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Research Paper

Farmers Perception of Impact of Climate Change on Shrubs and Grasses in Semi-Arid Areas of Katsina State, Northern Nigeria

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Semi arid environment of Nigeria has been identified as an area highly vulnerable to climate change than other ecological zones of the country and the local people's perception of biodiversity are vital source of information on pattern of vegetation changes. This study investigates the local perception of impact of climate change on shrubs and grasses in semi arid areas of Katsina state, northern Nigeria. Data were collected through questionnaire administration, focus group discussion, and key informants interview. Majority of the respondents in the six study villages of the three local governments reported late onset, early cessation, decreased duration of rainy season and increasing incidence of dry spell. More than 80% of the sampled villagers reported increasing intensity of temperature and the number of hot days.These changes had adversely affect the availability of plants biodiversity in the area particularly shrubs and grasses which the villagers attributed to the changing pattern of climatic elements particularly rainfall and temperature. More than 75% of shrubs and grasses mentioned by farmers were classified as decreased or disappeared. Findings from this study could be used as baseline information for conservation of species identified to be declining or disappearing in the study area.

Keywords: Climate change, perception, semiarid, shrubs, grasses

INTRODUCTION

Climate change (CC) refers to a change in the pattern of climate that can be assessed by change in the mean and/or the variability of its properties, and that persists for an extended period typically decades or longer (IPCC, 2007a). It was also described as change in climate over time, this include change in temperature, precipitation wind and other climatic elements over a period of time, ranging from 30 years and above, the normal period often used in climate change assessment (IPCC, 2001). Many studies have demonstrated that climate change is a reality; poses serious challenge to survival of mankind and is a primary environmental threat to sustainable development in developing countries including Nigeria were an adequate and reliable climate change information can help farming communities to adapt and enhancing the resilience among farmers to cope with the posed challenging conditions. Many studies in Nigeria reported manifestation of climate change in different parts of the country. Odjugo,(2010) indicated that the mean temperature in Nigeria between 1901-1938 was 26°C While the mean between 1971- 2008 was 27.83°C which indicate a mean of 1.70°C for the period, more than the global mean temperatures rise of between 1906 and 2005 (0. 74°C). He maintained that if these trends continue unchecked, Nigeria may experience between the middle (2.5°C) and high (4.5°C) risk temperature increase by the year 2100. Also the rainfall data between 1940-2000 from 23 metrological stations of savanna zones of Nigeria indicate that deviation of rainfall from the grand means is negative i.e the trend and pattern of the rainfall in the sixty years shows significant reduction in the amount of rainfall received in the area. The mean rainfall value for the 1901-1938 was 1571 mm while it deceased to 1480 in 1971-2008, which indicate a

decrease of 91 mm between the two climatic periods (Odjugo, 2011). It was also observed that the number of rainy-days dropped by 53% in the north-eastern Nigeria and 14% in the Niger Delta coastal areas while rainfall intensity is increasing across the country (Fasona and Omojola, 2005; Odjugo, 2011). Roma, (2008) indicated that Nigeria experience a 3-4% reduction in rainfall per decade since the beginning of 19th century; northern Nigeria rainy day decrease from 150 to 120 days in the last four decade.

