EFFECT OF DIFFERENT LAND-USE ON FODDER TREES COMPOSITION IN DUTSE, JIGAWA STATE, NIGERIA

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Abstract

The expansion of urban areas driven by increasing population, need to ensure maximum crop yield and desert encroachment has largely affected the diversity of fodder and non-fodder tree species in most rural areas of the sudan-savanna ecoregion. The extent of these threats has not been adequately documented. The effects land-use type on fodder trees diversity and composition were investigated in Dutse LGA. Three 20x20m sample plots were randomly located in each of: farmland, farm fallow, cattle route and homestead. All fodder tree species with Diameter at Breast Height (DBH)≥10cm was enumerated within the 20x20m sample plots. Data collected were analyzed using Shannon-wiener Diversity Index, Simpson's evenness Index and frequency. Fifteen (15) fodder trees were identified. Cattle route was the most diverse having a species density of 14.33/0.5ha and species richness of 19.67/0.5ha. Fodder tress diversity was significantly different among the 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 rout*

Introduction

Nigeria is one of the most endowed country in Africa in terms of vegetation cover (Agbelade et al., 2016). Virtually all the vegetation types found in other African countries can be found in different geopolitical zones of Nigeria. Biodiversity is a driver for sustainable development that offers opportunities for poverty reduction, human livelihoods as well as the socio-cultural integrity of people especially those in the developing countries (Fuwape et al., 2011). Plant diversity is essential to sustainable human development and ecosystem health (De Mazancourt et al., 2013). The diversity of plants and other micro elements is now globally threatenedas a result of human continued degradation and unsustainable land use (Murphy and Romanuk, 2014). The continuous degradation of the forest reserve base in most parts of northern Nigeria has been reported to be the cause of rapid disappearance of forest cover that has resulted to erosion, food security, loss of biological diversity, soil degradation, and unfavorable hydrological changes (Aweto, 2001).Forests provide fodder and livelihoods supports to considerable number of rural communities in Jigawa state (Abbass, 2012). However, most of the 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). Competition driven conflicts between arable crop farmers and cattle herdsmen amongst other land-use, have become common occurrences in Northwest Nigeria (Abbass, 2012).Number of cases have been reported between herders, farmers and other resource users who fell fodder and other tree species along grazing routs in Jigawa State.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 in the northwest Nigeria 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 5,919,269 persons in 2016 projected from 2006 census figures at 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°C and 35°C respectively. The rainy season starts around May to September with a range of 1000mm-2000mm (Abbass, 2012). It covers a land mass of about 22,410 square kilometers while about 80% of itsinhabitants engage in crop and animal agriculture. It is characterized by undulating land, with several kilometers of sand dunes of different sizes in some parts of the state.

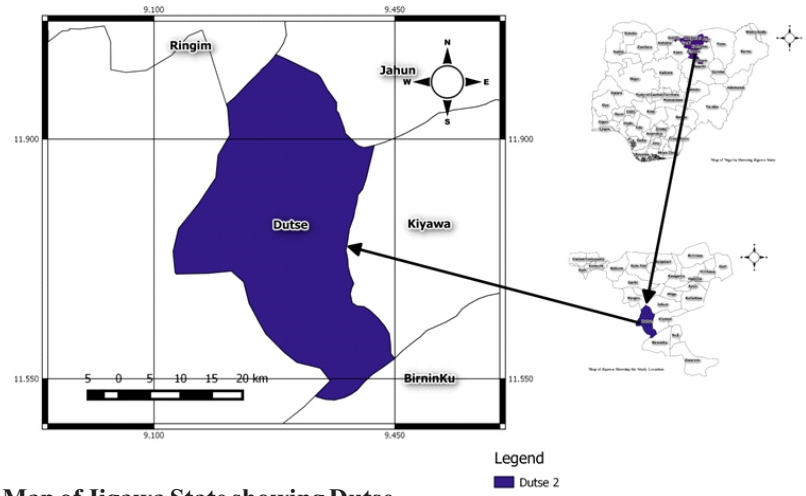

Figure 1: Map of Jigawa State showing Dutse

Data Collection and Analysis

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 20x20m were randomly located across the land use types with a minimum distance of 50m 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 5x5m plot, one 1x1m sub-plot was also established (Jimoh and Lawal, 2016).Number of individual of individual fodder tree with Diameter at breast height (DBH) ≥10cm, and height were counted and measured respectively within the 20x20m plots. All fodder tree species >2cm but ≤9cm DBH were enumerated within the 5x5m subplots. Also seedlings between 0-2cm were enumerated within 1x1m 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).

