Challenges and threats to rangeland utilization and appropriate intervention indicators for sustainable livestock production in North Bank Region of The Gambia

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Abstract

The North Bank Region (NBR) of The Gambia rangeland is composed of shrubby vegetation with few widely spaced trees and undergrowth forbs and grass species on a flat terrain. A study was conducted to ascertain the challenges and threats to rangelands utilization by livestock in NBR, and to identify appropriate intervention indicators for sustainable rangeland livestock production in the region. A multi-stage sampling technique was employed to select 200 respondents from the seven districts in the NBR. Data obtained from the study were analyzed using descriptive statistics. Majority (94.9%) of the respondents were not satisfied with the current condition of their rangelands. A large number (54.3%) of the respondents noted crop cultivation as a source of rangeland encroachment. Other sources of rangeland encroachment in NBR noted by the respondents were transhumance grazing, bush burning and firewood fetching. Provision of water is the most intervention of interest in NBR as opined by 46.9% of the respondents, while 16.9% recommended pasture establishment for sustainable rangeland livestock production. Challenges faced by livestock keepers and context-specific areas of intervention were highlighted. The study revealed a decline in rangeland forage resources in NBR of The Gambia. Crop farming was found to be the major cause of rangeland encroachment. Priority should be given to rangeland development and protection for sustainable livestock production in The Gambia.

Keywords: Ecological knowledge, feed resources, pastoralists, range ecosystem

Défis et menaces pour l'utilisation des pâturages et indicateurs d'intervention appropriés pour une production animale durable dans la région de North Bank en Gambie

Résumé

La région de la rive nord (RRN) des parcours de la Gambie est composée d'une végétation arbustive avec peu d'arbres largement espacés et de sous-bois et d'espèces d'herbes sur un terrain plat. Une étude a été menée pour déterminer les défis et les menaces à l'utilisation des pâturages par le bétail dans la NBR, et pour identifier les indicateurs d'intervention appropriés pour une production animale durable sur les parcours dans la région. Une technique d'échantillonnage à plusieurs degrés a été utilisée pour sélectionner 200 répondants dans les sept districts de la RRN. Les données obtenues à partir de l'étude ont été analysées à l'aide de statistiques descriptives. La majorité (94,9%) des répondants n'étaient pas satisfaits de l'état actuel de leurs parcours. Un grand nombre (54,3 %) des répondants ont indiqué que la culture des cultures était une source d'empiètement sur les parcours. Les autres sources d'empiètement sur les parcours dans la RRN notées par les répondants étaient le pâturage de transhumance, le brûlage de brousse et le ramassage de bois de chauffage. L'approvisionnement en eau est l'intervention la plus intéressante dans la RRN, comme l'ont exprimé 46,9% des personnes interrogées, tandis que 16,9% ont recommandé

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l'établissement de pâturages pour une production animale durable sur les parcours. Les défis auxquels sont confrontés les éleveurs et les domaines d'intervention spécifiques au contexte ont été mis en évidence. L'étude a révélé un déclin des ressources fourragères des parcours dans la RRN de la Gambie. L'agriculture s'est avérée être la principale cause de l'empiètement des pâturages. La priorité devrait être donnée au développement et à la protection des parcours pour une production animale durable en Gambie.

Mots-clés : Connaissances écologiques, ressources alimentaires, pasteurs, écosystème de parcours

Introduction

Livestock contributes about 8.6% of the national gross domestic product to The Gambia's economy. In addition to income generation, animals are reared for manure and ceremonial purposes (Tourayet *et al.*, 2010). In Sub-Saharan Africa, most ruminants are reared on rangelands which provide traditional grazing grasses, forbs, browse trees and shrubs (Abusuwar and Ahmad, 2010). However, livestock production is constrained by scarcity of feed and water during the long dry season, aggravated by rampant bush fires which destroy crop residues, hays and other by-products that are reserved for feeding livestock (NAPA, 2007; ANR, 2009). Furthermore, the challenge is exacerbated by the degradation and depletion of rangeland resources (GNAIP, 2011) which are attributed to non-regulation of transhumance, expansion in human settlements and the encroachment on natural grazing lands for crop farming (Touray *et al.*, 2010; Daffeh, 2014). Rangelands in The Gambia are common property resources with open, uncontrolled access to both migratory and sedentary livestock keepers (Daffeh, 2015). Regulations regarding rangeland use are often not strictly enforced, as individual livestock keepers follow their own grazing practices with little adoption for systematic management of grazing areas resulting in over-grazing (Akinboade, 1998). Sustainability of feed resources available on rangelands calls for a continuous assessment and monitoring of the distribution and changes of these resources,