In Katsina state, rainfall records (1941-1970) analyzed by Tomlinson, (2010) from more than 120 stations extending between 9° to 13.5°N, 7° in present Kaduna and Katsina states indicates reduction in the amount of rainfall received in the study area from 700mm in 1970 to less than 600 mm in 2008. Tomlinson, (2010) indicated that if the downward trends persist the amount of rainfall in northern Katsina state will decrease from 700 mm in the 1970 to less than 400 mm by the year 2030. Tomlinson, (2010) noted that "the trends observed in Katsina state over the last 50 years are in conformity with the result from climatic modeling of the Hadley Centre which has shown a reduction in annual rainfalls of about 4 mm/y over the next 100 years at the Nigerian edge of the Sahel'. Tomlinson, (2010) further posited that the general effect of rainfall variability on the environment is "woodland becoming thorn shrub and savanna becoming desert, with sustain rain fed agriculture becoming unviable" and added that the condition in Katsina town up to Nigeria-Niger republic border is expected to be worst, which may compel people to migrate southward. Tomlinson, (2010) backed his findings with the report of Intergovernmental Panel on Climate Change (2007) which indicated that "In West Africa, the long term decline in rainfall from the 1970s to the 1990s caused a 25-35 km southward shift of the Sahelian, Sudanese, and Guinean ecological zones in the second half of the 20th century. The Intergovernmental Panel on Climate Change (IPCC, 2007b) report indicated that smallholder and subsistent farmers and pastoralists will suffer complex, localized impacts of climate change and become more vulnerable than ever to changes that are beyond their control. Hence, Doss and Morris, (2001) posited that the perspectives of the local farmers and pastoralist, the way they think and behave in relation to climate, as well as their values and aspirations have a significant role to play in addressing climate change challenges. Local people depend on the natural resources, thus have immense knowledge of their micro-environment by observing changes in times and seasons through their traditional knowledge of using certain events example appearance of certain birds, mating of certain animals, or flowering of certain plants as indicators; hence are first to identify any changes and adapt to them. The increasing demand of vegetation resources as a result of human and livestock population pressure coupled with fluctuation in climatic elements had led to decrease in the vegetation density and diversity particularly in semi-arid areas of Nigeria and other part of West Africa. However, studies largely based on interpretation of remotely sense data have documented vegetation recovery as indicated by increase in Normalize Difference Vegetation Index (NDVI) in semi arid areas of West Africa (Eklundh and and Olsson, 2003; Herrman *and* Hutchinson, 2005). But studies on local knowledge on vegetation changes in sudano-sahelian region of West Africa consistently indicated wide spread decline and extinction of some plant species (Wezel and Haigis, 2002; Lykke, 2000; Wezel and Lykke, 2006; Sop and Oldeland 2011; Sop *et al.,* 2012; Spiekerman *et al.,* 2015). Some scientists reported improvement in the vegetation condition as a result of increase in rainfall trend (Eklundh and Olsson, 2003; Nicholson, 2005). Others linked the improved vegetation condition not only to increase in rainfall but also to changes in land use and management practices particularly in Burkina Faso (West *et al.,* 2008), Niger (Wezel and Haigis, 2000). These conflicting research results necessitate the need to make thorough investigation with evidence from the local knowledge along the border in Nigeria very close to area studied by Wezel and Haigis, (2000) in Niger republic to see whether the claimed vegetation improvement particularly herbs and grasses as claimed by some scientist is also experienced there. Local knowledge is widely believed to be useful and reliable data source on historical distribution pattern of plants particularly rare and endangered species which are difficult to assess using sophisticated equipment (Spiekerman, 2015). Investigating how changes are perceived at the local level is crucial in planning for the impacts of climate variability and/or change, as only farmers who perceive a problem will implement strategies to adapt or respond to it. Thus, the overall objective of this study was to get the perspectives of the farmers on the impacts of climate change on shrubs and grasses.

MATERIAL AND METHODS

The study area

The study area is located between latitude 12° 52'N and 13° 19'N and longitude 7° 16'E and 8° 43'E. The area is characterized by unimodal rainfall pattern with most of the rain received between May to September, annual average below 700mm.Temperatures are high in most parts of the year with the mean daily maximum ranging between 27°C to over 40°C occurring between March and May.

The mean minimum ranging between 18°C to 25°C experienced in the month of November to early February. The area has four different seasons; a cool dry season (December to February), a hot dry season (March to

Table 1. Sample sizes and some characteristics of the study area.