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

$$D = = \frac{S}{\sqrt{N}}$$

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:

$$H' = -\sum_{i=1}^{s} P_i \ln P_i$$

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

A total of fifteen fodder tree species was recorded. Four stands of *Azadirachta indica*was recorded in three different land-use type. *Tamarindus indica*was only encountered in farm fallow and homestead have a frequency of one in each. *Adansonia digitate*was only encountered under farm land with a frequency of one.

Table 1: Fodder tree species (>10cm DBH) from the land-use type

S/No.	Species	Local Name	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 digitate*	Kuka	1	33.3
			Cattle Route	
6.	*Diospyros mespiliformis*	Kanya	4	33.3
7.	*Acacia sieberana*	Banje	1	08.3
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

From table 2 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 having 4.33/0.5ha and farmland having the lowest density of 3/0.5ha (Figure 2). Cattle route hadthe 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 (Figure 3). Cattle route alsohadthehighest species abundance of 19.67/0.5ha, followed by homestead with 7.33/0.5ha, then farm fallow with 6/0.5ha and lastly the farmland with an abundance of 4/0.5ha (Figure 4). 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 4/0.5hawhile farmland had the least species richness of 3/0.5ha (Figure 5).

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

Land-use Type abundance	Density	Abundance	Species richness	Species index	Total
Farmland	3	4.33	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

