

Research Article

# Feeding Ecology and Distribution Patterns of the Common Eland (*Tragelaphus Oryx*) in the Ngorongoro Conservation Area, Northern Tanzania

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## Abstract

This study examined the feeding ecology and distribution patterns of Common eland (*Tragelaphus oryx*) in the Ngorongoro Conservation Area (NCA). Study conducted early in the morning (0600-1130 HRS) and late evening (1700-1830 HRS) in both wet (April) and dry (September) seasons, in 2020 and 2021, using field observations along pre-established plots for feeding ecology, transects for distribution patterns of the common eland crossed diverse representation of vegetation types. The eland's diet varied significantly between plant species grazed often grazing on *Chloris pycnothrix* and *Themeda triandra*, but rarely browsing on *Hibiscus aponeurus* and *Vachellia tortilis*. Eland distribution patterns were computed and mapped using ArcGIS Software, while diet composition was demonstrated using Generalised Linear Model (GLM) in R statistical software. The results illustrate that 92 % of elands were mostly chosen grassland, 2% preferred shrubland, 4.8% preferred woodland, and 0.7% used the forest. The distribution patterns of eland in different vegetation did not vary significantly with the season and vegetation types, as there was no ecological association between season and vegetation types. The study provides recommendations for vegetation management in favour of the feeding ecology of common eland because they cluster into all vegetation types, whereas grassland influences the feeding of eland. The few remaining vegetation types were browsed but also used as tree cover, a security advantage, and an ability to reduce exposure to predators.

## Keywords

Ngorongoro, Common Eland, Feeding Ecology, Distribution Patterns, and Protected Area Conservation

## 1. Introduction

The common eland (*Tragelaphus oryx*), is an essential wildlife resource in NCA due to its ecological benefits, such as serving as prey species for large predators, including lion (*Panthera leo*), spotted hyena (*Crocuta crocuta*), African wild dog (*Lycaon pictus*) and leopard (*P. pardus*). [3]. The common eland inhabits heterogeneous habitats such as Grassland, Woodland, Shrubs, and Forest. It was demonstrated that

common elands are less selective of habitats and diet, as the animals need a large home range to obtain sufficient forage and habitat preferences [4]. The common eland (*Tragelaphus oryx*), formerly *Taurotragus oryx*, is among the rare African antelopes, including sable antelope (*Hippotragus niger*), tsessebe (*Damaliscus lunatus*), roan antelope (*Hippotragus equinus*), fringed-eared oryx (*Oryx beisa callotis*), gerenuk