Local Govt.	Location (Coordinate)		Estimated Population	No. of Sample Selected in the village	No. of Sample selected in the Local Govt.	Dominant tribe
Maiadua	Bumbum	13°16'N, 8°07'E	1,700	17	39	Hausa/Fulani
	Kwangwalam	13°10'N, 07°32'E	2,200	22		Hausa/Fulani
Mashi	Birnin Kuka	13°19'N, 07°59'E	3,200	32	57	Hausa/Fulani
	Majigiri	13°15'N, 07°53'E	2,500	25		Hausa/Fulani
Zango	Yakubawa	13°04'N, 08°29'E	1,800	18	40	Hausa
	Yardaje	13°01'N, 08°34'E	2,200	22		Hausa/Fulani
			11,600	136	136	

Sources: Field Work 2016

May), a warm wet season (May to September) and a season of falling temperature (September to November), (Tomlinson, 2010). The landscape is underlain by sedimentary rock, flat with an average of 300 meters above sea level, broken in some parts by hills. Trees and grasses adapt to climate rhythm of long dry season and short wet season. Most trees developed long tap roots, thick bark which enable them to withstand the long dry season and bush fires). The soils are sandy ferruginous type of the latosols group which is highly weathered and markedly laterised and slightly acidic in reaction to low organic matter content and phosphorous, its total nitrogen rarely exceed 0.2 % (Abubakar, 2006). The vegetation is subjected to various form of abuse which includes fire, wood cutting, cultivation, overgrazing and bush fire. The subsistence rainfed farming is the common economic activity in the area and fragmented farm land form the dominant feature of the land use pattern (Table 1).

Data collection

Twenty respondents were randomly selected in a pilot survey conducted in order to identify potential problems associated with the interpretation and administration of the questionnaires. This allowed for restructuring and paraphrasing of questions and devised ways of minimizing all questionnaire-related problems before the actual data collection. Sampling technique with proportionate representation was used to determine sample size. A total of 136 respondents were sampled in the order of 57 in Mashi, 40 in Zango, and 39 in Maiadua local government areas. Respondents who are aged 50 years and above; and lived in the study area and can recall temperature and rainfall patterns in their communities for decades were purposively given priority. To get information on farmer's knowledge of the climate change in their immediate environment, farmers were asked about their method of estimation of rainfall, temperature, the date of rainy season that is, onset and cessation. Farmers were also asked to compare the pattern of rainy season(s) in present days with past when they were young, to determine if there are changes in climate. If there are changes, the farmers were then asked to mention the time of the start of the change referring to a year, or any important event which the farmers could remember (Mkonda and Xinhua, 2017). Farmers were also asked if the rainfall onset / cessation was now early, late or remained unchanged compared to the past time; if the number of rainfall events or dry spells have decreased, increased or stay unchanged; if temperature, that is the number of hot and cool days in the past years have decreased, increased, or remained unchanged, etc (Akponike et al., 2014) open-ended questions were also used to get the perspectives of the farmers on any other indicators of climate change in their locality which they have not mentioned.To examine how the change in rainfall and temperature affect the availability of herb and grasses the following activities were pursued to achieve this objective

(i) A transect walk with selected respondents was carried out. But preference was given to those who are 50 years and above, following Wezel and Haigis, (2000) and Wezel and Lykke, (2006).

(ii) Questionnaire was administered with purposively selected heads of the households and pastoralists who are 50 years and above. The questions covered several topics related. In general, the respondents were asked to mention plant species and qualify their present occurrence compared to the past following four criteria by indicating herbs and grasses which:

(1) Increased
(2) Decreased
(3) Disappeared.

(iii) After the questionnaire administration, Focus Group Discussion were held which involved dialogues with group of respondents selected from among the local respondents who participated in the transect walk in every village, and government officials in charge of forestry. The findings from the household survey were presented to the group for discussion. This allowed the researcher to make comparison between locally held views and the official sentiment on vegetation, whether it increases or there is newly introduced species or the vegetation is decreasing, or some species are disappearing.

