



## Community Perceptions of Land Use Change Impacts on Wildlife and Community Livelihoods in Kitengela Conservation Area, Kenya

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### Abstract

*The Kitengela Conservation Area, located adjacent to Nairobi National Park in Kenya, has undergone significant land use changes over the past three decades, with critical implications on biodiversity and local community livelihoods. This study investigated the perceived drivers and impacts of these changes, and their effects on migratory wild ungulates and local communities. Data were collected using structured questionnaires administered to 110 households selected using stratified random sampling in three village clusters. The questionnaire captured information on socio-demographic characteristics, perceptions on land use change drivers, benefits and drawbacks of these changes, and their perceived ecological consequences. Drivers of land use change cited included human population growth (90%), agricultural expansion (51.8%), and urbanization (39.1%). Respondents reported accruing socio-economic benefits such as increased business opportunities, job creation, and access to services, while negative impacts experienced included pollution, habitat degradation, and loss of biodiversity. A majority of the respondents (87.3%) perceived a decline in wildlife populations, with species such as lions and elephants reported as locally extinct. Ecological impacts cited included habitat destruction (67.4%), direct mortality due to human activities (16.4%), and behavioral disturbance of wildlife (16.2%). We found significant differences in perceptions of impact categories, with habitat-related impacts being most prominent. The findings highlight growing competition between development and conservation in peri-urban ecosystems and underscore the need for integrated land use planning and strengthened community-based conservation initiatives to ensure coexistence between people and wildlife.*

**Keywords:** Land use change, Kitengela, migratory ungulates, community perceptions

### Introduction

Land use and land cover change is a critical environmental concern across sub-Saharan Africa, where rapid population growth, agricultural expansion, and urbanization are transforming ecosystems and affecting biodiversity (Idowu & Ajibade, 2024). These changes are particularly pronounced in peri-urban areas bordering protected ecosystems (Petroni *et al.*, 2022), where development pressures intersect with conservation priorities (Nevzati *et al.*, 2024). The Kitengela Conservation Area (KCA), located south of Nairobi National Park in Kenya, exemplifies this challenge (Mwangi *et al.*, 2022). Once characterized by open rangelands and traditional Maasai pastoralism, Kitengela is experiencing intense landscape transformation driven by human settlement, infrastructure development, and land subdivision (Nkedianye & Ogutu, 2020).

The foregoing transitions have profound implications for migratory wild ungulates (Kauffman *et al.*, 2021), notably wildebeest (*Connochaetes taurinus*) and plains zebra (*Equus quagga*), which depend on corridors between Nairobi National Park and the Athi-Kapiti Plains for their seasonal movement (Idowu & Ajibade, 2024). Increasing habitat fragmentation, road construction, and human encroachment are threatening these species' survival by disrupting migratory routes and diminishing access to key resources (Cooke *et al.*, 2024). The subdivision of group ranches in the Kitengela-Athi-Kapiti plains covering areas like Kitengela, North Kaputei, Emboloi, Olkinos, and Kisaju began in the mid-1980s, largely due to ineffective management by local community leaders (Nyaila, 2021). By the 1990s, land sales were on the rise, with owners either selling parts of their plots or passing them down to multiple heirs (Nyaila, 2021).