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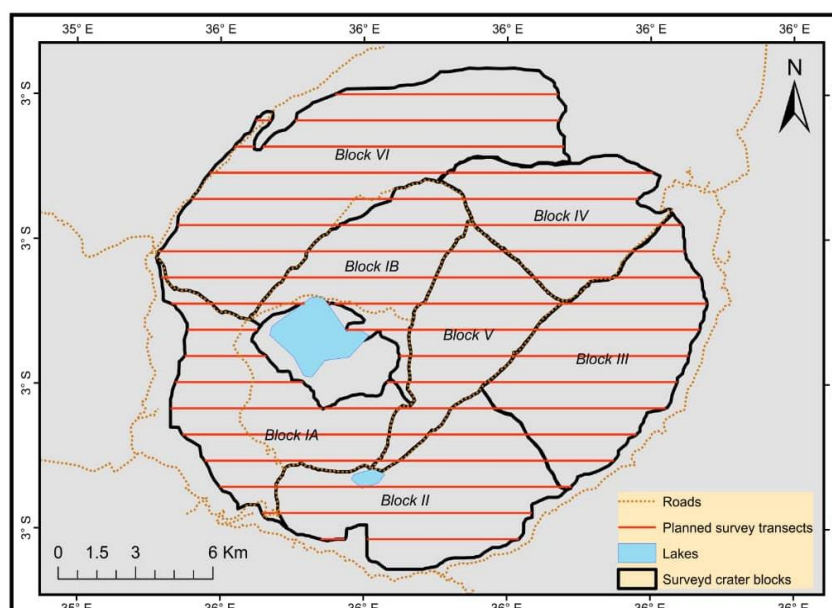
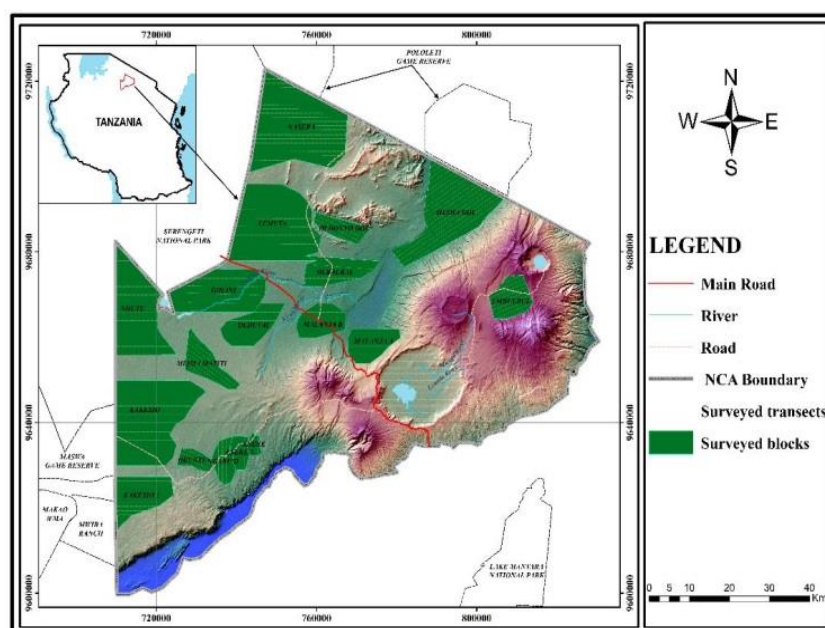
(*Litocranius walleri*) and lesser kudu (*Tragelaphus imberbis*) [7]. It is the second largest African antelope after the giant eland (*Tragelaphus derbianus*) [10]. The common eland occurs in eastern and southern Africa [16], and inhabits heterogeneous habitats that contain more shrubs and is frequently seen in grassland, woodland, and sub-desert bush habitats [8].

Although the International Union for Conservation of Na-

ture (IUCN) has categorized the species as “Least Concern” (LC), like other ungulates in the Ngorongoro Conservation Area (NCA). Needs close management and monitoring of their feeding ecology and distribution patterns, understanding the overhead ecological resources is vital for their existence in the NCA-[15].

## 2. Materials and Methods

### Study Area Description



Sources: Fieldwork (2025).

**Figure 1.** Surveyed Blocks in the Ngorongoro Conservation Area and its Crater.

Scanty information on feeding ecology and distribution patterns in NCA is available. Therefore, this study intended to examine the feeding ecology and distribution patterns of the common eland, which builds significant baseline data to effectively manage habitats in the face of conservation and contribute to the general body of knowledge, which is critical for conservation and management of the species-specific and the ecosystem at large.

## 2.2. Data Collection

### 2.2.1. Feeding Ecology of the Common Eland

Elands were searched twice a day, early in the morning (0600 - 1130 HRS) and late evening (1700 - 1800 HRS suitable time for common eland feeding [9]. Whenever Eland groups were encountered feeding a plot of 1 hectare (100 m width x 100 m length) was established [1], within a 1-hectare quadrat, four subplots of 1 m<sup>2</sup> were established at each corner, subsequently; at the center of 1 hectare a 50 m width x 50 m length was established where four sub-plots each 1 m<sup>2</sup> were placed at each corner which makes a total of eight 8 plots. In locating the feeding point, signs of visual marks of fresh tufted grasses with bites and fresh hoof prints of eland were used [11]. Remnants of the grazed plants within the plot were identified at the species level. At each sampling point, parameters such as vegetation type, time, GPS coordinates, and foraged plant species were noted, and samples of unidentified specimens were collected for further identification using the Flora of Tropical East Africa plant identification book [5],

### 2.2.2. Distribution Patterns of the Common Eland

The habitats in the Ngorongoro Conservation Area were classified into numerous vegetation types, such as grassland, shrubs, woodland, wooded grassland, forest, and wetland [18]. Ecological data such as GPS coordinates, eland numbers, Date, time, and vegetation type were recorded once a group of Eland was sighted in NCA. The information was later recorded and overlaid into ArcGIS Software Version 10.3 to display eland habitats in heterogeneous vegetation [13].

