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Research Application Summary

Camel forage range in Uganda's dryland

Salamula, J.B.[1], Aleper, D.[2], Egeru, A.[3] & Namaalwa, J.[1]
[1]School of Forestry, Environmental and Geographical Science, Makerere University, P. O. Box 7062, Kampala, Uganda
[2]National Agricultural Research Organisation, Tororo, Uganda
[3]Regional Universities Forum for Capacity Building in Agriculture, P. O. Box 16811, Wandegeya, Kampala, Uganda
Corresponding author: a.egeru@ruforum.org

Abstract

Camels thrive best in arid and semi-arid lands of Africa and have the potential to reduce the vulnerability of pastoral communities to impacts of climate change and variability. The study was conducted in Karamoja sub-region and involved assessment of vegetation with intent to characterize the foraging range for the camels. The camel grazing area was stratified based on vegetation classes namely; woodland, bushland, grassland and farmland using the District vegetation maps. A total of 46, 10, 6 and 5 plots were assessed in the bushland, woodland, farmland and grassland strata respectively. In each plot, all the tree and shrub species were identified. The findings revealed high species diversities in the bushlands and woodlands of both districts and the lowest species diversities in the farmlands of both districts. Also, species compositional similarity statistics revealed a high similarity between the plant communities in the bushlands and the woodlands and a low similarity among the plant communities in the farmlands and those of other habitats. The study therefore brought to light the unique opportunity for exploration of camel rearing offered by Karamoja region as evidenced by its vegetation spectrum.

Key words: Bushlands, Karamoja region, woodlands

Résumé

Les chameaux sont des animaux bien adaptés aux zones arides et semi-arides de l'Afrique et ont le potentiel de réduire la vulnérabilité des communautés pastorales aux impacts de la variabilité et du changement climatique. L'étude a été menée dans la sous-région de Karamoja et a consisté en une évaluation de la végétation dans le but de caractériser l'aire d'alimentation des chameaux. La zone de pâturage du chameau a été stratifiée en fonction des classes de végétation à savoir; les zones boisées, les zones de végétation, les prairies et les zones de terres agricoles en utilisant les cartes de végétation du district. Un total de 46, 10, 6 et 5 parcelles ont été respectivement évaluées dans les zones boisées, forêts, terres agricoles et de prairies. Dans chacune des parcelles, toutes les espèces d'arbres et arbustes ont été

identifiées. Les résultats ont révélé une diversité d'espèces élevée dans les brousses et forêts tandis que la plus faible diversité est enregistrée au niveau des terres agricoles. En outre, les statistiques de similarité de composition d'espèces ont révélé une forte similitude entre les communautés végétales des zones de forêts et de savanes brousses et une faible similitude entre les communautés végétales des terres agricoles et celles des autres habitats. L'étude a donc mise en lumière l'opportunité unique offerte par la région de Karamoja pour l'exploration de l'élevage du chameau comme en témoigne son spectre de végétation.

Mots clés: Zone boisée, région de Karamoja, forêts

Introduction

Pastoral communities are among the most vulnerable to climate change due to their highly risk-prone and less resilient production environments and low adaptive capacity (Megersa *et al*., 2014). They grapple with numerous challenges that range from recurrent drought to disease mostly driven by adverse climate variability and climate change (Elhadi *et al*., 2012b). Climate change and variability present a major challenge to livestock production in arid and semi-arid environments through their impacts on pasture production, water availability, disease risks and thermal stresses (Megersa *et al*., 2014; Thornton *et al*., 2009).

Consequently, the vulnerability of livestock systems will intensify due to the reduced productivity and higher nutritional stress that animals are likely to suffer, potentially making livestock less effective as a sustainable livelihood option (Elhadi *et al.*, 2012a; Sejian *et al.*, 2015). Pastoralists use numerous traditional risk management systems to cope with these challenges among which comprise,increase of the herd size and herd diversification to include improved and resistant breeds such as donkeys and camels (Schwartz, 2005; Kirkbride and Grahn, 2008).