and also the identification of the factors driving the observed change dynamics (Feng *et al.*, 2009). Pastoralists' perception and environmental knowledge of pastoral areas are often disregarded in studies aimed at enhancing rangeland resources management (Roba and Oba, 2009). In recent times, scientists have come to the realization that pastoralists have immense ecological knowledge (Berkes *et al.*, 2000; Ladio and Lozada, 2009), which are unique to different locations (Fernandez-Gimenez, 2000), and even to community members (Kgosikoma *et al.*, 2012). Investigating the variations in pastoralists' ecological knowledge within various environmental and cultural contexts will give a wider perspective of ecosystem dynamics (Kgosikoma *et al.*, 2012). Therefore, the aim of this study was to ascertain challenges and threats to rangelands utilization by livestock, and also to identify appropriate intervention indicators for sustainable rangeland livestock production in North Bank Region of The Gambia.

Materials and methods

Description of study area

The study was conducted in North Bank Region (NBR) of The Gambia. The Gambia is located in the Sudano-Sahelian zone of West Africa, with a climate typically characterized by a short rainy season from June to October and a dry season from November to May. NBR lies between latitude 13°35'24" and longitude 16°32'45" Northwest, latitude 13°38'21" and longitude 15°27'37" Northeast, latitude 13°21'44" and

longitude 16°30'27" Southwest, and latitude 13°29'59" and longitude 15°18'53" Southeast. It consists of seven districts inhabited by farmers practicing both crop cultivation and sedentary livestock rearing. It falls under the Agricultural Ecology Zone 2 with length of the growing period between 120 – 135 days with the start of the wet season beginning mid-June. The annual cumulative rainfall is reported to be between 700 – 800mm (Daffeh, 2014).

Data collection

Livestock owners, herdsman, Livestock Owners Association (LOA) executive members and livestock field officers were the target respondents for the study considering their involvement in livestock production system. Data were collected from a total of 200 respondents (Table 1). One hundred and seventy-five respondents,

consisting only of livestock owners and herdsman, were interviewed using close-ended questionnaire. A structured questionnaire was developed and administered to the respondents. From each district, five villages and five household members per village were selected. This questionnaire was used to investigate livestock species ownership structure, current condition of rangelands, rangeland use constraints (degrading factors), and potential areas of intervention to enhance sustainable rangeland livestock production. Survey data were collected from the month of November to December 2017 by the researcher in collaboration with livestock officers stationed in the concerned study areas. Individual respondents were visited at their homes for interview from one village to the other, and then from one district to the next.

Table 1: Number of villages covered and respondents interviewed per district for the study

District	Number of villages	Number of respondents
Central Badibou	5	25
Jokadou	5	25
Lower Badibou	5	25
Lower Niumi	5	25
Sabah Sanjal	5	25
Upper Badibou	5	25
Upper Niumi	5	25
Total	35	175

Data analysis

Data collected were analyzed using descriptive statistics of percentages and frequencies using statistical package for Social Sciences (SPSS) version 16.0.