## 2.3. Data Analysis

### 2.3.1. Feeding Ecology of the Common Eland

A Generalized Linear Model (GLM) was fitted whereby the number of elands recorded was used as a response variable while plant species on which the animal was observed feeding were used as explanatory variables. The model was checked for over-dispersion by using the *dispersion test function* from the *AER Package* [23], in R 4.1.2 [17]. If dispersion was

observed to be significant, the negative binomial distribution was implemented by using the *glm.nb function* from the *MASS Package* [22]. After the model was fitted, type three Wald chi-square was applied for model selection performed using the *ANOVA function* from *CAR Package* [6], in R 4.1.2 [17]. The variable was considered significant if the *p*-value was less than 0.05.

### 2.3.2. Distribution Patterns of Common Eland

The ArcGIS Software was used to map the habitats and quantify autocorrelation between different heterogeneous habitats and vegetation utilized by the eland. data from field surveys were collected and converted into a vector format. Datasets included, GPS coordinates (eastings and northings), vegetation type (grassland, woodland, shrubland, forest), and eland numbers were recorded in an Excel spreadsheet and overlaid into ArcGIS Version 10.3. Moreover, the R Software Version 4.1.1 for statistical analysis was used to illustrate seasonal eland habitat usage in heterogeneous vegetation at a 5% level of significance.

## 2.4. Research Findings

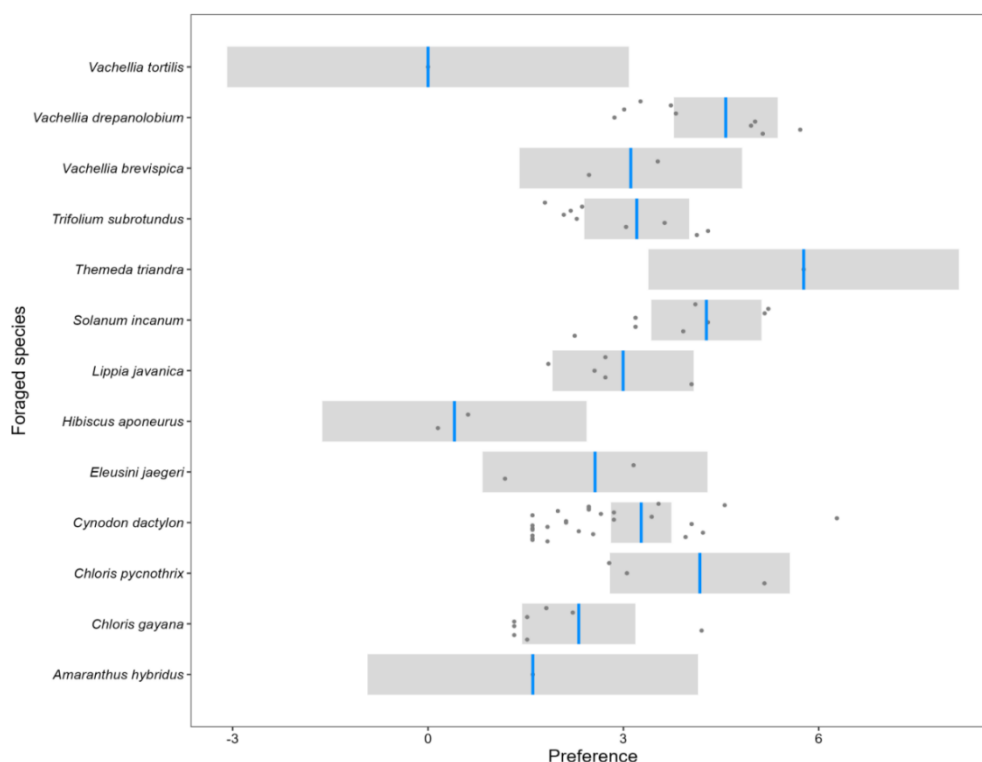
### 2.4.1. Feeding Ecology of the Common Eland