Camels unlike other livestock species are well adapted, known to survive in extreme climatic conditions of the arid and semi-arid areas which are unsuitable for crop production. Also in such areas, other livestock species hardly thrive, due to deficient biological and physiological adaptations (Kagunyu and Wanjohi, 2014; Awoke *et al*., 2015). Camels are very reliable milk producers during dry seasons and drought years when milk from cattle, sheep and goats is scarce (Farah, 2004). Subsequently camels have the potential to enhance the livelihoods and build resilience of pastoral communities to impacts of climate change. These animals are likely to be an even more important food source for pastoralists in the face of global warming and climate change (Kadim *et al*., 2008; Awoke *et al*., 2015). Despite the important roles played by camels in pastoral livelihoods, there is currently limited literature in the Ugandan context. This study therefore aimed at characterizing the spatial distribution of camels as well as determine their contribution in enhancing pastoralist household resilience.

Literature summary

Camels do not show any clear preference for any vegetation type (McLeod and Pople, 2008).They generally graze on a broad spectrum of fodder plants, including thorny bushes,

halophytes and aromatic species, usually avoided by other domestic herbivores (El-Keblawy *et al*., 2009). The food spectrum of camels is related to the amount of rainfall (Phillips *et al*., 2001). Under dry conditions camels generally feed on trees and shrubs, however after substantial rainfall, they alter their browsing habits and feed mainly on ground storey vegetation (Phillips *et al*., 2001; Dörges and Heucke, 2003). Grasses are usually consumed during the dry season (Elmi *et al*., 1992). Nonetheless, camels are predominantly browsers and their feed mainly consists of shrubs, bushes and trees that grow up to 3.5m above ground level (Iqbal and Khan, 2001; Laudadio *et al*., 2009).

Dorge and Heuke (1995) observed that, camels are capable of using all habitats available to them within arid and semi-arid environments. However, usage was seasonally variable with the preference for open bushland all year round. Such preference is attributed to a constant rich and varied food supply, good observational awareness of surrounds and the presence of shade trees during hot months. Open woodlands are also preferred by camels because they provide a large variety of food plants all year round (Dörges and Heucke, 2003).

It has been documented that Acacia species are the most favorite forage plants for camels in all seasons because they stay green throughout the dry season up to the onset of the wet season (Elmi *et al*., 1992; Tolera and Abebe, 2007). However other forage plants such as *Balanites, Commiphora, Grewia, Euphorbia, Terminalia* and *Dichrostachys* sp. among others play an in important role in camel diet in one season or another (Elmi *et al*., 1992; Tolera and Abebe, 2007). Overall, camels graze on a broad spectrum of fodder plants (Iqbal and Khan, 2001).

Materials and methods

The study was conducted in Karamoja region that lies between latitudes 1^{o} 30'and 4^{o} N, and longitudes 33^{o} 30' and 35^{o}E in North Eastern Uganda. Two districts namely Amudat and Moroto were purposively selected within the region based on prior information from key informants on the presence of camels in the two districts. At least one sub-county was selected in each district, for the indepth investigations.

The study considered both biophysical/vegetation assessments as well as social research approaches. The vegetation assessment was intended to characterize the foraging range for the camels. A multi-stage sampling procedure was used. In the first stage, where each sub-county was stratified based on the vegetation classes, of bushland, woodland, farmland and other classes. A grid of 1 x 1 km was laid on the district map in order to facilitate systematic sampling with the different strata. At every point of intersection, a cluster of 5 sampling points were systematically laid out at an interval of 100m apart distributed in the 4 cardinal points of the intersection. Sample clusters lying in the preferred vegetation strata were purposively selected based on accessibility and representativeness of the vegetation class. Due to financial and time constraints, 3 plots were randomly selected from each cluster for assessment.

