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ASSESSMENT OF INDIGENOUS FODDER TREE SPECIES FROM DIFFERENT LAND-USE TYPES IN DUTSE, JIGAWA, NIGERIA

***Lawal, A. A., Jibo A.U., Salami K.D., Ilu, K.J., Muhammad, Y.K., Amina, G.H.,** and **Saidu M.**

Department of Forestry and Wildlife Management, Federal University Dutse, Jigawa, Nigeria.
***Corresponding author:** *lawal.abdulhakeem@fud.edu.ng;* +2347067881013

ABSTRACT

The expansion of urban areas driven by increasing human population and the conversion of forested lands into other use has largely affected the diversity of fodder and non-fodder tree species in most areas of the Sudan-Savanna ecoregion. Long drought period has made edible tree species, an alternative for livestock owners. This has affected indigenous fodder trees composition while the extent of this loss has not been adequately documented in most parts of Jigawa State. To check this, indigenous fodder trees were identified while density and diversity of these species was assessed. One hundred and twenty questionnaires were administered to document preferred fodder trees while four land-use types were selected to determine the diversity of fodder trees in Dutse Local Government area. Qualitative data were analyzed using frequencies and percentages. Shannon weiner's index was used to calculate the diversity, where Chi-square and distribution table were used to analyze the result and compare variables. Age played a role in keeping livestock while majority of the respondents (65%) had non-formal education. Forty-two (42) fodder tree species of choice were identified, the common and preferred species with highest percentage are: Philiostigma reticulata, Tamarindus indica, Adansonia digitata, Ficus thorningii, Mangifera indica and Parkia biglobosa. Cattle route had the highest diversity with a Shannon index of 1.07/0.5ha, followed by farm fallow, farmland and homestead with less diverse index of 0.98/0.5ha, 0.84/0.5ha, and 0.82/0.5ha respectively. Fodder tress diversity was significantly different among the different land-use type. The need to regulate the rate in which fodder trees are unsustainably felled is paramount else, most of these species will disappear within a short time. Multiple land-use and Agroforestry practices that will protect these components of the ecosystem are recommended as a management approach.

Key words: Land-use, fodder tree, diversity, composition, cattle route

INTRODUCTION

Biodiversity is central to sustainable development, alleviates poverty, improve human livelihoods as well as the socio-cultural integrity of the human populace (Jimoh and Lawal, 2016). Plant diversity supports sustainable human development and ecosystem health (De Mazancourt *et al.*, 2013). The diversity of plants and other micro elements in and above the ground are now globally threatened as a result of human unrelenting actions of degradation and unsustainable land-use (Murphy and Romanuk, 2014). These careless activities of man have been perceived to be the cause of rapid disappearance of forest cover resulting to erosion, food insecurity, loss of biological diversity, soil degradation, and unfavorable hydrological changes as observed in some northern parts of Nigeria (Aweto, 2001). Forest serves its host community in a number of ways. According to Abbass (2012), pockets of forests around Jigawa State, provides fodder and livelihoods supports to considerable number of rural communities. However, most of these forests and their resources are under intense pressure and threat from inimical human activities associated with high population growth, unregulated grazing by indigenous and non-indigenous herders and economic demands (FAO, 2016).

Ideally, the conservation of biodiversity should be an essential responsibility for all mankind (IUCN, 2009). Contrarily, the rate at which flora (fodder) ecosystem is being destroyed through human

influence within Jigawa like other northwestern states is disturbing (Ikyaagba *et al.,* 2015). This necessitates the need to assess the fodder trees composition under different land-use with the aim to contribute data on which sustainable management and conservation of floral diversity in the region could be based.

MATERIALS AND METHODS

Study Area

Jigawa is situated between latitudes 11.00°N to 13.00°N and longitudes 8.00°E to 10.15°E. It has an elevation of 460 meters above sea level. The State has a population of 4,384,649 persons, (NPC, 2006) and 7,097,407 persons in 2020 3.5% growth rate. It is largely dominated by the Hausa/Fulanis with some traces of other ethnic groups in some areas of the State. The State lies within the Sudan Savanna with elements of Guinea Savanna in the southern part and Sahel savanna to the north bordering Niger Republic (FAO, 2016). It is characterized with a mean daily minimum and maximum temperatures of 19^{o}C and 35^{o}C respectively. The rainy season starts around May to September with a range of 1000 mm -2000 mm (Abbass, 2012). It covers a land mass of about 22,410 square kilometers while about 80% of its inhabitants engage in crop and animal agriculture. Jigawa State is characterized by undulating land, with several kilometers of sand dunes of different sizes in some parts of the state.