The feeding composition for common eland found thirteen plant species with six browsed including *Vachelia tortilis*, *Vachelia drepanolobium*, *Vachelia brevispica*, *Solanum incanum*, *Lippia javanica*, *Hibiscus aponeurus* and seven grazed species *Themeda triandra*, *Trifolium subterraneum*, *Eleusine jaegeri*, *Cynodon dactylon*, *Chloris pycnothrix*, *Chloris gayana*, and *Amaranthus hybridus*. The findings illustrate that most of the species were preferred with percentage preference ranging from 15-60% reflected by eleven plant species. Figure 2 indicates that only two plant species, *Vachelia tortilis*, and *Hibiscus aponeurus* showed negative preference. The level of preference for most grazed species influenced the distribution pattern in line with the feeding ecology of the common eland in NCA. The results of the Poisson model showed significant over-dispersion ( $z = 2.262$ ,  $P = 0.012$ ). The model showed that the eland diet varied significantly between plant species ( $\chi^2 = 43.811$ ,  $df = 14$ ,  $P < 0.001$ ). Field observations indicated that eland was feeding frequently on *Themeda triandra*, *Chloris pycnothrix* and *Vachellia drepanolobium* followed by *Chloris gayana*, *Cynodon dactylon*, *Solanum incanum* and *Vachellia brevispica* (all skewed towards positive preference), but rarely on *Vachellia tortilis* and *Hibiscus aponeurus* (both skewed towards negative preference (Figure 2).

## 2.4.2. Distribution Patterns of the Common Eland

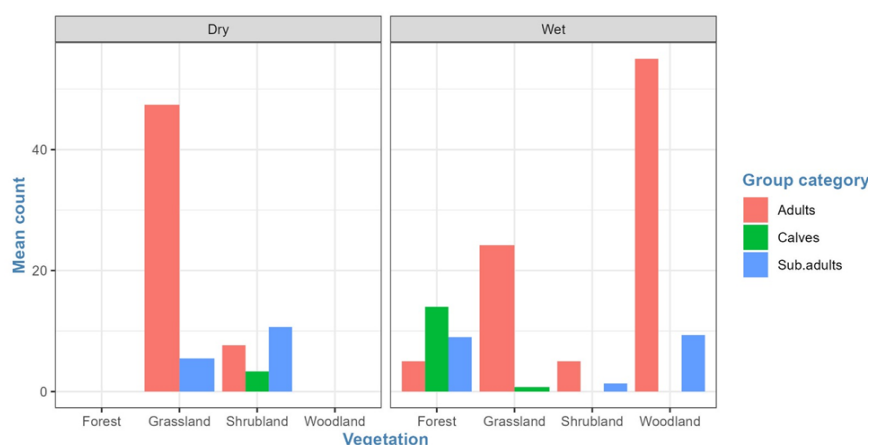
Distribution patterns of the common eland were compared by age groups to see which age group preferred which habitat in which season. The mean abundance of the common eland for adults, calves, and subadults is spread across all habitats in the wet season, with varying mean numbers of individuals per age group. The findings indicate that the forest habitat in the wet season recorded all the age groups, with calves registering a high mean, followed by subadults. The grassland had more adults with very few calves, while shrubland and woodland

had only adults and subadults. In contrast to the wet season. The findings that the common eland utilized mostly the grassland other than shrubs, forest, and woodland habitats is ascribed to resource utilization, diet preference, and security advantage-ability to see their predators. The wet season results show that adult common eland and subadults utilize mostly the grassland as they feed on fresh grasses, and grazing becomes a more dominant feeding habit allowing them to spend more time in the grassland. Contrary to adults and subadults, juvenile eland spent more time in the forest to enhance hiding and reduce exposure to predators.



Source: Fieldwork (2022).