Results and discussion

Demographic information of livestock owners and herders in North Bank Region of The Gambia

Demographic information of livestock owners and herders in North Bank Region (NBR) of The Gambia are shown in Table 2. One hundred and twenty-one livestock owners and 54 herders were interviewed in the study area. Respondents were between

the ages of 15 and 85; 94.9% were male and 5.1% female. The livestock management system in NBR is predominantly traditional; livestock ownership was mostly vested on male. Results revealed that 47.8% of the respondents had experience in livestock rearing from 15 to 35 years. Touray *et al.* (2010) emphasized in their report that livestock rearing is an important economic activity in The Gambia, whereby 46% of rural households own one or more head of cattle and 89% raise at least one sheep or goat. Majority of the respondents (36%) purchased their initial herd stock, while 28.6%, 15.4% and 20% of the respondents acquired theirs through

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inheritance, breeding, and others, respectively. Others referred to stock acquisition through gift, dowry, herding on contract or entrusted by relationships. The respondents' acquisition of initial stock through inheritance, breeding and others (dowry, entrusted for breeding or contract herding) confirms the report of Touray *et al.*

(2010) who documented that livestock are generally kept in herds and are rarely individually owned, for the current study showed that owners pooled their animals (mostly cattle) and entrust them to one herder called caretaker. The finding of this study is indicative that livestock resources are highly valued among other livelihood needs (Garba *et al.*, 2015).

Table 2: Demographic information about livestock owners and herders in North Bank Region of The Gambia

Variables	Data distribution	
	Frequency	Percentage
Respondents		
Number of livestock owners	121	69.2
Number of herders	54	30.8
Gender		
Male	166	94.9
Female	9	5.1
Age (years)		
15 – 35	24	13.7
35 – 55	89	50.9
55 – 75	58	33.1
75 – 95	4	2.3
Duration of livestock rearing (years)		
5 – 15	35	20
15 – 25	47	26.9
25 – 35	47	26.9
35 – 45	36	20.6
45 – 55	9	5.1
55 – 65	1	0.6
Acquisition of initial stock		
Purchase	63	36
Inheritance	50	28.6
Breeding	27	15.4
Others	35	20

The population of livestock species reared by respondents in NBR of The Gambia is presented in Table 3. The most reared livestock species were cattle (7191) while donkey (224) was the least reared. The cattle population reported in this study is similar to the report of the National Livestock Census (DLS, 2016), but donkey population is found to be contrary to their report. Livestock keepers in NBR

considered cattle as the most important livestock species for livelihoods, then followed by horses and donkeys. However, sheep and goats were regarded as the most important species in terms of income generation (ILRI, 2012). The result further revealed dominance of females (7373) across all species compared to males (2327). Female dominance among all livestock species highlights the sector's potential for sustainability.

Table 1: Population structure of livestock species reared in North Bank Region of The Gambia

Category	Livestock species				
	Cattle	Sheep	Goat	Horse	Donkey
Young	1793	304	443	35	32
Matured	1449	155	212	52	50
Pregnant	1017	180	224	59	43
Lactating	1801	257	317	33	28
Dry	173	8	13	5	4
Male	1617	231	250	127	102
Female	5574	701	843	133	122
Total	7191	932	1093	260	224

Current condition of rangelands in North Bank Region of The Gambia

Respondents' opinions about rangeland condition and comparison of forage resources quantity to number of livestock are shown in Table 4. Forages play a critical role in the nutrition of ruminants, providing energy, protein and minerals (Kamlak, 2010). Angassa *et al.* (2012) noted that assessment of pastoral areas using ecological indicators by inhabitants is pertinent in conducting integrated evaluation that could aid setting research and development priorities. The quantity of forages produced was considered inadequate for livestock as reported by 94.2% of the respondents. As observed in the survey results, 80% of the respondents kept livestock for over 15 years, highlighting their familiarity with the trend of availability of rangeland forage resources. Majority (94.9%) of the respondents expressed their dissatisfaction about the current condition of their rangelands as a result of inadequate forage and water resources. Sadiq (2014) reported that forage availability and quality are important factors in extensive nomadic ruminant production system. Grazers are greatly influenced by the nutritional dynamics of forage, especially during the dry season (Teka *et al.*, 2012). Grazing areas in the tropics are subjected to wet and dry seasons (Hardy *et al.*, 1997), which results into large fluctuations in quantity