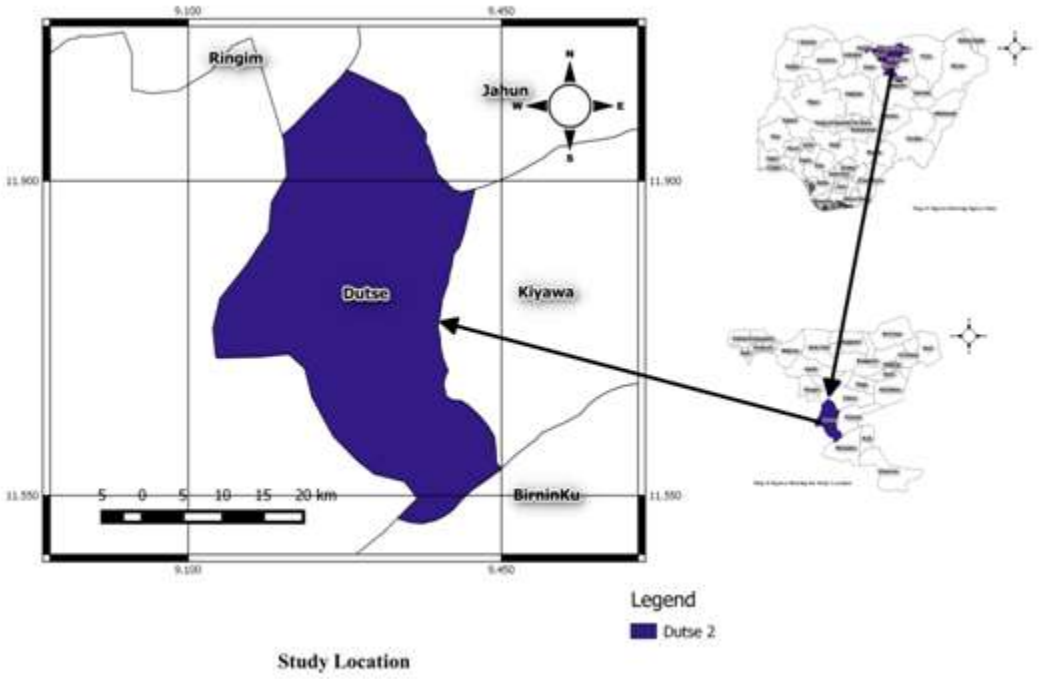

Figure 1: Map of Jigawa State showing Dutse

Experimental Design

The study area was stratified into four land use types as described by Gauch (l982). These include: Crop Farm (CF), Farm Fallow (FF), Cattle Route (CR) and Homestead (Hs). Twelve plots of 20 x 20 m were randomly located across the land use types with a minimum distance of 50 m between any two plots in each land use type. Each plot was further subdivided into five subplots of 5x5m. The five plots were established such that four quadrants were at the edge and one at the center. At the center of each 5 x 5 m plot, one 1 x 1 m sub-plot was also established (Jimoh and Lawal, 2016).

Data Collection Technique

Number of individual fodder tree with Diameter at breast height (DBH) ≥10 cm, and height were counted and measured respectively within the 20 x 20 m plots. All fodder tree species >2cm but ≤ 9cm DBH were enumerated within the 5 x 5 m subplots. Also, seedlings between 0 – 2 cm were enumerated within 1 x 1 m mini plots (Jimoh and Lawal, 2016).

Data Analysis

Shannon-Wiener diversity index and species distribution were used to measure species richness, diversity and density of fodder tree in the study area

respectively as cited by Spellerberg (1991), Turyahabwe and Tweheyo (2010), (Jimoh and Lawal, 2016).

Species richness was calculated using Menhinick's biodiversity index. The formula is stated as:

$$D = \frac{S}{\sqrt{N}} \quad \text{.....[1]}$$

Where:
D equals species richness,
S equals the number of different species in the sample, and
N equals the total number of individual species of fodder plants in that sample.