The identification of botanical name of plants

To identify the botanical names of each of the mentioned species, their local names given by the farmers and pastoralists, and characteristics in terms of flower, root system, body morphology and local name, were compared with the details given by Blench, (2004) where the names and characteristics were found to correspond with that of the above author, the botanical names given by the author were adopted as names for the plants identified. However, some plants particularly that disappeared could not be identified and named through the above mentioned method. Hence, their specimens were obtained from other ecological zones (Sudan or Guinea savanna) where they are available with the help of the local famers/pastoralists. The specimens were taken to the Herbarium, in the Faculty of Sciences, Department of Biological Sciences, Ahmadu Bello University, Zaria where they are identified and named.

Data analysis

Quantitative data was analyzed by SPSS software to generate cross tabulations and frequency tables.

RESULTS AND DISCUSSION

The occupational distribution of the respondents

Agriculture is the main occupation of the population, providing the mainstay of the economy. Majority of the respondents (more than 80%) in five local government areas except Mai adua (70%) were farmers. For those who engage both in crop production and livestock rearing, livestock is seen as an inseparable complements to successful farming. An important off-farm activity of the younger men is migration to neighbouring urban centers or to other parts of the country (Table 2).

Land tenure and farm land sizes

The domination of farming as the major occupation in the study area reflects the importance and value attached to land. The pattern of land tenure has been playing on important role in agricultural production in the area. Hence, an examination of farming practices is critical to any study on man-land interrelationship as well as in understanding the land degradation process in the area. It has been found that land tenure in the area has a double ancestry, i.e the traditional concept of communal landownership and Islamic law, which recognizes individual tenure. This was reflected in the pattern of land ownership, as shown in (Table 3). It has been found that majority of the respondents got their land through inheritance in Zango (70%). The pattern of land ownership (largely through inheritance) clearly indicated widespread land fragmentation and the small size of farmlands, on the average 1.5 hectares was found in Mashi and 1.3 hectres in Mai'adua. While those who own land through forest clearance (owners) were dominantly elderly people. Despite the small size of the respondents' land, most of them felt that the land tenure system is fair to all and land acquisition is not a problem; as long as one has the means of investing in the land, it is easy to get land free or for little rent for crop production.

Farmers' perception of climate variability and change

Majority of the farmers believed that there had been changes in the overall climate pattern. However, there was little variation between the 6 villages concerning the time these changes had begun to manifest. Most of the farmers in the villages believe the changes in climate to have started between 15-30 years ago, while the minority mentioned less than 10 years ago (Table 4).

Changes in rainfall pattern

The onset of the first rain in the season of the year was perceived by farmers to be starting late nowadays than before (Table 4). On the other hand the cessation of rainfall was mentioned to be earlier. These two perceptions were consistent with the perceived shorter season duration observed in Burkina Faso by West et al., (2008).The late onset of the first rainy season and the earlier cessation were reported by a higher proportion of farmers (more than 80% and 70- 80% respectively) in all the sampled villages. The season duration were perceived to have decreased by more than 80% of the respondents and the number of rainfall events have decreased consistently with the number of dry spells perceived to have increased.

Changes in temperature and sunshine pattern

The farmers were asked for observed changes in temperature, length of cold periods and length of dry period in order to determine their level of perception. The

Table 2. Demographic characteristics respondents.

	Mashi (n=57)		Zango (n=40)		Maiadua (n=39)	
	Frq.	%	Frq.	%	Frq.	%
Gender						
male	51	89	38	95	37	95
Female	06	11	02	05	02	05
Age						
10-20	00	00	00	00	02	05
21-30	07	12	06	15	03	08
31- 40	05	09	04	10	11	28
41-50	10	18	15	37	07	18
51-60	17	29	08	20	06	15
61-70	07	13	02	05	05	13
71-80	06	10	03	08	02	05
Above 80 years	05	9	02	05	03	08
Occupation						
Farming	32	82	46	81	28	70
C/ Servant	02	5	03	05	05	12
Trading	04	10	02	04	05	12
Other	07	03	06	10	02	06

Table 3. Land tenure and farm land size.