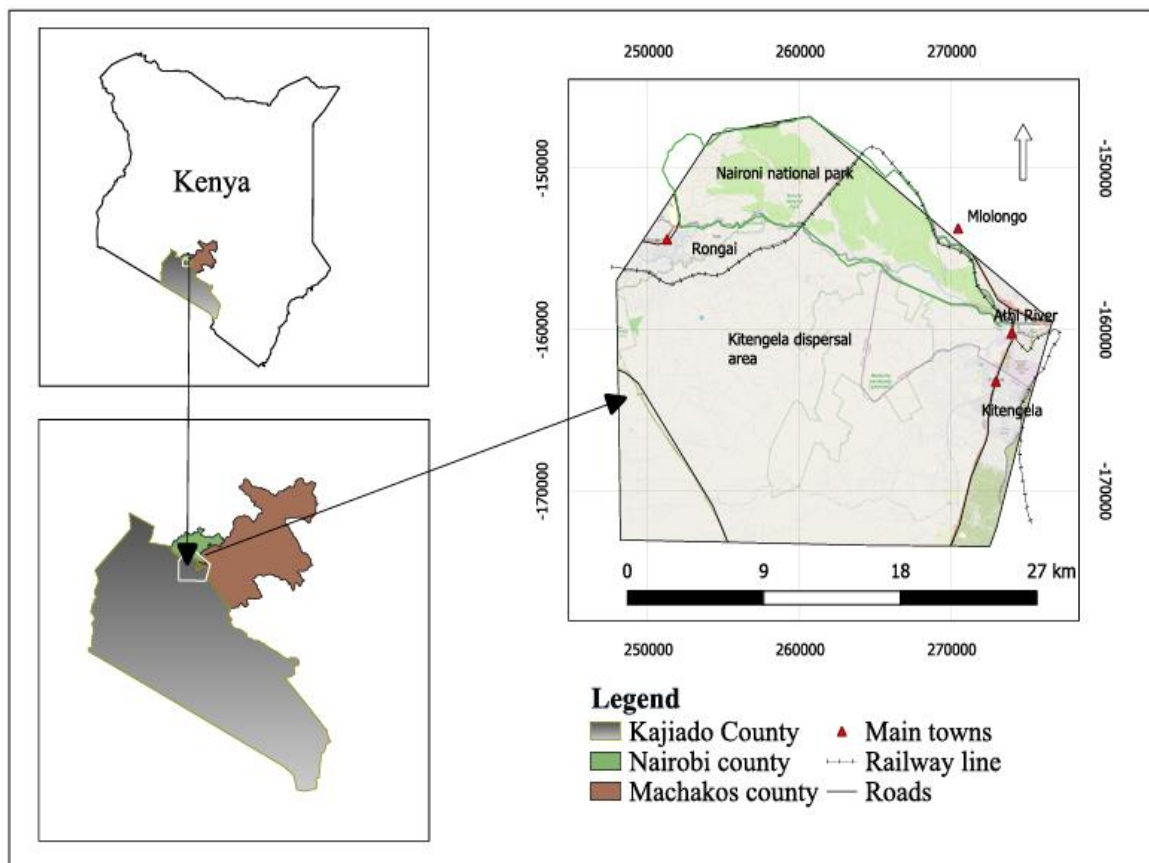
While previous ecological studies have documented habitat loss and wildlife decline in the region, few have focused on local community perceptions of these changes and their socio-ecological implications. Understanding community-level insights is essential for developing context-sensitive conservation strategies and enhancing participatory land management (Kamau & Odhiambo, 2025). Perceptions influence behaviors, and community engagement is critical in landscapes where wildlife and human livelihoods overlap (Nkansah-Dwamena, 2023).

This study investigates community perceptions of land use changes in Kitengela Conservation Area (Katswera *et al.*, 2022). It examines the drivers of change, perceived socio-economic benefits, negative environmental impacts of the changes, and the effects on migratory wildlife. The study also assesses how socio-demographic factors influence these perceptions, offering insights into knowledge gaps and potential leverage points for conservation education (Bhattacharjee *et al.*, 2022). The findings provide a foundation for integrating local perspectives into sustainable land use planning and biodiversity conservation efforts in Kenya and similar dry land ecosystems.

## Materials And Methods

### Study area description

The study was conducted in the Kitengela Conservation Area, located south of Nairobi National Park in southern Kenya (Mwangi *et al.*, 2022) (**Figure 1**). The area lies within Kajiado County and is part of the Athi-Kapiti Plains, a critical dry-season dispersal zone for migratory wild ungulates such as wildebeest and plains zebra (Thuo, 2020). Kitengela is characterized by a semi-arid climate, with bimodal rainfall ranging from 500 to 1,000 mm annually, and average temperatures between 18°C and 28°C (Maina, 2020). The landscape includes open grasslands, scattered acacia woodlands, and seasonal rivers that support both wildlife and livestock grazing (Gichuru, 2022). Historically dominated by Maasai pastoralism, the area has witnessed intense land use changes (Nkedianye & Ogutu, 2020). Kitengela's ecological significance and its proximity to Nairobi city make it a key interface between conservation and development, providing a unique context for assessing the impacts of land use change on both biodiversity and local communities (Gichuru, 2022).