Species diversity was estimated using Shannon-Wiener diversity index as cited by Spellerberg (1991) and Turyahabwe and Tweheyo (2010). The formula is stated as:

$$H' = -\sum_{i=1}^{s} P_i \, In \, P_i \quad \text{..... [2]}$$

Where:
H = species diversity index,
P_i = the proportion of number of individuals or the abundance of i^{th} species expressed as a proportion of the total abundance.

RESULTS

Table 1 represents the demographic characteristics of the respondents. It was observed that 38.3% of the respondents were within an age range of 15-30. Following that was 31.7% of the respondents who happened to be within an age range of 31-45 while 30.0% were between 46 ≥ 60 years of age. The gender proportion favored the male respondents with 65.8%. Majority of the respondents' occupation was farming (50%); followed by 30% of herders and civil servants with the least with 20%. Most of the respondents had non-formal education to a tone of 65%. Majority of them are married (61.7%); 24.2% are single while 11.7% and 2.5% are divorced and widow respectively.

Table 2 represents the livestock housing and feeding systems used by the respondents. Under the housing system, 88.8% of the respondents practices extensive system under which livestock are kept in an open space with no roof/shade. Also, 58.8% of these livestock feeds on foliage in open lands. Just 40.8% supplements the feed of their livestock besides the foliage they browse on.

Table 3 shows the level of dependence of the respondent's livestock on fodder trees especially during the dry season. A total of 48.3% of the livestock browse on ground foliage (e.g seedlings, herbs and shrubs); 38.3% of their feed are met through slashing of fodder tree branches; while 13.3% of their feed are met by completely felling of fodder trees.

Table 1: Demographic characteristics of the respondents

Variables	Parameters	Frequency	Percentage (100)
Age (Years)	15-30	46	38.3
	31-45	38	31.7
	46-60	23	19.2
	61-above	13	10.8
Gender	Male	79	65.8
	Female	41	34.2
Occupation	Farmer	60	50.0
	Civil servant	24	20.0
	Herder	36	30.0
Educational Qualification	Formal	42	35.0
	Non-formal	78	65.0
Marital Status	Married	74	61.7
	Single	29	24.2
	Divorced	14	11.7
	Widow	03	2.5

Table 2: Respondent's Livestock Rearing System

Variables	Parameters	Frequency	Percentage (100)
Housing system	Intensive rearing	31	25.82
	Extensive rearing	89	74.2
Feeding System	Intensive feeding	20	16.7
	Semi-intensive	41	34.2
	Extensive	59	49.2

Table 3: Respondent's Livestock Level of Dependence on Fodder Trees

Variables	Parameters	Frequency	Percentage (100)
Frequency of feeding on fodder	Self-browsing	58	48.3
	Slash and feed	46	38.3
	Fell to feed	16	13.3

Composition of fodder trees in the study area

A total of fifteen fodder tree species was recorded as shown in table 4 below. Four stands of *Azadirachta indica* was recorded in three different land-use types. *Tamarindus indica* was only encountered under farm fallow while homestead have a frequency of one in each. *Adansonia digitata* was only encountered under farm land with a frequency of one.

From table 5 below, cattle route had the highest density of 14.33/0.5ha. It was followed by homestead with a density of 4.66/0.5ha; farm fallow with 4.33/0.5ha and farmland having the lowest density of 3/0.5ha. Cattle route has the highest diversity index of 1.07/0.5ha, followed by farm fallow, farmland and homestead which are less diverse with an index of 0.98/0.5ha, 0.84/0.5ha, and 0.82/0.5ha respectively. Cattle route also had the highest species abundance of 19.67/0.5ha; followed by homestead with 7.33/0.5ha; farm fallow with 6/0.5ha and lastly the farmland with an abundance of 4/0.5ha. The highest species was recorded at cattle route, with a species richness of 7/0.5ha, which are *Dyspyrous mespiliformis*, *Acacia sieberana*, *Casia singuena*, *Philiostigma reticulatum*, *Hyphaene thebaica*, *Guiera senegalensis*, and *Balanite aegyptica*. Farm fallow and homestead had equal species richness of 4/0.5ha while farmland had the least species

richness of 3/0.5ha. Species like *Tamarindus indica; Balanite aegyptica; Hyphaene thebaica; Sygium guinensis; vitex doniana and Adansonia digitata*, had the lowest density of 0.33/0.5ha each, and each appears in only one land use type.