and/or quality of the available forages (Da Silva and de Carvalho, 2005). Livestock field officers and livestock owners' association executives lamented that rangelands are invaded by noxious forage species (such as *Senna obtusifolia*, *Croton hirtus* and *Hyptissu aveolens*) that grow vigorously. Similarly, Haftay *et al.* (2013) reported that less desirable grass species, such as *Setaria verticillata* and *Sporobolus marginatus*, were found in open-access grazed areas due to their low preference by grazing livestock. Herdsmen claimed that these forage species make grazing difficult for cattle. The nature of vegetation, especially around November when vegetation is dominated by thorny forage species, makes rangelands to be seasonally utilized as reported by majority (87.4%) of the respondents. This is contrary to the report of Touray *et al.* (2010) who documented that rangelands provide adequate nutrition for ruminant livestock during the rainy season. Arzani *et al.* (2008) argued that seasonal variation is one of the important factors affecting forage quality. Dominance of unpalatable grass species and forbs as observed by the herders is an indicator of poor range condition (Angassa *et al.*, 2012). Seasonal grazing often results in overgrazing which causes a decline in rangeland resources (Prosper, 2010), an increase in soil erosion and weedy species that thrive under disturbance, and consequently decrease important forage production (Roselle, 2011).

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Table 4: Opinion of respondents on current range condition, quantity of forage resources and grazing type utilization of rangelands in North Bank Region of The Gambia

Variables	Data distribution	
	Frequency	Percentage
Availability of forage resources		
Adequate	8	4.6
Very adequate	2	1.1
Inadequate	65	37.1
Very inadequate	100	57.1
Satisfaction with rangeland condition		
No	166	94.9
Yes	9	5.1
Nature of rangeland utilization		
Permanent grazing	22	12.6
Seasonal grazing	153	87.4

Causes of rangeland resources decline and sources of encroachment in North Bank Region of The Gambia

The causes of resources decline, sources of encroachment to rangeland in NBR of The Gambia are presented in Table 5. A high proportion (34%) of the respondents, based on their experiences, reported crop encroachment as the major cause of decline in rangeland resources. This is in agreement with the reports of Admasu *et al.* (2010) who documented that the extension of crop production due to human population growth causes a decline in natural grazing areas. Stakeholders in the sector observed an increase in crop production (due to population) at the expense of rangeland, particularly wet season production of groundnut, rice and water melon, and also dry season cashew and vegetable production.

Furthermore, 20.6% of the respondents noted indiscriminate land use as a major cause of decline in rangeland resources. Under the traditional land tenure system administered by District Authorities, rights to cropland are inheritable and relatively secure. However, neither individuals nor households have rights to specific parcels of grazing land (Touray *et al.*, 2010). The current trends in land use have led to restricted movement of herdsmen and reduction in grazing areas which ultimately

have a bearing on the grazing resource base (Oba, 2012). Minority (14.3%) of the respondents indicated poor soil fertility as a factor that contributes to decline in rangeland resources. Rangeland resources are diverse and distributed across various seasons characterized by irregular climatic conditions (Nori *et al.*, 2008). Sustainability of rangelands is dependent on soil carbon and nutrient balance and the capacity to maintain suitable soil conditions for water availability and root development (Noellemeyer *et al.*, 2006). In addition, nutritional quality of forages is greatly influenced by soil nutrient status (Tessema *et al.*, 2011).

Due to its low vegetative cover (Yaffa, 2013), NBR is very prone to soil erosion especially during periods of heavy rainfall in wet season and occurrence of windstorms in the dry season. The North Bank Region has been reported to be characterized by poor soil structure and fertility (Department of Agriculture, 2005). In addition, 14.9% of the respondents reported overgrazing as a cause for the decline in rangeland resources. High grazing pressure on native pasture species severely impedes their regenerative ability and often results in a decline in highly desirable and nutrient-rich species (Fensham *et al.*, 2010; Haftay *et al.*, 2013). Similarly, Sternberg *et al.* (2000) reported that heavy grazing influences the botanical

composition and species heterogeneity by suppressing the presence of dominant species, setting the ground for noxious forages to grow in vigor. Majority (54.3%) of the respondents stated that crop farmers are the major source of rangeland encroachment in NBR. Similar observation was reported by Desalew (2008). Other sources of rangeland encroachment in NBR noted by the respondents were transhumance grazing, bush burning and

firewood fetching. Frequent bush fires significantly contribute to loss of natural forage resources which could help farmers adapt to the effects of climate change (Olaniyan, 2016). These bush fires burn down the entire short-lived, less resistant grass species and their seeds, which then enables colonization by less competitive forages. These forages grow in vigor, become more tolerant to fire and produce more viable seeds for their multiplication on seasonal basis.