**Figure 1: Location of Kitengela Conservation Area**

### Data collection and analyses



Data for this study were collected between June and September 2022 using a structured household questionnaire administered to 110 respondents. The sample was selected through stratified random sampling from three village clusters. The questionnaire which had both closed and open-ended questions, captured socio-demographic characteristics as well as community perceptions regarding drivers of land use change, perceived benefits, negative environmental impacts, and trends in wildlife populations (Dalu *et al.*, 2022a).

The sample size was determined using Yamane's (1973) formula to achieve a confidence level of 91% and a margin of error of 9%, ensuring statistical reliability for the study population (Abebe, 2020).

Quantitative data were analyzed using SPSS version 23 and R software (Rahman & Muktadir, 2021). Descriptive statistics summarized respondents' answers, while Chi-square Goodness-of-Fit test evaluated whether observed perception distributions differed significantly from expected patterns (Assuah *et al.*, 2022). Chi-square test of independence further examined relationships between socio-demographic variables and community perceptions (Dalu *et al.*, 2022b). Qualitative responses from open-ended questions were analyzed thematically to provide deeper contextual understanding and to complement the quantitative results (de Jesús-Espinosa *et al.*, 2024).

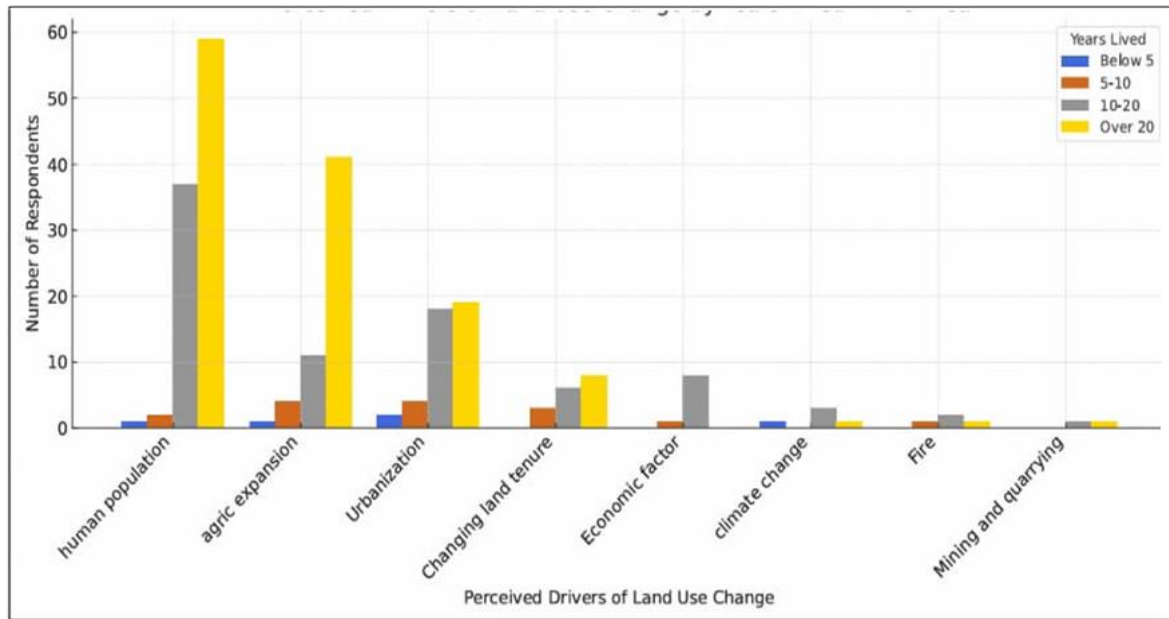
### Findings

#### Socio-demographic characteristics of respondents

A total of 110 individuals participated in the survey, achieving a 100% response rate (Wu *et al.*, 2022). Most respondents were male (56.4%), 42.7% were females, and 0.9% were intersex, with a statistically significant gender distribution ( $\chi^2 = 78.8$ ,  $df = 2$ ,  $p < 0.001$ ). The dominant age group was 51–60 years (50.9%), followed by 31–40 years (19.1%), thus showing a significant variation ( $\chi^2 = 82.2$ ,  $df = 4$ ,  $p < 0.001$ ). Education levels ranged from secondary (40.0%) and primary (30.9%) to college (19.1%), with fewer having no formal education (7.3%) or university degrees (2.7%), showing a significant difference ( $\chi^2 = 43.5$ ,  $df = 4$ ,  $p < 0.001$ ). A majority of the respondents had lived in the area for over 20 years (59.1%), indicating long-term community attachment ( $\chi^2 = 75.5$ ,  $df = 3$ ,  $p < 0.001$ ). In terms of economic activity, most were engaged in business (62.2%), followed by pastoralism (27.0%) and formal employment (10.8%) ( $\chi^2 = 46.3$ ,  $df = 2$ ,  $p < 0.001$ ).

#### Drivers of land use changes in Kitengela conservation area

Land use changes in the Kitengela Conservation Area were primarily driven by population growth (90%), agricultural expansion (51.8%), and urbanization (39.1%). A Chi-square goodness-of-fit test result ( $\chi^2 = 279.6$ ,  $df = 7$ ,  $p < 0.001$ ) confirmed significant variation in how frequently these drivers were cited. Other less-reported drivers included land tenure changes (15.5%), economic incentives (8.2%), and environmental stressors such as climate change, fire, and mining. Perceptions of these drivers were significantly influenced by duration of residency ( $\chi^2 = 51.0$ ,  $df = 15$ ,  $p < 0.001$ ), with long-term residents more likely to highlight population growth and agriculture, while gender, age, education, and economic activity showed no significant associations (**Figure 2**).