Land Tenure	Mashi (n=57)		Zango (n=40)		Maiadua (n=39)		Average %
	Freq.	%	Freq.	%	Freq.	%	
Owner	14	25	11	27	10	26	26
Inherited	37	65	28	70	25	64	66
Purchased	06	10	01	2.5	03	8.0	06
Others	0.0	0.0	00	00	01	2.6	01
Average Farm Size Hectres	1.7		1.4		1.3		1.5

Source: Field Work (2016).

Table 4. Farmers' perceived changes in the rainy season pattern in northern Katsina state.

SPECIE NAME		MASHI LGA. n=57		ZANGO LGA n=40		MAI'ADUA LGA n=39	
		Frequency	%	Frequency	%	Frequency	%
Rain onset	Early	07	13	04	10	01	02
	No change	03	05	03	08	06	15
	Late	47	82	33	82	32	83
Rain cessation	Early	45	80	32	80	28	72
	No change	04	07	05	13	06	14
	Late	08	13	03	07	06	14
Season duration	Decreased	50	88	35	88	32	83
	No Change	03	05	02	05	06	15
	Increased	04	07	03	07	01	02
Heavy events	Decreased	40	70	30	75	30	77
	No change	10	18	02	05	03	08
	Increased	07	12	08	20	06	15
Dry spell frequency	Decreased	03	05	05	12	04	10
	No change	14	25	03	07	06	15
	Increased	40	70	32	81	29	75
Total amount	Decreased	50	88	35	88	35	90
	No change	02	03	02	05	02	05
	Increased	05	09	03	07	02	05

Source: Field work (2016).

results of farmers perception of temperature is presented in (Table 5). It indicates that the number of hot days had increased but it had reduced during the rainy season periods. More than 80% of the surveyed farmers in the three local governments have observed increasing temperature while only an insignificant 11% in Mashi local government noticed a decreased in temperature, and 8% of the respondents in Zango and Maiadua local

Table 5. Farmers' perceived changes in temperature in northern Katsina state.

		MASHI LGA. n=57		ZANGO LGA. n=40		MAI'ADUA LGA n=39	
		Frequency	%	Frequency	%	Frequency	%
Temperature	Decreased	06	11	04	10	02	05
	No change	03	05	03	08	03	08
	Increased	48	84	33	82	34	87
Number of hot days	Decreased	06	11	03	07	10	25
	No change	05	09	07	18	03	08
	Increased	46	80	30	75	26	67
Number of cool days	Decreased	45	79	32	80	20	51
	No Change	08	14	02	05	07	18
	Increased	04	07	06	15	12	31
Hottest month	Change	40	70	27	68	15	38
	No change	17	30	13	32	24	62
Coolest month	Change	46	80	27	68	25	64
	No change	11	20	13	32	14	36

Source: Field survey (2016)

Table 6. Vegetation species identified by farmers during the FGD sessions.

Vegetation species	Hausa Name
Abutilon Mauritianum	Kyablu
Acanthospernum hispidum	Kashin yawo
Achyranthes aspera (linn)	Kamin kadangare
Alysicarpus Vaginalis	Gadagi
Andropogon gayamus	Gamba
Andropogon pseudopricus	Shuci
Amarathus Viridis	Zaki banza
Boerhavia erecta	Zakon gada
Brachiara distichophylla	Garaji
Cenctirus biflorus (Roxb)	Karangiya
Cenchrus biflorus (Diaz)	Karangiyar bera
Celosia leptostachya	Tozalin mage
Ceratotheca sesamoides Eval	Yodo
Ceralluma diazalli	Wutsiyar damo
Centuara alexandrina C	Dayi
Chameochrista mi mosoides	Bagaruwar Kas
Chrozophora brochiana	Gyada Gyada
Chrozophora senegalensis (A. Juss)	Damagi
Corchorus olitorius (Linn)	Lalo
Conyza attenvate Dc	Goron Mayu
Crinum yuccaeflorum (salisb)	Albasar Kwadi
Crotalaria ashrek (forsk)	Jar birna
Crotalaria aschrek (linn)	Farar birana
Cu cumis melo Ilinn)	Gurji
Cus cumis prohetarum	Ciccidu
Cy perrus platycaulis (Bak)	Jiji
Datura inoxia	Zakami
Desmodium lasiorcarpum (Dc)	Dankadafi
Dicoma tomentosa (cass) Daiz2)	Garkuwar bera
Eragrostic cilaris and E. Lingulata	Komayya
Euphoriba polycmordes (Hosch)	Kwalin kuda
Evolvulus alsinoides(Linn)	Kafi Malam
Eratia contheiodes (Heirn)	Kuru Kuru
Fimbristylis hispidula (alv.) Kuntt	Gude-gude
Hisbiscus asper (Hook) Daiz	Yakuwar kwadi
Hibiscus sabda riffa (vari intermedius)	Jar yakowa
Indigofera astra gulina (DC)	Kai kai komaka mashe kiya

