conducted. The null hypothesis that knowledge, attitude and practice did not affect the conservation of the Greater Kudu in Lake Bogoria landscape was rejected. It is recommended that all-inclusive adaptive management and conservation strategies should embrace continuous monitoring, and understanding dispersal of Greater Kudu to ensure its survival, in the lake Bogoria landscape and its environs. This will enhance and sustain livelihoods dependent on the existence of Greater Kudu in the study area.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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