**Figure 2: Number of respondents identifying drivers of land use changes, grouped by years lived in the area.**

The dominance of population growth, agriculture, and urbanization as drivers of land use change in Kitengela aligns with broader patterns in sub-Saharan Africa, where rising populations and urban expansion near protected areas lead to habitat conversion (Mwangi *et al.*, 2022b; Petroni *et al.*, 2022). The shift from pastoralism to farming and urban livelihoods has reduced traditional mobility, contributing to land degradation and fragmentation (Wafula, 2022b). The strong link between length of residence and awareness of these drivers underscores the importance of local knowledge in understanding landscape changes (Adade *et al.*, 2020). Meanwhile, gender and education had no significant effect on perception, suggesting a shared community understanding of the forces shaping land use.

### Community perceptions of benefits and negative impacts

**Perceived benefits of land use changes and development on the local community:** Respondents identified several benefits from land use changes, with business opportunities (55.5%) and employment creation (28.2%) being the most reported. Improved road infrastructure (10.0%) and educational development (6.4%) were least cited. We found significant differences in how these benefits were perceived, thus highlighting a stronger association with economic gains than with social services.

Economic benefits resulting from land use changes, such as increased business opportunities and employment, highlight the dual-edged nature of landscape transformation (Syaban & Appiah-Opoku, 2024). These benefits are essential for local livelihoods and poverty alleviation, which conservation efforts must consider to be sustainable (He & Jiao, 2023). However, the relatively lower recognition of improvements in infrastructure and education suggests that development gains are uneven and possibly concentrated in economic domains rather than social services, a trend noted in peri-urban areas undergoing rapid change (Rajendran *et al.*, 2024).

**Negative impacts of land use changes on the local community:** In addition to perceived benefits, respondents identified several negative impacts of land use changes. Notable among these were pollution (39.1%), wildlife road mortality (27.3%), and deforestation (17.3%), with fewer mentioning soil erosion (10.0%) and reduced water quality (6.4%). The effects were seen as differing greatly, with pollution and road deaths noted as the most prominent. These findings indicate increasing worries regarding ecological damage and risks to both humans and wildlife wellness. Moreover, the adverse effects noted by participants indicate a rise in environmental pressure linked to heightened land utilization. Agricultural runoff, sewage, and construction pollution interfere with ecosystem functions and water quality, posing risks to the health of both humans and wildlife (Yadav *et al.*, 2024). Road mortality is a well-documented danger to wildlife close to protected areas, where growing road networks fragment habitats and raise vehicle encounters with wildlife (Barrientos *et al.*, 2021). Deforestation and soil erosion intensify habitat destruction and diminish the land's ability to sustain both fauna and livelihoods (Bodo *et al.*,



2021). These results highlight the necessity for coordinated land management that tackles environmental deterioration together with development objectives.