**Figure 2.** A checklist of plant species fed by the Common eland in NCA.



**Figure 3.** Eland Distribution Patterns in Heterogeneous Vegetation in NCA.

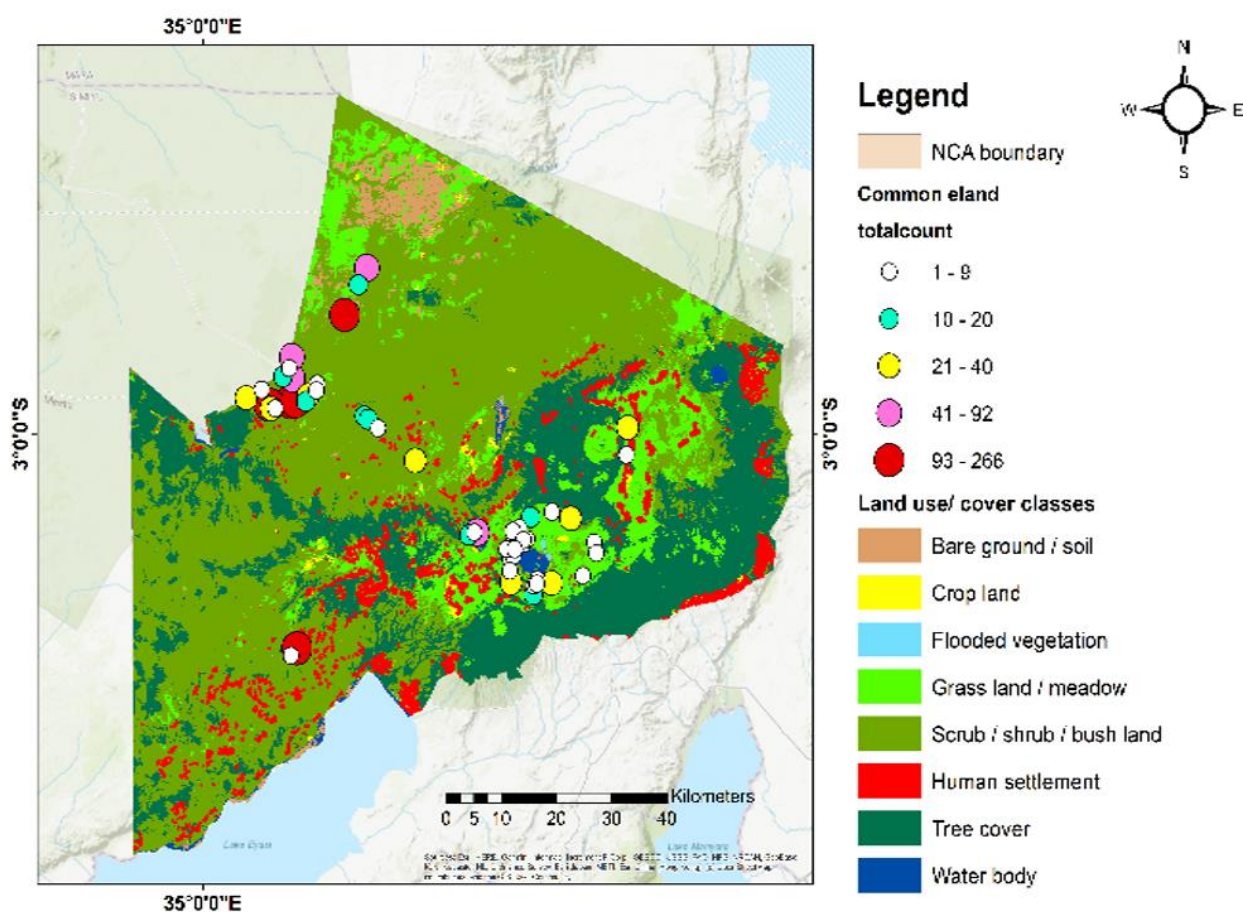
Common Eland distribution patterns in the Heterogeneous Vegetations.