Table 6. Contd.

Kohentia grandiflora (DC)	Rimin samari
Kyalinaga eracta (schumid)	Gemon kwado
Largeraria vulgaris (Seringe)	Duma
Laggeria aurita (Linn)	Namijin goro
Levcas spp.	Hana rates
Levcas matine cesis (Jacq) Ait	Kan barawo
Leptadanta lancifolia (Decne)	Yadiya
Leptadania pyrotcchnica	Kalimbo
Mitra carpum virtiallatum	Goga Masu
Momordica balsamia	Garafuni
Pennisetum pedice llatum	Kansuwa
Pergularia to mentosa (Inn)	Fataka
Peritrophe bicalyculata (Rezt)	Tumamin dawaki
Polycarpae lincarifolia (DC)	Bakin suda
Portolaca oleracea	Fasa Kaba
Ricinus commudis	Zurman
Regeria adanophylla	Baba rado
Sesamuni spp	Ridin Kadan gare
Schaene feldia gracilis	Kalawo
Scoparia dulcis (linn)	Ramafada
Securidaca lengepedumuculata (trees)	Sanya
Senna halica (Mill)	Bauren kiyashi
Senna accidentalis	Raidore
Sasbania aegyptiaca	Zamarke
Solanum incanun	Idon saniya
Sanchus Oleraceus	Farar bafulatana
Spermacoce stoch yadie (DC)	Alkamar Tururuwa
Striga Spp	Wuta-wuta
Tephro sia humilis (Gull & per)	Tsintsiyar maharba
Tephrosia purpera	Maragowa
Trian thema pentadra	Godon Maciji
Trianthema portulacastrum	Babba juji
Vernonia ambigua	Mekiya
Vernonia perrofeti	Burzu
Watheria amencana	Hankunfa

Source: field work (2016)

governments reported temperature remain unchanged. The result also indicates a reduction in the number of cold days and an increase in the number of extreme hot days in the study area. It also implies that farmers' perception of an increase in temperature is mainly due to extreme temperature events and a decrease in the number of cold days compare to the past.

Impact of climate change on herbs and grasses

According to the Intergovernmental Panel for Climate Change [IPPC] (2007), increase in global average temperature above the range of 1.5- 2.5°C may result in significant changes in the structure, function and geographical ranges of ecosystems, which may negatively influences species distribution and survival. Several species around Africa are now affected by the combined impacts of climate factors and their interactions with other anthropogenic stressors such as desert encroachment, land fragmentation and destruction of natural habitats. In developing countries including Nigeria where the majority of the population largely depends on natural resource as source of livelihoods, this can affect the socio-economic status of communities; hamper progress of the communities (IPCC, 2007a). The study area have useful indigenous plant species scattered within the crop fields and rangeland and forest reserves. However, these vegetation resources are undergoing persistent changes due to natural and human influence. Hence, there is the need to know the extent of these changes particularly base on the local people understanding, from time to time in different areas especially in semi-arid areas which are highly vulnerable to climate change and prone to desertification. Trees form a striking component of the farmland (Lawal, 2017). This land use system is commonly known as the agroforestry parkland system and has been successively described by Pullan, (1974) as farmed parkland, Most of the trees and shrubs in the area have fine leaf, with sparse grasses and herbs, some having a thorny and short structure. Average height of 21.69, 9.15 and 3.9 feet have been recorded for trees, shrubs and herbs/

Table 7. Pattern of shrubs and grasses changes in northern Katsina state.