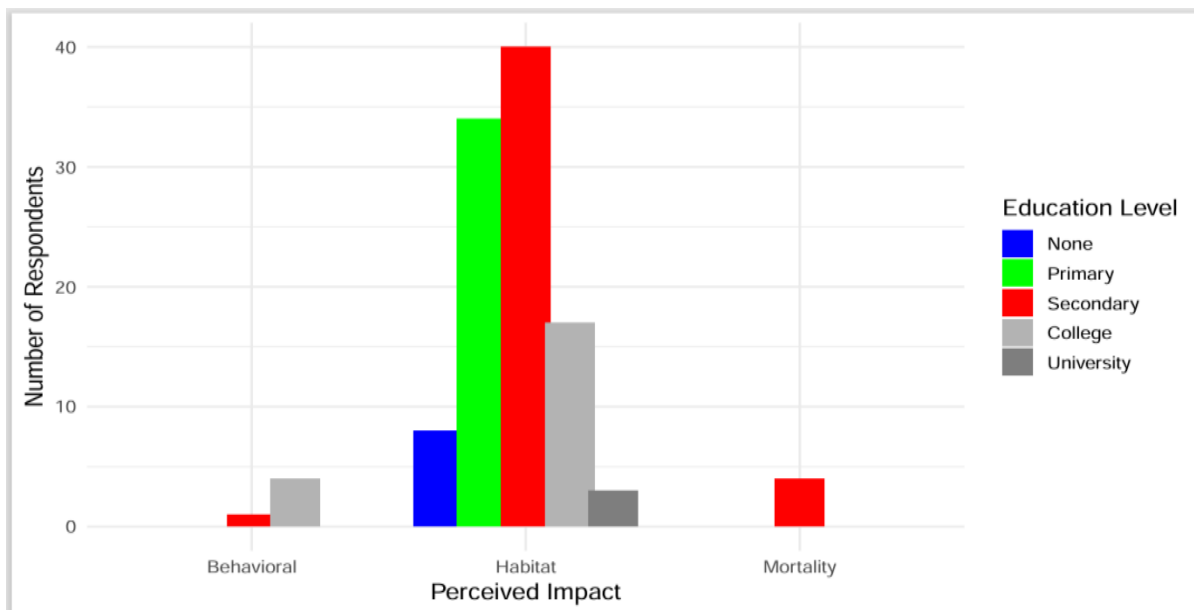
### Impacts of land use changes on migratory wild ungulates

Respondents categorized three primary types of land use effects of changes on migratory wild ungulates, specifically habitat-related, mortality-related, and behavioral (**Table 1**). Habitat-related effects were the most frequently cited, including habitat fragmentation, habitat destruction, and environmental modification being the most referenced. The main mortality-related effects were mainly caused by road-kill and deaths linked to construction. Behavioral effects involved alterations in animal conduct and a rise in human activity in wildlife regions, indicating substantial disturbances to migration behaviors and stress reactions in animal populations

**Table 1: Impacts of land use changes by thematic category, impact type, and respondent frequency (%) in the study area**

Thematic Category	Impact Type	Frequency	Percentage (%)
Habitat (Ecological)	Habitat fragmentation	101	91.8
	Habitat loss	87	79.1
	Physical alteration	62	56.4
<b>Subtotal</b>		<b>250</b>	<b>67.4</b>
Mortality	Road mortality	43	39.1
	Construction mortality	18	16.4
<b>Subtotal</b>		<b>61</b>	<b>16.4</b>
Behavioral	Animal behavior changes	32	29.1
	Increased human presence	28	25.5
<b>Subtotal</b>		<b>60</b>	<b>16.2</b>

We found that these categories were not equally perceived, with habitat-related issues emerging as the most critical concern. Additionally, education level was the only demographic variable significantly associated with impact perception ( $\chi^2 = 17.3$ ,  $df = 8$ ,  $p = 0.03$ ), indicating that individuals with higher education were more likely to recognize subtle or less visible impacts, such as behavioral changes. Other socio-demographic factors showed no significant influence on how impacts were perceived (**Figure 3**).