The average number of the common eland inhabited across different habitats for both wet and dry seasons shows that the

distribution of individuals was statistically significant ( $F=4.235$ ,  $P=0.0302$ ). Furthermore, in the wet season, the mean difference in eland located across all vegetation types was significant ( $F=3.499$ ,  $P=0.0185$ ). (Table 1)

**Table 1.** Common Eland distribution patterns in the Heterogeneous Vegetations.

| Variable                                   | Grassland                 | Shrubs                     | Woodland                     | Forest   | F-value | P-value |
|--------------------------------------------|---------------------------|----------------------------|------------------------------|----------|---------|---------|
| Average number of elands in the dry season | 52.16 <sup>A</sup> ±13.87 | 21.67 <sup>AB</sup> ±11.68 | 2.67 <sup>B</sup> ±1.20      | 0        | 4.235   | 0.0302  |
| Average number of elands in the wet season | 38.90 <sup>A</sup> ±9.48  | 6.25 <sup>B, C</sup> ±1.84 | 64.33 <sup>A, C</sup> ±48.66 | 28.00±NA | 3.499   | 0.0185  |



Source: Fieldwork, 2025

**Figure 4.** Distribution patterns in the Wet Season.

### 3. Discussions

Feeding Ecology of the Common Eland in the NCA

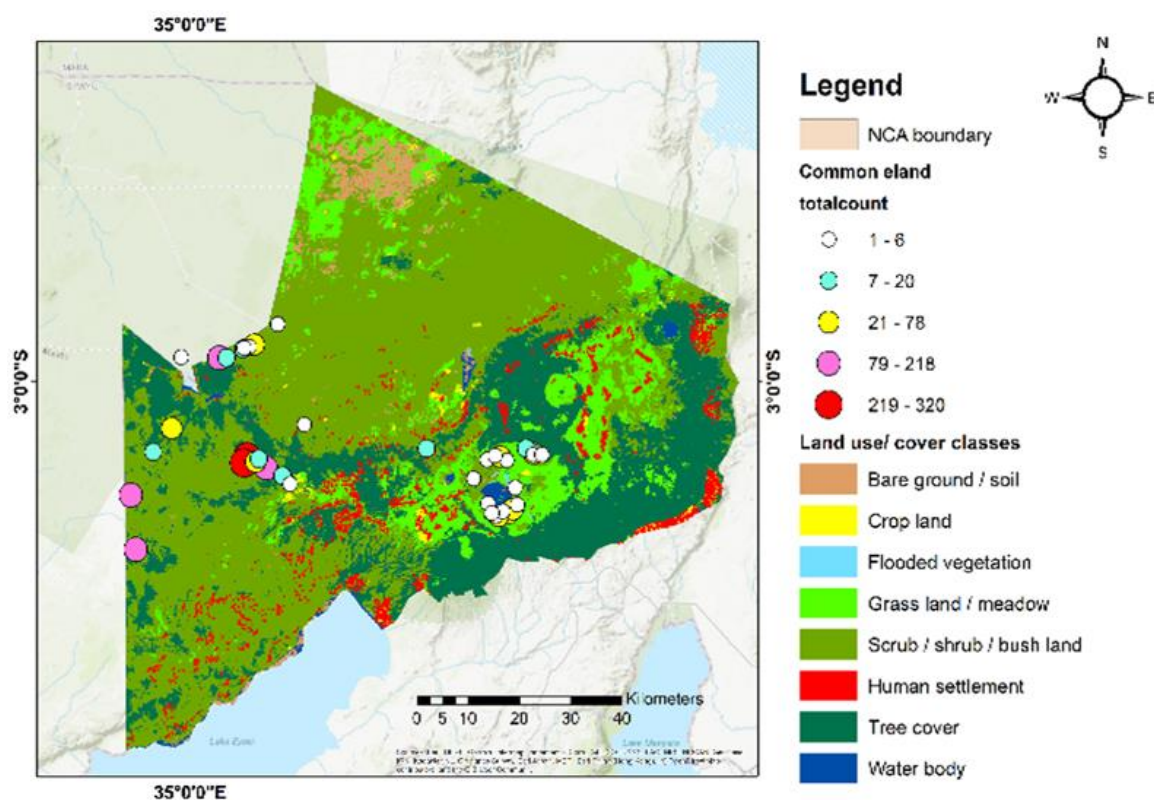
The common elands are well-known as mixed feeders that graze during the wet season and browse during the dry season

[16]. Elands switched to feeding seasonally because it was an alternative feeding strategy when food was scarce [19]. As previously shown, elands fed frequently on grasses but rarely on browse. The disproportionate availability of vegetation in the Serengeti ecosystem, which is more plains than other habitats, favors the common eland in response to food avail-

ability [2, 8, 21], predicting that the common eland of the East African plateau would have more grasses in their diet.