Table 4: Fodder tree species (>10cm DBH) from the land-use type

S/No.	Species	Local Name (*Hausa*)	Frequency	Percentage
			Farm Fallow	
1.	*Vitex doniana*	Dinya	2	50.0
2.	*Azadirachta indica*	Maina	1	25.0
3.	*Tamarindus indica*	Tsamiya	1	25.0
			Farm Land	
4.	*Azadirachta indica*	Maina	2	66.7
5.	*Adansonia digitata*	Kuka	1	33.3
			Cattle Route	
6.	*Diospyros mespiliformis*	Kanya	4	33.3
7.	*Acacia sieberana*	Banje	1	0.83
8.	*Casia singuena*		2	16.7
9.	*Philiostigma reticulatum*	Kargo	2	16.7
10.	*Hyphaene thebaica*	Kaba	1	08.3
11.	*Guiera senegalensis*	Sabara	1	08.3
12.	*Balanite aegyptica*	Adua	1	08.3
			Homestead	
13.	*Azadirachta indica*	Maina	1	33.3
14.	*Tamarindus indica*	Tsamiya	1	33.3
15.	*Sygium guinensis*		1	33.3

Table 5: Summary of Fodder Species Composition Indices in the Land-use Type

Land-use Type	Density	Abundance	Species richness	Species index	Total abundance
Farmland	3	4.44	3	0.84	9
Farm Fallow	4.33	6	4	0.98	13
Homestead	4.66	7.33	4	0.82	14
Cattle route	14.33	19.67	7	1.07	43

DISCUSSION

The result revealed that 70% of the respondents who are involved in livestock or arable farming were within productive age of 15-45 years. This is in agreement with Yekinni (2011), when he reported that most farmers in Nigeria are below 45 years of age which is an age range that comprises both youths and adults. Almost 66% of the respondents were male as against 34% female. Their marital status also shows that 61.7% were married with 24.2% singles. Gender and marital status factors could have been favored by the cultural norms in the northern part of Nigeria were males are the most involved in crop and livestock farming (Lawal *et al.*, 2018).

Result also indicates that most of the livestock are reared in the traditional methods of keeping animals in an open space after thee return from open spaced grazing. This to some extend could affect the

livestock unlike when innovation is given a chance. Livestock kept under improved facility could result in an increase folds as observed in Bangladesh (Alam *et al.*, 2016). The situation is however different in Nigeria as reported by Mafimisebi *et al.* (2014) who recorded that the level of adaption of innovative technology towards livestock rearing in Nigeria is low. This could translate to the increasing rates of clash between farmers and herders and also forest degradation which has remain popular in recent time due to unimproved livestock rearing facilities.

Most of the livestock depend on fodder tree for self-feeding or when slashed for (86.6%). This is in line with Babayemi and Bamikole (2006) view that fodder trees and shrubs are important components of ruminant diet and they have been found to play some important roles in the nutrition of grazing animals in areas where few or no alternatives are available.

Azadirachta indica was observed in three of the four land-use type. This may be attributed to the fact that *Azadirachta indica* is one of the most useful trees in the northern savanna eco-region (Lawal *et al.*, 2017). *Vitex doniana* and *Tamarindus indica* were only observed on farm fallow and homestead. This could be as result of their intensive felling for socio-economic interest. In addition to the frequent felling of such choice species, their seedlings and saplings are further cleared in the process of arable farming or for other land-uses.

Farmland had the least specie density, abundance and species richness. The increasing density of woody species at farm fallow, homestead and cattle route is a clear indication of anthropogenic activities like farming and rural/urban expansion. The increase in fodder trees density from farm fallow to farmland insinuate that, if the land will be left for some years, fodder trees will rejuvenate to their normal population and species richness can also be achieved. This is in line with Jimoh and Lawal (2016), who stated that the increasing densities of woody species from crop farm to primary forest is an indication that plant species composition of the original native forest could be regained; if left to follow for a sufficiently long period. Cattle route having the highest diversity is an indication of lesser disturbances. This could be due to law enforced by the state government on restricting felling and farming along the cattle routs.

CONCLUSION

Fodder trees composition is affected by different land-use type. Cattle route had the highest species diversity this followed the fact that only few (13%) of herders do fell fodder trees completely to feed their livestock. Contrarily, most fodder trees on the other land use type were impacted negatively by the uses to which the lands were subjected to. Species richness, density, abundance and frequency were influenced by the land use type. Therefore, carless felling of fodder trees when subjecting land to other use should be controlled to guide continued loss of biodiversity.

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