**Figure 3: Number of respondents reporting each impact type of land use changes, grouped by education level**



The predominance of habitat fragmentation and loss as perceived impacts on migratory wild ungulates aligns with the widely documented literature on how fragmentation disrupts animal movement corridors, limits access to critical resources, and isolates populations (Verzuh, 2024). For migratory species such as wildebeest and zebra, maintaining connectivity between dry and wet season habitats is vital for their survival (Weeber *et al.*, 2020). Mortality from road kill and construction activities represents a direct human-induced threat that reduces population viability and can alter natural behaviors (Oddone Aquino & Nkomo, 2021). Behavioral modifications, including avoidance of human settlements and altered movement patterns due to increased human presence, can increase stress, reduce reproductive success, and cause long-term population declines (Fehlmann *et al.*, 2021). As documented elsewhere, education plays a key role in helping communities recognize subtle impacts like behavioral changes in wildlife (Castillo-Huitrón *et al.*, 2020). Greater environmental education fosters deeper understanding, encouraging stewardship and support for conservation actions such as wildlife-friendly infrastructure and community monitoring (Walwambe & Barakagira, 2024).

### Wildlife population trends and species loss

**Trends in wildlife population:** Majority of respondents (87.3%) perceived a decline in wildlife populations in the area, while 10.9% believed populations were increasing and only 1.8% perceived no change. The significant skew in these perceptions ( $\chi^2 = 144.86$ ,  $df = 2$ ,  $p < 0.001$ ) indicated a strong consensus on wildlife decline. This finding aligns with observed reductions in key species as documented in studies by (Edwards *et al.*, 2024; Loveridge *et al.*, 2022) and suggests broader ecosystem degradation, likely driven by habitat loss and intensified human activity (Radić & Gavrilovic, 2020).

**Species reported as no longer present in Kitengela:** Respondents reported the disappearance of lions (66.0%) and elephants (29.3%), indicating a notable decline in large mammal diversity, with a significant difference in attribution ( $\chi^2 = 36.73$ ,  $df = 4$ ,  $p < 0.001$ ). The overwhelming perception of declining wildlife populations, particularly of iconic species such as lions and elephants, mirrors documented trends in protected areas across East Africa where habitat loss, poaching, and human-wildlife conflicts contribute to biodiversity decline (Mhlanga, 2024). The loss of keystone species has cascading effects on ecosystem structure and function, potentially disrupting trophic interactions and vegetation dynamics (Risdiyanto *et al.*, 2024).

**Perceived causes of wildlife disappearance in Kitengela:** Wildlife disappearance was mainly attributed to habitat destruction (44.3%) and climate change (34.0%), with fewer respondents citing human population growth (13.2%) and human-wildlife conflict (8.5%). These perceptions varied, emphasizing environmental degradation and climate stress as key drivers (Ruiz *et al.*, 2020). Community attributions of species disappearance primarily due to habitat destruction and climate change rather than solely to human population growth indicate an understanding of complex, multi-scalar drivers of biodiversity loss (Pörtner *et al.*, 2021). This suggests a foundation for engaging communities in integrated conservation strategies that address habitat protection and climate adaptation concurrently (Pathak *et al.*, 2022).

### Conclusions And Recommendations

Land use changes in Kitengela are mainly driven by population growth, agriculture, and urbanization, leading to habitat fragmentation and degradation. While economic benefits like business and employment opportunities have emerged, negative impacts such as pollution, wildlife road mortality, and deforestation are significant concerns. Habitat-related impacts on migratory wild ungulates, especially fragmentation and loss, are viewed as the greatest threats, along with mortality and behavioral disruptions. Most respondents agree that wildlife populations, including lions and elephants, are declining due to habitat destruction and climate change. Education improves awareness of these impacts, supporting conservation efforts. To address these challenges, integrated land use planning, community education, environmental mitigation, climate adaptation, ongoing monitoring, and inclusive policies involving local knowledge are recommended for sustainable development and biodiversity conservation in Kitengela.

**Acknowledgement:** I thank the Erasmus + ICM Exchange Program for supporting my three-month research stay at the University of Groningen, which greatly improved my skills and academic outlook. I appreciate the guidance of mentors, reviewers, field assistants, and local community members who contributed valuable insights. This research did not receive any specific external funding.

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