Information on occurrence,density and distribution of fodder tree species

Species Density Across the Land-use Type

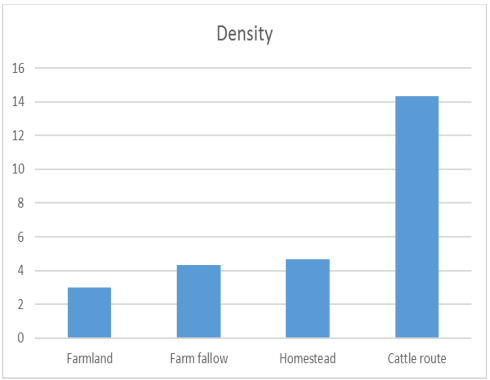

Figure 1
Fodder Species Diversity Across the Land-use Type

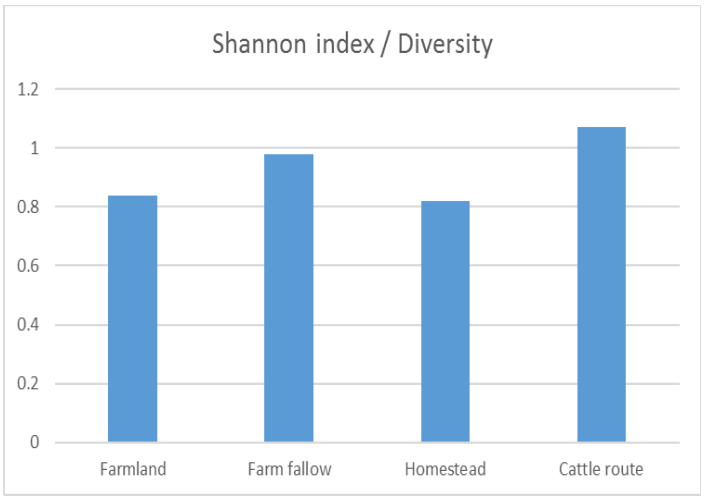

Figure 2
Fodder Tree Species Abundance in the Land-use Type

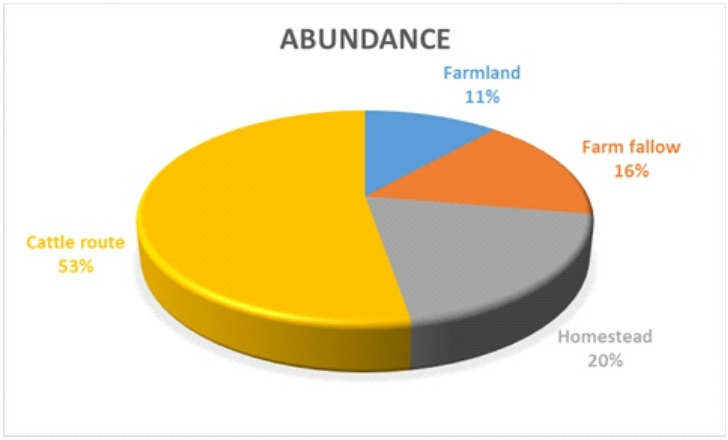

Figure 3
Fodder Tree Species Richness

Discussion

Azadirachta indicawas observed in three of the four land-use types. This may be attributed to the fact the fact that Azadirachta indica is one of the most useful tree in the northern savanna eco-region. Vitex doniana and Tamarindus indicawere 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 ofarable 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 less disturbances.This could be due to law enforced by the state government on restricting felling and farming along the cattle routs.

Conclusion

Fodder trees compositions are affected by different land-use type. Cattle route was favored by the state government policy that prohibits any usage of the resources on the cattle routes except for livestock. Contrarily, most fodder trees on the other land use types were impacted negatively for economic interest. Species richness, density, abundance and frequency were influenced by the land use type. Therefore, careless felling of fodder trees when subjecting land to other use should be controlled to guide continued loss of biodiversity.

Reference

Abbass, I. M. (2012). No Retreat No Surrender: Conflict for Survival between Fulani Pastoralists and Farmers in Northern Nigeria. European Scientific Journal, Vol. 8, No.1, pp. 331-346.

Agbelade, A.D., Onyekwelu J.C. and Apobgona, O. (2016). Assessment of Urban Tree Species Population and Diversity in Ibadan, Nigeria. Environmental and Ecology Research, 4(4): 185-192.

Aweto, O.A, (2001). Organic carbon diminution and estimates of carbon dioxide released from c a r b o n plantation soil. The Environmentalist. 15: 10-15.

Butler, 2015.The impact of selective logging and clearcutting on forest structure, tree diversity and above-ground biomass of African tropical forests. Ecological Research January 2015, Volume 30, Issue 1, pp 119-132.

De Mazancourt C., Forest I., Allen L., Frank B., and James B.G. (2013). Predicting ecosystem stability from community and biodiversity. Ecology Letters. 16: 617-625.

Food and Agricultural Organization, (2016). Social protection and agriculture: breaking the cycle of rural poverty. Rome (available at http://www.fao.org/publications/forest/conversion/2016/en/).

Gauch, H. G., 1982. Multivariate Analysis in Community Ecology. Cambridge University.

Ikyaagba, T. E., Tee, T. N., Dagba, B.I., Ancha, U. P., Ngibo, K. D. and Tume, C. (2015). Tree Composition and Distribution in Federal University of AgricultureMakurdi,Nigeria. JFEWR Publications. Pp147-157

IUCN (2009): International Union for the Conservation of Nature. Red list statistics www.iucn.redlist.com

Jimoh, S.O., and Lawal, A.A., (2016). Woody Plant Composition and Diversity in Disturbed and Undisturbed Areas of Omo Forest Reserve, Ogun State, Nigeria. African Journal of Agriculture, Technology and Environment: vol. 5(2): 60-73.

Murphy T.P. and Romanuk N. (2014). A meta-analysis of declines in local species richness from human disturbances. Ecology and Evolution. Vol. 4:1.

National population commission (2016). Projected data on national population. Retrieved on 2/5/2018. Available at https//census.jigawa.dutse.ndb

Spellerberg, I. F. (1991). Monitoring Ecological Change, Cambridge University Press, Cambridge.

Spellerberg, I.F. (1991). Monitoring Ecological Change, Cambridge University Press, Cambridge.

Turyahabwe, N. and Tweheyo, M. (2010). Does Forest tenure influence forest vegetation characteristics? A comparative analysis of private, local and central government forest reserves in Central Uganda: The International Forestry Review 12 (4), pp. 320-338.