A sampling intensity of 0.01% was adopted as recommended by Malimbwi and Mugasha (2002) and Malimbwi *et al.* (2005). The number of plots assessed per vegetation strata varied depending on the area (size) of the strata and relevancy to camel foraging. A total of 46, 10, 6 and 5 plots were assessed in the bushland, woodland, farmland and grassland strata respectively. A GPS was used to capture spatial information for each plot, from which all the tree and shrub species wereidentified. The height, diameter at breast height and crown diameter of the dominant (most occurring) trees were recorded. Similarly, the height, crown depth and width of the dominant bushes was were recorded. In addition to characterizing the vegetation, the spatial attributes of the watering points were also captured.

Results

A total of 44 species were recorded with the most common being: *Acacia brevispica, Acacia nilotica, A. senegal; A. seyal; A. tortilis A. brevispica and A. sieberiana; Balanites aegyptiaca; Opuntia cochenillifera; Commiphora africana; Dicrostachys cinerea; Euphorbia candelabrum; Grewia mollis; Maytenus undata; Rhus natalensis; Terminalia brownii; Zanthoxylum chalybeum; Rhus vulgaris and Lannea species*. Informal community discussions with camel herders revealed that species preferred by camels included *Grewia mollis, Euphorbia* sp. and *Acacia* sp. among others (Table 1). The species diversity indices revealed high diversities in the bushlands and woodlands (Table 2) and the lowest species diversities in the farmlands of both districts. Species compositional similarity statistics (Jaccard similarity index) showed that the plant communities in the Bushlands were more similar to those in the woodlands. The plant communities in the farmlands were found to be the least similar to those in the woodlands and bushlands (Table 3).

Table 1. Preferred forages as perceived by the pastoralists

Vernacular	Scientific name
Esuguru	*Tribulus terestris*
Eligoi/Ekilala	*Euphorbia tirucalis*
Ekorete (desert date)	*Balanites aegyptica*
Echogorom	*Capparis sp.*
Edapal (cactus)	*Opuntia cochenillifera*
Emekui	*Baleria acanthoides*
Erereng	*Cadaba farinosa*
Ekadeluae	*Capparis tomentosa*
Ekodiokodioi	*Acacia senegal*
Eregai	*A. melifera*
Eminit	*A. tortilis*
Ekapelimen	*A. nilotica*
Amugit	*Lagenaria siceraria*
Ekaleruk	*Cucumis sp*
Etopojo	*Lannea discolor*
Ekadeli	*Comiphora africana*

Table 2. Species diversity among the vegetation strata

Distrit	Vegetation strata	Shannon index	Simpson dominance index
Amudat	Bushland	2.453	0.864828
	Farmland	0	0
	Woodland	2.366	0.908034
Moroto	Bushland	2.417	0.878491
	Farmland	0.9369	0.638889
	Grassland	1.962	0.844082
	Woodland	2.166	0.854237

Discussion

Bushland and woodland habitats have a high species diversity thus offer a wide range of nutritional choices for camels and are therefore preferred by camels (Dorges and Heucke, 1995; Dorges and Heucke, 2003). The species that were recorded as common and those that were perceived by the camel herders as preferred by camels are also among those that are reported, from previous studies, as most preferred by camels (Rutagwenda *et al.*, 1990; Tolera and Abebe, 2007; Elmi *et al*., 1992; Kuria *et al.*, 2012). The similarity in the plant community structure between the bushland and woodland ecosystems probably affirms why camels thrive well in both. Previous studies have concluded that bushlands and woodland are the habitats that are most preferred by the camels because they provide a large variety of food plants all year round (Dorges and Heucke, 2003).

Conclusion

The study area offers a unique opportunity for exploration of camel rearing as evidenced by its vegetation spectrum.

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Table 3. Species compositional similarity

1	Bushland Amudat	Farmland Amudat	Woodland Amudat	Bushland Moroto	Farmland Moroto	Grassland Moroto	Woodland Moroto
Bushland Amudat							
Farmland Amudat	0						
Woodland Amudat	0.366667	0					
Bushland Moroto	0.447368	0	0.448276				
Farmland Moroto	0.071429	0	0.0625	0.068966			
Grassland Moroto	0.193548	0	0.142857	0.225806	0.181818		
Woodland Moroto	0.34375	0	0.428571	0.466667	0.0555556	0.181818	

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