The findings of this study on the feeding of the common eland agree with the findings, such as those of [12], who found that elands frequently prefer feeding on grasses such as *Setaria* sp. and *T. triandra*. Furthermore, [12], the study explained that the common eland mostly utilized habitats where there were abundant grasses in response to diet avail-

ability, as naturally, they are water-independent and capable of surviving for a considerable period without free water; water is obtained from their diet [4]. The similarity of the feeding ecology of the common eland in NCA with other study areas confirms the feeding ecology of the common eland. It explains the influence of diet on habitat use and distribution patterns in NCA.



Sources: Fieldwork, 2025

**Figure 5.** Distribution Patterns in Dry Season.

#### Distribution Patterns of the Common eland in NCA

The common eland inhabits heterogeneous habitats, as demonstrated by the results of this study. The finding that the common eland utilized mostly grassland, other than shrubs, forest, and woodland habitats, is ascribed to resource utilization, diet preference, and a security advantage to see their predators. The common eland, being a mixed feeder, can inhabit heterogeneous habitats based on the abundance of dietary items at a particular season of the year. These findings are similar to those of [20], who found that the extent of grasses for grazers in East Africa influences the preference of grassland for the common eland. The wet season results show that adult common eland and subadults utilize mostly the grassland as they feed on fresh grasses, and grazing becomes a more dominant feeding habit, allowing them to spend more time in the grassland. Contrary to adults and subadults, juvenile eland spent more time in the forest to enhance hiding and

reduce exposure to predators.

In the dry season, the common eland became less selective of habitats and diet, as the animals need a large home range to obtain sufficient forage. This suggests that eland habitat use was influenced by the availability of food resources [4]. These findings support studies on habitat heterogeneity as a driver of ungulate diversity and distribution patterns where Hluhluwe-iMfolozi Park, South Africa is a good example [14]. Similarly, a study by [1], in the Serengeti National Park, (SNP) showed that the availability of forage mostly influences resource use by ungulates. Additionally, the findings showed that in areas with human settlements for both seasons wet and dry, there was no common eland sighted this is probably because of the existence of human settlement and human development, these results agreed with that of [10], who revealed that conservation pressures such as habitat loss and fragmentation are the major key factors for the decline of common eland else-

where which exacerbated by human development.

## 4. Conclusion and Recommendation

### 4.1. Conclusion

The study on the feeding ecology and distribution patterns of the Common eland (*Tragelaphus oryx*) in the Ngorongoro Conservation Area provides critical insights into their dietary preferences and habitat utilization. The results indicate that the Common eland primarily feeds on grasses such as *Themeda triandra* and *Chloris pycnothrix*, while also occasionally browsing on certain shrubs and trees like *Vachellia drepanolobium*. The distribution patterns suggest a strong grassland preference, with limited use of shrubland, woodland, and forested areas. Seasonal variations did not significantly affect habitat selection, although juveniles were more likely to be found in forested areas for protection. The study underscores the importance of grassland habitats for the sustenance of the Common eland population, as they provide both food and security from predators.

### 4.2. Recommendations

Habitat Management and Monitoring through the use of satellite GPS collars for tracking movement patterns would provide more precise data on eland distribution patterns, permitting improved conservation plans.

Further study focusing on the impacts of climate change is recommended to enhance long-term conservation strategies.

## Abbreviations

|      |                                                |
|------|------------------------------------------------|
| SNP  | Serengeti National Park                        |
| NCAA | Ngorongoro Conservation Area Authority         |
| NCA  | Ngorongoro Conservation Area                   |
| GLM  | Generalised Linear Model                       |
| IUCN | International Union for Conservation of Nature |
| LC   | Least Concern                                  |

## Author Contributions

**Gregory Mtega:** Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Project administration, Software, Validation, Visualization, Writing – original draft, Writing – review & editing

**Victoria Shayo:** Data curation, Formal Analysis, Funding acquisition, Methodology, Project administration, Resources, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing

**Peter Nyanswi:** Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Software, Visualization, Writing – original draft, Writing – review & editing

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## Conflicts of Interest

The authors declare no conflicts of interest.

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