Species names	MASHI L.G.A.		ZANGO L.G.A.		MAI'ADUA L.G.A	
	B/Kuka	Majigiri	Yakubawa	Yaardaje	Bumbum	Kwangwalan
Alysicarpus Vaginalis	↓	↓	↓		↓	↕
Andropogon gayamus	↓	↓	↓	↓	↕	↓
Andropogon pseudopricus	↕	↓	↕	↓	↓	↕
Amarathus Viridis	↕		↓	↕		
Boerhavia erecta	↕		↕	↕		↓
Brachiara distichophylla	↕	↓	↕		↕	
Cenctirus biflorus (Roxb	↕	↕		↓		↓
Cenchrus biflorus (Diaz	↓		↕	↕		↓
Celosia leptostachya	↕	↓		↕		↓
Ceratotheca sesamoides Eval		↕	↕	↕		↓
Ceralluma diazalli	↓		↓	↕		
Chameochrista mi mosoides	↕		↓	↓	↓	
Chrozophora brochiana		↕	↓	↕		↕
Chrozophora senegalensis (A. Juss)	↓	↕		↕		↕
Corchorus olitorius (Linn	↕	↕	↓	↕	↕	↕
Conyza attenvate Dc	↓	↓	↓			↕
Crinum yuccaeflorum (salisb)	↕	↓	↓	↕	↓	
Crotalaria ashrek (forsk)	↓	↓		↓		↕
Crotalaria aschrek (linn)	↓		↓		↓	
Cucumis melo Ilinn)	↓		↓		↓	↓
Cus cumis prohetarum	↓		↓		↓	↓
Cy perrus platycaulis (Bak)		↓		↓	↓	
Datura inoxia	↓		↕	↕		↕
Desmodium lasiorcarpum (Dc)	↕		↕		↓	↕
Dicoma tomentosa (cass) Daiz2)	↓		↕		↕	↕

Table 7. Contd.

Species names	MASHI L.G.A.		ZANGO L.G.A.		MAI'ADUA L.G.A	
	B/Kuka	Majigiri	Yakubawa	Yaardaje	Bumbum	Kwangwalan
Evolvulus alsinoides(Linn)	↕	↕	↓			↓
Eratia contheiodes (Heirn)	↓		↕		↕	↕
Eragrostic cilaris and E. Lingulata	↓	↓	↓		↕	
Euphoriba polycmordes (Hosch)	↕		↓		↓	↕
Fimbristylis hispidula (alv.) Kuntt	↓	↕	↕	↕		↓
Hisbiscus asper (Hook) Daiz	↓	↓		↓	↓	↓
Hibiscus sabda riffa (vari intermedius	↓	↕		↓		↕
Indigofera astra gulina (DC)	↓	↓	↓		↓	↓
Kohentia grandiflora (DC)	↓	↕		↕		↕
Kyalinaga eracta (schumid)		↕	↕	↕		↕
Largeraria vulgaris (Seringe)	↕	↓		↓		↕
Laggeria aurita (Linn)	↓	↓		↓	↓	↕
Levcas spp	↓		↓		↓	↓
Levcas matine cesis (Jacq) Ait	↓	↕	↓		↓	↓
Leptadanta lancifolia (Decne)	↓	↓	↓	↕		↕
Leptadania pyrotcchnica	↓	↓		↓	↓	↓
Mitra carpum virtiallatum	↓		↕		↕	↕
Momordica balsamia	↓	↓		↓		↓
Pennisetum pedice llatum	↓		↕	↕		↕
Fimbristylis hispidula (alv.) Kuntt	↓	↕	↕	↕		↓
Hisbiscus asper (Hook) Daiz	↓	↓		↓	↓	↓

grasses respectively in similar environment in some parts of Kano and Yobe states studied by Mohammed (1994). The study area is part of Nigeria experiencing rapid population growth (Mortimore, 2006), increasing climatic variability (Wezel and Haigis, 2000; Wezel and Lykke, 2006) an increasing demand for vegetation resources (Boatene, 1998; Odihi, 2003), particularly fuel wood, which cannot be met from the existing scanty vegetation without further environmental degradation. The most important common herbs and grasses found in the area were mentioned by the farmers and pastoralists in (Table 6).