Table 5: Causes of resources decline, source of encroachment and opinion about crop cultivation being a threat to rangelands in North Bank Region of The Gambia

Variables	Data distribution	
	Frequency	Percentage
Causes of rangeland resource decline		
Poor soil fertility	25	14.3
Overgrazing	26	14.9
Bush fire	28	16
Crop encroachment	60	34.3
Indiscriminate land use	36	20.6
Types of encroachment encountered		
Transhumance grazers	35	20
Crop farmers	95	54.3
Firewood	12	6.9
Bush burning (bush fire)	33	18.9

Livestock production constraints and areas for intervention in North Bank Region of The Gambia

Livestock production constraints and areas of interest for intervention as reported by the respondents are presented in Table 6. Majority (35%) of the respondents noted reduction in rangeland size as a production constraint. Inadequate forage species, inadequate sources of water, low soil fertility and others were reported by 28.6%, 28%, 5.1% and 2.9% of the respondents, respectively. Others here refer to production constraints such as poverty, access to veterinary services, pest and diseases, livestock theft and inadequate government support. Sustainability of rangelands in The Gambia is advocated for in order to prevent unpalatable consequences (Olaniyan, 2017). Majority (46.9%) of the respondents

opted for water provision. This was probably due to the fact that cattle herds graze on areas that are generally inadequate in terms of watering facilities and fodder as reported by Touray *et al.* (2010). The Gambian agricultural sector is predominantly traditional and largely depends on rainfall, which lasts for four to five months of the year (Olaniyan, 2017). Though, 16.9% of the respondents selected pasture establishment. A regular supply of good quality pasture is important for livestock production systems that rely on pasture (Hughes *et al.*, 2012). Therefore, pasture establishment could be an important strategy to enhance the livestock sector by addressing the decline in quantity and quality of rangeland forage resources as documented by Touray *et al.* (2010) and Daffeh (2015).

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In view of the numerous challenges to rangeland production and management, 16.9% of the respondents opted for legislation on rangeland resources as an intervention strategy. Yaffa (2013) reported that the region is characterized by low vegetative cover which suggests high level of deforestation and vulnerability to desertification. Therefore, strategies for proper management and conservation aspects of livestock feed resources are essential for the efficient utilization of the native forage resources (Teka *et al.*, 2012).

The protection of these resources through proper implementation of regulatory system will enhance sustainable rangeland productivity considering the level at which rangeland resources are misused in NBR. Similarly, brush control was one of key intervention needed for sustainable rangeland livestock production as opined by 13.1% of the respondents. Furthermore, 7.4% of the respondents considered provision of fire stressors and or fire belts as important intervention to impede the devastating effects of uncontrolled bush burning on rangeland resources.

Table 6: Intervention needed for sustainable rangeland livestock production in North Bank Region of The Gambia

Variables	Data distribution	
	Frequency	Percentage
Production constraints		
Declining rangeland	62	35.4
Low soil fertility	9	5.1
Inadequate water source	49	28
Inadequate forage species	50	28.6
Interventions needed		
Water provision	82	46.9
Pasture establishment	29	16.6
Fertilizer application	2	1.1
Brush control	23	13.1
Fire belt	13	7.4
Legislation on range resources	26	14.9

Conclusion

The study revealed a decline in rangeland forage resources in North Bank Region of The Gambia. Also, crop farming was found to be the major cause of rangeland encroachment. Thus, priority should be given to rangeland development and protection for sustainable rangeland livestock production in The Gambia. Pasture establishment and provision of watering facilities are required interventions. In addition, legislation on use of rangeland resources should be strictly enforced.

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