Table 7. Contd.

Species name	Mashu LGA		Zango LGA		Mai adua LGA	
	B/kuka	Majigiri	Yakubawa	Yardaje	Bumbum	Kwangwalam
Hibiscus sabda riffa (vari intermedius	↓	↕		↓		↕
Indigofera astra gulina (DC)	↓	↓	↓		↓	↓
Kohentia grandiflora (DC)	↓	↕		↕		↕
Kyalinaga eracta (schumid)		↕	↕	↕		↕
Largeraria vulgaris (Seringe)	↕	↓		↓		↕
Laggeria aurita (Linn)	↓	↓		↓	↓	↕
Levcas spp	↓		↓		↓	↓
Levcas matine cesis (Jacq) Ait	↓	↕	↓		↓	↓
Sasbania aegyptiaca	↕	↕	↓			↓
Solanum incanun	↕	↕	↕		↕	
Sanchus Oleraceus	↓	↕	↓	↕		↕
Spermacoce stoch yadie (DC	↕		↕		↕	↕
Striga Spp	↕		↕			↓
Tephro sia humilis (Gull & per)	↕	↓		↓	↕	
Tephrosia purpera	↓		↓		↓	↓
Trian thema pentadra	↓	↕	↓	↓		↕
Trianthema portulacastrum		↓		↓	↓	↓
Vernonia ambigua	↕	↕	↓	↕		
Vernonia perrofeti	↕	↓	↕	↓	↕	↓
Watheria amencana		↓		↓		

↕ Decreasing, ↓ Disappeared, ↑ Increasing Source: Field Work (2016)

Shrubs and grasses changes in northern Katsina state

The number of shrubs and grasses that were mentioned to have decreased or disappeared was higher than the species that increased. More than 75% of the species listed in (Table 7) were either decreased or completely disappeared in the study area. Local perception of more decrease and disappearance than increase in shrubs and grasses conforms with earlier studies in neighbouring Niger republic close to the study area where increase in the disappearance and decline of vegetation particularly trees, was documented by Wezel and Haigis, (2000) and Wezel and Lykke, (2006). Local farmers attributed the decrease and disappearance of these species to a decline in the amount of rainfall received in the area and frequent drought in recent years. To prove the decrease in the amount of rainfall received in the area, the local farmers compared the amount of rainfall received with the level of the water table below the surface. They claimed that in the past 20 years the water table was less than 10 metres below the surface, but presently one had to dig a well of nearly or more than 30 metres before reaching the water table and water no longer remained in the stream during the dry season for a longer time as it used to be. Farmers' claim conform with the findings of Oluwasemire and Alabi, (2004); Tomlinson, (2010) and Ekpho and Nsa, (2011). Apart from the climate changes, the respondents also suggested that an increase in population has contributed a lot in the use of more shrubs and grasses to meet the increasing demand for fuel wood and the expansion of new area for cultivation. However, case studies from other countries have revealed many instances where population growth and agricultural intensification did not lead to the degradation of natural resources (Mortimore and Adam, 2001). But it could be argued that the increase in population in the study area could necessitate the destruction of more vegetation resources because alternative energy in the form of kerosene and cooking gas were not readily available or affordable. Hence, people have to use the available source of energy (fuel wood) without thinking of the consequences. Also lack of job opportunities and a reliable source of income apart from farming have compelled many farmers to cut down shrubs in their farms and forest reserve. That is why heaps of fuel wood for sale has become a common feature along the major roads in the study area.

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